FHFA MORTGAGE ANALYTICS PLATFORM

Version 3.0

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1 Release Notes

This white paper incorporates the following major enhancements and updates reflected in the third version of the Single-family FHFA Mortgage Analytics Platform (FMAP v3.0) since version 2.0 of FMAP was released in May 2020:[1]

- Redesigns and re-estimates loan behavioral equations.
- Develops and implements a proprietary loss severity model.
- Uses expanded and more representative loan performance data and more granular level economic data to estimate mortgage performance model.
- Estimates the behavioral equations via an iterative, out-of-sample, model building process.

2 Executive Summary

FMAP is a proprietary analytic system developed by the Federal Housing Finance Agency (FHFA) to inform Agency policy decisions. Essentially, the system forecasts mortgage performance of Fannie Mae and Freddie Mac (the Enterprises) loan portfolios under various economic scenarios and time horizons. These forecasts are based upon historical relationships among borrower, collateral, and macroeconomic information. This white paper describes the most recent version of FMAP, FMAP v3.0.

FMAP v3.0, like its predecessors, provides analytic support for Agency policy decisions. Previous examples of FMAP support include the following:

- FHFA issued the Enterprise Regulatory Capital Framework Final Rule (ERCF) that establishes credit and market risk capital requirements for the guarantee, whole loan, and retained portfolios of the Enterprises using credit score, loan-to-value, and other loan characteristics. FMAP informed the ERCF credit risk capital requirements for single-family new acquisitions.

- The Dodd-Frank Act Stress Test requires certain financial institutions to conduct periodic stress tests to determine whether they have sufficient capital to absorb losses and support operations during adverse economic conditions. FHFA requires the Enterprises to conduct stress tests pursuant to the Dodd-Frank Act. FHFA uses FMAP to provide an independent benchmark to compare against the Enterprises' single-family credit loss projections.

- During and after the 2007-2008 financial crisis, the Enterprises suffered losses due to the failure of insufficiently capitalized counterparties to honor their respective obligations. As a safety and soundness matter, FHFA established the Private Mortgage Insurance Eligibility Requirements Standards (PMIERS), which mandated financial requirements for mortgage insurers interested in serving as counterparties to the Enterprises. FMAP provided analytic support in establishing these standards.

FMAP v3.0 contains a series of major enhancements and upgrades to FMAP v20, the current production version. These new changes include the redesign and re-estimation of the loan performance model and

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[1] The FMAP v2.0 White Paper is located at
https://www.fhfa.gov/PolicyProgramsResearch/Research/PaperDocuments/FHFA_MortgageAnalyticsPlatform_Whitepaper_V2.0.pdf .

implementation of an internally developed loss severity model. The new loan performance model expanded FMAP's ability to model loan performance at a more granular level. Additionally, FMAP v3.0 loan performance equation were estimated using an out-of-time model building approach and more robust nonlinearity specification, which minimizes model overfitting.

3   Overview

3.1   Objective and Purpose

FHFA developed FMAP as an analytic system to independently inform Agency management about the potential performance of the Enterprises' portfolio of loans under various scenarios and time horizons. FHFA considers forecasted loan performance when developing and evaluating various housing policies. FHFA benefits from the external forecasts provided by the Enterprises and the vendor platforms to which FHFA subscribes. Simultaneously, FHFA developed FMAP for several reasons. First, FMAP provides an independent view of portfolio performance rather than a view informed by external entities. Second, FHFA develops and maintains FMAP in a manner reflective of Agency priorities and perspectives on how mortgages are expected to perform under various economic conditions and time horizons. Third, FMAP is accessible and transparent relative to other external analytic systems.

The objective of this white paper is to provide interested stakeholders with an overview of FMAP. The distribution of this paper reflects the broader Agency-wide effort to provide transparency on the data and analytical tools used by FHFA for policy support. This white paper describes version 3.0, the latest version of FMAP as of this paper's publication. The Agency anticipates updating this document periodically.

3.2   Description

FMAP is constructed and used to forecast mortgage cash flows within the structure depicted below in Figure 1, which describes the inter-relationships of the following five FMAP v3.0 modules:

- Data module
- Behavioral models module
- Loss severity models module
- Simulation module
- Reporting module

Figure 1. FMAP v3.0 Structure
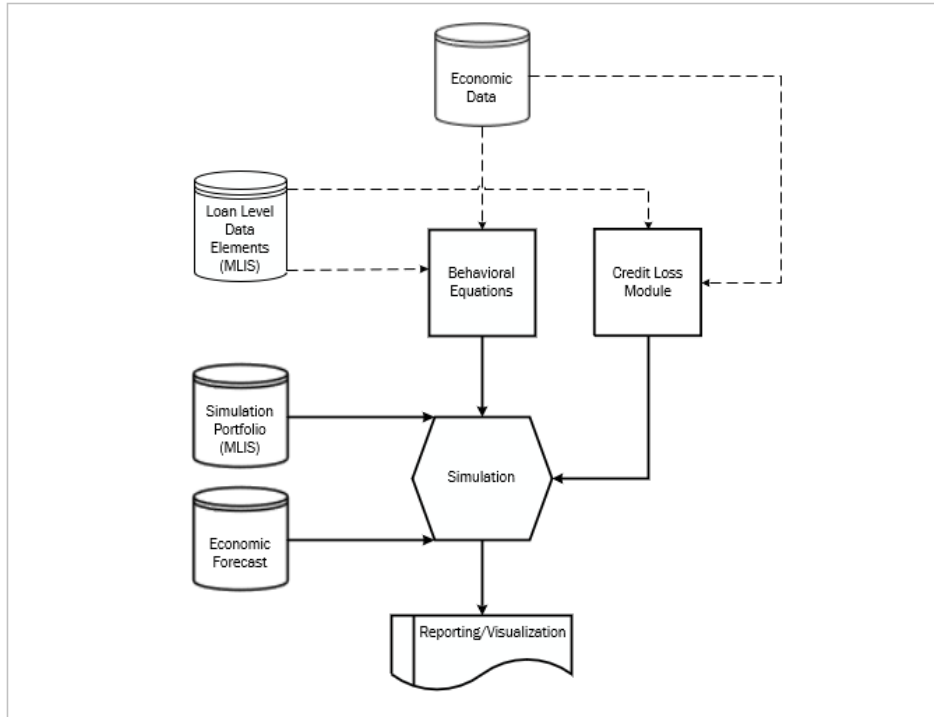
Each module of FMAP v3.0 is described in the sections following the Release Notes.

4   Data Module

4.1   Overview

FMAP v3.0 requires multiple source data to build the statistical models and simulate mortgage performance; namely,

- Borrower data
- Collateral data
- Macroeconomic data
- Loss severity data

4.2   Borrower and Collateral Data

Monthly, the Enterprises submit to FHFA historical loan-level data containing borrower and collateral characteristics. These data consist of static origination information as well as monthly dynamic information. FMAP v3.0 uses historical Enterprise borrower and collateral data to estimate both the behavioral and loss severity models. FMAP v3.0 also uses Enterprise borrower and collateral information as of the simulation date to define the set of loans for which to simulate mortgage performance and the initial values for these loans in terms of borrower and collateral characteristics.

4.3   Macroeconomic Data

In addition to borrower and collateral information, FMAP v3.0 requires both historical and forecasted macroeconomic information; namely, house prices, unemployment rates, and certain relevant interest

rates. Historical house price indices (HPIs) are provided by FHFA, while historical unemployment rates and interest rates are provided by a vendor. Forecasted HPIs, unemployment rates, and interest rates are also provided by a vendor.

Combined with borrower and collateral information, FMAP v3.0 uses macroeconomic historical data to estimate the statistical models and macroeconomic forecast data to simulate loan performance for various economic scenarios and time horizons.

4.4   Loss Severity Data

The input data for the loss severity module come from several sources. First, the Enterprises provide loss and loan level data. Second, the monthly loan-level submissions provided by the Enterprises include data for real-estate owned fixed costs and alternatives as well as the transaction costs for non-performing loan sales. Lastly, house price index data is provided by a vendor.

4.5   Simulation Data

The simulation data is one input into the simulation engine. The data is created based on borrower, collateral, and macroeconomic data. These data reflect the portfolio of each Enterprise and contain loan attributes as of the simulation date.

5   Behavioral Models Module

5.1   Overview

The behavioral models are statistical equations that vary across the Enterprises and other dimensions. These models predict a given loan's transition among states. A transition refers to a loan changing to a different state from one period to the next, where a state is defined as a loan performance category e.g. performing or delinquent.

5.2   Framework Specification

In particular, FMAP v3.0 proposes a transition probability methodology to model monthly mortgage performance[2]. This methodology projects monthly probabilities of a given loan transitioning from one state to another state. Typically, states include current, 30-, 60-, 90-, 120-, 150- day delinquencies, and 180 or more days in delinquency. The advantage of the transition methodology is that loan performance can be modeled at a more granular delinquency level and each transition equation can be individually specified and estimated. In addition, the transition technique is particularly useful if modelers need to predict delinquency status of each loan in a portfolio. The downside of the transition model is that when the granularity of loan state is high, the number of transition equations become very large and unmanageable, and equations for transitions between certain delinquency states cannot be reasonably estimated because of the low transition frequency. For this reason, institutions cannot always estimate every transition of interest. Instead, modelers either group delinquency states or omit some of the transition equations.[3]

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[2] For example, BlackRock (2020), Fannie Mae (2019), and Milliman (2020).

[3] For example, BlackRock (2020) omitted transitions from 120+ day delinquencies to reperforming status. This omission may incorrectly predict what happens to some seriously delinquent loans as it does not allow for a seriously delinquent loan to be cured when the loan is given a modification.

FMAP v3.0 groups active loans into either performing, re-performing, or nonperforming loan segments to balance the granularity and reliable estimation of the transition equations. The segmentation is conditional on the delinquency or performance and modification status of loans. The portfolio, or simulation, date represents the first date upon which FMAP simulates loan transitions. Depending on the modification history, re-performing loans are further classified into either modified re-performing or non-modified re-performing loans.

The segmentation leads to seven loan states:

1. Performing (PER) loans: Loans neither 1) currently delinquent more than two months, 2) ever delinquent more than two months, nor 3) modified before the portfolio date.

2. Modified Re-performing loans (MRPL): There are two groups of modified re-performing loans. The first group of modified re-performing loans are neither i) currently delinquent more than two months nor ii) ever delinquent more than two months; but have been modified before the portfolio date. The second group of modified-reperforming loans are i) not currently delinquent more than two months, ii) have been delinquent at least three months before the portfolio date, iii) have not been delinquent at least three months since the portfolio date, and iv) have been modified before the portfolio date.

3. Non-Modified Re-performing loans (NRPL): Loans that are i) not currently delinquent more than two months, ii) have been delinquent at least three months in the past, albeit not since the portfolio date, and iii) have not been modified before the portfolio date.

4. Re-performing (RPL) loans: Loans not currently delinquent more than two months but have been delinquent at least three months since the portfolio date.[4]

5. Light delinquent (LDQ) loans: Loans 3 - 5 months delinquent, inclusive.

6. Seriously delinquent (SDQ) loans: Loans 6 - 11 months delinquent, inclusive.

7. Deeply delinquent (DDQ) loans: Loans 12+ months delinquent, inclusive.

PER loans are further classified by product types; namely, the FRM 30/40-year and 15/20-year product types as well as the ARM product type. The nine transition states comprise the same seven active states along with two termination states.[5] A termination state is a state from which a loan cannot transition such as:

8. Prepay loan (Prepay)

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[4] An RPL loan is a loan that transitions from one of the nonperforming states to the performing state in the simulation. In the simulation, a loan cannot transition to either modified or non-modified re-performing as FMAP v3.0 does not specify if the transition is due to a modification. Also, the only re-performing loans that exist at the start of the simulation are modified and non-modified re-performing loans.
[5] Separate models are also estimated by Enterprise.

9. Defaulted loan (Default)

FMAP v3.0 defines default as either real-estate owned (REO), foreclosure alternative (deed-in-lieu, pre-foreclosure sale, and third-party sale), or nonperforming loan sale.

The mutually exclusive nature of the seven loan states is presented in the schematic below:

Figure 2. Loan Status Schematic
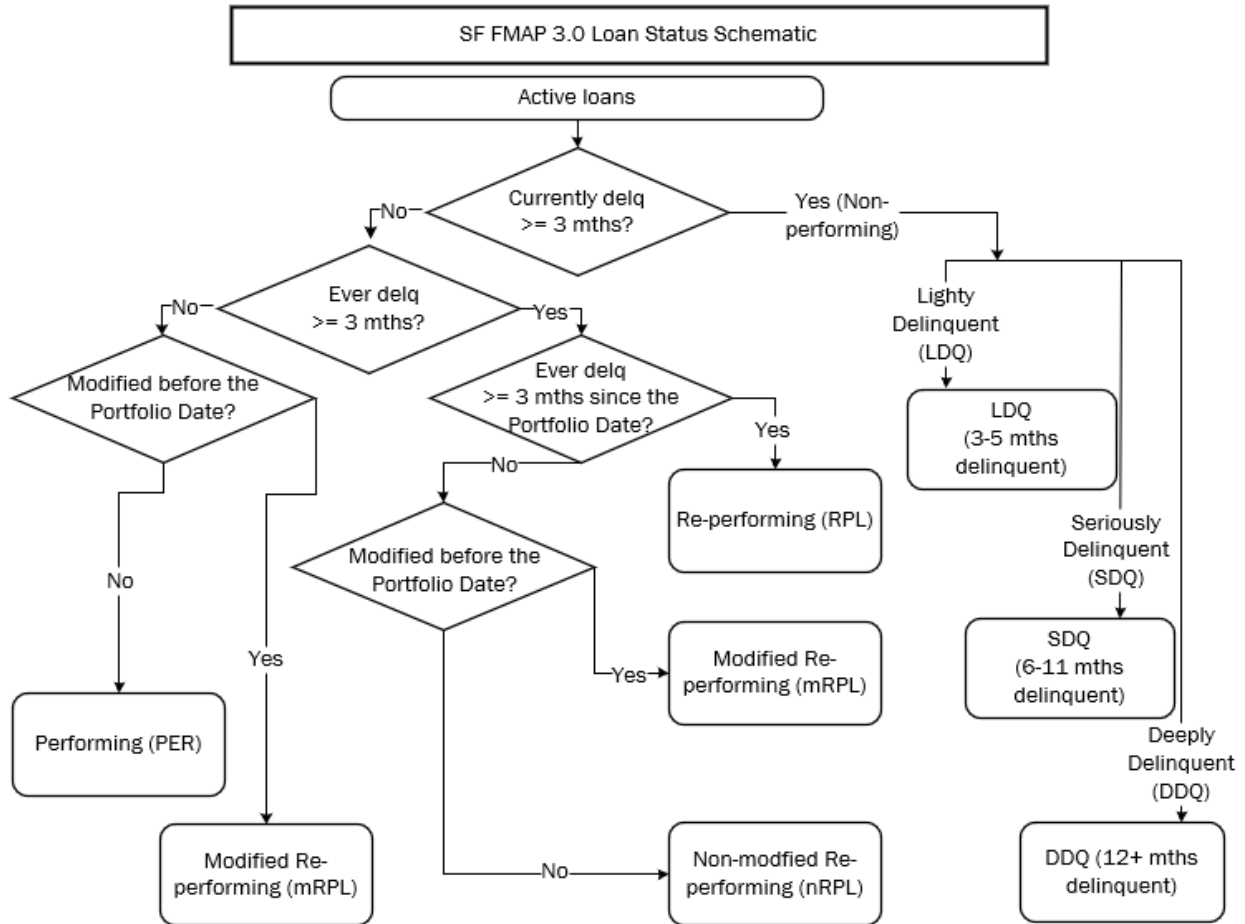
FMAP v3.0 reflects that some transitions are impossible. For example, a lightly delinquent loan is prohibited from transitioning to a performing state, though it can transition to a reperforming state.

The eligible transition states for each loan, conditional on the current state of a given loan, are given as follows:

Table 1. Transition Table

Current state (t)	Transition state (t+1)								
	PER	MRPL	NRPL	RPL	LDQ	SDQ	DDQ	Prepay	Default
PER	x				x			x	
MRPL		x			x			x	
NRPL			x		x			x	
RPL				x	x			x	
LDQ				x	x	x		x	x
SDQ				x	x	x	x	x	x
DDQ				x	x	x	x	x	x

To illustrate, consider the performing loan transitions. FMAP v3.0 selects a sample of performing loans from among all loans to inform the performing loan equations, which estimate the probability of transitioning to either one of the following three states: lightly delinquent, prepay, or remain performing. This same outcome distribution is adopted for each of the seven active states.

5.3   Model Specification

Borrower behavior may vary based on the current and subsequent transition states of a given loan. For example, a borrower with a fixed-rate, 30-year mortgage may face different economic incentives to refinance than a borrower with an adjustable-rate mortgage. Given the framework described in the previous section and to account for these different incentives, we allow the model specification to vary by segment type, current state, and transition state. This leaves us with the following nine sets of equations: six sets for performing loans and three sets for nonperforming loans:

1. Performing 30/40-year fixed-rate to either LDQ or Prepay: Predicts probability of transition for performing loans with fixed-rate, either 30- or 40-year mortgages to either LDQ or Prepay using separate equations for each outcome.

2. Performing 15/20-year fixed-rate to either LDQ or Prepay: Predicts probability of transition for performing loans with fixed-rate, either 15- or 20-year mortgages to either LDQ or Prepay using separate equations for each outcome.

3. Performing adjustable-rate to LDQ or Prepay: Predicts probability of transition for performing loans with adjustable-rate mortgages to either LDQ or Prepay using separate equations for each outcome.

4. mRPL to either LDQ or Prepay: Predicts probability of transition for all mRPLs to either LDQ or Prepay using separate equations for each outcome.

5. nRPL to either LDQ or Prepay: Predicts probability of transition for all nRPLs to either LDQ or Prepay using separate equations for each outcome.

6. RPL to either LDQ or Prepay: Predicts probability of transition for all RPLs to either LDQ or Prepay using separate equations for each outcome.

7. LDQ to either SDQ, RPL, Prepay, or Default: Predicts probability of transition for all currently LDQ loans to each outcome (SDQ, RPL, Prepay, or Default) with four separate equations.

8. SDQ to either LDQ, DDQ, RPL, Prepay, or Default: Predicts probability of transition for all currently SDQ loans to each outcome (LDQ, DDQ, RPL, Prepay, or Default) with five separate equations.

9. DDQ to either LDQ, SDQ, RPL, Prepay, or Default: Predicts probability of transition for all currently DDQ loans to each outcome (LDQ, SDQ, RPL, Prepay, or Default) with five separate equations.

Covariates assigned to each equation include two types of independent variables: (i) static loan characteristics such as loan purpose and (ii) dynamic loan characteristics such as age. Covariates are assigned to each specification using an iterative model building process that relied on out-of-time (OOT) fit.[6] The iterative process begins with a simple base model that contains few variables. Then variables were added iteratively and the OOT fit was checked with each iteration to ensure that every variable added improved OOT fit. OOT fit evaluations are used to assess whether a variable should be added to an equation since doing so improves the generalizability of the model on new mortgage loans, which is the primary objective of FMAP.

To produce OOT fits, the iterative process uses a sliding window for the estimation data and tests OOT fit on each year from 2006 to 2019, inclusive. The sliding window produces OOT fits as the estimation data used to fit for each relevant year is only from years prior. By using a sliding window FMAP v3.0 also minimizes the issue of having significantly older data for 2019 fit estimates versus 2006. For example, data from 2000 through 2006 is used to estimate OOT model fits for 2007, data from 2001 to 2007 is used to estimate OOT model fits for 2008 and so on. The output from this process is multiple OOT fit statistics for each year between 2006 and 2019 which allow for comparison of a base regression to a regression with either new or different variables. With this iterative process, FMAP efficiently searches for the optimal subset of covariates. Consistent with borrower behavior varying based on differences in either incentives or characteristics of their loans, the specifications chosen based on this iterative process are not the same for all segments and states.

This iterative process led to either variables included as standalone variables, interactions, polynomials, or splines. The nonlinearity effects of the continuous covariates on mortgage outcomes are captured through either spline or polynomial functions based on the model fit statistics. The number and location of spline knots were identified using a multivariate adaptive regression spline (MARS) technique. Interactions and polynomials of certain covariates are also based on model OOT fit statistics.

Covariate definitions are provided below. Not all covariates are used in every set of equations. Some equations use differently defined variables. The appendix contains a table presenting covariates included in each equation.

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[6] An out-of-time fit is a particular type of out-of-sample fit where the model predictions are tested on data outside of the sample the model was estimated on. Specifically, an out-of-time fit relies on testing the fit of predictions of a model on data that is from a different time period than the sample the model was estimated on.

Age

Age refers to the number of months since the first payment date, inclusive. FMAP v3.0 includes age (age), its square term (age_sq), and its cubic term (age_cb) in some behavioral equations[7]. FMAP v3.0 also constructs a set of age splines chosen by MARS to improve model fit in some equations.

Burnout

The burnout factor reflects missed refinanced opportunities over the life of the loan. Burnout count (brnt_cnt) represents the number of months of missed refinanced opportunities, where a refinance opportunity occurs whenever the prevailing PMMS (Primary Mortgage Market Survey) rate falls below the PMMS rate at origination by 50 basis points.

FMAP v3.0 includes burnout and its splines in the behavioral equations. The number and location of spline knots are selected based the optimal spline locations detected by MARS, given certain parameters.

Current Unpaid Principal Balance (UPB)

Current unpaid principal balance (cur_upb_k) is the outstanding principal balance at a given month. FMAP v3.0 also includes its square (cur_upb_k_sq) in the behavioral equations.

Current UPB to Origination UPB

The ratio of current UPB to original UPB captures the remaining percentage of the loan amount as a measure of the cost of default.

Additionally, FMAP v3.0 also includes the interaction term of current UPB to original UPB ratio with house price appreciation (HPA) percentage change lag 24 months (sunk_cost * HPA with lag).

Debt-to-Income Ratio (DTI)

DTI refers to the back-end ratio of the sum of the borrower's monthly payment for principal, interest, taxes, homeowners' association fees and insurance, plus all fixed debts to the total monthly income of all borrowers determined at origination.

DTI enters the FMAP v3.0 equations as either the value (debt_ratio) or splines chosen by MARS.

Documentation

Documentation is a flag (no_full_doc) for the loans without full documentation. These are low credit quality loans often acquired before 2008 that are more likely to default than full documentation loans.

House Price Index

HPI is the FHFA all-transaction house price index. HPI is at the metropolitan statistical area (MSA) level. If the MSA-level HPI value is missing, then the state-level HPI is used. If the MSA-level and state-level HPI are missing, then the national level HPI is used.

FMAP v3.0 uses the MSA-level HPI in two ways. First, the HPI is used to derive the mark-to-market loan-to-value (MTMLTV). Second, the HPI is used to capture house price percentage change. Specifically,

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[7] In the loss forecast, loan age in the behavioral equations is capped at 240 months to prevent the predicted probability from being unreasonably high.

FMAP v3.0 captures recent house price dynamics using the housing price appreciation over the last 24 months (hpa24).

IO Loan

IO loan is a flag (io_loan) for interest only loans.

Judicial State

A state legal structure indicator is included to control for variation in state foreclosure laws. In judicial foreclosure states, a lender is required to get a judgment against the borrower and a court order authorizing the sale of the property by an office of the court. The foreclosure timelines in judicial states are longer than non-judicial states. As such, it is necessary to control for the local legal structures when modeling delinquent loan outcomes.

The judicial state indicator (judicial_state) equals 1 when the loan is in a judicial state.

Jumbo Loan

Generally, the Enterprises are prohibited by law from purchasing single-family loans with an original principal balance above the prevailing conforming loan limit. A jumbo loan is a loan that exceeds the conforming loan limit. Jumbo loans may have tighter underwriting requirements, larger down payment requirements, and higher interest rates.

Jumbo loan (jumbo_loan) is an indicator equaling 1 when the loan is a jumbo loan in the NPL behavioral equations.

Junior Lien

A junior lien is a debt (HELOC or HELOAN) undertaken by a borrower who already has a primary mortgage. Loans with junior liens are potentially riskier than loans without a junior loan.

Junior lien is a flag (junior_lien) equaling 1 indicating the loan is for a mortgage with an attached junior lien.

Loan Purpose

Loan purpose reflects the borrower's stated reason for obtaining a mortgage, and is constructed as multiple indicator variables; namely, purchase-only (purchase), cash-out refinance (cashout), and rate/term refinance (raterefi). Purchase only is used as the base value and is omitted from the behavioral equations for identification purposes.

Mark-to-market Loan-to-value Ratio

The MTMLTV is the ratio of the prevailing unpaid principal balance to the current market value of the property. The current value market of the property is determined using the HPI.

FMAP v3.0 includes the MTMLTV field (mtmltv) and its splines. Additionally, an MTMLTV variable is created separately for cash-out (mtmltv_cashout) and for rate-refi loans (mtmltv_raterefi) which allows the specification to control for an interaction between these variables.

Months Until Interest Rate is Reset

For ARMs, the principal and interest payments may change once the initial fixed-rate period expires. This potential payment shock can increase the propensity of a borrower to refinance to either a lower interest rate shortly preceding or immediately after the initial fixed-rate period.

The number of months until the interest rate is reset (time_to_arm_reset) is specific to the ARM behavioral equations.

Occupancy Type

Occupancy type reflects the borrower's intended use of the property. Occupancy type is captured across multiple fields, with separate flags for whether the property is an investment property (investment), a second home (second_home), or a primary residence (primary_residence). 'Primary residence' serves as the base value and is omitted from the behavioral equations for identification purposes.

Origination Credit Score

Origination credit score intends to capture borrower(s) credit worthiness at origination.

FMAP v3.0 includes origination credit score (cred_score) and its square (cred_score_sq) term. Additionally, the behavioral equations also interact origination credit score only with an indicator for mortgages without co-borrowers (cred_score_one_borrower).

Origination LTV

The origination loan-to-value (LTV) ratio measures the amount of financing to acquire the home. The numerator of the ratio measures loan size at origination, while the denominator of the ratio measures the appraised value at origination.

FMAP v3.0 includes both the origination LTV (orig_ltv) field and a field defined as the origination LTV interacted with an indicator for mortgages with a junior lien (orig_ltv_junior_lien).

Product Type

Product type is defined by the amortization term of the loan at origination. The origination attribute includes the following product types: FRM 15/20-year, FRM 30/40-year, and all ARMs.

Unlike other fields, FMAP v3.0 does not include a product type field in the behavioral equations. Rather, as noted earlier, FMAP v3.0 develops separate behavioral equations for performing loans across the product types.

The exception is the treatment of product types in the NPL behavioral equations, which includes indicator fields for each product type.

Refi Boom - 2001-2003

The 2001-2003 refinance boom (refi_boom) field is a flag for the refinance boom period of 2001-2003. This variable aims to capture additional reasons individuals refinanced in record numbers during this period such as historically low interest rates and media coverage.

Refinance Incentive

Refinance incentive is defined as the level difference between the PMMS at origination and the PMMS in the current month. As the difference increases, the incentive for the borrower to refinance increases.

FMAP v3.0 uses the lag 2 months refi-incentive (refi_incentive_level_l2) and its splines in the behavioral equations. The number and location of spline knots are selected based on the optimal spline locations detected by MARS.

Sole Borrower

Sole borrower is a flag (one_borrower) for loans without a co-borrower. As described earlier, the behavioral equations also include an interaction (cred_score_one_borrower) of origination credit score and the sole borrower field.

Seasonality

Seasonality is represented by indicator fields for each of the 12 months (M1-M12) along with each of the four quarters (q1-q4). The month of December (M12) and the fourth quarter (q4) are omitted from the behavioral equations for identification purposes.

Spread at Origination (SATO)

The SATO covariate is defined as the difference between the mortgage rate at origination and the prevailing 30-year PMMS at origination. The SATO field aims to capture other unobservable credit-related factors in the transaction at origination.

FMAP v3.0 includes SATO for FRM 30-year mortgages (sato_f30).

Third-party Origination

A third-party origination is a loan in which a third-party participates in the origination for a lender. Third-party originators include both brokers and correspondent lenders.

Third-party origination is a flag (third_party) equaling 1 when the loan was originated by a third-party originator.

Unemployment Burnout Count

Unemployment burnout count is designed to help capture the survival bias in the unemployment coefficients. The field is defined as the number of times the unemployment rate in the MSA (or state if MSA is missing) in which the property is located exceeds a certain threshold since origination. FMAP v3.0 includes multiple fields to represent the unemployment burnout count, specifically the frequencies of the unemployment rate greater than 8% (brnt_cnt_8p), 10% (brnt_cnt_10p) or 12% (brnt_cnt_12p).

Unemployment Rate

The unemployment rate serves as a proxy for borrower(s) job loss and MSA-level macroeconomic activity. FMAP v3.0 incorporates either the unemployment rate (unemp_rate) or splines of the unemployment variable, depending upon the behavioral equations.

Vintage

Vintage refers to loan origination year. These vintage-specific fixed effects intend to capture time-varying features such as underwriting standards not captured by other fields in the behavioral equations.

FMAP v3.0 includes indicators for vintages 2005-2008 (vintage_05_08), 2009-2013 (vintage_09_13), and 2014 onward (vintage_ge_14) to capture vintage effects.

5.4   Sample and Methodology

Given the technological constraints on estimating models with the entire portfolios of loans from both Enterprises, FMAP v3.0 samples Fannie Mae and Freddie Mac loans to estimate separate behavioral equations for each Enterprise. The time period for the estimation sample reflects borrower and collateral information from January 2000 to December 2019.

In FMAP v2.0, the performing equations for 30-year and 15-year fixed-rate loans and adjustable-rate 5/1 loans were estimated on samples of loans originated from February 1997 to December 2014. Selected loans were followed from acquisition to either first 90-day delinquency, prepayment, or to December 2014, whichever occurred earliest.

FMAP v3.0 includes several changes to this sampling approach to increase the representativeness and usefulness of the samples. FMAP v3.0 randomly samples loans from each monthly portfolio of loan performance observations for loans with a given starting state. This sample is stratified by age, credit score, origination loan-to-value, and loan status. Different sampling rates were set for the different starting states to ensure a sufficient number of loans for estimation. Sampling rates are one percent for FRM 30/40-year and FRM 15/20-year 10 percent for arms, 50 percent for mRPL and nRPL, 25 percent for RPL, and 80 percent for LDQ, SDQ, and DDQ. For each month, this stratified random sampling method generates a sample of loans more representative of the true Fannie Mae and Freddie Mac portfolios of active loans.

5.5   Estimation and Results

Multiple statistical modeling approaches have been used to estimate borrower behavior. Jenkins (1995), Calhoun and Deng (2000), and Clapp et. al. (2001) demonstrate that the multinomial logit approach provides a relatively convenient method for modeling prepayment and delinquency risks as discrete time, competing risks.[8] The multinomial approach is also consistent with the approach adopted in the prior version of FMAP.

With the sampled data we estimate binomial and multinomial logistic regressions for each Enterprise separately.[9] Performing and reperforming equations are estimated using a binomial logistic regression (i.e., one vs. the rest scheme), which estimates the probability a certain transition against all other possible transitions. Taking as an example the performing equation there are three possible transitions: prepay, LDQ, and performing. When we estimate the prepay probability, we estimate the probability of prepaying vs the probability of [LDQ or performing]. Estimating the transition probabilities in this way can cause probabilities to sum greater than one. To combat this, we assume the probability of staying in

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[8] Discrete-time refers to the fact that borrower behavior is generally observed discretely such as monthly rather than at a more granular frequency more closely associated with continuous-time.

[9] Estimating binomial logits in place of multinomial logits follows Begg, Colin B. and Robert Gray. "Calculation of Polychotomous Logistic Regression Parameters Using Individualized Regression." Biometrika, 71, no. 1 (1984): 11-18. For computational expediency, multinomial logits were estimated in instances where all the models within the same multinomial framework contained the same set of regressors. For example, the nonperforming loan equations all contained the same regressors and hence were estimated within a single multinomial logit rather than across multiple binomial logits.

your starting state (i.e., performing to performing) is equal to one minus the probabilities of transitioning to other states. Nonperforming loan equations were estimated using multinomial logits.

The appendix includes an excel file with the estimation results for all specifications. For performing loans for each Enterprise, segment (e.g., fixed-rate 30-year or ARMs), and event (outcome state) has its own table. For nonperforming loans, each Enterprise and segment has its own table. As the behavioral equations are not focused on identifying why a loan changes state, these coefficients cannot be interpreted causally. Instead, these coefficients can only be used in jointly predicting the probability a loan changes state. Therefore, in reviewing the coefficients the focus should be on whether the sign of the coefficient is reasonable. As many of the variables are represented with polynomials, splines, or included in interactions, the signs on all relevant coefficients should be considered.

5.6   Model Performance Tracking Results

In this section, we show excerpts from the model performance tracking report, which compares forecasts to actuals for selected historical single-family loan portfolios. FMAP v3.0 includes two types of performance tracking reports to assess the behavioral equation performance. First, the Component Model Performance Tracking (cMPT) compares monthly predicted transition rates with actual transition rates for each behavioral equation. Second, the Integrated Model Performance Tracking (iMPT) compares predicted loan termination rates, i.e., default and prepay rates with the actual termination rates on past portfolios.

5.6.1   Component Model Performance Tracking Report (cMPT)

The Component Model Performance Tracking (cMPT) report monitors the performance for all 29 behavioral models. The cMPT is performed for the 201606 portfolio with forecast until 202003. Below is the sample report for LDQ and prepay equations for PERF FRM 30yr and PERF FRM 15yr products. The AUC statistics show the model fit for these four equations is reasonable.

Figure 3. Example of Performance Tracking, Fixed-rate Mortgage 30-year and 15-year, LDQ and Prepay
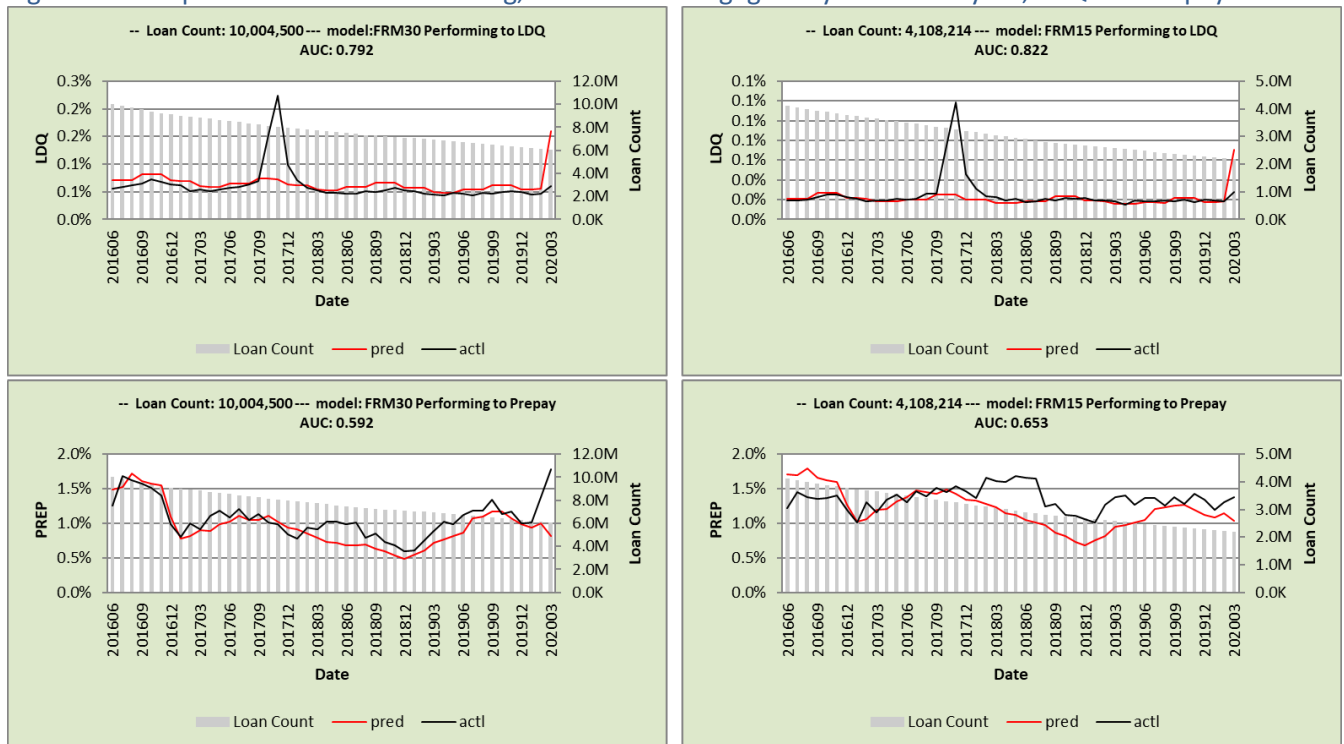
5.6.2   Integrated Model Performance Tracking Report

Each MPT report contains approximately 70 graphs designed to assess varying views of model performance. For brevity, in this document we will focus only on select results aggregated at the activity date level for the single-month mortality (SMM), monthly default rate (MDR), Cumulative Prepay, and Cumulative Default metrics. All additional graphs can be found linked in the appendix. To gauge the forecast capabilities of FMAP v3.0, MPT reports for two different portfolios were created: June 2014 and December 2016. Results will be shown in this order.

The table below summarizes results for the four metrics across the two portfolios. As shown in this table, we see model performance is similar between the two Enterprises as can be seen by the similar average errors between the two Enterprises. Additionally, we can see that, as expected, the in-time performance is slightly better than the out-of-time performance, though the difference is minimal.

The first two figures below show the results from the June 2014 MPT reports for Enterprise 1 and Enterprise 2, respectively. These graphs yield several observations. First, fit results by Enterprise are similar, this indicates forecast capability is similar for both Enterprises. Second, the in-time and out-of-time results (out-of-time results use coefficients estimated on data from 2000 to May 2014) are close. The similarity in results indicate minimal over-fitting in the final specification, and that the out-of-time iterative model building worked as intended. For prepayment, ignoring the pandemic as illustrated by the red vertical line, SMM shows the predicted prepayments follow the general shape of the actual prepayments. However, there is some overprediction in the first year and a half (June 2014 to December 2016) of the forecast, though this overprediction is decreased after the large prepayment decrease of December 2016. Looking at the pandemic we see that FMAP v3.0 predicts a large and steep increase in

prepayments. However, the magnitude is slightly lacking as both Enterprises show an approximate 0.75 percent under prediction in late 2020. It should be noted that FMAP v3.0 excludes COVID-specific treatments or variables. Additionally, the sample used to create FMAP v3.0 finishes at the end of 2019 and therefore includes no pandemic information.

The MDR graph is more difficult to read due to the "spiky" nature of the default data. These spikes represent NPL loan sales, which refer to large loan sales made at the discretion of the Enterprises. Therefore, their exact timing is difficult to model. Looking past the spikes we see FMAP v3.0 predictions seem to be following the general downward trend of actual defaults over the forecast period. We see the cumulative default graphs that FMAP v3.0 slightly underestimates the number of defaults. Similarly, for the prepay results we can see that for the pandemic FMAP v3.0 correctly estimates a decrease in defaults, though the magnitude of the predicted decrease is slightly less than the actual decrease.

The third and fourth figures below show the results from the December 2016 MPT report for Enterprise 1 and Enterprises 2, respectively. The FMAP v3.0 OOT results are based on coefficients estimated on data from 2000 through 2014. Similarly, to the June 2014 MPT, FMAP 3.0 very accurately forecasts the December 2016 portfolio. The estimated prepay rates very closely match the actual prepay rates with only slight overpredictions for both enterprises. There is slightly more variation in the accuracy of default forecasts, the forecast for Enterprise #2 is very close, with an MAE of 0.0205% and slightly under the actual, while the forecast for Enterprise #1 is slightly worse with an MAE of 0.0343% and over the actual default rate. The error in forecast for Enterprise #1 seems to be a result of a large NPL sale that occurred mid 2018 as can be seen by a large spike in defaults in figure 6 subgraph: Cumulative Default Amt % for act_dte.

Table 2. Summary MPT Results for the June 2014, and December 2016 Portfolios*

| | June 2014 MPT | | | |
| | Enterprise 1 | | Enterprise 2 | |
Metric	**3.0 OOT MAE**	**3.0 IT MAE**	**3.0 OOT MAE**	**3.0 IT MAE**
SMM	0.2593%	0.2139%	0.2362%	0.2196%
MDR	0.0169%	0.0188%	0.0152%	0.0087%
Cumulative Prepay	3.5047%	3.2212%	2.4372%	2.5721%
Cumulative Default	0.1350%	0.1093%	0.1391%	0.1370%

| | December 2016 MPT | | | |
| | Enterprise 1 | | Enterprise 2 | |
Metric	**3.0 OOT MAE**	**3.0 IT MAE**	**3.0 OOT MAE**	**3.0 IT MAE**
Cumulative Prepay	0.7743%	1.2909%	0.9047%	1.9370%
Cumulative Default	0.0343%	0.0466%	0.0205%	0.0113%

*OOT refers to out-of-time results use coefficients estimated on data from 2000 to May 2014. IT refers to in-time results use final coefficients estimated.

Figure 4. June 2014 Portfolio MPT – Enterprise 1
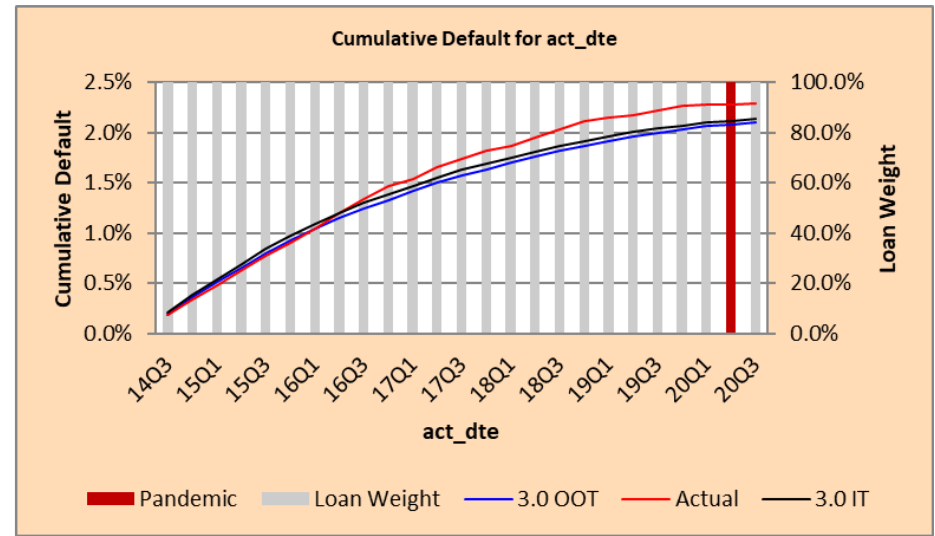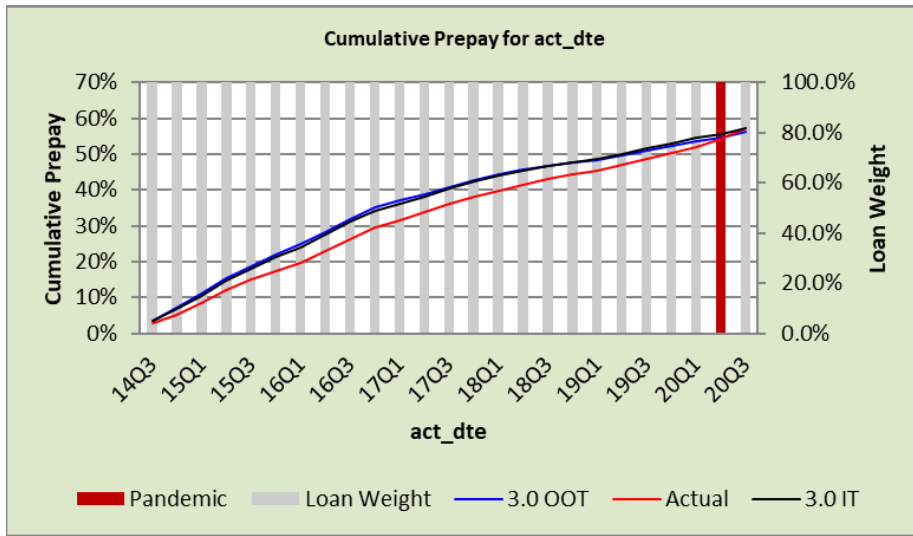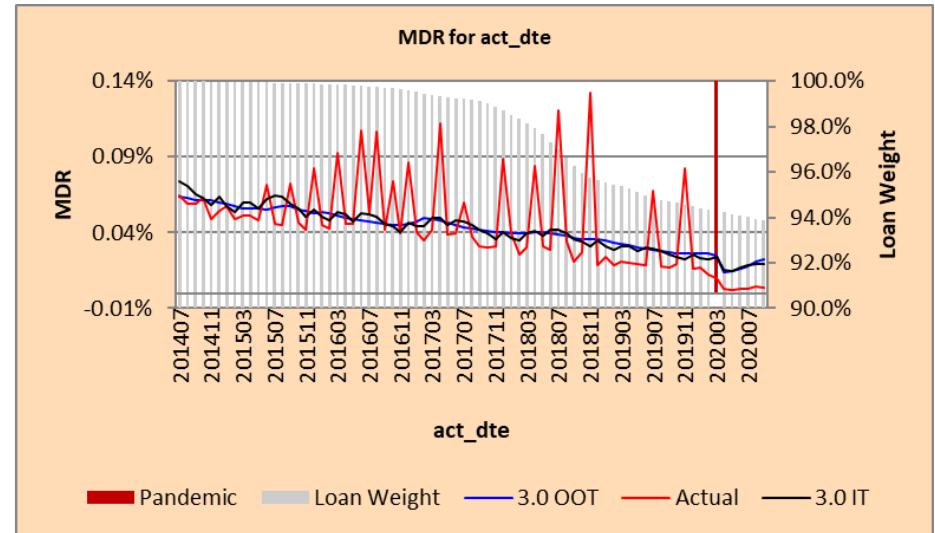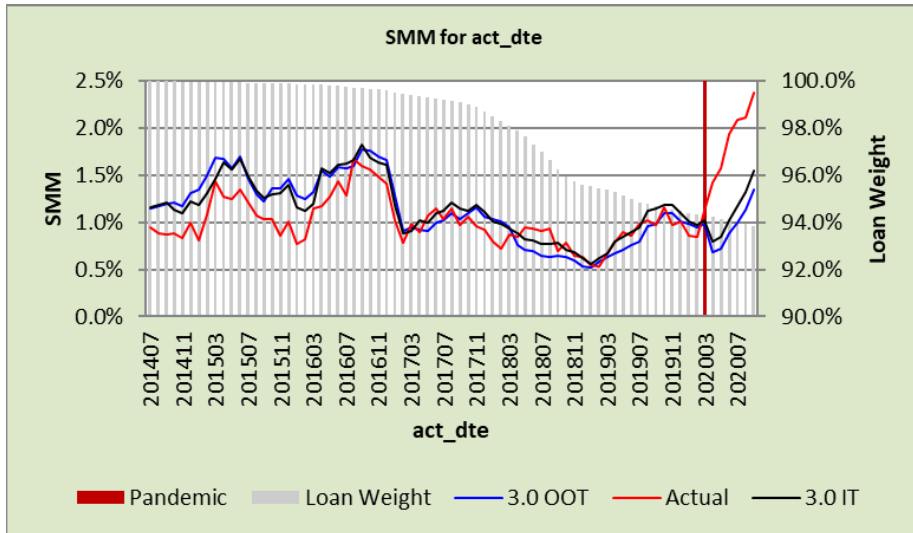
Figure 5. June 2014 Portfolio MPT – Enterprise 2
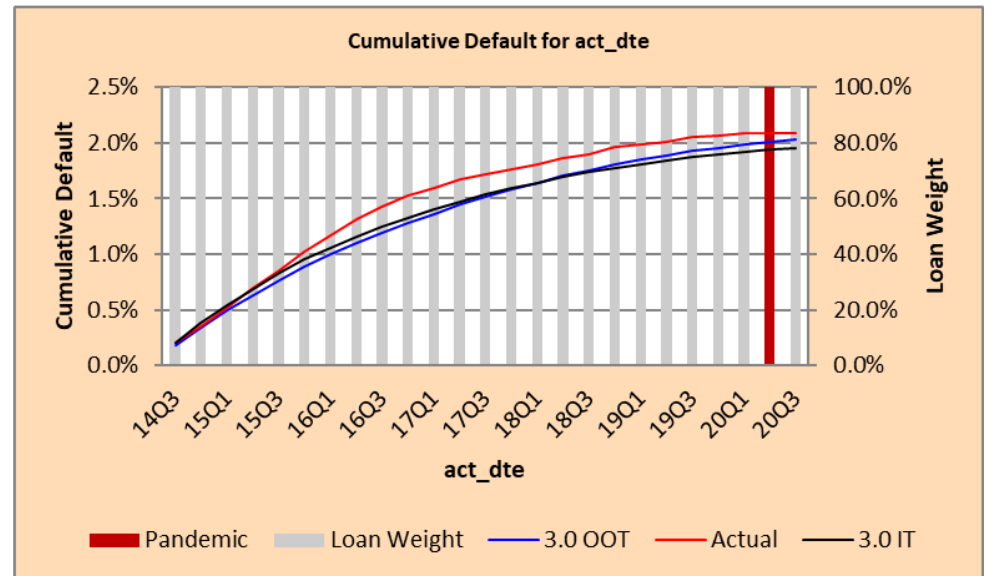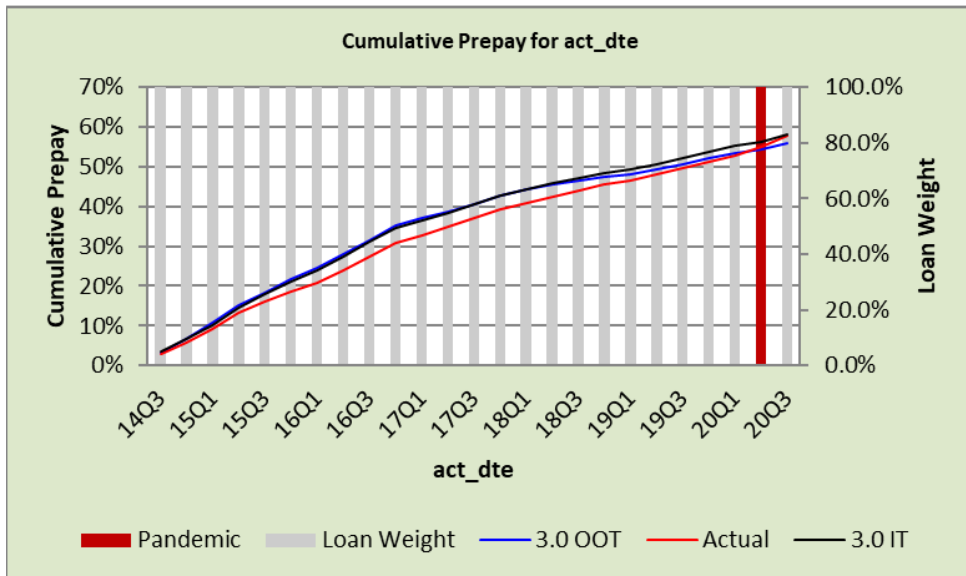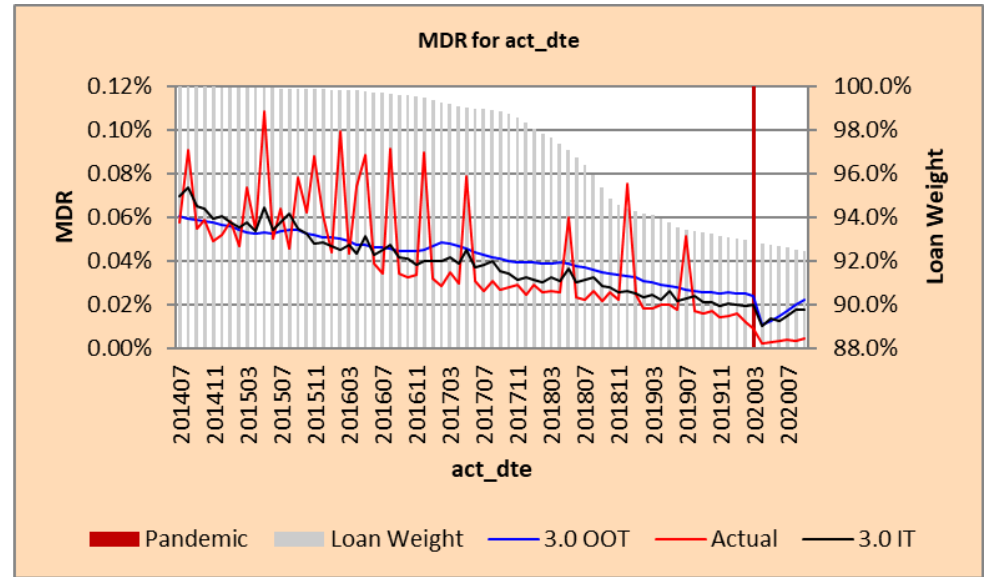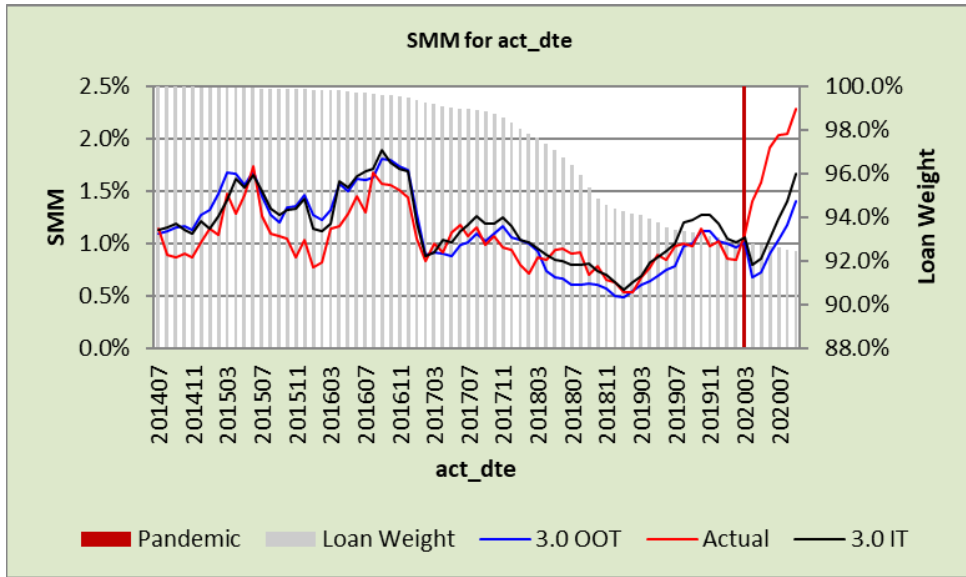
Figure 6. December 2016 Portfolio MPT – Enterprise 1
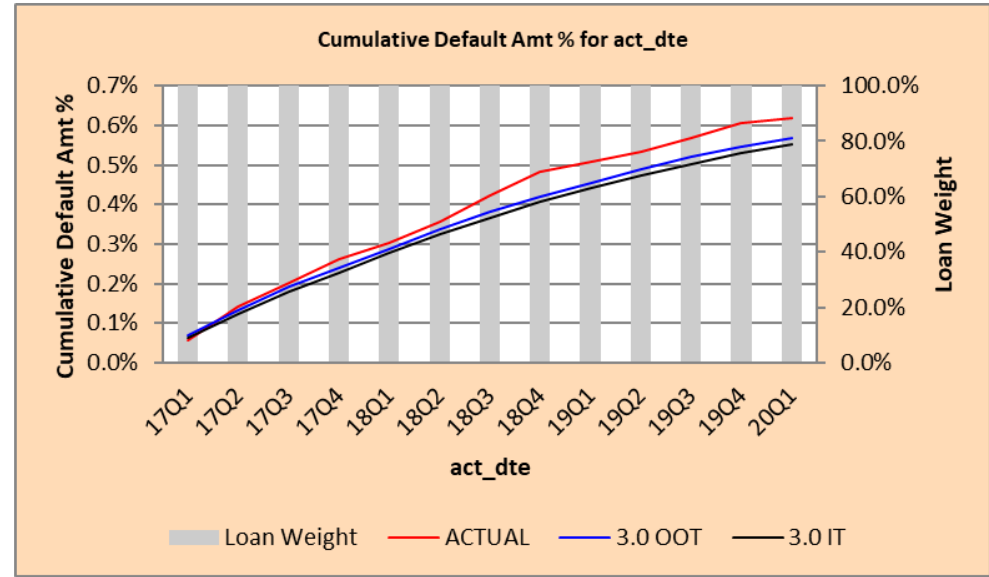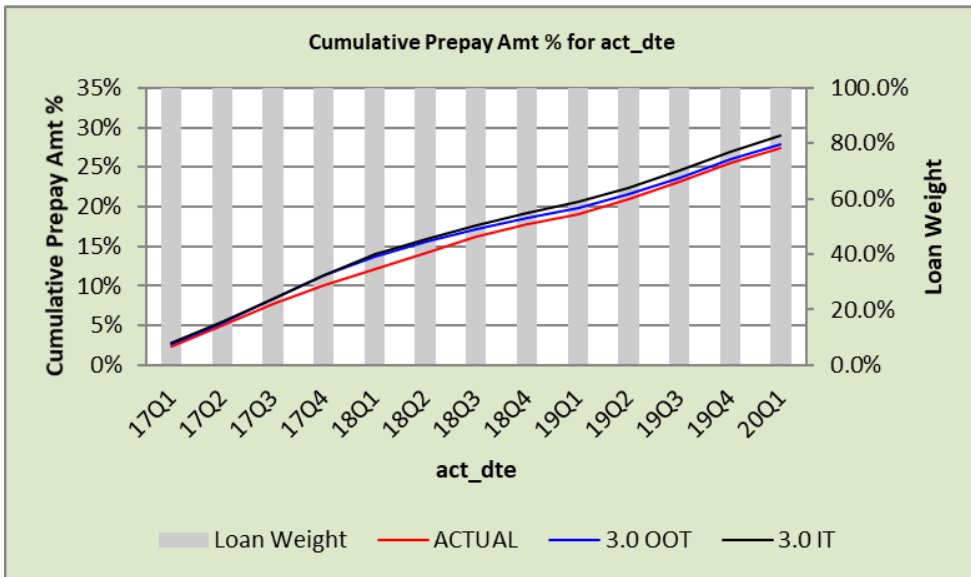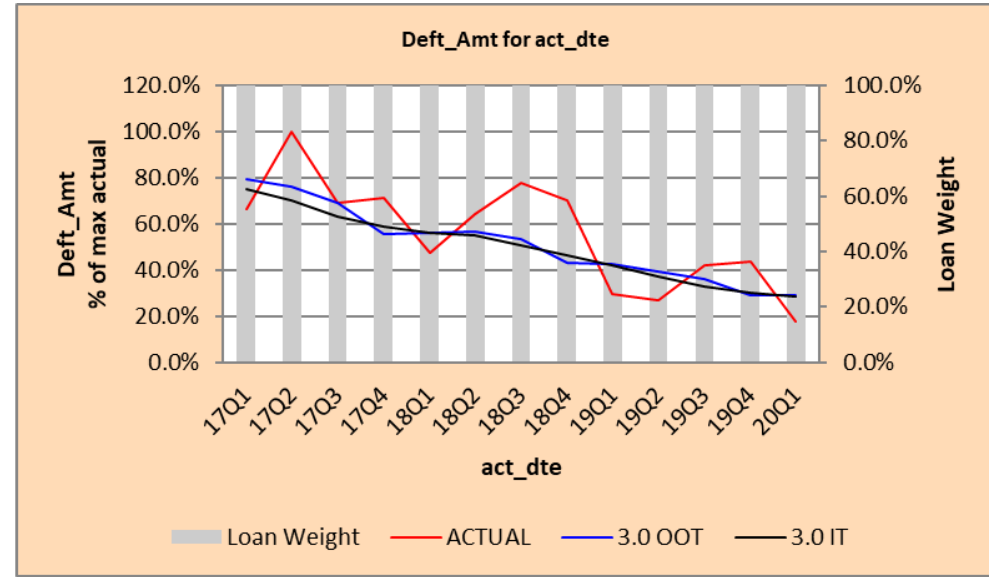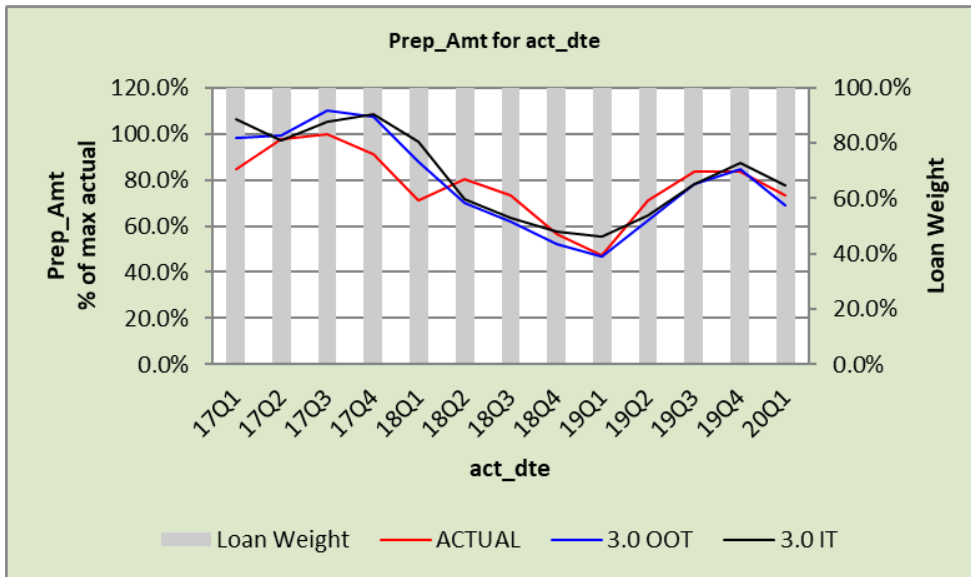
Figure 7. December 2016 Portfolio MPT – Enterprise 2
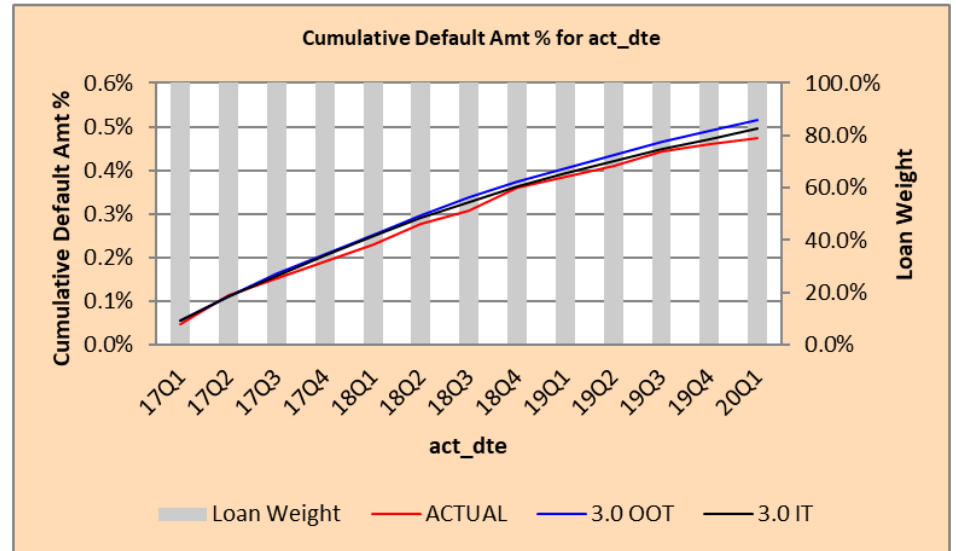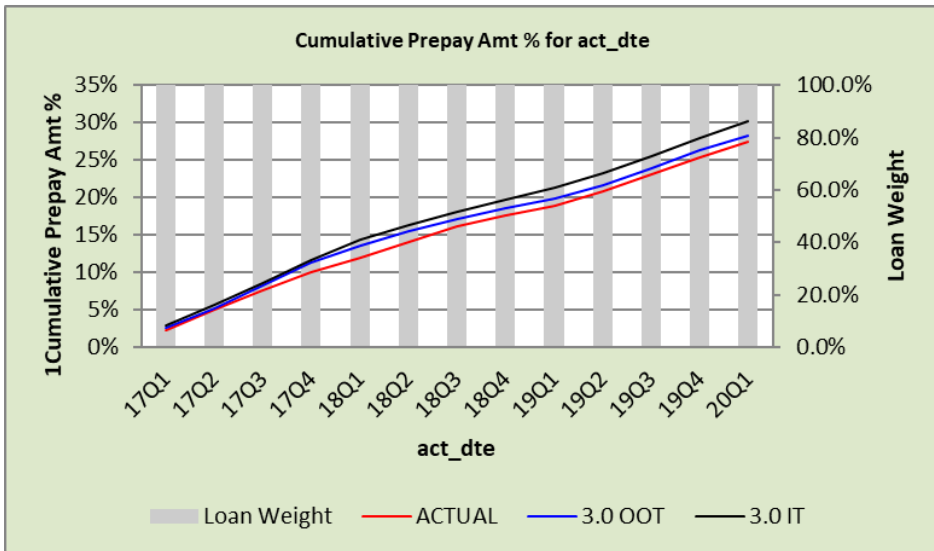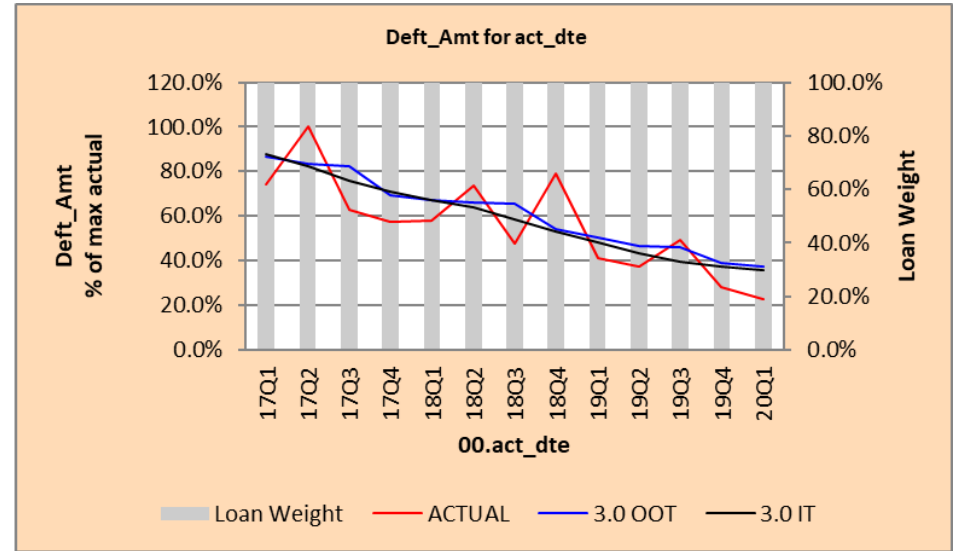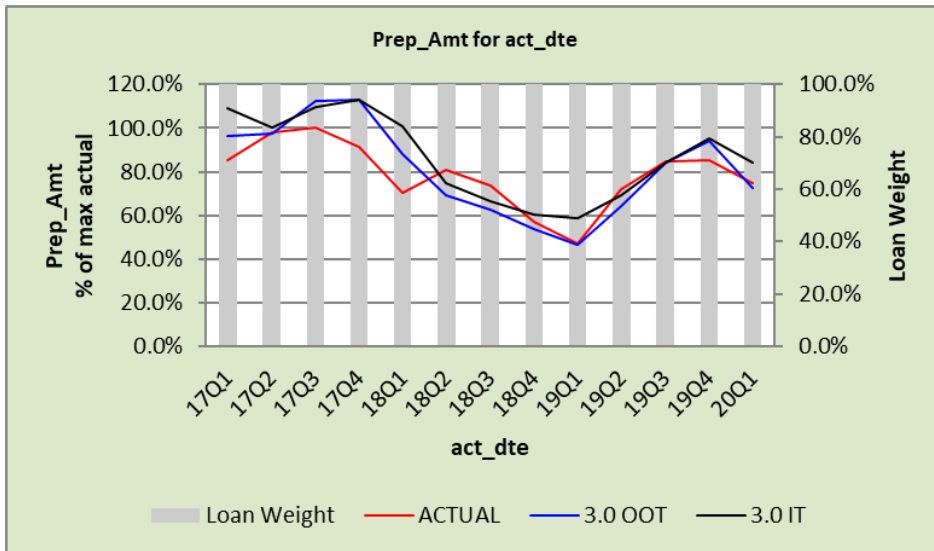
6   Loss Severity Models Module

6.1   Overview

Loss severity models predict credit loss on defaulted loans. These models are either statistical or relational equations that vary across the Enterprises and other dimensions. The historical data used to estimate the loss severity models include borrower and collateral characteristics, payments and receipts for troubled loans and REOs data, along with house price data.

6.2   Framework Specification

Loans predicted to default will transition into the loss severity module, which calculates credit loss. Credit loss can result from one of three outcomes: foreclosure, foreclosure alternative, and nonperforming loan sale. [10],[11]

Foreclosure transfers property title from the borrower to the lender. The lender in this analysis is one of the two Enterprises. Once transferred, the Enterprise owns the property, which becomes REO. The Enterprises can then market and sell the property to a new owner. The final credit loss on the loan is calculated after the property is sold from REO inventory.

Foreclosure alternatives is an alternative outcome for a defaulted loan. Foreclosure alternatives consist of three major types: deed-in-lieu, pre-foreclosure sale (short sale), and third-party sale. Deed-in-lieu occurs when the lender (in this case one of the Enterprises) forgives the mortgage debt and takes title to the property. In this case, the property becomes REO and the lender can sell it to recoup credit loss. Another foreclosure alternative is a pre-foreclosure sale. This occurs when the lender agrees to allow the borrower to sell the property for less than the outstanding mortgage debt (sometimes called a short sale) and the lender forgives the mortgage debt. Another foreclosure alternative is a third-party sale. This occurs when a third party buys the property for the outstanding loan balance and expenses at the foreclosure sale. The credit loss is recognized at the completion of the foreclosure sale. The pre-foreclosure sale and third-party sale do not result in the Enterprises owning the property. Consequently, there are no expenses after the completion of the sale.

The last potential outcome is a nonperforming loan (NPL) sale[12], which occurs when an Enterprise sells a defaulted mortgage within a pool of mortgages to an investor. The investor who purchases the pool of mortgages receives cash flows from the mortgages. Credit loss from a nonperforming loan sale equal the

---

[10] FMAP v3.0 omits repurchase and RPL sales as terminal outcomes.

[11] The behavioral equations do not allocate loans across the three outcomes separately. Hence, for loss severity the amount of a loan predicted to be defaulted is divided into three portions associated with the three default outcomes using the following percentages:

Judicial State	REO	Foreclosure Alternative	NPL Sale
TRUE	48%	26%	26%
FALSE	50%	32%	18%

[12] Nonperforming loan (NPL) sales have been used by the Enterprises to sell severely delinquent mortgages from their portfolios. This reduces the losses to the Enterprises. A particular group of servicers are approved to participate in NPL sales with the stipulation they will work out the loans once purchased.

unpaid principal balance plus transaction costs minus expected sale price for the mortgage. This outcome is new in FMAP v3.0.

6.3   Data

The models that make up the loss severity module are estimated separately for Fannie Mae and Freddie Mac using the Enterprises' data of borrower and collateral characteristics and payments and receipts for troubled loans and REOs and the Enterprises purchase only HPI data from 2012 to 2020.

6.4   Credit Losses

For REO dispositions, four components comprise credit losses: 1) the charge-off amount at the title transfer date (for a foreclosure outcome, the title transfer date is foreclosure completion date for REO and all other foreclosure alternative outcomes this is liquidation date), 2) sale price adjustment, 3) carrying costs and accrued interest, and 4) fixed costs. Details on each are provided below:

- Charge-off occurs at foreclosure completion. It equals the unpaid principal balance of the mortgage at the time of default (defaulted UPB) plus any relevant expenses up to the foreclosure date minus predicted sale price at the foreclosure date.

- Sale price adjustment occurs monthly from foreclosure completion to REO property disposition. This monthly adjustment is calculated as the difference between the expected sale price every month and the expected sale price at foreclosure completion. These monthly adjustments end when the property is disposed of from REO inventory. The sum of these monthly adjustments equals the entire sale price adjustment from foreclosure completion date to REO property disposition date.

- Carrying costs are calculated from foreclosure completion to REO property disposition and include taxes, insurance, and homeowner association (HOA) fees from foreclosure completion to REO property disposition. Accrued interest is calculated from last paid installment to foreclosure completion and is included in carrying costs for that period.

- Fixed costs are calculated from foreclosure completion to REO property disposition and include certain liquidation expenses and fees plus utility and repair costs, etc.

For non-REO dispositions, the credit losses are limited to the charge-off amount.

Below are the formulas to calculate the credit loss for each outcome.

$$
\begin{aligned}
Credit\ loss_i &= Charge-off_i \\
&+ Sale\ price\ adjustment\ from\ foreclosure\ completion\ to\ REO\ property\ disposition_i \\
&+ Carrying\ costs\ including\ accrued\ interest\ from\ foreclosure\ completion\ to\ REO\ property\ disposition_i \\
&+ Fixed\ costs\ from\ foreclosure\ completion\ to\ REO\ property\ disposition_i
\end{aligned}
$$

$$\forall\ i \in REO$$

$$Credit\ loss_i = Charge-off_i$$

$$\forall\ i \in Foreclosure\ alternatives, NPL\ sales$$

6.5 Charge-off Amounts

For each outcome, the formulas below calculate the charge-off amount, which is equal to the unpaid principal balance at the time of default (defaulted UPB) minus expected net sales proceeds on the liquidation (foreclosure) date plus any relevant expenses up to liquidation (foreclosure) date including Carrying costs from LPI to liquidation date.

$$Charge-off_i = Defaulted\ unpaid\ principal\ balance_i$$
$$- Expected\ net\ sale\ proceeds\ at\ liquidation\ date_i$$
$$+ Carrying\ costs\ including\ accrued\ interest\ from\ LPI\ to\ liquidation\ date_i$$
$$+ Fixed\ costs\ from\ LPI\ to\ liquidation\ date_i$$

$$\forall\ i \in REO, Foreclosure\ alternatives$$

$$Charge-off_i = Defaulted\ unpaid\ principal\ balance_i$$
$$- Expected\ NPL\ sale\ proceeds\ at\ liquidation\ date_i$$
$$+ Carrying\ costs\ including\ accrued\ interest\ from\ LPI\ to\ liquidation\ date_i$$
$$+ Transaction\ costs\ from\ LPI\ to\ liquidation\ date_i$$

$$\forall\ i \in NPL\ sales$$

6.5.1 Expected Net Sales Proceeds for REO and Foreclosure Alternatives

Net sale proceeds are the difference between gross property sale proceeds and other relevant expenses, which include sales and other selling expenses, broker fees and borrower closing costs. The expected net sale proceeds for REO and foreclosure alternatives used to calculate charge-offs are estimated using a piecewise linear regression technique with a separate model for each state and disposition type. The technique relates historical actual net sale proceeds with the mark-to-market property value at the time of disposition for properties collateralizing Enterprise loans liquidated between 2012 and 2020. [13] Specifically, the technique captures the relationship between a defaulted loan i of the actual net sale proceeds ($Net\ Sale\ Proceeds_i$) against the mark-to-market property value ($PropValue_i$) with a truncated power function series for each state defined as follows:

$$Net\ Sale\ Proceeds_i$$
$$= \beta_0 + \beta_1 * (PropValue_i) + \beta_2 * (PropValue_i - k_1)_+ + \beta_3 * (PropValue_i - k_2)_+$$
$$+ \beta_4 * (PropValue_i - k_3)_+ + \beta_5 * (PropValue_i - k_4)_+ + \varepsilon_i$$

$$\forall\ i \in REO\ and\ Foreclosure\ alternatives$$

where

$$\left(PropValue_i - k_p\right)_+ = \begin{cases} 0, & PropValue_i < k_p \\ PropValue_i - k_p, & PropValue_i \geq k_p \end{cases}$$

p = 1 to 4

---

[13] The time of disposition equates to REO property disposition for REO resolutions, and the time of disposition equates to the title transfer for foreclosure alternatives.

$$PropValue_i = \left(\frac{Original\ UPB_i}{Original\ LTV_i}\right) * \left(\frac{HPI\ at\ Disposition_i}{HPI\ at\ Origination_i}\right)$$

$$k_p = Spline\ knots\ located\ at\ the\ 20th, 40th, 60th, and\ 80th\ percentiles\ of\ PropValue_i$$

6.5.2 Expected NPL Sale Proceeds (Recovery Rate)

NPL sale proceeds are equal to the note sale proceeds minus other relevant expenses, which include sales and other selling expenses, broker fees and borrower closing costs.

$NPL\ Sale\ Proceeds_i$
$$\begin{aligned}
&= \beta_0 + \beta_{11} * (MTMLTV_i) + \beta_{12} * (MTMLTV_i - k_1)_+ + \beta_{13} * (MTMLTV_i - k_2)_+ + \beta_{14} \\
&\quad * (MTMLTV_i - k_3)_+ + \beta_{21} * \left(Liq_{UPB_i}\right) + \beta_{22} * \left(Liq_{UPB_i} - k_1\right)_+ + \beta_{23} \\
&\quad * \left(Liq_{UPB_i} - k_2\right)_+ + \beta_{24} * \left(Liq_{UPB_i} - k_3\right)_+ + \beta_{31} * \left(Delinq_{Pmts_i}\right) + \beta_{32} \\
&\quad * \left(Delinq_{Pmts_i} - k_1\right)_+ + \beta_{33} * \left(Delinq_{Pmts_i} - k_2\right)_+ + \beta_{34} * \left(Delinq_{Pmts_i} - k_3\right)_+ \\
&\quad + liquidation\ year\ dummies + \varepsilon_i
\end{aligned}$$

$$\forall\ i \in NPL\ sales$$

where

$$(MTMLTV_i - k_m)_+ = \begin{cases} 0, & MTMLTV_i < k_m \\ MTMLTV_i - k_m, & MTMLTV_i \geq k_m \end{cases}, \text{m = 1 to 3}$$

$$(Liq_{UPB_i} - k_l)_+ = \begin{cases} 0, & Liq_{UPB_i} < k_l \\ Liq_{UPB_i} - k_l, & Liq_{UPB_i} \geq k_l \end{cases}, \text{l = 1 to 3}$$

$$\left(Delinq_{Pmts_i} - k_d\right)_+ = \begin{cases} 0, & Delinq_{Pmts_i} < k_d \\ Delinq_{Pmts_i} - k_d, & Delinq_{Pmts_i} \geq k_d \end{cases}, \text{d= 1 to 3}$$

$$k_m = Spline\ knots\ located\ the\ 25th, 50th, and\ 75th\ percentiles\ of\ MTMLTV_i$$

$$k_l = Spline\ knots\ located\ the\ 25th, 50th, and\ 75th\ percentiles\ of\ Liq_{UPB_i}$$

$$k_d = Spline\ knots\ located\ at\ the\ 25th, 50th, and\ 75th\ percentiles\ of\ Delinq_{Pmts_i}$$

We divide the NPL sale proceeds by liquidation UPB to get the recovery rates, which are defined as follows:

$$\begin{aligned}
Expected\ NPL\ sale\ proceeds_i &= Recovery\ rate_i * Liquidated\ UPB \\
&= \frac{Net\ sale\ proceeds\ from\ loan\ sale_i}{Liqidation\ UPB_i}
\end{aligned}$$

Expected NPL sale proceeds apply only to NPL sales.

The expected NPL sale proceeds used to calculate charge-offs are estimated using a piecewise linear regression model, which relates historical actual NPL sale proceeds with MTMLTV at liquidation date, liquidation unpaid principal balance, number of delinquency payments, and liquidation year. These variables were chosen to approximate factors rationale buyers would use to determine the price of a loan in an NPL sale package. Specifically, the piecewise linear regression model captures the relationship

between a defaulted loan *i* of the actual NPL sale proceeds ($Actual\ NPL\ Sale\ Proceeds_i$) against the MTMLTV ($MTMLTV_i$), liquidation unpaid principal balance (Liq_{UPB_i}), delinquent payments ($Delinq_{Pmts_i}$), with a truncated power function series and with separate liquidation year indicator variables ($liq_{year2015}, liq_{year2016}, etc$). See the appendix for details. Additional details are provided as follows:

- The MTMLTV is calculated using the internal FHFA seasonally adjusted purchase-only house price index at the MSA level. If the MSA is missing, the desired value is replaced with the state value of the internal FHFA purchase-only house price index.

- A set of liquidation year dummies are created. Both Fannie Mae and Freddie Mac regressions set the 2019 and beyond liquidation year coefficient as the base liquidation year. The spans of years are from 2015 to 2019 for Fannie Mae and from 2014 to 2019 for Freddie Mac. Fannie Mae started NPL sales in 2015, while Freddie Mac started its NPL sales program in 2014. So, the regression for Fannie has no 2014 dummy.

- Number of delinquent payments refers to the missing payments from LPI to the liquidation date.

Coefficients are combined with the MTMLTV, liquidation unpaid principal balance, delinquency payments, and liquidation year of the defaulted loan to generate expected NPL sale proceeds.

6.5.3   Carrying Costs
While the carrying costs are identical across disposition types, the way they are aggregated when defining charge-offs differs by disposition type. Specifically, for REO dispositions, these expenses are accumulated between last paid installment date and foreclosure completion date. These expenses for both foreclosure alternatives and NPL sales are accumulated from last paid installment date to title transfer date (liquidation date) and are included in the charge-off amount.

Carrying costs included HOA fees, property tax, insurance, and accrued interest. Accrued interest included in the charge off amount for REO, foreclosure alternatives and Nonperforming Loan Sales is calculated by multiplying the defaulted unpaid loan balance by the interest rate multiplied by the time from last paid installment data to title transfer (liquidation date).

For REO properties, carrying costs also occur during the time from foreclosure completion to REO disposition.

Carrying costs used to calculate charge-offs are estimated using the look-up tables approach. First, carrying costs are calculated at the loan level for all defaulted loans from 2012 to 2020. Second, the defaulted loans are matched to categories uniquely defined by the combination of the property value at origination group, the state in which the property is located, and the disposition type. See the appendix for the carrying cost equations and the property value at origination groups.

6.5.4   Fixed Costs for REO or Foreclosure Alternative
Fixed costs are calculated from last payment date to foreclosure completion date and include appraisal fees, attorney and trustee fees, other foreclosure expenses, other liquidation expenses, maintenance expenses, property inspection, repairs, and utilities. These costs were estimated using a piecewise linear

regression technique with a separate model for each state and disposition type (REO and foreclosure alternatives which comprise deed-in-lieu, short sales and third-party sales). This estimation used Enterprise liquidations from 2016–2020. We didn't use the data from 2012 to 2015 in the estimation, as fixed costs seemed to have experienced regime switching and jumped to a much higher level after 2016. Fixed costs components are calculated using the same formula for the two disposition types. The formula is given as follows:

$$Fixed\ cost_i = Appraisal\ fees_i + Attorney\ and\ trustee\ fees_i + Other\ foreclosure\ expenses_i \\ + Other\ liquidiation\ expenses_i + Maintenance\ expenses_i \\ + Property\ inspection_i + Repairs_i + Utilities_i$$

$$\forall\ i \in REO, Foreclosure\ alternatives$$

The regression equation is as follows:

$$\frac{Fixed\ costs_i}{Liq\_UPB_i} * 100$$
$$= \beta_0 + \beta_1 * Liq\_UPB_i + \beta_2 * \left(Liq_{UPB_i} - k_1\right)_+ + \beta_3 * \left(Liq_{UPB_i} - k_2\right)_+ + \beta_4 \\ * \left(Liq_{UPB_i} - k_3\right)_+ + \beta_5 * (Liq\_UPB_i - k_4) + \varepsilon_i$$

$$\forall\ i \in REO, Foreclosure\ alternatives$$

where

$$(Liq_{UPB_i} - k_l)_+ = \begin{cases} 0, & Liq_{UPB_i} < k_l \\ Liq_{UPB_i} - k_l, & Liq_{UPB_i} \geq k_l \end{cases}, l = 1\ to\ 4$$

$k_i = Spline\ knots\ located\ the\ 25th, 50th, and\ 75th\ percentiles\ of\ the\ liquidation\ UPB\ amount_i$

The variables k1 to k4 are 20%, 40%, 60% and 80% percentiles of the liquidation UPB amount, respectively.

We use the same specification for the two disposition types. But the equations are estimated separately for each disposition and for Enterprise 1 and Enterprise 2 separately

Even though both disposition types use the same regression equation above to produce the predicted fixed cost ratios, FMAP v3.0 omits maintenance expense from the definition of total fixed cost for REOs before estimating the regression for REO loans. As a result, the coefficients reflect estimated fixed costs without maintenance expense. To compensate for the omission of maintenance expense in the regression, FMAP v3.0 adds monthly HOA, insurance fees as well as taxes between last paid installment dates and liquidation dates (charge-off dates) to get the predicted total fixed cost ratios for REOs that includes maintenance expense.

Additionally, FMAP v3.0 assumes that the REOs maintenance expenses occur between charge-off date and REO disposition date.

6.5.5 Transaction Costs for an NPL Sale

Transaction costs (also known as fixed costs or liquidation expenses) for an NPL sale, also known as liquidation expenses, include all expenses associated with an NPL sale such as appraisal fees and attorney and trustee fees. Excluded from transaction costs for a NPL sale are aggregated expenses

incurred by the Enterprises to execute the NPL sales. These expenses may include incentives to brokers to facilitate transactions and website maintenance where investors can obtain information regarding the loans offered in the note sale pool.

Transaction costs for an NPL sale used to calculate charge-offs are estimated using look-up tables. First, the transaction costs for an NPL sale are calculated at the loan level for all defaulted loans from 2014 to 2020. Second, the defaulted loans are matched to categories uniquely defined by the combination of the Enterprise, liquidated unpaid principal balance group, and the judicial status of the state in which the property is located.

$$
\begin{aligned}
Transaction\ Costs_i \\
= Appraisal\ fees_i + Attorney\ and\ trustee\ fees_i + Other\ foreclosure\ expenses_i \\
+ Other\ liquidiation\ expenses_i + Other\ non-selling\ expenses_i \\
+ Maintenance\ expenses_i + Property\ inspection_i + Repairs_i + Utilities_i \\
+ Possessory\ and\ eviction\ fees_i + Title\ insurance\ fees_i \\
+ Property\ management\ fees_i + Servicer\ incentive\ payment_i \\
\forall\ i \in NPL\ sales
\end{aligned}
$$

Transaction costs[14] are calculated as a percentage of liquidated unpaid principal balance, which were estimated separately for Enterprise 1 and Enterprise 2. Predicted transaction costs are calculated as the liquidation UPB weighted average transaction costs of all NPL note sales from 2014 to 2020 by liquidated unpaid principal loan balance category and judicial versus non-judicial state indicators. For a given loan, if a particular state is missing, then the national average transaction costs by liquidated unpaid principal loan balance categories will be applied. The liquidated unpaid loan balance categories were chosen based on the percentiles of the population. Also, the measures are calculated separately for judicial and non-judicial states. The separation by judicial and non-judicial states is intended to capture the difference in length of delinquency and expenses associated with delinquency. Mortgages in judicial states must go through a lengthy legal process to complete a foreclosure or transfer title. Even though non-performing note sales do not have a foreclosure, these court processes can result in extreme times in delinquency which we hypothesize will impact the sale price for a non-performing loan sale. In contrast, mortgages in non-judicial states moving quickly through the delinquency process resulting in short delinquencies before the non-performing loan sale.

Further, states are considered either judicial or non-judicial. A judicial state is one in which a lender must receive court approval to foreclose on a property. A non-judicial state does not. Judicial states include the following:

Connecticut (CT), Delaware (DE), Florida (FL), Hawaii (HI), Iowa (IA), Illinois (IL), Indiana (IN), Kansas (KS), Kentucky (KY), Louisiana (LA), Maine (ME), North Dakota (ND), New Jersey (NJ), New Mexico (NM), New

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[14] Many of the components of fixed costs are zero for non-performing loan sales.

York (NY), Ohio (OH), Oklahoma (OK), Pennsylvania (PA), South Carolina (SC), Vermont (VT), and Wisconsin (WI).[15]

All other states are considered non-judicial states.

Once the historical loans have been allocated to the unique combination of the Enterprise, liquidated unpaid principal balance group, and the judicial status of the state in which the property is located, the liquidation unpaid principal balance-weighted average transaction costs for an NPL sale are calculated within each category. The resulting look-up table is used to estimate the transaction costs for an NPL sale of a defaulted loan. Specifically, the Enterprises, liquidated unpaid principal balance, and the judicial status of the state in which the property is located of the defaulted loan is matched to the corresponding Enterprise, liquidated unpaid principal balance group, and the judicial status of the state in which the property is located category in the look-up table and the liquidation unpaid principal balance-weighted average transaction costs for an NPL sale of the matched category represents the estimated transaction costs for an NPL sale of the defaulted loan.

Initially, FMAP v3.0 set fixed cost ratios as constant values within different cohorts grouped based on states. However, the setting did not produce accurate predictions of fixed costs components throughout years. Upon further research, FMAP v3.0 uses spline regressions to improve the estimation results.

6.5.6 Mortgage Insurance (MI) Claim

The MI claim refers to the amount included in the claim submitted by the Enterprises to the mortgage insurance company. An Enterprise can only receive reimbursement for MI claims on loans with mortgage insurance as of the title transfer date.

The MI claim amount for defaulted loan i ($MI\ Claim\ Amount_i$) is defined as follows:

$$MI\ claim\ amount_i \\ = Liquidated\ unpaid\ principal\ balance_i \\ + Carrying\ costs\ including\ accrued\ interest\ from\ LPI\ to\ liquidation_i \\ + Fixed\ costs\ from\ LPI\ to\ liquidation_i$$

$$\forall\ i \in REO\ with\ MI, Foreclosure\ alternatives\ with\ MI$$

Mortgage insurance companies might also default, failing to reimburse the claimed amount.

Therefore, the following formula calculates MI proceeds after accounting for the potential failure of MI companies to honor claims, which is represented by the MI haircut ratios. MI haircuts are differentiated by the credit rating of the mortgage insurer and their level of concentration in the mortgage insurance business, loan performance and loan amortization term.

$$MI\ proceeds_i = MI\ claim\ amount_i * MI\ coverage_i * (1 - MI\ haircut_i)$$

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[15] Federal Housing Finance Agency, Division of Research and Statistics (2020).

6.6 REO Operating Expense

For REO properties, there are extra losses between Liquidate Date and Disposition Date, which are described as the REO Operating Expense. When a loan becomes REO at month T, there are subsequent monthly operating expenses in the next few months:

- Fixed Expense
  The fixed expense includes monthly tax, HOA, and insurance expenses.

- Sale Price Adjustment from Foreclosure Completion to REO Property Disposition
  The property value component of charge off is measured by house price at foreclosure date. The house price may decrease further, so the property value, after foreclosure date that incur additional losses. The model tracks property value decrease if it occurs, month by month, between foreclosure and disposition and record as additional losses.

- True Up at Disposition Date
  At disposition date, the house price may increase, the sum of additional recorded losses in step 2 may be overly recorded. Total loss will be adjusted by comparing to property value at disposition date.

6.7 Fit Statistics

The Loss Severity Module proposes updated parameters for FMAP v3.0 equations and introduced regression techniques to predict net sales proceeds and fixed costs for all three disposition types as well as recovery rates for NPL sales. To validate and improve model predictions, a standard back-testing technique was implemented.

The net losses are defined as follows:

$$Net\ losses_i = Liquidation\ UPB_i - Net\ sale\ proceeds_i + Liquidation\ expenses\ (fixed\ costs)_i + Carrying\ costs_i - MI\ proceed$$

To make it consistent for different loans, the total net losses as well as each of the five components are divided by the liquidation unpaid principal balance amounts to obtain the ratios. The actual and predicted values are compared.

Fit statistics used include RMSE (Root Mean Square Error) and MAE (Mean Absolute Error), both of which are weighted by the liquidation unpaid principal balance of all the loans.

The loss severity equals net losses divided by liquidation UPB. Each component is considered individually in the appendix.

This section covers the in-sample back testing results on the total net losses as percentages of the liquidation unpaid principal balances (loss severity ratios) on Enterprise 1 loans liquidated between 2012 and 2020. Here we took out the mortgage insurance proceeds components, as NPL sales do not have mortgage insurance proceeds and we would like to maintain the comparison consistent between the three disposition types. The figure below summarizes RMSE and MAE for the three disposition types. NPL sales have the lowest RMSE followed by foreclosure alternatives and then REO dispositions.

Figure 8. Enterprise 1 RMSE and MAE on Loss Severity between 2012-2020

Figure 8. Enterprise 1 RMSE and MAE on Loss Severity between 2012-2020
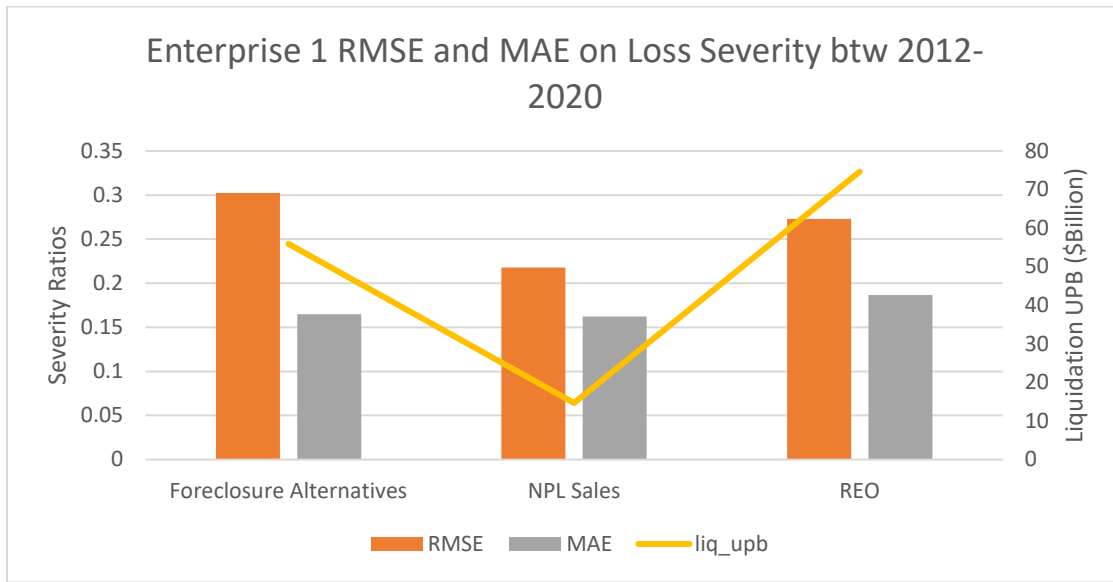
The figure below shows the trends of RMSE and MAE from 2012 to 2020. Except for the year 2020, the RMSE values fall below 0.45 and the MAEs are under 0.25 for the other years.

Figure 9. Enterprise 1 RMSE and MAE of Total Loss Severity Ratios, 2012-2020
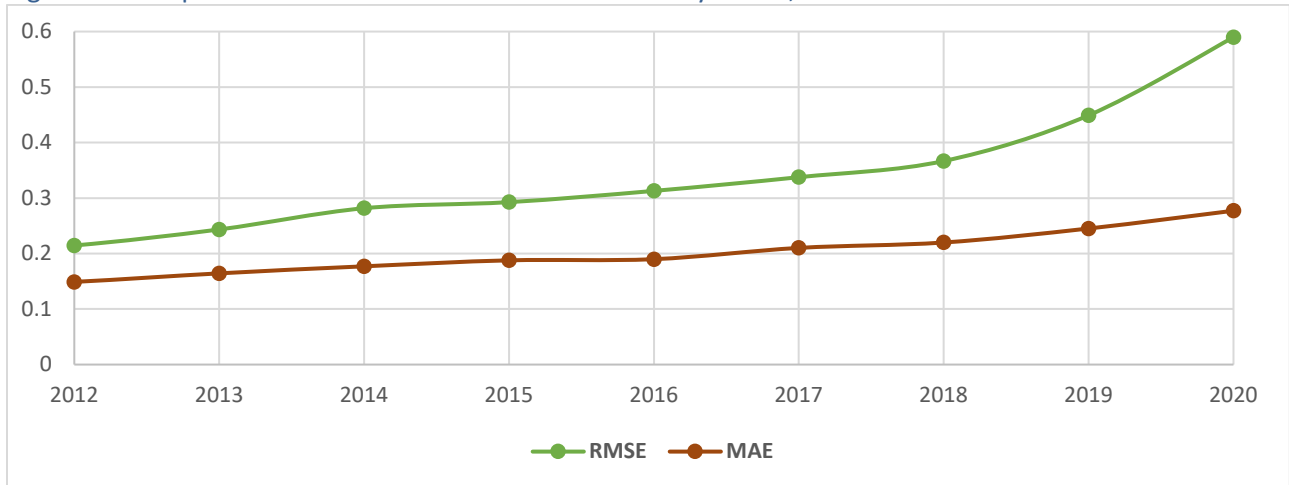
The figure below compares the actual values and predicted values of loss severity ratios. The orange line represents the liquidation unpaid principal balances of all loans liquidated in each year. Except for 2019-2020, inclusive, the predicted values track actual loss severity ratios closely. Also, the total liquidation unpaid principal balances of all loans are well under $20 billion except for the years from 2012 to 2014.

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Figure 10. Enterprise 1 Back-testing Results of Total Loss Severity Ratios by Year
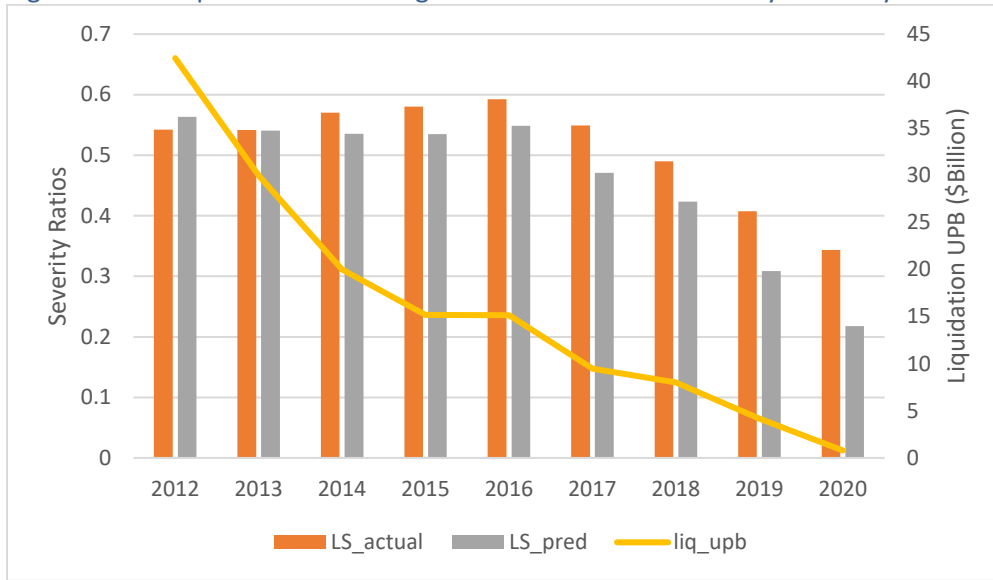
The figure below shows the back-testing results by disposition type. As shown below, the predicted loss severity ratios are the closest to the actual values for NPL sales, followed by foreclosure alternatives, and then REO loans

Figure 11. Enterprise 1 Back-testing Results of Total Loss Severity Ratios by Disposition Type
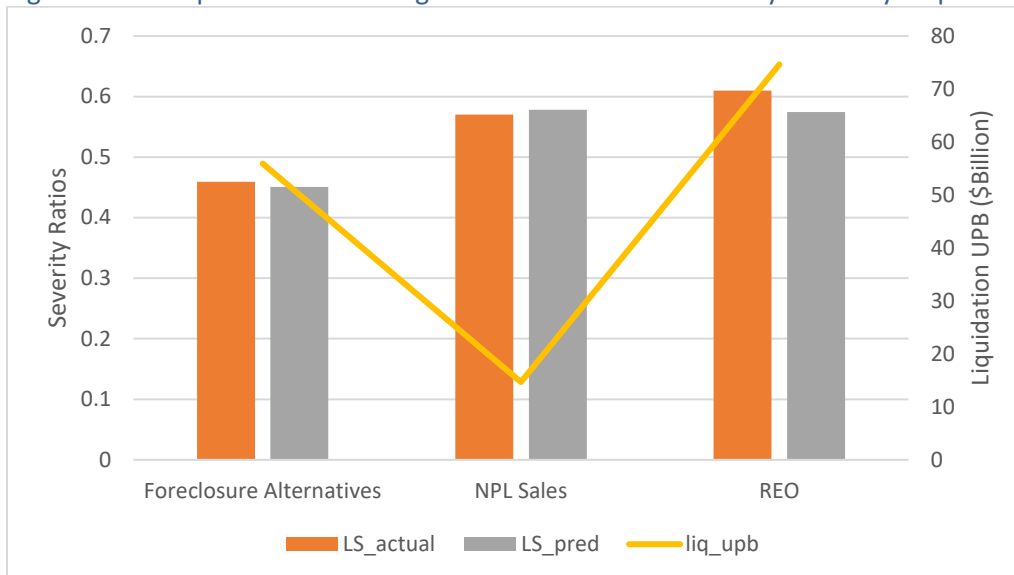
7   Simulation Module

7.1   Overview

The simulation module uses statistical models (behavioral models and loss severity models) to simulate cash flows, given a set of loan profiles and forecasted macroeconomic environment.

Figure 12. Simulation Engine within FMAP
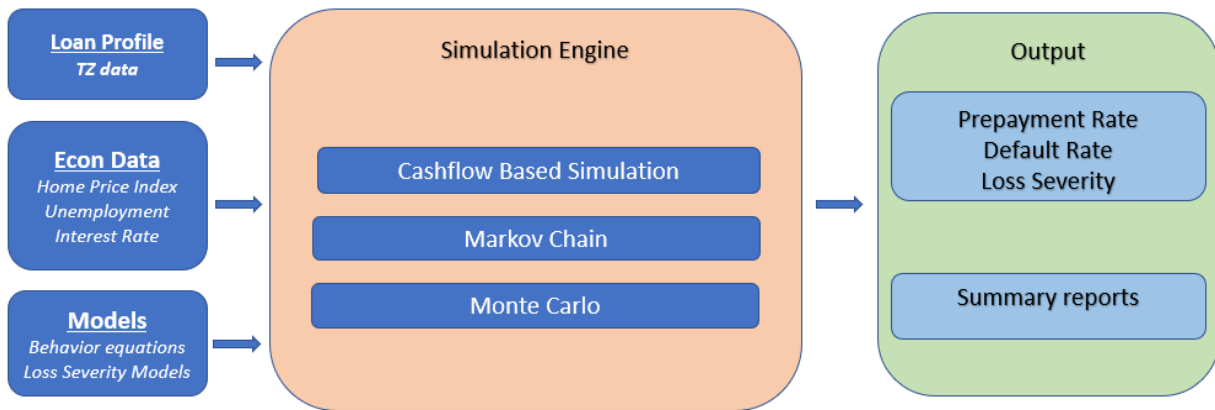
Loan Profile

Given a date, called portfolio date, the loan profile data provides required loan attributes measured as of the portfolio date. In FMAP, the loan profile data are called time-zero (TZ) data.

Economic Data

Historical and forecast home price index, unemployment rate, and market rates, commonly used in the mortgage industry, are used to represent macroeconomic environments which may influence loan performance and borrower's behavior.

Models

During the simulation, models are invoked according to the simulation algorithm to compute conditional probabilities of potential outcomes in transitioning from one month to the next month.

Simulation Engine

FMAP v3.0 implements three simulation techniques: (i) a cashflow-based simulation; (ii) Markov Chain simulation; and (iii) Monte Carlo simulation. Each technique will be described briefly.

- Cashflow-based Simulation
  This approach has been used in FMAP for many years. Every month, the unpaid principal balance of a loan, scheduled/ unscheduled payment and dollar amount of each loan segments are calculated and tracked.

- Markov Chain (Continuous) Simulation
  This approach focuses on the marginal probabilities of each loan segment.

- Monte Carlo (Discrete) Simulation
  This is a widely used simulation method for dealing with large amount of data. This approach uses the conditional probabilities and a random number to provide a deterministic status of a loan at month end.

Theoretically, the cashflow based simulation and Markov Chain simulation techniques produce comparable results. With two simulation techniques, one set of simulation results can be benchmarked against the other. Stated differently, one set of simulation results can serve as a cross validation for the other. This cross-validation feature has proven to be a crucial component for FMAP v3.0 development. Comparing the two approaches of Markov Chain and Monte Carlo, statistical theory warrants the two approaches are comparable for a large pool of loans or sufficient time of simulation runs.

7.2   Cashflow-based Simulation

The proposed cashflow-based simulation for FMAP v3.0 is similar to the cashflow projection method used in FMAP v2.0 and based on the following two equations:

- $UPB_{t-1} = performingUPB_t + schedPrinPaid_t + prepayAmt_t + delinquentAmt_t + defaultAmt_t$

- $UPB_t = UPB_{t-1} - schedPrinPaid_t - prepayAmt_t - defaultAmt_t$

This method directly calculates projections for the following cash flows:

- Performing unpaid principal balance
- Paid scheduled principal
- Unscheduled principal
- Prepayment
- Paid scheduled interest
- Delinquent unpaid principal balance: LDQ, SDQ, DDQ
- Default unpaid principal balance
- Credit loss related cash flows, including charge off, foreclosure expense, MI, etc.

Detailed descriptions of cashflow projections can be found in the appendix.

7.3   Markov Chain (Continuous) Simulation

In this framework, the behavioral equations provide conditional probabilities from states in a given month to states in the next month. These probabilities feed the transition matrix needed by this framework. With a given conditional distribution of states of a loan at one month, we can calculate the marginal probabilities of states at the next month. The Markov Chain algorithm is described as follows:

State Space: In terms of the Markov Chain, the state space is the set of all possible values each loan could take. In our case, state space = {*perf, nrpl, mrpl, rpl, ldq, sdq, ddq, prep, default*}, where *prep* and *default* are absorbing states, as stated previously in the behavioral equation section.

State Vector: a vector SV(t) of the following elements:
$(P_{perf}, \ P_{nrpl}, \ P_{mrpl}, \ P_{rpl}, \ P_{ldq}, \ P_{sdq}, \ P_{ddq}, \ P_{prep,} \ P_{deft})$

where the subscript represents the state.

These elements are the unconditional probabilities of each state of a loan at month *t*.

At the portfolio month, when month t = 0, the SV(0) is initialized by the following rules, based on the provided loan characteristics: "*Loan Segment*":

> *If Loan Segment is PERF, then*   SV(0) = (1, 0, 0, 0, 0, 0, 0, 0, 0).

> *If Loan Segment is NON-MOD RPL, then* SV(0) = (0, 1, 0, 0, 0, 0, 0, 0, 0).

> *If Loan Segment is MOD RPL, then*   SV(0) = (0, 0, 1, 0, 0, 0, 0, 0, 0).

> *If Loan Segment is LDQ, then*   SV(0) = (0, 0, 0, 0, 1, 0, 0, 0, 0).

> *If Loan Segment is SDQ, then*   SV(0) = (0, 0, 0, 0, 0, 1, 0, 0, 0).

> *If Loan Segment is DDQ, then*   SV(0) = (0, 0, 0, 0, 0, 0, 1, 0, 0).

At month t=0, "Loan Segment" can only be in one of the above mentioned six states. It is impossible to have a scenario to define SV(0) as *(0, 0, 0, 1, 0, 0, 0, 0, 0)*.

Transition Matrix(t)

The transition matrix TM(t) is invoked by the behavioral equations for each loan at time t. In the TM(t):

TM	Transition to: (next month)								
	SURVIVING							TERMINATIONS	
Transition from:	PERF	mRPL	nRPL	RPL	LDQ	SDQ	DDQ	Prep	Deft
PERF	residual				perf_ldq			perf_prep	
nRPL		Residual			nrpl_ldq			nrpl_prep	
mRPL			residual		mrpl_ldq			mrpl_prep	
RPL				residual	rpl_ldq			rpl_prep	
LDQ				ldq_rpl	residual	ldq_sdq		ldq_prep	ldq_deft
SDQ				sdq_rpl	sdq_ldq	residual	sdq_ddq	sdq_prep	sdq_deft
DDQ				ddq_rpl	ddq_ldq	ddq_sdq	residual	ddq_prep	ddq_deft

Calculate State Vector at next month (skipping the last 2 elements of SV(t-1)):

$$SV(t) = SV(t-1) * TM(t-1)$$

(This is matrix multiplication of a 1x7 row vector and a matrix of 7x9).

Through chain multiplication, we can have: *SV(t) = SV(0) * TM(0) * TM(1) * TM(2) * … * TM(t-1)*

Once the distribution of future status (or their marginal probabilities) is computed, the cashflow of prepayment, default, and loss can be calculated by combining scheduled amortization.

Prepayment

$Prepaid\ amount\ (t) = Prepay\ Prob(t) * Schd\_UPB(t)$

Default

$$Default\ amount\ (t) = Default\ Prob(t) * Schd\_UPB(LPI), \qquad where\ lpi < t$$

Loss and Loss Severity

When a default is simulated, the LGD models are applied to calculate loss and loss severity. In the LGD module, a default is classified by three types: REO, FA (Foreclosure Alternative including Dee-in-Lieu, Pre-foreclosure Sale, and Third-Party Sale) and NS (NPL Sale), which are used to define formulas for losses. Loss has two parts:

$$Charge\ Off = Liquidation\ UPB + Fixed\ Cost + Carrying\ Expense\ Including\ Accrued\ Interest$$
$$- Sale\ Proceed$$

$$Operating\ Expense = Applies\ only\ to\ REO\ liquidation.$$

Loss is further distinguished by gross loss (before considering mortgage insurance) and net Loss (after the mortgage insurance). The relation is as follows:

$$Net\ Loss = Gross\ Loss - MI\ Proceeds$$

7.4 Monte Carlo (Discrete) Simulation

While the Markov Chain (continuous) method computes the probabilities of several states in each month, the Monte Carlo (discrete) method simulates a single outcome in each month, which would be useful for certain applications. The Monte Carlo algorithm is as follows:

Given the state of the loan at month *t*, one invokes the corresponding behavior equation to calculate the probabilities of states at month *t+1*, then use a random number to select a state among the several possible states. Statistical theory proves that continuous and discrete simulations produce comparable results for large populations. The results from the simulations using the two approaches are reasonably close.

8 Reporting Module

FMAP v3.0 produces the loan-level cash flow components over the remaining life of the loans for different scenarios and time horizons. For example:

- Unpaid principal balance
- Scheduled and unscheduled principal payments
- Prepayment dollar amount
- Default dollar amount
- Dollar amount by loan delinquency status (i.e., LDQ, SDQ, DDQ)
- Credit loss

FMAP v3.0 possesses the capability to aggregate loan-level cash flow reports (e.g., aggregate them by either delinquent status or key risk metrics categories, such as mark-to-market loan-to-value, credit score, etc…).[16]

9 Appendix

9.1 Behavioral Equations

The tables below provide context on the behavioral equations along with the results of the separately estimated behavioral equations for each Enterprise-segment-transition state.

Table 3. Variable Specification for Each Segment and Transition State

Variable	Perf(F30/F15) - LDQ	Perf(F30/F15) - Prepay	ARM - LDQ	ARM - Prepay	mRPL- LDQ	mRPL- Prepay	nRPL- LDQ	nRPL- Prepay	RPL- LDQ	RPL- Prepay	NPL - Same Spec for All
Refinance Rate	X	X	X	X	X	X	X	X	X	X	X
Cash Out	X	X	X	X	X	X	X	X	X	X	X
Investment	X	X	X	X	X	X	X	X	X	X	X
Second Home	X	X	X	X	X	X	X	X	X	X	X
Age	X		X		X		X		X		X
Age Sq.	X		X		X		X		X		X
Age Cb.	X		X		X		X		X		
Current UPB (000s)	X	X	X	X	X	X	X	X	X	X	X
Current UPB (000s) Sq.	X	X	X	X	X	X	X	X	X	X	X
Credit Score	X	X	X	X	X	X	X	X	X	X	X
Credit Score Sq.	X	X	X	X	X	X	X	X	X	X	
Sato F30	X	X	X	X	X	X	X	X	X	X	X
Burnout Count	X		X		X		X		X		X
Unemployment Rate	X	X	X	X	X	X	X	X	X	X	
Unemployment Burnout Count, 8%	X	X	X	X	X	X	X	X	X	X	
Unemployment Burnout Count, 10%	X	X	X	X	X	X	X	X	X	X	
Unemployment Burnout Count, 12%	X	X	X	X	X	X	X	X	X	X	
max(0, mtmltv-79)	X		X		X		X		X		
max(0, 79 - mtmltv)	X		X		X		X		X		
max(0, mtmltv-154)	X		X		X		X		X		
max(0, mtmltv-90)	X		X		X		X		X		
max(0, mtmltv-105)	X		X		X		X		X		
max(0,debt_ratio - .60);	X	X	X	X	X	X	X	X	X	X	
max(0,.60 - debt_ratio);	X	X	X	X	X	X	X	X	X	X	
max(0,debt_ratio - .30);	X	X	X	X	X	X	X	X	X	X	
max(0,debt_ratio - .95);	X	X	X	X	X	X	X	X	X	X	
Origination LTV	X	X	X	X	X	X	X	X	X	X	
Junior Lien Indicator	X	X	X	X	X	X	X	X	X	X	X
Orig. LTV x Junior Lien Ind	X	X	X	X	X	X	X	X	X	X	
One Borrower Indicator	X	X	X	X	X	X	X	X	X	X	X
Credit Score x One Borrower	X	X	X	X	X	X	X	X	X	X	X
No Full Doc Loan	X	X	X	X	X	X	X	X	X	X	X
Third Party Loan	X	X	X	X	X	X	X	X	X	X	
Judicial State	X	X	X	X	X	X	X	X	X	X	X
Current UPB/Origination UPB	X	X	X	X	X	X	X	X	X	X	
HPA with 24 month lag	X	X	X	X	X	X	X	X	X	X	
HPA with lag x Sunk Cost	X	X	X	X	X	X	X	X	X	X	
MTMLTV x Refinance Rate	X	X	X	X	X	X	X	X	X	X	
MTMLTV x Cash Out	X	X	X	X	X	X	X	X	X	X	
Q1	X	X	X	X	X	X	X	X	X	X	
Q2	X	X	X	X	X	X	X	X	X	X	
Q3	X	X	X	X	X	X	X	X	X	X	
2005-2008 Indicator	X	X	X	X	X	X	X	X	X	X	X
2009-2013 Indicator	X	X	X	X	X	X	X	X	X	X	X
>= 2014 Indicator	X	X	X	X	X	X	X	X	X	X	X
max(0,17-age)		X		X		X		X		X	
max(0,age-17)		X		X		X		X		X	
max(0,age-7)		X		X		X		X		X	
max(0,age-93)		X		X		X		X		X	
max(0,age-35)		X		X		X		X		X	
max(0,mtmltv - 66)		X		X		X		X		X	
max(0,66 - mtmltv)		X		X		X		X		X	
max(0,mtmltv - 30)		X		X		X		X		X	
max(0,mtmltv - 6)		X		X		X		X		X	
max(0,mtmltv - 101)		X		X		X		X		X	
max(0,mtmltv - 9)		X		X		X		X		X	

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[16] Additional information about the information used, provided, and reported can be found in the appendix.

max(0,refi_incentive_level_l2 - 1.4)		X		X		X		X		X	
max(0,1.4 - refi_incentive_level_l2)		X		X		X		X		X	
max(0,refi_incentive_level_l2 - 0.02)		X		X		X		X		X	
max(0,refi_incentive_level_l2 - 1.1)		X		X		X		X		X	
max(0, brnt_cnt-1)		X		X		X		X		X	
max(0, brnt_cnt-8)		X		X		X		X		X	
max(0, 8-brnt_cnt)		X		X		X		X		X	
max(0, brnt_cnt-50)		X		X		X		X		X	
max(0, brnt_cnt-74)		X		X		X		X		X	
Indicator for 2001-2003 Refi Boom		X		X		X		X		X	
Months until Interest Rate is reset			X	X							
Min # of months since Mod. or Del.					X	X					
min_dt sq.					X	X					
min_dt cb.					X	X					
# of months since last 3+ months delinquent							X	X			
month_from_last_dq sq.							X	X			
month_from_last_dq cb.							X	X			
Debt to Income Ratio											X
Fixed Rate Mortgage 40 YR											X
Fixed Rate Mortgage 30 YR											X
Fixed Rate Mortgage 15 YR											X
Non Fixed Rate Mortgage											X
Alta Loan Indicator											X
IO Loan Indicator											X
Jumbo Loan Indicator											X
max(0,unemp_rate - 9)											X
max(0,9 - unemp_rate)											X
max(0,unemp_rate - 7)											X
max(0,unemp_rate - 3)											X
max(0,unemp_rate - 5.5)											X
max(0,mtmltv - 95)											X
max(0,95 - mtmltv)											X
max(0,mtmltv - 50)											X
max(0,mtmltv - 80)											X
max(0,mtmltv - 30)											X
max(0,mtmltv - 140)											X
max(0,mtmltv - 5)											X
Refi Incentive with 2 months lag											X
January Indicator											X
February Indicator											X
March Indicator											X
April Indicator											X
May Indicator											X
June Indicator											X
July Indicator											X
August Indicator											X
September Indicator											X
October Indicator											X
November Indicator											X
Number of variables (not including intercept):	45	57	46	58	48	60	48	60	45	57	51

Table 4. Segment: F30 Performing, Enterprise 1, Event: ldq

Variable Name	Estimate	StdErr	Probt
Intercept	-38.2439	0.9184	<.0001
Refinance Rate	0.2014	0.0522	0.0001
Cash Out	0.6437	0.0497	<.0001
Investment	0.0253	0.0232	0.2738
Second Home	-0.2218	0.0373	<.0001
Age	0.0332	0.0009	<.0001
Age Sq.	-0.0003	0.0000	<.0001
Age (Years) Cb.	0.0012	0.0000	<.0001
Current UPB (000s)	0.0012	0.0002	<.0001
Current UPB (00000s) Sq.	0.0028	0.0000	<.0001
Credit Score	0.0186	0.0015	<.0001
Credit Sq (0s) Sq.	-0.0020	0.0000	<.0001
Sato F30	0.3464	0.0105	<.0001
Burnout Count	0.0056	0.0005	<.0001
Unemployment Rate	0.1059	0.0038	<.0001
Unemployment Burnout Count, 8%	-0.4291	0.0319	<.0001
Unemployment Burnout Count, 10%	-0.6098	0.0438	<.0001
Unemployment Burnout Count, 12%	-1.0179	0.0619	<.0001
max(0, mtmltv-79)	0.0320	0.0021	<.0001
max(0, 79 - mtmltv)	-0.0203	0.0009	<.0001
max(0, mtmltv-154)	-0.0191	0.0025	<.0001
max(0, mtmltv-90)	-0.0093	0.0035	0.007
max(0, mtmltv-105)	-0.0128	0.0024	<.0001
max(0,debt_ratio - .60);	-0.7255	0.2931	0.0133
max(0,.60 - debt_ratio);	-0.9295	0.1772	<.0001
max(0,debt_ratio - .30);	0.5298	0.2173	0.0148
max(0,debt_ratio - .95);	0.1939	0.1600	0.2254
Origination LTV	0.5353	0.0610	<.0001
Junior Lien Indicator	0.6868	0.0938	<.0001
Orig. LTV x Junior Lien Ind	-0.5582	0.1157	<.0001
One Borrower Indicator	-1.5515	0.1328	<.0001
Credit Score x One Borrower (00s)	0.3093	0.0002	<.0001
No Full Doc Loan	0.4780	0.0180	<.0001
Third Party Loan	0.1423	0.0120	<.0001
Judicial State	0.1430	0.0119	<.0001
Current UPB/Origination UPB	30.4879	0.7884	<.0001
HPA with 24 month lag	20.4234	0.5906	<.0001
HPA with lag x Sunk Cost	-22.9901	0.6168	<.0001
MTMLTV x Refinance Rate (00s)	-0.0030	0.0006	0.956
MTMLTV x Cash Out (00s)	-0.5070	0.0006	<.0001
Q1	-0.1383	0.0157	<.0001
Q2	-0.2647	0.0162	<.0001
Q3	-0.1455	0.0157	<.0001
2005-2008 Indicator	0.1088	0.0178	<.0001
2009-2013 Indicator	-0.5820	0.0268	<.0001
>= 2014 Indicator	-0.4746	0.0339	<.0001

Table 5. Segment: F15 Performing, Enterprise 1, Event: ldq

Variable Name	Estimate	StdErr	Probt
Intercept	-17.4693	1.0186	<.0001
Refinance Rate	0.1995	0.1001	0.0464
Cash Out	0.3712	0.0978	0.0001
Investment	0.0747	0.0436	0.0862
Second Home	-0.0983	0.0815	0.2279
Age	0.0550	0.0017	<.0001
Age Sq.	-0.0004	0.0000	<.0001
Age (Years) Cb.	0.0020	0.0000	<.0001
Current UPB (000s)	-0.0039	0.0004	<.0001
Current UPB (00000s) Sq.	0.0903	0.0000	<.0001
Credit Score	0.0285	0.0027	<.0001
Credit Sq (0s) Sq.	-0.0030	0.0000	<.0001
Sato F30	0.0628	0.0164	0.0001
Burnout Count	0.0036	0.0007	<.0001
Unemployment Rate	0.1306	0.0069	<.0001
Unemployment Burnout Count, 8%	-0.2698	0.0593	<.0001
Unemployment Burnout Count, 10%	-0.2052	0.0787	0.0091
Unemployment Burnout Count, 12%	-0.9642	0.1165	<.0001
max(0, mtmltv-79)	0.0410	0.0065	<.0001
max(0, 79 - mtmltv)	-0.0273	0.0020	<.0001
max(0, mtmltv-154)	-0.0460	0.0059	<.0001
max(0, mtmltv-90)	-0.0263	0.0132	0.0459
max(0, mtmltv-105)	-0.0004	0.0117	0.9756
max(0,debt_ratio - .60);	0.1426	0.4809	0.7668
max(0,.60 - debt_ratio);	-1.0286	0.2585	<.0001
max(0,debt_ratio - .30);	0.1214	0.3475	0.7268
max(0,debt_ratio - .95);	-0.2645	0.2556	0.3006
Origination LTV	-0.3775	0.1161	0.0011
Junior Lien Indicator	0.1668	0.1379	0.2265
Orig. LTV x Junior Lien Ind	0.1300	0.1855	0.4836
One Borrower Indicator	-1.7962	0.2360	<.0001
Credit Score x One Borrower (00s)	0.3594	0.0003	<.0001
No Full Doc Loan	0.5238	0.0414	<.0001
Third Party Loan	0.1179	0.0227	<.0001
Judicial State	0.1804	0.0223	<.0001
Current UPB/Origination UPB	5.6573	0.5657	<.0001
HPA with 24 month lag	2.7332	0.4209	<.0001
HPA with lag x Sunk Cost	-3.6433	0.5155	<.0001
MTMLTV x Refinance Rate (00s)	0.0586	0.0016	0.7171
MTMLTV x Cash Out (00s)	0.2611	0.0016	0.0963
Q1	-0.2120	0.0293	<.0001
Q2	-0.3551	0.0304	<.0001
Q3	-0.2629	0.0296	<.0001
2005-2008 Indicator	0.1529	0.0350	<.0001
2009-2013 Indicator	-0.3077	0.0414	<.0001
>= 2014 Indicator	0.0296	0.0557	0.5945

Table 6. Segment: F30 Performing, Enterprise 1, Event: prepay

Variable Name	Estimate	StdErr	Probt
Intercept	-34.0126	0.7351	<.0001
Refinance Rate	0.0711	0.0150	<.0001
Cash Out	0.1086	0.0163	<.0001
Investment	-0.3128	0.0080	<.0001
Second Home	-0.1185	0.0099	<.0001
max(0,17-age)	-0.1650	0.0033	<.0001
max(0,age-17)	0.1435	0.0040	<.0001
max(0,age-7)	-0.1464	0.0039	<.0001
max(0,age-93)	-0.0044	0.0004	<.0001
max(0,age-35)	-0.0010	0.0005	0.0491
Current UPB (000s)	0.0056	0.0001	<.0001
Current UPB (00000s) Sq.	-0.0572	0.0000	<.0001
Credit Score	0.0113	0.0007	<.0001
Credit Sq (0s) Sq.	-0.0007	0.0000	<.0001
Sato F30	0.4473	0.0045	<.0001
Unemployment Rate	-0.0465	0.0015	<.0001
Unemployment Burnout Count, 8%	0.0474	0.0102	<.0001
Unemployment Burnout Count, 10%	0.2849	0.0134	<.0001
Unemployment Burnout Count, 12%	0.1611	0.0225	<.0001
max(0,mtmltv - 66)	-0.5174	0.0108	<.0001
max(0,66 - mtmltv)	0.4958	0.0108	<.0001
max(0,mtmltv - 30)	0.0048	0.0011	<.0001
max(0,mtmltv - 6)	0.4702	0.0252	<.0001
max(0,mtmltv - 101)	0.0060	0.0009	<.0001
max(0,mtmltv - 9)	0.0223	0.0163	0.1694
max(0,debt_ratio - .60);	0.1304	0.0984	0.1853
max(0,.60 - debt_ratio);	-0.2829	0.0427	<.0001
max(0,debt_ratio - .30);	-0.5297	0.0596	<.0001
max(0,debt_ratio - .95);	0.3993	0.0659	<.0001
Origination LTV	0.2894	0.0249	<.0001
Junior Lien Indicator	0.1943	0.0295	<.0001
Orig. LTV x Junior Lien Ind	-0.3202	0.0397	<.0001
One Borrower Indicator	-0.2102	0.0484	<.0001
Credit Score x One Borrower (00s)	0.0155	0.0001	0.0195
No Full Doc Loan	-0.1214	0.0078	<.0001
Third Party Loan	0.0449	0.0038	<.0001
Judicial State	-0.1201	0.0040	<.0001
Current UPB/Origination UPB	-3.1012	0.1275	<.0001
HPA with 24 month lag	-0.6704	0.1103	<.0001
HPA with lag x Sunk Cost	1.8635	0.1166	<.0001
MTMLTV x Refinance Rate (00s)	-0.1370	0.0002	<.0001
MTMLTV x Cash Out (00s)	-0.2800	0.0003	<.0001
Q1	-0.0706	0.0053	<.0001
Q2	0.0470	0.0052	<.0001
Q3	0.0658	0.0052	<.0001
2005-2008 Indicator	-0.1741	0.0072	<.0001
2009-2013 Indicator	-0.4301	0.0073	<.0001
>= 2014 Indicator	-0.4597	0.0092	<.0001
max(0,refi_incentive_level_l2 - 1.4)	0.3549	0.0314	<.0001
max(0,1.4 - refi_incentive_level_l2)	-0.5152	0.0109	<.0001
max(0,refi_incentive_level_l2 - 0.02)	0.7021	0.0163	<.0001
max(0,refi_incentive_level_l2 - 1.1)	-0.5290	0.0317	<.0001
max(0, brnt_cnt-1)	-0.1741	0.0083	<.0001
max(0, brnt_cnt-8)	0.1629	0.0083	<.0001
max(0, 8-brnt_cnt)	-0.1609	0.0076	<.0001
max(0, brnt_cnt-50)	-0.0009	0.0007	0.2053
max(0, brnt_cnt-74)	0.0037	0.0007	<.0001
Indicator for 2001-2003 Refi Boom	0.6014	0.0064	<.0001

Table 7. Segment: F15 Performing, Enterprise 1, Event: prepay

Variable Name	Estimate	StdErr	Probt
Intercept	-48.7778	0.3720	<.0001
Refinance Rate	0.0370	0.0127	0.0035
Cash Out	0.0336	0.0133	0.0116
Investment	-0.1890	0.0093	<.0001
Second Home	-0.0386	0.0118	0.0011
max(0,17-age)	-0.2016	0.0043	<.0001
max(0,age-17)	0.1770	0.0051	<.0001
max(0,age-7)	-0.1822	0.0050	<.0001
max(0,age-93)	-0.0004	0.0003	0.2476
max(0,age-35)	-0.0040	0.0006	<.0001
Current UPB (000s)	0.0056	0.0001	<.0001
Current UPB (00000s) Sq.	-0.0606	0.0000	<.0001
Credit Score	0.0110	0.0007	<.0001
Credit Sq (0s) Sq.	-0.0007	0.0000	<.0001
Sato F30	0.2751	0.0040	<.0001
Unemployment Rate	-0.0343	0.0016	<.0001
Unemployment Burnout Count, 8%	0.0313	0.0106	0.0032
Unemployment Burnout Count, 10%	0.2468	0.0154	<.0001
Unemployment Burnout Count, 12%	0.1119	0.0247	<.0001
max(0,mtmltv - 66)	-0.7416	0.0039	<.0001
max(0,66 - mtmltv)	0.7232	0.0038	<.0001
max(0,mtmltv - 30)	0.0222	0.0007	<.0001
max(0,mtmltv - 6)	0.8820	0.0092	<.0001
max(0,mtmltv - 101)	-0.0212	0.0041	<.0001
max(0,mtmltv - 9)	-0.1936	0.0062	<.0001
max(0,debt_ratio - .60);	-0.1746	0.1022	0.0876
max(0,.60 - debt_ratio);	-0.1403	0.0383	0.0002
max(0,debt_ratio - .30);	-0.3014	0.0593	<.0001
max(0,debt_ratio - .95);	0.4762	0.0686	<.0001
Origination LTV	1.5600	0.0222	<.0001
Junior Lien Indicator	0.0826	0.0228	0.0003
Orig. LTV x Junior Lien Ind	-0.0682	0.0364	0.0609
One Borrower Indicator	-0.1125	0.0563	0.0458
Credit Score x One Borrower (00s)	0.0080	0.0001	0.2899
No Full Doc Loan	-0.0355	0.0096	0.0002
Third Party Loan	0.0631	0.0042	<.0001
Judicial State	-0.0713	0.0042	<.0001
Current UPB/Origination UPB	-0.4813	0.0736	<.0001
HPA with 24 month lag	-0.2967	0.0491	<.0001
HPA with lag x Sunk Cost	0.2178	0.0616	0.0004
MTMLTV x Refinance Rate (00s)	0.0046	0.0003	0.8624
MTMLTV x Cash Out (00s)	0.0895	0.0003	0.0015
Q1	-0.0541	0.0058	<.0001
Q2	0.0696	0.0056	<.0001
Q3	0.0789	0.0056	<.0001
2005-2008 Indicator	0.0646	0.0086	<.0001
2009-2013 Indicator	-0.1413	0.0072	<.0001
>= 2014 Indicator	-0.2437	0.0108	<.0001
max(0,refi_incentive_level_l2 - 1.4)	-0.2175	0.0342	<.0001
max(0,1.4 - refi_incentive_level_l2)	-0.3505	0.0112	<.0001
max(0,refi_incentive_level_l2 - 0.02)	0.5869	0.0168	<.0001
max(0,refi_incentive_level_l2 - 1.1)	-0.2129	0.0344	<.0001
max(0, brnt_cnt-1)	-0.1733	0.0091	<.0001
max(0, brnt_cnt-8)	0.1654	0.0091	<.0001
max(0, 8-brnt_cnt)	-0.1696	0.0083	<.0001
max(0, brnt_cnt-50)	-0.0028	0.0007	<.0001
max(0, brnt_cnt-74)	0.0096	0.0007	<.0001
Indicator for 2001-2003 Refi Boom	0.7077	0.0071	<.0001

Table 8. Segment: RPL, Enterprise 1, Event: ldq

Variable Name	Estimate	StdErr	Probt
Intercept	-4.1234	0.1457	<.0001
Refinance Rate	0.0536	0.0103	<.0001
Cash Out	0.0399	0.0093	<.0001
Investment	0.1055	0.0067	<.0001
Second Home	0.0066	0.0103	0.5216
Age	-0.0367	0.0003	<.0001
Age Sq.	0.0002	0.0000	<.0001
Age (Years) Cb.	-0.0009	0.0000	<.0001
Current UPB (000s)	-0.0014	0.0000	<.0001
Current UPB (00000s) Sq.	0.0160	0.0000	<.0001
Credit Score	0.0066	0.0003	<.0001
Credit Sq (0s) Sq.	-0.0007	0.0000	<.0001
Sato F30	0.0010	0.0020	0.6228
Burnout Count	-0.0024	0.0001	<.0001
Unemployment Rate	0.0609	0.0010	<.0001
Unemployment Burnout Count, 8%	-0.4410	0.0087	<.0001
Unemployment Burnout Count, 10%	-0.7310	0.0115	<.0001
Unemployment Burnout Count, 12%	-0.6791	0.0150	<.0001
max(0, mtmltv-79)	0.0002	0.0005	0.7736
max(0, 79 - mtmltv)	0.0081	0.0002	<.0001
max(0, mtmltv-154)	0.0017	0.0005	0.0016
max(0, mtmltv-90)	-0.0088	0.0009	<.0001
max(0, mtmltv-105)	0.0044	0.0006	<.0001
max(0,debt_ratio - .60);	0.1833	0.0691	0.008
max(0,.60 - debt_ratio);	-0.2650	0.0386	<.0001
max(0,debt_ratio - .30);	-0.5131	0.0479	<.0001
max(0,debt_ratio - .95);	0.3299	0.0415	<.0001
Origination LTV	0.7153	0.0144	<.0001
Junior Lien Indicator	0.1829	0.0267	<.0001
Orig. LTV x Junior Lien Ind	-0.2053	0.0340	<.0001
One Borrower Indicator	-0.3645	0.0294	<.0001
Credit Score x One Borrower (00s)	0.0701	0.0000	<.0001
No Full Doc Loan	-0.0176	0.0046	0.0001
Third Party Loan	-0.0074	0.0027	0.0067
Judicial State	-0.0203	0.0027	<.0001
Current UPB/Origination UPB	2.1259	0.0979	<.0001
HPA with 24 month lag	-1.2252	0.0866	<.0001
HPA with lag x Sunk Cost	-0.3342	0.0913	0.0003
MTMLTV x Refinance Rate (00s)	-0.2620	0.0001	<.0001
MTMLTV x Cash Out (00s)	-0.1820	0.0001	<.0001
Q1	-0.1019	0.0037	<.0001
Q2	-0.1663	0.0037	<.0001
Q3	-0.0597	0.0036	<.0001
2005-2008 Indicator	-0.0675	0.0042	<.0001
2009-2013 Indicator	-0.0016	0.0069	0.8183
>= 2014 Indicator	-0.2747	0.0109	<.0001

Table 9. Segment: RPL, Enterprise 1, Event: prepay

Variable Name	Estimate	StdErr	Probt
Intercept	-45.4811	1.1362	<.0001
Refinance Rate	0.0264	0.0170	0.1209
Cash Out	0.0095	0.0163	0.562
Investment	0.0913	0.0119	<.0001
Second Home	0.0712	0.0170	<.0001
max(0,17-age)	-0.0829	0.0969	0.3925
max(0,age-17)	0.0705	0.0986	0.4747
max(0,age-7)	-0.0903	0.0985	0.3591
max(0,age-93)	0.0025	0.0003	<.0001
max(0,age-35)	0.0087	0.0012	<.0001
Current UPB (000s)	0.0075	0.0001	<.0001
Current UPB (00000s) Sq.	-0.1000	0.0000	<.0001
Credit Score	-0.0047	0.0006	<.0001
Credit Sq (0s) Sq.	0.0005	0.0000	<.0001
Sato F30	0.0911	0.0040	<.0001
Unemployment Rate	-0.0927	0.0023	<.0001
Unemployment Burnout Count, 8%	-0.1923	0.0195	<.0001
Unemployment Burnout Count, 10%	-0.0387	0.0251	0.1232
Unemployment Burnout Count, 12%	0.7050	0.0298	<.0001
max(0,mtmltv - 66)	-0.7694	0.0078	<.0001
max(0,66 - mtmltv)	0.7450	0.0078	<.0001
max(0,mtmltv - 30)	-0.0128	0.0012	<.0001
max(0,mtmltv - 6)	1.0055	0.0202	<.0001
max(0,mtmltv - 101)	0.0172	0.0009	<.0001
max(0,mtmltv - 9)	-0.2619	0.0136	<.0001
max(0,debt_ratio - .60);	0.0753	0.1244	0.5451
max(0,.60 - debt_ratio);	-0.1245	0.0666	0.0613
max(0,debt_ratio - .30);	-0.2831	0.0844	0.0008
max(0,debt_ratio - .95);	0.2000	0.0785	0.0108
Origination LTV	0.9290	0.0263	<.0001
Junior Lien Indicator	-0.0038	0.0479	0.9364
Orig. LTV x Junior Lien Ind	-0.0423	0.0624	0.4975
One Borrower Indicator	-0.0829	0.0527	0.1155
Credit Score x One Borrower (00s)	-0.0050	0.0001	0.5346
No Full Doc Loan	-0.2167	0.0083	<.0001
Third Party Loan	0.0019	0.0050	0.7086
Judicial State	-0.0670	0.0051	<.0001
Current UPB/Origination UPB	-3.9341	0.1234	<.0001
HPA with 24 month lag	-0.8143	0.0986	<.0001
HPA with lag x Sunk Cost	2.6407	0.1089	<.0001
MTMLTV x Refinance Rate (00s)	-0.2880	0.0003	<.0001
MTMLTV x Cash Out (00s)	-0.3880	0.0003	<.0001
Q1	-0.0841	0.0070	<.0001
Q2	0.0642	0.0067	<.0001
Q3	0.0615	0.0067	<.0001
2005-2008 Indicator	-0.0874	0.0086	<.0001
2009-2013 Indicator	-0.3867	0.0129	<.0001
>= 2014 Indicator	-0.4403	0.0215	<.0001
max(0,refi_incentive_level_l2 - 1.4)	0.6094	0.0452	<.0001
max(0,1.4 - refi_incentive_level_l2	-0.0766	0.0231	0.0009
max(0,refi_incentive_level_l2 - 0.02	0.1530	0.0317	<.0001
max(0,refi_incentive_level_l2 - 1.1)	-0.5121	0.0495	<.0001
max(0, brnt_cnt-1)	-0.0774	0.0213	0.0003
max(0, brnt_cnt-8)	0.0821	0.0214	0.0001
max(0, 8-brnt_cnt)	-0.0824	0.0194	<.0001
max(0, brnt_cnt-50)	-0.0074	0.0007	<.0001
max(0, brnt_cnt-74)	0.0013	0.0005	0.0169
Indicator for 2001-2003 Refi Boom	0.4645	0.0130	<.0001

Table 10. Segment: ARMs Performing, Enterprise 1, Event: ldq

Variable Name	Estimate	StdErr	Probt
Intercept	-14.9125	0.7112	<.0001
Refinance Rate	0.5406	0.0463	<.0001
Cash Out	0.7660	0.0446	<.0001
Investment	0.0803	0.0175	<.0001
Second Home	-0.0857	0.0207	<.0001
Age	0.0202	0.0009	<.0001
Age Sq.	-0.0003	0.0000	<.0001
Age (Years) Cb.	0.0014	0.0000	<.0001
Current UPB (000s)	0.0012	0.0002	<.0001
Current UPB (00000s) Sq.	0.0074	0.0000	<.0001
Credit Score	0.0034	0.0015	0.0191
Credit Sq (0s) Sq.	-0.0009	0.0000	<.0001
Sato F30	0.1830	0.0050	<.0001
Burnout Count	0.0018	0.0005	0.0007
Unemployment Rate	0.0553	0.0035	<.0001
Unemployment Burnout Count, 8%	-0.3543	0.0360	<.0001
Unemployment Burnout Count, 10%	-0.2637	0.0466	<.0001
Unemployment Burnout Count, 12%	-0.3594	0.0626	<.0001
max(0, mtmltv-79)	0.0365	0.0019	<.0001
max(0, 79 - mtmltv)	-0.0134	0.0009	<.0001
max(0, mtmltv-154)	-0.0473	0.0016	<.0001
max(0, mtmltv-90)	-0.0257	0.0030	<.0001
max(0, mtmltv-105)	-0.0009	0.0018	0.6216
max(0,debt_ratio - .60);	-0.7123	0.3282	0.03
max(0,.60 - debt_ratio);	-1.1156	0.1462	<.0001
max(0,debt_ratio - .30);	0.1903	0.1887	0.3132
max(0,debt_ratio - .95);	0.5201	0.2381	0.0289
Origination LTV	2.0750	0.0772	<.0001
Junior Lien Indicator	0.6979	0.1268	<.0001
Orig. LTV x Junior Lien Ind	-0.4401	0.1619	0.0066
One Borrower Indicator	-0.2411	0.1352	0.0745
Credit Score x One Borrower (00s)	0.1019	0.0002	<.0001
No Full Doc Loan	0.5410	0.0116	<.0001
Third Party Loan	0.0888	0.0104	<.0001
Judicial State	0.1269	0.0114	<.0001
Current UPB/Origination UPB	11.6751	0.5037	<.0001
HPA with 24 month lag	5.7011	0.4961	<.0001
HPA with lag x Sunk Cost	-8.8743	0.5058	<.0001
MTMLTV x Refinance Rate (00s)	-0.3170	0.0005	<.0001
MTMLTV x Cash Out (00s)	-0.4940	0.0005	<.0001
Q1	-0.0249	0.0140	0.0749
Q2	-0.1144	0.0143	<.0001
Q3	-0.1069	0.0142	<.0001
2005-2008 Indicator	0.2482	0.0160	<.0001
2009-2013 Indicator	-0.7762	0.0448	<.0001
>= 2014 Indicator	-0.8717	0.0921	<.0001
Months until Interest Rate is reset	0.0075	0.0003	<.0001

Table 11. Segment: ARMs Performing, Enterprise 1, Event: prepay

Variable Name	Estimate	StdErr	Probt
Intercept	-32.6130	0.5230	<.0001
Refinance Rate	0.1736	0.0140	<.0001
Cash Out	0.2045	0.0153	<.0001
Investment	-0.3190	0.0076	<.0001
Second Home	-0.2154	0.0080	<.0001
max(0,17-age)	-0.1520	0.0028	<.0001
max(0,age-17)	0.1473	0.0035	<.0001
max(0,age-7)	-0.1426	0.0033	<.0001
max(0,age-93)	0.0035	0.0004	<.0001
max(0,age-35)	-0.0212	0.0005	<.0001
Current UPB (000s)	0.0029	0.0001	<.0001
Current UPB (00000s) Sq.	-0.0297	0.0000	<.0001
Credit Score	0.0094	0.0007	<.0001
Credit Sq (0s) Sq.	-0.0006	0.0000	<.0001
Sato F30	0.1146	0.0024	<.0001
Unemployment Rate	-0.0376	0.0015	<.0001
Unemployment Burnout Count, 8%	0.1333	0.0105	<.0001
Unemployment Burnout Count, 10%	0.3550	0.0142	<.0001
Unemployment Burnout Count, 12%	0.3628	0.0260	<.0001
max(0,mtmltv - 66)	-0.4957	0.0071	<.0001
max(0,66 - mtmltv)	0.4726	0.0071	<.0001
max(0,mtmltv - 30)	0.0108	0.0010	<.0001
max(0,mtmltv - 6)	0.4514	0.0170	<.0001
max(0,mtmltv - 101)	0.0085	0.0010	<.0001
max(0,mtmltv - 9)	0.0034	0.0114	0.7646
max(0,debt_ratio - .60);	0.3258	0.1086	0.0027
max(0,.60 - debt_ratio);	-0.3381	0.0371	<.0001
max(0,debt_ratio - .30);	-0.5255	0.0556	<.0001
max(0,debt_ratio - .95);	0.1993	0.0813	0.0142
Origination LTV	1.3283	0.0264	<.0001
Junior Lien Indicator	0.1164	0.0261	<.0001
Orig. LTV x Junior Lien Ind	-0.3315	0.0360	<.0001
One Borrower Indicator	-0.1366	0.0506	0.007
Credit Score x One Borrower (00s)	0.0044	0.0001	0.5222
No Full Doc Loan	-0.0898	0.0054	<.0001
Third Party Loan	0.0847	0.0038	<.0001
Judicial State	-0.0684	0.0041	<.0001
Current UPB/Origination UPB	-1.0167	0.0869	<.0001
HPA with 24 month lag	-0.7869	0.0729	<.0001
HPA with lag x Sunk Cost	1.3144	0.0764	<.0001
MTMLTV x Refinance Rate (00s)	-0.1560	0.0002	<.0001
MTMLTV x Cash Out (00s)	-0.3070	0.0002	<.0001
Q1	-0.0623	0.0054	<.0001
Q2	0.1410	0.0052	<.0001
Q3	0.1269	0.0052	<.0001
2005-2008 Indicator	-0.0849	0.0062	<.0001
2009-2013 Indicator	-0.2302	0.0078	<.0001
>= 2014 Indicator	-0.3992	0.0116	<.0001
max(0,refi_incentive_level_l2 - 1.4)	0.1781	0.0364	<.0001
max(0,1.4 - refi_incentive_level_l2)	-0.2903	0.0095	<.0001
max(0,refi_incentive_level_l2 - 0.02)	0.1067	0.0149	<.0001
max(0,refi_incentive_level_l2 - 1.1)	-0.3401	0.0359	<.0001
max(0, brnt_cnt-1)	-0.1412	0.0071	<.0001
max(0, brnt_cnt-8)	0.1362	0.0072	<.0001
max(0, 8-brnt_cnt)	-0.1379	0.0065	<.0001
max(0, brnt_cnt-50)	0.0038	0.0008	<.0001
max(0, brnt_cnt-74)	0.0059	0.0007	<.0001
Indicator for 2001-2003 Refi Boom	0.4416	0.0066	<.0001
Months until Interest Rate is reset	0.0056	0.0001	<.0001

Table 12. Segment: MRPL, Enterprise 1, Event: ldq

Variable Name	Estimate	StdErr	Probt
Intercept	-7.7288	0.1544	<.0001
Refinance Rate	-0.0278	0.0105	0.0082
Cash Out	-0.0680	0.0095	<.0001
Investment	0.0745	0.0078	<.0001
Second Home	0.0226	0.0115	0.0506
Age	-0.0085	0.0003	<.0001
Age Sq.	0.0001	0.0000	<.0001
Age (Years) Cb.	-0.0004	0.0000	<.0001
Current UPB (000s)	-0.0008	0.0000	<.0001
Current UPB (00000s) Sq.	0.0079	0.0000	<.0001
Credit Score	0.0053	0.0003	<.0001
Credit Sq (0s) Sq.	-0.0007	0.0000	<.0001
Sato F30	0.0339	0.0020	<.0001
Burnout Count	0.0019	0.0001	<.0001
Unemployment Rate	-0.0191	0.0011	<.0001
Unemployment Burnout Count, 8%	-0.3047	0.0086	<.0001
Unemployment Burnout Count, 10%	-0.5213	0.0115	<.0001
Unemployment Burnout Count, 12%	-0.0723	0.0154	<.0001
max(0, mtmltv-79)	-0.0022	0.0005	<.0001
max(0, 79 - mtmltv)	0.0064	0.0002	<.0001
max(0, mtmltv-154)	-0.0003	0.0004	0.5096
max(0, mtmltv-90)	-0.0026	0.0009	0.0027
max(0, mtmltv-105)	0.0041	0.0005	<.0001
max(0,debt_ratio - .60);	-0.1127	0.0718	0.1167
max(0,.60 - debt_ratio);	-0.0709	0.0443	0.1096
max(0,debt_ratio - .30);	-0.2040	0.0530	0.0001
max(0,debt_ratio - .95);	0.3166	0.0400	<.0001
Origination LTV	0.5584	0.0143	<.0001
Junior Lien Indicator	0.1642	0.0262	<.0001
Orig. LTV x Junior Lien Ind	-0.1665	0.0330	<.0001
One Borrower Indicator	-0.3034	0.0295	<.0001
Credit Score x One Borrower (00s)	0.0629	0.0000	<.0001
No Full Doc Loan	-0.0473	0.0044	<.0001
Third Party Loan	0.0273	0.0027	<.0001
Judicial State	-0.0108	0.0028	<.0001
Current UPB/Origination UPB	5.5720	0.1057	<.0001
HPA with 24 month lag	2.7824	0.0959	<.0001
HPA with lag x Sunk Cost	-3.9223	0.0975	<.0001
MTMLTV x Refinance Rate (00s)	-0.1140	0.0001	<.0001
MTMLTV x Cash Out (00s)	-0.0620	0.0001	<.0001
Q1	-0.1335	0.0037	<.0001
Q2	-0.2159	0.0037	<.0001
Q3	-0.0819	0.0036	<.0001
2005-2008 Indicator	-0.0824	0.0045	<.0001
2009-2013 Indicator	-0.1277	0.0073	<.0001
>= 2014 Indicator	-0.4000	0.0122	<.0001
Min # of months since Mod. or Del.	-0.0583	0.0002	<.0001
min_dt sq.	0.0003	0.0000	<.0001
min_dt cb.	0.0000	0.0000	<.0001

Table 13. Segment: MRPL, Enterprise 1, Event: prepay

Variable Name	Estimate	StdErr	Probt
Intercept	-42.4729	1.6101	<.0001
Refinance Rate	-0.0274	0.0194	0.1573
Cash Out	-0.0916	0.0184	<.0001
Investment	0.0820	0.0149	<.0001
Second Home	0.0335	0.0201	0.0948
max(0,17-age)	-0.0859	0.1399	0.5395
max(0,age-17)	0.0507	0.1421	0.7211
max(0,age-7)	-0.0771	0.1420	0.5871
max(0,age-93)	0.0076	0.0004	<.0001
max(0,age-35)	0.0090	0.0019	<.0001
Current UPB (000s)	0.0068	0.0001	<.0001
Current UPB (00000s) Sq.	-0.1000	0.0000	<.0001
Credit Score	-0.0035	0.0007	<.0001
Credit Sq (0s) Sq.	0.0004	0.0000	<.0001
Sato F30	0.0483	0.0041	<.0001
Unemployment Rate	-0.0940	0.0026	<.0001
Unemployment Burnout Count, 8%	-0.2175	0.0192	<.0001
Unemployment Burnout Count, 10%	-0.2237	0.0239	<.0001
Unemployment Burnout Count, 12%	0.8128	0.0288	<.0001
max(0,mtmltv - 66)	-0.7137	0.0107	<.0001
max(0,66 - mtmltv)	0.6937	0.0107	<.0001
max(0,mtmltv - 30)	-0.0206	0.0014	<.0001
max(0,mtmltv - 6)	0.8722	0.0272	<.0001
max(0,mtmltv - 101)	0.0184	0.0008	<.0001
max(0,mtmltv - 9)	-0.1762	0.0181	<.0001
max(0,debt_ratio - .60);	0.0622	0.1300	0.6322
max(0,.60 - debt_ratio);	-0.0658	0.0812	0.4174
max(0,debt_ratio - .30);	-0.3278	0.0973	0.0008
max(0,debt_ratio - .95);	0.2655	0.0707	0.0002
Origination LTV	1.0624	0.0274	<.0001
Junior Lien Indicator	0.1723	0.0453	0.0001
Orig. LTV x Junior Lien Ind	-0.2466	0.0585	<.0001
One Borrower Indicator	-0.0040	0.0536	0.941
Credit Score x One Borrower (00s)	-0.0270	0.0001	0.0006
No Full Doc Loan	-0.2654	0.0077	<.0001
Third Party Loan	0.0014	0.0050	0.7804
Judicial State	-0.0563	0.0053	<.0001
Current UPB/Origination UPB	-3.9956	0.1741	<.0001
HPA with 24 month lag	-1.3946	0.1425	<.0001
HPA with lag x Sunk Cost	2.8463	0.1549	<.0001
MTMLTV x Refinance Rate (00s)	-0.2650	0.0003	<.0001
MTMLTV x Cash Out (00s)	-0.2800	0.0003	<.0001
Q1	-0.0860	0.0071	<.0001
Q2	0.0780	0.0067	<.0001
Q3	0.0785	0.0066	<.0001
2005-2008 Indicator	-0.1268	0.0092	<.0001
2009-2013 Indicator	-0.3945	0.0140	<.0001
>= 2014 Indicator	-0.4221	0.0224	<.0001
max(0,refi_incentive_level_l2 - 1.4)	1.0980	0.0515	<.0001
max(0,1.4 - refi_incentive_level_l2)	-0.1134	0.0286	<.0001
max(0,refi_incentive_level_l2 - 0.02)	0.0279	0.0396	0.4804
max(0,refi_incentive_level_l2 - 1.1)	-0.7872	0.0563	<.0001
max(0, brnt_cnt-1)	-0.0398	0.0304	0.1909
max(0, brnt_cnt-8)	0.0422	0.0305	0.167
max(0, 8-brnt_cnt)	-0.0382	0.0274	0.1628
max(0, brnt_cnt-50)	-0.0075	0.0008	<.0001
max(0, brnt_cnt-74)	0.0013	0.0006	0.0289
Indicator for 2001-2003 Refi Boom	0.6885	0.0224	<.0001
Min # of months since Mod. or Del.	0.0270	0.0003	<.0001
min_dt sq.	-0.0001	0.0000	<.0001
min_dt cb.	0.0000	0.0000	<.0001

Table 14. Segment: NRPL, Enterprise 1, Event: ldq

Variable Name	Estimate	StdErr	Probt
Intercept	-4.9498	0.1390	<.0001
Refinance Rate	0.0954	0.0109	<.0001
Cash Out	0.1481	0.0099	<.0001
Investment	-0.0712	0.0060	<.0001
Second Home	-0.1574	0.0095	<.0001
Age	-0.0044	0.0003	<.0001
Age Sq.	0.0000	0.0000	<.0001
Age (Years) Cb.	-0.0001	0.0000	<.0001
Current UPB (000s)	0.0006	0.0001	<.0001
Current UPB (00000s) Sq.	0.0027	0.0000	<.0001
Credit Score	0.0028	0.0003	<.0001
Credit Sq (0s) Sq.	-0.0004	0.0000	<.0001
Sato F30	0.0523	0.0020	<.0001
Burnout Count	0.0007	0.0001	<.0001
Unemployment Rate	0.0373	0.0009	<.0001
Unemployment Burnout Count, 8%	-0.2289	0.0090	<.0001
Unemployment Burnout Count, 10%	-0.3231	0.0120	<.0001
Unemployment Burnout Count, 12%	-0.3500	0.0149	<.0001
max(0, mtmltv-79)	0.0093	0.0006	<.0001
max(0, 79 - mtmltv)	0.0009	0.0002	<.0001
max(0, mtmltv-154)	-0.0013	0.0010	0.2095
max(0, mtmltv-90)	-0.0087	0.0010	<.0001
max(0, mtmltv-105)	-0.0008	0.0008	0.2982
max(0,debt_ratio - .60);	-0.0390	0.0691	0.5719
max(0,.60 - debt_ratio);	-0.3096	0.0353	<.0001
max(0,debt_ratio - .30);	-0.1530	0.0455	0.0008
max(0,debt_ratio - .95);	0.1919	0.0435	<.0001
Origination LTV	0.4005	0.0152	<.0001
Junior Lien Indicator	0.1304	0.0271	<.0001
Orig. LTV x Junior Lien Ind	-0.1214	0.0348	0.0005
One Borrower Indicator	-0.1842	0.0298	<.0001
Credit Score x One Borrower (00s)	0.0448	0.0000	<.0001
No Full Doc Loan	0.0622	0.0048	<.0001
Third Party Loan	0.0057	0.0027	0.035
Judicial State	0.0015	0.0028	0.5956
Current UPB/Origination UPB	3.4143	0.0905	<.0001
HPA with 24 month lag	1.5261	0.0755	<.0001
HPA with lag x Sunk Cost	-2.5608	0.0826	<.0001
MTMLTV x Refinance Rate (00s)	-0.1740	0.0002	<.0001
MTMLTV x Cash Out (00s)	-0.1970	0.0001	<.0001
Q1	-0.0934	0.0037	<.0001
Q2	-0.1839	0.0037	<.0001
Q3	-0.0609	0.0037	<.0001
2005-2008 Indicator	0.0828	0.0040	<.0001
2009-2013 Indicator	0.0618	0.0068	<.0001
>= 2014 Indicator	-0.0261	0.0101	0.0095
# of months since last 3+ months delinquent	-0.1234	0.0004	<.0001
month_from_last_dq sq.	0.0015	0.0000	<.0001
month_from_last_dq cb.	0.0000	0.0000	<.0001

Table 15. Segment: NRPL, Enterprise 1, Event: prepay

Variable Name	Estimate	StdErr	Probt
Intercept	-47.8098	0.7915	<.0001
Refinance Rate	0.0043	0.0155	0.7811
Cash Out	-0.0308	0.0150	0.0402
Investment	0.0375	0.0100	0.0002
Second Home	0.0234	0.0148	0.1135
max(0,17-age)	-0.0844	0.0625	0.1764
max(0,age-17)	0.1144	0.0638	0.0727
max(0,age-7)	-0.1268	0.0637	0.0464
max(0,age-93)	0.0029	0.0003	<.0001
max(0,age-35)	0.0019	0.0010	0.0501
Current UPB (000s)	0.0068	0.0001	<.0001
Current UPB (00000s) Sq.	-0.1000	0.0000	<.0001
Credit Score	-0.0057	0.0006	<.0001
Credit Sq (0s) Sq.	0.0006	0.0000	<.0001
Sato F30	0.0665	0.0037	<.0001
Unemployment Rate	-0.0746	0.0020	<.0001
Unemployment Burnout Count, 8%	0.0204	0.0195	0.2947
Unemployment Burnout Count, 10%	0.1509	0.0261	<.0001
Unemployment Burnout Count, 12%	0.4328	0.0320	<.0001
max(0,mtmltv - 66)	-0.7985	0.0063	<.0001
max(0,66 - mtmltv)	0.7883	0.0063	<.0001
max(0,mtmltv - 30)	0.0161	0.0011	<.0001
max(0,mtmltv - 6)	1.0351	0.0164	<.0001
max(0,mtmltv - 101)	0.0156	0.0011	<.0001
max(0,mtmltv - 9)	-0.2741	0.0111	<.0001
max(0,debt_ratio - .60);	0.2061	0.1204	0.0871
max(0,.60 - debt_ratio);	-0.2768	0.0579	<.0001
max(0,debt_ratio - .30);	-0.2581	0.0772	0.0008
max(0,debt_ratio - .95);	0.0523	0.0769	0.4966
Origination LTV	0.7672	0.0248	<.0001
Junior Lien Indicator	-0.0423	0.0478	0.3767
Orig. LTV x Junior Lien Ind	-0.0641	0.0634	0.3124
One Borrower Indicator	-0.2335	0.0515	<.0001
Credit Score x One Borrower (00s)	0.0225	0.0001	0.0035
No Full Doc Loan	-0.1408	0.0090	<.0001
Third Party Loan	0.0091	0.0049	0.0616
Judicial State	-0.0518	0.0050	<.0001
Current UPB/Origination UPB	-4.0426	0.1069	<.0001
HPA with 24 month lag	-1.4260	0.0847	<.0001
HPA with lag x Sunk Cost	3.8305	0.0945	<.0001
MTMLTV x Refinance Rate (00s)	-0.0590	0.0003	0.027
MTMLTV x Cash Out (00s)	-0.0380	0.0003	0.1373
Q1	-0.0720	0.0069	<.0001
Q2	0.0620	0.0066	<.0001
Q3	0.0505	0.0067	<.0001
2005-2008 Indicator	-0.1260	0.0083	<.0001
2009-2013 Indicator	-0.3268	0.0127	<.0001
>= 2014 Indicator	-0.2823	0.0207	<.0001
max(0,refi_incentive_level_l2 - 1.4)	0.1751	0.0406	<.0001
max(0,1.4 - refi_incentive_level_l2)	-0.0120	0.0193	0.5345
max(0,refi_incentive_level_l2 - 0.02)	0.2277	0.0266	<.0001
max(0,refi_incentive_level_l2 - 1.1)	-0.2311	0.0442	<.0001
max(0, brnt_cnt-1)	-0.0821	0.0170	<.0001
max(0, brnt_cnt-8)	0.0879	0.0170	<.0001
max(0, 8-brnt_cnt)	-0.0877	0.0155	<.0001
max(0, brnt_cnt-50)	-0.0092	0.0006	<.0001
max(0, brnt_cnt-74)	0.0024	0.0005	<.0001
Indicator for 2001-2003 Refi Boom	0.4437	0.0101	<.0001
# of months since last 3+ months delinquent	0.0180	0.0004	<.0001
month_from_last_dq sq.	-0.0002	0.0000	<.0001
month_from_last_dq cb.	0.0000	0.0000	<.0001

Table 16. Segment: NPL - ldq, Enterprise 1

Variable Name	Event: RPL Estimate	Event: RPL StdErr	Event: RPL Probt	Event: Prepay Estimate	Event: Prepay StdErr	Event: Prepay Probt	Event: SDQ Estimate	Event: SDQ StdErr	Event: SDQ Probt	Event: Default Estimate	Event: Default StdErr	Event: Default Probt
Intercept	7.8211	0.5716	<.0001	-51.7355	0.7248	<.0001	-6.5517	0.5801	<.0001	23.1044	9.9344	0.0200
Refinance Rate	-0.1215	0.0021	<.0001	-0.3180	0.0075	<.0001	0.0247	0.0018	<.0001	0.1639	0.0071	<.0001
Cash Out	-0.1026	0.0020	<.0001	-0.3748	0.0075	<.0001	0.0330	0.0017	<.0001	-0.0312	0.0073	<.0001
Investment	-0.1808	0.0037	<.0001	0.0436	0.0121	0.0003	0.1787	0.0028	<.0001	0.5295	0.0091	<.0001
Second Home	-0.0740	0.0057	<.0001	0.1557	0.0185	<.0001	0.1331	0.0042	<.0001	0.3659	0.0151	<.0001
Age	0.0009	0.0001	<.0001	-0.0240	0.0002	<.0001	-0.0011	0.0001	<.0001	-0.0002	0.0003	0.4173
Age Sq.	0.0000		.	0.0000		.	0.0000		.	-0.0001		.
Current UPB (000s)	-0.0006	0.0000	<.0001	0.0041	0.0001	<.0001	-0.0004	0.0000	<.0001	-0.0092	0.0001	<.0001
Current UPB (00000s) Sq.	0.0050		.	-0.0885		.	0.0080		.	0.1100		.
Debt to Income Ratio	0.0000	0.0001	0.6899	-0.0021	0.0033	0.5328	0.0000	0.0001	0.7260	-0.2733	0.0182	<.0001
Credit Score	-0.0019	0.0000	<.0001	0.0035	0.0001	<.0001	0.0010	0.0000	<.0001	0.0073	0.0001	<.0001
Burnout Count	0.0042	0.0001	<.0001	0.0051	0.0002	<.0001	-0.0036	0.0001	<.0001	0.0062	0.0003	<.0001
Sato F30	-0.0370	0.0013	<.0001	0.0552	0.0048	<.0001	0.0222	0.0010	<.0001	0.0331	0.0040	<.0001
Judicial State	-0.0711	0.0016	<.0001	-0.1361	0.0059	<.0001	0.1272	0.0014	<.0001	-1.5860	0.0080	<.0001
2005-2008 Indicator	-0.1616	0.0022	<.0001	-0.6295	0.0086	<.0001	-0.0602	0.0021	<.0001	-0.6086	0.0082	<.0001
2009-2013 Indicator	-0.1404	0.0034	<.0001	-0.4067	0.0105	<.0001	-0.0821	0.0033	<.0001	-0.6889	0.0130	<.0001
>= 2014 Indicator	-0.1042	0.0050	<.0001	-0.8181	0.0152	<.0001	-0.2443	0.0053	<.0001	-1.7263	0.0338	<.0001
No Full Doc Loan	-0.1036	0.0029	<.0001	-0.1982	0.0113	<.0001	0.0350	0.0022	<.0001	-0.3097	0.0089	<.0001
Fixed Rate Mortgage 40 YR	0.0788	0.0103	<.0001	-0.3803	0.0736	<.0001	-0.1283	0.0073	<.0001	-0.3767	0.0326	<.0001
Fixed Rate Mortgage 30 YR	0.1882	0.0033	<.0001	-0.1108	0.0122	<.0001	-0.1092	0.0024	<.0001	-0.0793	0.0095	<.0001
Fixed Rate Mortgage 15 YR	0.2102	0.0042	<.0001	-0.1153	0.0140	<.0001	-0.1127	0.0035	<.0001	-0.0965	0.0157	<.0001
Non Fixed Rate Mortgage	0.0000		.	0.0000		.	0.0000		.	0.0000		.
One Borrower Indicator	-0.0971	0.0169	<.0001	0.0764	0.0626	0.2222	0.1437	0.0154	<.0001	1.4562	0.0653	<.0001
Credit Score x One Borrower (00s	0.0092	0.0000	0.0003	-0.0260	0.0001	0.0045	-0.0110	0.0000	<.0001	-0.2130	0.0001	<.0001
Junior Lien Indicator	-0.1424	0.0028	<.0001	-0.3214	0.0118	<.0001	0.0563	0.0021	<.0001	0.1715	0.0084	<.0001
Alta Loan Indicator	-0.0255	0.0023	<.0001	-0.0847	0.0097	<.0001	-0.0165	0.0019	<.0001	-0.0002	0.0075	0.9758
IO Loan Indicator	0.0000		.	0.0000		.	0.0000		.	0.0000		.
Jumbo Loan Indicator	0.1335	0.0216	<.0001	0.7032	0.0616	<.0001	-0.0161	0.0206	0.4344	-0.3313	0.1261	0.0086
max(0,unemp_rate - 9)	0.0092	0.0147	0.5280	0.1843	0.0392	<.0001	0.0032	0.0172	0.8514	0.3842	0.0993	0.0001
max(0,9 - unemp_rate)	0.1044	0.0144	<.0001	0.0809	0.0375	0.0312	-0.0108	0.0170	0.5246	-0.3421	0.0989	0.0005
max(0,unemp_rate - 7)	-0.0652	0.0036	<.0001	-0.1160	0.0144	<.0001	-0.0011	0.0031	0.7377	-0.3296	0.0117	<.0001
max(0,unemp_rate - 3)	0.0428	0.0151	0.0046	-0.0387	0.0399	0.3321	0.0147	0.0177	0.4058	-0.4447	0.1012	<.0001
max(0,unemp_rate - 5.5)	0.0176	0.0034	<.0001	-0.0121	0.0120	0.3115	-0.0192	0.0034	<.0001	0.2659	0.0135	<.0001
max(0,mtmltv - 95)	0.0950	0.0062	<.0001	-0.5230	0.0079	<.0001	-0.0499	0.0063	<.0001	0.3166	0.1099	0.0040
max(0,95 - mtmltv)	-0.0893	0.0062	<.0001	0.5413	0.0074	<.0001	0.0493	0.0063	<.0001	-0.3412	0.1099	0.0019
max(0,mtmltv - 50)	-0.0030	0.0003	<.0001	-0.0220	0.0009	<.0001	0.0048	0.0003	<.0001	0.0150	0.0020	<.0001
max(0,mtmltv - 80)	-0.0034	0.0003	<.0001	-0.0439	0.0015	<.0001	0.0008	0.0002	0.0008	-0.0098	0.0010	<.0001
max(0,mtmltv - 30)	-0.0014	0.0006	0.0145	0.0164	0.0015	<.0001	-0.0002	0.0006	0.7144	0.0026	0.0052	0.6181
max(0,mtmltv - 140)	0.0037	0.0003	<.0001	0.0744	0.0042	<.0001	-0.0030	0.0002	<.0001	-0.0088	0.0006	<.0001
max(0,mtmltv - 5)	-0.0933	0.0064	<.0001	0.5057	0.0081	<.0001	0.0491	0.0065	<.0001	-0.3118	0.1111	0.0050
Refi Incentive with 2 months lag	-0.0424	0.0015	<.0001	0.0501	0.0053	<.0001	0.0878	0.0014	<.0001	-0.1170	0.0053	<.0001
January Indicator	-0.0653	0.0037	<.0001	-0.2157	0.0136	<.0001	0.0175	0.0032	<.0001	-0.0720	0.0133	<.0001
February Indicator	0.0726	0.0036	<.0001	-0.2354	0.0137	<.0001	0.0652	0.0032	<.0001	-0.0617	0.0134	<.0001
March Indicator	0.2450	0.0036	<.0001	-0.0104	0.0132	0.4312	0.0913	0.0032	<.0001	0.0526	0.0133	<.0001
April Indicator	0.1139	0.0037	<.0001	-0.0265	0.0136	0.0511	0.1107	0.0032	<.0001	0.0723	0.0134	<.0001
May Indicator	0.0906	0.0038	<.0001	0.0057	0.0136	0.6766	0.0670	0.0033	<.0001	0.0403	0.0136	0.0031
June Indicator	0.0774	0.0038	<.0001	0.0336	0.0136	0.0135	0.0360	0.0033	<.0001	0.1736	0.0132	<.0001
July Indicator	0.0276	0.0038	<.0001	-0.0032	0.0137	0.8169	0.0285	0.0033	<.0001	0.1684	0.0132	<.0001
August Indicator	0.0360	0.0038	<.0001	0.0567	0.0134	<.0001	0.0104	0.0033	0.0018	0.1775	0.0131	<.0001
September Indicator	-0.0694	0.0038	<.0001	-0.0677	0.0137	<.0001	0.0217	0.0033	<.0001	0.1987	0.0129	<.0001
October Indicator	-0.0281	0.0037	<.0001	-0.0522	0.0135	0.0001	0.0051	0.0033	0.1153	0.1619	0.0129	<.0001
November Indicator	-0.0948	0.0038	<.0001	-0.1318	0.0137	<.0001	0.0341	0.0032	<.0001	0.0442	0.0132	0.0008

Table 17. Segment: NPL - sdq, Enterprise 1

Variable Name	Event: RPL Estimate	Event: RPL StdErr	Event: RPL Probt	Event: Prepay Estimate	Event: Prepay StdErr	Event: Prepay Probt	Event: LDQ Estimate	Event: LDQ StdErr	Event: LDQ Probt	Event: DDQ Estimate	Event: DDQ StdErr	Event: DDQ Probt	Event: Default Estimate	Event: Default StdErr	Event: Default Probt
Intercept	16.6756	1.1717	<.0001	-30.9422	0.9585	<.0001	5.6129	1.9049	0.0032	-8.9694	0.8138	<.0001	35.3743	5.5355	<.0001
Refinance Rate	0.0033	0.0033	0.3178	-0.3529	0.0092	<.0001	-0.0990	0.0061	<.0001	0.0283	0.0025	<.0001	0.0829	0.0039	<.0001
Cash Out	0.0657	0.0031	<.0001	-0.4150	0.0091	<.0001	-0.1570	0.0058	<.0001	0.0367	0.0023	<.0001	-0.0078	0.0038	0.0421
Investment	-0.3347	0.0062	<.0001	-0.0523	0.0151	0.0005	-0.6132	0.0124	<.0001	0.1347	0.0036	<.0001	0.3415	0.0052	<.0001
Second Home	-0.2342	0.0090	<.0001	0.0909	0.0228	<.0001	-0.4421	0.0193	<.0001	0.0751	0.0054	<.0001	0.3674	0.0077	<.0001
Age	0.0076	0.0001	<.0001	-0.0212	0.0003	<.0001	0.0051	0.0002	<.0001	0.0059	0.0001	<.0001	-0.0058	0.0002	<.0001
Age Sq.	0.0000	.	.	0.0000	.	.	-0.0001	.	.	0.0000	.	.	0.0000	.	.
Current UPB (000s)	0.0027	0.0000	<.0001	0.0057	0.0002	<.0001	-0.0016	0.0001	<.0001	0.0001	0.0000	0.0533	-0.0070	0.0001	<.0001
Current UPB (00000s) Sq.	-0.0324	.	.	-0.1000	.	.	0.0202	.	.	0.0034	.	.	0.0852	.	.
Debt to Income Ratio	-0.0001	0.0001	0.7406	-0.0005	0.0011	0.6163	0.0001	0.0002	0.7530	0.0001	0.0001	0.4039	-0.0009	0.0008	0.2542
Credit Score	-0.0017	0.0000	<.0001	0.0033	0.0001	<.0001	-0.0029	0.0001	<.0001	0.0002	0.0000	<.0001	0.0054	0.0000	<.0001
Burnout Count	0.0033	0.0001	<.0001	0.0042	0.0003	<.0001	0.0060	0.0002	<.0001	-0.0013	0.0001	<.0001	0.0032	0.0001	<.0001
Sato F30	-0.0321	0.0019	<.0001	0.0058	0.0060	0.3373	-0.0029	0.0036	0.4257	0.0219	0.0013	<.0001	-0.0135	0.0020	<.0001
Judicial State	-0.2060	0.0025	<.0001	-0.2565	0.0072	<.0001	-0.3897	0.0047	<.0001	0.2737	0.0019	<.0001	-1.2323	0.0035	<.0001
2005-2008 Indicator	-0.0739	0.0038	<.0001	-0.5323	0.0105	<.0001	-0.1317	0.0066	<.0001	0.0243	0.0030	<.0001	-0.4189	0.0047	<.0001
2009-2013 Indicator	0.1849	0.0057	<.0001	-0.3401	0.0128	<.0001	-0.4327	0.0119	<.0001	0.1120	0.0049	<.0001	-0.6318	0.0075	<.0001
>= 2014 Indicator	0.5715	0.0086	<.0001	-0.6681	0.0201	<.0001	-0.1798	0.0184	<.0001	0.0127	0.0095	0.1824	-1.1761	0.0160	<.0001
No Full Doc Loan	-0.0631	0.0041	<.0001	-0.1695	0.0134	<.0001	0.0011	0.0080	0.8922	0.0464	0.0028	<.0001	-0.1628	0.0045	<.0001
Fixed Rate Mortgage 40 YR	0.1505	0.0136	<.0001	-0.2602	0.0848	0.0022	0.2466	0.0260	<.0001	-0.0391	0.0092	<.0001	-0.4364	0.0164	<.0001
Fixed Rate Mortgage 30 YR	0.2950	0.0049	<.0001	-0.0302	0.0147	0.0405	0.1320	0.0091	<.0001	-0.0583	0.0031	<.0001	-0.1406	0.0048	<.0001
Fixed Rate Mortgage 15 YR	0.4832	0.0065	<.0001	-0.0696	0.0168	<.0001	0.0917	0.0119	<.0001	-0.0434	0.0049	<.0001	-0.2105	0.0084	<.0001
Non Fixed Rate Mortgage	0.0000	.	.	0.0000	.	.	0.0000	.	.	0.0000	.	.	0.0000	.	.
One Borrower Indicator	0.1320	0.0271	<.0001	0.1154	0.0778	0.1381	-0.0153	0.0485	0.7532	0.0203	0.0213	0.3409	0.4902	0.0351	<.0001
Credit Score x One Borrower (00s	-0.0210	0.0000	<.0001	-0.0320	0.0001	0.0053	-0.0140	0.0001	0.0549	0.0062	0.0000	0.0506	-0.0860	0.0001	<.0001
Junior Lien Indicator	-0.1586	0.0041	<.0001	-0.2907	0.0135	<.0001	-0.0860	0.0079	<.0001	0.0485	0.0028	<.0001	0.1213	0.0043	<.0001
Alta Loan Indicator	-0.0606	0.0035	<.0001	-0.0875	0.0120	<.0001	-0.0156	0.0065	0.0170	-0.0161	0.0025	<.0001	-0.0007	0.0040	0.8641
IO Loan Indicator	0.0000	.	.	0.0000	.	.	0.0000	.	.	0.0000	.	.	0.0000	.	.
Jumbo Loan Indicator	0.1093	0.0308	0.0004	0.2486	0.0795	0.0018	-0.0996	0.0791	0.2080	-0.0850	0.0314	0.0069	-0.5216	0.0713	<.0001
max(0,unemp_rate - 9)	-0.0263	0.0269	0.3281	0.0747	0.0489	0.1265	-0.1735	0.0505	0.0006	0.0194	0.0297	0.5143	0.1608	0.0484	0.0009
max(0,9 - unemp_rate)	0.0673	0.0266	0.0114	0.1826	0.0470	0.0001	0.1901	0.0500	0.0001	-0.0424	0.0296	0.1517	-0.0981	0.0482	0.0417
max(0,unemp_rate - 7)	-0.0606	0.0056	<.0001	-0.0731	0.0174	<.0001	0.0207	0.0104	0.0462	0.0020	0.0043	0.6386	-0.0071	0.0067	0.2932
max(0,unemp_rate - 3)	-0.0686	0.0277	0.0134	0.0123	0.0501	0.8054	0.1365	0.0521	0.0087	-0.0050	0.0305	0.8693	-0.2205	0.0495	<.0001
max(0,unemp_rate - 5.5)	0.1326	0.0058	<.0001	0.0167	0.0149	0.2622	0.0229	0.0107	0.0328	-0.0118	0.0050	0.0176	0.0032	0.0074	0.6684
max(0,mtmltv - 95)	0.2012	0.0128	<.0001	-0.2488	0.0105	<.0001	0.0876	0.0208	<.0001	-0.0672	0.0087	<.0001	0.4544	0.0613	<.0001
max(0,95 - mtmltv)	-0.2086	0.0128	<.0001	0.3025	0.0100	<.0001	-0.0865	0.0208	<.0001	0.0669	0.0087	<.0001	-0.4593	0.0613	<.0001
max(0,mtmltv - 50)	0.0070	0.0005	<.0001	-0.0270	0.0011	<.0001	-0.0096	0.0009	<.0001	0.0022	0.0005	<.0001	0.0027	0.0010	0.0072
max(0,mtmltv - 80)	0.0124	0.0004	<.0001	-0.0566	0.0019	<.0001	-0.0026	0.0008	0.0011	-0.0002	0.0003	0.4985	-0.0119	0.0005	<.0001
max(0,mtmltv - 30)	-0.0048	0.0010	<.0001	0.0100	0.0018	<.0001	0.0016	0.0019	0.3976	0.0026	0.0010	0.0074	-0.0065	0.0026	0.0127
max(0,mtmltv - 140)	-0.0013	0.0003	<.0001	0.0429	0.0084	<.0001	0.0077	0.0009	<.0001	-0.0016	0.0002	<.0001	-0.0091	0.0003	<.0001
max(0,mtmltv - 5)	-0.2152	0.0131	<.0001	0.2664	0.0107	<.0001	-0.0887	0.0213	<.0001	0.0658	0.0091	<.0001	-0.4255	0.0618	<.0001
Refi Incentive with 2 months lag	-0.0192	0.0025	<.0001	0.0150	0.0067	0.0243	-0.1488	0.0045	<.0001	0.0687	0.0020	<.0001	-0.0896	0.0031	<.0001
January Indicator	-0.0760	0.0061	<.0001	-0.1876	0.0183	<.0001	-0.2078	0.0114	<.0001	0.0301	0.0045	<.0001	0.0027	0.0075	0.7224
February Indicator	-0.1167	0.0061	<.0001	-0.1641	0.0180	<.0001	-0.1116	0.0110	<.0001	-0.0221	0.0046	<.0001	0.1002	0.0073	<.0001
March Indicator	0.1060	0.0058	<.0001	0.0577	0.0169	0.0006	0.0796	0.0105	<.0001	-0.0267	0.0045	<.0001	0.0944	0.0073	<.0001
April Indicator	0.0549	0.0059	<.0001	0.0618	0.0168	0.0002	0.0978	0.0104	<.0001	-0.0267	0.0045	<.0001	0.0782	0.0073	<.0001
May Indicator	0.0912	0.0058	<.0001	0.1339	0.0166	<.0001	0.0223	0.0106	0.0361	0.0200	0.0045	<.0001	0.0980	0.0073	<.0001
June Indicator	0.0347	0.0059	<.0001	0.1008	0.0168	<.0001	-0.1237	0.0111	<.0001	0.0646	0.0045	<.0001	0.1981	0.0072	<.0001
July Indicator	0.0629	0.0059	<.0001	0.0812	0.0170	<.0001	-0.0379	0.0109	0.0005	0.1034	0.0045	<.0001	0.2259	0.0072	<.0001
August Indicator	0.1695	0.0059	<.0001	0.0849	0.0172	<.0001	-0.0710	0.0111	<.0001	0.1499	0.0045	<.0001	0.1897	0.0073	<.0001
September Indicator	0.0092	0.0061	0.1329	-0.0146	0.0177	0.4081	-0.0881	0.0112	<.0001	0.1645	0.0045	<.0001	0.1246	0.0074	<.0001
October Indicator	-0.0180	0.0061	0.0033	0.0288	0.0175	0.0996	-0.1142	0.0113	<.0001	0.1356	0.0045	<.0001	0.0828	0.0075	<.0001
November Indicator	-0.0849	0.0062	<.0001	-0.0743	0.0178	<.0001	-0.1632	0.0114	<.0001	0.0564	0.0045	<.0001	0.0307	0.0076	<.0001

Table 18. Segment: NPL - ddq, Enterprise 1

Variable Name	Event: RPL Estimate	Event: RPL StdErr	Event: RPL Probt	Event: Prepay Estimate	Event: Prepay StdErr	Event: Prepay Probt	Event: LDQ Estimate	Event: LDQ StdErr	Event: LDQ Probt	Event: SDQ Estimate	Event: SDQ StdErr	Event: SDQ Probt	Event: Default Estimate	Event: Default StdErr	Event: Default Probt
Intercept	18.8560	1.8057	<.0001	-16.5612	1.0897	<.0001	8.7375	4.8591	0.0721	10.6596	2.5967	<.0001	52.4906	3.1662	<.0001
Refinance Rate	0.2346	0.0049	<.0001	-0.3538	0.0130	<.0001	0.0733	0.0204	0.0003	-0.1227	0.0100	<.0001	0.0998	0.0031	<.0001
Cash Out	0.3106	0.0043	<.0001	-0.4448	0.0124	<.0001	0.0793	0.0183	<.0001	-0.2546	0.0093	<.0001	-0.0203	0.0029	<.0001
Investment	-0.4878	0.0090	<.0001	-0.1424	0.0199	<.0001	-0.3424	0.0346	<.0001	-0.8104	0.0197	<.0001	0.0431	0.0041	<.0001
Second Home	-0.5013	0.0134	<.0001	0.0974	0.0292	0.0009	-0.5497	0.0584	<.0001	-0.7962	0.0338	<.0001	0.1008	0.0061	<.0001
Age	0.0043	0.0002	<.0001	-0.0256	0.0004	<.0001	-0.0077	0.0008	<.0001	-0.0175	0.0004	<.0001	-0.0093	0.0001	<.0001
Age Sq.	0.0000	.	.	0.0000	.	.	0.0000	.	.	0.0000	.	.	0.0000	.	.
Current UPB (000s)	0.0001	0.0001	0.1952	0.0049	0.0002	<.0001	-0.0023	0.0002	<.0001	-0.0045	0.0001	<.0001	-0.0053	0.0000	<.0001
Current UPB (00000s) Sq.	0.0536	.	.	-0.0788	.	.	0.0697	.	.	0.0660	.	.	0.0599	.	.
Debt to Income Ratio	0.0000	0.0001	0.7681	-0.0004	0.0009	0.6460	-0.0006	0.0028	0.8229	-0.0010	0.0024	0.6805	0.0001	0.0001	0.4625
Credit Score	-0.0023	0.0001	<.0001	0.0017	0.0001	<.0001	-0.0034	0.0002	<.0001	-0.0032	0.0001	<.0001	0.0027	0.0000	<.0001
Burnout Count	-0.0001	0.0002	0.7457	0.0055	0.0003	<.0001	0.0028	0.0007	<.0001	0.0062	0.0003	<.0001	0.0038	0.0001	<.0001
Sato F30	-0.0297	0.0023	<.0001	-0.0137	0.0078	0.0787	-0.0468	0.0097	<.0001	-0.0542	0.0052	<.0001	-0.0110	0.0015	<.0001
Judicial State	-0.6347	0.0036	<.0001	-0.3887	0.0098	<.0001	-0.7894	0.0152	<.0001	-0.7971	0.0075	<.0001	-0.4259	0.0024	<.0001
2005-2008 Indicator	-0.5926	0.0064	<.0001	-0.4850	0.0145	<.0001	-0.3689	0.0255	<.0001	-0.3575	0.0112	<.0001	-0.1251	0.0039	<.0001
2009-2013 Indicator	-0.1970	0.0104	<.0001	-0.4294	0.0188	<.0001	-0.5544	0.0438	<.0001	-0.8599	0.0216	<.0001	-0.2326	0.0065	<.0001
>= 2014 Indicator	0.3287	0.0195	<.0001	-0.4396	0.0330	<.0001	0.0554	0.0716	0.4391	-0.6152	0.0389	<.0001	-0.4401	0.0152	<.0001
No Full Doc Loan	-0.0962	0.0053	<.0001	-0.2299	0.0177	<.0001	-0.0543	0.0228	0.0171	-0.1124	0.0122	<.0001	-0.0982	0.0033	<.0001
Fixed Rate Mortgage 40 YR	0.0998	0.0166	<.0001	-0.2664	0.1034	0.0100	0.1488	0.0663	0.0247	0.1323	0.0385	0.0006	-0.2132	0.0115	<.0001
Fixed Rate Mortgage 30 YR	0.3743	0.0063	<.0001	-0.0547	0.0197	0.0055	0.2284	0.0262	<.0001	0.1351	0.0137	<.0001	-0.0785	0.0037	<.0001
Fixed Rate Mortgage 15 YR	0.8344	0.0092	<.0001	-0.1141	0.0220	<.0001	0.3971	0.0383	<.0001	-0.0332	0.0188	0.0775	-0.1330	0.0063	<.0001
Non Fixed Rate Mortgage	0.0000	.	.	0.0000	.	.	0.0000	.	.	0.0000	.	.	0.0000	.	.
One Borrower Indicator	0.4370	0.0402	<.0001	-0.2269	0.1056	0.0316	0.0503	0.1634	0.7581	-0.0965	0.0783	0.2179	0.3103	0.0276	<.0001
Credit Score x One Borrower (00s)	-0.0680	0.0001	<.0001	0.0146	0.0002	0.3483	-0.0210	0.0002	0.3855	-0.0070	0.0001	0.5371	-0.0610	0.0000	<.0001
Junior Lien Indicator	-0.0704	0.0054	<.0001	-0.2327	0.0178	<.0001	-0.0609	0.0230	0.0081	-0.1238	0.0123	<.0001	0.0630	0.0033	<.0001
Alta Loan Indicator	-0.1088	0.0047	<.0001	-0.0998	0.0165	<.0001	-0.0803	0.0196	<.0001	0.0275	0.0101	0.0063	-0.0130	0.0030	<.0001
IO Loan Indicator	0.0000	.	.	0.0000	.	.	0.0000	.	.	0.0000	.	.	0.0000	.	.
Jumbo Loan Indicator	-0.6877	0.0487	<.0001	0.2675	0.0982	0.0064	-0.7801	0.2426	0.0013	-0.2903	0.1381	0.0355	-0.3879	0.0546	<.0001
max(0,unemp_rate - 9)	-0.0362	0.0510	0.4774	0.3329	0.0712	<.0001	0.1425	0.2071	0.4914	-0.1689	0.0870	0.0522	0.6186	0.0371	<.0001
max(0,9 - unemp_rate)	-0.0306	0.0507	0.5466	-0.1006	0.0690	0.1446	-0.1825	0.2058	0.3750	0.2158	0.0863	0.0123	-0.4693	0.0369	<.0001
max(0,unemp_rate - 7)	0.0431	0.0079	<.0001	-0.0827	0.0231	0.0003	-0.1143	0.0337	0.0007	0.0344	0.0166	0.0379	0.0978	0.0051	<.0001
max(0,unemp_rate - 3)	-0.1382	0.0523	0.0082	-0.3335	0.0730	<.0001	-0.3797	0.2130	0.0746	0.0869	0.0898	0.3335	-0.6186	0.0379	<.0001
max(0,unemp_rate - 5.5)	0.0607	0.0088	<.0001	0.1389	0.0203	<.0001	0.3058	0.0383	<.0001	0.0992	0.0178	<.0001	-0.0515	0.0055	<.0001
max(0,mtmltv - 95)	0.2209	0.0197	<.0001	-0.1008	0.0116	<.0001	0.1031	0.0517	0.0461	0.1299	0.0280	<.0001	0.5955	0.0350	<.0001
max(0,95 - mtmltv)	-0.2379	0.0197	<.0001	0.1783	0.0109	<.0001	-0.1107	0.0516	0.0320	-0.1285	0.0280	<.0001	-0.5981	0.0350	<.0001
max(0,mtmltv - 50)	0.0183	0.0009	<.0001	-0.0351	0.0014	<.0001	0.0062	0.0036	0.0879	-0.0114	0.0016	<.0001	-0.0074	0.0007	<.0001
max(0,mtmltv - 80)	0.0204	0.0007	<.0001	-0.0377	0.0029	<.0001	0.0177	0.0028	<.0001	0.0029	0.0013	0.0290	-0.0098	0.0004	<.0001
max(0,mtmltv - 30)	-0.0125	0.0017	<.0001	-0.0025	0.0021	0.2302	0.0089	0.0065	0.1690	-0.0006	0.0031	0.8535	-0.0041	0.0016	0.0083
max(0,mtmltv - 140)	-0.0058	0.0003	<.0001	0.0255	0.0060	<.0001	0.0003	0.0013	0.8002	0.0043	0.0011	0.0001	-0.0018	0.0002	<.0001
max(0,mtmltv - 5)	-0.2332	0.0201	<.0001	0.1432	0.0117	<.0001	-0.1282	0.0538	0.0172	-0.1317	0.0290	<.0001	-0.5694	0.0353	<.0001
Refi Incentive with 2 months lag	-0.0883	0.0038	<.0001	-0.1512	0.0095	<.0001	-0.2687	0.0159	<.0001	-0.2354	0.0076	<.0001	-0.1529	0.0024	<.0001
January Indicator	-0.0463	0.0086	<.0001	-0.2107	0.0245	<.0001	-0.0615	0.0381	0.1063	-0.2024	0.0184	<.0001	-0.1233	0.0056	<.0001
February Indicator	-0.1207	0.0088	<.0001	-0.1951	0.0243	<.0001	-0.0603	0.0378	0.1110	-0.1555	0.0180	<.0001	-0.2146	0.0057	<.0001
March Indicator	0.1011	0.0083	<.0001	-0.0046	0.0232	0.8442	0.0916	0.0365	0.0120	-0.0145	0.0174	0.4048	-0.0346	0.0055	<.0001
April Indicator	0.0186	0.0085	0.0284	-0.0187	0.0232	0.4211	0.1510	0.0359	<.0001	0.0414	0.0172	0.0160	-0.0135	0.0054	0.0129
May Indicator	-0.0026	0.0085	0.7591	0.0918	0.0226	<.0001	0.3103	0.0347	<.0001	0.2227	0.0165	<.0001	-0.1127	0.0056	<.0001
June Indicator	-0.0727	0.0087	<.0001	0.0581	0.0228	0.0107	-0.0732	0.0379	0.0535	-0.1397	0.0180	<.0001	0.0273	0.0054	<.0001
July Indicator	-0.0364	0.0086	<.0001	0.0429	0.0228	0.0602	0.0381	0.0370	0.3026	-0.0798	0.0177	<.0001	0.0436	0.0054	<.0001
August Indicator	0.1556	0.0082	<.0001	0.0766	0.0226	0.0007	0.2189	0.0354	<.0001	-0.0208	0.0174	0.2313	0.0324	0.0054	<.0001
September Indicator	0.1108	0.0083	<.0001	-0.0223	0.0231	0.3347	0.0645	0.0367	0.0784	-0.1248	0.0178	<.0001	-0.0414	0.0055	<.0001
October Indicator	0.1180	0.0083	<.0001	0.0116	0.0229	0.6110	0.1662	0.0358	<.0001	-0.1210	0.0178	<.0001	-0.0687	0.0055	<.0001
November Indicator	0.0457	0.0084	<.0001	-0.1258	0.0236	<.0001	0.1280	0.0362	0.0004	-0.1824	0.0181	<.0001	-0.1694	0.0056	<.0001

Table 19. Segment: F30 Performing, Enterprise 2, Event: ldq

Variable Name	Estimate	StdErr	Probt
Intercept	-45.5872	2.0991	<.0001
Refinance Rate	0.0033	0.0947	0.9721
Cash Out	0.2724	0.0944	0.0039
Investment	-0.1811	0.0510	0.0004
Second Home	-0.1413	0.0619	0.0224
Age	0.0534	0.0018	<.0001
Age Sq.	-0.0003	0.0000	<.0001
Age (Years) Cb.	0.0016	0.0000	<.0001
Current UPB (000s)	0.0006	0.0004	0.1658
Current UPB (00000s) Sq.	0.0094	0.0000	<.0001
Credit Score	0.0171	0.0027	<.0001
Credit Sq (0s) Sq.	-0.0020	0.0000	<.0001
Sato F30	0.3249	0.0272	<.0001
Burnout Count	0.0055	0.0009	<.0001
Unemployment Rate	0.0862	0.0076	<.0001
Unemployment Burnout Count, 8%	-0.2195	0.0515	<.0001
Unemployment Burnout Count, 10%	-0.2853	0.0672	<.0001
Unemployment Burnout Count, 12%	-0.6926	0.1046	<.0001
max(0, mtmltv-79)	0.0313	0.0040	<.0001
max(0, 79 - mtmltv)	-0.0163	0.0016	<.0001
max(0, mtmltv-154)	-0.0141	0.0044	0.0014
max(0, mtmltv-90)	-0.0129	0.0068	0.0594
max(0, mtmltv-105)	-0.0105	0.0049	0.0323
max(0,debt_ratio - .60);	-0.9244	0.5159	0.0732
max(0,.60 - debt_ratio);	-1.0222	0.3105	0.001
max(0,debt_ratio - .30);	0.7336	0.3982	0.0654
max(0,debt_ratio - .95);	0.1900	0.2511	0.4493
Origination LTV	0.2525	0.1089	0.0204
Junior Lien Indicator	0.3924	0.1335	0.0033
Orig. LTV x Junior Lien Ind	-0.2363	0.1587	0.1366
One Borrower Indicator	-1.3313	0.2482	<.0001
Credit Score x One Borrower (00s)	0.2733	0.0004	<.0001
No Full Doc Loan	-0.0464	0.0728	0.5234
Third Party Loan	0.0589	0.0374	0.115
Judicial State	0.1063	0.0228	<.0001
Current UPB/Origination UPB	38.9118	1.9622	<.0001
HPA with 24 month lag	23.0431	1.6340	<.0001
HPA with lag x Sunk Cost	-26.2402	1.7148	<.0001
MTMLTV x Refinance Rate (00s)	0.2688	0.0011	0.0182
MTMLTV x Cash Out (00s)	0.0355	0.0011	0.7514
Q1	-0.1287	0.0298	<.0001
Q2	-0.3058	0.0312	<.0001
Q3	-0.1727	0.0300	<.0001
2005-2008 Indicator	0.1438	0.0373	0.0001
2009-2013 Indicator	-0.5833	0.0459	<.0001
>= 2014 Indicator	-0.2895	0.0567	<.0001

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Table 20. Segment: F15 Performing, Enterprise 2, Event: ldq

Variable Name	Estimate	StdErr	Probt
Intercept	-20.7634	2.0698	<.0001
Refinance Rate	0.1922	0.1648	0.2434
Cash Out	0.1039	0.1682	0.5366
Investment	-0.0061	0.0877	0.9447
Second Home	-0.2122	0.1363	0.1195
Age	0.0619	0.0034	<.0001
Age Sq.	-0.0004	0.0000	<.0001
Age (Years) Cb.	0.0019	0.0000	<.0001
Current UPB (000s)	-0.0048	0.0008	<.0001
Current UPB (00000s) Sq.	0.1100	0.0000	<.0001
Credit Score	0.0345	0.0055	<.0001
Credit Sq (0s) Sq.	-0.0040	0.0000	<.0001
Sato F30	0.1462	0.0441	0.0009
Burnout Count	0.0032	0.0013	0.0107
Unemployment Rate	0.1204	0.0124	<.0001
Unemployment Burnout Count, 8%	-0.1604	0.0986	0.1036
Unemployment Burnout Count, 10%	-0.2110	0.1343	0.1163
Unemployment Burnout Count, 12%	-0.8154	0.1989	<.0001
max(0, mtmltv-79)	0.0333	0.0126	0.0083
max(0, 79 - mtmltv)	-0.0224	0.0035	<.0001
max(0, mtmltv-154)	-0.0166	0.0185	0.3702
max(0, mtmltv-90)	-0.0147	0.0254	0.5629
max(0, mtmltv-105)	-0.0049	0.0217	0.8199
max(0,debt_ratio - .60);	-1.2613	0.8642	0.1444
max(0,.60 - debt_ratio);	-0.9564	0.4108	0.0199
max(0,debt_ratio - .30);	0.8269	0.5891	0.1604
max(0,debt_ratio - .95);	0.3633	0.5351	0.4972
Origination LTV	-0.0580	0.1945	0.7656
Junior Lien Indicator	0.3117	0.2093	0.1364
Orig. LTV x Junior Lien Ind	-0.2144	0.2809	0.4452
One Borrower Indicator	-0.4023	0.4430	0.3639
Credit Score x One Borrower (00s)	0.1605	0.0006	0.0123
No Full Doc Loan	-0.0239	0.0989	0.8089
Third Party Loan	-0.1353	0.0862	0.1166
Judicial State	0.1389	0.0389	0.0004
Current UPB/Origination UPB	6.1141	1.0248	<.0001
HPA with 24 month lag	1.8197	0.7436	0.0144
HPA with lag x Sunk Cost	-3.0296	0.9412	0.0013
MTMLTV x Refinance Rate (00s)	-0.1210	0.0028	0.6652
MTMLTV x Cash Out (00s)	0.4856	0.0028	0.0871
Q1	-0.1371	0.0503	0.0064
Q2	-0.3880	0.0539	<.0001
Q3	-0.2791	0.0521	<.0001
2005-2008 Indicator	0.3172	0.0645	<.0001
2009-2013 Indicator	-0.1373	0.0699	0.0495
>= 2014 Indicator	0.4089	0.0867	<.0001

Table 21. Segment: F30 Performing, Enterprise 2, Event: prepay

Variable Name	Estimate	StdErr	Probt
Intercept	-32.9723	1.1235	<.0001
Refinance Rate	0.1370	0.0228	<.0001
Cash Out	0.1156	0.0269	<.0001
Investment	-0.3318	0.0139	<.0001
Second Home	-0.1250	0.0149	<.0001
max(0,17-age)	-0.1788	0.0055	<.0001
max(0,age-17)	0.1719	0.0066	<.0001
max(0,age-7)	-0.1690	0.0064	<.0001
max(0,age-93)	-0.0055	0.0006	<.0001
max(0,age-35)	-0.0066	0.0008	<.0001
Current UPB (000s)	0.0053	0.0001	<.0001
Current UPB (00000s) Sq.	-0.0558	0.0000	<.0001
Credit Score	0.0131	0.0012	<.0001
Credit Sq (0s) Sq.	-0.0008	0.0000	<.0001
Sato F30	0.5480	0.0082	<.0001
Unemployment Rate	-0.0515	0.0025	<.0001
Unemployment Burnout Count, 8%	0.0296	0.0149	0.0471
Unemployment Burnout Count, 10%	0.2731	0.0198	<.0001
Unemployment Burnout Count, 12%	0.1431	0.0335	<.0001
max(0,mtmltv - 66)	-0.4772	0.0161	<.0001
max(0,66 - mtmltv)	0.4566	0.0160	<.0001
max(0,mtmltv - 30)	0.0091	0.0017	<.0001
max(0,mtmltv - 6)	0.4024	0.0371	<.0001
max(0,mtmltv - 101)	0.0073	0.0016	<.0001
max(0,mtmltv - 9)	0.0436	0.0239	0.0679
max(0,debt_ratio - .60);	0.3195	0.1495	0.0325
max(0,.60 - debt_ratio);	-0.3130	0.0639	<.0001
max(0,debt_ratio - .30);	-0.6965	0.0945	<.0001
max(0,debt_ratio - .95);	0.3780	0.0948	<.0001
Origination LTV	0.5204	0.0385	<.0001
Junior Lien Indicator	0.1909	0.0384	<.0001
Orig. LTV x Junior Lien Ind	-0.2334	0.0513	<.0001
One Borrower Indicator	-0.2152	0.0852	0.0115
Credit Score x One Borrower (00s)	0.0153	0.0001	0.1854
No Full Doc Loan	0.0437	0.0201	0.0294
Third Party Loan	0.0614	0.0083	<.0001
Judicial State	-0.0787	0.0062	<.0001
Current UPB/Origination UPB	-1.6442	0.2141	<.0001
HPA with 24 month lag	0.0612	0.1841	0.7395
HPA with lag x Sunk Cost	0.7873	0.1957	<.0001
MTMLTV x Refinance Rate (00s)	-0.2720	0.0003	<.0001
MTMLTV x Cash Out (00s)	-0.2890	0.0004	<.0001
Q1	-0.1068	0.0084	<.0001
Q2	0.0218	0.0081	0.0071
Q3	0.0611	0.0080	<.0001
2005-2008 Indicator	-0.1326	0.0124	<.0001
2009-2013 Indicator	-0.3752	0.0121	<.0001
>= 2014 Indicator	-0.3772	0.0142	<.0001
max(0,refi_incentive_level_l2 - 1.4)	0.2291	0.0493	<.0001
max(0,1.4 - refi_incentive_level_l2)	-0.5061	0.0175	<.0001
max(0,refi_incentive_level_l2 - 0.02)	0.8376	0.0257	<.0001
max(0,refi_incentive_level_l2 - 1.1)	-0.6157	0.0489	<.0001
max(0, brnt_cnt-1)	-0.1933	0.0137	<.0001
max(0, brnt_cnt-8)	0.1801	0.0138	<.0001
max(0, 8-brnt_cnt)	-0.1720	0.0124	<.0001
max(0, brnt_cnt-50)	0.0061	0.0010	<.0001
max(0, brnt_cnt-74)	0.0001	0.0012	0.9056
Indicator for 2001-2003 Refi Boom	0.6763	0.0110	<.0001

Table 22. Segment: F15 Performing, Enterprise 2, Event: prepay

Variable Name	Estimate	StdErr	Probt
Intercept	-39.4951	0.5856	<.0001
Refinance Rate	0.0015	0.0185	0.934
Cash Out	-0.0112	0.0201	0.5766
Investment	-0.2492	0.0160	<.0001
Second Home	-0.0282	0.0164	0.0849
max(0,17-age)	-0.2259	0.0062	<.0001
max(0,age-17)	0.2011	0.0074	<.0001
max(0,age-7)	-0.2077	0.0072	<.0001
max(0,age-93)	-0.0040	0.0005	<.0001
max(0,age-35)	-0.0030	0.0008	0.0003
Current UPB (000s)	0.0050	0.0001	<.0001
Current UPB (00000s) Sq.	-0.0517	0.0000	<.0001
Credit Score	0.0104	0.0013	<.0001
Credit Sq (0s) Sq.	-0.0007	0.0000	<.0001
Sato F30	0.3885	0.0071	<.0001
Unemployment Rate	-0.0459	0.0024	<.0001
Unemployment Burnout Count, 8%	0.0377	0.0151	0.0122
Unemployment Burnout Count, 10%	0.2679	0.0219	<.0001
Unemployment Burnout Count, 12%	0.1219	0.0370	0.001
max(0,mtmltv - 66)	-0.6012	0.0054	<.0001
max(0,66 - mtmltv)	0.5801	0.0053	<.0001
max(0,mtmltv - 30)	0.0230	0.0010	<.0001
max(0,mtmltv - 6)	0.6431	0.0124	<.0001
max(0,mtmltv - 101)	-0.0136	0.0053	0.0099
max(0,mtmltv - 9)	-0.0951	0.0084	<.0001
max(0,debt_ratio - .60);	-0.0183	0.1513	0.9036
max(0,.60 - debt_ratio);	-0.1502	0.0513	0.0034
max(0,debt_ratio - .30);	-0.3070	0.0866	0.0004
max(0,debt_ratio - .95);	0.3255	0.1012	0.0013
Origination LTV	1.3643	0.0323	<.0001
Junior Lien Indicator	0.0805	0.0307	0.0088
Orig. LTV x Junior Lien Ind	-0.0600	0.0478	0.2088
One Borrower Indicator	-0.1226	0.0931	0.1878
Credit Score x One Borrower (00s)	0.0093	0.0001	0.4544
No Full Doc Loan	0.0673	0.0152	<.0001
Third Party Loan	0.0910	0.0103	<.0001
Judicial State	-0.0317	0.0059	<.0001
Current UPB/Origination UPB	-0.1923	0.1103	0.0812
HPA with 24 month lag	0.1148	0.0733	0.1174
HPA with lag x Sunk Cost	-0.3499	0.0930	0.0002
MTMLTV x Refinance Rate (00s)	-0.0480	0.0004	0.216
MTMLTV x Cash Out (00s)	0.0387	0.0004	0.3643
Q1	-0.0792	0.0083	<.0001
Q2	0.0500	0.0080	<.0001
Q3	0.0745	0.0079	<.0001
2005-2008 Indicator	-0.0312	0.0132	0.0178
2009-2013 Indicator	-0.1745	0.0106	<.0001
>= 2014 Indicator	-0.3323	0.0149	<.0001
max(0,refi_incentive_level_l2 - 1.4)	-0.1810	0.0497	0.0003
max(0,1.4 - refi_incentive_level_l2)	-0.3679	0.0165	<.0001
max(0,refi_incentive_level_l2 - 0.02)	0.6041	0.0243	<.0001
max(0,refi_incentive_level_l2 - 1.1)	-0.2241	0.0493	<.0001
max(0, brnt_cnt-1)	-0.1436	0.0130	<.0001
max(0, brnt_cnt-8)	0.1330	0.0130	<.0001
max(0, 8-brnt_cnt)	-0.1410	0.0118	<.0001
max(0, brnt_cnt-50)	0.0078	0.0010	<.0001
max(0, brnt_cnt-74)	-0.0001	0.0010	0.9003
Indicator for 2001-2003 Refi Boom	0.7301	0.0102	<.0001

Table 23. Segment: RPL, Enterprise 2, Event: ldq

Variable Name	Estimate	StdErr	Probt
Intercept	-4.3820	0.2636	<.0001
Refinance Rate	-0.0791	0.0188	<.0001
Cash Out	-0.0659	0.0182	0.0003
Investment	0.0579	0.0150	0.0001
Second Home	-0.0299	0.0183	0.1033
Age	-0.0273	0.0005	<.0001
Age Sq.	0.0002	0.0000	<.0001
Age (Years) Cb.	-0.0005	0.0000	<.0001
Current UPB (000s)	-0.0018	0.0001	<.0001
Current UPB (00000s) Sq.	0.0214	0.0000	<.0001
Credit Score	0.0062	0.0006	<.0001
Credit Sq (0s) Sq.	-0.0006	0.0000	<.0001
Sato F30	0.0142	0.0052	0.0069
Burnout Count	-0.0016	0.0002	<.0001
Unemployment Rate	0.0546	0.0019	<.0001
Unemployment Burnout Count, 8%	-0.2387	0.0164	<.0001
Unemployment Burnout Count, 10%	-0.5476	0.0210	<.0001
Unemployment Burnout Count, 12%	-0.4928	0.0269	<.0001
max(0, mtmltv-79)	0.0000	0.0011	0.9738
max(0, 79 - mtmltv)	0.0082	0.0004	<.0001
max(0, mtmltv-154)	0.0020	0.0014	0.1566
max(0, mtmltv-90)	-0.0092	0.0019	<.0001
max(0, mtmltv-105)	0.0042	0.0014	0.0031
max(0,debt_ratio - .60);	0.6040	0.1256	<.0001
max(0,.60 - debt_ratio);	-0.3839	0.0695	<.0001
max(0,debt_ratio - .30);	-0.8170	0.0912	<.0001
max(0,debt_ratio - .95);	0.2129	0.0690	0.002
Origination LTV	0.4093	0.0265	<.0001
Junior Lien Indicator	0.0584	0.0405	0.1495
Orig. LTV x Junior Lien Ind	-0.1210	0.0507	0.0171
One Borrower Indicator	-0.1879	0.0576	0.0011
Credit Score x One Borrower (00s)	0.0403	0.0001	<.0001
No Full Doc Loan	-0.0534	0.0138	0.0001
Third Party Loan	-0.0012	0.0102	0.9099
Judicial State	-0.0184	0.0054	0.0007
Current UPB/Origination UPB	2.3630	0.1744	<.0001
HPA with 24 month lag	-0.4653	0.1506	0.002
HPA with lag x Sunk Cost	-1.0048	0.1620	<.0001
MTMLTV x Refinance Rate (00s)	-0.1700	0.0003	<.0001
MTMLTV x Cash Out (00s)	-0.0680	0.0002	0.0036
Q1	-0.0884	0.0073	<.0001
Q2	-0.1497	0.0073	<.0001
Q3	-0.0723	0.0072	<.0001
2005-2008 Indicator	-0.1470	0.0086	<.0001
2009-2013 Indicator	-0.0741	0.0111	<.0001
>= 2014 Indicator	-0.3368	0.0171	<.0001

Table 24. Segment: RPL, Enterprise 2, Event: prepay

Variable Name	Estimate	StdErr	Probt
Intercept	-37.6907	2.0413	<.0001
Refinance Rate	0.0339	0.0307	0.2701
Cash Out	-0.0027	0.0316	0.9322
Investment	0.0899	0.0254	0.0004
Second Home	0.1165	0.0288	<.0001
max(0,17-age)	0.0167	0.1750	0.924
max(0,age-17)	-0.0607	0.1795	0.7355
max(0,age-7)	0.0407	0.1793	0.8204
max(0,age-93)	0.0036	0.0006	<.0001
max(0,age-35)	0.0082	0.0025	0.0009
Current UPB (000s)	0.0059	0.0002	<.0001
Current UPB (00000s) Sq.	-0.1000	0.0000	<.0001
Credit Score	-0.0027	0.0012	0.0202
Credit Sq (0s) Sq.	0.0003	0.0000	<.0001
Sato F30	0.1402	0.0096	<.0001
Unemployment Rate	-0.0904	0.0042	<.0001
Unemployment Burnout Count, 8%	-0.1751	0.0363	<.0001
Unemployment Burnout Count, 10%	-0.0765	0.0461	0.0973
Unemployment Burnout Count, 12%	0.5445	0.0547	<.0001
max(0,mtmltv - 66)	-0.5926	0.0130	<.0001
max(0,66 - mtmltv)	0.5725	0.0129	<.0001
max(0,mtmltv - 30)	-0.0088	0.0020	<.0001
max(0,mtmltv - 6)	0.6881	0.0324	<.0001
max(0,mtmltv - 101)	0.0184	0.0020	<.0001
max(0,mtmltv - 9)	-0.1229	0.0218	<.0001
max(0,debt_ratio - .60);	-0.0292	0.2179	0.8932
max(0,.60 - debt_ratio);	-0.0171	0.1156	0.8823
max(0,debt_ratio - .30);	-0.2239	0.1552	0.1492
max(0,debt_ratio - .95);	0.2519	0.1220	0.0388
Origination LTV	0.8111	0.0473	<.0001
Junior Lien Indicator	-0.0354	0.0699	0.6132
Orig. LTV x Junior Lien Ind	-0.0175	0.0898	0.8457
One Borrower Indicator	-0.3514	0.1042	0.0007
Credit Score x One Borrower (00s)	0.0376	0.0002	0.0137
No Full Doc Loan	-0.0749	0.0252	0.003
Third Party Loan	-0.0667	0.0177	0.0002
Judicial State	-0.0366	0.0098	0.0002
Current UPB/Origination UPB	-2.4197	0.2325	<.0001
HPA with 24 month lag	0.0793	0.1813	0.662
HPA with lag x Sunk Cost	1.6043	0.2044	<.0001
MTMLTV x Refinance Rate (00s)	-0.3440	0.0005	<.0001
MTMLTV x Cash Out (00s)	-0.3680	0.0005	<.0001
Q1	-0.0961	0.0135	<.0001
Q2	0.0611	0.0128	<.0001
Q3	0.0587	0.0127	<.0001
2005-2008 Indicator	-0.1433	0.0167	<.0001
2009-2013 Indicator	-0.3194	0.0213	<.0001
>= 2014 Indicator	-0.3954	0.0320	<.0001
max(0,refi_incentive_level_l2 - 1.4)	0.4215	0.0819	<.0001
max(0,1.4 - refi_incentive_level_l2)	-0.1414	0.0410	0.0006
max(0,refi_incentive_level_l2 - 0.02)	0.0813	0.0561	0.1474
max(0,refi_incentive_level_l2 - 1.1)	-0.3322	0.0890	0.0002
max(0, brnt_cnt-1)	-0.0437	0.0430	0.3095
max(0, brnt_cnt-8)	0.0480	0.0431	0.2652
max(0, 8-brnt_cnt)	-0.0393	0.0386	0.3083
max(0, brnt_cnt-50)	-0.0071	0.0013	<.0001
max(0, brnt_cnt-74)	0.0023	0.0010	0.0194
Indicator for 2001-2003 Refi Boom	0.4557	0.0249	<.0001

Table 25. Segment: ARMs Performing, Enterprise 2, Event: ldq

Variable Name	Estimate	StdErr	Probt
Intercept	-23.4132	1.3252	<.0001
Refinance Rate	0.3032	0.0764	<.0001
Cash Out	0.5594	0.0779	<.0001
Investment	0.0515	0.0353	0.1445
Second Home	-0.0412	0.0320	0.1975
Age	0.0249	0.0016	<.0001
Age Sq.	-0.0002	0.0000	<.0001
Age (Years) Cb.	0.0010	0.0000	<.0001
Current UPB (000s)	0.0020	0.0004	<.0001
Current UPB (00000s) Sq.	-0.0064	0.0000	<.0001
Credit Score	0.0090	0.0025	0.0003
Credit Sq (0s) Sq.	-0.0010	0.0000	<.0001
Sato F30	0.3936	0.0155	<.0001
Burnout Count	0.0027	0.0010	0.005
Unemployment Rate	0.0795	0.0063	<.0001
Unemployment Burnout Count, 8%	-0.4851	0.0629	<.0001
Unemployment Burnout Count, 10%	-0.3399	0.0786	<.0001
Unemployment Burnout Count, 12%	-0.4293	0.1051	<.0001
max(0, mtmltv-79)	0.0294	0.0035	<.0001
max(0, 79 - mtmltv)	-0.0132	0.0017	<.0001
max(0, mtmltv-154)	-0.0041	0.0027	0.1299
max(0, mtmltv-90)	-0.0082	0.0054	0.1279
max(0, mtmltv-105)	-0.0172	0.0032	<.0001
max(0,debt_ratio - .60);	-0.3649	0.4885	0.4551
max(0,.60 - debt_ratio);	-0.9140	0.2460	0.0002
max(0,debt_ratio - .30);	0.2101	0.3246	0.5176
max(0,debt_ratio - .95);	0.1495	0.3064	0.6257
Origination LTV	1.6377	0.1126	<.0001
Junior Lien Indicator	0.9656	0.2060	<.0001
Orig. LTV x Junior Lien Ind	-0.9104	0.2624	0.0005
One Borrower Indicator	-0.5609	0.2285	0.0141
Credit Score x One Borrower (00s)	0.1439	0.0003	<.0001
No Full Doc Loan	0.3044	0.0239	<.0001
Third Party Loan	0.0920	0.0659	0.1624
Judicial State	0.1145	0.0198	<.0001
Current UPB/Origination UPB	18.0858	1.0249	<.0001
HPA with 24 month lag	10.6921	0.9266	<.0001
HPA with lag x Sunk Cost	-13.9216	0.9505	<.0001
MTMLTV x Refinance Rate (00s)	0.0481	0.0008	0.535
MTMLTV x Cash Out (00s)	-0.2010	0.0008	0.008
Q1	-0.0334	0.0244	0.171
Q2	-0.1571	0.0251	<.0001
Q3	-0.1373	0.0250	<.0001
2005-2008 Indicator	0.2188	0.0319	<.0001
2009-2013 Indicator	-0.9802	0.0786	<.0001
>= 2014 Indicator	-1.2345	0.1245	<.0001
Months until Interest Rate is reset	0.0025	0.0004	<.0001

Table 26. Segment: ARMs Performing, Enterprise 2, Event: prepay

Variable Name	Estimate	StdErr	Probt
Intercept	-29.5370	0.7887	<.0001
Refinance Rate	0.0872	0.0205	<.0001
Cash Out	0.0927	0.0232	<.0001
Investment	-0.4211	0.0144	<.0001
Second Home	-0.2483	0.0122	<.0001
max(0,17-age)	-0.1606	0.0050	<.0001
max(0,age-17)	0.1731	0.0061	<.0001
max(0,age-7)	-0.1642	0.0059	<.0001
max(0,age-93)	-0.0011	0.0006	0.0872
max(0,age-35)	-0.0230	0.0008	<.0001
Current UPB (000s)	0.0023	0.0001	<.0001
Current UPB (00000s) Sq.	-0.0209	0.0000	<.0001
Credit Score	0.0079	0.0012	<.0001
Credit Sq (0s) Sq.	-0.0005	0.0000	<.0001
Sato F30	0.1714	0.0055	<.0001
Unemployment Rate	-0.0471	0.0024	<.0001
Unemployment Burnout Count, 8%	0.1316	0.0161	<.0001
Unemployment Burnout Count, 10%	0.3584	0.0223	<.0001
Unemployment Burnout Count, 12%	0.4294	0.0407	<.0001
max(0,mtmltv - 66)	-0.4556	0.0101	<.0001
max(0,66 - mtmltv)	0.4350	0.0101	<.0001
max(0,mtmltv - 30)	0.0120	0.0015	<.0001
max(0,mtmltv - 6)	0.3766	0.0240	<.0001
max(0,mtmltv - 101)	0.0145	0.0013	<.0001
max(0,mtmltv - 9)	0.0390	0.0161	0.0152
max(0,debt_ratio - .60);	0.2999	0.1585	0.0585
max(0,.60 - debt_ratio);	-0.3070	0.0592	<.0001
max(0,debt_ratio - .30);	-0.5596	0.0915	<.0001
max(0,debt_ratio - .95);	0.2600	0.1082	0.0163
Origination LTV	1.2336	0.0402	<.0001
Junior Lien Indicator	0.0297	0.0393	0.4503
Orig. LTV x Junior Lien Ind	-0.1594	0.0536	0.0029
One Borrower Indicator	-0.1370	0.0851	0.1073
Credit Score x One Borrower (00s)	0.0029	0.0001	0.801
No Full Doc Loan	-0.1805	0.0131	<.0001
Third Party Loan	0.1418	0.0109	<.0001
Judicial State	-0.0294	0.0063	<.0001
Current UPB/Origination UPB	-0.4344	0.1425	0.0023
HPA with 24 month lag	-0.2867	0.1186	0.0157
HPA with lag x Sunk Cost	0.7923	0.1259	<.0001
MTMLTV x Refinance Rate (00s)	-0.0430	0.0003	0.1839
MTMLTV x Cash Out (00s)	-0.1740	0.0004	<.0001
Q1	-0.0965	0.0086	<.0001
Q2	0.1163	0.0082	<.0001
Q3	0.1148	0.0082	<.0001
2005-2008 Indicator	-0.1788	0.0107	<.0001
2009-2013 Indicator	-0.2475	0.0123	<.0001
>= 2014 Indicator	-0.3885	0.0148	<.0001
max(0,refi_incentive_level_l2 - 1.4)	-0.0100	0.0543	0.8543
max(0,1.4 - refi_incentive_level_l2)	-0.2243	0.0163	<.0001
max(0,refi_incentive_level_l2 - 0.02)	0.3016	0.0244	<.0001
max(0,refi_incentive_level_l2 - 1.1)	-0.2526	0.0539	<.0001
max(0, brnt_cnt-1)	-0.2006	0.0123	<.0001
max(0, brnt_cnt-8)	0.1937	0.0124	<.0001
max(0, 8-brnt_cnt)	-0.1968	0.0112	<.0001
max(0, brnt_cnt-50)	0.0045	0.0011	<.0001
max(0, brnt_cnt-74)	0.0060	0.0011	<.0001
Indicator for 2001-2003 Refi Boom	0.4408	0.0102	<.0001
Months until Interest Rate is reset	0.0052	0.0001	<.0001

Table 27. Segment: MRPL, Enterprise 2, Event: ldq

Variable Name	Estimate	StdErr	Probt
Intercept	-9.2683	0.3211	<.0001
Refinance Rate	-0.0534	0.0225	0.0176
Cash Out	-0.1054	0.0218	<.0001
Investment	0.0176	0.0198	0.375
Second Home	-0.0653	0.0237	0.0059
Age	-0.0070	0.0007	<.0001
Age Sq.	0.0001	0.0000	<.0001
Age (Years) Cb.	-0.0003	0.0000	<.0001
Current UPB (000s)	-0.0011	0.0001	<.0001
Current UPB (00000s) Sq.	0.0106	0.0000	<.0001
Credit Score	0.0102	0.0007	<.0001
Credit Sq (0s) Sq.	-0.0010	0.0000	<.0001
Sato F30	0.0358	0.0057	<.0001
Burnout Count	0.0014	0.0002	<.0001
Unemployment Rate	0.0015	0.0024	0.5292
Unemployment Burnout Count, 8%	-0.3990	0.0184	<.0001
Unemployment Burnout Count, 10%	-0.6510	0.0244	<.0001
Unemployment Burnout Count, 12%	-0.2432	0.0314	<.0001
max(0, mtmltv-79)	0.0005	0.0011	0.6639
max(0, 79 - mtmltv)	0.0051	0.0004	<.0001
max(0, mtmltv-154)	-0.0015	0.0012	0.1977
max(0, mtmltv-90)	-0.0056	0.0019	0.0025
max(0, mtmltv-105)	0.0029	0.0013	0.0197
max(0,debt_ratio - .60);	-0.1219	0.1399	0.3835
max(0,.60 - debt_ratio);	-0.1050	0.0857	0.2207
max(0,debt_ratio - .30);	-0.2067	0.1075	0.0547
max(0,debt_ratio - .95);	0.3276	0.0709	<.0001
Origination LTV	0.4192	0.0288	<.0001
Junior Lien Indicator	0.1959	0.0432	<.0001
Orig. LTV x Junior Lien Ind	-0.2632	0.0533	<.0001
One Borrower Indicator	-0.2023	0.0631	0.0014
Credit Score x One Borrower (00s)	0.0436	0.0001	<.0001
No Full Doc Loan	-0.0111	0.0144	0.4399
Third Party Loan	0.0445	0.0109	<.0001
Judicial State	-0.0130	0.0061	0.0318
Current UPB/Origination UPB	5.6106	0.2315	<.0001
HPA with 24 month lag	2.5929	0.2092	<.0001
HPA with lag x Sunk Cost	-3.8017	0.2130	<.0001
MTMLTV x Refinance Rate (00s)	-0.1270	0.0003	<.0001
MTMLTV x Cash Out (00s)	-0.0010	0.0002	0.966
Q1	-0.1211	0.0079	<.0001
Q2	-0.2193	0.0080	<.0001
Q3	-0.0941	0.0078	<.0001
2005-2008 Indicator	-0.1205	0.0099	<.0001
2009-2013 Indicator	-0.1528	0.0134	<.0001
>= 2014 Indicator	-0.5742	0.0216	<.0001
Min # of months since Mod. or Del	-0.0653	0.0007	<.0001
min_dt sq.	0.0006	0.0000	<.0001
min_dt cb.	0.0000	0.0000	<.0001

Table 28. Segment: MRPL, Enterprise 2, Event: prepay

Variable Name	Estimate	StdErr	Probt
Intercept	-42.9250	7.4085	<.0001
Refinance Rate	-0.0113	0.0406	0.7797
Cash Out	-0.0631	0.0417	0.13
Investment	0.1727	0.0352	<.0001
Second Home	0.0295	0.0399	0.4599
max(0,17-age)	0.2187	0.7170	0.7603
max(0,age-17)	-0.2170	0.7251	0.7648
max(0,age-7)	0.2139	0.7248	0.7679
max(0,age-93)	0.0049	0.0008	<.0001
max(0,age-35)	-0.0118	0.0041	0.0036
Current UPB (000s)	0.0056	0.0002	<.0001
Current UPB (00000s) Sq.	-0.1000	0.0000	<.0001
Credit Score	0.0019	0.0013	0.1394
Credit Sq (0s) Sq.	-0.0001	0.0000	<.0001
Sato F30	0.1105	0.0108	<.0001
Unemployment Rate	-0.0793	0.0053	<.0001
Unemployment Burnout Count, 8%	-0.2980	0.0414	<.0001
Unemployment Burnout Count, 10%	-0.2881	0.0513	<.0001
Unemployment Burnout Count, 12%	0.6323	0.0603	<.0001
max(0,mtmltv - 66)	-0.6186	0.0219	<.0001
max(0,66 - mtmltv)	0.6030	0.0218	<.0001
max(0,mtmltv - 30)	-0.0040	0.0028	0.1489
max(0,mtmltv - 6)	0.6974	0.0534	<.0001
max(0,mtmltv - 101)	0.0151	0.0019	<.0001
max(0,mtmltv - 9)	-0.1127	0.0350	0.0013
max(0,debt_ratio - .60);	-0.0320	0.2433	0.8953
max(0,.60 - debt_ratio);	0.0875	0.1489	0.5567
max(0,debt_ratio - .30);	-0.1872	0.1881	0.3198
max(0,debt_ratio - .95);	0.2175	0.1202	0.0703
Origination LTV	1.2008	0.0521	<.0001
Junior Lien Indicator	0.0826	0.0722	0.2521
Orig. LTV x Junior Lien Ind	-0.1627	0.0905	0.0722
One Borrower Indicator	-0.1839	0.1157	0.1119
Credit Score x One Borrower (00s)	0.0006	0.0002	0.9726
No Full Doc Loan	-0.1234	0.0271	<.0001
Third Party Loan	-0.0392	0.0180	0.0295
Judicial State	-0.0083	0.0111	0.4556
Current UPB/Origination UPB	-2.7248	0.3575	<.0001
HPA with 24 month lag	-0.6096	0.2908	0.036
HPA with lag x Sunk Cost	2.2975	0.3162	<.0001
MTMLTV x Refinance Rate (00s)	-0.2670	0.0006	<.0001
MTMLTV x Cash Out (00s)	-0.2790	0.0006	<.0001
Q1	-0.1251	0.0150	<.0001
Q2	0.0769	0.0141	<.0001
Q3	0.0741	0.0139	<.0001
2005-2008 Indicator	-0.2190	0.0196	<.0001
2009-2013 Indicator	-0.3780	0.0274	<.0001
>= 2014 Indicator	-0.2301	0.0399	<.0001
max(0,refi_incentive_level_l2 - 1.4)	0.9466	0.0989	<.0001
max(0,1.4 - refi_incentive_level_l2)	-0.1015	0.0476	0.0329
max(0,refi_incentive_level_l2 - 0.02)	0.0036	0.0680	0.9576
max(0,refi_incentive_level_l2 - 1.1)	-0.6698	0.1089	<.0001
max(0, brnt_cnt-1)	-0.0322	0.0616	0.6013
max(0, brnt_cnt-8)	0.0370	0.0618	0.5493
max(0, 8-brnt_cnt)	-0.0229	0.0546	0.6755
max(0, brnt_cnt-50)	-0.0084	0.0017	<.0001
max(0, brnt_cnt-74)	0.0022	0.0012	0.0667
Indicator for 2001-2003 Refi Boom	0.8496	0.0395	<.0001
Min # of months since Mod. or Del.	0.0246	0.0011	<.0001
min_dt sq.	-0.0001	0.0000	<.0001
min_dt cb.	0.0000	0.0000	<.0001

Table 29. Segment: NRPL, Enterprise 2, Event: ldq

Variable Name	Estimate	StdErr	Probt
Intercept	-3.9875	0.2393	<.0001
Refinance Rate	0.0702	0.0177	<.0001
Cash Out	0.1112	0.0174	<.0001
Investment	-0.0710	0.0125	<.0001
Second Home	-0.1189	0.0155	<.0001
Age	-0.0012	0.0004	0.0081
Age Sq.	0.0000	0.0000	0.0006
Age (Years) Cb.	0.0000	0.0000	<.0001
Current UPB (000s)	0.0003	0.0001	0.0027
Current UPB (00000s) Sq.	-0.0002	0.0000	<.0001
Credit Score	0.0039	0.0006	<.0001
Credit Sq (0s) Sq.	-0.0004	0.0000	<.0001
Sato F30	0.0487	0.0049	<.0001
Burnout Count	0.0010	0.0001	<.0001
Unemployment Rate	0.0270	0.0017	<.0001
Unemployment Burnout Count, 8%	-0.1176	0.0148	<.0001
Unemployment Burnout Count, 10%	-0.2207	0.0187	<.0001
Unemployment Burnout Count, 12%	-0.2340	0.0243	<.0001
max(0, mtmltv-79)	0.0073	0.0011	<.0001
max(0, 79 - mtmltv)	0.0001	0.0003	0.8516
max(0, mtmltv-154)	0.0034	0.0021	0.111
max(0, mtmltv-90)	-0.0105	0.0021	<.0001
max(0, mtmltv-105)	-0.0012	0.0017	0.486
max(0,debt_ratio - .60);	-0.0653	0.1173	0.5781
max(0,.60 - debt_ratio);	-0.2676	0.0598	<.0001
max(0,debt_ratio - .30);	-0.1601	0.0813	0.0489
max(0,debt_ratio - .95);	0.2263	0.0685	0.0009
Origination LTV	0.2414	0.0255	<.0001
Junior Lien Indicator	0.0801	0.0389	0.0396
Orig. LTV x Junior Lien Ind	-0.1244	0.0497	0.0122
One Borrower Indicator	-0.1887	0.0536	0.0004
Credit Score x One Borrower (00s)	0.0437	0.0001	<.0001
No Full Doc Loan	-0.0010	0.0132	0.9395
Third Party Loan	0.0054	0.0097	0.5758
Judicial State	-0.0266	0.0050	<.0001
Current UPB/Origination UPB	2.1535	0.1554	<.0001
HPA with 24 month lag	0.7169	0.1293	<.0001
HPA with lag x Sunk Cost	-1.6600	0.1452	<.0001
MTMLTV x Refinance Rate (00s)	-0.1820	0.0003	<.0001
MTMLTV x Cash Out (00s)	-0.1900	0.0003	<.0001
Q1	-0.0874	0.0068	<.0001
Q2	-0.1710	0.0067	<.0001
Q3	-0.0827	0.0067	<.0001
2005-2008 Indicator	0.0310	0.0078	<.0001
2009-2013 Indicator	0.0044	0.0101	0.6653
>= 2014 Indicator	-0.0537	0.0147	0.0003
# of months since last 3+ months delinquen	-0.1342	0.0006	<.0001
month_from_last_dq sq.	0.0017	0.0000	<.0001
month_from_last_dq cb.	0.0000	0.0000	<.0001

Table 30. Segment: NRPL, Enterprise 2, Event: prepay

Variable Name	Estimate	StdErr	Probt
Intercept	-39.2095	1.2872	<.0001
Refinance Rate	0.0782	0.0254	0.0021
Cash Out	-0.0245	0.0265	0.3553
Investment	0.0083	0.0204	0.6839
Second Home	-0.0145	0.0237	0.5405
max(0,17-age)	0.0183	0.1000	0.8549
max(0,age-17)	-0.0007	0.1030	0.9949
max(0,age-7)	-0.0070	0.1028	0.9459
max(0,age-93)	0.0022	0.0005	<.0001
max(0,age-35)	-0.0010	0.0019	0.6176
Current UPB (000s)	0.0055	0.0002	<.0001
Current UPB (00000s) Sq.	-0.0873	0.0000	<.0001
Credit Score	-0.0071	0.0010	<.0001
Credit Sq (0s) Sq.	0.0007	0.0000	<.0001
Sato F30	0.0760	0.0086	<.0001
Unemployment Rate	-0.0768	0.0036	<.0001
Unemployment Burnout Count, 8%	-0.0905	0.0314	0.0039
Unemployment Burnout Count, 10%	0.0076	0.0408	0.8528
Unemployment Burnout Count, 12%	0.2240	0.0511	<.0001
max(0,mtmltv - 66)	-0.6241	0.0100	<.0001
max(0,66 - mtmltv)	0.6211	0.0100	<.0001
max(0,mtmltv - 30)	0.0189	0.0017	<.0001
max(0,mtmltv - 6)	0.7632	0.0252	<.0001
max(0,mtmltv - 101)	0.0119	0.0018	<.0001
max(0,mtmltv - 9)	-0.1741	0.0170	<.0001
max(0,debt_ratio - .60);	0.1460	0.1947	0.4532
max(0,.60 - debt_ratio);	0.0136	0.0958	0.8871
max(0,debt_ratio - .30);	-0.0396	0.1339	0.7673
max(0,debt_ratio - .95);	-0.1072	0.1130	0.3426
Origination LTV	0.7077	0.0410	<.0001
Junior Lien Indicator	0.0153	0.0609	0.8012
Orig. LTV x Junior Lien Ind	-0.1233	0.0794	0.1203
One Borrower Indicator	-0.2794	0.0922	0.0025
Credit Score x One Borrower (00s)	0.0306	0.0001	0.0242
No Full Doc Loan	-0.0364	0.0230	0.1137
Third Party Loan	-0.0301	0.0169	0.0741
Judicial State	-0.0078	0.0086	0.3643
Current UPB/Origination UPB	-2.6363	0.1929	<.0001
HPA with 24 month lag	-0.6133	0.1493	<.0001
HPA with lag x Sunk Cost	2.8193	0.1709	<.0001
MTMLTV x Refinance Rate (00s)	-0.1990	0.0004	<.0001
MTMLTV x Cash Out (00s)	-0.1050	0.0005	0.0227
Q1	-0.0625	0.0120	<.0001
Q2	0.0684	0.0114	<.0001
Q3	0.0517	0.0114	<.0001
2005-2008 Indicator	-0.0791	0.0147	<.0001
2009-2013 Indicator	-0.2740	0.0186	<.0001
>= 2014 Indicator	-0.2716	0.0283	<.0001
max(0,refi_incentive_level_l2 - 1.4)	0.1392	0.0700	0.0466
max(0,1.4 - refi_incentive_level_l2)	-0.1111	0.0353	0.0016
max(0,refi_incentive_level_l2 - 0.02)	0.1032	0.0475	0.0298
max(0,refi_incentive_level_l2 - 1.1)	-0.1047	0.0753	0.1645
max(0, brnt_cnt-1)	-0.0493	0.0338	0.1446
max(0, brnt_cnt-8)	0.0530	0.0339	0.1181
max(0, 8-brnt_cnt)	-0.0463	0.0305	0.1296
max(0, brnt_cnt-50)	-0.0080	0.0011	<.0001
max(0, brnt_cnt-74)	0.0041	0.0009	<.0001
Indicator for 2001-2003 Refi Boom	0.4379	0.0193	<.0001
# of months since last 3+ months delinquent	0.0079	0.0007	<.0001
month_from_last_dq sq.	0.0000	0.0000	0.0001
month_from_last_dq cb.	0.0000	0.0000	<.0001

Table 31. Segment: NPL - ldq, Enterprise 2

Variable Name	Event: RPL Estimate	Event: RPL StdErr	Event: RPL Probt	Event: Prepay Estimate	Event: Prepay StdErr	Event: Prepay Probt	Event: SDQ Estimate	Event: SDQ StdErr	Event: SDQ Probt	Event: Default Estimate	Event: Default StdErr	Event: Default Probt
Intercept	9.7283	0.9893	<.0001	-40.1931	1.2767	<.0001	-20.8654	0.8322	<.0001	0.4165	13.0726	0.9746
Refinance Rate	-0.1406	0.0038	<.0001	-0.2265	0.0129	<.0001	0.0272	0.0035	<.0001	0.1046	0.0138	<.0001
Cash Out	-0.1067	0.0039	<.0001	-0.2999	0.0139	<.0001	0.0260	0.0035	<.0001	-0.1135	0.0154	<.0001
Investment	-0.1651	0.0080	<.0001	0.0630	0.0246	0.0105	0.1807	0.0062	<.0001	0.3624	0.0218	<.0001
Second Home	-0.1321	0.0098	<.0001	0.1111	0.0308	0.0003	0.1412	0.0072	<.0001	0.3379	0.0261	<.0001
Age	0.0017	0.0001	<.0001	-0.0192	0.0004	<.0001	-0.0007	0.0001	<.0001	-0.0002	0.0006	0.7433
Age Sq.	0.0000	.	.	0.0000	.	.	0.0000	.	.	-0.0001	.	.
Current UPB (000s)	-0.0007	0.0001	<.0001	0.0018	0.0002	<.0001	-0.0006	0.0001	<.0001	-0.0102	0.0002	<.0001
Current UPB (00000s) Sq.	0.0074	.	.	-0.0400	.	.	0.0109	.	.	0.1400	.	.
Debt to Income Ratio	-0.0003	0.0006	0.6049	0.0003	0.0006	0.6144	-0.0003	0.0005	0.5592	-0.0159	0.0127	0.2090
Credit Score	-0.0019	0.0000	<.0001	0.0038	0.0001	<.0001	0.0012	0.0000	<.0001	0.0073	0.0002	<.0001
Burnout Count	0.0030	0.0001	<.0001	0.0022	0.0004	<.0001	-0.0031	0.0001	<.0001	0.0050	0.0005	<.0001
Sato F30	-0.0207	0.0031	<.0001	0.0640	0.0112	<.0001	0.0159	0.0028	<.0001	0.0027	0.0115	0.8162
Judicial State	-0.0690	0.0030	<.0001	-0.1382	0.0104	<.0001	0.1140	0.0028	<.0001	-1.4940	0.0153	<.0001
2005-2008 Indicator	-0.1083	0.0045	<.0001	-0.6500	0.0163	<.0001	-0.0395	0.0043	<.0001	-0.8658	0.0173	<.0001
2009-2013 Indicator	-0.0775	0.0055	<.0001	-0.4760	0.0162	<.0001	-0.0114	0.0053	0.0322	-0.7784	0.0213	<.0001
>= 2014 Indicator	-0.0193	0.0080	0.0155	-0.8939	0.0233	<.0001	-0.1932	0.0084	<.0001	-1.7935	0.0516	<.0001
No Full Doc Loan	-0.0220	0.0083	0.0077	-0.1353	0.0307	<.0001	0.0031	0.0068	0.6459	0.4508	0.0216	<.0001
Fixed Rate Mortgage 40 YR	0.0127	0.0356	0.7220	-0.1837	0.1506	0.2228	-0.1022	0.0277	0.0002	-0.7826	0.1396	<.0001
Fixed Rate Mortgage 30 YR	0.1800	0.0063	<.0001	-0.0110	0.0233	0.6367	-0.0955	0.0048	<.0001	-0.2060	0.0187	<.0001
Fixed Rate Mortgage 15 YR	0.2217	0.0076	<.0001	-0.0437	0.0255	0.0860	-0.1135	0.0066	<.0001	-0.2655	0.0288	<.0001
Non Fixed Rate Mortgage	0.0000	.	.	0.0000	.	.	0.0000	.	.	0.0000	.	.
One Borrower Indicator	-0.1342	0.0319	<.0001	-0.1560	0.1158	0.1777	0.2243	0.0304	<.0001	1.1403	0.1332	<.0001
Credit Score x One Borrower (00s	0.0130	0.0000	0.0060	0.0110	0.0002	0.5128	-0.0240	0.0000	<.0001	-0.1740	0.0002	<.0001
Junior Lien Indicator	-0.1727	0.0049	<.0001	-0.2549	0.0179	<.0001	0.0560	0.0039	<.0001	0.2080	0.0155	<.0001
Alta Loan Indicator	-0.0972	0.0079	<.0001	-0.2306	0.0360	<.0001	0.0373	0.0059	<.0001	-0.3672	0.0258	<.0001
IO Loan Indicator	0.0000	.	.	0.0000	.	.	0.0000	.	.	0.0000	.	.
Jumbo Loan Indicator	0.1042	0.0318	0.0011	0.4416	0.0895	<.0001	0.0152	0.0311	0.6247	-0.9934	0.2576	0.0001
max(0,unemp_rate - 9)	0.1145	0.0279	<.0001	0.0369	0.0740	0.6181	-0.0632	0.0319	0.0476	1.3248	0.2941	<.0001
max(0,9 - unemp_rate)	0.0295	0.0274	0.2819	0.1679	0.0712	0.0184	0.0516	0.0316	0.1030	-1.2489	0.2936	<.0001
max(0,unemp_rate - 7)	-0.0963	0.0069	<.0001	-0.0601	0.0253	0.0177	-0.0107	0.0062	0.0874	-0.3981	0.0232	<.0001
max(0,unemp_rate - 3)	-0.0188	0.0287	0.5112	0.0821	0.0752	0.2752	0.0774	0.0328	0.0184	-1.2262	0.2975	<.0001
max(0,unemp_rate - 5.5)	0.0321	0.0065	<.0001	-0.0757	0.0212	0.0004	-0.0075	0.0065	0.2455	0.1815	0.0273	<.0001
max(0,mtmltv - 95)	0.1089	0.0108	<.0001	-0.3791	0.0138	<.0001	-0.2033	0.0089	<.0001	0.0097	0.1432	0.9460
max(0,95 - mtmltv)	-0.1070	0.0108	<.0001	0.4018	0.0130	<.0001	0.2021	0.0089	<.0001	-0.0338	0.1432	0.8132
max(0,mtmltv - 50)	-0.0029	0.0005	<.0001	-0.0146	0.0016	<.0001	0.0059	0.0006	<.0001	0.0026	0.0037	0.4901
max(0,mtmltv - 80)	-0.0044	0.0006	<.0001	-0.0434	0.0027	<.0001	0.0012	0.0005	0.0140	-0.0093	0.0020	<.0001
max(0,mtmltv - 30)	-0.0031	0.0009	0.0009	0.0096	0.0025	0.0001	-0.0025	0.0011	0.0190	-0.0016	0.0102	0.8733
max(0,mtmltv - 140)	0.0083	0.0007	<.0001	0.0593	0.0078	<.0001	-0.0034	0.0004	<.0001	-0.0090	0.0011	<.0001
max(0,mtmltv - 5)	-0.1088	0.0110	<.0001	0.3720	0.0141	<.0001	0.2033	0.0093	<.0001	0.0099	0.1462	0.9461
Refi Incentive with 2 months lag	-0.0388	0.0029	<.0001	0.0640	0.0095	<.0001	0.0784	0.0027	<.0001	-0.0980	0.0107	<.0001
January Indicator	-0.0492	0.0070	<.0001	-0.2058	0.0246	<.0001	0.0136	0.0063	0.0318	-0.0747	0.0269	0.0055
February Indicator	0.1002	0.0068	<.0001	-0.1996	0.0246	<.0001	0.0687	0.0063	<.0001	-0.0921	0.0271	0.0007
March Indicator	0.2638	0.0068	<.0001	0.0559	0.0235	0.0175	0.1018	0.0063	<.0001	0.0847	0.0265	0.0014
April Indicator	0.1135	0.0071	<.0001	0.0158	0.0243	0.5160	0.1197	0.0064	<.0001	0.0866	0.0268	0.0013
May Indicator	0.0747	0.0072	<.0001	0.0716	0.0242	0.0031	0.0970	0.0065	<.0001	0.0981	0.0270	0.0003
June Indicator	0.0789	0.0072	<.0001	0.1005	0.0242	<.0001	0.0669	0.0066	<.0001	0.1337	0.0269	<.0001
July Indicator	0.0902	0.0072	<.0001	0.1030	0.0241	<.0001	0.0521	0.0066	<.0001	0.2052	0.0264	<.0001
August Indicator	0.0330	0.0072	<.0001	0.1010	0.0240	<.0001	0.0438	0.0066	<.0001	0.1619	0.0265	<.0001
September Indicator	-0.0726	0.0073	<.0001	0.0226	0.0243	0.3517	0.0534	0.0065	<.0001	0.1718	0.0263	<.0001
October Indicator	-0.0024	0.0072	0.7355	0.0482	0.0239	0.0437	0.0237	0.0065	0.0003	0.1586	0.0261	<.0001
November Indicator	-0.0655	0.0072	<.0001	-0.0471	0.0243	0.0524	0.0334	0.0064	<.0001	0.0691	0.0265	0.0091

Table 32. Segment: NPL - sdq, Enterprise 2

Variable Name	Event: RPL Estimate	Event: RPL StdErr	Event: RPL Probt	Event: Prepay Estimate	Event: Prepay StdErr	Event: Prepay Probt	Event: LDQ Estimate	Event: LDQ StdErr	Event: LDQ Probt	Event: DDQ Estimate	Event: DDQ StdErr	Event: DDQ Probt	Event: Default Estimate	Event: Default StdErr	Event: Default Probt
Intercept	12.1270	2.0685	<.0001	-15.8459	1.8931	<.0001	9.0076	3.8680	0.0199	-23.0566	1.2491	<.0001	48.6970	15.3094	0.0015
Refinance Rate	-0.0611	0.0062	<.0001	-0.2563	0.0149	<.0001	-0.1341	0.0115	<.0001	0.0406	0.0048	<.0001	0.0487	0.0075	<.0001
Cash Out	-0.0149	0.0063	0.0173	-0.3952	0.0162	<.0001	-0.1236	0.0116	<.0001	0.0443	0.0047	<.0001	-0.0981	0.0080	<.0001
Investment	-0.2790	0.0131	<.0001	-0.1345	0.0302	<.0001	-0.5528	0.0272	<.0001	0.1493	0.0080	<.0001	0.1843	0.0120	<.0001
Second Home	-0.2810	0.0157	<.0001	0.0319	0.0366	0.3836	-0.5281	0.0340	<.0001	0.0866	0.0091	<.0001	0.3072	0.0134	<.0001
Age	0.0058	0.0002	<.0001	-0.0186	0.0005	<.0001	0.0020	0.0004	<.0001	0.0059	0.0002	<.0001	-0.0086	0.0003	<.0001
Age Sq.	0.0000		.	0.0000		.	0.0000		.	0.0000		.	0.0000		.
Current UPB (000s)	0.0025	0.0001	<.0001	0.0031	0.0002	<.0001	-0.0002	0.0002	0.3148	-0.0001	0.0001	0.3462	-0.0085	0.0001	<.0001
Current UPB (00000s) Sq.	-0.0344		.	-0.0610		.	-0.0031		.	0.0068		.	0.1100		.
Debt to Income Ratio	0.0007	0.0007	0.2955	0.0013	0.0007	0.0889	0.0007	0.0015	0.6322	-0.0002	0.0007	0.7789	-0.0017	0.0021	0.4193
Credit Score	-0.0014	0.0001	<.0001	0.0028	0.0002	<.0001	-0.0033	0.0001	<.0001	0.0003	0.0000	<.0001	0.0047	0.0001	<.0001
Burnout Count	0.0046	0.0002	<.0001	0.0014	0.0004	0.0015	0.0046	0.0003	<.0001	-0.0014	0.0002	<.0001	-0.0005	0.0003	0.0686
Sato F30	-0.0529	0.0051	<.0001	0.0316	0.0128	0.0136	0.0141	0.0090	0.1165	0.0285	0.0038	<.0001	-0.0033	0.0061	0.5894
Judicial State	-0.2736	0.0050	<.0001	-0.2907	0.0121	<.0001	-0.3640	0.0092	<.0001	0.2659	0.0038	<.0001	-1.1195	0.0068	<.0001
2005-2008 Indicator	-0.0372	0.0078	<.0001	-0.6980	0.0190	<.0001	-0.2419	0.0133	<.0001	0.0400	0.0062	<.0001	-0.4657	0.0097	<.0001
2009-2013 Indicator	0.0400	0.0096	<.0001	-0.6041	0.0194	<.0001	-0.5378	0.0182	<.0001	0.1510	0.0080	<.0001	-0.5152	0.0121	<.0001
>= 2014 Indicator	0.4730	0.0139	<.0001	-0.9199	0.0296	<.0001	-0.3982	0.0291	<.0001	0.0671	0.0145	<.0001	-1.0405	0.0235	<.0001
No Full Doc Loan	0.0156	0.0131	0.2342	-0.1454	0.0355	<.0001	-0.0108	0.0237	0.6486	-0.0637	0.0090	<.0001	0.2924	0.0126	<.0001
Fixed Rate Mortgage 40 YR	0.2808	0.0479	<.0001	-0.0605	0.1470	0.6807	0.0338	0.0920	0.7137	0.0151	0.0350	0.6667	-0.4345	0.0633	<.0001
Fixed Rate Mortgage 30 YR	0.2318	0.0094	<.0001	0.0077	0.0262	0.7694	0.1302	0.0175	<.0001	-0.0248	0.0062	<.0001	-0.1919	0.0098	<.0001
Fixed Rate Mortgage 15 YR	0.4206	0.0120	<.0001	-0.1130	0.0289	<.0001	0.1404	0.0221	<.0001	0.0079	0.0091	0.3827	-0.2777	0.0156	<.0001
Non Fixed Rate Mortgage	0.0000		.	0.0000		.	0.0000		.	0.0000		.	0.0000		.
One Borrower Indicator	0.0363	0.0515	0.4806	-0.2984	0.1334	0.0253	0.0791	0.0905	0.3822	0.0837	0.0410	0.0414	0.4020	0.0705	<.0001
Credit Score x One Borrower (00s	-0.0100	0.0001	0.1807	0.0326	0.0002	0.0934	-0.0280	0.0001	0.0389	-0.0020	0.0001	0.6966	-0.0740	0.0001	<.0001
Junior Lien Indicator	-0.1257	0.0073	<.0001	-0.2389	0.0199	<.0001	-0.1355	0.0144	<.0001	0.0364	0.0052	<.0001	0.1380	0.0081	<.0001
Alta Loan Indicator	-0.1302	0.0113	<.0001	-0.1581	0.0384	<.0001	-0.0939	0.0210	<.0001	0.0283	0.0072	<.0001	-0.1089	0.0121	<.0001
IO Loan Indicator	0.0000		.	0.0000		.	0.0000		.	0.0000		.	0.0000		.
Jumbo Loan Indicator	0.0490	0.0481	0.3079	0.3866	0.1070	0.0003	0.1141	0.1114	0.3054	-0.0740	0.0474	0.1186	-1.2237	0.1445	<.0001
max(0,unemp_rate - 9)	0.2033	0.0484	<.0001	0.0664	0.0896	0.4588	-0.0489	0.0961	0.6107	0.0289	0.0532	0.5868	0.3569	0.1041	0.0006
max(0,9 - unemp_rate)	-0.1095	0.0478	0.0220	0.1766	0.0866	0.0415	0.1058	0.0951	0.2658	-0.0469	0.0528	0.3753	-0.3157	0.1037	0.0023
max(0,unemp_rate - 7)	-0.0591	0.0112	<.0001	-0.0353	0.0292	0.2262	0.0092	0.0204	0.6523	-0.0244	0.0085	0.0043	-0.0209	0.0133	0.1165
max(0,unemp_rate - 3)	-0.1934	0.0498	0.0001	0.0576	0.0913	0.5276	0.0573	0.0988	0.5621	-0.0279	0.0546	0.6092	-0.3817	0.1061	0.0003
max(0,unemp_rate - 5.5)	0.0395	0.0109	0.0003	-0.0889	0.0247	0.0003	-0.0190	0.0203	0.3484	0.0276	0.0094	0.0034	-0.0287	0.0145	0.0486
max(0,mtmltv - 95)	0.1377	0.0227	<.0001	-0.0770	0.0207	0.0002	0.1172	0.0423	0.0056	-0.2248	0.0133	<.0001	0.5847	0.1698	0.0006
max(0,95 - mtmltv)	-0.1453	0.0226	<.0001	0.1414	0.0199	<.0001	-0.1159	0.0423	0.0061	0.2232	0.0133	<.0001	-0.5908	0.1698	0.0005
max(0,mtmltv - 50)	0.0038	0.0009	<.0001	-0.0253	0.0018	<.0001	-0.0109	0.0017	<.0001	0.0029	0.0008	<.0001	-0.0056	0.0019	0.0029
max(0,mtmltv - 80)	0.0099	0.0009	<.0001	-0.0599	0.0034	<.0001	-0.0013	0.0016	0.4437	0.0008	0.0007	0.1976	-0.0184	0.0011	<.0001
max(0,mtmltv - 30)	-0.0012	0.0017	0.4970	0.0131	0.0028	<.0001	0.0003	0.0032	0.9173	0.0021	0.0016	0.1979	-0.0042	0.0049	0.3876
max(0,mtmltv - 140)	0.0005	0.0008	0.5105	0.0143	0.0179	0.4241	0.0014	0.0021	0.5018	-0.0006	0.0004	0.1838	-0.0097	0.0007	<.0001
max(0,mtmltv - 5)	-0.1525	0.0231	<.0001	0.1060	0.0209	<.0001	-0.1156	0.0431	0.0073	0.2219	0.0138	<.0001	-0.5479	0.1706	0.0013
Refi Incentive with 2 months lag	-0.1443	0.0048	<.0001	0.0113	0.0113	<.0001	-0.0907	0.0088	<.0001	0.0904	0.0039	<.0001	-0.0176	0.0062	0.0043
January Indicator	-0.0180	0.0121	0.1372	-0.1641	0.0308	<.0001	-0.1737	0.0221	<.0001	0.0156	0.0090	0.0825	0.0298	0.0148	0.0447
February Indicator	0.0195	0.0119	0.0999	-0.1605	0.0304	<.0001	-0.1221	0.0216	<.0001	-0.0190	0.0090	0.0347	0.0144	0.0148	0.3295
March Indicator	0.1689	0.0114	<.0001	0.0926	0.0284	0.0011	0.0819	0.0205	<.0001	-0.0216	0.0089	0.0159	0.0763	0.0145	<.0001
April Indicator	0.0677	0.0116	<.0001	0.0545	0.0285	0.0560	0.0753	0.0205	0.0002	-0.0306	0.0089	0.0006	0.0371	0.0146	0.0111
May Indicator	-0.0126	0.0118	0.2858	0.1446	0.0279	<.0001	-0.0925	0.0213	<.0001	-0.0007	0.0089	0.9396	0.0509	0.0146	0.0005
June Indicator	0.1406	0.0115	<.0001	0.1055	0.0283	0.0002	-0.0381	0.0211	0.0712	0.0350	0.0088	<.0001	0.0907	0.0145	<.0001
July Indicator	0.0664	0.0117	<.0001	0.1195	0.0284	<.0001	0.0142	0.0210	0.4983	0.0754	0.0088	<.0001	0.1330	0.0145	<.0001
August Indicator	0.1124	0.0117	<.0001	0.1064	0.0288	0.0002	-0.1040	0.0218	<.0001	0.1175	0.0088	<.0001	0.1780	0.0145	<.0001
September Indicator	0.0032	0.0120	0.7878	0.0241	0.0295	0.4135	-0.1306	0.0220	<.0001	0.1240	0.0088	<.0001	0.1210	0.0147	<.0001
October Indicator	-0.0145	0.0121	0.2303	0.0699	0.0292	0.0164	-0.1088	0.0219	<.0001	0.1032	0.0089	<.0001	0.1000	0.0148	<.0001
November Indicator	-0.0250	0.0121	0.0385	-0.0718	0.0301	0.0169	-0.1593	0.0222	<.0001	0.0589	0.0089	<.0001	0.0368	0.0149	0.0137

Table 33. Segment: NPL - ddq, Enterprise 2

Variable Name	Event: RPL Estimate	Event: RPL StdErr	Event: RPL Probt	Event: Prepay Estimate	Event: Prepay StdErr	Event: Prepay Probt	Event: LDQ Estimate	Event: LDQ StdErr	Event: LDQ Probt	Event: SDQ Estimate	Event: SDQ StdErr	Event: SDQ Probt	Event: Default Estimate	Event: Default StdErr	Event: Default Probt
Intercept	9.6821	3.3201	0.0035	3.3402	2.9108	0.2512	-11.1738	8.4166	0.1843	9.6171	5.6048	0.0862	29.8447	6.8475	<.0001
Refinance Rate	0.0921	0.0087	<.0001	-0.3411	0.0209	<.0001	0.0222	0.0376	0.5551	-0.1793	0.0192	<.0001	0.0786	0.0064	<.0001
Cash Out	0.1575	0.0084	<.0001	-0.4499	0.0217	<.0001	0.0592	0.0363	0.1022	-0.2228	0.0190	<.0001	-0.0415	0.0063	<.0001
Investment	-0.3405	0.0173	<.0001	-0.3678	0.0420	<.0001	-0.3968	0.0754	<.0001	-0.7562	0.0431	<.0001	-0.0274	0.0100	0.0063
Second Home	-0.3858	0.0203	<.0001	0.0233	0.0472	0.6216	-0.3546	0.0903	<.0001	-0.5762	0.0526	<.0001	0.1408	0.0109	<.0001
Age	0.0030	0.0003	<.0001	-0.0272	0.0007	<.0001	-0.0067	0.0014	<.0001	-0.0151	0.0007	<.0001	-0.0063	0.0003	<.0001
Age Sq.	0.0000	.	.	0.0000	.	.	0.0000	.	.	0.0000	.	.	0.0000	.	.
Current UPB (000s)	-0.0011	0.0001	<.0001	0.0020	0.0003	<.0001	-0.0033	0.0004	<.0001	-0.0041	0.0003	<.0001	-0.0059	0.0001	<.0001
Current UPB (00000s) Sq.	0.0572	.	.	-0.0369	.	.			0.0914	0.0595	.	.	0.0659	.	.
Debt to Income Ratio	-0.0001	0.0008	0.9058	-0.0107	0.0132	0.4183	-0.0181	0.0329	0.5820	-0.0119	0.0141	0.4008	-0.0005	0.0009	0.6328
Credit Score	-0.0011	0.0001	<.0001	0.0022	0.0002	<.0001	-0.0027	0.0003	<.0001	-0.0031	0.0002	<.0001	0.0025	0.0001	<.0001
Burnout Count	0.0028	0.0003	<.0001	0.0054	0.0006	<.0001	0.0017	0.0012	0.1507	0.0043	0.0006	<.0001	0.0006	0.0002	0.0059
Sato F30	-0.1299	0.0067	<.0001	0.0630	0.0164	0.0001	-0.0822	0.0281	0.0034	-0.0349	0.0141	0.0134	-0.0123	0.0050	0.0137
Judicial State	-0.5271	0.0068	<.0001	-0.3628	0.0163	<.0001	-0.6058	0.0292	<.0001	-0.7353	0.0150	<.0001	-0.3474	0.0051	<.0001
2005-2008 Indicator	-0.4593	0.0120	<.0001	-0.8196	0.0258	<.0001	-0.4770	0.0496	<.0001	-0.4198	0.0231	<.0001	-0.1606	0.0088	<.0001
2009-2013 Indicator	-0.2507	0.0158	<.0001	-0.8890	0.0284	<.0001	-0.5409	0.0669	<.0001	-0.8507	0.0322	<.0001	-0.2187	0.0118	<.0001
>= 2014 Indicator	0.1713	0.0276	<.0001	-1.1352	0.0495	<.0001	-0.1503	0.1154	0.1928	-0.7275	0.0571	<.0001	-0.4278	0.0239	<.0001
No Full Doc Loan	0.1085	0.0168	<.0001	-0.0882	0.0486	0.0698	-0.1088	0.0804	0.1756	0.2304	0.0374	<.0001	0.0816	0.0118	<.0001
Fixed Rate Mortgage 40 YR	0.0501	0.0600	0.4042	0.1644	0.1768	0.3525	0.2404	0.2288	0.2935	-0.0288	0.1377	0.8345	-0.2616	0.0472	<.0001
Fixed Rate Mortgage 30 YR	0.2396	0.0114	<.0001	-0.1118	0.0350	0.0014	0.2062	0.0509	<.0001	0.0247	0.0272	0.3645	-0.1102	0.0079	<.0001
Fixed Rate Mortgage 15 YR	0.5533	0.0159	<.0001	-0.2076	0.0382	<.0001	0.4084	0.0691	<.0001	-0.0866	0.0354	0.0144	-0.1865	0.0127	<.0001
Non Fixed Rate Mortgage	0.0000	.	.	0.0000	.	.	0.0000	.	.	0.0000	.	.	0.0000	.	.
One Borrower Indicator	-0.0271	0.0704	0.6998	0.0972	0.1741	0.5769	-0.1371	0.2885	0.6346	-0.0431	0.1454	0.7669	0.1534	0.0566	0.0068
Credit Score x One Borrower (00s	-0.0040	0.0001	0.7341	-0.0340	0.0003	0.1775	-0.0050	0.0004	0.9076	-0.0250	0.0002	0.2454	-0.0360	0.0001	<.0001
Junior Lien Indicator	-0.0689	0.0096	<.0001	-0.2464	0.0269	<.0001	-0.2042	0.0442	<.0001	-0.1072	0.0230	<.0001	0.0943	0.0067	<.0001
Alt-a Loan Indicator	-0.1796	0.0134	<.0001	-0.2430	0.0481	<.0001	-0.1108	0.0586	0.0587	-0.1625	0.0323	<.0001	-0.0439	0.0092	<.0001
IO Loan Indicator	0.0000	.	.	0.0000	.	.	0.0000	.	.	0.0000	.	.	0.0000	.	.
Jumbo Loan Indicator	-0.8943	0.0729	<.0001	0.2334	0.1408	0.0974	-0.9295	0.2987	0.0019	-0.6208	0.2216	0.0051	-0.5983	0.0969	<.0001
max(0,unemp_rate - 9)	0.1726	0.0801	0.0312	0.3765	0.1324	0.0045	-0.1589	0.3282	0.6283	-0.0527	0.1601	0.7421	0.4876	0.0784	<.0001
max(0,9 - unemp_rate)	-0.1020	0.0794	0.1990	-0.2083	0.1290	0.1064	0.1973	0.3250	0.5437	0.1216	0.1584	0.4425	-0.3973	0.0780	<.0001
max(0,unemp_rate - 7)	0.0047	0.0146	0.7483	0.0809	0.0386	0.0363	0.1833	0.0634	0.0038	0.1233	0.0330	0.0002	0.1860	0.0108	<.0001
max(0,unemp_rate - 3)	-0.1930	0.0821	0.0187	-0.3930	0.1351	0.0036	0.1550	0.3367	0.6453	0.0014	0.1644	0.9934	-0.4884	0.0799	<.0001
max(0,unemp_rate - 5.5)	-0.0136	0.0151	0.3694	-0.0407	0.0337	0.2276	-0.2197	0.0644	0.0006	-0.0495	0.0330	0.1339	-0.1754	0.0114	<.0001
max(0,mtmltv - 95)	0.1239	0.0363	0.0006	0.1059	0.0319	0.0009	-0.0822	0.0900	0.3611	0.1175	0.0610	0.0540	0.3575	0.0757	<.0001
max(0,95 - mtmltv)	-0.1323	0.0363	0.0003	-0.0320	0.0308	0.2990	0.0790	0.0899	0.3797	-0.1109	0.0610	0.0688	-0.3564	0.0757	<.0001
max(0,mtmltv - 50)	0.0042	0.0014	0.0034	-0.0384	0.0024	<.0001	-0.0123	0.0059	0.0379	-0.0175	0.0028	<.0001	-0.0190	0.0014	<.0001
max(0,mtmltv - 80)	0.0133	0.0012	<.0001	-0.0504	0.0053	<.0001	0.0142	0.0052	0.0069	-0.0022	0.0027	0.4190	-0.0166	0.0009	<.0001
max(0,mtmltv - 30)	-0.0047	0.0027	0.0761	0.0019	0.0035	0.5803	0.0152	0.0106	0.1541	0.0047	0.0051	0.3562	0.0106	0.0033	0.0011
max(0,mtmltv - 140)	-0.0065	0.0007	<.0001	0.0348	0.0153	0.0230	-0.0075	0.0035	0.0333	0.0005	0.0028	0.8677	-0.0023	0.0005	<.0001
max(0,mtmltv - 5)	-0.1259	0.0370	0.0007	-0.0616	0.0319	0.0530	0.0725	0.0934	0.4375	-0.1118	0.0624	0.0730	-0.3274	0.0764	<.0001
Refi Incentive with 2 months lag	-0.1977	0.0069	<.0001	-0.1565	0.0159	<.0001	-0.0781	0.0294	0.0079	-0.2244	0.0148	<.0001	-0.0980	0.0052	<.0001
January Indicator	0.0463	0.0161	0.0039	-0.2056	0.0403	<.0001	-0.2617	0.0639	<.0001	-0.2274	0.0354	<.0001	-0.0479	0.0120	<.0001
February Indicator	0.0271	0.0161	0.0913	-0.2468	0.0406	<.0001	-0.3039	0.0645	<.0001	-0.2142	0.0351	<.0001	-0.0683	0.0120	<.0001
March Indicator	0.1332	0.0157	<.0001	-0.0297	0.0384	0.4395	-0.2007	0.0627	0.0014	-0.0700	0.0338	0.0386	0.0094	0.0118	0.4251
April Indicator	0.0145	0.0161	0.3657	0.0092	0.0380	0.8083	-0.3383	0.0652	<.0001	-0.1151	0.0342	0.0008	-0.0578	0.0120	<.0001
May Indicator	0.0030	0.0161	0.8505	0.0374	0.0378	0.3213	-0.1736	0.0624	0.0054	-0.1214	0.0343	0.0004	0.1889	0.0114	<.0001
June Indicator	0.1359	0.0157	<.0001	0.0363	0.0378	0.3362	-0.2527	0.0637	<.0001	-0.1544	0.0345	<.0001	-0.0239	0.0119	0.0448
July Indicator	0.0767	0.0159	<.0001	0.0257	0.0378	0.4968	-0.4875	0.0682	<.0001	-0.1049	0.0341	0.0021	0.0464	0.0117	<.0001
August Indicator	0.0909	0.0158	<.0001	0.0256	0.0378	0.4974	-0.4500	0.0675	<.0001	-0.1305	0.0343	0.0001	0.1476	0.0115	<.0001
September Indicator	0.0244	0.0160	0.1276	-0.0721	0.0385	0.0612	-0.3083	0.0645	<.0001	-0.1921	0.0347	<.0001	0.0248	0.0118	0.0347
October Indicator	0.0556	0.0159	0.0005	0.0014	0.0378	0.9713	-0.2826	0.0639	<.0001	-0.1278	0.0342	0.0002	0.0154	0.0118	0.1915
November Indicator	-0.0425	0.0162	0.0088	-0.0604	0.0383	0.1146	-0.3837	0.0656	<.0001	-0.2033	0.0348	<.0001	-0.0641	0.0120	<.0001

9.2 Loss Severity Model

9.2.1 Net Sales Proceeds

Table 34. Enterprise 1&2 Net Sale Proceeds Coefficients for REO properties only (disposition years 2012-2020)

STATE	Intercept	B1	B2	B3	B4	B5
US	-12,770	0.6100	0.4037	-0.2962	0.4257	-0.7506
AK	-6,629	0.5896	0.1399	0.0817	-0.0189	-0.3981
AL	-4,625	0.4362	0.6206	-0.2467	0.1910	-0.4823
AR	-6,853	0.5092	0.3353	-0.0581	0.0036	-0.2365
AZ	-21,142	0.8813	0.2741	-0.4058	0.3300	-0.6441
CA	-24,400	0.9065	0.1832	-0.4021	0.4324	-0.8152
CO	-17,019	0.7471	0.1400	-0.1218	-0.1299	-0.2058
CT	4,454	0.4705	0.2142	0.0323	0.1421	-0.2392
DC	-204,334	1.9612	-0.8966	-0.6565	1.6885	-1.5867
DE	-22,316	0.6420	0.5005	-0.0440	-0.1772	-0.2271
FL	-15,634	0.7377	0.4177	-0.3895	0.4998	-0.8587
GA	-13,374	0.6745	0.3974	-0.1993	0.1257	-0.4938
HI	-49,182	0.7797	-0.2256	0.2252	0.1202	-0.5315
IA	-4,471	0.4285	0.2619	0.0265	0.2717	-0.2937
ID	-14,382	0.7768	0.3558	-0.5865	0.3144	-0.5115
IL	-9,810	0.5199	0.4761	-0.2639	0.4812	-0.7892
IN	-2,522	0.3463	0.3673	0.0441	0.3125	-0.5105
KS	-1,622	0.4087	0.3278	0.0992	0.4764	-0.6023
KY	-7,191	0.4655	0.4254	-0.0057	0.0560	-0.3701
LA	-5,037	0.4662	0.2961	-0.0013	0.2983	-0.5261
MA	-11,433	0.6190	0.1543	-0.2059	0.7204	-1.1389
MD	-20,018	0.6131	0.2978	-0.0508	-0.0053	-0.3005
ME	-8,024	0.3889	0.1687	0.1822	0.1107	-0.5415
MI	-7,868	0.5110	0.4240	-0.2232	0.6625	-0.9378
MN	-15,567	0.6506	0.5308	-0.4883	0.4825	-0.8187
MO	-2,524	0.3538	0.4809	-0.0839	0.6246	-0.8867
MS	-2,226	0.3811	0.4733	0.0897	-0.0627	-0.3817
MT	-19,052	0.6848	0.0579	-0.2007	0.1575	-0.4375
NC	-8,053	0.5369	0.3975	-0.1080	0.0404	-0.4089
ND	-6,887	0.4572	0.5572	-0.9104	1.3295	-1.2491
NE	-3,621	0.4825	0.1923	0.4157	-0.2405	-0.0997
NH	-7,224	0.5523	0.2285	-0.1163	0.2773	-0.5377

STATE		B1	B2	B3	B4	B5
NJ	-14,445	0.5891	0.1074	-0.0834	0.4658	-0.6003
NM	-20,386	0.7801	0.0645	-0.1154	-0.0016	-0.2471
NV	-18,959	0.9179	0.3429	-0.3622	0.2919	-0.6829
NY	-2,431	0.4159	0.2092	0.0949	0.2198	-0.2972
OH	-3,262	0.3570	0.3436	0.0194	0.4084	-0.4390
OK	-4,697	0.4578	0.3087	0.0407	0.0175	-0.2276
OR	-27,713	0.8434	0.1366	-0.1530	-0.0017	-0.4396
PA	-3,775	0.4049	0.3180	-0.1013	0.2682	-0.3375
PR	-7,975	0.7121	-0.0190	-0.0285	-0.0194	-0.2714
RI	-10,096	0.5592	0.2087	-0.1637	0.2259	-0.2738
SC	-10,251	0.5703	0.4202	-0.1738	0.1019	-0.4257
SD	-10,164	0.5620	0.2202	-0.2154	0.6774	-0.7411
TN	-15,612	0.6565	0.1536	-0.0193	0.1773	-0.4686
TX	-7,780	0.6338	0.4151	-0.6397	1.2427	-1.5674
UT	-23,482	0.8670	0.2005	-0.4450	0.4129	-0.6626
VA	-16,643	0.6402	0.5021	-0.4499	0.5944	-1.0209
VT	4,386	0.2613	0.5016	-0.0410	0.0947	-0.6198
WA	-21,531	0.7457	0.2502	-0.1796	0.2995	-0.7615
WI	-6,424	0.4697	0.3741	-0.2192	0.7870	-1.1130
WV	-4,826	0.3933	0.2396	-0.0793	0.8209	-1.1347
WY	-12,197	0.6273	0.1832	-0.1092	-0.0658	-0.1365

Table 35. Enterprise 1 & 2 Net Sale Proceeds Coefficients for Foreclosure Alternative dispositions only (disposition years 2012-2020)

STATE	Intercept	B1	B2	B3	B4	B5
US	-12,937	0.6320	0.3170	-0.2145	0.1795	-0.4911
AK	-68,471	1.0266	-0.6896	0.4820	0.0220	-0.5137
AL	-4,841	0.4824	0.5270	-0.1712	0.0240	-0.3841
AR	-5,739	0.5242	0.5302	-0.3051	0.0035	-0.2281
AZ	-16,815	0.8481	0.2330	-0.4189	0.3095	-0.6320
CA	-14,483	0.8291	0.2472	-0.4792	0.2734	-0.4455
CO	-13,550	0.6898	0.1636	-0.2747	-0.0072	-0.2686
CT	-2,192	0.5489	0.1337	0.1194	0.0443	-0.3845
DC	74,260	0.0593	1.0922	-1.1669	1.3033	-0.6736
DE	4,279	0.3450	1.0827	-0.6356	0.4246	-0.7439
FL	-11,980	0.7111	0.4263	-0.2612	0.2199	-0.6501
GA	-10,438	0.6745	0.2464	-0.1737	0.2013	-0.5950

HI	-32,970	0.6518	-0.0271	0.3030	-0.6643	0.7487
IA	-6,371	0.4959	0.2613	0.0031	0.1500	-0.2253
ID	-22,693	0.8908	-0.2946	0.0305	0.1844	-0.4355
IL	-7,900	0.5103	0.3440	-0.0104	0.1217	-0.4532
IN	-3,271	0.3991	0.3043	0.1270	0.0969	-0.4209
KS	-5,059	0.4862	0.1826	-0.0833	0.8277	-0.8301
KY	-5,554	0.4541	0.3863	0.0774	0.1938	-0.6880
LA	-12,668	0.5804	0.0933	0.1286	0.1549	-0.5041
MA	-22,948	0.7305	-0.2601	0.4076	-0.1426	-0.2437
MD	-12,859	0.5709	0.4052	-0.2040	0.0832	-0.3182
ME	-4,291	0.3651	0.5760	-0.5830	0.2589	-0.1610
MI	-7,791	0.5356	0.2697	-0.0978	0.3555	-0.5246
MN	-15,988	0.6538	0.3340	-0.4419	1.1690	-1.7260
MO	-7,268	0.4520	0.3874	0.0097	0.1893	-0.4564
MS	-6,438	0.4606	0.6797	-0.6163	0.6952	-0.8523
MT	-42,760	0.8780	-0.3375	-0.0169	-0.2275	0.6137
NC	-14,357	0.6331	0.3887	-0.3090	0.0301	-0.4586
ND	2,584	0.2871	1.2159	-1.7264	1.1670	-0.6065
NE	305	0.4178	0.4166	-0.1881	0.4295	-0.6463
NH	-17,563	0.5884	0.0860	-0.0849	0.3545	-0.4330
NJ	-18,338	0.6594	0.0980	-0.2615	0.6348	-0.7978
NM	-31,814	0.9430	-0.2885	-0.0935	0.4370	-0.6968
NV	-9,116	0.8163	0.4322	-0.2957	-0.0043	-0.4066
NY	-8,927	0.4864	0.1744	0.0525	0.2968	-0.5528
OH	-6,956	0.4647	0.2601	-0.1354	0.5204	-0.5291
OK	928	0.3120	0.6845	-0.2928	0.1616	-0.3447
OR	-38,353	0.9563	-0.1255	-0.1358	-0.1202	-0.1499
PA	-5,794	0.4521	0.3631	-0.2032	0.1649	-0.1843
PR	-4,320	0.6793	-0.0873	0.0298	-0.0651	-0.2615
RI	-47,395	0.8176	-0.2674	0.2152	0.0902	-0.4470
SC	-22,490	0.7866	0.2130	-0.1084	-0.2170	-0.2344
SD	-7,824	0.4734	0.3574	-0.2233	0.3033	-0.4284
TN	-14,437	0.6511	0.4374	-0.2428	-0.1311	-0.2371
TX	-9,621	0.6561	0.2907	-0.3754	0.2648	-0.3994
UT	-6,463	0.7220	0.1378	0.0098	-0.1421	-0.2699
VA	-25,562	0.7461	0.3102	-0.2234	0.0533	-0.4796
VT	34,558	0.0548	1.0312	-0.5873	-0.0926	-0.0572

WA	-13,445	0.6859	0.3682	-0.2751	0.2124	-0.6654
WI	-10,068	0.5521	0.2209	-0.0938	0.6046	-1.0043
WV	6,877	0.2878	0.7027	-0.5897	-0.0158	0.5982
WY	-42,640	0.9389	-0.6792	0.6230	-0.1416	-0.4281

Table 36. Spline Knot Locations for MTMLTV

Knots for Spline Effect spl_mtmltv for Enterprise 1		Knots for Spline Effect spl_mtmltv for Enterprise 2
Knot No.	Mtmltv	Mtmltv
1	0.52885	0.59869
2	0.69608	0.75535
3	0.87137	0.92017

Table 37. Spline Knot Locations for Liquidation UPB

Knots for Spline Effect spl_liq_upb_amt for Enterprise 1		Knots for Spline Effect spl_liq_upb_amt for Enterprise 2
Knot No.	LIQ_UPB_AMT	LIQ_UPB_AMT
1	95924.91	110447.25
2	162645.34	183194.59
3	251687.21	273009.43

Table 38. Spline Knot Locations for Number of Delinquent Payments

Knots for Spline Effect spl_delinq_pmts for Enterprise 1		Knots for Spline Effect spl_delinq_pmts for Enterprise 2
Knot No.	DELINQ_PMTS	DELINQ_PMTS
1	16	19
2	24	29
3	50	53

Table 39. Expected Net Sale Proceeds Parameter Estimates

Parameter	Enterprise 1 Estimate	Enterprise 2 Estimate
Intercept	104.309673	111.8691
$MTMLTV_i$	-83.451902	-97.7261
$MTMLTV_i - k1$ (MTMLTV)	-2.567037	24.14092
$MTMLTV_i - k2$ (MTMLTV)	-10.186433	-18.7589

MTMLTV$_i$ – k3 (MTMLTV)	55.513358	55.28634
Liq_UPB$_i$	0.000351	0.000315
Liq_UPB$_i$ -k1 (LIQ_UPB)	-0.000273	-0.00024
Liq_UPB$_i$ -k2 (LIQ_UPB)	-4.34E-05	-4.8E-05
Liq_UPB$_i$ -k3 (LIQ_UPB)	-2.451E-05	-2E-05
Delinq_Pmts$_i$	-0.02794	-0.20748
Delinq_Pmts$_i$-k1 (DELINQ_PMTS)	0.198039	0.373129
Delinq_Pmts$_i$-k2 (DELINQ_PMTS)	-0.150491	-0.12762
Delinq_Pmts$_i$-k3 (DELINQ_PMTS)	0.018001	-0.10637
liq_year 2014	0	7.111032
liq_year 2015	-1.824248	2.485942
liq_year 2016	-6.849069	-4.48202
liq_year 2017	-4.596242	-3.86806
liq_year 2018	-1.15602	-1.42732
liq_year 2019	0	0

9.2.2 Transaction Costs for an NPL Sale

The transaction costs for an NPL sale i ($Transaction\ costs\ for\ an\ NPL\ sale_i$) are defined as follows:

$$
\begin{aligned}
Transaction\ &costs\ for\ an\ NPL\ sale_i \\
&= Appraisal\ fees_i + Attorney\ and\ trustee\ fees_i + Other\ foreclosure\ expense_i \\
&+ Other\ liquidiation\ expenses_i + Other\ non-selling\ expense_i \\
&+ Property\ inspection_i + Maintenance\ expense_i + Utilities_i \\
&+ Possessory\ and\ eviction\ fees_i + Repairs_i + Title\ insurance\ fees_i \\
&+ Property\ management\ expense_i + Servicer\ incentive\ payment_i
\end{aligned}
$$

$$\forall\ i \in NPL\ sales$$

Most NPL sales doesn't have values for the following components: (1) possessory and eviction fees; (2) repairs; (3) title insurance fees; (4) service incentive payment, and (5) Property_Management_Expense.

Table 40. Liquidated UPB Categories by Enterprise

Enterprise 1 Liquidated UPB Categories[17]	Enterprise 2 Liquidated UPB Categories
Liquidated UPB < 95924	Liquidated UPB <179765
95924 <=Liquidated UPB < 162645	107400<=Liquidated UPB <179765
162645 <=Liquidated UPB < 251689	179765<=Liquidated UPB <270431

---

[17] The liquidated loan balance categories were chosen based on the percentiles of the population.

Liquidated UPB => 251689	Liquidated UPB>=270431

Table 41. Enterprise 1 NPL Note Sales Transaction Costs

liq_upb_group	Judicial state	trans_cost_w
All	Entire	6.4760
Liquidated UPB <95924	Entire	11.7498
95924<=Liquidated UPB <162645	Entire	7.5359
162645<=Liquidated UPB <251689	Entire	5.8004
Liquidated UPB>=251689	Entire	5.5275
Liquidated UPB <95924	Non-Judicial	8.4810
Liquidated UPB <95924	Judicial	13.3240
95924<=Liquidated UPB <162645	Non-Judicial	5.7777
95924<=Liquidated UPB <162645	Judicial	8.3994
162645<=Liquidated UPB <251689	Non-Judicial	4.3930
162645<=Liquidated UPB <251689	Judicial	6.4754
Liquidated UPB>=251689	Non-Judicial	4.0830
Liquidated UPB>=251689	Judicial	6.0537

Table 42. Enterprise 2 NPL Note Sales Transaction Costs

liq_upb_group	Judicialstate	trans_cost_w
All	Entire	2.7557
Liquidated UPB <107400	Entire	6.4614
107400<=Liquidated UPB <179765	Entire	3.6052
179765<=Liquidated UPB <270431	Entire	2.5703
Liquidated UPB>=270431	Entire	1.8093
Liquidated UPB <107400	Non-Judicial	4.8332
Liquidated UPB <107400	Judicial	7.2157
107400<=Liquidated UPB <179765	Non-Judicial	2.9401
107400<=Liquidated UPB <179765	Judicial	3.9719
179765<=Liquidated UPB <270431	Non-Judicial	2.1510
179765<=Liquidated UPB <270431	Judicial	2.8002
Liquidated UPB>=270431	Non-Judicial	1.5142
Liquidated UPB>=270431	Judicial	1.9388

9.2.3 Fixed Costs

The table below presents the results for REO fixed costs using data for liquidation dates from 2016-2020.

Table 43. Fixed Cost for REO Dispositions (Enterprise 1)

STATE	Intercept	B1	B2	B3	B4	B5
US	62.15438	-0.81129	0.960884	-0.23366	0.055273	0.017983
AK	17.2172	-0.0393	-0.07538	0.194558	-0.13164	0.046234
AL	45.52273	-0.68285	0.74622	-0.08351	-0.03542	0.027185
AR	50.84624	-0.90275	1.082902	-0.23006	0.021381	0.009975
AZ	17.77514	-0.01663	-0.10524	0.131037	-0.02567	0.001724
CA	25.39388	-0.10908	0.137152	-0.06406	0.010242	0.03445
CO	41.78155	-0.46414	0.449543	0.012064	-0.02087	0.012878
CT	212.4139	-2.07243	3.092698	-1.33104	0.321759	-0.00882
DC	20.34779	-0.02712	-0.04948	-0.0241	0.107145	0.000371
DE	42.68649	-0.26832	0.324705	-0.17881	0.175152	-0.08823
FL	60.15516	-0.51858	0.58568	-0.13554	0.049322	0.013847
GA	34.25614	-0.37566	0.503163	-0.1732	0.029372	0.002176
HI	73.93931	-0.3718	0.431651	-0.1185	0.035263	0.012605
IA	56.84247	-0.97621	0.775079	0.447421	-0.3477	0.084003
ID	10.43044	0.1507	-0.38734	0.123158	0.069131	0.0262
IL	57.54701	-0.67405	0.698755	-0.10389	0.069907	0.012388
IN	56.54632	-0.97632	1.002276	-0.0613	0.027309	0.003174
KS	44.68834	-0.66924	0.340629	0.497289	-0.14883	-0.03281
KY	61.35904	-0.89819	1.00929	-0.18856	0.057181	-0.02518
LA	59.93409	-0.7547	0.882484	-0.26408	0.12515	-0.01314
MA	84.48434	-0.61951	0.79657	-0.24319	0.05026	0.006185
MD	65.87139	-0.53194	0.590166	-0.10506	0.010914	0.036022
ME	56.31967	-0.62403	0.697897	-0.17105	0.027081	0.042339
MI	63.01637	-1.12864	1.393842	-0.35296	0.145884	-0.07379
MN	36.07118	-0.25068	0.127144	0.182041	-0.15005	0.07606
MO	51.84551	-0.91029	1.145894	-0.32901	0.083769	-0.01035
MS	50.74813	-0.92879	1.376872	-0.52876	0.051888	-0.00411
MT	16.96773	0.003681	-0.11792	-0.07363	0.209869	-0.06472
NC	43.59939	-0.49796	0.595517	-0.14482	-0.01442	0.037181
ND	68.90828	-0.8488	1.269247	-0.63887	0.183677	0.012822
NE	41.34585	-0.68334	0.439329	0.298702	0.016064	-0.10585
NH	22.39889	-0.10296	0.134657	-0.06839	0.030689	-0.01621
NJ	54.06007	-0.34307	0.371452	-0.05937	-0.00749	0.051732
NM	45.52069	-0.35938	0.39768	-0.13745	0.061827	0.003249
NV	20.62588	-0.05372	0.00889	0.094873	-0.12768	0.078015

NY	75.50369	-0.81076	0.820652	-0.06648	0.029578	0.028891
OH	93.28538	-1.69936	1.932875	-0.396	0.152397	-0.01194
OK	72.10584	-1.39206	1.508805	-0.23982	0.140375	-0.04153
OR	37.13697	-0.17345	0.10134	0.040983	-0.04829	0.063562
PA	101.6934	-1.74906	1.827449	-0.18608	0.030814	0.073071
PR	283.3666	-4.83659	6.497131	-2.29368	0.675592	-0.07237
RI	29.19746	-0.11667	0.092515	-0.06248	0.11116	-0.02892
SC	56.07867	-0.71668	0.887692	-0.23101	-0.0098	0.030864
SD	26.20384	-0.13636	-0.2582	0.409132	-0.18944	0.177869
TN	34.59828	-0.37943	0.374099	-0.04349	0.0655	-0.05719
TX	36.9413	-0.43074	0.562681	-0.17788	0.004875	0.024242
UT	24.83056	-0.15439	0.262127	-0.14267	0.005659	-0.00695
VA	28.33618	-0.17915	0.232648	-0.11359	0.049812	-0.01128
VI	-9.85308	0.18337	-0.29112	0.121999	-0.02775	0.012076
VT	74.69792	-0.8864	1.08888	-0.28975	0.043039	0.008158
WA	42.28299	-0.27853	0.349395	-0.16209	0.084347	-0.02025
WI	82.6139	-1.15594	1.592182	-0.6651	0.193786	0.022689
WV	55.87077	-1.17673	1.774517	-0.9025	0.333015	-0.06221
WY	10.16275	0.044781	-0.23764	0.211581	-0.09532	0.052949

Table 44. Fixed Cost for REO Dispositions (Enterprise 2)

STATE	Intercept	B1	B2	B3	B4	B5
US	58.7005	-0.8336	0.9093	-0.1321	0.0171	0.0238
AK	19.1879	-0.1044	0.0754	-0.0203	0.0242	0.0150
AL	60.7445	-1.1176	1.2389	-0.1812	0.0233	0.0192
AR	66.7763	-1.1998	1.5137	-0.4775	0.1666	-0.0372
AZ	27.9379	-0.2793	0.3573	-0.1604	0.0725	-0.0080
CA	17.1443	-0.0613	0.0426	-0.0076	0.0082	0.0127
CO	53.1233	-0.5806	0.6391	-0.1265	0.0630	-0.0100
CT	39.6107	-0.2621	0.1909	0.0218	0.0551	-0.0200
DC	33.7667	-0.1610	0.2049	-0.2025	0.1469	-0.0205
DE	69.0246	-0.6135	0.5609	-0.0662	0.2421	-0.1442
FL	51.6637	-0.4078	0.3968	-0.0142	-0.0370	0.0351
GA	55.9990	-0.8840	1.1047	-0.3209	0.0726	0.0072
GU	6.2613	0.0439	-0.0530	0.0293	-0.2451	0.6821
HI	61.2453	-0.3729	0.3871	-0.0578	0.0412	-0.0089
IA	55.4055	-1.0115	0.9408	-0.3398	0.5341	-0.1518
ID	46.5672	-0.5566	0.4172	0.0974	0.0025	0.0305
IL	56.5334	-0.7751	0.8310	-0.1256	0.0372	0.0196
IN	79.6362	-1.7715	2.0289	-0.4599	0.1076	0.0824

KS	54.9459	-1.0156	0.7486	0.1972	0.0909	-0.0421
KY	77.7979	-1.2889	1.0532	0.1399	0.0831	-0.0243
LA	64.3843	-0.9210	0.8016	0.4185	-0.4179	0.0989
MA	86.9093	-0.6645	0.8086	-0.2324	0.0489	0.0323
MD	39.6932	-0.3129	0.4058	-0.1769	0.0771	-0.0058
ME	42.9206	-0.3902	0.3733	-0.1553	0.1765	-0.0456
MI	44.7297	-0.7147	0.7376	-0.0556	0.0044	0.0006
MN	38.8046	-0.3784	0.4449	-0.1447	0.0236	0.0427
MO	66.0195	-1.3101	1.5694	-0.4005	0.1350	-0.0195
MS	50.3810	-0.9051	0.9543	0.0096	-0.1287	0.0521
MT	32.7075	-0.4218	0.5526	-0.2092	0.0612	0.0235
NC	40.0866	-0.5962	0.9497	-0.4999	0.1196	0.0002
ND	66.3568	-1.1695	1.2034	-0.2234	0.2146	-0.0585
NE	31.6452	-0.5072	0.4482	0.0636	-0.1117	0.0925
NH	35.2285	-0.2531	0.3065	-0.0763	-0.0352	0.0532
NJ	44.1197	-0.2867	0.2350	-0.0189	0.0906	-0.0306
NM	51.3937	-0.5709	0.6791	-0.3554	0.2808	-0.0502
NV	55.5477	-0.4352	0.5606	-0.2306	0.0612	0.0446
NY	80.6409	-1.1537	1.2002	-0.0860	0.0135	0.0050
OH	113.9570	-2.4745	3.4526	-1.9225	1.1239	-0.2221
OK	14.3259	0.1256	-0.6604	0.4895	-0.0373	0.0804
OR	37.6775	-0.2538	0.2911	-0.1308	0.0616	0.0186
PA	98.2858	-1.6598	1.8483	-0.3315	0.0860	0.0343
PR	50.8536	-0.6831	0.6636	-0.0825	0.0774	0.0026
RI	64.4846	-0.4029	0.5115	-0.1824	0.0296	0.0315
SC	60.0823	-0.7675	0.5115	0.3994	-0.2334	0.0720
SD	41.0836	-0.4748	0.8578	-0.6202	0.1217	0.1015
TN	57.4126	-1.0230	1.3868	-0.5238	0.1459	-0.0105
TX	70.2164	-1.1503	1.5566	-0.5268	0.0827	0.0243
UT	24.2724	-0.1367	0.0746	0.0745	-0.0631	0.0576
VA	42.4424	-0.4530	0.5851	-0.2088	0.0587	0.0042
VI	8.1555	0.0000	0.0000	0.0000	0.0000	0.0000
VT	24.2921	-0.0975	-0.0635	0.0857	0.0541	0.0013
WA	32.1831	-0.2362	0.2722	-0.0959	0.0872	-0.0497
WI	48.3233	-0.5873	0.6307	-0.0702	-0.0568	0.0662
WV	71.0662	-1.4952	1.4694	0.0019	-0.0542	0.0606
WY	16.8071	-0.0776	-0.0377	0.1674	-0.1003	0.0371

Table 45. Fixed Cost for Foreclosure Alternative Dispositions (Enterprise 1)

STATE	Intercept	B1	B2	B3	B4	B5

US	55.9529	-0.7627	0.8370	-0.1417	0.0481	0.0215
AK	15.4275	-0.0606	-0.1900	0.3482	-0.2008	0.1164
AL	43.6793	-0.7203	0.6467	-0.0213	0.0978	-0.0241
AR	34.6199	-0.4280	0.2986	0.0741	0.0030	0.0577
AZ	18.0757	-0.1646	0.1946	-0.0639	0.0290	-0.0015
CA	22.4919	-0.1699	0.2149	-0.0759	0.0305	0.0096
CO	19.8573	-0.1786	0.1798	-0.0246	0.0210	-0.0100
CT	26.9429	-0.1662	0.1480	0.0194	-0.0259	0.0230
DC	217.0335	-2.3509	3.3717	-1.2501	0.2179	0.0026
DE	49.4197	-0.5259	0.6238	-0.1695	0.0776	-0.0094
FL	68.3766	-0.8068	0.9060	-0.1823	0.0685	0.0243
GA	63.5088	-0.9943	1.3262	-0.4885	0.1735	-0.0267
GU	3.3187	0.0000	0.0000	0.0000	0.0000	0.0000
HI	46.8573	-0.2947	0.3445	-0.1366	0.0909	-0.0078
IA	54.3771	-0.9500	0.9836	-0.1112	0.0158	0.0525
ID	80.7022	-1.3146	1.5467	-0.3271	0.0559	0.0371
IL	54.9320	-0.6596	0.6793	-0.0902	0.0621	0.0110
IN	62.2011	-1.2124	1.1390	-0.0880	0.0874	0.0616
KS	33.7624	-0.3884	0.1981	0.0301	0.1045	0.0339
KY	61.5472	-1.0761	1.2010	-0.1312	-0.1133	0.0997
LA	60.9864	-0.9412	1.0347	-0.2052	0.0724	0.0308
MA	94.0006	-0.7641	0.9490	-0.2697	0.0769	0.0052
MD	43.0862	-0.3676	0.3856	-0.0668	0.0373	0.0165
ME	143.8074	-1.8460	2.5972	-1.1291	0.3972	-0.0304
MI	103.1890	-2.6243	3.5366	-1.2152	0.2802	0.0016
MN	28.8041	-0.2774	0.2532	0.0275	-0.0279	0.0103
MO	42.4799	-0.7529	0.9222	-0.3186	0.1248	0.0115
MS	22.0516	-0.2408	0.1308	0.0229	0.0882	-0.0138
MT	16.7987	-0.1350	0.0935	-0.0390	0.1300	-0.1022
NC	54.1829	-0.9110	1.0509	-0.2248	0.0448	0.0333
ND	36.5955	-0.3748	0.3284	-0.0780	0.1147	0.0263
NE	22.3685	-0.1302	-0.3215	0.4346	-0.0532	0.0831
NH	88.2587	-0.9076	1.1821	-0.4067	0.1403	-0.0105
NJ	56.4996	-0.4669	0.5579	-0.1586	0.0594	0.0259
NM	51.7441	-0.4805	0.4720	-0.0417	0.0546	-0.0307
NV	24.8223	-0.1844	0.1918	-0.0212	0.0084	0.0024
NY	75.5901	-0.7698	0.7778	-0.0592	0.0427	0.0190
OH	83.7845	-1.5915	2.0193	-0.6894	0.2275	0.0205
OK	68.8996	-1.3265	1.5584	-0.4137	0.1701	-0.0069
OR	31.3947	-0.2198	0.1747	-0.0078	0.0538	-0.0147

PA	93.2363	-1.5522	1.7927	-0.4311	0.1667	0.0148
PR	24.6676	-0.0492	-0.2333	0.2742	-0.0581	0.0549
RI	39.9144	-0.2982	0.5106	-0.3126	0.1035	-0.0014
SC	55.7951	-0.8256	0.8879	-0.1437	0.0314	0.0428
SD	13.2115	0.1061	-0.2953	-0.0359	0.1274	0.1044
TN	60.4061	-1.2919	1.6058	-0.4201	0.0839	0.0076
TX	42.0795	-0.6645	0.7953	-0.2211	0.0839	-0.0046
UT	90.0846	-1.0526	1.5810	-0.6195	0.0788	0.0058
VA	19.9911	-0.1639	0.1820	-0.0736	0.0471	0.0001
VI	27.9477	-0.1612	0.2209	0.2233	-0.3747	0.0889
VT	16.0225	0.1093	-0.6459	0.5505	-0.0259	-0.0167
WA	31.8490	-0.2731	0.2827	-0.0313	0.0088	0.0195
WI	52.9369	-0.7181	0.7772	-0.1985	0.1082	0.0182
WV	36.0211	-0.4060	0.1468	0.2371	0.0298	-0.0186
WY	23.0371	-0.2509	0.3389	-0.1509	0.0361	0.0041

Table 46. Fixed Cost for Foreclosure Alternative Dispositions (Enterprise 2)

STATE	Intercept	B1	B2	B3	B4	B5
US	59.5212	-0.6263	0.6521	-0.1093	0.0408	0.0195
AK	31.8235	-0.2773	0.2119	0.0893	-0.1591	0.1391
AL	47.2413	-0.6647	0.6679	-0.0539	-0.0131	0.0462
AR	16.4704	0.0295	-0.2539	0.3968	-0.2518	0.0395
AZ	33.7405	-0.2156	0.2497	-0.2145	0.1711	0.0004
CA	20.5509	-0.0674	0.0547	0.0306	-0.0840	0.0506
CO	27.7726	-0.1249	-0.0882	0.2333	-0.0171	-0.0308
CT	41.6334	-0.2099	0.1597	0.0851	-0.0899	0.0295
DC	954.5213	-8.4789	0.0000	8.3527	0.2492	0.0000
DE	62.6938	-0.6230	0.7157	0.3926	-0.6354	0.1712
FL	41.8567	-0.2374	0.1620	0.0413	0.0029	0.0111
GA	55.7654	-0.5034	0.4603	0.0508	-0.1334	0.1210
HI	324.7684	-2.0498	2.0492	-0.3799	0.3863	-0.0113
IA	63.2919	-1.0005	1.0564	-0.0369	-0.0967	0.0960
ID	33.3678	-0.1970	-0.0362	0.3156	-0.2609	0.1936
IL	93.0373	-1.1886	1.5371	-0.5807	0.1830	0.0210
IN	50.6721	-0.7646	0.8314	-0.5480	0.6174	-0.1748
KS	36.5250	-0.3005	-0.1428	0.6722	-0.4278	0.1721
KY	60.7447	-0.8977	0.8410	0.2245	-0.3585	0.1407
LA	32.4736	-0.2916	0.4120	-0.0638	-0.1474	0.0535
MA	18.3947	-0.0087	-0.0909	0.0734	-0.0163	0.0295
MD	38.4352	-0.1928	0.1404	0.0199	-0.0008	0.0060

ME	41.9006	-0.1386	-0.5029	0.6700	-0.1219	0.0355
MI	77.0202	-1.0953	1.0396	-0.0873	0.0143	0.0961
MN	63.6950	-0.5855	0.5426	-0.0107	-0.0130	0.0549
MO	33.0767	-0.2277	-0.2976	0.4610	0.0592	-0.0349
MS	38.0896	-0.4247	0.2872	0.3688	-0.3067	0.0687
MT	50.9950	-0.6112	0.6708	-0.1622	0.1366	-0.0730
NC	52.0286	-0.4798	0.4360	-0.0465	0.0634	-0.0056
ND	68.3336	-0.8943	0.9229	-0.0464	0.0117	0.0684
NE	-89.1849	3.0877	-4.5025	1.4480	-0.2429	0.3629
NH	-20.1635	0.3912	-0.4236	-0.0963	0.0826	0.0141
NJ	47.9133	-0.2435	0.2657	-0.1061	0.0530	0.0074
NM	72.6396	-0.7141	0.7645	-0.1489	0.0493	0.0361
NV	18.2384	-0.0539	-0.0847	0.7581	-0.7308	0.1337
NY	121.8580	-1.3284	1.0955	0.1398	0.0880	-0.0325
OH	60.1167	-0.7175	0.4293	0.3590	-0.2770	0.1799
OK	50.6357	-0.8312	1.3103	-0.9560	0.4728	-0.0418
OR	57.0231	-0.3379	0.4216	-0.1851	0.0227	0.0475
PA	65.7722	-0.5479	0.2824	0.1931	0.0212	0.0009
PR	46.0253	-0.4831	0.6009	-0.2424	0.1139	0.0370
RI	38.7495	-0.2187	0.3836	-0.2728	0.1405	-0.0500
SC	35.4251	-0.1931	-0.2097	0.4187	-0.1237	0.0714
SD	19.4031	-0.0404	0.0000	-0.0033	0.0000	0.0000
TN	55.1561	-0.6919	0.8324	-0.5386	0.4584	-0.1113
TX	85.3453	-1.0108	1.1157	-0.2364	0.0780	0.0610
UT	26.9843	-0.1201	-0.2490	0.4962	-0.1393	-0.0211
VA	14.5760	0.0418	-0.2181	0.1728	-0.0357	0.0128
VI	1.7625	0.0000	0.0000	0.0000	0.0000	0.0000
VT	-67.5559	0.7940	-0.9457	0.1750	-0.0949	0.0957
WA	37.0203	-0.2278	0.2021	0.0246	-0.0828	0.0663
WI	35.5584	-0.2687	0.4086	-0.5903	0.4319	-0.0044
WV	44.4562	-0.5284	0.5511	-0.0315	-0.0233	0.0068
WY	-16.3683	0.1493	0.0000	-0.2120	-0.0235	0.0000

Table 47. Fixed Cost (or Transaction Expenses) for Non-Performing Loan Sale Dispositions (Enterprise 1)

STATE	Intercept	B1	B2	B3	B4	B5
US	29.39081	-0.26216	0.26404	-0.03274	0.018987	0.021296
AK	19.4426	-0.13974	0.194466	-0.15224	0.100766	0.005111
AL	25.48085	-0.30231	0.23058	0.057084	-0.00839	0.007202
AR	29.18113	-0.46256	0.491023	-0.12037	0.078855	0.00265
AZ	14.09432	-0.1058	0.090947	-0.0017	0.008403	0.011397

CA	11.88882	-0.06661	0.070025	-0.00858	0.008864	0.006868
CO	15.30777	-0.10816	0.086874	0.012867	-0.00078	0.015905
CT	25.05863	-0.16659	0.180383	-0.02971	0.016395	0.009551
DC	25.44852	-0.18049	0.171383	0.016537	-0.01722	0.00614
DE	20.01625	-0.13586	0.07047	0.042779	0.022852	0.00226
FL	34.06473	-0.28523	0.293704	-0.03816	0.019716	0.024328
GA	29.80606	-0.37491	0.475945	-0.15385	0.053041	-0.0074
HI	23.81148	-0.11879	0.121415	-0.02311	0.013511	0.00874
IA	33.28467	-0.4693	0.517336	-0.10679	0.10968	-0.07769
ID	24.56054	-0.28486	0.329444	-0.12083	0.082779	-0.0209
IL	27.9051	-0.23216	0.229945	-0.01809	0.012983	0.020793
IN	34.69314	-0.54205	0.540965	-0.05263	0.013456	0.036876
KS	29.14582	-0.46562	0.486553	-0.14911	0.168912	-0.02678
KY	46.56793	-0.70409	0.687709	-0.03083	0.021072	0.005886
LA	38.44814	-0.51371	0.510341	-0.02422	0.051807	-0.04448
MA	21.76046	-0.13449	0.147923	-0.02943	0.008404	0.018292
MD	18.60948	-0.12413	0.11758	-0.01184	0.011126	0.021358
ME	25.93898	-0.22552	0.210255	-0.00687	0.004638	0.017213
MI	53.2339	-0.95747	1.197252	-0.33969	0.101638	-0.00815
MN	37.40145	-0.39742	0.571436	-0.22204	0.045523	0.003525
MO	29.51481	-0.47289	0.622711	-0.18237	-0.00973	0.038544
MS	27.61974	-0.40215	0.328605	0.093332	-0.05621	0.039406
MT	25.3058	-0.18027	0.106116	0.108087	-0.08646	0.065491
NC	20.46653	-0.19896	0.133103	0.047768	-0.00877	0.020596
ND	35.15197	-0.50413	0.08844	0.884303	-0.70479	0.217986
NE	33.27652	-0.43716	0.413482	-0.01238	0.063305	-0.02305
NH	37.36032	-0.36301	0.404052	-0.09433	0.087075	-0.03028
NJ	33.49279	-0.21322	0.22248	-0.03411	0.008888	0.034182
NM	33.48826	-0.34451	0.389316	-0.10637	0.0399	0.018768
NV	11.29515	-0.07211	0.074769	-0.01505	0.014996	0.000646
NY	35.68663	-0.23526	0.21127	0.011226	0.003352	0.025791
OH	39.73075	-0.56135	0.503186	-0.0447	0.094699	0.000973
OK	39.56837	-0.66576	0.550855	0.051062	0.052374	-0.00154
OR	22.42751	-0.14541	0.15373	-0.06742	0.042772	0.020893
PA	43.72884	-0.55586	0.487228	0.031266	-0.00691	0.050942
PR	22.14992	-0.39628	0.390993	-0.0176	0.030013	-0.0208
RI	13.20695	-0.06846	0.071438	0.006686	-0.00282	0.000431
SC	32.29118	-0.35418	0.294409	0.040026	-0.01591	0.020521
SD	-6.09134	0.261987	-0.3474	-0.01803	0.192619	-0.119
TN	27.50024	-0.39916	0.376061	0.034334	-0.04849	0.039482

TX	22.69102	-0.24325	0.237922	0.0017	0.000384	0.005992
UT	15.59645	-0.10866	0.109657	-0.01088	0.011508	-0.0101
VA	15.42962	-0.10944	0.077502	0.014246	0.005703	0.02688
VI	5.112422	-0.00792	0	0	0	0
VT	19.03838	-0.09468	0.011512	0.031093	0.04375	-0.00333
WA	22.69898	-0.18739	0.188943	-0.00909	-0.00472	0.01917
WI	26.68847	-0.28133	0.336691	-0.11792	0.056367	0.00968
WV	16.50412	-0.15424	-0.04931	0.203155	-0.04184	0.042401
WY	7.680851	-0.00475	-0.13832	0.18366	-0.09588	0.076708

Table 48. Fixed Cost (or Transaction Expenses) for Non-Performing Loan Sale Dispositions (Enterprise 2)

STATE	Intercept	B1	B2	B3	B4	B5
US	19.0708	-0.1735	0.1822	-0.0266	0.0108	0.0038
AK	3.8319	-0.0343	0.2917	-0.6639	0.4125	0.0158
AL	18.1130	-0.2300	0.1326	0.0667	0.0109	0.0164
AR	35.9577	-0.8189	1.0359	-0.3167	0.0610	0.0368
AZ	4.8769	-0.0180	0.0139	0.0070	-0.0097	-0.0057
CA	22.6999	-0.1283	0.1859	-0.0773	0.0176	0.0016
CO	7.7053	-0.0151	-0.0602	0.0703	-0.0259	0.0360
CT	15.1129	-0.1050	0.1281	-0.0359	0.0071	0.0025
DC	3.9214	-0.0078	0.0227	-0.0197	-0.0180	0.0198
DE	10.1418	-0.0727	0.0659	0.0086	-0.0037	-0.0091
FL	30.2605	-0.2809	0.3160	-0.0627	0.0180	0.0033
GA	9.6381	-0.0722	0.0309	0.0186	0.0165	0.0014
HI	14.9187	-0.0591	0.0583	-0.0001	-0.0086	0.0056
IA	5.9781	-0.0519	0.0948	-0.0625	0.0010	0.0068
ID	14.6004	-0.1561	0.3085	-0.2789	0.1290	-0.0085
IL	24.4571	-0.2598	0.2977	-0.0580	0.0137	0.0023
IN	9.0174	-0.1044	0.1678	-0.1316	0.0561	0.0075
KS	22.2138	-0.4683	0.6131	-0.3844	0.2574	-0.0221
KY	100.0934	-2.1444	3.5029	-1.5619	0.1956	-0.0012
LA	14.7683	-0.1561	0.1731	-0.0593	0.0086	0.0324
MA	10.7001	-0.0517	0.0507	-0.0011	-0.0102	0.0070
MD	13.0964	-0.0907	0.0963	-0.0194	0.0102	0.0032
ME	35.4116	-0.3545	0.2775	0.1123	-0.0565	0.0148
MI	14.5730	-0.1874	0.1381	0.0261	0.0180	0.0006
MN	7.1098	-0.0329	-0.0150	0.0634	-0.0165	-0.0085
MO	20.6054	-0.3504	0.3460	-0.0254	0.0251	0.0010
MS	7.5533	-0.0636	0.0997	-0.0788	0.0112	0.0264
MT	20.1671	-0.2085	0.2104	-0.0896	0.1296	-0.0460

NC	26.6363	-0.3759	0.4659	-0.1475	0.0535	-0.0010
ND	-2.8644	0.5464	-0.5922	-0.2765	0.3295	-0.0146
NE	23.3240	-0.3050	0.2774	0.0763	-0.1449	0.1059
NH	5.0810	-0.0165	0.0479	-0.0898	0.0213	0.0472
NJ	16.8384	-0.0945	0.0930	-0.0177	0.0134	0.0007
NM	15.7203	-0.1105	0.0750	0.0354	-0.0383	0.0363
NV	7.2220	-0.0249	0.0055	0.0165	-0.0039	0.0030
NY	23.5023	-0.1594	0.1586	-0.0082	0.0052	0.0016
OH	20.2435	-0.2939	0.2387	0.0467	-0.0048	0.0051
OK	11.4625	-0.0746	-0.1983	0.3678	-0.1912	0.0884
OR	8.7982	-0.0408	0.0526	0.0029	-0.0414	0.0243
PA	25.4541	-0.3355	0.3414	-0.0551	0.0399	0.0037
PR	-2.1136	0.1070	-0.1363	0.0436	-0.1580	0.1431
RI	-1.2780	0.0376	-0.0923	0.1679	-0.1961	0.0866
SC	19.8291	-0.2508	0.2245	-0.0214	0.0346	0.0113
SD	3.4610	-0.0164	-0.0805	0.1749	-0.0694	-0.0076
TN	22.6046	-0.3676	0.3302	0.0871	-0.0789	0.0234
TX	27.6189	-0.3320	0.3244	-0.0019	-0.0042	0.0106
UT	-6.9436	0.0809	-0.1487	0.1077	-0.0673	0.0227
VA	10.6915	-0.0889	0.1094	-0.0243	-0.0143	0.0173
VI	0.2724	0.0009	-0.0172	0.0174	-0.0008	0.0000
VT	2.2661	0.0011	0.0243	-0.0924	0.0831	-0.0259
WA	10.9757	-0.0638	0.0634	-0.0325	0.0386	-0.0117
WI	25.1053	-0.3660	0.5381	-0.2103	0.0204	0.0123
WV	18.8994	-0.3100	0.3291	-0.0461	-0.0037	0.0321
WY	-19.8514	0.1882	-0.2073	0.0046	0.0165	0.1918

*Many fixed cost categories are zero for NPL sales.

9.2.4   Carrying Costs

Carrying costs for defaulted loan i (Carrying Costs$_i$) are defined as carrying costs times the number of months from last paid installment date to REO liquidation date. For foreclosure alternatives carrying costs are calculated from last paid installment date to title transfer date (liquidation).

$Carrying\ Costs_i$
$$= (Property\ taxes_i + Property\ insurance_i + HOA\ fees_i + Condominimum\ fees_i$$
$$+ Maintenance\ fees_i)$$
$$* Number\ of\ months\ from\ Last\ Paid\ Installment\ Rate\ to\ REO\ liquidation_i$$

$$\forall\ i \in REO$$

$$Carrying\ Costs_i$$
$$= (Property\ taxes_i + Property\ insurance_i + HOA\ fees_i + Condominimum\ fees_i$$
$$+ Maintenance\ fees_i)$$
$$* Number\ of\ months\ from\ Last\ Paid\ Installment\ Date\ to\ title\ transfer\ date_i$$

$$\forall\ i \in Foreclosure\ alternative$$

Months from Foreclosure to REO Property Disposition
The number of months from foreclosure to property disposition is estimated for both Enterprises for REOs that have completed their disposition between 2012 and 2020. This measure is the liquidated UPB weighted average months from foreclosure completion date to property disposition date. Months from foreclosure date to property disposition date are multiplied by calculated monthly carrying costs to create total for REO dispositions. See table below for weighted average months by Enterprise.

Table 49. Liquidation UPB-weighted Average Months to REO Disposition, by Enterprise

State	Enterprise 1 Liquidation UPB Weighted Average Months to REO Disposition	Enterprise 2 Liquidation UPB Weighted Average Months to REO Disposition
US	8.6	8.4
AK	8.6	9.9
AL	7.3	7.6
AR	6.4	7.1
AZ	5.8	5.5
CA	8.2	7.6
CO	7.2	7.3
CT	9.4	9.1
DC	12.6	16.7
DE	8.2	9.0
FL	7.1	7.0
GA	6.8	6.8
HI	14.7	16.6
IA	6.3	6.6
ID	7.0	6.4
IL	10.8	10.6
IN	6.3	5.2
KS	8.3	8.8
KY	8.9	8.6
LA	7.0	7.8
MA	10.0	11.6
MD	12.4	13.9
ME	6.6	7.7

MI	10.6	11.7
MN	10.9	11.7
MO	6.8	6.5
MS	6.8	7.3
MT	8.0	7.0
NC	6.7	6.7
ND	11.9	11.8
NE	6.2	6.2
NH	8.7	8.9
NJ	11.1	10.9
NM	10.5	11.2
NV	6.7	6.6
NY	11.1	12.7
OH	7.9	8.6
OK	6.9	7.7
OR	12.2	8.9
PA	8.0	8.4
PR	11.5	13.8
RI	7.4	9.8
SC	6.8	7.2
SD	10.3	12.9
TN	7.2	6.7
TX	7.4	7.4
UT	6.0	6.2
VA	7.8	7.3
VT	11.7	11.4
WA	7.7	7.0
WI	8.0	7.9
WV	9.8	7.7
WY	12.0	10.9

9.2.5   Loss Severity Module Variable Definition

Loss Severity Module involves numerous definitions and variables. Below is a table summarizing the major variables in the module.

Table 50. Loss Severity Module Fields and Definitions

Accounting transaction types
  Appraisal Fees
  Attorney and Trustee Fees
  Borrower Closing Costs
  Broker Fees

Credit Enhancement Proceeds
Discount Points
Gross Property Sale Price
HOA and Condo Fees
Insurance
Maintenance Expense
MI Proceeds
Other Foreclosure Expense
Other Income
Other Liquidation Expenses
Other Non-Selling Expense
Possessory and Eviction Fees
Property Rental Income
Property Inspection
Property Management Expense
Repairs
Sales Expense
Seller Closing Expense
Seller Loan Repair Amount
Taxes
Title Insurance Fee
Utilities
Reps and Warrants Proceeds
Incentive Payment
Net Sales Proceeds

Other Loss severity data

Foreclosure date – the date when the foreclosure is completed and the title has been transferred from borrower to the Enterprises.

Disposition date – the date the REO property is sold from REO inventory

Sale price at liquidation – the sale price of the property at liquidation date for foreclosure alternatives (third party sale and short sale)

Dummy variable Judicial state – this dummy identifies the states that have foreclosures go through the courts. These are states Connecticut (CT), Delaware (DE), Florida (FL), Hawaii (HI), Iowa (IA), Illinois (IL), Indiana (IN), Kansas (KS), Kentucky (KY), Louisiana (LA), Maine (ME), North Dakota (ND), New Jersey (NJ), New Mexico (NM), New York (NY), Ohio (OH), Oklahoma (OK), Pennsylvania (PA), South Carolina (SC), Vermont (VT), and Wisconsin (WI).

Dummy variable non-Judicial state – all other states do not have court proceedings to complete the foreclosure.

Net sale proceeds= Gross sale proceeds or note sale proceeds minus the sum of sales expense - other selling expense - broker fees - borrower closing costs

Fixed costs for foreclosure and foreclosure alternatives = the sum of appraisal fees + attorney and trustee fees+ other foreclosure expenses + other liquidation expenses + maintenance expense + property inspection + repairs + utilities.

Fixed costs ratio for foreclosure and foreclosure alternatives = (fixed costs/liquidated upb)*100

Monthly condo fee = (condo fee per day*360)/12

Monthly insurance fee = (insurance fee per day*360)/12

Monthly property taxes = (property taxes per day*360)/12

Marked to market loans to value ratio at liquidation=original LTV*(liquidate unpaid amount/original unpaid loan amount) *(original house price index/liquidation house price index)

Original sale price= original unpaid loan balance/original loan to value ratio

9.2.6   Loss Severity Module Back-testing of Each Component

In this section, we look at the first component of net losses, which is the net sales proceeds on three different disposition types. We divide net sales proceeds by the liquidation unpaid principal balance to obtain the net sale proceed ratios. Overall, predicted values track actual values throughout the years with the largest discrepancies for years 2012 to 2013 as well as 2020. See the figure below. Here the net sales proceeds are calculated as follows:

$$
\begin{aligned}
Net\ sale\ proceeds_i \\
= Gross\ property\ sale\ proceeds_i\ - Sales\ expense_i - Other\ selling\ expense_i \\
- Broker\ fees_i - Borrower\ closing\ costs_i
\end{aligned}
$$

$$\forall i\ for\ REOs\ or\ foreclosure\ alternatives$$

$$
\begin{aligned}
Net\ sale\ proceeds_i \\
= NPL\ sale\ proceeds_i - Sales\ expense_i - Other\ selling\ expense_i - Broker\ fees_i \\
- Borrower\ closing\ costs_i
\end{aligned}
$$

$$\forall i\ for\ NPL\ sales$$

Figure 13. Enterprise 1 Back-testing Results of Net Sales Proceeds Ratios, 2012-2022
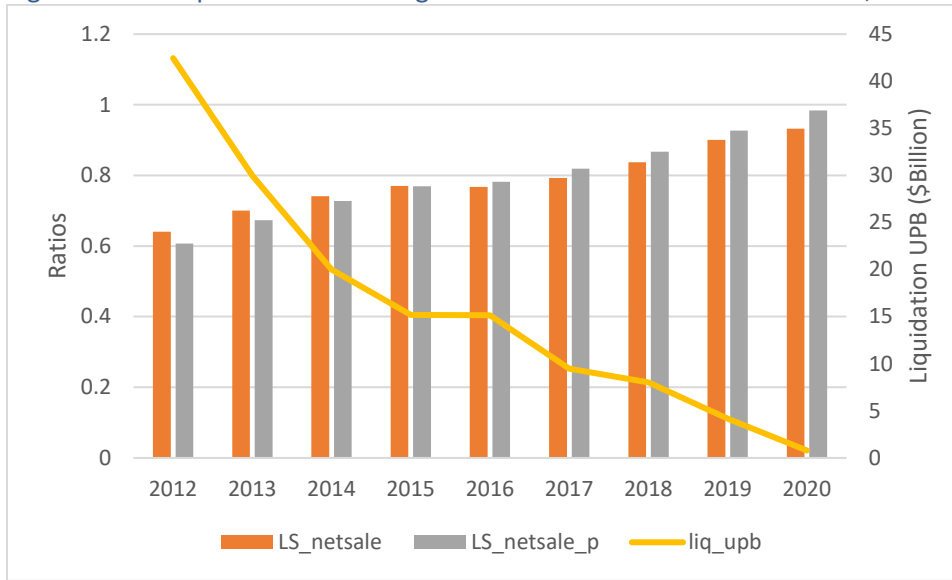
9.2.7 Fixed Costs Ratios

The figure below compares the predicted fixed costs ratios with actual cost ratios, both scaled by liquidation unpaid principal balance. We divide fixed costs by the liquidation unpaid principal balance to get the fixed costs ratios. As shown in the figure below, before year 2017 the predicted values consistently overestimate fixed cost ratios. However, the predicted values underestimated the ratios since 2017. It seems that there is still some recent upward shifting trend in fixed costs being missed in predicting the fixed costs component. Below is the formula for calculating fixed costs for REOs and foreclosure alternatives:

$$
\begin{aligned}
Fixed\ costs_i\ =\ &Appraisal\ Fees_i +\ Attorney\ and\ Trustee\ Fees_i \\
&+\ Other\ Foreclosure\ Expenses_i\ +\ Other\ Liquidation\ Expenses_i \\
&+\ Maintenance\ Expenses_i +\ Property\ Inspection\ Fees_i\ +\ Repairs_i \\
&+\ Utilities\ costs_i
\end{aligned}
$$

$$\forall i\ for\ REOs\ or\ foreclosure\ alternatives$$

The fixed costs on NPL sales are also called liquidation expenses and they are calculated as follows[18]:

$$
\begin{aligned}
Fixed\ costs_i\ =\ &Appraisal\ Fees_i +\ Attorney\ and\ Trustee\ Fees_i \\
&+\ Other\ Foreclosure\ Expenses_i\ +\ Other\ Liquidation\ Expenses_i \\
&+\ Other\ Non\ Selling\ Expenses_i +\ Maintenance\ Expenses_i \\
&+\ Property\ Inspection\ Fees_i\ +\ Repairs_i\ +\ Utilities\ costs_i \\
&+\ Possessory\ and\ Eviction\ Fees_i +\ Title\ Insurance\ Fees_i \\
&+\ Property\ Management\ Expenses_i +\ Servicer\ Incentive\ Payments_i
\end{aligned}
$$

$$\forall i\ for\ NPL\ sales$$

---

[18] Many of the fixed cost components are zero for Nonperforming Loan (NPL) Sales.

Figure 14. Enterprise 1 Back-testing Results of Fixed Costs Ratios, 2016-2020
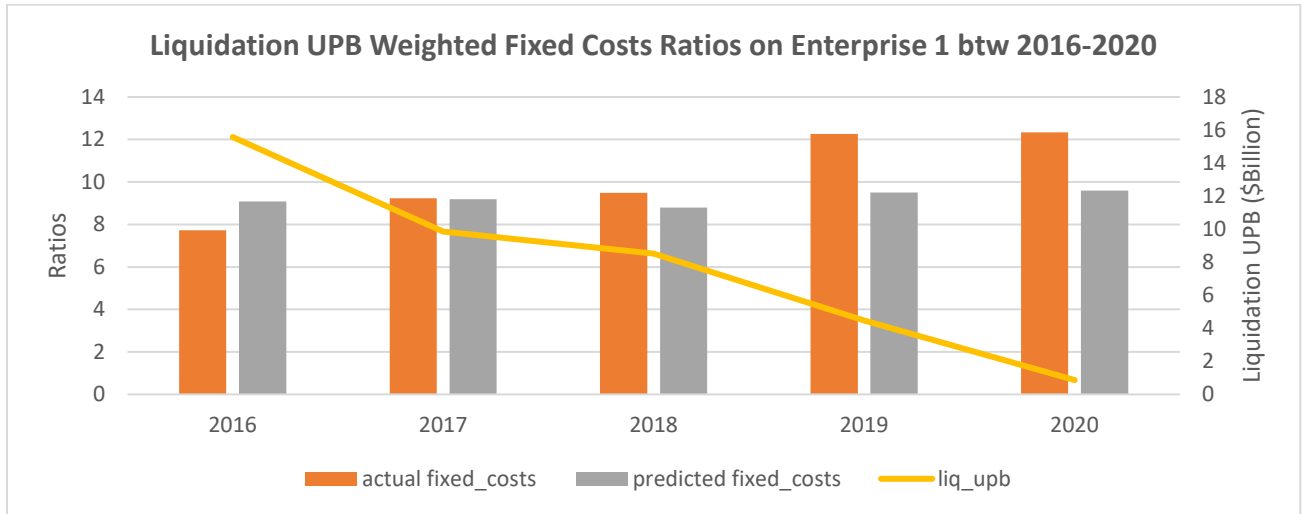
9.2.8   Carrying Costs Ratios

Carrying costs consist of five components: (1) insurance fees, (2) taxes, (3) HOA, (4) condo fees, and (5) accrued interests before disposition. As with other items, carrying cost ratios, which equals carrying costs divided by liquidation unpaid balance amount, are also reasonably well predicted in aggregate across all loans (see figure below). Though not shown below, the predictions match well with actuals also across different cohorts by disposition types, and by judicial or non-judicial states.

Figure 15. Enterprise 1 Back-testing Results of Carrying Costs Ratios, 2012-2020
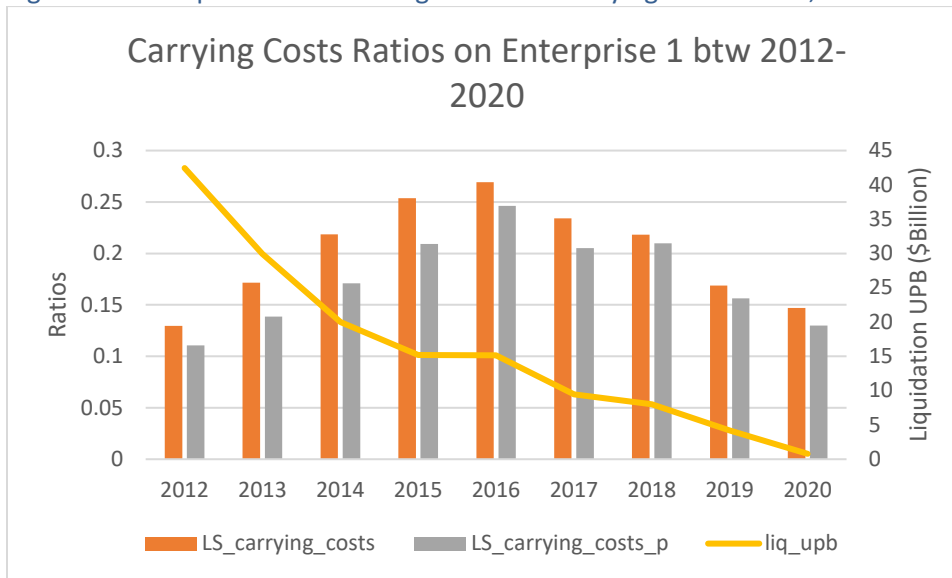
9.2.9   Mortgage Insurance Proceeds Ratios

Mortgage insurance proceeds ratios are calculated by dividing mortgage insurance proceeds by the liquidation unpaid principal balance to get mortgage insurance proceed ratios. Mortgage insurance proceeds ratios have the second largest discrepancy between predicted and actual values after fixed

costs ratios (see the figure below). However, other than the last year considered (2020), most other years seem to have reasonable predictions.

Figure 16. Enterprise 1 Back-testing Results of MI Proceeds Ratios, 2012-2020
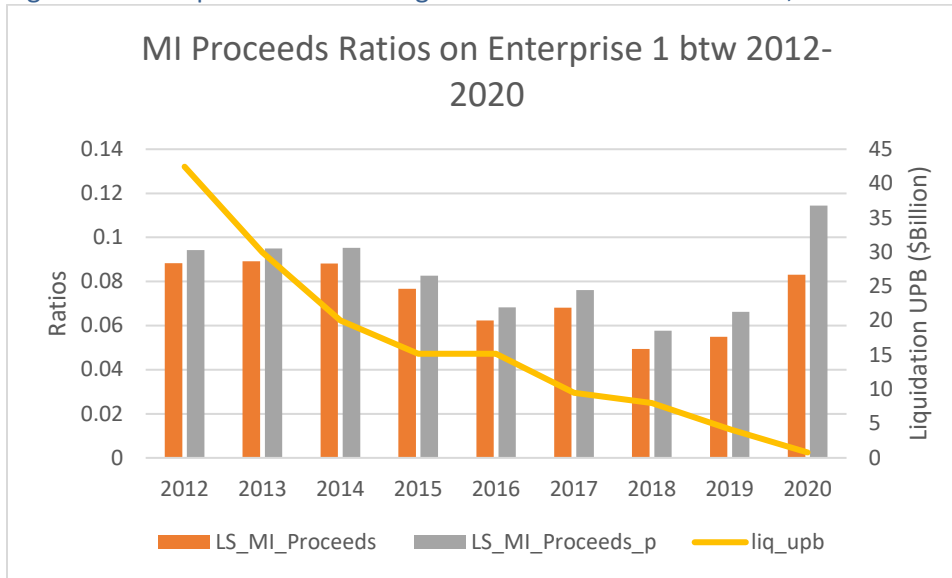
9.3 Simulation

9.3.1 Markov Chain Simulation Framework Implementation

In the main context, we illustrate the Markov Chain in terms of matrix operations. Here we are presenting how it is implemented.

Problem: Given that, at time t, the probability in each state is known, how to compute the probability of each state at time t+1.

Solution:

1. Use behavioral equations to get transition rate from time *t* to time *t+1*.

   - x_perf_ldq, x_perf_prep, x_perf_perf

   - x_nrpl_ldq, x_nrpl_prep, x_nrpl_nrpl

   - x_mrpl_ldq, x_mrpl_prep, x_mrpl_mrpl

   - x_rpl_ldq, x_rpl_prep, x_rpl_rpl

   - x_ldq_ldq, x_ldq_prep, x_ldq_def, x_ldq_sdq,x_ldq_rpl
   - x_sdq_sdq, x_sdq_prep, x_sdq_def, x_sdq_ldq,x_sdq_rpl,x_sdq_ldq

   - x_ddq_ddq, x_ddq_prep, x_ddq_def, x_ddq_sdq,x_ddq_rpl,x_ddq_ldq

2. Compute the marginal probabilities at time *t+1*, which is the weighted average of transition rates weighted by the probabilities of each state at time *t*.

- **next_SProb_perf** = SProb_perf * x_perf_perf;

- **next_SProb_nrpl** = SProb_nrpl * x_nrpl_nrpl;

- **next_SProb_mrpl** = SProb_mrpl * x_mrpl_mrpl;

- **next_SProb_rpl** = SProb_rpl * x_rpl_rpl
  + SProb_ldq * x_ldq_rpl
  + SProb_sdq * x_sdq_rpl
  + SProb_ddq * x_ddq_rpl;

- **next_SProb_ldq** = SProb_perf * x_perf_ldq
  + SProb_nrpl * x_nrpl_ldq
  + SProb_mrpl * x_mrpl_ldq
  + SProb_rpl * x_rpl_ldq
  + SProb_ldq * x_ldq_ldq
  + SProb_sdq * x_sdq_ldq
  + SProb_ddq * x_ddq_ldq;

- **next_SProb_sdq** = SProb_ldq * x_ldq_sdq
  + SProb_sdq * x_sdq_sdq
  + SProb_ddq * x_ddq_sdq;

- **next_SProb_ddq** = SProb_sdq * x_sdq_ddq
  + SProb_ddq * x_ddq_ddq;

- **next_SProb_P** = SProb_perf * x_perf_prep
  + SProb_nrpl * x_nrpl_prep
  + SProb_mrpl * x_mrpl_prep
  + SProb_rpl * x_rpl_prep
  + SProb_ldq * x_ldq_prep
  + SProb_sdq * x_sdq_prep
  + SProb_ddq * x_ddq_prep;

- **next_SProb_D** = SProb_ldq * x_ldq_def
  + SProb_sdq * x_sdq_def
  + SProb_ddq * x_ddq_def;

9.3.2 Monte Carlo Simulation Framework Implementation

Based on the state of the loan at month *t*, one invokes the corresponding behavior equation to calculate the probabilities of states at month *t+1*, then use a random number to select a state among the several possible states.

Here is a pseudo-code example for the PERF loan status:

```
For each simulation scenario
    for each loan
        for each month (t)
            Draw a uniform random number, U, in the range of (0, 1)

            Select LOAN_STATUS:
                • case PERF:

                    Invoke PERF models to computing the probabilities of LDQ, Prepay and PERF, which
                    are denoted as   x_perf_ldq, x_perf_prep and x_perf_perf.

                    if ( U <= x_perf_perf) then
                        NEXT_LOAN_STATUS = PERF
                    else if ( U <= x_perf_perf + x_perf_ldq) then
                        NEXT_LOAN_STATUS = LDQ
                    else
                        NEXT_LOAN_STATUS = PREPAY
    END of month
  END of loan
END of scenario
```

9.3.3   Cash Flow-Based Simulation

9.3.3.1   *Performing and Nonperforming Unpaid Principal Balance*

In general, for a particular month, a given loan can either perform (i.e., pay as scheduled per terms of the loan contract) or fail to perform (i.e., not pay as scheduled per terms of the loan contract) or prepay. If a loan performs, then its unpaid principal balance (i.e., the amount contractually owed) is characterized as a performing unpaid principal balance. If a given loan fails to perform, then it is considered delinquent, and its unpaid principal balance is characterized as a nonperforming unpaid principal balance.

Performing unpaid principal balance at a current point in time, say month t, equals a sum of two parts. The first part reflects the amount of performing unpaid principal balance from the prior period, say the previous month t-1, that remains performing at month t. The second part reflects the amount of the delinquent unpaid principal balance from a prior period that transitions to performing status at month t.

To calculate the projected performing unpaid principal balance for month t, consider the following two steps. First, the projected performing unpaid principal balance, at month t, equals the performing unpaid principal balance from the prior period, month t-1, minus the projected scheduled principal payment. Second, this projected performing unpaid principal balance is multiplied by the likelihood (i.e., conditional probability) of transitioning from the performing status in the prior period to the performing status in month t.

For a delinquent loan to be reclassified as performing at month t, the borrower(s) must pay the sum of two amounts: what was owed (i.e., the unpaid scheduled principal owed from last paid installment date in the previous period) and what is due (i.e., scheduled principal due currently).

To calculate the projected performing unpaid principal balance for a delinquent loan for the month t, consider again the following two steps. First, the projected performing unpaid principal balance from the prior period delinquency equals the delinquent unpaid principal balance from the prior period minus what was owed (i.e., the unpaid scheduled principal from the last paid installment date to the previous

period) and what is due (i.e., the scheduled principal due in the current period), multiplied by the likelihood of performing from the prior period delinquency.

9.3.3.2 Prepayment Amount (Unscheduled Principal)

The projection of prepayment amount is similar to the projection of performing unpaid principal balance described previously. Prepayment amount in a current period, say at month t, equals the sum of the following: the amount of performing unpaid principal balance from a previous period, say month t-1, that prepays in the current period plus the amount of the delinquent unpaid principal balance from the previous period that prepays in the current period. For a performing loan to prepay at month t, the borrower(s) must pay scheduled principal due at month t. The projected prepaid amount for the current period performing in the previous period is the performing unpaid principal balance in the previous period minus the projected scheduled principal payment in the current period. This differential is multiplied by the likelihood (e.g., conditional probability) transitioning from the performing status in the previous period to prepay in the current period. For a delinquent loan to prepay in the current period, the borrower(s) must pay the sum of two amounts: what was owed (i.e., the unpaid scheduled principal owed from last paid installment date in the previous period) and what is due (i.e., scheduled principal due currently). The projected prepay amount in the current period that is delinquent at the previous period equals the delinquent unpaid principal balance from the prior period minus what was owed and what is due multiplied by the likelihood of prepaying in the current period given the previous period delinquency.

9.3.3.3 Delinquent Amount

Delinquent amount at month t is the sum of LDQ (3 – 5 months delinquent) amount, SDQ (6-11 month of delinquent) amount, and DDQ (12 or more month of delinquent) amount. A loan that is LDQ at month t may result from the following: transition from performing loan at month t – 1; remains LDQ from prior month LDQ loan; transition from a SDQ loan at prior month; or transition from DDQ loan at prior month. A SDQ loan at month t may: transition from a LDQ loan at month t – 1; remains SDQ status from prior month SDQ status; or transition from a DDQ loan at prior month. A DDQ loan at month t may result from the following: transition from a SDQ loan at month t – 1; or remains DDQ from a DDQ loan at prior month. In order for a loan to transition from higher delinquency status to lower delinquency status, for example, SDQ, to LDQ, DDQ to LDQ, DDQ to SDQ, the loan is expected to pay a portion of unpaid principal. LDQ amount at month t is the sum of the following: performing UPB at month t – 1 multiplied by the likelihood of transition to LDQ from performing at t -1; the LDQ amount at month t -1 multiplied by the likelihood of transition to LDQ from LDQ at t – 1; the SDQ amount at month t – 1 minus the portion of unpaid (owed) scheduled principal balance, multiplied by the likelihood of transition to LDQ from SDQ at month t – 1; and DDQ amount at month t – 1 minus the portion of unpaid (owed) scheduled principal balance, multiplied by the likelihood of transition to LDQ from DDQ at month t - 1. SDQ amount at month t is projected as the sum of the following: the LDQ amount at month t -1 multiplied by the likelihood of transition to SDQ status from LDQ at t – 1; the SDQ amount at month t – 1, multiplied by the likelihood of transition to SDQ from SDQ at month t – 1; and DDQ amount at month t – 1 minus the portion of unpaid (owed) scheduled principal balance, multiplied by the likelihood of transition to SDQ status from DDQ at month t - 1. DDQ amount at month t is the sum of the SDQ amount at month t – 1 multiplied by the likelihood of transition to DDQ from SDQ at month t – 1; and DDQ amount at month t – 1 multiplied by the likelihood of transition to DDQ from DDQ at month t - 1.

9.3.3.4 Default Unpaid Principal Balance

Projected default amount at month t is the amount of delinquent UPB at month t-1 defaults at month t. This amount is equal to delinquent UPB at month $t-1$ multiplies the conditional probabilities of default at month t given delinquency at $t-1$.

9.3.4 Cashflow-based Simulation vs. Markov Chain Simulation

Markov chain approach is focusing on the unconditional probabilities first (without the cashflow consideration), then using scheduled UPB to derive the prepay amount and using weighted lagged scheduled UPB to derive the default amount. Cashflow based simulation first calculates conditional probabilities, and then uses the projected UPB in the prior period to derive cash flows.

As an example, consider the calculation of prepayment amount.

In Markov chain approach,

$$Prepaid\ amount\ (t) = \text{Prep\_prob(t) * Schd\_UPB(t)}$$

In cash flow-based approach, this amount is calculated as the sum of:

- Prepay amount transition from performing UPB at $t-1$: perf_prep (t) * Perf_UPB(t-1), subtract scheduled principal payment (amount due)

- Prepay amount transition from LDQ at $t-1$: ldq_prep (t) * LDQ_UPB(t-1), subtract scheduled principal payment (amount due), and amount owe from LPI to $t-1$.

- Prepay amount transition from SDQ at $t-1$: sdq_prep (t) * SDQ_UPB(t-1), subtract scheduled principal payment (amount due), and amount owe from LPI to t - 1

- Prepay amount transition from DDQ at $t-1$: ddq_prep (t) * DDQ_UPB(t-1), subtract scheduled principal payment (amount due), and amount owe from LPI to $t-1$, where perf_prep(t), ldq_prep(t), ldq_prep(t), ldq_prep(t) are conditional probabilities of prepay.

Although the difference seems obvious in formulation, the actual differences (both formulation and numerical) are small.

9.4 Summary Information

Below is summary information provided in compliance with FHFA's Information Quality Guidelines.

Table 51. Summary Information

Requirement	Response
1. Describe the underlying source of any data used to create the product, including whether FHFA or a different agency collected the data.	Single-Family Mortgage Analytics Platform (SF FMAP) consists of two separate sets of underlying data, which vary depending on the type of SF FMAP equation: behavioral equations or loss severity equations. For the behavioral equations, the underlying data come from three sources; namely, (i) Mortgage Loan Integrated System (MLIS); (ii) FHFA-produced House Price Index (HPI); and (iii) a vendor. Regarding MLIS, each month, Fannie Mae and Freddie Mac provide FHFA with borrower and collateral information on their mortgage

	holdings. Regarding FHFA-produced HPI, the Office of Capital Policy receives HPI information from the Division of Research and Statistics of the Agency. The vendor provides historical and forecast house price, market rates, and unemployment rates. For the loss severity equations, the underlying source data come from multiple sources as well. First, Fannie Mae and Freddie Mac (The Enterprises) provide monthly loan-level real-estate owned fixed costs data. Second, The Enterprises provide monthly transaction-level costs for non-performing loan sales. Lastly, house price index data is provided by a vendor. Combined, these data serve as the estimation data that feed SF FMAP.
2. Describe the statistical methods or models used to create the product.	SF FMAP consists of three sets of statistical/quantitative methods embedded within SF FMAP. In the behavioral equations of SF FMAP, the statistical methods include a set of binomial logistic regressions and a set of multinomial logistic regressions. In the loss severity equations of SF FMAP, the statistical method is a set of linear regressions. Lastly, the simulation module of SF FMAP includes a cash flow calculation method, Markov Chain-based method, and Monte Carlo-based method.
3. Describe the intended uses of the product, and if applicable, uses not recommended.	SF FMAP is a decision support tool used to provide independent analytic support to Agency decision makers on a wide variety of policies such as, but not limited to, Dodd-Frank Act Stress Test, Conservatorship Capital Framework, and the Private Mortgage Insurer Eligibility Requirements. The white paper describes the modeling rationale, theoretical underpinnings, and empirical results from updating and enhancing the production version of SF FMAP.
4. Describe the time period presented in the event or phenomenon reflected in the product.	SF FMAP consists of several sets of time periods, which vary depending upon the SF FMAP module. For the set of behavioral equations of SF FMAP, the time period for the estimation sample reflects borrower and collateral information from Jan. 2000 to Dec. 2019. For the loss severity equations of SF FMAP, the time period for the loss data sample ranges from Jan. 2011 to Jul. 2022. For the simulation module, the time period for simulated single-family credit loss forecasts can range from one to 40 years.
5. Describe the granularity (*i.e.*, amount of disaggregation) of any key estimates. Granularity can be expressed in units of time, level of geographic detail available, or the amount of detail available on any number of characteristics.	SF FMAP consists of several levels of granularity, which vary depending upon the SF FMAP module. For the set of behavioral equations of SF FMAP, the level of granularity is threefold: (i) loan-level for behavioral and collateral data; (ii) metropolitan level for house price and unemployment rate; and (iii) national-level for market rates. For the set of loss severity equations of SF FMAP, the level of granularity is loan-level varies from loan-level to aggregate-levels of various dimensions. For the simulation module of SF FMAP, the level of granularity varies from loan-level to aggregate-levels of various dimensions (e.g., loan characteristic, geography, book-level, etc....)
6. Where applicable, describe any known major or significant errors in the	The loan level data used for the model fitting is from the historical loan-level database of mortgage, property, and borrower characteristics (excluding Personally Identifiable Information)

underlying source data used to create the product.	submitted by the Enterprises. The Enterprises perform data validation for each submission.. Since FMAP is estimated using a sample of loans from the historical loan-level database, loans with errors (missing or unreasonable values) are filtered out from the sample to ensure that data used for model estimation is clean.
7. Where applicable, describe how users can estimate errors, such as errors from sampling.	To estimate errors, users need to repeat the sampling and estimation process that were done in the update and collect the errors from the estimation. To estimate sampling error, users need to calculate the summary statistics of the sample and population and calculate the difference of the two sets of summary statistics.
8. Where applicable, describe the consistency or comparability with estimates contained in other products published by FHFA.	The document describes a model that is an update to the predecessor model described in the prior version of the document. Since the equations have been re-estimated since the prior model, the estimates themselves are incomparable. There is no other products published by FHFA that has same intended uses as SF FMAP.
9. Where applicable, describe the steps taken to ensure the product protects the privacy and confidentiality of underlying entity (*e.g.*, borrower, business) reflected in the source data, where applicable.	FHFA staff do not disclose any private or confidential information in the working paper. At the individual loan level, the analysis relies upon the historical loan-level database of mortgage, property, and borrower characteristics submitted by the Enterprises. the database omits private or confidential information. At the Enterprise level, FHFA staff anonymize the Enterprises rather than reveal their names when appropriate.
10. Where applicable, describe the verification and validation steps taken to ensure errors are not introduced in the production process.	FHFA staff continually review the working paper until it has been posted. In particular, (i) FHFA SF FMAP model risk personnel series of collaboration/meetings, (ii) external review of FHFA non-SF-FMAP personnel, (iii) external presentation and review by FHFA Office of Financial Analysis and Division of Research and Statistics personnel, and (iv) executive-level review.
11. Where applicable, describe the "chain of custody" of the product from its verification and validation to when it is posted on the website.	After posting of the working paper, FHFA staff intends to perform a check to ensure the file posted matches the file intended for posting.

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