

FHFA MORTGAGE ANALYTICS PLATFORM

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FHFA Mortgage Analytics Platform

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1. Background & Introduction

The Federal Housing Finance Agency (FHFA) maintains a proprietary Mortgage Analytics Platform to support the Agency's strategic plan. The objective of this white paper is to provide interested stakeholders with a detailed description of the platform, as it is one of the tools the FHFA uses in policy analysis. The distribution of this white paper is part of a larger effort to increase transparency on mortgage performance and the analytical tools used for policy analysis and evaluation within the FHFA.

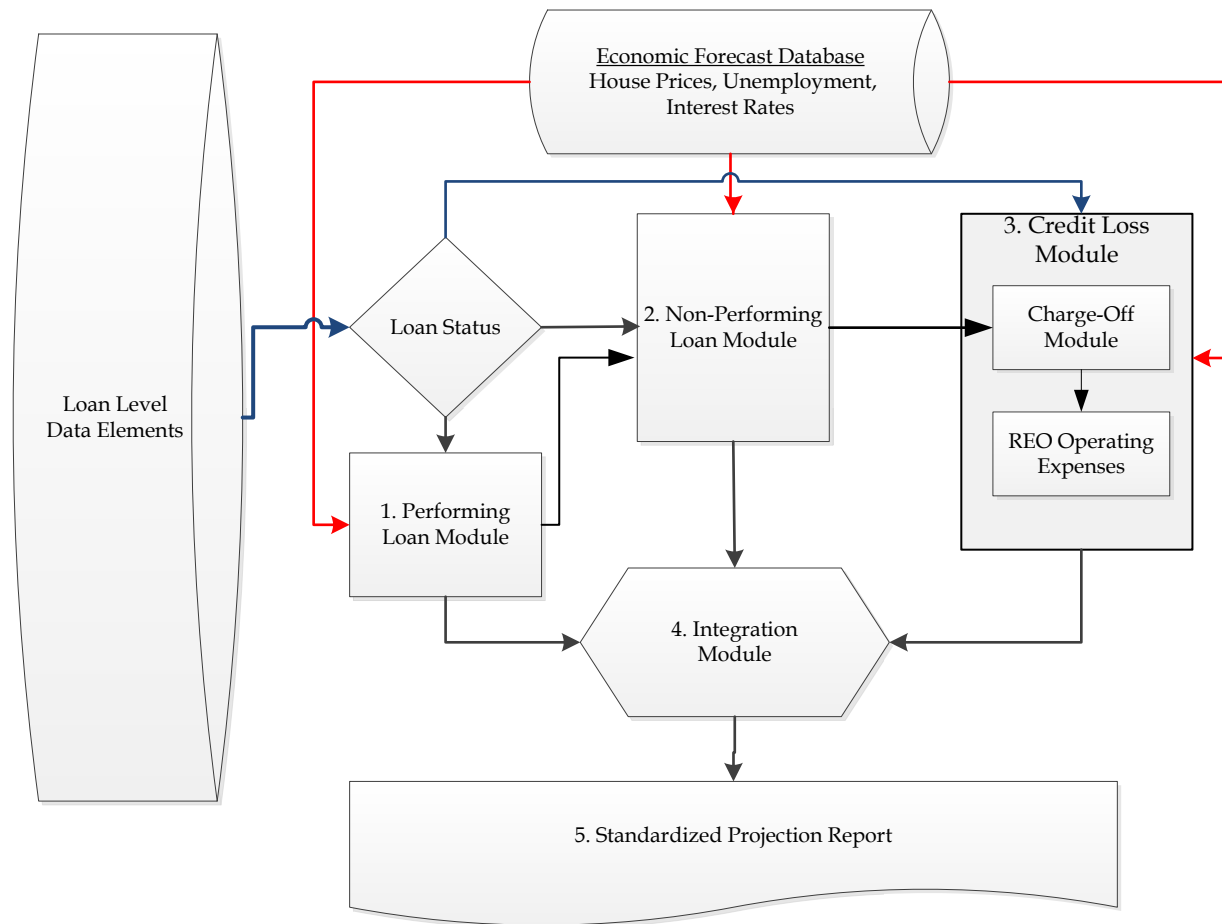
The motivation to build the FHFA Mortgage Analytics Platform derived from the Agency's need for an independent empirical view on multiple policy initiatives. Academic empirical studies may suffer from a lack of high quality data, while empirical work from inside the industry typically represents a specific view. The FHFA maintains several vendor platforms from which an independent view is possible, yet these platforms tend to be inflexible and opaque. The unique role of the FHFA as regulator and conservator necessitated platform flexibility and transparency to carry out its responsibilities.

The FHFA Mortgage Analytics Platform is maintained on a continuous basis; as such, the material herein represents the platform as of the publication date of this document. As resources permit, this document will be updated to reflect enhancements to the platform.

2. FHFA Mortgage Analytics Platform Overview

The platform integrates econometric loan performance models, loan level data and external economic forecasts to project mortgage cash flows. This section offers an overview of the modules and their interconnections.

Figure 1: FHFA Mortgage Analytics Platform



There are two sources of external inputs to the analytics platform: loan level data and economic forecasts. The economic forecasts include projections of house prices, interest rates and unemployment rates through the forecast horizon. Both vendor-supplied economic forecasts and FHFA projections of economic variables are stored in the

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economic forecast database. These economic forecasts cover a wide range of economic environments from baseline to highly optimistic to extremely stressful economic conditions. The economic forecast databases are quarterly.

The loan level data elements are the second source of external inputs; these include approximately thirty variables per loan comprising loan attributes and borrower characteristics. The platform projects mortgage performance from the loan's current age to termination, including foreclosure alternatives and the resolution of real estate owned (REO). The platform applies projected probabilities of termination to performing loan balances such that a portion of the loan prepays, becomes delinquent and may resolve as a default each month. To simplify the discussion within this paper, when a loan is said to prepay (or default), only a portion of the loan is prepaying (or defaulting), not the whole loan. The components of the platform are summarized below and are described in greater detail in subsequent sections of this paper.

1. Performing Loan Module – the primary function of this module is to project monthly loan level prepayment and 90-day delinquency probabilities on performing and modified performing loans. Loans enter into this module if they are current, less than 90 days delinquent, or forecasted to cure from a delinquency during the simulation. The prepayment and delinquency equations are functions of borrower characteristics, loan characteristics, home values and other economic variables. Multiple pairs of prepayment and delinquency equations collectively cover several loan products and modified loans guaranteed or owned by the Enterprises.
2. Non-Performing Loan Module – the primary function of this module is to project lifetime outcomes for delinquent loans. Loans enter into this module if they are 90 to 180 days delinquent at the beginning of the projection, or if they are predicted to become delinquent within the performing loan module. The module outputs four mutually exclusive loan-specific probabilities each month: foreclosure completion (REO), voluntary prepayment, foreclosure alternative resolutions and re-performance (cure). The foreclosure alternative resolutions include deed-in-lieu of foreclosure, pre-foreclosure sale (short sale), and third party sale. A loan is defined as re-performing when all arrearages are paid and the cure is not due to a modification or restructuring. The models are a function of borrower characteristics, house prices and state legal structures. Unlike the performing loan module where multiple product level models are constructed, only one set of equations is estimated for non-performing loans.

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3. Credit Loss Module– the primary function of this module is to calculate loan level credit losses and determine the appropriate timing of loss recognition. Loans enter into this module if they are greater than 180 days delinquent at the start of the projection or are projected to generate a credit loss from the non-performing module. Credit losses are measured as charge-offs and REO operating expenses. Charge-offs and REO operating expenses are calculated at the loan level using an accounting approach.
4. The Integration Module - combines the forecasted performance elements, mortgage contractual terms, and interest rates to generate loan level cash flows. This module outputs are aggregated across loans into the Standardized Projection Report.
5. The Standardized Projection Report –summarizes projections of portfolio performance measures over the forecast horizon. Key credit loss elements reported in the report are charge-offs and REO operation expenses. Other variables in the report include performing balances, dollars of new 90 day delinquencies, scheduled and unscheduled principal payments, guarantee fee income, and credit enhancement claims.

The subsequent sections of the paper discuss each of the modules in detail. Sections 3 through 5 focus on the design of the econometric behavioral equations, Section 6 reviews the credit loss calculations, and Section 7 covers the calculation of the monthly projections. The appendices include the parameter estimates and back testing results from the modules covered in Sections 3 through 5.

3. Performing Loan Module

The Performing Loan Module contains a series of Multinomial Logit (MNL) equations that predict the loan's monthly status: current, prepaid or delinquent. Many authors including Clapp et al (2005) and Jenkins (1995) demonstrate that the MNL provides a convenient method for structuring prepayment and delinquency risk as a discrete-time competing hazard. Using the estimated equation parameters, the platform calculates the conditional probability of prepayment and 90-day delinquency as,

$$P(\text{prepay}_{i,t}) = \left(\frac{\exp(x_{i,t}' \hat{\beta}_{pp})}{1 + \exp(x_{i,t}' \hat{\beta}_{pp}) + \exp(v_{i,t}' \hat{\beta}_{f90})} \right), \text{ and}$$

$$P(f90_{i,t}) = \left(\frac{\exp(v_{i,t}' \hat{\beta}_{f90})}{1 + \exp(x_{i,t}' \hat{\beta}_{pp}) + \exp(v_{i,t}' \hat{\beta}_{f90})} \right).$$

The probability of remaining current is calculated as,

$$P(\text{current}_{i,t}) = 1 - P(f90_{i,t}) - P(\text{prepay}_{i,t}).$$

Where $\hat{\beta}_{pp}$ and $\hat{\beta}_{f90}$ represent the estimated prepayment and 90-day delinquency parameter vectors, while $x_{i,t}$ and $v_{i,t}$ represent the variables in the prepayment and delinquency equations for the i th loan at time period t . The resulting prepayment probability represents the likelihood that loans will prepay in the current month, given that it has neither prepaid nor become 90 days delinquent in the prior month. The delinquency probability is similarly defined.

Fifteen loan product specific models are estimated using historical loan-level data in addition to a single model for all modified loans. The treatment of performing modified loans is discussed in detail in Section 3.2. The loan product models are based on the following eight products:

Fixed Rate Products: 40yr. FRM, 30yr. FRM, 20yr. FRM, 15yr. FRM

Adjustable Rate Products: 10/1 ARM, 7/1 ARM, 5/1 ARM, 3/1 ARM,

Separate loan product models are estimated for each Enterprise, with the exception of the fixed rate 40 year loan product and modified loans, which are estimated with data combined from both Enterprises due to the low volume of fixed rate 40 year loan product and modified loans. When possible, the entire historical population of loans is used for estimation. In the case of the fixed rate 30 year loans, a stratified proportional sample of three million loans is selected for each Enterprise. The stratification variables include: geography, credit scores, origination quarter, property type, loan size, original loan to value (LTV) and occupancy. The marginal distributions of the population and the selected samples are compared to ensure representativeness to the loan population.

These eight loan products for each GSE represent approximately 99 percent of the Enterprise mortgages originated since 1995. The remaining loans are comprised mostly of single family balloon mortgages and step rate mortgages. These loans are assigned to the product model based on their maturity term, for example, a 30 year step rate mortgage is assigned to the 30 year fixed rate model.

3.1 Common Independent Variables in the Performing Loan Module

This section reviews the common independent variables across all of the estimated behavioral equations for performing loans. Most of the continuous explanatory variables are constructed as spline functions, with the locations of the spline knots varying across models¹. The parameter estimates, standardized errors, and the locations of spline knots are listed in Appendix B. Back-testing plots of each model is located in Appendix C.

3.1.1 Loan Seasoning

The loan age, or seasoning, is included in the models to capture changes in the delinquency and prepayment tendencies over the life of the loan. The seasoning functions in the models are constructed as a set of age spline variables; the spline knots

¹ The spline specification for continuous independent variables is a common practice in prepayment and default modeling (see Dunskey and Ho (2007), Bajari, Chu, and Park (2008), Tracey Seslen and William C. Wheaton (2010)). An important benefit of the spline specification is that it avoids sudden jumps within a continuous variable while allows for the non-linearity relationship between independent and dependent variable.

are chosen from the product specific hazard curve(s) that best represents the product loan population².

3.1.2 Vintage-Fixed Effects

In lieu of a constant term, each model is estimated with a series of vintage-specific fixed effects. The estimated fixed effects capture unobservable changes in underwriting standards and other non-observables that are not controlled for elsewhere in the model.

3.1.3 Seasonality

All of the models include a set of eleven monthly indicators (dummy variables) to capture seasonality. Seasonality is a common phenomenon in mortgage performance: prepayments during the summer months are typically borrowers moving, while late payments frequently occur in April. The estimated seasonality parameters measure sensitivity of prepayment and delinquency relative to January, the omitted month.

3.1.4 Down Payment at Origination

Down payment is measured in terms of the original loan-to-value (LTV) ratio; loan size is the balance of the loan at origination and value is the appraised value at origination. Underwriting requirements typically predetermine loan down payments. Enterprise loans require a minimum original LTV of 80 on first lien mortgages, or, if the down payment is less than 20 percent, then a form of credit enhancement is required, (e.g. mortgage insurance). The original LTV enters the model as a set of spline variables, where the spline knots are selected at approximately the 20th, 40th and 80th percentiles of original LTV in the estimation data.

3.1.5 Credit Score at Origination

The Enterprises fully adopted credit scores in their underwriting criteria in the mid-1990s. Nearly 100 percent of loans originated since 1995 in the estimation data contain credit scores. Credit scores are typically reported from all three of the credit repositories. The model only uses one credit score per loan. When multiple scores are available per borrower, the model uses the lower of the two scores if two are reported, and the middle score if three scores are reported. The lowest score across all borrowers is used when co-borrowers are reported in the loan data. Credit scores are specified as

² The historical hazards are plotted from the loan populations even when sampling is required.

five spline variables; the spline knots are selected based on the distribution of credit scores in the estimation data.

3.1.6 Spread at Origination (SATO)

The SATO variable captures the difference between the borrower's mortgage rate and the prevailing interest rate reported in the Primary Mortgage Market Survey (PMMS) on the date of the origination. Historically, this spread measures the borrower's price of credit relative to the market average. To the extent that borrower credit is priced imperfectly, the SATO measure captures other unobservable in the transaction. There are two SATO spline variables (two spline segments, one spline knot) in each model. The spline knot is located at the median value of the difference between the initial rate on the mortgage and the market rate (PMMS rate) in the month of the first payment.

3.1.7 Loan Size at Origination

Loan size (in thousands) is an important factor in the prepayment equation; the value of refinancing a loan is proportional to the size of the loan. For some mortgage products, loan size is also inversely related to the incidence of delinquency. The loan size at origination enters the specification as a series of four spline variables; the spline knots are selected based on the distribution of loan size in the estimation data sets.

3.1.8 Time Varying Credit-Equity Function (Credit Score Current-LTV Interaction)

The credit equity function is the interaction between the original credit score group indicator and spline variables of the current LTV (or mark-to-market LTV, MTM LTV) over the observed life of the loan, similar to Lam et al [2013]³. The function enables measuring the borrower's responsiveness to changes in current LTV while controlling for the borrower's original credit score.

There are (k) groups of credit score indicators; each borrower's score falls uniquely into one of the five buckets ($k=5$). The width of each bucket is based on the distribution observed in the estimation data. The time dependent MTM LTV ratio is expanded into (h) spline variables. The length and locations of the spline segments are defined from the estimation data. The credit equity function in compact format for the i^{th} loan in period t is defined as

³ LTVs are updated in the simulation model via house price indexes from the economic forecast database. The FHFA state-level purchase-only index is used for both model estimation and forecasting.

$$Credit_Equity_{i,t} = \sum_{h=1}^5 \sum_{k=1}^5 \hat{\beta}_{h,k} Credit_Score_{i,t,k} MTM_LTV_{i,t,h}.$$

Where $Credit_Score_{i,t,k}$ takes the value of zero or one, depending on the loan's credit score, and $MTM_LTV_{i,t,h}$ are a series of spline variables based on the current LTV of the loan. For each combination of credit score groups ($k=1$ to 5) and MTM LTV range ($h=1$ to 5) a $\hat{\beta}_{h,k}$ parameter is estimated.

Estimated Credit Equity Parameters

Credit Score Group	MTM LTV Spline Variables				
	0 to 60	60 to 70	70 to 85	85 to 95	95 to 120
350 to 682	2.921	1.335	1.816	3.463	0.913
682 to 720	2.154	3.384	3.989	3.078	1.444
720 to 750	1.921	4.088	4.650	4.096	1.755
750 to 780	1.485	5.424	5.109	5.571	2.011
780 to 850	1.307	5.306	5.025	6.961	2.125

The above table displays credit equity function parameter estimates (not marginal effects) from the delinquency equation for a 30 fixed rate product model. The table is included here only to demonstrate that the estimated parameter values vary across the MTM LTV spline variables for a given credit score group. A loan remains in one credit score group throughout the simulation yet moves left and right in the table as the loan MTM LTV changes during the simulation. The benefit of the credit equity function is that the marginal change in the probability of delinquency is not assumed to be constant across credit score groups or over the MTM LTV spline variables.

3.1.9 Time Varying Refinance Burnout Function

The refinance function is constructed to capture the sensitivity of borrower prepayment behavior to changes in market interest rates, similar to Dunskey & Ho [2007]. The refinance function is specified as the interaction between a refinance ratio and a burnout factor. The burnout factor captures the difference in the refinancing efficiency between two otherwise identical loans that have gone through different historical interest rate experiences.

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The refinance function is defined as

$refinance_function_{i,t} = refinance_ratio_{i,t} * burnout_{i,t}$, where

$$refinance_ratio_{i,t} = \left(\frac{PMMS_{i,t=0}}{PMMS_{i,t}} \right)$$

The refinance ratio is constructed as the ratio of the Primary Mortgage Market Survey (PMMS) rate for the i th loan at origination ($t=0$) to the current period PMMS rate. The PMMS rate is the current mortgage rate at time t . The refinance ratio is a pure macroeconomic measure of the value of the refinance option and devoid of borrower specific credit information; this is in contrast to the spread at origination variable (SATO). The burnout factor is defined in terms of the significantly positive refinance spread cumulated over the age of the mortgage, reflecting missed refinance opportunities. Explicitly the burnout function is defined as,

$$burnout_{i,t} = \sum_{t=0}^T MAX \left(\frac{PMMS_{i,t=0} - PMMS_{i,t}}{PMMS_{i,t}} - 0.1, 0 \right).$$

We assume that a refinance opportunity occurs whenever the prevailing PMMS rate falls below the PMMS rate at origination by 10 percent.

The refinance burnout function should have the qualitative behavior of an S curve, which typically represents the refinance incentive as a function of interest rates; when the refinance -ratio is low, there is a constant base refinancing rate. As the refinance ratio increases, the refinancing rate also increases. But when the refinance-ratio exceeds a certain level, the refinancing rate should remain stable, at a high level. However, the behavior of this S function varies with the burnout level. The refinance function estimates multiple S functions as we categorize the loans into five buckets by the burnout function. The burnout refinance function is only included in the prepayment equations for the fixed rate products.

3.1.10 State Unemployment Rate

The unemployment rate serves as a proxy for job loss of the borrower as well as to capture local economic activity. Although prepayment is generally insensitive to the unemployment rate, the delinquency rate increases with the unemployment rate. There are four unemployment spline variables in each model. The selection of the spline knots is based on the distribution of the unemployment rate of the states represented in the input data.

3.1.11 Yield Curve Spread at Origination

The yield curve spread, measured by the difference between the 2-year and the 10-year swap rate, captures the slope of the swap curve and serves as a proxy for the state of the macro-economy. In the absence of large scale monetary intervention, empirical evidence suggests an upward sloping yield curve presents a healthy macro-economic environment. Existing borrowers would be expected to respond to a flattening of the yield curve when long term rates decline as a refinance opportunity. Alternatively, when the yield curve inverts, although refinance opportunities may persist, delinquencies typically increase reflecting a weaker macro-economic environment. Yield curve spread is only included in the prepayment equation.

Parameter estimates, spline knots and back testing results of models discussed in the Performing Loan Module are located in Appendices B and C.

3.2 Special Treatment of Performing Modified Loans

Performing modified loans include loans that have been modified through Home Affordable Modification Program (HAMP) or the Enterprises' proprietary modification programs and have not re-defaulted (90+ days delinquent). Performing modified loans are treated differently from unmodified performing loans. Modified loans, most of which were seriously delinquent before modification, have a higher likelihood of delinquency than unmodified performing loans. Modification of the mortgage terms (mortgage rate, amortization term and principal forbearance) and the delinquency status prior to modification are important variables in projecting the prepayment and re-default behaviors. A single prepayment and re-default model is developed and deployed for all modified loans.

The behavioral equations for modified loans are modeled in the same multinomial logit framework as unmodified performing loans described above. While most of the

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independent variables and all the economic variables used in the performing loan model are retained in the modified loan model, some independent variables are reconstructed. The reconstructed variables include loan age, seasonality, loan size and the refinance spread. Loan age for modified loans is measured from the modification date, and loan size is the post modification loan balance. Seasonality is captured by a quarterly dummy variable instead of a monthly dummy due to the short performance history of modified loans. The refinance spread is defined as the modified interest rate of the mortgage minus the prevailing mortgage rate and is constructed as a spline variable.

The independent variables for the performing loan behavioral equations that are not retained in the modified loans treatment are original vintage, original down payment, SATO and the credit equity function. Vintage is not considered for the modified loans treatment as most modified Enterprises loans were modified after 2009, and the underwriting environment has not changed significantly from 2009 to 2012. Down payment and SATO are also not retained as these two variables are not meaning given that loan has been modified. Finally, the credit equity function is excluded to maintain a relatively simple structure for the modified loan equations.

Additional independent variables are added to the behavioral equations for modified loans:

Percentage Change in the Monthly Mortgage Payment: The monthly payment on most modified loans is reduced through interest rate reductions, term extensions or principal forbearance. The monthly payment reduction represents a financial relief to the distressed mortgage borrower and should reduce the borrower's tendency to default on the loan. The percentage change in the monthly mortgage payment is constructed as a spline variable with the knots determined by the selected percentiles of the distribution of the monthly payment percentage change.

Delinquency Status prior to Modification: Deeply delinquent borrowers face a greater financial challenge than less delinquent borrowers to bring the payment status of the loan back to current. Deeply delinquent borrowers also have less flexibility to prepay the loan due to the large financial obligation of accrued or capitalized interest. The Delinquency Status prior to Modification is constructed as linear spline variables with knots at 3, 6 and 12 month delinquency.

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Home Price Appreciation since Modification: Home Price Appreciation since Modification is measured as a percentage change of the home price since modification at the state level. A positive home price appreciation indicates an improved borrower's equity position in the property, and should reduce the borrower's probability to re-default on the mortgage. Home Price Appreciation is measured at the state level and is constructed as linear spline variables with knots determined by selected percentiles of the distribution of the percentage of the home price change.

The behavioral equations are estimated with performance history on Fannie Mae and Freddie Mac loans from June 2009 to December 2011. The estimated coefficients and back-testing results for the Modified Loan equations are included in Appendices B and C.

4. Non-Performing Loan Module

Loans enter into the non-performing module if they are 90 to 180 days delinquent at the beginning of the projection or if they are predicted to become 90-days or more delinquent (F90) during the forecast horizon. The module computes four mutually exclusive lifetime probabilities conditional on a loan being at least 90 days delinquent: re-performance (cure), voluntary prepayment, alternative foreclosure resolution, and foreclosure completion (REO). The lifetime probability of the loan resolving as real estate owned (REO) is calculated as the residual of one minus the other three computed probabilities. The alternative foreclosure resolutions include deed-in-lieu of foreclosure, pre-foreclosure sale, and third party sale. Re-performance is defined as a loan returning to current status without having been modified or restructured. The loans that are projected to be re-performing are treated as performing loans and are sent back to the Performing Loan Module.

The equations in the non-performing module are estimated simultaneously on a population of loans that became 90 days delinquent for the first time between 1997 and 2012. The estimation data excludes loans that became 90 or more days delinquent and were subsequently modified. Conceptually, the resolution of delinquent loans is jointly determined by the borrower and the servicer. Information on servicers is unobservable; therefore the equations are a function of borrower, house characteristics and state legal structures. The lifetime probability of each of the terminal states is represented below in a competing risks framework:

$$P(LifetimeSale_{i,t} | f90_{i,t}) = \left(\frac{\exp(x_{i,t}' \hat{\beta}_{FCA})}{1 + \exp(x_{i,t}' \hat{\beta}_{FCA}) + \exp(v_{i,t}' \hat{\beta}_{RPerf}) + \exp(\omega_{i,t}' \hat{\beta}_{PP})} \right)$$

$$P(RPerf_{i,t} | f90_{i,t}) = \left(\frac{\exp(v_{i,t}' \hat{\beta}_{RPerf})}{1 + \exp(x_{i,t}' \hat{\beta}_{FCA}) + \exp(v_{i,t}' \hat{\beta}_{RPerf}) + \exp(\omega_{i,t}' \hat{\beta}_{PP})} \right)$$

$$P(\text{lifetimePrepay}_{i,t} \mid f90_{i,t}) = \left(\frac{\exp(\omega_{i,t}' \hat{\beta}_{PP})}{1 + \exp(x_{i,t}' \hat{\beta}_{FCA}) + \exp(v_{i,t}' \hat{\beta}_{RPerf}) + \exp(\omega_{i,t}' \hat{\beta}_{PP})} \right), \text{ and}$$

$$P(\text{LifetimeREO}_{i,t} \mid f90_{i,t}) = 1 - P(\text{LifetimeSale}_{i,t} \mid f90_{i,t}) - P(RPerf_{i,t} \mid f90_{i,t}) - P(\text{LifetimePrepay}_{i,t} \mid f90_{i,t})$$

Where $\hat{\beta}_{FCA}$, $\hat{\beta}_{RPerf}$ and $\hat{\beta}_{PP}$ represent the equation specific parameters of exiting by a foreclosure alternative, re-performance and voluntary prepayment of the mortgage. The corresponding independent variable vectors are $x_{i,t}$, $v_{i,t}$ and $\omega_{i,t}$ for the i th loan at the time of the 90 day delinquency event, time t .

The following subsection discusses the construction of the independent variables in the model.

4.1 Independent Variables in the Non-Performing Loan Module

There are seven groups of independent variables in the non-performing loan model, and an intercept term. Similar to the performing modified loan model, only one model is deployed for all non-performing loans. Consideration of explanatory variables is restricted to variables that are observable in the month of the first 90 day delinquency and for which economic forecasts are available.

4.1.1 Current LTV at the Delinquency Date

In order to capture the level of equity or negative equity in the property, the current LTV (MTM LTV) of the loan in the month of the first 90 day delinquency is included as five spline variables. The spline knots are located at 68%, 82%, 99% and 120% current LTV. MTM LTV is calculated from the loan balance on the last paid installment, and house values are updated using the FHFA state-level purchase-only House Price Index.

4.1.2 Original Loan Size

Similar to the performing loan module, original loan size (in thousands) is included in the model by five spline variables with knot locations based on the distribution of loan size in the delinquent loan data. The spline knots are located at \$90k, \$150k, \$232k, and \$360k.

4.1.3 Property Type

The property type is represented by three indicator variables; condominium, planned urban development and manufactured housing. Single family detached residence serves as the comparator.

4.1.4 Stated Occupancy at Origination

To differentiate between outcomes across owner occupants and non-owner occupants an indicator variable is included in all of the specifications. Relative to owner occupants, non-owner occupants are less likely to re-perform.

4.1.5 Mortgage Insurance Coverage

For loans with mortgage insurance, two spline variables based on the level of insurance coverage are included in the specification. The spline knot is located at 25% coverage. The spline variables for loan without mortgage insurance are set at zero.

4.1.6 Credit Score at Origination

Original credit scores enter into the model as five spline variables with spline knots located at 623, 661, 703, and 750. Original credit scores may no longer accurately represent the borrower's recent payment history, yet they remain statistically significant in the non-performing loan model.

4.1.7 State Unemployment at Delinquency Date

Four unemployment spline variables are included in each model where the selection of the spline knots is based on the distribution of the unemployment rate of the states represented in the input data. The spline knots are located at 5.5, 7.8, and 10.3 percent.

4.1.8 Judicial State Indicator

Lastly, a state legal structure indicator is included to control for variation in state foreclosure laws. The judicial state indicator is set to 1 when the loans is located in the following states: DE, FL, HI, IA, ID, IL, IN, KS, KY, LA, ND, NE, NJ, NM, NY, OH, OK, PA, SC, and SD. 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, (Hayre and Saraf, 2008). 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.

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The estimated parameters for the equations of the non-performing loan module are provided in Appendix D.

5. Credit Loss Module

The Credit Loss Module projects credit losses on loan balances that are 180+ days delinquent at the beginning of the projection period, and on loan balances that are projected to go to either foreclosure completion (i.e., REO) or to a foreclosure-alternative sale from the Non-Performing Loan Module. The platform projects two accounting measures of loss; *Charge-off* and *REO Operating Expenses*.

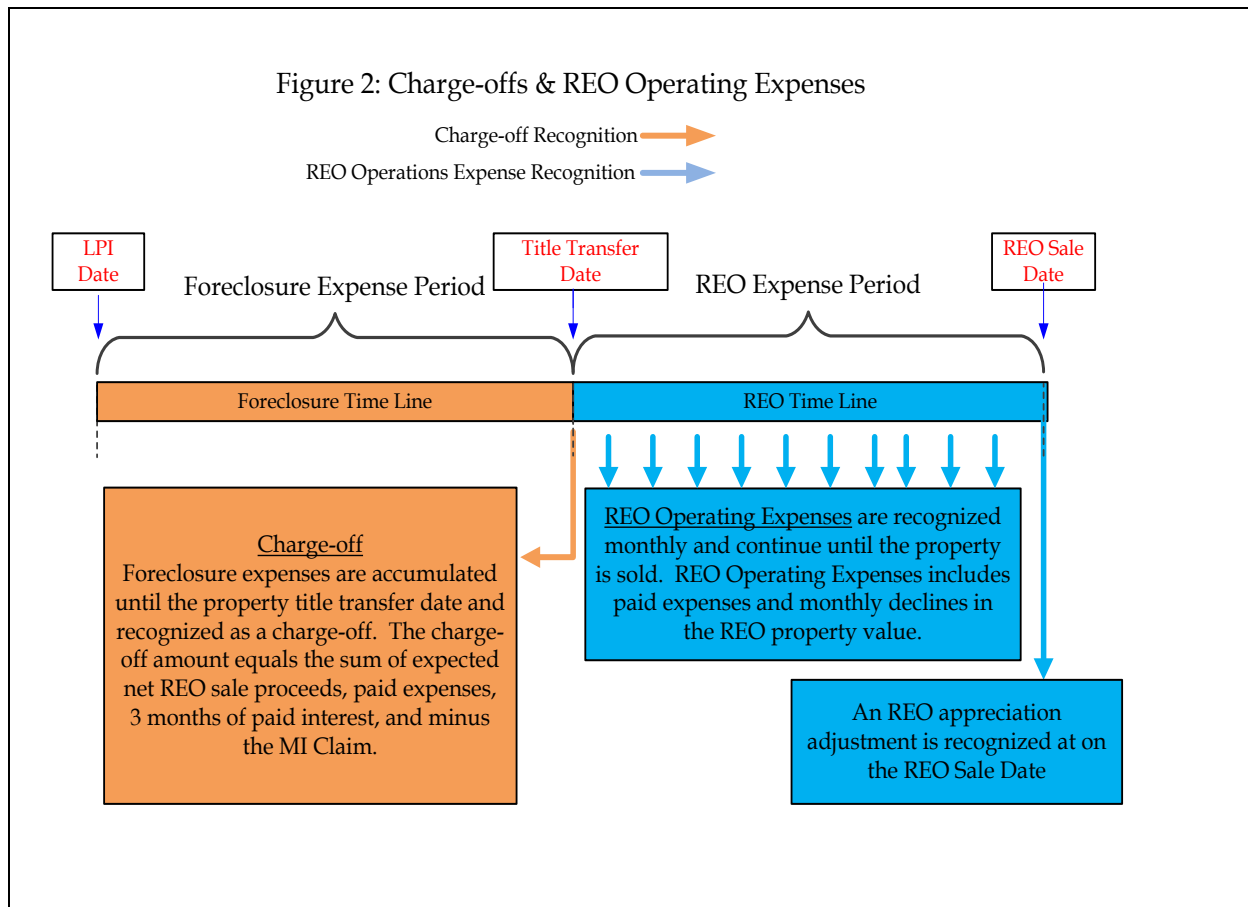


Figure 2 schematically separates the differences between Charge-offs and REO operating expenses over the delinquency and resolution lifecycle. Expense components included in the charge-off measure are accumulated from the borrower's last paid installment (LPI) date to the date of the title transfer. Two forms of title transfers generate credit losses; foreclosure completions and alternative foreclosure resolutions. Loans that complete the foreclosure process and become real estate owned (REO) are charged off at the title transfer date (orange arrow) and begin to generate REO

operating expenses thereafter. Meanwhile, loans that terminate via an alternative foreclosure resolution are charged off at the title transfer date (orange arrow); these loans do not become REO and therefore do not generate REO operating expenses. The calculation of charge-offs for both forms of title transfer are identical, while only completed foreclosures generate losses captured in REO operating expense.

In contrast to charge-offs, where expenses are accumulated over the foreclosure period and recognized on the title transfer date (orange arrow), REO Operating Expenses are calculated and recognized monthly (blue arrows). The sections below discuss the specifics of the recognition timing, charge-offs amounts, and REO Operations Expenses.

5.1 Charge-Off Timing

Non-performing loans are charged off when the property title is transferred at the completion of the foreclosure process or at the culmination of an alternative foreclosure resolution⁴. The title-transfer timelines are calculated from historical data as the average number of months to complete the process in each state. The platform includes both a long run timeline and a stressed foreclosure timeline. The stressed timeline represents the average foreclosure timeline for loans that completed the foreclosure process (or alternative foreclosure resolution) during the December 2010 to December 2011 period. The long-run average timelines are calculated from foreclosures (and alternatives) completed from January 1995 to December 2011.

Non-performing loans with a level of delinquency greater than the historical state average foreclosure timelines require a special treatment. These loans are assumed to complete foreclosure (or an alternative foreclosure resolution) and be charged off during the first 12 months of the projection. To avoid concentrating all of the charge-offs in a particular month, each of these loans were randomly assigned a charge-off date (based on a uniform distribution) during the first year of the projection.

5.2 Charge-Off Amount

The charge-off amount represents the expected proceeds from the property sale net of all transaction costs, accrued expenses and credit enhancements.

$$\text{ChargeOff} = \text{Expected Net REO Sale Proceeds}$$

⁴ Alternative foreclosure resolutions include deed-in-lieu of foreclosure, pre-foreclosure sale, and third party sales.

$$+ \text{Paid Expenses} + \text{Paid Interest} - \text{MI Claim Amount}$$

More specifically, the charge-off amount is composed of four components: (1) Expected Net REO Sale Proceeds, (2) Paid Expenses during the Foreclosure Process, (3) Three Months of Lost Interest, and (4) the Mortgage Insurance Claim Amount. Each of these elements is discussed below.

5.2.1 Expected Net REO Sale Proceeds

The expected net REO sale proceeds are calculated as,

$$\text{Expected Net REO Sale Proceeds} = (\text{UPB} * (1 + FC_{\text{costs}})) - (\text{ReoSalePrice}_{t+k} * (1 - \text{Settlement}_{\text{costs}}))$$

where $(\text{UPB} * (1 + FC_{\text{costs}}))$ represents the unpaid principal balance (UPB) scaled up by the foreclosure cost factor $(1 + FC_{\text{costs}})$. The foreclosure cost factor is adapted from the Home Affordable Modification Program Net Present Value (HAMP NPV) model's state-level averages of "Foreclosure and REO costs" as a percentage of UPB⁵. The NPV model documentation indicates that these costs are comprised of the following.

- Attorney and trustee fees
- Possessory and eviction fees and expenses
- Bankruptcy expenses
- Servicer liquidation expenses
- MI premium
- Flood insurance premium
- Title insurance
- Appraisal fees
- Property inspection
- Utilities
- Property maintenance/preservation
- Other foreclosure and holding costs
- Total repairs (capped at \$3,000 to exclude discretionary repairs)
- Participation expenses
- Foreclosure costs paid out at property sale (from HUD-1)

These items combine both foreclosure costs (which belong in charge-off) and REO costs (which do not belong in charge-off). To balance out the inclusion of REO cost elements,

⁵ The HAMP model documentation is available at,
https://www.hmpadmin.com/portal/programs/docs/hamp_servicer/npvmodeldocumentationv502.pdf

the “Foreclosure and REO costs” are reduced by half when calculating the charge-off amount. The remaining half is allocated to REO operations expense in Section 5.3.2.

The second part of expected net REO sale proceeds ($ReoSalePrice_{t+k} * (1 - Settlement_{Costs})$) captures the expected revenue from the sale of the REO property net of brokerage fees and other settlement costs. REO sales price, denoted as $ReoSalePrice_{t+k}$, represents the expected value at time period t given a foreclosure timeline of k months. REO property typically sells at a depressed price relative to a non-distressed transaction. The REO sale price is calculated in two steps to account for the distressed nature of REO property.

1. The original value of the property is “marked forward” by the percentage change in the FHFA state-level purchase-only house price index between loan origination and charge-off date.
2. The “marked forward” value of the house is haircut by a state-level REO stigma correction.

While many REO sales are cash transactions⁶, the FHFA state-level purchase-only house price index includes a very small percentage of REO purchase transactions. Therefore, it is necessary to adjust the REO property value in step 1 above by a state-level REO stigma. The REO stigma correction maps the relationship between FHFA state-level purchase-only house price index-based home values to distressed REO sales prices. REO stigma correction follows a modified version of the approach used in the HAMP Net Present Value (NPV) model⁷. In contrast to the HAMP NPV model, where REO Sale prices are regressed on home values generated by an automated valuation model (AVM), the AVM prices are replaced by the property values in step 1 above (home values generated from the FHFA state-level purchase-only home price). An REO stigma equation is estimated for each of the 50 states based on Enterprise data. For all alternative foreclosure resolutions, it is assumed that there is no REO stigma.

⁶ See for example, http://www.corelogic.com/blog/authors/molly-boesel/2014/05/cash-sales-made-up-40-percent-of-total-home-sales-in-february.aspx?WT.mc_id=crlg_140519_oBvIb&relq=a1f819d883a44c33952168e917f41adc#.U3osDfldV8E

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The REO Sales price is reduced by settlement costs ($1 - \text{Settlement}_{\text{costs}}$) as a percentage of the calculated REO disposition sale price, the percentage varies by state. The state-level settlement cost percentages are from the HAMP NPV model.

Settlement Charges include:

- Discount Points
- Loan Origination Fees
- Broker's Bonus
- Broker Commission Fees
- Buyer's Closing Costs (paid by seller only – not total buyer's closing costs)
- Title Fee Cost
- Seller's Closing Costs
- Assessments
- FHA/VA Non-Allowable Costs
- Other Costs
- Wire Fees
- Subtract miscellaneous revenues received at property sale:
 - o Per diem amount
 - o Other rent/interest amount
 - o Prepaid interest amount

5.2.2 Paid Expenses during the Foreclosure Process

There are three groups of expenses that are accumulated from the last paid installment to the foreclosure completion (or alternative foreclosure resolution) date: property taxes, property insurance, and maintenance costs. Lookup tables containing the three average expense rates are calculated from American Community Survey (ACS 2010) by location and property value. Apart from homeowners' association fees or condominium fees, maintenance costs on single family homes are not reported in ACS. As a proxy for monthly maintenance cost on single family homes, it is assumed that the property maintenance costs are equal to one half homeowners' association fees that would have been applied if the home belonged to a homeowners' association.

The expense rates are applied to the property value at loan origination and by geographic state to project these monthly expenses in dollars. The monthly expenses

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are accumulated for every month between LPI date and foreclosure completion date and recognized on the charge-off date.

5.2.3 Paid Interest

The module assumes that the loan servicer advances the borrower's interest payment to investors for three months, and this amount is reimbursed to the loan servicer by the Enterprise when the loan is purchased out of the security. Three months of interest payments are included as an expense in the charge-off amount.

5.2.4 MI Claim Amount

For loans with active MI coverage, the MI claim amount is limited to the insured UPB plus foreclosure expenses. Foreclosure expenses are equal to the expenses in charge-off plus lost interest for all months from the LPI date to foreclosure completion date. As noted in 5.2.3 above, only three months of lost interest is included in the charge-off measure.

The model assumes that the MI Company will exercise their right to buy the foreclosed property (conveyance) in lieu of paying the MI Claim when the MI payment is greater than the sum of the charge-off and REO operating expenses. In the case of conveyance, the value of the property is based on the FHFA state-level purchase-only house price index at the foreclosure completion date, not at the projected REO sale date. Both the charge-off and REO net expenses attributed to the Enterprise are zero when the MI Company purchases the foreclosed property.

For loans with original LTV greater than 80% and with first pay date on or later than July 29, 1999, that coverage is projected to cancel at the earlier of: (a) the month after the loan's amortization LTV reaches 78 percent, and (b) the month in which the loan's age reaches one half its amortization term.⁸ For loans originated before July 29, 1999 where the data indicate that MI coverage is in effect at the beginning of the projection, the coverage is never canceled.

The calculated MI claim, whether or not the property conveys, is subject to the risk that the MI Company either fails to meet its obligations (e.g. State regulator places the

⁸ See 12 U.S. Code § 4902 - Termination of private mortgage insurance regarding the "automatic" and "final" termination provisions of section 3 of the Homeowners Protection Act of 1998. There is no projection of the borrower-initiated cancellation allowable under the Act.

company into runoff), or the MI company denies the claims. To allow for these forms of counter party credit risk, the Module reduces the value of the calculated MI benefit by a “haircut” percentage. When the platform is run to measure counterparty exposures the haircut is assumed to be zero, yet when the platform is run to project GSE credit losses the haircut ranges between 20 and 25 percent.

For alternative foreclosure resolutions, mortgage insurance is applied in the same way as it is with foreclosed loans. The conveyance calculation is identical to the one used for foreclosure, based on the idea that the MI would not make any payment beyond that which would reduce the Enterprise’s loss to zero.

5.3 REO Operations Expenses

5.3.1 REO Operation Expense Timing

REO operation expenses are calculated and reported one month after foreclosure completion until the REO property is sold. Similar to the foreclosure timings, the platform includes both a long run REO timeline and a stressful timeline. The stressed timeline represents the average state-level timelines for REO properties that were sold between December 2010 and December 2011. The long-run average timelines are calculated from REO sales completed from January 1995 to December 2011. Both sets of REO sale time lines are computed from GSE historical data at the state level.

5.3.2 REO Operation Expense Amount

REO operations expenses are posted monthly and calculated as the sum of (1) paid expenses and (2) mark-to-market REO property value changes. The REO expenses are the same as the expenses included in the charge-off amount; “Paid Expenses” described in Section 5.2.2 and the remaining 50% of the “Foreclosure and REO costs” allocated across the REO holding period. In contrast to the expenses in the charge-off amount, REO operating expenses are recognized each month while the property is held in inventory.

Mark-to-market REO property values enter into the REO operations expense amount in two parts. During the REO holding period, only declines in the value of the REO property are added to the monthly REO operations expenses. Increases in the REO property value are only included in the REO operating expenses when the property is

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sold. The mark-to-market property values are computed using projected FHFA state-level purchase-only house price index.

As noted above, if the calculated charge-off excluding the estimated MI payment is negative, both the charge-off and the REO operations expenses that would have been associated with the loan termination are set to zero. It is explicitly assumed that foreclosed or alternative foreclosures cannot generate gains. The best outcome for a non-performing loan is a zero credit loss.

6. Integration Module

This module integrates the prepayment and default probabilities from the Performing and Non-performing Modules with the outputs from the Credit Loss Module to project monthly loan-level cash flows. The primary outputs include scheduled and unscheduled principal payments, scheduled interest payments, and losses. Ancillary outputs include servicing fees, guaranty fee revenue, and MI payments.

For each mortgage, the unpaid principal balance is projected forward one month by subtracting expected amounts of scheduled, prepaid (unscheduled), and defaulted principal from the performing balance (UPB_{t-1}).

$$UPB_{t+1} = UPB_{t-1} - schedPrinPaid_t - prepayDollars_t - dollarsF90ToPrepay_t - dollarsF90ToReo_t - dollarsF90ToSale_t.$$

For expository purposes the above equation is separated into two parts, (1) scheduled and unscheduled principal, and (2) elements that are subtracted from performing balance that are directed to the credit losses ($dollarsF90ToReo_t$, and $dollarsF90ToSale_t$).

6.1 Scheduled and Unscheduled Related Principal

The scheduled and unscheduled principal payments include scheduled paid principal ($schedPrinPaid_t$) net lifetime losses, unscheduled or prepaid principal ($prepayDollars_t$) from performing balances, and unscheduled or prepaid principal from delinquent loans balances ($dollarsF90toPrepay_t$). More specifically, scheduled principal paid is defined as

$$schedPrinPaid_t = schedPrin_t * (1 - P(lifetimeReo_t | f90_t) - P(lifetimeSale_t | f90_t)).$$

And the remaining component ($1 - P(lifetimeReo_t | f90_t) - P(lifetimeSale_t | f90_t)$) represents the portion of the balance related to foreclosure and foreclosure-alternative as described in the Non-Performing Module, Section 4.

Prepaid dollars on performing loan balances ($prepayDollars_t$) is defined as

$$prepayDollars_t = P(prepay_t) * (UPB_{t-1} - schedPrin_t),$$

Where $P(\text{prepay}_t)$ represents the probability of prepayment defined in Section 3, Performing Loan Module. The second term in the prepaid dollars equation ($UPB_{t-1} - \text{schedPrin}_t$), represent the loan balances at risk of prepaying not of their scheduled principal payment.

The final source of prepaid dollars is from repayments on non-performing loans. There are three components to $\text{dollarsF90ToPrepay}_t$: (1) the probability of going 90 days delinquent from the performing loan module (Section 3), (2) the lifetime probability of prepaying given that the balance is delinquent from the Non-Performing Module (Section 4), and (3) the unpaid principal balance at risk.

$$\begin{aligned}\text{dollarsF90ToPrepay}_t \\ = P(f90_t) * P(\text{lifetimePrepay}_t | f90_t) * (UPB_{t-1} - \text{schedPrin}_t)\end{aligned}$$

6.2 Credit Loss Related Principal

Non-performing loan balances resolving as REO or an alternative foreclosure resolution generate lost principal and contribute to the credit loss measures charge-off and REO operating expenses. These two components of principal are subtracted from the performing unpaid principal balance and represent the delinquent loan balances that are later used to calculate charge-offs.

$$\begin{aligned}\text{dollarsF90ToReo}_t &= P(f90_t) * P(\text{lifetimeReo}_t | f90_t) * UPB_{t-1} \\ \text{dollarsF90ToSale}_t &= P(f90_t) * P(\text{lifetimeSale}_t | f90_t) * UPB_{t-1}\end{aligned}$$

6.3 Credit Loss Measures

Loan balance projected to go to REO or foreclosure-alternative sale lead to principal losses and are recognized as charge-offs. The monthly expected values for foreclosure-related charge-offs can be expressed in terms of the charge-off amount calculated in Section 5,

$$\text{chargeOffDollars}_{t+k} = P(f90_t) * P(\text{lifetimeReo}_t | f90_t) * \text{chargeOff}_{t+k},$$

or, equivalently for both foreclosure complete and alternative foreclosure resolutions,

$$\text{chargeOffDollars}_{t+k} = (\text{dollarsF90ToReo}_t / UPB_{t-1}) * \text{chargeOff}_{t+k}$$

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$$chargeOffDollars_{t+k} = (dollarsF90ToSale_t / UPB_{t-1}) * chargeOff_{t+k}$$

where $chargeOff_{t+k}$ is the charge-off amount calculated in Section 6 (which would be the charge-off amount if the entire loan balance were going to foreclosure), and $chargeOffDollars_{t+k}$ is the charge-off amount scaled to take account of the portion of the balance that is projected to go to foreclosure. The k subscript indicates that the charge-off will be realized following the appropriate foreclosure or alternative foreclosure time line.

The logic for REO operating expenses is identical except that the charge-off amount is replaced with the REO Operating expense variable.

7. Standardized Report Elements

The platform generates a summary report containing monthly projections of portfolio performance measures over the forecast horizon. The standard report includes key credit loss elements (charge-offs and REO operation expenses), and many ancillary variables: performing balances, dollars of new 90 day delinquencies, scheduled and unscheduled principal payments, guarantee fee income, and credit enhancement claims.

Custom reports are frequently constructed to meet the needs of new projects, for example, aggregating credit losses by vintage year, credit score group, original LTV, and states. Most custom reports are aggregations of the variables in the standard report.

The primary elements in the standardized report are aggregated across the portfolio and posted in the month of recognition:

- Forecast Date – each row of the report corresponds to a future month during the forecast horizon for which the dollar amount is recognized.
- Performing UPB – is defined in Section 6 and represents aggregate unpaid principal balance in the forecast month that is at risk of defaults and prepayments (see Section 6).
- Scheduled Paid Principal Balance – is defined as aggregate scheduled principal paid on performing balances (see Section 6).
- Unscheduled Paid Principal – is defined as aggregate scheduled principal paid on performing balances. Unscheduled principal includes prepayments from performing and non-performing loans. (see Section 6)
- Dollars of New 90 day Delinquencies (F90Dollars) - is defined as aggregate newly non-performing loan balances.
- Scheduled Interest Net of Fees – is defined as aggregate scheduled interest on loan balances before non-performing balances are removed.
- Paid Interest Net of Fees – is defined as aggregate paid interest on performing loan balances excluding servicing and guarantee fees.
- Paid Guarantee Fees – is defined as aggregate paid guarantee fees on performing loan balances.
- Non-Performing Lifetime Balances- three variables report the terminal outcome on non-performing balances in the future month in which they are recognized.

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For example, loan balances projected to resolve as REO in month t will be recognized in a future date when foreclosure is completed.

- o 90 days delinquent balances completing the foreclosure process (REO) is calculated in Section 6 as $P(f90_t) * P(lifetimeReo_t | f90_t) * UPB_{t-1}$
 - o 90 days delinquent balances completing the alternative foreclosure process is calculated in Section 6 as $P(f90_t) * P(lifetimeSale_t | f90_t) * UPB_{t-1}$
 - o 90 days delinquent balances resolve as prepayments is calculated as $P(f90_t) * P(lifetimePrepay_t | f90_t) * (UPB_{t-1} - schedPrin_t)$
- Credit Loss Measures – Sections 5 and 6 discusses the construction and timing of both of the credit loss measures, Charge-Off Dollars and REO Operating Expenses.
- Charge-off Subcomponents (See Section 5) – the following components used to calculate charge-off are aggregated across the portfolio and contained in the standard report. These elements are posted in the month of the title transfer (recognition of losses).
 - o Non-performing Balances
 - o Property Value of Non-Performing Loans
 - o Paid Expenses on non-performing loans during the foreclosure process
 - o Three months of paid interest
 - o 50% of “Foreclosure and REO costs”
 - o Mortgage insurance claim amount
- REO Operations Expense Subcomponents (see Section 5) - the follow components used to calculate REO Operating Expenses are aggregated across the portfolio and contained in the standard report. These elements are recognized in the month they occur.
 - o Monthly Paid Expenses & 50% of “Foreclosure and REO costs” on REO Properties
 - o Mark-to-Market REO Property value declines
 - o Mark-to-Market REO Property value increases at REO sale date

8. References

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9. Appendix A: Spline Construction

Spline variables are used extensively in the behavioral models, and the general function below is referenced throughout this section.

Let V_i , $i = 1, \dots, n$, be the spline variables created; k_i , $i = 1, \dots, n - 1$, be the corresponding spline knot locations; and Var is the variable being splined. Then

$$\begin{aligned} V_1 &= \min(Var, k_1) \\ V_i &= \max[\min(Var, k_i), k_{i-1}] - k_{i-1} \quad i = 2, \dots, n \end{aligned}$$

Spline knot locations are listed in the Parameter Table starting at row 139; both the left knot and the right knot are listed in each row of the table. Selection of the spline knot locations is based on the distribution of the variable within estimation data. Please see Stata Reference Manual "R", page 1057.

10. *Appendix B: Performing Loan Module Model*

Coefficients

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Performing Loan Equation
GSE_01 Fixed Rate 15yr

Variable	Spline Interval		Prepay		Default	
	Min	Max	Coef.	Std. Err.	Coef.	Std. Err.
age spline variable 1	0	6	0.199774	0.0016303	0.2412	0.0107781
age spline variable 2	6	9	0.0284786	0.0019025	0.03938	0.0127994
age spline variable 3	9	18	0.0223113	0.0005534	0.06806	0.0035097
age spline variable 4	18	24	-0.006553	0.0007074	0.0453	0.0039906
age spline variable 5	24	39	-0.013518	0.0003437	0.01329	0.00167
age spline variable 6	39	41	0.0079235	0.0025967	-0.01433	0.0123192
age spline variable 7	41	53	-0.014521	0.0004984	0.00783	0.0024245
age spline variable 8	53	62	-0.02634	0.0006919	0.0081	0.003432
age spline variable 9	62	67	-0.039264	0.0015512	0.02161	0.0073449
age spline variable 10	67	72	-0.012983	0.001951	0.01183	0.0089693
age spline variable 11	72	74	-0.045883	0.0041831	0.01224	0.0193025
age spline variable 12	74	89	-0.013206	0.0005189	0.00555	0.0024799
age spline variable 13	89	95	-0.009215	0.0011365	-0.00105	0.0058327
age spline variable 14	95	107	-0.019741	0.0003585	0.01052	0.0018886
February			0.1422305	0.0042046	-0.07366	0.0196803
March			0.3364623	0.0040248	-0.21567	0.0205699
April			0.2729959	0.0041187	-0.19306	0.0209477
May			0.3012954	0.0041095	-0.15143	0.0206522
June			0.3584626	0.0040709	-0.20123	0.020465
July			0.3212514	0.0041047	-0.14739	0.0201045
August			0.4219155	0.0040294	-0.07578	0.0198747
September			0.2667196	0.0041142	0.02036	0.0195338
October			0.2065397	0.0041656	0.01837	0.0196068
November			0.2700829	0.0041133	0.26415	0.0184282
December			0.3171681	0.0040603	0.1208	0.0189152
Cohort 1996			-9.657426	0.0919399	-5.02647	0.1394982
Cohort 1997			-9.659332	0.0919746	-5.04301	0.1401427
Cohort 1998			-9.757547	0.0916819	-5.38356	0.1391805
Cohort 1999			-9.876375	0.0917117	-5.11016	0.1390131
Cohort 2000			-9.701238	0.0919759	-4.37374	0.1402742
Cohort 2001			-9.798893	0.0918433	-4.68755	0.1392165
Cohort 2002			-9.85435	0.0918541	-4.84978	0.1388043
Cohort 2003			-9.982407	0.091823	-4.99693	0.1389283
Cohort 2004			-10.06878	0.0919901	-4.73853	0.1390429
Cohort 2005			-10.18031	0.0920893	-4.71079	0.1392417
Cohort 2006			-10.24845	0.0920006	-4.58673	0.1392994
Cohort 2007			-10.28982	0.0920461	-4.46859	0.1397216
Cohort 2008			-10.22325	0.0921071	-4.51183	0.1408705
Cohort 2009			-10.47769	0.0920455	-5.6167	0.1461013
Cohort 2010			-10.51492	0.092209	-5.92163	0.1543388
swap spread			-0.316561	0.0013848	0	0
owner occupied			0.1699621	0.002915	0.00287	0.0137334
refi_burn_10			2.959067	0.0942303	0	0
refi_burn_20			2.73738	0.112568	0	0
refi_burn_30			3.650554	0.1263997	0	0
refi_burn_40			3.286157	0.264513	0	0
refi_burn_50			3.637703	0.0945398	0	0
refi_burn_11			1.287125	0.0478387	0	0
refi_burn_21			6.128705	0.6455225	0	0
refi_burn_31			-5.689704	0.8855823	0	0
refi_burn_41			0.2916782	2.306752	0	0
refi_burn_12			4.134065	0.0474739	0	0
refi_burn_22			2.800925	0.1932376	0	0
refi_burn_32			11.78487	0.2527825	0	0
refi_burn_42			6.131898	0.2533482	0	0
refi_burn_52			2.508723	0.240704	0	0

Performing Loan Equation
GSE_01 Fixed Rate 15yr

Variable	Spline Interval		Prepay		Default	
	Min	Max	Coef.	Std. Err.	Coef.	Std. Err.
refi_burn_13			6.673858	0.1246991	0	0
refi_burn_23			2.141735	0.1828337	0	0
refi_burn_33			-10.781	0.222549	0	0
refi_burn_43			-3.448804	0.2390853	0	0
refi_burn_53			-0.244321	0.1984221	0	0
refi_burn_14			0.8476733	0.271384	0	0
refi_burn_24			4.257198	0.067311	0	0
refi_burn_34			4.361329	0.0501292	0	0
refi_burn_44			2.236152	0.0434919	0	0
refi_burn_54			1.391129	0.0267674	0	0
refi_burn_55			1.166491	0.0349122	0	0
Orig LTV Spline 1	0	0.46	2.369856	0.0165967	-0.9772	0.145061
Orig LTV Spline 2	0.46	0.62	0.5119502	0.0215044	-0.2872	0.137258
Orig LTV Spline 3	0.62	0.75	1.466159	0.0242892	0.65608	0.125036
Orig LTV Spline 4	0.75	1.1	0.6980252	0.0263311	-1.2625	0.094331
Credit Score Spline 1	0	0.685	1.415804	0.0533398	-9.1545	0.127567
Credit Score Spline 2	0.685	0.726	1.049101	0.1508745	-17.244	0.840416
Credit Score Spline 3	0.726	0.757	1.927742	0.1850185	-19.25	1.44508
Credit Score Spline 4	0.757	0.781	1.87526	0.2328504	-26.95	2.533282
Credit Score Spline 5	0.781	0.85	-1.52719	0.1611307	-12.801	2.040571
Credit Equity_11			-7.80043	0.0384727	4.35311	0.251124
Credit Equity_12			0.4178763	0.0713124	3.52701	0.27181
Credit Equity_13			-1.409807	0.0698777	3.55992	0.233043
Credit Equity_14			-1.721021	0.0437601	2.97531	0.130505
Credit Equity_15			-2.713576	0.0521211	1.61005	0.079103
Credit Equity_21			-8.119005	0.0332729	3.027	0.270038
Credit Equity_22			0.7004658	0.069941	4.9827	0.426132
Credit Equity_23			-1.620275	0.0726927	3.6818	0.383949
Credit Equity_24			-1.457144	0.047134	2.25716	0.1210723
Credit Equity_25			-2.282387	0.0551523	3.07462	0.104054
Credit Equity_31			-8.365888	0.0305889	3.55961	0.297907
Credit Equity_32			0.9254578	0.0657284	3.24785	0.538124
Credit Equity_33			-1.731327	0.0706376	4.51419	0.515713
Credit Equity_34			-1.213445	0.0470696	2.8059	0.277368
Credit Equity_35			-2.068815	0.0562678	3.3256	0.125181
Credit Equity_41			-8.750874	0.0286686	3.43689	0.347683
Credit Equity_42			1.251792	0.0620374	3.78646	0.671101
Credit Equity_43			-1.943211	0.0699188	4.28888	0.675119
Credit Equity_44			-0.943162	0.0483899	3.03917	0.369962
Credit Equity_45			-1.791002	0.0588386	3.80568	0.156926
Credit Equity_51			-9.155302	0.0298437	3.11919	0.429952
Credit Equity_52			1.495338	0.0589209	5.04409	0.794172
Credit Equity_53			-1.875131	0.0686717	3.7992	0.838357
Credit Equity_54			-0.723979	0.0482107	3.1977	0.472061
Credit Equity_55			-1.395947	0.0547291	4.1683	0.196502
Orig UPB Spline 1	0	66	0.0081786	0.000119	-0.0073	0.000509
Orig UPB Spline 2	66	101	0.0052124	0.0000912	-0.0057	0.00047
Orig UPB Spline 3	101	152	0.0051359	0.000056	0.00056	0.000329
Orig UPB Spline 4	152	417	0.0022735	0.0000194	0.00109	0.000119
SATO Spline 1	-8	-0.44	0.6448725	0.0029414	0.45686	0.01624
SATO Spline 2	-0.44	4	0.167645	0.0021579	0.07572	0.005903
Unemp Rate Spline 1	0	4.6	-0.021008	0.0027526	0.15859	0.017271
Unemp Rate Spline 2	4.6	5.6	0.0053543	0.0031508	-0.0014	0.019272
Unemp Rate Spline 3	5.6	7.4	-0.060552	0.0019792	0.24393	0.010684
Unemp Rate Spline 4	7.4	12	-0.032116	0.0008911	0.10964	0.003713

FHFA Mortgage Analytics Platform

Performing Loan Equation
GSE_01 Fixed Rate 20yr

Variable	Spline Interval		Prepay		Default	
	Min	Max	Coef.	Std. Err.	Coef.	Std. Err.
age spline variable 1	0	6	0.2187	0.0016	0.2823	0.0090
age spline variable 2	6	17	0.0243	0.0005	0.0688	0.0026
age spline variable 3	17	20	-0.0139	0.0016	0.0519	0.0073
age spline variable 4	20	33	-0.0073	0.0005	0.0181	0.0018
age spline variable 5	33	35	-0.0333	0.0037	0.0043	0.0134
age spline variable 6	35	39	-0.0250	0.0022	-0.0047	0.0078
age spline variable 7	39	45	0.0099	0.0012	0.0014	0.0046
age spline variable 8	45	53	-0.0195	0.0008	0.0124	0.0031
age spline variable 9	53	66	-0.0307	0.0005	0.0062	0.0020
age spline variable 10	66	72	-0.0022	0.0015	0.0004	0.0054
age spline variable 11	72	75	-0.0254	0.0036	0.0122	0.0130
age spline variable 12	75	80	-0.0394	0.0026	0.0082	0.0090
age spline variable 13	80	83	0.0076	0.0046	0.0174	0.0159
age spline variable 14	83	86	0.0238	0.0041	-0.0279	0.0150
February			0.2036	0.0048	-0.1145	0.0176
March			0.3743	0.0046	-0.2584	0.0184
April			0.2563	0.0048	-0.1812	0.0185
May			0.3236	0.0048	-0.1709	0.0184
June			0.3821	0.0047	-0.1746	0.0180
July			0.3091	0.0048	-0.1462	0.0178
August			0.4558	0.0047	-0.0349	0.0174
September			0.2951	0.0047	0.0479	0.0172
October			0.2331	0.0048	0.0453	0.0172
November			0.3551	0.0047	0.1979	0.0165
December			0.3813	0.0047	0.1023	0.0168
Cohort 1996			-12.6431	0.1037	-7.0959	0.1222
Cohort 1997			-12.4992	0.1037	-6.7061	0.1217
Cohort 1998			-12.5612	0.1033	-6.9252	0.1198
Cohort 1999			-12.7289	0.1034	-6.5967	0.1197
Cohort 2000			-12.6719	0.1037	-6.0168	0.1213
Cohort 2001			-12.7201	0.1035	-6.1587	0.1202
Cohort 2002			-12.7865	0.1036	-6.3304	0.1200
Cohort 2003			-12.9115	0.1036	-6.6682	0.1202
Cohort 2004			-12.9903	0.1037	-6.4116	0.1201
Cohort 2005			-13.1271	0.1038	-6.3716	0.1200
Cohort 2006			-13.2767	0.1038	-6.0999	0.1202
Cohort 2007			-13.3498	0.1038	-5.9050	0.1205
Cohort 2008			-13.3019	0.1039	-5.8551	0.1213
Cohort 2009			-13.6550	0.1037	-7.0625	0.1254
Cohort 2010			-13.7726	0.1039	-6.9531	0.1274
swap spread			-0.3167	0.0016	0.0000	0.0000
owner occupied			0.2582	0.0044	0.0486	0.0162
refi_burn_10			3.6871	0.1090	0.0000	0.0000
refi_burn_20			3.3282	0.1436	0.0000	0.0000
refi_burn_30			3.8858	0.1877	0.0000	0.0000
refi_burn_40			4.1323	0.4131	0.0000	0.0000
refi_burn_50			4.5235	0.1113	0.0000	0.0000
refi_burn_11			2.5844	0.0531	0.0000	0.0000
refi_burn_21			10.0437	0.9297	0.0000	0.0000
refi_burn_31			-1.0869	1.5361	0.0000	0.0000
refi_burn_41			-1.4109	3.7027	0.0000	0.0000
refi_burn_12			5.1317	0.0518	0.0000	0.0000
refi_burn_22			2.8782	0.2241	0.0000	0.0000
refi_burn_32			15.0422	0.3675	0.0000	0.0000
refi_burn_42			10.0460	0.3724	0.0000	0.0000
refi_burn_52			2.3733	0.3592	0.0000	0.0000

Performing Loan Equation
GSE_01 Fixed Rate 20yr

Variable	Spline Interval		Prepay		Default	
	Min	Max	Coef.	Std. Err.	Coef.	Std. Err.
refi_burn_13			8.3735	0.1338	0.0000	0.0000
refi_burn_23			2.4586	0.2010	0.0000	0.0000
refi_burn_33			-12.0432	0.2654	0.0000	0.0000
refi_burn_43			-4.7796	0.3078	0.0000	0.0000
refi_burn_53			2.5521	0.2854	0.0000	0.0000
refi_burn_14			0.8271	0.2929	0.0000	0.0000
refi_burn_24			5.0363	0.0736	0.0000	0.0000
refi_burn_34			4.7076	0.0583	0.0000	0.0000
refi_burn_44			2.8652	0.0507	0.0000	0.0000
refi_burn_54			2.0395	0.0339	0.0000	0.0000
refi_burn_55			1.5124	0.0462	0.0000	0.0000
Orig LTV Spline 1	0	0.66	1.1248	0.0161	0.0355	0.0844
Orig LTV Spline 2	0.66	0.78	1.3503	0.0316	-0.1024	0.1350
Orig LTV Spline 3	0.78	0.8	0.9102	0.1698	4.4451	0.6636
Orig LTV Spline 4	0.8	1.2	-0.2307	0.0340	-2.1186	0.0979
Credit Score Spline 1	0	0.682	2.1160	0.0507	-7.6452	0.1046
Credit Score Spline 2	0.682	0.718	0.2218	0.1703	-16.8050	0.7457
Credit Score Spline 3	0.718	0.751	0.2457	0.1889	-20.7683	1.1336
Credit Score Spline 4	0.751	0.77	-0.4104	0.2758	-27.2602	2.1384
Credit Score Spline 5	0.77	0.85	-2.1844	0.2097	-10.9381	2.0848
Credit Equity_11			-1.5175	0.0180	2.8479	0.0792
Credit Equity_12			-2.4508	0.0636	2.2248	0.1691
Credit Equity_13			-3.0925	0.0776	1.3527	0.1562
Credit Equity_14			-5.5660	0.2590	1.7043	0.2945
Credit Equity_15			-2.2190	0.2158	0.3320	0.1331
Credit Equity_21			-1.5747	0.0167	2.3681	0.0824
Credit Equity_22			-2.1327	0.0727	2.6765	0.3020
Credit Equity_23			-2.4040	0.0900	2.7203	0.2824
Credit Equity_24			-4.0663	0.2847	4.4687	0.4849
Credit Equity_25			-3.0848	0.2481	0.9649	0.1833
Credit Equity_31			-1.5368	0.0162	2.5739	0.0928
Credit Equity_32			-1.7895	0.0732	2.9534	0.3993
Credit Equity_33			-2.2180	0.0923	2.7957	0.3806
Credit Equity_34			-4.1799	0.2929	5.7809	0.6475
Credit Equity_35			-2.6320	0.2533	1.1222	0.2460
Credit Equity_41			-1.5443	0.0167	2.5935	0.1150
Credit Equity_42			-1.3402	0.0721	3.0233	0.5363
Credit Equity_43			-1.8888	0.0916	4.6719	0.4981
Credit Equity_44			-3.9276	0.2904	5.8523	0.8166
Credit Equity_45			-2.5882	0.2566	1.4713	0.2908
Credit Equity_51			-1.5694	0.0184	2.1968	0.1548
Credit Equity_52			-0.3303	0.0896	3.7399	0.8536
Credit Equity_53			-1.9526	0.1119	5.8679	0.7697
Credit Equity_54			-4.0061	0.3378	5.7905	1.1935
Credit Equity_55			-1.9294	0.2689	1.7718	0.3943
Orig UPB Spline 1	0	92	0.0123	0.0001	-0.0022	0.0003
Orig UPB Spline 2	92	135	0.0051	0.0001	-0.0024	0.0003
Orig UPB Spline 3	135	198	0.0041	0.0001	0.0014	0.0003
Orig UPB Spline 4	198	417	0.0019	0.0000	0.0019	0.0001
SATO Spline 1	-8	0.1	0.8136	0.0032	0.4740	0.0131
SATO Spline 2	0.1	4	0.0373	0.0026	-0.0170	0.0057
Unemp Rate Spline 1	0	4.5	-0.0015	0.0035	0.1491	0.0172
Unemp Rate Spline 2	4.5	5.4	0.0201	0.0041	0.1197	0.0199
Unemp Rate Spline 3	5.4	6.8	-0.0757	0.0027	0.1632	0.0115
Unemp Rate Spline 4	6.8	12	-0.0527	0.0010	0.1100	0.0031

FHFA Mortgage Analytics Platform

Performing Loan Equation
GSE_01 Fixed Rate 30yr

Variable	Spline Interval		Prepay		Default	
	Min	Max	Coef.	Std. Err.	Coef.	Std. Err.
age spline variable 1	0	3	0.3578	0.0034	0.0000	0.0000
age spline variable 2	3	11	0.0427	0.0006	0.1415	0.0017
age spline variable 3	11	17	0.0027	0.0006	0.0400	0.0017
age spline variable 4	17	35	-0.0179	0.0002	0.0077	0.0005
age spline variable 5	35	39	-0.0184	0.0012	-0.0378	0.0024
age spline variable 6	39	51	-0.0091	0.0005	-0.0036	0.0011
age spline variable 7	51	59	-0.0193	0.0008	0.0058	0.0019
age spline variable 8	59	65	-0.0373	0.0013	0.0160	0.0032
age spline variable 9	65	75	-0.0128	0.0009	0.0179	0.0024
age spline variable 10	75	80	-0.0383	0.0021	0.0059	0.0059
age spline variable 11	80	86	0.0137	0.0021	0.0130	0.0059
age spline variable 12	86	92	-0.0191	0.0024	-0.0116	0.0070
age spline variable 13	92	95	-0.0117	0.0058	0.0149	0.0114
age spline variable 14	95	98	-0.0025	0.0057	0.0000	0.0000
February			0.1503	0.0040	-0.0908	0.0093
March			0.2807	0.0039	-0.2027	0.0096
April			0.2123	0.0040	-0.1718	0.0097
May			0.2073	0.0040	-0.1371	0.0096
June			0.2733	0.0040	-0.1402	0.0095
July			0.2409	0.0040	-0.1129	0.0094
August			0.2955	0.0040	-0.0505	0.0093
September			0.1371	0.0041	0.0265	0.0091
October			0.1538	0.0040	0.0327	0.0091
November			0.2042	0.0040	0.0742	0.0090
December			0.2541	0.0040	0.0358	0.0090
Cohort 1996			-12.8344	0.1047	-6.5830	0.0753
Cohort 1997			-12.8652	0.1047	-6.7309	0.0750
Cohort 1998			-12.9073	0.1043	-6.9829	0.0741
Cohort 1999			-12.9797	0.1045	-6.6019	0.0740
Cohort 2000			-12.9034	0.1047	-6.0899	0.0745
Cohort 2001			-13.0521	0.1046	-6.3233	0.0740
Cohort 2002			-13.1259	0.1046	-6.4035	0.0738
Cohort 2003			-13.2120	0.1046	-6.5881	0.0737
Cohort 2004			-13.2274	0.1048	-6.3806	0.0737
Cohort 2005			-13.4098	0.1049	-6.2200	0.0733
Cohort 2006			-13.5696	0.1047	-5.8924	0.0730
Cohort 2007			-13.7734	0.1048	-5.7478	0.0731
Cohort 2008			-13.7904	0.1049	-5.9153	0.0736
Cohort 2009			-14.1628	0.1048	-7.2585	0.0764
Cohort 2010			-14.3353	0.1051	-7.5306	0.0815
swap spread			-0.2724	0.0014	0.0000	0.0000
owner occupied			0.3061	0.0029	0.0380	0.0066
refi_burn_10			4.4288	0.1120	0.0000	0.0000
refi_burn_20			4.0245	0.1328	0.0000	0.0000
refi_burn_30			5.0053	0.1520	0.0000	0.0000
refi_burn_40			5.8969	0.2962	0.0000	0.0000
refi_burn_50			5.3348	0.1143	0.0000	0.0000
refi_burn_11			2.9548	0.0505	0.0000	0.0000
refi_burn_21			10.5756	0.7305	0.0000	0.0000
refi_burn_31			-3.6227	1.0701	0.0000	0.0000
refi_burn_41			-11.1106	2.5807	0.0000	0.0000
refi_burn_12			5.0684	0.0452	0.0000	0.0000
refi_burn_22			3.7501	0.1933	0.0000	0.0000
refi_burn_32			14.2765	0.2958	0.0000	0.0000
refi_burn_42			11.4444	0.3297	0.0000	0.0000
refi_burn_52			2.0750	0.3587	0.0000	0.0000

Performing Loan Equation
GSE_01 Fixed Rate 30yr

Variable	Spline Interval		Prepay		Default	
	Min	Max	Coef.	Std. Err.	Coef.	Std. Err.
refi_burn_13			8.4176	0.1144	0.0000	0.0000
refi_burn_23			2.2872	0.1750	0.0000	0.0000
refi_burn_33			-9.4143	0.2405	0.0000	0.0000
refi_burn_43			-4.2828	0.2824	0.0000	0.0000
refi_burn_53			3.7319	0.2806	0.0000	0.0000
refi_burn_14			1.2167	0.2125	0.0000	0.0000
refi_burn_24			4.5996	0.0589	0.0000	0.0000
refi_burn_34			4.1885	0.0476	0.0000	0.0000
refi_burn_44			2.8383	0.0441	0.0000	0.0000
refi_burn_54			2.1544	0.0307	0.0000	0.0000
refi_burn_55			2.0800	0.0381	0.0000	0.0000
Orig LTV Spline 1	0	0.66	1.0940	0.0150	0.1756	0.0657
Orig LTV Spline 2	0.66	0.79	1.6214	0.0244	-0.4380	0.0676
Orig LTV Spline 3	0.79	0.83	1.0651	0.1085	-1.0846	0.2422
Orig LTV Spline 4	0.83	1.2	2.3861	0.0344	-0.0713	0.0594
Credit Score Spline 1	0	0.678	2.3355	0.0458	-6.1786	0.0678
Credit Score Spline 2	0.678	0.716	0.8921	0.1527	-10.6461	0.3921
Credit Score Spline 3	0.716	0.75	0.7484	0.1710	-12.9296	0.5849
Credit Score Spline 4	0.75	0.78	0.4587	0.1796	-16.6710	0.7910
Credit Score Spline 5	0.78	0.85	-0.5375	0.2060	-10.7205	1.0852
Credit Equity_11			-1.4952	0.0168	2.9214	0.0733
Credit Equity_12			-3.5788	0.0536	1.3353	0.1349
Credit Equity_13			-3.7905	0.0473	1.8157	0.0861
Credit Equity_14			-5.7094	0.0964	3.4627	0.1021
Credit Equity_15			-4.6356	0.0758	0.9129	0.0251
Credit Equity_21			-1.5688	0.0156	2.1536	0.0767
Credit Equity_22			-2.7274	0.0602	3.3840	0.2306
Credit Equity_23			-3.4707	0.0541	3.9894	0.1397
Credit Equity_24			-5.6149	0.1122	3.0778	0.1544
Credit Equity_25			-4.3207	0.0808	1.4439	0.0336
Credit Equity_31			-1.5535	0.0149	1.9205	0.0823
Credit Equity_32			-2.4455	0.0612	4.0879	0.3048
Credit Equity_33			-2.9277	0.0559	4.6502	0.1859
Credit Equity_34			-5.5435	0.1173	4.0962	0.2017
Credit Equity_35			-3.9967	0.0817	1.7546	0.0411
Credit Equity_41			-1.5818	0.0151	1.4848	0.0931
Credit Equity_42			-1.9546	0.0608	5.4235	0.4013
Credit Equity_43			-2.4273	0.0563	5.1085	0.2467
Credit Equity_44			-5.6257	0.1186	5.5709	0.2603
Credit Equity_45			-3.4907	0.0767	2.0110	0.0491
Credit Equity_51			-1.6361	0.0170	1.3074	0.1144
Credit Equity_52			-1.2736	0.0766	5.3061	0.5974
Credit Equity_53			-1.9186	0.0699	5.0251	0.3832
Credit Equity_54			-5.0841	0.1400	6.9609	0.3964
Credit Equity_55			-2.9671	0.0809	2.1250	0.0717
Orig UPB Spline 1	0	96	0.0110	0.0001	0.0003	0.0002
Orig UPB Spline 2	96	141	0.0052	0.0001	0.0010	0.0002
Orig UPB Spline 3	141	206	0.0039	0.0000	0.0036	0.0001
Orig UPB Spline 4	206	417	0.0015	0.0000	0.0018	0.0000
SATO Spline 1	-8	0.1	0.8478	0.0032	0.6349	0.0096
SATO Spline 2	0.1	4	0.3419	0.0022	0.5067	0.0034
Unemp Rate Spline 1	0	4.6	-0.0399	0.0027	0.1753	0.0098
Unemp Rate Spline 2	4.6	5.7	0.0288	0.0028	0.0711	0.0091
Unemp Rate Spline 3	5.7	8	-0.1182	0.0016	0.1546	0.0040
Unemp Rate Spline 4	8	12	-0.0005	0.0010	0.0471	0.0018

FHFA Mortgage Analytics Platform

Performing Loan Equation
GSE_01 Adjustable Rate 3/1

Variable	Spline Interval		Prepay		Default	
	Min	Max	Coef.	Std. Err.	Coef.	Std. Err.
age spline variable 1	0	9	0.1061	0.0009	0.2231	0.0047
age spline variable 2	9	11	0.1225	0.0028	0.0295	0.0123
age spline variable 3	11	21	-0.0151	0.0006	0.0715	0.0024
age spline variable 4	21	23	0.1115	0.0037	0.0273	0.0123
age spline variable 5	23	26	-0.0657	0.0030	0.0640	0.0093
age spline variable 6	26	30	-0.0073	0.0025	0.0099	0.0069
age spline variable 7	30	32	0.0278	0.0052	0.0339	0.0138
age spline variable 8	32	35	0.2520	0.0033	0.0298	0.0093
age spline variable 9	35	39	-0.1949	0.0025	0.0575	0.0062
age spline variable 10	39	44	-0.0033	0.0024	-0.0405	0.0051
age spline variable 11	44	47	0.0861	0.0041	0.0063	0.0083
age spline variable 12	47	55	-0.0650	0.0016	-0.0057	0.0030
age spline variable 13	55	66	-0.0209	0.0015	-0.0107	0.0024
age spline variable 14	66	73	-0.0361	0.0031	-0.0125	0.0046
age spline variable 15	73	83	-0.0152	0.0024	0.0055	0.0039
age spline variable 16	83	92	-0.0020	0.0009	0.0085	0.0020
February			0.0973	0.0062	-0.1046	0.0160
March			0.3223	0.0059	-0.1875	0.0163
April			0.2072	0.0060	-0.1531	0.0164
May			0.2820	0.0059	-0.1714	0.0164
June			0.3358	0.0058	-0.1828	0.0163
July			0.2159	0.0060	-0.1464	0.0161
August			0.2840	0.0059	-0.1694	0.0162
September			0.1463	0.0061	-0.1221	0.0160
October			0.1562	0.0061	-0.1043	0.0160
November			0.1471	0.0061	-0.0366	0.0157
December			0.2121	0.0061	-0.0433	0.0156
Cohort 1996			-8.0044	0.0482	-10.2759	0.1387
Cohort 1997			-7.8085	0.0480	-10.1886	0.1374
Cohort 1998			-7.8359	0.0484	-10.3033	0.1439
Cohort 1999			-7.8073	0.0482	-10.1523	0.1412
Cohort 2000			-7.4896	0.0480	-9.7272	0.1366
Cohort 2001			-7.3896	0.0479	-9.1040	0.1344
Cohort 2002			-7.3040	0.0478	-9.1158	0.1342
Cohort 2003			-7.4543	0.0478	-9.0521	0.1341
Cohort 2004			-7.5810	0.0477	-8.9061	0.1336
Cohort 2005			-7.5453	0.0478	-8.8164	0.1337
Cohort 2006			-7.5279	0.0481	-8.6733	0.1338
Cohort 2007			-7.7903	0.0492	-8.4528	0.1347
Cohort 2008			-7.2174	0.0501	-8.3760	0.1370
Cohort 2009			-6.9764	0.0655	-8.8355	0.2383
Cohort 2010			-6.9071	0.0683	-9.4596	0.4299
swap spread			-0.0593	0.0019	0.0000	0.0000
owner occupied			0.2753	0.0034	0.0388	0.0090
io_frm			-0.1128	0.0047	0.0392	0.0115

Performing Loan Equation
GSE_01 Adjustable Rate 3/1

Variable	Spline Interval		Prepay		Default	
	Min	Max	Coef.	Std. Err.	Coef.	Std. Err.
Orig LTV Spline 1	0	0.66	1.0882	0.0225	0.8099	0.1119
Orig LTV Spline 2	0.66	0.76	1.8369	0.0540	0.7394	0.1805
Orig LTV Spline 3	0.76	0.8	1.0587	0.1033	2.0836	0.2996
Orig LTV Spline 4	0.8	1.2	3.5363	0.0341	-1.1516	0.0711
Credit Score Spline 1	0	0.667	2.5335	0.0637	-3.1843	0.1302
Credit Score Spline 2	0.667	0.7	1.1478	0.2254	-8.4920	0.6423
Credit Score Spline 3	0.7	0.72	1.5142	0.4105	-8.5658	1.2347
Credit Score Spline 4	0.72	0.75	1.9319	0.3293	-12.2541	1.2140
Credit Score Spline 5	0.75	0.85	-0.7616	0.2010	-11.4719	0.9533
Credit Equity_11			-1.0110	0.0298	1.0078	0.1343
Credit Equity_12			-1.5632	0.0694	2.0625	0.2346
Credit Equity_13			-5.2663	0.1302	2.3711	0.3472
Credit Equity_14			-4.4186	0.1457	3.4630	0.2514
Credit Equity_15			-7.4291	0.1438	0.6618	0.0462
Credit Equity_21			-1.2905	0.0280	-0.1959	0.1431
Credit Equity_22			-1.1746	0.0747	4.6398	0.1585
Credit Equity_23			-3.7455	0.1340	2.0248	0.5204
Credit Equity_24			-3.0376	0.1436	8.0039	0.3327
Credit Equity_25			-7.0802	0.1286	1.2487	0.0402
Credit Equity_31			-1.3907	0.0271	-0.7125	0.1585
Credit Equity_32			-1.0244	0.0831	6.2771	0.5103
Credit Equity_33			-3.3634	0.1485	3.4120	0.6701
Credit Equity_34			-2.6402	0.1558	8.6813	0.4012
Credit Equity_35			-6.4680	0.1308	1.4933	0.0425
Credit Equity_41			-1.4294	0.0254	-0.5690	0.1644
Credit Equity_42			-1.1319	0.0699	4.9350	0.5261
Credit Equity_43			-2.7642	0.1254	3.7896	0.7228
Credit Equity_44			-2.6064	0.1334	10.6081	0.4299
Credit Equity_45			-5.7055	0.1067	1.6027	0.0419
Credit Equity_51			-1.5805	0.0271	-0.8887	0.2029
Credit Equity_52			-0.7326	0.0901	5.5155	0.8322
Credit Equity_53			-2.6441	0.1744	3.8494	1.2318
Credit Equity_54			-0.9365	0.1817	11.2158	0.7174
Credit Equity_55			-4.7028	0.1216	1.7381	0.0573
Orig UPB Spline 1	0	110	0.0064	0.0001	-0.0003	0.0003
Orig UPB Spline 2	110	160	0.0021	0.0001	0.0012	0.0003
Orig UPB Spline 3	160	228	0.0022	0.0001	0.0022	0.0002
Orig UPB Spline 4	228	417	-0.0001	0.0000	0.0008	0.0001
SATO Spline 1	-8	-1.2	0.0926	0.0014	-0.1544	0.0031
SATO Spline 2	-1.2	4	0.1297	0.0017	0.3637	0.0038
Unemp Rate Spline 1	0	4.7	0.0265	0.0034	0.1417	0.0161
Unemp Rate Spline 2	4.7	5.4	0.0036	0.0061	-0.1400	0.0249
Unemp Rate Spline 3	5.4	6.6	-0.0774	0.0039	0.3035	0.0123
Unemp Rate Spline 4	6.6	11	-0.1622	0.0024	-0.0154	0.0028

FHFA Mortgage Analytics Platform

Performing Loan Equation
GSE_01 Adjustable Rate 5/1

Variable	Spline Interval		Prepay		Default	
	Min	Max	Coef.	Std. Err.	Coef.	Std. Err.
age spline variable 1	0	6	0.1934	0.0013	0.3395	0.0063
age spline variable 2	6	12	0.0330	0.0008	0.0799	0.0029
age spline variable 3	12	20	-0.0119	0.0007	0.0450	0.0018
age spline variable 4	20	23	0.0110	0.0020	0.0050	0.0048
age spline variable 5	23	27	-0.0241	0.0019	0.0016	0.0041
age spline variable 6	27	30	-0.0254	0.0026	0.0048	0.0053
age spline variable 7	30	34	0.0089	0.0020	-0.0025	0.0038
age spline variable 8	34	40	-0.0145	0.0011	-0.0096	0.0022
age spline variable 9	40	52	0.0062	0.0006	0.0016	0.0011
age spline variable 10	52	57	0.1130	0.0014	0.0274	0.0030
age spline variable 11	57	63	-0.1542	0.0016	-0.0318	0.0032
age spline variable 12	63	69	-0.0528	0.0020	-0.0163	0.0038
age spline variable 13	69	75	-0.0879	0.0025	-0.0082	0.0045
age spline variable 14	75	83	-0.0213	0.0020	0.0079	0.0037
age spline variable 15	83	109	-0.0060	0.0009	0.0227	0.0023
age spline variable 16	109	120	0.0029	0.0026	0.0141	0.0086
February			0.1512	0.0050	-0.0353	0.0103
March			0.3793	0.0048	-0.1144	0.0105
April			0.3298	0.0048	-0.0370	0.0105
May			0.3799	0.0048	-0.0771	0.0106
June			0.4267	0.0047	-0.1080	0.0105
July			0.2989	0.0048	-0.1431	0.0105
August			0.3936	0.0047	-0.0968	0.0104
September			0.2851	0.0049	-0.0348	0.0103
October			0.2505	0.0049	0.0062	0.0103
November			0.2183	0.0050	0.0300	0.0102
December			0.3041	0.0049	0.0025	0.0101
Cohort 1996			-7.9075	0.0496	-10.8909	0.1237
Cohort 1997			-7.9632	0.0494	-11.2768	0.1237
Cohort 1998			-8.0387	0.0495	-11.3566	0.1243
Cohort 1999			-7.7939	0.0494	-10.9826	0.1241
Cohort 2000			-7.2938	0.0493	-10.4841	0.1214
Cohort 2001			-7.4071	0.0495	-10.7325	0.1221
Cohort 2002			-7.4558	0.0493	-10.6699	0.1193
Cohort 2003			-7.9173	0.0493	-10.3472	0.1182
Cohort 2004			-7.9494	0.0493	-10.1107	0.1177
Cohort 2005			-7.9765	0.0493	-10.0243	0.1175
Cohort 2006			-7.8112	0.0494	-9.6885	0.1175
Cohort 2007			-7.8812	0.0496	-9.5246	0.1177
Cohort 2008			-7.8910	0.0496	-9.8351	0.1181
Cohort 2009			-8.1198	0.0500	-11.2716	0.1276
Cohort 2010			-8.1492	0.0498	-11.3695	0.1277
swap spread			-0.2418	0.0015	0.0000	0.0000
owner occupied			0.3752	0.0030	0.2137	0.0058
io_frm			-0.0594	0.0027	0.1511	0.0053

Performing Loan Equation
GSE_01 Adjustable Rate 5/1

Variable	Spline Interval		Prepay		Default	
	Min	Max	Coef.	Std. Err.	Coef.	Std. Err.
Orig LTV Spline 1	0	0.66	3.0906	0.0148	1.5199	0.0883
Orig LTV Spline 2	0.66	0.79	3.5162	0.0344	0.5080	0.0990
Orig LTV Spline 3	0.79	0.8	1.8514	0.3293	8.1547	0.8134
Orig LTV Spline 4	0.8	1.01	4.5344	0.0256	-0.8222	0.0424
Credit Score Spline 1	0	0.693	1.6815	0.0674	-3.0040	0.1224
Credit Score Spline 2	0.693	0.717	0.4161	0.2195	-6.2003	0.4580
Credit Score Spline 3	0.717	0.747	1.1397	0.2030	-9.0143	0.5316
Credit Score Spline 4	0.747	0.781	-0.4655	0.1896	-13.3814	0.6664
Credit Score Spline 5	0.781	0.85	-2.7496	0.2291	-8.0312	0.9563
Credit Equity_11			-3.4318	0.0190	2.2667	0.1128
Credit Equity_12			-3.4572	0.0634	0.9013	0.2188
Credit Equity_13			-6.6822	0.0968	0.8444	0.2436
Credit Equity_14			-6.5403	0.1026	3.4520	0.1433
Credit Equity_15			-8.1335	0.1084	0.7988	0.0263
Credit Equity_21			-3.5526	0.0173	1.1190	0.1173
Credit Equity_22			-3.1297	0.0617	3.1097	0.2904
Credit Equity_23			-6.5301	0.0935	2.4932	0.2922
Credit Equity_24			-7.1245	0.1009	6.5742	0.1481
Credit Equity_25			-7.1219	0.0888	0.6176	0.0185
Credit Equity_31			-3.5612	0.0157	0.7070	0.1223
Credit Equity_32			-3.1986	0.0612	4.0205	0.3596
Credit Equity_33			-6.3406	0.0943	2.4177	0.3619
Credit Equity_34			-6.7278	0.1017	8.0443	0.1847
Credit Equity_35			-6.4866	0.0840	0.7291	0.0270
Credit Equity_41			-3.6028	0.0149	0.3061	0.1313
Credit Equity_42			-3.2893	0.0603	4.0018	0.4549
Credit Equity_43			-6.0474	0.0968	3.2562	0.4825
Credit Equity_44			-6.1577	0.1044	8.4058	0.2408
Credit Equity_45			-5.5220	0.0767	1.3995	0.0298
Credit Equity_51			-3.7062	0.0172	-0.0009	0.1542
Credit Equity_52			-3.7099	0.0794	4.4772	0.6690
Credit Equity_53			-5.0302	0.1340	2.2166	0.7700
Credit Equity_54			-4.8464	0.1367	9.6903	0.3918
Credit Equity_55			-4.5653	0.0845	1.6187	0.0438
Orig UPB Spline 1	0	124	0.0052	0.0001	-0.0004	0.0002
Orig UPB Spline 2	124	180	0.0018	0.0001	0.0033	0.0002
Orig UPB Spline 3	180	255	0.0009	0.0000	0.0026	0.0001
Orig UPB Spline 4	255	417	0.0005	0.0000	0.0009	0.0001
SATO Spline 1	-8	0.06	0.2964	0.0018	0.5539	0.0059
SATO Spline 2	0.06	4	0.1678	0.0040	0.4929	0.0041
Unemp Rate Spline 1	0	4.7	0.0370	0.0028	0.1625	0.0115
Unemp Rate Spline 2	4.7	5.6	0.1098	0.0040	0.0789	0.0144
Unemp Rate Spline 3	5.6	7.6	0.0269	0.0022	0.2976	0.0055
Unemp Rate Spline 4	7.6	11	0.0683	0.0012	0.0517	0.0018

FHFA Mortgage Analytics Platform

Performing Loan Equation
GSE_01 Adjustable Rate 7/1

Variable	Spline Interval		Prepay		Default	
	Min	Max	Coef.	Std. Err.	Coef.	Std. Err.
age spline variable 1	0	5	0.2588	0.0038	0.3945	0.0181
age spline variable 2	5	12	0.0576	0.0015	0.0798	0.0055
age spline variable 3	12	22	0.0016	0.0009	0.0377	0.0028
age spline variable 4	22	29	-0.0208	0.0014	0.0014	0.0035
age spline variable 5	29	40	-0.0147	0.0010	-0.0061	0.0024
age spline variable 6	40	46	0.0062	0.0021	0.0076	0.0049
age spline variable 7	46	52	-0.0243	0.0024	-0.0046	0.0057
age spline variable 8	52	59	0.0161	0.0021	0.0139	0.0054
age spline variable 9	59	64	-0.0195	0.0030	0.0179	0.0081
age spline variable 10	64	71	0.0105	0.0021	0.0140	0.0061
age spline variable 11	71	81	-0.0172	0.0017	0.0182	0.0054
age spline variable 12	81	90	-0.0438	0.0137	0.0140	0.0434
age spline variable 13	90	92				
age spline variable 14	92	94				
age spline variable 15	94	96				
age spline variable 16	96	98				
February			0.1373	0.0092	-0.0856	0.0231
March			0.3981	0.0088	-0.1579	0.0236
April			0.3391	0.0090	-0.0671	0.0236
May			0.3901	0.0089	-0.0804	0.0236
June			0.4325	0.0087	-0.1227	0.0235
July			0.2819	0.0090	-0.1665	0.0236
August			0.3836	0.0089	-0.0739	0.0231
September			0.3002	0.0092	-0.0405	0.0230
October			0.2484	0.0092	0.0103	0.0229
November			0.2225	0.0092	0.0378	0.0226
December			0.3351	0.0091	-0.0043	0.0226
Cohort 1996			-8.0639	0.0852	-9.8140	0.2617
Cohort 1997			-7.8409	0.0842	-9.9826	0.2507
Cohort 1998			-8.1505	0.0845	-10.1934	0.2537
Cohort 1999			-7.9284	0.0843	-9.5080	0.2488
Cohort 2000			-7.4400	0.0846	-9.0470	0.2514
Cohort 2001			-7.7075	0.0845	-9.4351	0.2523
Cohort 2002			-7.8774	0.0841	-9.1368	0.2429
Cohort 2003			-8.3414	0.0840	-9.0146	0.2408
Cohort 2004			-8.2450	0.0840	-8.7698	0.2402
Cohort 2005			-8.2041	0.0840	-8.5207	0.2396
Cohort 2006			-7.9965	0.0844	-8.1941	0.2399
Cohort 2007			-8.1142	0.0848	-7.9523	0.2404
Cohort 2008			-8.2973	0.0847	-8.1777	0.2411
Cohort 2009			-8.7488	0.0871	-9.5360	0.2728
Cohort 2010			-8.7999	0.0852	-10.4822	0.2772
swap spread			-0.3537	0.0028	0.0000	0.0000
owner occupied			0.3899	0.0065	0.2544	0.0146
io_frm			-0.1235	0.0053	0.0443	0.0120

Performing Loan Equation
GSE_01 Adjustable Rate 7/1

Variable	Spline Interval		Prepay		Default	
	Min	Max	Coef.	Std. Err.	Coef.	Std. Err.
Orig LTV Spline 1	0	0.64	3.4127	0.0290	1.3578	0.2069
Orig LTV Spline 2	0.64	0.78	3.6366	0.0601	0.6347	0.2042
Orig LTV Spline 3	0.78	0.8	3.5969	0.3105	-1.3227	0.8823
Orig LTV Spline 4	0.8	1.2	4.3882	0.0448	-0.0447	0.0941
Credit Score Spline 1	0	0.697	0.8900	0.1091	-6.3294	0.1962
Credit Score Spline 2	0.697	0.73	1.1300	0.4894	-7.4293	1.4245
Credit Score Spline 3	0.73	0.759	-0.7463	0.4832	-13.1947	1.6795
Credit Score Spline 4	0.759	0.784	-1.2714	0.4580	-17.6095	2.0186
Credit Score Spline 5	0.784	0.83	-4.2568	0.4139	-10.6113	2.2522
Credit Equity_11			-3.7849	0.0406	3.2921	0.2950
Credit Equity_12			-3.8014	0.1782	1.0220	0.7028
Credit Equity_13			-4.8765	0.1072	1.8783	0.3126
Credit Equity_14			-6.6485	0.1262	3.3612	0.1983
Credit Equity_15			-7.8696	0.1736	0.8471	0.0501
Credit Equity_21			-3.8493	0.0370	2.5889	0.3110
Credit Equity_22			-3.1256	0.2061	2.8647	1.1296
Credit Equity_23			-5.0650	0.1290	1.6995	0.5086
Credit Equity_24			-7.0072	0.1643	4.9178	0.3095
Credit Equity_25			-6.9732	0.2114	1.1767	0.0658
Credit Equity_31			-3.9052	0.0335	1.8072	0.3231
Credit Equity_32			-2.5895	0.1767	4.3974	1.2883
Credit Equity_33			-5.2236	0.1121	2.4961	0.5656
Credit Equity_34			-6.7365	0.1451	5.8616	0.3299
Credit Equity_35			-6.6256	0.1810	1.5577	0.0655
Credit Equity_41			-3.8833	0.0307	1.4697	0.3419
Credit Equity_42			-3.1871	0.1668	4.0987	1.5653
Credit Equity_43			-4.7545	0.1111	2.7801	0.7265
Credit Equity_44			-6.4437	0.1438	6.8988	0.4193
Credit Equity_45			-5.1121	0.1483	1.9548	0.0735
Credit Equity_51			-3.9573	0.0341	1.3864	0.3849
Credit Equity_52			-3.3594	0.2062	2.6756	2.2095
Credit Equity_53			-4.9893	0.1475	2.8945	1.1279
Credit Equity_54			-4.9428	0.1860	8.7481	0.6494
Credit Equity_55			-4.1448	0.1565	1.9363	0.1030
Orig UPB Spline 1	0	123	0.0054	0.0001	-0.0021	0.0005
Orig UPB Spline 2	123	177	0.0017	0.0001	0.0019	0.0004
Orig UPB Spline 3	177	251	0.0009	0.0001	0.0020	0.0003
Orig UPB Spline 4	251	417	0.0008	0.0001	0.0011	0.0001
SATO Spline 1	-8	-0.5	0.3337	0.0051	0.2725	0.0216
SATO Spline 2	-0.5	4	0.3385	0.0058	0.6795	0.0095
Unemp Rate Spline 1	0	4.6	0.0468	0.0058	0.1765	0.0284
Unemp Rate Spline 2	4.6	5.5	0.0855	0.0077	0.0680	0.0320
Unemp Rate Spline 3	5.5	7.6	0.1239	0.0039	0.2894	0.0115
Unemp Rate Spline 4	7.6	11	0.0935	0.0020	0.0501	0.0039

FHFA Mortgage Analytics Platform

Performing Loan Equation
GSE_01 Adjustable Rate 10/1

Variable	Spline Interval		Prepay		Default	
	Min	Max	Coef.	Std. Err.	Coef.	Std. Err.
age spline variable 1	0	6	0.1335	0.0033	0.3065	0.0200
age spline variable 2	6	8	-0.0181	0.0077	-0.0210	0.0382
age spline variable 3	8	11	0.3660	0.0047	0.1232	0.0245
age spline variable 4	11	14	-0.2350	0.0046	0.0952	0.0210
age spline variable 5	14	16	-0.0651	0.0071	0.0377	0.0249
age spline variable 6	16	23	-0.0044	0.0021	0.0313	0.0060
age spline variable 7	23	28	-0.0628	0.0025	0.0000	0.0064
age spline variable 8	28	45	-0.0045	0.0008	-0.0113	0.0018
age spline variable 9	45	59	-0.0056	0.0011	0.0043	0.0028
age spline variable 10	59	63	-0.0358	0.0050	0.0061	0.0139
age spline variable 11	63	70	-0.0157	0.0035	-0.0047	0.0102
age spline variable 12	70	79	-0.0355	0.0032	0.0342	0.0097
age spline variable 13	79	83	0.0096	0.0105	0.0187	0.0320
age spline variable 14	83	108	0.0000	0.0000	0.0000	0.0000
age spline variable 15	108	133	0.0000	0.0000	0.0000	0.0000
age spline variable 16	133	140	0.0000	0.0000	0.0000	0.0000
February			0.1271	0.0110	-0.0300	0.0306
March			0.3131	0.0107	-0.0926	0.0312
April			0.2346	0.0110	-0.0835	0.0319
May			0.2680	0.0109	-0.0990	0.0320
June			0.2673	0.0107	-0.1411	0.0317
July			0.1496	0.0110	-0.1533	0.0317
August			0.2441	0.0108	-0.1200	0.0315
September			0.1877	0.0111	-0.0244	0.0309
October			0.1946	0.0111	-0.0071	0.0309
November			0.2097	0.0110	0.0238	0.0305
December			0.3114	0.0109	-0.0221	0.0305
Cohort 1996			-12.8756	0.1248	-13.9778	0.3526
Cohort 1997			-12.7159	0.1248	-13.9738	0.3515
Cohort 1998			-13.1281	0.1252	-14.2559	0.3550
Cohort 1999			-13.3222	0.1252	-13.9967	0.3591
Cohort 2000			-12.9467	0.1254	-13.6983	0.3597
Cohort 2001			-13.0443	0.1263	-13.4524	0.3632
Cohort 2002			-13.4830	0.1257	-13.7412	0.3616
Cohort 2003			-13.7908	0.1253	-13.4963	0.3585
Cohort 2004			-13.4753	0.1253	-13.2771	0.3579
Cohort 2005			-13.5074	0.1253	-12.8061	0.3570
Cohort 2006			-13.4848	0.1255	-12.5467	0.3572
Cohort 2007			-13.6263	0.1258	-12.2303	0.3574
Cohort 2008			-14.1498	0.1263	-12.4844	0.3586
Cohort 2009			-14.4714	0.1298	-14.3828	0.4219
Cohort 2010			-14.5273	0.1276	-14.6184	0.4163
swap spread			-0.2048	0.0038	0.0000	0.0000
owner occupied			0.1808	0.0078	0.2665	0.0185
io_frm			-0.1057	0.0067	-0.0228	0.0161

Performing Loan Equation
GSE_01 Adjustable Rate 10/1

Variable	Spline Interval		Prepay		Default	
	Min	Max	Coef.	Std. Err.	Coef.	Std. Err.
Orig LTV Spline 1	0	0.66	2.2076	0.0336	1.9767	0.2046
Orig LTV Spline 2	0.66	0.8	1.4555	0.0567	1.6476	0.1697
Orig LTV Spline 3	0.8	0.87	4.1182	0.1447	0.0557	0.4205
Orig LTV Spline 4	0.87	1.2	1.0837	0.1514	-4.3112	0.4059
Credit Score Spline 1	0	0.666	7.1424	0.1741	-3.9928	0.3521
Credit Score Spline 2	0.666	0.71	0.2249	0.3285	-6.7980	0.8635
Credit Score Spline 3	0.71	0.745	-0.2162	0.4343	-9.3968	1.4762
Credit Score Spline 4	0.745	0.777	-0.7879	0.5962	-12.7526	2.7904
Credit Score Spline 5	0.777	0.85	-3.7255	0.4021	-14.7343	1.9120
Credit Equity_11			-2.2644	0.0618	1.7797	0.3591
Credit Equity_12			-2.7997	0.1441	0.8900	0.5081
Credit Equity_13			-3.6506	0.2160	-2.5890	0.6343
Credit Equity_14			-4.3649	0.2517	3.5828	0.5128
Credit Equity_15			-8.4181	0.3242	1.0570	0.0945
Credit Equity_21			-2.7600	0.0525	0.1737	0.3762
Credit Equity_22			-1.8578	0.1183	1.7667	0.6719
Credit Equity_23			-2.7452	0.1788	0.1483	0.7920
Credit Equity_24			-4.4423	0.2037	7.3681	0.5284
Credit Equity_25			-7.5842	0.1978	1.1671	0.0679
Credit Equity_31			-2.7054	0.0475	-0.6682	0.4059
Credit Equity_32			-1.5450	0.1184	2.8530	0.9106
Credit Equity_33			-2.8519	0.1848	0.1278	1.0898
Credit Equity_34			-4.5908	0.2134	7.9163	0.7070
Credit Equity_35			-6.9213	0.1908	1.8476	0.0777
Credit Equity_41			-2.6480	0.0454	-0.6463	0.4437
Credit Equity_42			-1.7042	0.1313	1.1512	1.2329
Credit Equity_43			-2.4581	0.2167	0.8419	1.6342
Credit Equity_44			-4.9903	0.2577	9.1962	1.0464
Credit Equity_45			-6.1890	0.2120	2.1809	0.1025
Credit Equity_51			-2.8370	0.0456	-1.0819	0.4515
Credit Equity_52			-1.5713	0.1106	2.3407	1.0990
Credit Equity_53			-2.5243	0.1953	0.5166	1.5307
Credit Equity_54			-3.2693	0.2259	9.9961	1.0082
Credit Equity_55			-4.7715	0.1389	2.1629	0.0997
Orig UPB Spline 1	0	60	0.0396	0.0007	0.0528	0.0022
Orig UPB Spline 2	60	112	0.0103	0.0002	0.0011	0.0009
Orig UPB Spline 3	112	180	0.0027	0.0001	0.0019	0.0004
Orig UPB Spline 4	180	417	-0.0005	0.0000	0.0009	0.0001
SATO Spline 1	-8	-0.65	-0.1044	0.0035	-0.3771	0.0158
SATO Spline 2	-0.65	4	-0.2206	0.0060	0.5443	0.0119
Unemp Rate Spline 1	0	4.3	0.0999	0.0067	0.1823	0.0435
Unemp Rate Spline 2	4.3	5.2	-0.0668	0.0092	0.1439	0.0462
Unemp Rate Spline 3	5.2	6.5	0.1370	0.0069	0.3332	0.0252
Unemp Rate Spline 4	6.5	11	0.1432	0.0025	0.0594	0.0050

FHFA Mortgage Analytics Platform

Performing Loan Equation
GSE_02 Fixed Rate 15yr

Variable	Spline Interval		Prepay		Default	
	Min	Max	Coef.	Std. Err.	Coef.	Std. Err.
age spline variable 1	0	7	0.1874	0.0012	0.2012	0.0098
age spline variable 2	7	14	0.0102	0.0008	0.0764	0.0064
age spline variable 3	14	17	0.0475	0.0018	0.0717	0.0141
age spline variable 4	17	21	-0.0213	0.0013	0.0404	0.0097
age spline variable 5	21	30	-0.0114	0.0005	0.0453	0.0034
age spline variable 6	30	42	-0.0120	0.0004	0.0149	0.0022
age spline variable 7	42	53	-0.0133	0.0005	0.0151	0.0029
age spline variable 8	53	56	-0.0278	0.0019	0.0102	0.0109
age spline variable 9	56	68	-0.0299	0.0005	0.0312	0.0028
age spline variable 10	68	83	-0.0189	0.0004	0.0145	0.0022
age spline variable 11	83	88	-0.0019	0.0013	0.0076	0.0074
age spline variable 12	88	102	-0.0246	0.0006	0.0099	0.0034
age spline variable 13	102	115	-0.0151	0.0009	0.0222	0.0047
age spline variable 14	115	128	-0.0285	0.0013	0.0132	0.0066
age spline variable 15	128	130	-0.0210	0.0017	0.0094	0.0089
age spline variable 16						
age spline variable 17						
age spline variable 18						
February			0.0471	0.0041	-0.0839	0.0222
March			0.2521	0.0039	-0.2305	0.0232
April			0.3115	0.0039	-0.1865	0.0234
May			0.2017	0.0040	-0.2129	0.0236
June			0.2604	0.0040	-0.1785	0.0229
July			0.3593	0.0039	-0.2002	0.0230
August			0.3459	0.0039	-0.1477	0.0228
September			0.1854	0.0040	-0.0582	0.0224
October			0.2314	0.0040	-0.0127	0.0221
November			0.2223	0.0040	0.1457	0.0212
December			0.2557	0.0039	0.0494	0.0215
Cohort 1996			-10.2670	0.0960	-4.0835	0.1587
Cohort 1997			-10.3391	0.0961	-4.1620	0.1588
Cohort 1998			-10.4119	0.0958	-4.2284	0.1582
Cohort 1999			-10.5367	0.0958	-3.9523	0.1582
Cohort 2000			-10.4163	0.0961	-3.4455	0.1599
Cohort 2001			-10.4260	0.0960	-3.7383	0.1587
Cohort 2002			-10.4716	0.0960	-3.8686	0.1582
Cohort 2003			-10.6166	0.0959	-4.0808	0.1585
Cohort 2004			-10.6512	0.0961	-3.8229	0.1587
Cohort 2005			-10.7692	0.0962	-3.7790	0.1589
Cohort 2006			-10.8469	0.0961	-3.5510	0.1588
Cohort 2007			-10.9217	0.0962	-3.3508	0.1592
Cohort 2008			-10.9001	0.0963	-3.3728	0.1611
Cohort 2009			-11.0912	0.0962	-4.3528	0.1674
Cohort 2010			-11.1123	0.0963	-4.5641	0.1759
swap spread			-0.3514	0.0014	0.0000	0.0000
owner occupied			0.2174	0.0032	0.1041	0.0179
refi_burn_10			2.6636	0.0967	0.0000	0.0000
refi_burn_20			2.4927	0.1166	0.0000	0.0000
refi_burn_30			3.4937	0.1232	0.0000	0.0000
refi_burn_40			3.2425	0.2580	0.0000	0.0000
refi_burn_50			3.4582	0.0967	0.0000	0.0000
refi_burn_11			1.1072	0.0474	0.0000	0.0000
refi_burn_21			5.8950	0.6805	0.0000	0.0000
refi_burn_31			-6.9978	0.8144	0.0000	0.0000
refi_burn_41			-2.0428	2.2372	0.0000	0.0000
refi_burn_12			4.4560	0.0458	0.0000	0.0000
refi_burn_22			2.0090	0.2050	0.0000	0.0000
refi_burn_32			11.8010	0.2412	0.0000	0.0000

Performing Loan Equation
GSE_02 Fixed Rate 15yr

Variable	Spline Interval		Prepay		Default	
	Min	Max	Coef.	Std. Err.	Coef.	Std. Err.
refi_burn_42			6.2576	0.2547	0.0000	0.0000
refi_burn_52			1.6404	0.2306	0.0000	0.0000
refi_burn_13			7.0107	0.1195	0.0000	0.0000
refi_burn_23			4.0811	0.1849	0.0000	0.0000
refi_burn_33			-10.4200	0.2165	0.0000	0.0000
refi_burn_43			-3.9270	0.2358	0.0000	0.0000
refi_burn_53			-0.4631	0.1921	0.0000	0.0000
refi_burn_14			1.0561	0.2724	0.0000	0.0000
refi_burn_24			4.1534	0.0666	0.0000	0.0000
refi_burn_34			4.5779	0.0489	0.0000	0.0000
refi_burn_44			2.5645	0.0427	0.0000	0.0000
refi_burn_54			1.5830	0.0258	0.0000	0.0000
refi_burn_55			1.0411	0.0331	0.0000	0.0000
Orig LTV Spline 1	0	0.48	2.4987	0.0160	-1.5497	0.1588
Orig LTV Spline 2	0.48	0.64	0.7468	0.0210	-0.9437	0.1559
Orig LTV Spline 3	0.64	0.75	1.5174	0.0279	-0.3800	0.1682
Orig LTV Spline 4	0.75	1.2	0.7787	0.0261	-0.3188	0.1099
Credit Score Spline 1	0	0.691	2.1215	0.0601	-10.8730	0.1453
Credit Score Spline 2	0.691	0.73	1.6052	0.1572	-19.3860	1.0182
Credit Score Spline 3	0.73	0.758	3.1084	0.1996	-23.6426	1.8538
Credit Score Spline 4	0.758	0.779	-0.0342	0.1867	-23.0954	2.2838
Credit Score Spline 5	0.779	0.85	-1.5948	0.2006	-5.8392	2.9710
Credit Equity_11			-5.6031	0.0274	4.3120	0.1830
Credit Equity_12			12.9308	0.4558	7.6275	1.7462
Credit Equity_13			-1.3544	0.0887	4.5361	0.3171
Credit Equity_14			-1.6704	0.0463	4.0491	0.1521
Credit Equity_15			-2.7357	0.0551	2.2282	0.0874
Credit Equity_21			-5.8783	0.0237	3.6941	0.1938
Credit Equity_22			13.9444	0.4288	10.4011	2.7102
Credit Equity_23			-1.1886	0.0862	4.4444	0.5132
Credit Equity_24			-1.5296	0.0465	3.4540	0.2427
Credit Equity_25			-2.2627	0.0557	3.3166	0.1234
Credit Equity_31			-6.1293	0.0215	3.9707	0.2192
Credit Equity_32			17.2575	0.3924	7.7402	3.4512
Credit Equity_33			-1.5310	0.0805	5.2599	0.6636
Credit Equity_34			-1.2831	0.0450	3.1410	0.3139
Credit Equity_35			-2.2822	0.0570	4.1722	0.1488
Credit Equity_41			-6.5333	0.0194	3.6793	0.2602
Credit Equity_42			20.4697	0.3350	16.5924	4.1568
Credit Equity_43			-1.7220	0.0708	4.1831	0.8153
Credit Equity_44			-1.0546	0.0415	4.5278	0.3967
Credit Equity_45			-1.9064	0.0538	4.3515	0.1908
Credit Equity_51			-6.8582	0.0224	3.2152	0.3446
Credit Equity_52			21.9036	0.4258	11.3339	6.5179
Credit Equity_53			-1.5971	0.0924	6.1565	1.3198
Credit Equity_54			-0.8866	0.0548	3.9497	0.6309
Credit Equity_55			-1.4239	0.0667	4.2273	0.2811
Orig UPB Spline 1	0	61	0.0078	0.0001	-0.0119	0.0006
Orig UPB Spline 2	61	94	0.0053	0.0001	-0.0028	0.0006
Orig UPB Spline 3	94	140	0.0051	0.0001	-0.0012	0.0004
Orig UPB Spline 4	140	417	0.0026	0.0000	0.0016	0.0001
SATO Spline 1	-8	-0.47	0.6177	0.0030	0.1663	0.0181
SATO Spline 2	-0.47	4	0.3092	0.0027	0.4034	0.0112
Unemp Rate Spline 1	0	4.4	-0.0024	0.0032	0.1028	0.0221
Unemp Rate Spline 2	4.4	5.2	-0.0095	0.0041	0.0955	0.0289
Unemp Rate Spline 3	5.2	6.4	-0.0078	0.0025	0.1294	0.0165
Unemp Rate Spline 4	6.4	12	-0.0368	0.0008	0.0807	0.0038

FHFA Mortgage Analytics Platform

Performing Loan Equation
GSE_02 Fixed Rate 20yr

Variable	Spline Interval		Prepay		Default	
	Min	Max	Coef.	Std. Err.	Coef.	Std. Err.
age spline variable 1	0	7	0.1919	0.0015	0.2263	0.0097
age spline variable 2	7	17	0.0201	0.0006	0.0734	0.0041
age spline variable 3	17	19	0.0069	0.0034	0.0273	0.0197
age spline variable 4	19	23	-0.0204	0.0019	0.0633	0.0097
age spline variable 5	23	33	-0.0060	0.0007	0.0186	0.0032
age spline variable 6	33	39	-0.0201	0.0012	0.0075	0.0050
age spline variable 7	39	48	-0.0035	0.0009	0.0113	0.0036
age spline variable 8	48	55	-0.0274	0.0012	0.0093	0.0047
age spline variable 9	55	63	-0.0265	0.0012	0.0127	0.0047
age spline variable 10	63	68	-0.0153	0.0023	0.0073	0.0087
age spline variable 11	68	72	0.0022	0.0034	0.0155	0.0133
age spline variable 12	72	74	-0.0052	0.0067	-0.0034	0.0273
age spline variable 13	74	79	-0.0462	0.0027	0.0165	0.0112
age spline variable 14	79	84	0.0120	0.0025	0.0026	0.0102
age spline variable 15	84	93	-0.0199	0.0014	0.0013	0.0064
age spline variable 16	93	97	-0.0122	0.0034	-0.0096	0.0150
age spline variable 17	97	112	-0.0483	0.0014	-0.0001	0.0055
age spline variable 18	112	114	-0.0092	0.0026	0.0385	0.0091
February			0.1094	0.0057	-0.0442	0.0232
March			0.2755	0.0054	-0.2302	0.0245
April			0.3328	0.0055	-0.1735	0.0247
May			0.2068	0.0056	-0.1647	0.0246
June			0.2812	0.0055	-0.0947	0.0237
July			0.3851	0.0054	-0.1009	0.0237
August			0.3725	0.0055	-0.0447	0.0235
September			0.2003	0.0056	-0.0173	0.0235
October			0.2644	0.0055	0.0664	0.0231
November			0.2754	0.0055	0.1718	0.0224
December			0.2832	0.0055	0.1190	0.0225
Cohort 1996			-13.5418	0.1378	-4.6707	0.1817
Cohort 1997			-13.5896	0.1378	-4.7168	0.1816
Cohort 1998			-13.6430	0.1372	-4.9210	0.1797
Cohort 1999			-13.7979	0.1373	-4.6313	0.1794
Cohort 2000			-13.7199	0.1378	-3.8934	0.1820
Cohort 2001			-13.7849	0.1376	-4.1666	0.1803
Cohort 2002			-13.8395	0.1376	-4.3949	0.1797
Cohort 2003			-14.0242	0.1376	-4.7219	0.1803
Cohort 2004			-14.0907	0.1377	-4.4851	0.1801
Cohort 2005			-14.2437	0.1378	-4.4209	0.1797
Cohort 2006			-14.4139	0.1378	-4.2044	0.1800
Cohort 2007			-14.5196	0.1379	-4.0114	0.1805
Cohort 2008			-14.4547	0.1380	-4.0368	0.1819
Cohort 2009			-14.6955	0.1379	-5.1497	0.1896
Cohort 2010			-14.9025	0.1381	-5.4672	0.1936
swap spread			-0.3411	0.0019	0.0000	0.0000
owner occupied			0.3317	0.0057	0.1972	0.0247
refi_burn_10			4.4828	0.1421	0.0000	0.0000
refi_burn_20			3.8412	0.1778	0.0000	0.0000
refi_burn_30			5.2543	0.2078	0.0000	0.0000
refi_burn_40			5.3641	0.4874	0.0000	0.0000
refi_burn_50			5.3707	0.1443	0.0000	0.0000
refi_burn_11			2.1274	0.0647	0.0000	0.0000
refi_burn_21			12.8955	1.0718	0.0000	0.0000
refi_burn_31			-6.5213	1.5600	0.0000	0.0000
refi_burn_41			-5.8859	4.3451	0.0000	0.0000
refi_burn_12			5.9706	0.0603	0.0000	0.0000
refi_burn_22			1.8715	0.2610	0.0000	0.0000
refi_burn_32			14.8294	0.4097	0.0000	0.0000

Performing Loan Equation
GSE_02 Fixed Rate 20yr

Variable	Spline Interval		Prepay		Default	
	Min	Max	Coef.	Std. Err.	Coef.	Std. Err.
refi_burn_42			10.5519	0.4503	0.0000	0.0000
refi_burn_52			1.8222	0.4262	0.0000	0.0000
refi_burn_13			8.2521	0.1524	0.0000	0.0000
refi_burn_23			4.4622	0.2402	0.0000	0.0000
refi_burn_33			-11.0205	0.3111	0.0000	0.0000
refi_burn_43			-6.0724	0.3657	0.0000	0.0000
refi_burn_53			0.6894	0.3449	0.0000	0.0000
refi_burn_14			2.2158	0.3326	0.0000	0.0000
refi_burn_24			5.0218	0.0870	0.0000	0.0000
refi_burn_34			4.9999	0.0672	0.0000	0.0000
refi_burn_44			3.6076	0.0602	0.0000	0.0000
refi_burn_54			2.6692	0.0408	0.0000	0.0000
refi_burn_55			2.1596	0.0553	0.0000	0.0000
Orig LTV Spline 1	0	0.6	1.1351	0.0243	-0.8712	0.1570
Orig LTV Spline 2	0.6	0.72	0.7868	0.0380	-0.9508	0.1962
Orig LTV Spline 3	0.72	0.8	0.9792	0.0491	0.0364	0.2241
Orig LTV Spline 4	0.8	1.2	0.6476	0.0390	-0.0076	0.1261
Credit Score Spline 1	0	0.679	3.0662	0.0748	-10.2977	0.1507
Credit Score Spline 2	0.679	0.719	1.3728	0.2139	-15.9559	1.0102
Credit Score Spline 3	0.719	0.751	1.2311	0.2395	-18.0220	1.5986
Credit Score Spline 4	0.751	0.775	-0.7330	0.2567	-22.7123	2.3925
Credit Score Spline 5	0.775	0.85	-1.7113	0.3144	-5.7544	3.4763
Credit Equity_11			-2.3061	0.0417	2.8453	0.2670
Credit Equity_12			-0.4709	0.0846	4.1203	0.3040
Credit Equity_13			-1.7131	0.0985	3.1631	0.2953
Credit Equity_14			-1.8371	0.1051	4.0836	0.2662
Credit Equity_15			-3.4061	0.0671	1.3605	0.0723
Credit Equity_21			-2.4432	0.0376	2.1830	0.2788
Credit Equity_22			-0.2863	0.0854	4.9390	0.5067
Credit Equity_23			-1.5627	0.1038	2.8161	0.5271
Credit Equity_24			-1.4111	0.1127	5.0566	0.4646
Credit Equity_25			-3.1287	0.0716	2.4223	0.1000
Credit Equity_31			-2.5021	0.0348	2.1795	0.2974
Credit Equity_32			0.0826	0.0796	4.3762	0.6490
Credit Equity_33			-1.7130	0.0998	3.8863	0.7100
Credit Equity_34			-1.1377	0.1108	5.0147	0.6241
Credit Equity_35			-2.8435	0.0728	3.1209	0.1333
Credit Equity_41			-2.5664	0.0340	1.7542	0.3336
Credit Equity_42			0.3220	0.0711	5.0478	0.8037
Credit Equity_43			-1.8324	0.0929	3.7788	0.9301
Credit Equity_44			-0.4116	0.1061	5.3190	0.8340
Credit Equity_45			-2.7227	0.0713	3.8184	0.1569
Credit Equity_51			-2.7032	0.0376	0.8152	0.4274
Credit Equity_52			0.5196	0.0925	8.1271	1.2392
Credit Equity_53			-1.6424	0.1277	2.6490	1.4819
Credit Equity_54			0.1642	0.1455	5.8058	1.3521
Credit Equity_55			-2.4956	0.0910	3.7945	0.2498
Orig UPB Spline 1	0	75	0.0112	0.0002	-0.0052	0.0006
Orig UPB Spline 2	75	109	0.0078	0.0001	-0.0005	0.0006
Orig UPB Spline 3	109	160	0.0053	0.0001	-0.0007	0.0004
Orig UPB Spline 4	160	417	0.0026	0.0000	0.0023	0.0001
SATO Spline 1	-8	-0.1	0.7560	0.0044	0.1910	0.0199
SATO Spline 2	-0.1	4	0.4916	0.0046	0.4451	0.0154
Unemp Rate Spline 1	0	4.5	0.0167	0.0042	0.1386	0.0235
Unemp Rate Spline 2	4.5	5.5	-0.0093	0.0043	0.1208	0.0234
Unemp Rate Spline 3	5.5	7.2	-0.0624	0.0028	0.1642	0.0129
Unemp Rate Spline 4	7.2	12	-0.0522	0.0013	0.0668	0.0044

FHFA Mortgage Analytics Platform

Performing Loan Equation
GSE_02 Fixed Rate 30yr

Variable	Spline Interval		Prepay		Default	
	Min	Max	Coef.	Std. Err.	Coef.	Std. Err.
age spline variable 1	0	3	0.5185	0.0041	0.0000	0.0000
age spline variable 2	3	11	0.0375	0.0007	0.1508	0.0021
age spline variable 3	11	17	0.0113	0.0006	0.0467	0.0020
age spline variable 4	17	35	-0.0179	0.0002	0.0132	0.0006
age spline variable 5	35	39	-0.0164	0.0011	-0.0233	0.0027
age spline variable 6	39	51	-0.0096	0.0005	-0.0017	0.0012
age spline variable 7	51	59	-0.0179	0.0008	0.0080	0.0021
age spline variable 8	59	65	-0.0354	0.0012	0.0156	0.0035
age spline variable 9	65	75	-0.0096	0.0009	0.0122	0.0027
age spline variable 10	75	80	-0.0286	0.0021	0.0276	0.0066
age spline variable 11	80	86	0.0150	0.0020	0.0005	0.0068
age spline variable 12	86	92	-0.0443	0.0024	-0.0033	0.0082
age spline variable 13	92	95	-0.0152	0.0062	0.0394	0.0129
age spline variable 14	95	98	-0.0172	0.0062	0.0000	0.0000
age spline variable 15	98	111	-0.0427	0.0016	0.0000	0.0000
age spline variable 16	111	113	-0.0098	0.0035	0.0000	0.0000
age spline variable 17						
age spline variable 18						
February			0.1191	0.0040	-0.0776	0.0106
March			0.2405	0.0039	-0.2310	0.0111
April			0.2278	0.0040	-0.2050	0.0113
May			0.1400	0.0041	-0.1658	0.0111
June			0.2128	0.0040	-0.1877	0.0110
July			0.2669	0.0040	-0.1760	0.0109
August			0.2460	0.0040	-0.1144	0.0108
September			0.0983	0.0041	-0.0364	0.0106
October			0.1859	0.0040	0.0142	0.0105
November			0.2093	0.0040	0.0596	0.0103
December			0.2467	0.0039	0.0176	0.0103
Cohort 1996			-14.4863	0.1198	-5.3143	0.0864
Cohort 1997			-14.5439	0.1198	-5.4427	0.0867
Cohort 1998			-14.6015	0.1194	-5.6510	0.0861
Cohort 1999			-14.7001	0.1196	-5.2958	0.0860
Cohort 2000			-14.5917	0.1198	-4.8751	0.0866
Cohort 2001			-14.7557	0.1197	-5.0681	0.0865
Cohort 2002			-14.8187	0.1198	-5.1963	0.0865
Cohort 2003			-14.9318	0.1198	-5.4865	0.0866
Cohort 2004			-14.9619	0.1199	-5.3213	0.0864
Cohort 2005			-15.1346	0.1200	-5.1443	0.0859
Cohort 2006			-15.2542	0.1198	-4.8481	0.0856
Cohort 2007			-15.4666	0.1199	-4.6857	0.0856
Cohort 2008			-15.5412	0.1200	-4.7287	0.0862
Cohort 2009			-15.8852	0.1199	-5.9624	0.0885
Cohort 2010			-16.0965	0.1201	-6.2203	0.0927
swap spread			-0.3328	0.0015	0.0000	0.0000
owner occupied			0.3481	0.0031	0.0715	0.0082
refi_burn_10			4.3034	0.1287	0.0000	0.0000
refi_burn_20			4.1683	0.1445	0.0000	0.0000
refi_burn_30			4.9086	0.1558	0.0000	0.0000
refi_burn_40			5.6255	0.3013	0.0000	0.0000
refi_burn_50			5.4093	0.1302	0.0000	0.0000
refi_burn_11			3.3012	0.0552	0.0000	0.0000
refi_burn_21			8.2555	0.6938	0.0000	0.0000
refi_burn_31			-2.6530	0.9365	0.0000	0.0000
refi_burn_41			-8.7093	2.5651	0.0000	0.0000
refi_burn_12			5.5510	0.0463	0.0000	0.0000
refi_burn_22			4.0305	0.1960	0.0000	0.0000
refi_burn_32			13.4925	0.2691	0.0000	0.0000

Performing Loan Equation
GSE_02 Fixed Rate 30yr

Variable	Spline Interval		Prepay		Default	
	Min	Max	Coef.	Std. Err.	Coef.	Std. Err.
refi_burn_42			11.2517	0.3280	0.0000	0.0000
refi_burn_52			1.6841	0.3589	0.0000	0.0000
refi_burn_13			8.7406	0.1129	0.0000	0.0000
refi_burn_23			3.2018	0.1725	0.0000	0.0000
refi_burn_33			-9.0565	0.2353	0.0000	0.0000
refi_burn_43			-5.4204	0.2829	0.0000	0.0000
refi_burn_53			1.7201	0.2807	0.0000	0.0000
refi_burn_14			1.0113	0.2064	0.0000	0.0000
refi_burn_24			4.8104	0.0565	0.0000	0.0000
refi_burn_34			4.6346	0.0456	0.0000	0.0000
refi_burn_44			3.2201	0.0427	0.0000	0.0000
refi_burn_54			2.3453	0.0301	0.0000	0.0000
refi_burn_55			2.0750	0.0368	0.0000	0.0000
Orig LTV Spline 1	0	0.67	1.0236	0.0147	0.1812	0.0721
Orig LTV Spline 2	0.67	0.79	1.4477	0.0253	-1.4950	0.0793
Orig LTV Spline 3	0.79	0.84	1.8373	0.0857	1.1080	0.2087
Orig LTV Spline 4	0.84	1.2	1.5867	0.0388	-0.5179	0.0750
Credit Score Spline 1	0	0.682	4.1499	0.0497	-8.5574	0.0681
Credit Score Spline 2	0.682	0.718	1.4732	0.1510	-12.5373	0.4593
Credit Score Spline 3	0.718	0.749	0.8185	0.1728	-12.9227	0.7024
Credit Score Spline 4	0.749	0.77	-0.0292	0.2414	-17.8816	1.2272
Credit Score Spline 5	0.77	0.85	-1.7464	0.2185	-8.8873	1.3645
Credit Equity_11			-1.6069	0.0170	2.9008	0.0822
Credit Equity_12			-3.0928	0.0556	2.0169	0.1508
Credit Equity_13			-3.5830	0.0479	2.4327	0.0942
Credit Equity_14			-5.7635	0.1016	2.8309	0.1157
Credit Equity_15			-4.0310	0.0763	1.2075	0.0296
Credit Equity_21			-1.7353	0.0156	2.2561	0.0861
Credit Equity_22			-2.3985	0.0600	3.5519	0.2636
Credit Equity_23			-3.2161	0.0530	3.7085	0.1620
Credit Equity_24			-5.2893	0.1132	3.9984	0.1857
Credit Equity_25			-3.8284	0.0791	1.6854	0.0413
Credit Equity_31			-1.7153	0.0149	1.9346	0.0931
Credit Equity_32			-2.0607	0.0596	4.3497	0.3545
Credit Equity_33			-2.9892	0.0540	4.6832	0.2171
Credit Equity_34			-5.1632	0.1173	5.1192	0.2396
Credit Equity_35			-3.7132	0.0808	1.9136	0.0499
Credit Equity_41			-1.7169	0.0150	1.5951	0.1056
Credit Equity_42			-1.6672	0.0580	5.2186	0.4489
Credit Equity_43			-2.4932	0.0536	5.0411	0.2810
Credit Equity_44			-5.2258	0.1163	6.5906	0.3032
Credit Equity_45			-3.2094	0.0743	2.1745	0.0583
Credit Equity_51			-1.7500	0.0170	1.2039	0.1330
Credit Equity_52			-1.0537	0.0791	6.1277	0.7057
Credit Equity_53			-2.0420	0.0738	5.5007	0.4562
Credit Equity_54			-4.7566	0.1548	6.5306	0.4884
Credit Equity_55			-2.9684	0.0930	2.3408	0.0912
Orig UPB Spline 1	0	86	0.0123	0.0001	0.0004	0.0003
Orig UPB Spline 2	86	127	0.0064	0.0001	0.0002	0.0002
Orig UPB Spline 3	127	185	0.0042	0.0000	0.0036	0.0001
Orig UPB Spline 4	185	417	0.0019	0.0000	0.0020	0.0000
SATO Spline 1	-8	0.03	0.8607	0.0035	0.4450	0.0110
SATO Spline 2	0.1	4	0.4293	0.0026	0.5623	0.0053
Unemp Rate Spline 1	0	4.4	-0.0447	0.0032	0.1823	0.0134
Unemp Rate Spline 2	4.4	5.3	0.0186	0.0037	0.0784	0.0146
Unemp Rate Spline 3	5.3	6.7	-0.0841	0.0023	0.2104	0.0076
Unemp Rate Spline 4	6.7	12	-0.0273	0.0008	0.0625	0.0017

FHFA Mortgage Analytics Platform

Performing Loan Equation
GSE_02 Adjustable Rate 3/1

Variable	Spline Interval		Prepay		Default	
	Min	Max	Coef.	Std. Err.	Coef.	Std. Err.
age spline variable 1	0	9	0.0810	0.0014	0.2310	0.0109
age spline variable 2	9	11	0.0591	0.0048	0.0134	0.0305
age spline variable 3	11	17	-0.0491	0.0018	0.0970	0.0100
age spline variable 4	17	21	-0.0195	0.0030	0.0159	0.0144
age spline variable 5	21	23	0.0244	0.0071	0.1269	0.0313
age spline variable 6	23	25	-0.0545	0.0076	0.0577	0.0311
age spline variable 7	25	28	-0.0500	0.0050	-0.0014	0.0193
age spline variable 8	28	32	-0.0035	0.0038	0.0167	0.0141
age spline variable 9	32	35	0.1461	0.0050	0.0661	0.0197
age spline variable 10	35	37	-0.1737	0.0084	0.0506	0.0311
age spline variable 11	37	39	-0.1819	0.0091	-0.0284	0.0295
age spline variable 12	39	44	-0.0235	0.0039	0.0067	0.0116
age spline variable 13	44	47	0.1331	0.0062	0.0114	0.0197
age spline variable 14	47	50	-0.1842	0.0071	-0.0315	0.0219
age spline variable 15	50	53	-0.1076	0.0058	-0.0176	0.0165
age spline variable 16	53	72	-0.0352	0.0003	0.0073	0.0009
February			0.1253	0.0094	-0.1064	0.0323
March			0.5014	0.0089	-0.2728	0.0338
April			0.2813	0.0091	-0.2456	0.0341
May			0.3752	0.0091	-0.1897	0.0335
June			0.5273	0.0088	-0.2385	0.0335
July			0.3003	0.0089	-0.2556	0.0337
August			0.4357	0.0089	-0.2053	0.0332
September			0.3942	0.0092	-0.1504	0.0328
October			0.2935	0.0092	-0.1039	0.0325
November			0.3046	0.0093	0.0245	0.0313
December			0.4531	0.0092	0.0031	0.0312
Cohort 1996			-8.2249	0.1043	-7.8889	0.2720
Cohort 1997			-8.2111	0.1043	-7.8167	0.2723
Cohort 1998			-8.4684	0.1046	-7.9612	0.2756
Cohort 1999			-8.5417	0.1046	-7.8935	0.2764
Cohort 2000			-8.3005	0.1047	-7.7539	0.2784
Cohort 2001			-8.0374	0.1048	-7.6263	0.2795
Cohort 2002			-8.0158	0.1044	-7.1640	0.2744
Cohort 2003			-8.2465	0.1045	-7.1427	0.2746
Cohort 2004			-8.3457	0.1045	-6.9937	0.2744
Cohort 2005			-8.2401	0.1046	-6.8013	0.2744
Cohort 2006			-8.1888	0.1057	-6.4850	0.2756
Cohort 2007			-7.8230	0.1068	-6.1297	0.2761
Cohort 2008			-8.0137	0.1073	-6.2628	0.2790
Cohort 2009			-8.4350	0.1273	-6.7748	0.4094
Cohort 2010			-8.5868	0.1260	-7.5562	0.7586
swap spread			-0.1820	0.0026	0.0000	0.0000
owner occupied			0.3775	0.0060	0.1171	0.0198
io_frm			-0.7910	0.0172	0.2417	0.0217

Performing Loan Equation
GSE_02 Adjustable Rate 3/1

Variable	Spline Interval		Prepay		Default	
	Min	Max	Coef.	Std. Err.	Coef.	Std. Err.
Orig LTV Spline 1	0	0.68	5.4112	0.0269	0.7607	0.2234
Orig LTV Spline 2	0.68	0.79	8.8751	0.0771	-1.0065	0.3584
Orig LTV Spline 3	0.79	0.8	-12.2938	0.6569	9.0410	2.7094
Orig LTV Spline 4	0.8	1.2	7.8394	0.0477	-0.1048	0.1493
Credit Score Spline 1	0	0.666	2.9990	0.1498	-6.9738	0.2770
Credit Score Spline 2	0.666	0.704	-3.5800	0.3243	-12.3968	1.2208
Credit Score Spline 3	0.704	0.737	-6.0277	0.3924	-8.7271	2.0139
Credit Score Spline 4	0.737	0.767	-6.0395	0.2878	-11.5720	1.6679
Credit Score Spline 5	0.767	0.85	-11.3793	0.3637	-7.9742	2.7150
Credit Equity_11			-4.9924	0.0374	2.7450	0.2723
Credit Equity_12			-14.6225	0.1236	2.1605	0.4228
Credit Equity_13			-4.2315	0.3792	0.7510	0.9183
Credit Equity_14			-9.5345	0.2911	3.5902	0.5155
Credit Equity_15			-10.2809	0.2658	0.5656	0.1030
Credit Equity_21			-5.0421	0.0309	2.1029	0.2792
Credit Equity_22			-13.8029	0.1052	3.0679	0.5627
Credit Equity_23			-5.0160	0.3211	-0.7790	1.1957
Credit Equity_24			-8.6740	0.2482	6.5768	0.6255
Credit Equity_25			-9.4394	0.2343	1.2438	0.0940
Credit Equity_31			-4.7918	0.0277	1.7979	0.2987
Credit Equity_32			-13.4524	0.1094	3.1624	0.7569
Credit Equity_33			-3.8169	0.3356	1.8501	1.6020
Credit Equity_34			-9.0940	0.2615	7.1553	0.8000
Credit Equity_35			-8.8775	0.2511	1.6176	0.1025
Credit Equity_41			-4.4396	0.0248	1.0236	0.3217
Credit Equity_42			-12.9582	0.0875	4.5515	0.8252
Credit Equity_43			-3.7156	0.2715	-0.5318	1.7624
Credit Equity_44			-9.3286	0.2194	10.4402	0.8752
Credit Equity_45			-8.2157	0.2149	1.8487	0.0953
Credit Equity_51			-4.4665	0.0284	0.1909	0.4051
Credit Equity_52			-11.4061	0.1201	5.4845	1.3593
Credit Equity_53			-4.8156	0.4014	0.4222	3.1359
Credit Equity_54			-8.1689	0.3357	11.9578	1.5443
Credit Equity_55			-6.7017	0.3094	1.9284	0.1596
Orig UPB Spline 1	0	82	0.0095	0.0002	-0.0005	0.0010
Orig UPB Spline 2	82	124	0.0022	0.0002	0.0006	0.0008
Orig UPB Spline 3	124	180	0.0023	0.0001	0.0011	0.0005
Orig UPB Spline 4	180	417	0.0000	0.0001	0.0021	0.0001
SATO Spline 1	-8	-1.2	0.2465	0.0039	0.1289	0.0192
SATO Spline 2	-1.2	4	0.0282	0.0043	0.2323	0.0106
Unemp Rate Spline 1	0	4.5	0.1495	0.0053	0.1311	0.0290
Unemp Rate Spline 2	4.5	5.4	0.1138	0.0073	0.0201	0.0380
Unemp Rate Spline 3	5.4	6.5	0.0851	0.0061	0.1889	0.0263
Unemp Rate Spline 4	6.5	11	0.0145	0.0034	-0.0044	0.0057

FHFA Mortgage Analytics Platform

Performing Loan Equation
GSE_02 Adjustable Rate 5/1

Variable	Spline Interval		Prepay		Default	
	Min	Max	Coef.	Std. Err.	Coef.	Std. Err.
age spline variable 1	0	6	0.1818	0.0018	0.3445	0.0064
age spline variable 2	6	12	0.0100	0.0011	0.0738	0.0030
age spline variable 3	12	20	-0.0225	0.0009	0.0383	0.0018
age spline variable 4	20	23	-0.0105	0.0026	0.0029	0.0048
age spline variable 5	23	27	-0.0517	0.0024	0.0052	0.0041
age spline variable 6	27	30	-0.0391	0.0033	-0.0022	0.0053
age spline variable 7	30	34	0.0002	0.0025	-0.0109	0.0039
age spline variable 8	34	40	-0.0331	0.0014	-0.0148	0.0023
age spline variable 9	40	52	-0.0075	0.0007	-0.0082	0.0012
age spline variable 10	52	57	0.0530	0.0019	0.0205	0.0036
age spline variable 11	57	63	-0.1681	0.0021	-0.0136	0.0041
age spline variable 12	63	69	-0.0533	0.0027	-0.0146	0.0051
age spline variable 13	69	75	-0.0970	0.0033	0.0160	0.0061
age spline variable 14	75	83	-0.0151	0.0026	0.0345	0.0051
age spline variable 15	83	109	-0.0204	0.0011	0.0205	0.0028
age spline variable 16	109	112	-0.0358	0.0030	0.0386	0.0083
February			-0.0247	0.0065	-0.0504	0.0109
March			0.5569	0.0061	-0.1441	0.0111
April			0.3297	0.0062	-0.0604	0.0111
May			0.2276	0.0063	-0.1133	0.0113
June			0.5620	0.0060	-0.1476	0.0112
July			0.2960	0.0061	-0.1912	0.0113
August			0.2716	0.0062	-0.1605	0.0112
September			0.4328	0.0063	-0.0964	0.0110
October			0.3250	0.0062	-0.0624	0.0110
November			0.1892	0.0064	-0.0516	0.0109
December			0.5369	0.0062	-0.0658	0.0108
Cohort 1996			-8.3912	0.0598	-8.8016	0.1293
Cohort 1997			-8.5079	0.0596	-8.7081	0.1233
Cohort 1998			-8.7931	0.0598	-8.7661	0.1259
Cohort 1999			-8.3962	0.0595	-8.3767	0.1227
Cohort 2000			-7.9480	0.0595	-8.3018	0.1231
Cohort 2001			-8.1544	0.0596	-8.2349	0.1242
Cohort 2002			-8.2412	0.0595	-7.9917	0.1198
Cohort 2003			-8.6752	0.0595	-7.6673	0.1185
Cohort 2004			-8.6430	0.0595	-7.6105	0.1182
Cohort 2005			-8.1795	0.0595	-7.4398	0.1177
Cohort 2006			-7.8445	0.0596	-7.1775	0.1177
Cohort 2007			-7.9026	0.0597	-7.0081	0.1178
Cohort 2008			-8.3668	0.0600	-7.2804	0.1186
Cohort 2009			-8.9081	0.0625	-8.3064	0.1543
Cohort 2010			-8.9272	0.0603	-8.7007	0.1455
swap spread			-0.4347	0.0019	0.0000	0.0000
owner occupied			0.4598	0.0043	0.1785	0.0063
io_frm			-0.5571	0.0045	0.2694	0.0068

Performing Loan Equation
GSE_02 Adjustable Rate 5/1

Variable	Spline Interval		Prepay		Default	
	Min	Max	Coef.	Std. Err.	Coef.	Std. Err.
Orig LTV Spline 1	0	0.66	6.4719	0.0175	1.3300	0.1039
Orig LTV Spline 2	0.66	0.79	8.3147	0.0451	0.2302	0.1108
Orig LTV Spline 3	0.79	0.8	-0.0932	0.4502	4.8586	0.8974
Orig LTV Spline 4	0.8	1.2	8.1126	0.0296	-2.1225	0.0513
Credit Score Spline 1	0	0.693	1.8534	0.0813	-6.5512	0.0946
Credit Score Spline 2	0.693	0.717	-5.9562	0.2739	-7.5791	0.5239
Credit Score Spline 3	0.717	0.747	-4.9515	0.2486	-8.8665	0.6262
Credit Score Spline 4	0.747	0.781	-9.3111	0.2332	-14.8211	0.8070
Credit Score Spline 5	0.781	0.85	-14.9915	0.3724	-11.1283	1.6343
Credit Equity_11			-7.4027	0.0193	2.3013	0.1513
Credit Equity_12			-16.2432	0.0872	0.7072	0.2789
Credit Equity_13			-7.9156	0.1454	2.8308	0.2731
Credit Equity_14			-10.9219	0.1444	4.3937	0.1343
Credit Equity_15			-8.0258	0.1479	0.8386	0.0233
Credit Equity_21			-7.5151	0.0173	1.1057	0.1608
Credit Equity_22			-15.1105	0.0869	3.4078	0.4204
Credit Equity_23			-7.3575	0.1463	3.4823	0.3963
Credit Equity_24			-10.9487	0.1478	7.2593	0.1845
Credit Equity_25			-6.1014	0.1183	1.2210	0.0259
Credit Equity_31			-7.1956	0.0160	0.5232	0.1715
Credit Equity_32			-14.6692	0.0862	4.3825	0.5475
Credit Equity_33			-7.4488	0.1475	4.1249	0.5196
Credit Equity_34			-10.5097	0.1512	8.8334	0.2359
Credit Equity_35			-5.7228	0.1151	1.4876	0.0294
Credit Equity_41			-6.9308	0.0154	0.3886	0.1808
Credit Equity_42			-14.1704	0.0850	3.4088	0.6453
Credit Equity_43			-7.3210	0.1506	5.9256	0.6604
Credit Equity_44			-9.8241	0.1584	8.9471	0.3010
Credit Equity_45			-4.6758	0.1051	1.8207	0.0353
Credit Equity_51			-6.7698	0.0199	-0.1734	0.2251
Credit Equity_52			-13.5776	0.1281	5.6898	1.0494
Credit Equity_53			-6.4498	0.2375	4.8111	1.1618
Credit Equity_54			-8.7607	0.2456	9.6903	0.5669
Credit Equity_55			-3.3938	0.1344	2.0629	0.0631
Orig UPB Spline 1	0	124	0.0070	0.0001	0.0004	0.0003
Orig UPB Spline 2	124	180	0.0010	0.0001	0.0029	0.0002
Orig UPB Spline 3	180	255	0.0001	0.0001	0.0028	0.0001
Orig UPB Spline 4	255	417	0.0013	0.0000	0.0005	0.0001
SATO Spline 1	-8	0.06	0.2940	0.0027	0.4790	0.0071
SATO Spline 2	0.06	4	0.1663	0.0058	0.7048	0.0051
Unemp Rate Spline 1	0	4.7	0.1533	0.0036	0.1320	0.0119
Unemp Rate Spline 2	4.7	5.6	0.1904	0.0052	0.0151	0.0153
Unemp Rate Spline 3	5.6	7.6	0.0741	0.0029	0.2536	0.0058
Unemp Rate Spline 4	7.6	11	0.1226	0.0016	0.0261	0.0020

FHFA Mortgage Analytics Platform

Performing Loan Equation
GSE_02 Adjustable Rate 7/1

Variable	Spline Interval		Prepay		Default	
	Min	Max	Coef.	Std. Err.	Coef.	Std. Err.
age spline variable 1	0	4	0.3188	0.0080	0.5899	0.0395
age spline variable 2	4	8	0.0758	0.0048	0.0817	0.0182
age spline variable 3	8	11	0.0503	0.0050	0.1034	0.0174
age spline variable 4	11	19	-0.0284	0.0018	0.0495	0.0051
age spline variable 5	19	23	-0.0174	0.0040	0.0071	0.0095
age spline variable 6	23	25	-0.0150	0.0090	0.0349	0.0193
age spline variable 7	25	29	-0.0272	0.0044	-0.0160	0.0089
age spline variable 8	29	36	-0.0177	0.0021	0.0047	0.0043
age spline variable 9	36	46	-0.0254	0.0014	-0.0120	0.0030
age spline variable 10	46	52	-0.0237	0.0026	0.0037	0.0057
age spline variable 11	52	59	-0.0100	0.0026	0.0082	0.0063
age spline variable 12	59	63	-0.0198	0.0042	0.0333	0.0111
age spline variable 13	63	83	-0.0325	0.0010	0.0287	0.0030
age spline variable 14	83	86	-0.1900	0.0060	-0.0804	0.0163
age spline variable 15						
age spline variable 16						
February			-0.0136	0.0118	-0.0529	0.0256
March			0.5089	0.0111	-0.1396	0.0261
April			0.3134	0.0113	-0.0167	0.0259
May			0.2294	0.0114	-0.0855	0.0264
June			0.5506	0.0110	-0.1375	0.0262
July			0.3065	0.0111	-0.1454	0.0262
August			0.2994	0.0113	-0.0930	0.0259
September			0.4444	0.0115	-0.0763	0.0259
October			0.3174	0.0114	-0.0284	0.0256
November			0.2263	0.0116	0.0221	0.0252
December			0.5057	0.0115	-0.0475	0.0253
Cohort 1996			-9.4847	0.1024	-10.2071	0.3582
Cohort 1997			-9.2653	0.1017	-9.7011	0.3360
Cohort 1998			-9.4609	0.1019	-9.8802	0.3399
Cohort 1999			-9.2575	0.1016	-9.6211	0.3382
Cohort 2000			-8.6971	0.1018	-9.5085	0.3467
Cohort 2001			-8.9415	0.1018	-9.2864	0.3382
Cohort 2002			-8.9763	0.1013	-9.1132	0.3305
Cohort 2003			-9.6489	0.1013	-9.0063	0.3295
Cohort 2004			-9.3038	0.1014	-8.9131	0.3296
Cohort 2005			-9.2224	0.1014	-8.7351	0.3288
Cohort 2006			-8.9319	0.1016	-8.3607	0.3286
Cohort 2007			-8.9801	0.1019	-8.1419	0.3288
Cohort 2008			-9.3491	0.1024	-8.3420	0.3300
Cohort 2009			-10.0619	0.1105	-10.2677	0.5016
Cohort 2010			-10.1608	0.1035	-9.8978	0.3714
swap spread			-0.5563	0.0036	0.0000	0.0000
owner occupied			0.5249	0.0082	0.1672	0.0152
io_frm			-0.4504	0.0093	0.2443	0.0153

Performing Loan Equation
GSE_02 Adjustable Rate 7/1

Variable	Spline Interval		Prepay		Default	
	Min	Max	Coef.	Std. Err.	Coef.	Std. Err.
Orig LTV Spline 1	0	0.67	6.5555	0.0322	1.2393	0.1917
Orig LTV Spline 2	0.67	0.78	8.6161	0.0981	0.6536	0.2671
Orig LTV Spline 3	0.78	0.8	4.5527	0.4220	-6.3893	0.9950
Orig LTV Spline 4	0.8	1.2	7.6892	0.0539	0.7878	0.1255
Credit Score Spline 1	0	0.7	1.7146	0.1296	-8.0283	0.2080
Credit Score Spline 2	0.7	0.734	-5.5660	0.5744	-7.6704	1.6328
Credit Score Spline 3	0.734	0.748	-0.5173	0.9165	-15.8367	2.6935
Credit Score Spline 4	0.748	0.773	-4.7844	0.5443	-14.6254	2.0258
Credit Score Spline 5	0.773	0.85	-9.6419	0.6404	-10.3892	3.1691
Credit Equity_11			-6.0828	0.0459	3.0153	0.4804
Credit Equity_12			-14.1924	0.1173	1.5070	0.5952
Credit Equity_13			-9.3690	0.1169	2.1792	0.3176
Credit Equity_14			-11.8175	0.7879	7.3260	1.1004
Credit Equity_15			-7.4271	0.1745	1.1548	0.0476
Credit Equity_21			-6.2546	0.0429	2.4954	0.5176
Credit Equity_22			-13.6394	0.1444	-0.1989	1.0091
Credit Equity_23			-9.2171	0.1490	3.3945	0.5786
Credit Equity_24			-13.0851	1.0109	15.4362	1.8939
Credit Equity_25			-5.3913	0.1817	1.5943	0.0618
Credit Equity_31			-5.9674	0.0392	1.2301	0.5479
Credit Equity_32			-13.5792	0.1241	2.6367	1.1745
Credit Equity_33			-8.8297	0.1296	3.3763	0.6428
Credit Equity_34			-13.4234	0.8877	20.5649	2.1074
Credit Equity_35			-5.1020	0.1564	1.8268	0.0624
Credit Equity_41			-6.0433	0.0367	0.8810	0.5740
Credit Equity_42			-12.8295	0.1189	2.2175	1.3511
Credit Equity_43			-8.8289	0.1321	4.8261	0.7871
Credit Equity_44			-13.0024	0.9211	18.8957	2.5606
Credit Equity_45			-4.3243	0.1446	2.2555	0.0703
Credit Equity_51			-6.1609	0.0466	0.5978	0.6717
Credit Equity_52			-11.5795	0.1747	0.0017	2.0668
Credit Equity_53			-9.2088	0.2116	6.7331	1.3993
Credit Equity_54			-6.8758	1.4238	18.1079	4.5562
Credit Equity_55			-3.3715	0.1850	2.6338	0.1209
Orig UPB Spline 1	0	127	0.0056	0.0002	-0.0017	0.0006
Orig UPB Spline 2	127	184	0.0008	0.0001	0.0023	0.0004
Orig UPB Spline 3	184	263	-0.0001	0.0001	0.0023	0.0003
Orig UPB Spline 4	263	417	0.0016	0.0001	0.0007	0.0001
SATO Spline 1	-8	-0.52	0.2939	0.0074	0.2084	0.0275
SATO Spline 2	-0.52	4	0.2397	0.0076	0.7046	0.0109
Unemp Rate Spline 1	0	4.6	0.0817	0.0073	0.3209	0.0396
Unemp Rate Spline 2	4.6	5.5	0.0511	0.0097	0.0623	0.0403
Unemp Rate Spline 3	5.5	7.9	0.1752	0.0044	0.2958	0.0118
Unemp Rate Spline 4	7.9	11	0.1855	0.0028	0.0395	0.0046

FHFA Mortgage Analytics Platform

Performing Loan Equation
GSE_02 Adjustable Rate 10/1

Variable	Spline Interval		Prepay		Default	
	Min	Max	Coef.	Std. Err.	Coef.	Std. Err.
age spline variable 1	0	5	0.2197	0.0132	0.3876	0.0436
age spline variable 2	5	8	0.0165	0.0156	0.0783	0.0388
age spline variable 3	8	11	0.0818	0.0146	0.1445	0.0314
age spline variable 4	11	14	0.0016	0.0128	0.0790	0.0238
age spline variable 5	14	18	0.0035	0.0084	0.0186	0.0140
age spline variable 6	18	23	0.0006	0.0058	0.0216	0.0092
age spline variable 7	23	28	-0.0192	0.0043	-0.0060	0.0069
age spline variable 8	28	48	-0.0082	0.0009	-0.0106	0.0015
age spline variable 9	48	58	-0.0282	0.0020	-0.0064	0.0042
age spline variable 10	58	65	-0.0145	0.0040	0.0244	0.0097
age spline variable 11	65	69	-0.0168	0.0077	0.0074	0.0211
age spline variable 12	69	83	-0.0103	0.0024	0.0361	0.0085
age spline variable 13	83	112	-0.0486	0.0015	0.0134	0.0058
age spline variable 14						
age spline variable 15						
age spline variable 16						
February			-0.1130	0.0185	0.0319	0.0334
March			0.3656	0.0177	-0.0860	0.0344
April			0.2051	0.0181	0.0341	0.0342
May			0.0285	0.0185	-0.0518	0.0349
June			0.2669	0.0180	-0.1280	0.0349
July			0.0984	0.0180	-0.1398	0.0349
August			0.0365	0.0185	-0.0717	0.0343
September			0.2914	0.0186	-0.0415	0.0342
October			0.2855	0.0180	0.0361	0.0336
November			0.1394	0.0183	0.0392	0.0335
December			0.4249	0.0180	0.0329	0.0331
Cohort 1996			-9.7529	0.2479	-10.4758	0.5452
Cohort 1997			-9.5600	0.2476	-10.3420	0.5434
Cohort 1998			-10.0735	0.2482	-10.6781	0.5520
Cohort 1999			-9.7687	0.2477	-10.1483	0.5357
Cohort 2000			-9.1367	0.2482	-9.8637	0.5469
Cohort 2001			-9.3092	0.2489	-10.0809	0.5601
Cohort 2002			-9.6735	0.2512	-9.9284	0.6270
Cohort 2003			-9.9117	0.2482	-9.6102	0.5365
Cohort 2004			-9.7152	0.2480	-9.6412	0.5339
Cohort 2005			-9.5985	0.2478	-9.4184	0.5314
Cohort 2006			-9.2987	0.2478	-8.9926	0.5309
Cohort 2007			-9.2198	0.2480	-8.7231	0.5310
Cohort 2008			-9.5798	0.2489	-8.8865	0.5326
Cohort 2009			-10.0826	0.2583	-11.4102	0.8850
Cohort 2010			-10.4365	0.2519	-12.1219	0.8849
swap spread			-0.6008	0.0072	0.0000	0.0000
owner occupied			0.4340	0.0123	0.2499	0.0205
io_frm			-0.7003	0.0120	0.0714	0.0190

Performing Loan Equation
GSE_02 Adjustable Rate 10/1

Variable	Spline Interval		Prepay		Default	
	Min	Max	Coef.	Std. Err.	Coef.	Std. Err.
Orig LTV Spline 1	0	0.67	5.9626	0.0441	1.5412	0.2188
Orig LTV Spline 2	0.67	0.8	6.0075	0.0881	-0.3326	0.1834
Orig LTV Spline 3	0.8	0.88	6.9588	0.2519	2.3966	0.4160
Orig LTV Spline 4	0.88	1.2	7.0674	0.3431	-2.0963	0.6099
Credit Score Spline 1	0	0.693	2.9885	0.3429	-7.1756	0.4072
Credit Score Spline 2	0.693	0.71	-7.6449	1.3983	-4.9493	2.3126
Credit Score Spline 3	0.71	0.741	-1.9419	0.7599	-8.1872	1.5818
Credit Score Spline 4	0.741	0.779	-14.2107	0.8214	-11.5379	2.8533
Credit Score Spline 5	0.779	0.85	-5.7798	0.8211	-12.0322	2.9229
Credit Equity_11			-5.2008	0.1213	3.2458	0.9372
Credit Equity_12			-10.9109	0.2935	0.2087	1.3426
Credit Equity_13			-10.5213	0.4092	0.1816	1.0990
Credit Equity_14			-9.9391	0.3345	3.0625	0.4338
Credit Equity_15			-6.7996	0.3597	1.0194	0.0822
Credit Equity_21			-5.5569	0.0992	1.6246	0.9734
Credit Equity_22			-9.8319	0.2144	0.3553	1.5660
Credit Equity_23			-10.9696	0.2984	1.8069	1.2708
Credit Equity_24			-9.4876	0.2356	4.9064	0.4372
Credit Equity_25			-5.2700	0.1942	1.6133	0.0649
Credit Equity_31			-5.1349	0.0862	-0.2321	1.0719
Credit Equity_32			-9.9181	0.2064	3.6563	2.0625
Credit Equity_33			-11.2973	0.2981	2.2133	1.5789
Credit Equity_34			-8.4728	0.2394	5.7389	0.5448
Credit Equity_35			-4.9431	0.1872	1.8599	0.0772
Credit Equity_41			-4.6774	0.0776	-1.6761	1.2716
Credit Equity_42			-10.2230	0.2205	4.2199	3.0753
Credit Equity_43			-9.1869	0.3244	2.5731	2.4264
Credit Equity_44			-9.4588	0.2662	7.5334	0.8060
Credit Equity_45			-4.2170	0.1957	2.0610	0.1017
Credit Equity_51			-4.4921	0.0790	-1.9163	1.1768
Credit Equity_52			-9.1464	0.1834	4.8997	2.4878
Credit Equity_53			-9.6286	0.2824	-0.7288	2.2020
Credit Equity_54			-7.4045	0.2307	9.4797	0.8532
Credit Equity_55			-3.8870	0.1527	2.2459	0.1027
Orig UPB Spline 1	0	128	0.0052	0.0003	-0.0017	0.0009
Orig UPB Spline 2	128	185	0.0017	0.0003	0.0039	0.0006
Orig UPB Spline 3	185	263	-0.0004	0.0002	0.0014	0.0003
Orig UPB Spline 4	263	417	0.0019	0.0001	0.0005	0.0002
SATO Spline 1	-8	-0.52	0.3895	0.0170	0.4303	0.0582
SATO Spline 2	-0.52	4	0.0784	0.0122	0.5617	0.0157
Unemp Rate Spline 1	0	4.6	0.0214	0.0139	0.4471	0.0659
Unemp Rate Spline 2	4.6	5.5	0.0842	0.0181	0.2247	0.0626
Unemp Rate Spline 3	5.5	7.9	0.1752	0.0073	0.3507	0.0164
Unemp Rate Spline 4	7.9	11	0.2277	0.0039	0.0478	0.0061

FHFA Mortgage Analytics Platform

Performing Loan Equation
GSE F40

Variable	Spline Interval		Prepay		Default	
	Min	Max	Coef.	Std. Err.	Coef.	Std. Err.
Age Spline Variable 1	0	4	0.336562	0.019911	0.522525	0.027433
Age Spline Variable 2	4	7	0.008893	0.017250	0.036365	0.018364
Age Spline Variable 3	7	11	0.033397	0.010684	0.078754	0.009829
Age Spline Variable 4	11	23	0.017371	0.003655	0.026463	0.002598
Age Spline Variable 5	23	26	-0.018823	0.015991	#####	0.011071
Age Spline Variable 6	26	28	-0.033055	0.031631	#####	0.021590
Age Spline Variable 7	28	30	-0.027519	0.031691	#####	0.021785
Age Spline Variable 8	30	35	0.042486	0.012742	#####	0.009463
Age Spline Variable 9	35	39	-0.017176	0.019342	0.006654	0.015833
Age Spline Variable 10	39	41	0.064962	0.050699	#####	0.047159
Age Spline Variable 11	41	43	-0.027631	0.056570	0.016202	0.057371
Age Spline Variable 12	43	50	-0.021432	0.023065	0.031719	0.024079
February			0.281992	0.039076	#####	0.030863
March			0.329325	0.038610	#####	0.031593
April			0.046065	0.041183	#####	0.031830
May			0.154840	0.039808	#####	0.031827
June			0.131837	0.039713	#####	0.031040
July			-0.051305	0.041423	#####	0.030249
August			0.007975	0.041167	#####	0.030167
September			-0.073854	0.042437	#####	0.029951
October			-0.201341	0.045910	0.121499	0.030754
November			-0.185520	0.045226	0.091318	0.030702
December			0.064018	0.042772	#####	0.030884
Cohort 2005			-10.523410	0.845790	#####	0.389183
Cohort 2006			-9.972448	0.844139	#####	0.379935
Cohort 2007			-9.976894	0.843844	#####	0.379853
Cohort 2008			-10.200020	0.844614	#####	0.381276
Cohort 2009			-10.515990	0.852882	#####	0.426748
Cohort 2010			-10.515990	#####		
swap spread			-0.281457	0.022944	0.000000	
owner occupied			0.412539	0.035072	0.065278	0.033670
Orig LTV Spline 1	0	0.7	0.542492	0.110277	2.075895	0.204986
Orig LTV Spline 2	0.7	0.8	0.595449	0.316339	0.838936	0.287770
Orig LTV Spline 3	0.8	0.95	1.721439	0.289219	#####	0.175830
Orig LTV Spline 4	0.95	1.2	-0.617053	0.943870	2.431293	0.442943
Credit Score Spline 1	0	0.643	4.918434	1.304433	#####	0.497838
Credit Score Spline 2	0.643	0.679	2.808057	2.042954	#####	1.367908
Credit Score Spline 3	0.679	0.716	-0.652709	2.183210	#####	1.907194

Performing Loan Equation
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Variable	Spline Interval		Prepay		Default	
	Min	Max	Coef.	Std. Err.	Coef.	Std. Err.
Credit Score Spline 4	0.716	0.76	5.781444	1.048158	#####	1.271600
Credit Score Spline 5	0.76	0.85	1.784375	0.798237	#####	1.505453
Credit Equity_11			0.173724	-5.530000	0.182410	#####
Credit Equity_12			1.163900	-7.000000	0.780471	#####
Credit Equity_13			1.483367	-3.050000	0.683687	4.190000
Credit Equity_14			1.593472	-1.220000	0.512768	5.040000
Credit Equity_15			1.509557	-5.440000	0.129462	5.260000
Credit Equity_21			0.144083	-7.190000	0.185499	#####
Credit Equity_22			0.905718	-8.740000	0.794666	2.560000
Credit Equity_23			1.038486	-3.270000	0.593012	1.870000
Credit Equity_24			1.167977	-4.040000	0.456572	4.210000
Credit Equity_25			1.065670	-7.280000	0.104867	9.740000
Credit Equity_31			0.122143	-8.840000	0.182152	#####
Credit Equity_32			0.597372	-9.720000	0.711699	3.890000
Credit Equity_33			0.652280	-5.580000	0.508231	4.830000
Credit Equity_34			0.798341	-8.680000	0.382161	3.370000
Credit Equity_35			0.695719	-9.690000	0.090099	#####
Credit Equity_41			0.117510	-8.000000	0.222733	#####
Credit Equity_42			0.819906	-4.830000	1.300948	2.760000
Credit Equity_43			0.986720	-5.810000	0.942808	4.130000
Credit Equity_44			1.352435	-4.910000	0.727265	1.530000
Credit Equity_45			1.258279	-5.740000	0.180526	6.270000
Credit Equity_51			0.095059	-10.460000	0.203665	#####
Credit Equity_52			0.417663	-8.450000	0.909508	5.320000
Credit Equity_53			0.463396	-9.390000	0.655073	6.390000
Credit Equity_54			0.643307	-11.710000	0.502400	4.020000
Credit Equity_55			0.495302	-9.650000	0.128203	#####
Orig UPB Spline 1	0	140	0.005231	0.000549	0.003961	0.000533
Orig UPB Spline 2	140	199	0.000954	0.000559	0.003691	0.000455
Orig UPB Spline 3	199	275	0.002895	0.000423	0.001837	0.000321
Orig UPB Spline 4	275	417	-0.000769	0.000227	0.001378	0.000183
SATO Spline 1	-8	0.1	0.913115	0.043786	0.552150	0.037201
SATO Spline 2	0.1	4	0.368991	0.023051	0.428818	0.013993
UnEmp Rate Spline 1	0	5.1	-0.132636	0.022459	0.072269	0.028760
UnEmp Rate Spline 2	5.1	7.1	0.082218	0.019075	0.182066	0.017157
UnEmp Rate Spline 3	7.1	9.5	0.051020	0.014372	0.123207	0.010915
UnEmp Rate Spline 4	9.5	12	-0.038212	0.012990	0.007661	0.008995

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Performing Modified Equation

Variable	Spline Interval		Prepay		Default	
	Min	Max	Coef.	Std. Err.	Coef.	Std. Err.
Age Spline Variable 1	0	3	0.3451361	0.02054	1.14139	0.007418
Age Spline Variable 2	3	6	0.0255933	0.01326	0.13755	0.002503
Age Spline Variable 3	6	12	0.1011417	0.005841	0.03407	0.001127
Age Spline Variable 4	12	18	0.010364	0.004872	-0.1692	0.001427
Age Spline Variable 5	18	36	0.0037615	0.001783	-0.0256	0.001003
Age Spline Variable 6	36	60	0.0002543	0.001698	-0.0285	0.001464
Age Spline Variable 7	60	90	-0.003966	0.002055	0.00538	0.002036
Q1			-5.413796	0.417622	-5.0394	0.081157
Q2			-5.30169	0.417192	-4.7405	0.081213
Q3			-5.289101	0.415612	-4.6665	0.081238
Q4			-5.454594	0.415387	-4.5936	0.081145
mod_dlq1	0	3	-0.117732	0.009888	-0.1432	0.002514
mod_dlq2	3	6	-0.03693	0.007348	0.08056	0.002203
mod_dlq3	6	12	-0.016287	0.005138	0.01247	0.001172
mod_dlq4	12	24	0.0312494	0.003231	0.00557	0.000771
CLTV Spline Variable	0	0.65	-0.022331	0.001113	-0.0046	0.000427
CLTV Spline Variable	0.65	0.74	0.0421437	0.003545	0.04081	0.000992
CLTV Spline Variable	0.74	0.81	0.0125771	0.004404	0.04742	0.001155
CLTV Spline Variable	0.81	0.92	0.0242286	0.002564	0.00887	0.000641
CLTV Spline Variable	0.92	1.2	-0.062109	0.002251	0.00637	0.000389
Credit Score Spline Va	-1.746	-2.14	-0.001746	0.000345	-0.0021	0.000104
Credit Score Spline Va	0.635	-1.91	0.000635	0.00081	-0.0019	0.000227
Credit Score Spline Va	1.2279	-0.79	0.0012279	0.000985	-0.0008	0.000257
Credit Score Spline Va	0.2744	-0.78	0.0002744	0.000922	-0.0008	0.000224
Credit Score Spline Va	2.8837	-0.72	0.0028837	0.000701	-0.0007	0.000165
Pay Change Spline 1	-200	-46.6	-0.006133	0.001788	0.03775	0.000664

Performing Modified Equation

Variable	Spline Interval		Prepay		Default	
	Min	Max	Coef.	Std. Err.	Coef.	Std. Err.
Pay Change Spline 2	-46.6	-32.5	0.014487	0.0042043	0.01423	0.00063
Pay Change Spline 3	-32.5	-18.5	0.011504	0.0042001	0.02652	0.000568
Pay Change Spline 4	-18.5	7E-05	0.084298	0.002044	0.01461	0.000363
Pay Change Spline 5	7E-05	10	-0.012065	0.0014556	-4E-06	6.74E-06
Post UPB Spline 1	0.0063	-0	6.27E-06	5.26E-07	-2E-06	1.8E-07
Post UPB Spline 2	0.0038	-0	3.79E-06	5.37E-07	-5E-07	1.65E-07
Post UPB Spline 3	0.0007	4E-04	6.7E-07	5.63E-07	3.6E-07	1.43E-07
Post UPB Spline 4	-0.003	-0	-3.04E-06	5.05E-07	-8E-07	1E-07
Post UPB Spline 5	0.0007	-0	7E-07	3.91E-07	-6E-10	6.47E-08
HPA Spline 1	-0.2	-0.07	-1.014633	0.3034744	-0.9196	0.092717
HPA Spline 2	-0.067	-0.03	3.820714	1.178073	2.04724	0.208408
HPA Spline 3	-0.031	-0.01	-0.380739	1.843504	1.04052	0.316177
HPA Spline 4	-0.006	0.012	38.24566	1.864367	-2.3923	0.419078
HPA Spline 5	0.012	0.2	1.3786	0.0569542	-1.8911	0.079996
Refi Incentive Spline 1	-20	-2.35	0.541373	0.1303498	0	0
Refi Incentive Spline 2	-2.35	-1.21	-0.214571	0.0518424	0	0
Refi Incentive Spline 3	-1.21	0.665	0.12517	0.0197202	0	0
Refi Incentive Spline 4	0.665	1.69	0.098323	0.0219633	0	0
Refi Incentive Spline 5	1.69	5	0.08607	0.0101054	0	0
UnEmp Rate Spline 1	0	6.9	-0.153535	0.0081743	0.04785	0.003649
UnEmp Rate Spline 2	6.9	8.6	-0.481558	0.0202864	0.00175	0.005043
UnEmp Rate Spline 3	8.6	10	0.011858	0.0332038	0.05651	0.006013
UnEmp Rate Spline 4	10	11.1	-0.146284	0.0493049	0.07976	0.007322
UnEmp Rate Spline 5	11.1	15	-0.27477	0.0400816	0.06717	0.004365
forgiven			-12.01087	476.5121	-0.8799	0.219747

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Performing Loan Equation:
MODS_2012Q2

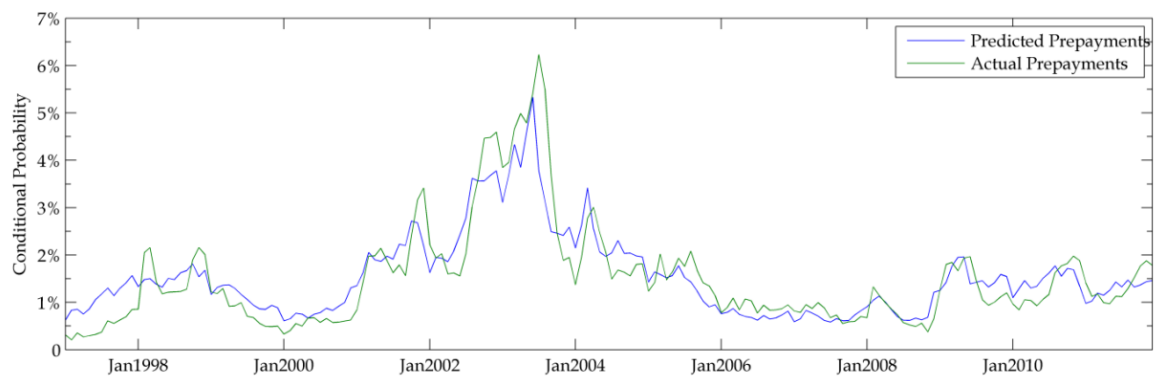
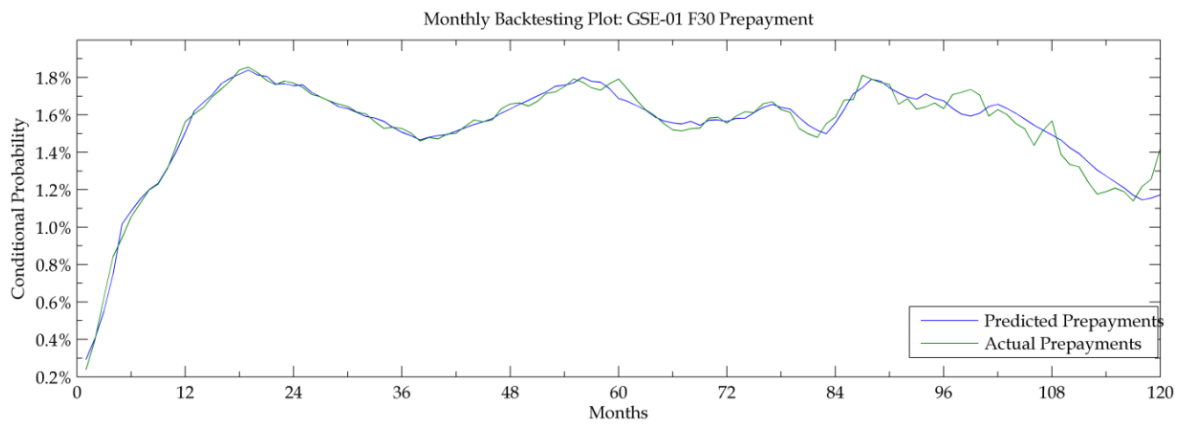
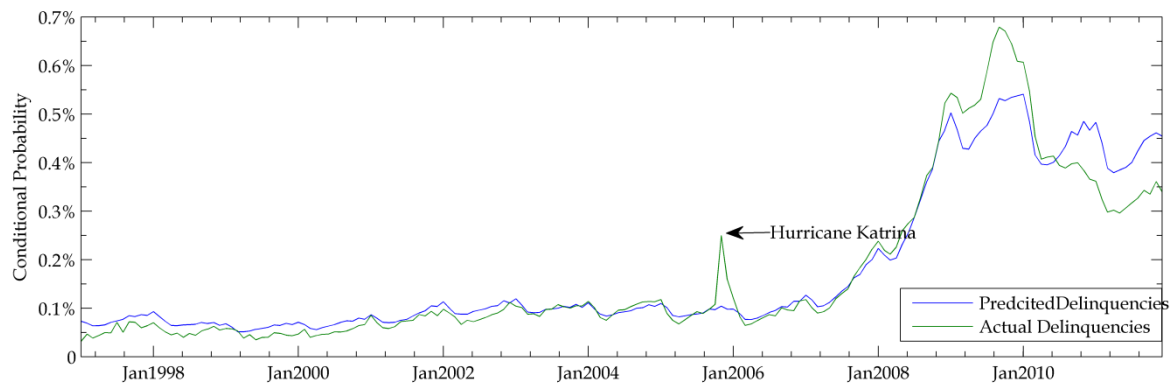
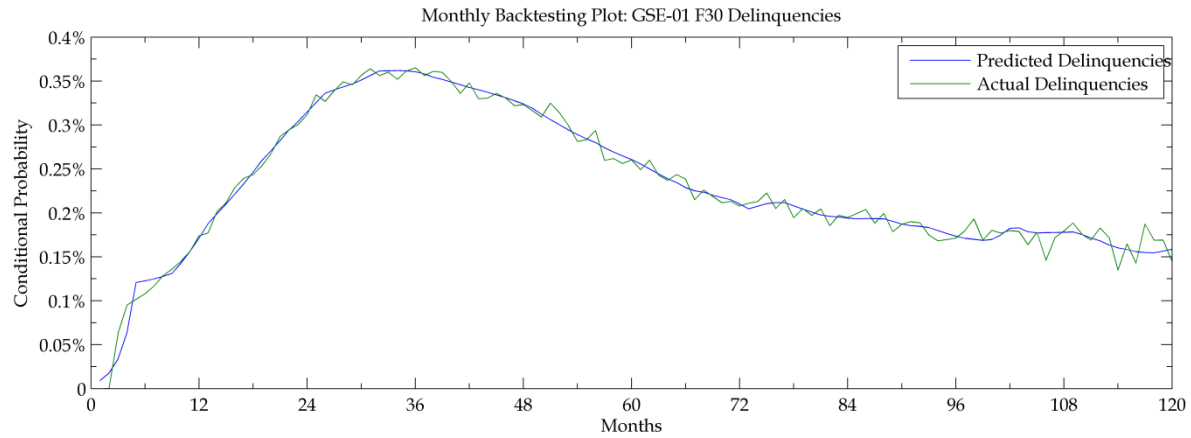
Variable	Spline Interval		Prepay		Default	
	Min	Max	Coef.	Std. Err.	Coef.	Std. Err.
Age Spline Variable 1	0	3	0.3451361	0.02054	1.14139	0.007418
Age Spline Variable 2	3	6	0.0255933	0.01326	0.13755	0.002503
Age Spline Variable 3	6	12	0.1011417	0.005841	0.03407	0.001127
Age Spline Variable 4	12	18	0.010364	0.004872	-0.16923	0.001427
Age Spline Variable 5	18	36	0.0037615	0.001783	-0.02562	0.001003
Age Spline Variable 6	36	60	0.0002543	0.001698	-0.02849	0.001464
Age Spline Variable 7	60	90	-0.003966	0.002055	0.00538	0.002036
Q1			-5.413796	0.417622	-5.03941	0.081157
Q2			-5.30169	0.417192	-4.74046	0.081213
Q3			-5.289101	0.415612	-4.66653	0.081238
Q4			-5.454594	0.415387	-4.59359	0.081145
mod_dlq1	0	3	-0.117732	0.009888	-0.14318	0.002514
mod_dlq2	3	6	-0.03693	0.007348	0.08056	0.002203
mod_dlq3	6	12	-0.016287	0.005138	0.01247	0.001172
mod_dlq4	12	24	0.0312494	0.003231	0.00557	0.000771
CLTV Spline Variable	0	0.65	-0.022331	0.001113	-0.00457	0.000427
CLTV Spline Variable	0.65	0.74	0.0421437	0.003545	0.04081	0.000992
CLTV Spline Variable	0.74	0.81	0.0125771	0.004404	0.04742	0.001155
CLTV Spline Variable	0.81	0.92	0.0242286	0.002564	0.00887	0.000641
CLTV Spline Variable	0.92	1.2	-0.062109	0.002251	0.00637	0.000389
Credit Score Spline Va	-1.746	-2.14	-0.001746	0.000345	-0.00214	0.000104
Credit Score Spline Va	0.635	-1.91	0.000635	0.00081	-0.00191	0.000227
Credit Score Spline Va	1.2279	-0.79	0.0012279	0.000985	-0.00079	0.000257
Credit Score Spline Va	0.2744	-0.78	0.0002744	0.000922	-0.00078	0.000224
Credit Score Spline Va	2.8837	-0.72	0.0028837	0.000701	-0.00072	0.000165

Performing Loan Equation:
MODS_2012Q2

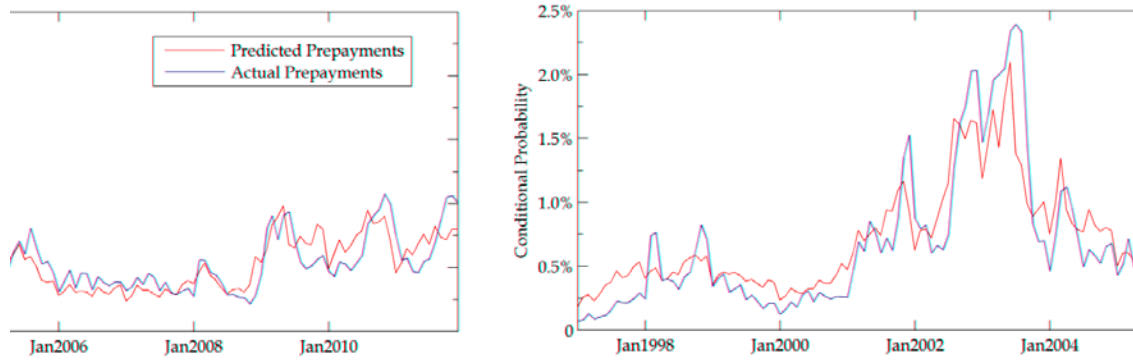
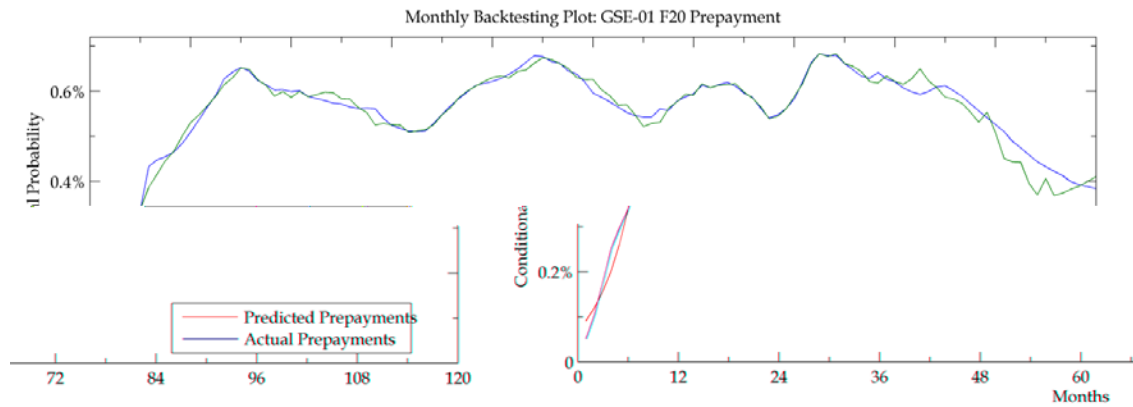
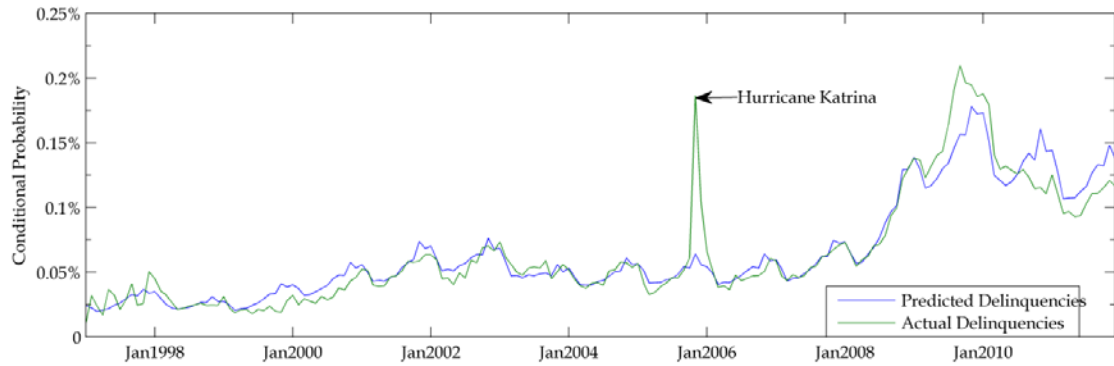
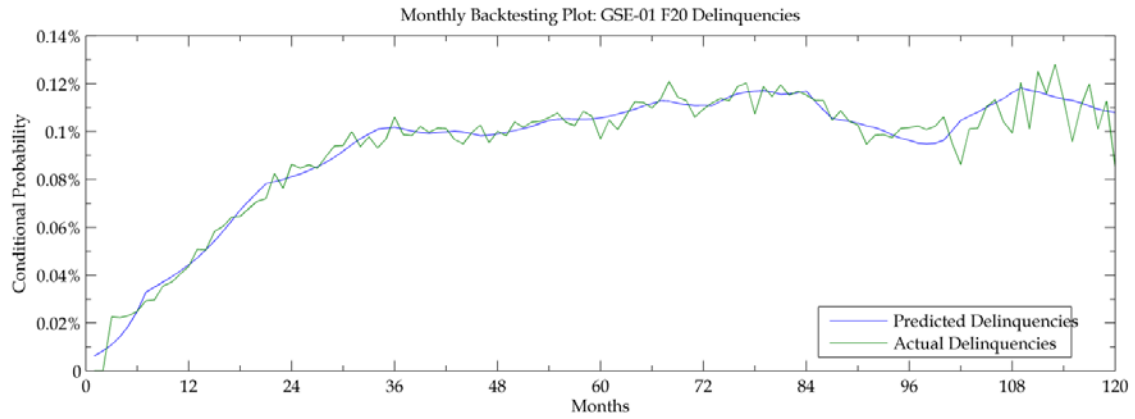
Variable	Spline Interval		Prepay		Default	
	Min	Max	Coef.	Std. Err.	Coef.	Std. Err.
Pay Change Spline 1	-200	-46.6	-0.006133	0.001788	0.03775	0.000664
Pay Change Spline 2	-46.6	-32.5	0.014487	0.004204	0.01423	0.00063
Pay Change Spline 3	-32.5	-18.5	0.011504	0.0042	0.02652	0.000568
Pay Change Spline 4	-18.5	0.00007	0.084298	0.002044	0.01461	0.000363
Pay Change Spline 5	0.00007	10	-0.012065	0.001456	-3.8E-06	6.74E-06
Post UPB Spline 1	0.00627	-0.0024	6.27E-06	5.26E-07	-2.4E-06	1.8E-07
Post UPB Spline 2	0.00379	-0.0005	3.79E-06	5.37E-07	-5.1E-07	1.65E-07
Post UPB Spline 3	0.00067	0.00036	6.7E-07	5.63E-07	3.6E-07	1.43E-07
Post UPB Spline 4	-0.003	-0.0008	-3.04E-06	5.05E-07	-8E-07	1E-07
Post UPB Spline 5	0.0007	-6E-07	7E-07	3.91E-07	-6.2E-10	6.47E-08
HPA Spline 1	-0.2	-0.067	-1.014633	0.303474	-0.91963	0.092717
HPA Spline 2	-0.067	-0.031	3.820714	1.178073	2.04724	0.208408
HPA Spline 3	-0.031	-0.006	-0.380739	1.843504	1.04052	0.316177
HPA Spline 4	-0.006	0.012	38.24566	1.864367	-2.39228	0.419078
HPA Spline 5	0.012	0.2	1.3786	0.056954	-1.89114	0.079996
Refi Incentive Spline 1	-20	-2.35	0.541373	0.13035	0	0
Refi Incentive Spline 2	-2.35	-1.21	-0.214571	0.051842	0	0
Refi Incentive Spline 3	-1.21	0.665	0.12517	0.01972	0	0
Refi Incentive Spline 4	0.665	1.69	0.098323	0.021963	0	0
Refi Incentive Spline 5	1.69	5	0.08607	0.010105	0	0
UnEmp Rate Spline 1	0	6.9	-0.153535	0.008174	0.04785	0.003649
UnEmp Rate Spline 2	6.9	8.6	-0.481558	0.020286	0.00175	0.005043
UnEmp Rate Spline 3	8.6	10	0.011858	0.033204	0.05651	0.006013
UnEmp Rate Spline 4	10	11.1	-0.146284	0.049305	0.07976	0.007322
UnEmp Rate Spline 5	11.1	15	-0.27477	0.040082	0.06717	0.004365

11. Appendix C: Back-Testing Plots

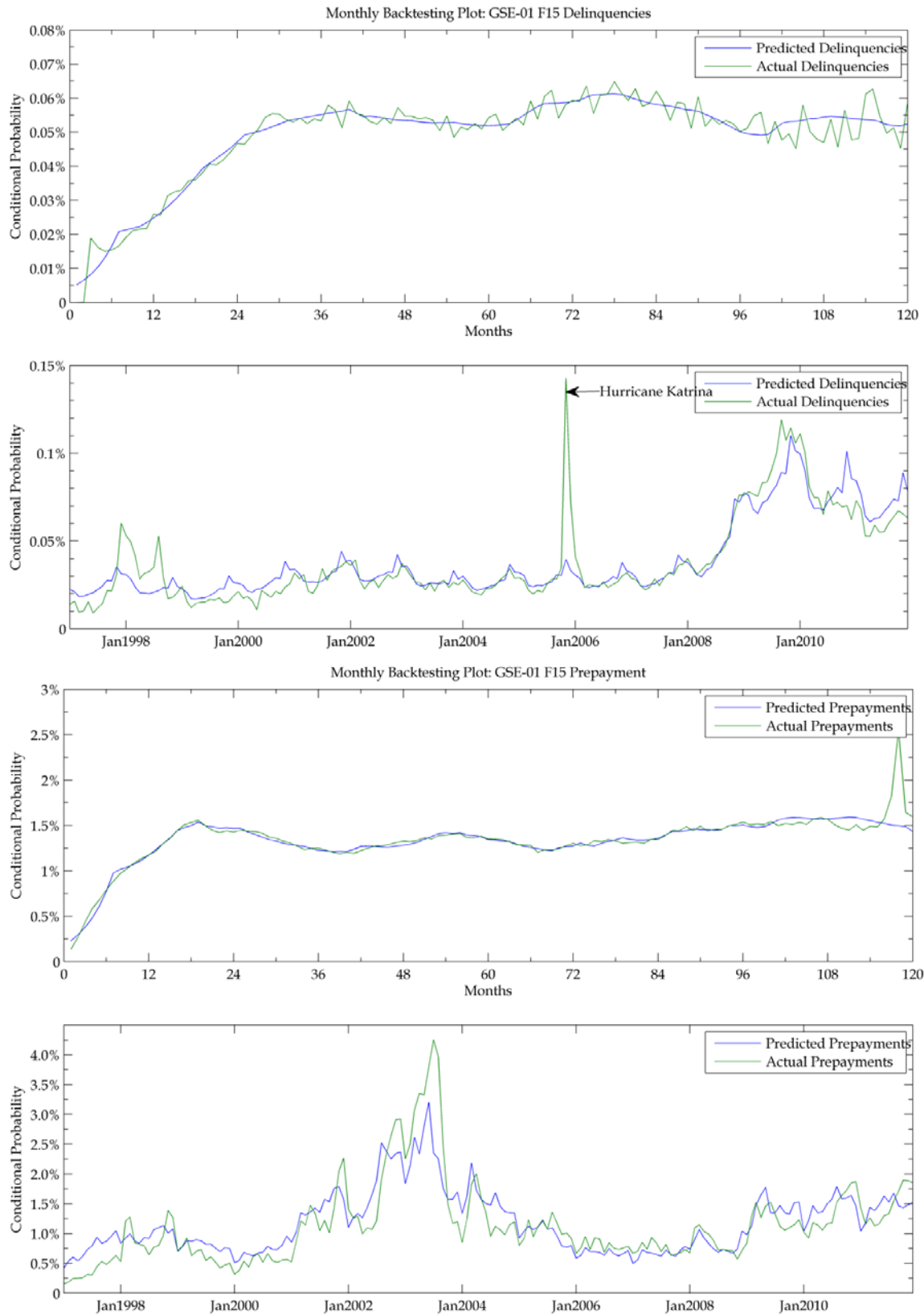
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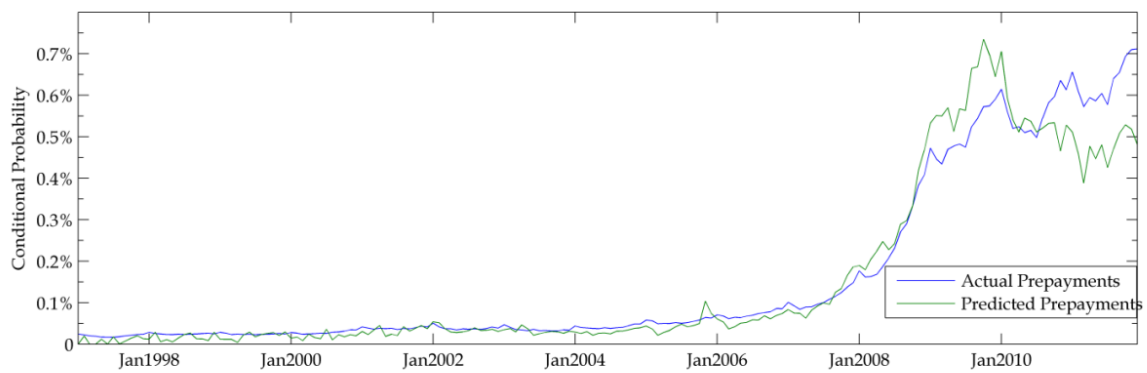
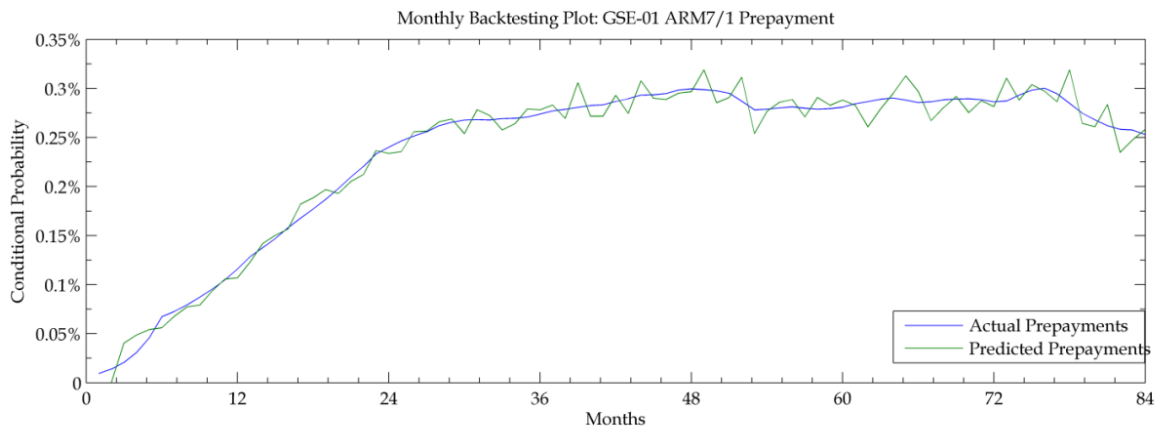
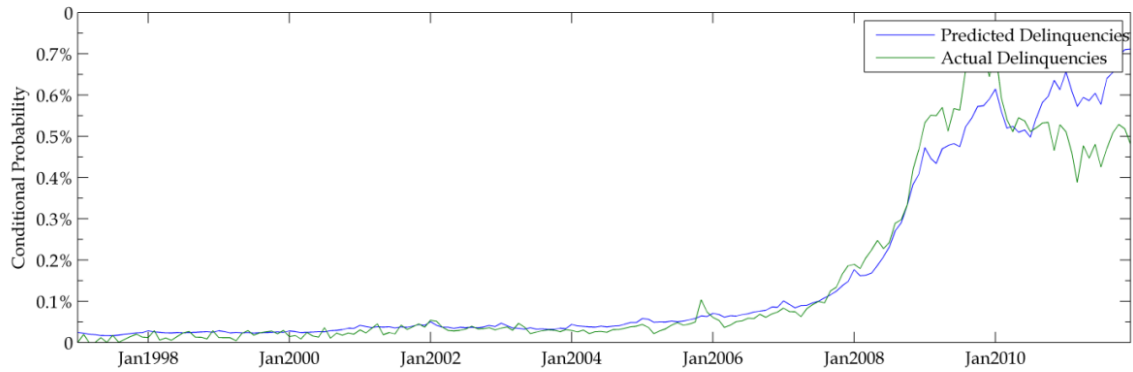
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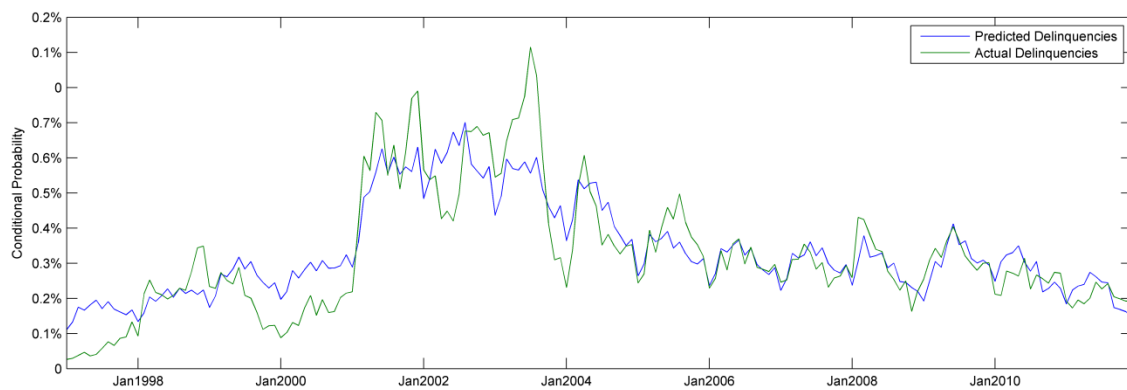
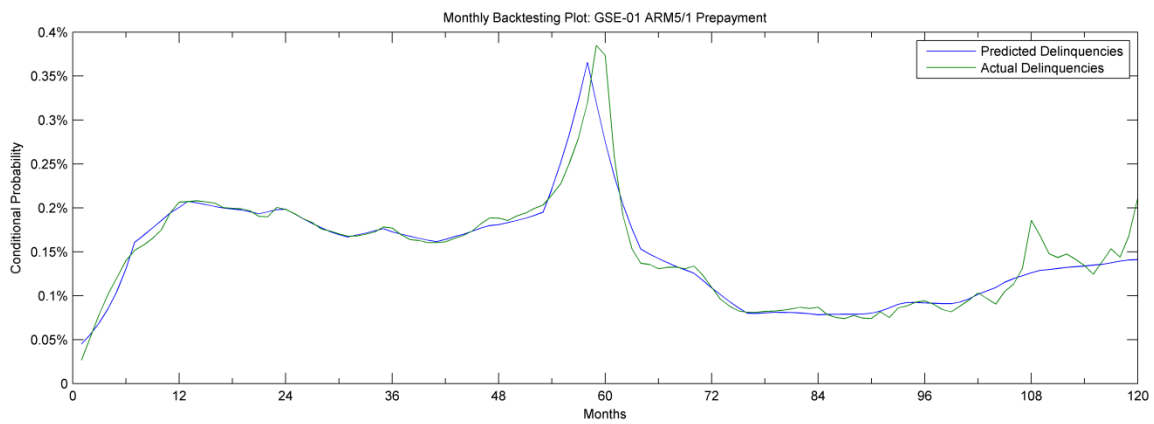
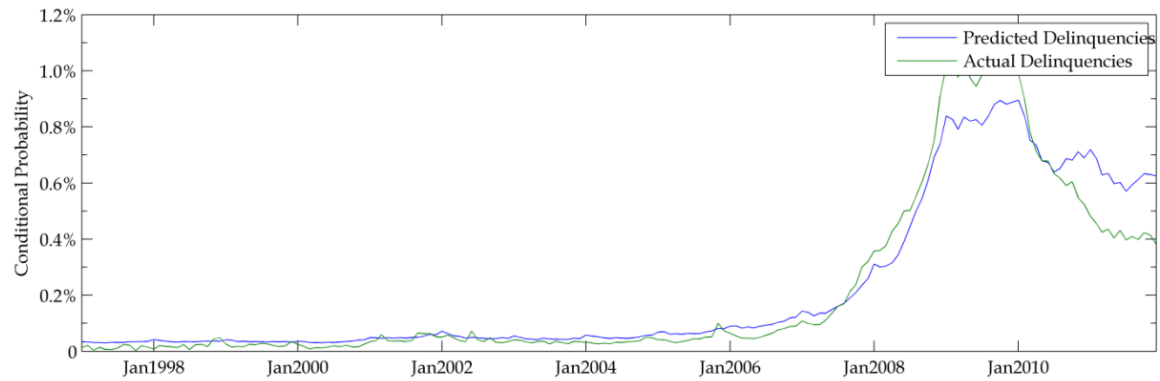
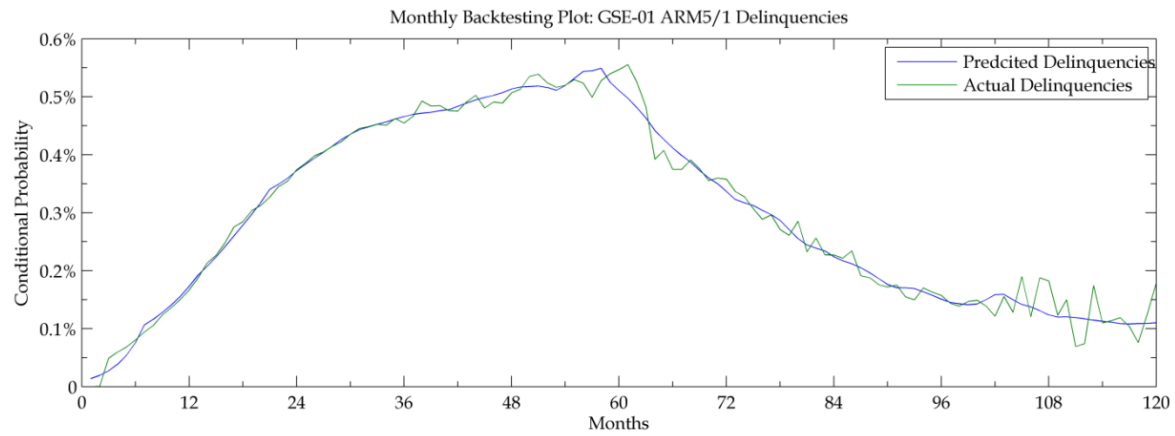
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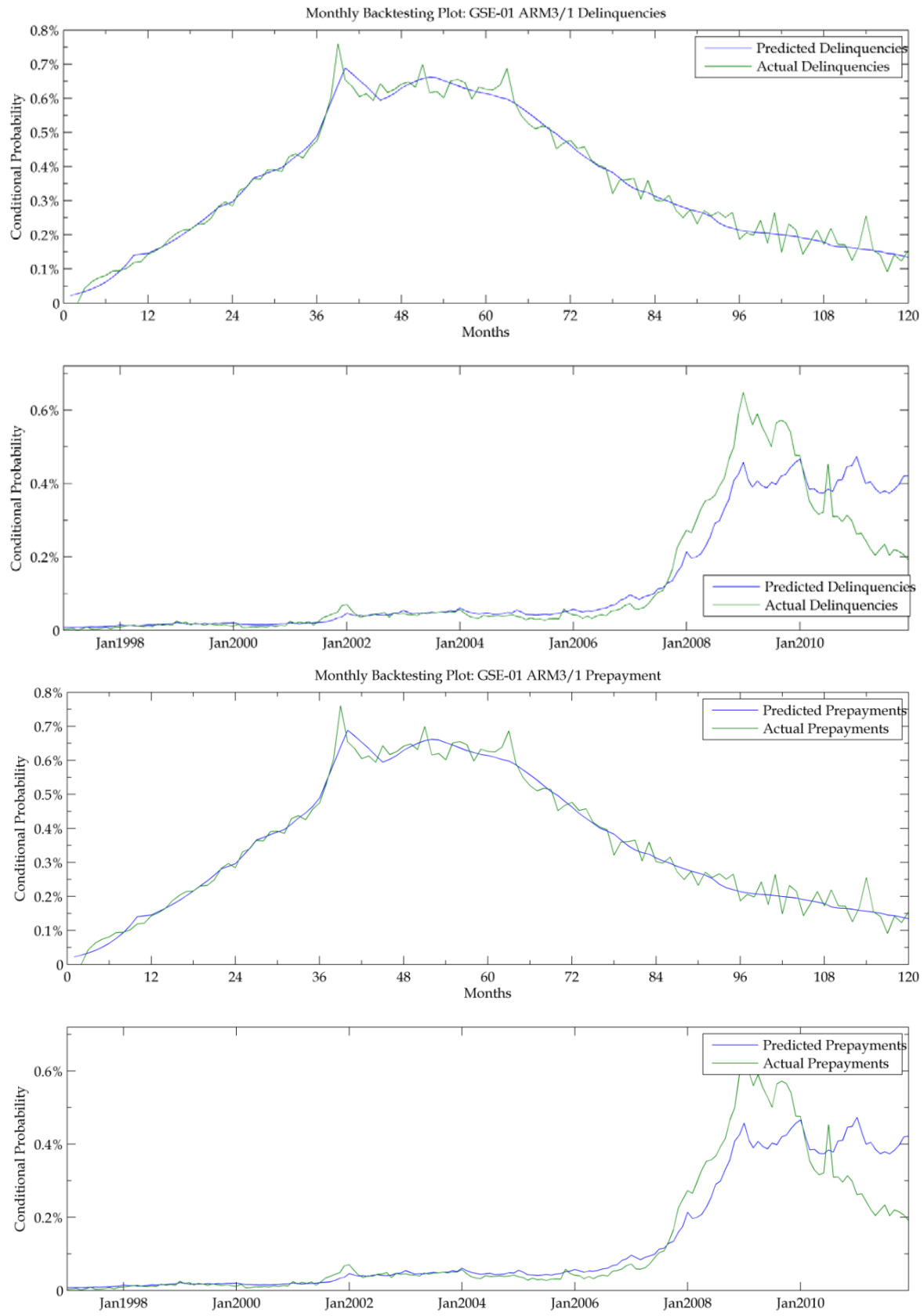
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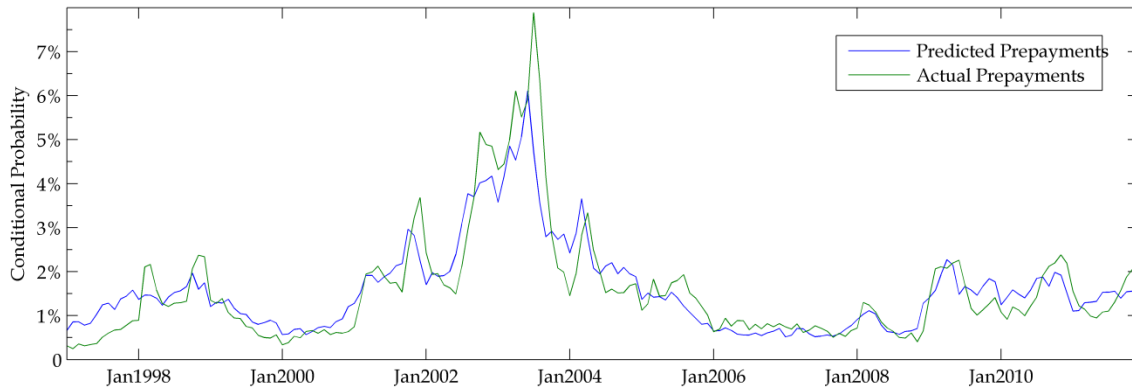
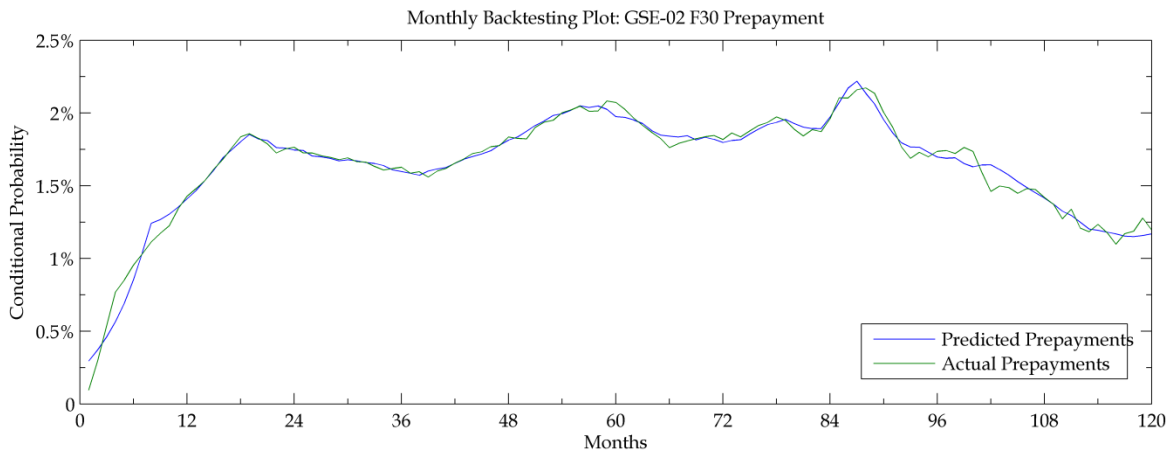
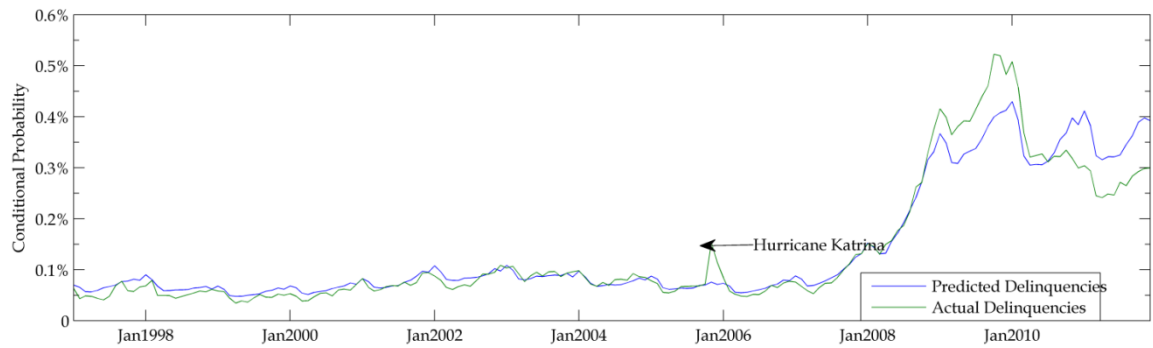
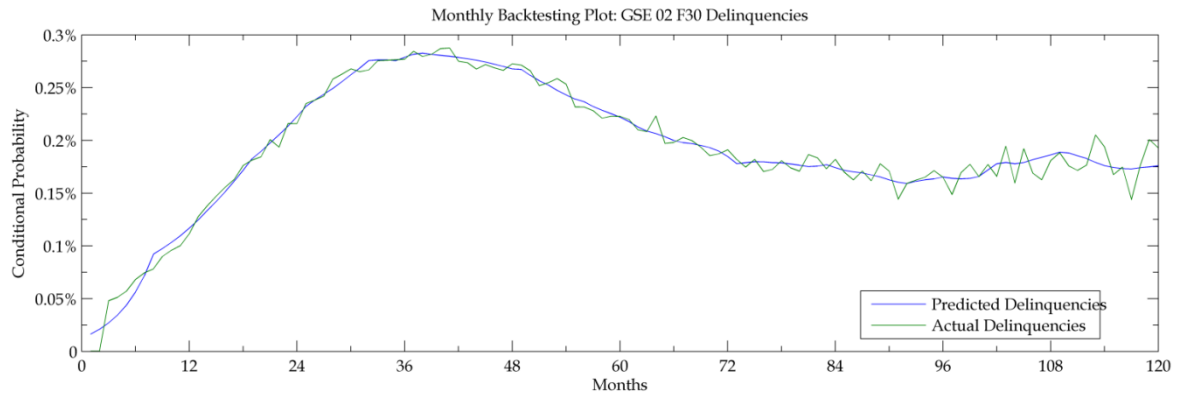
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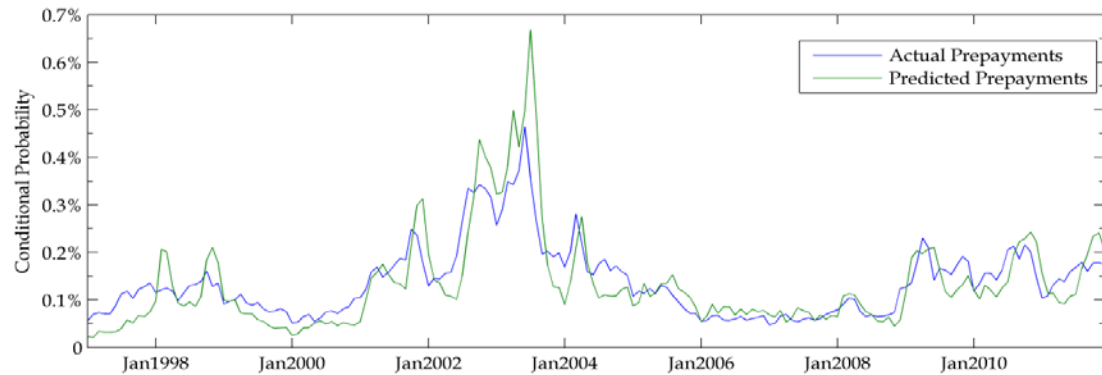
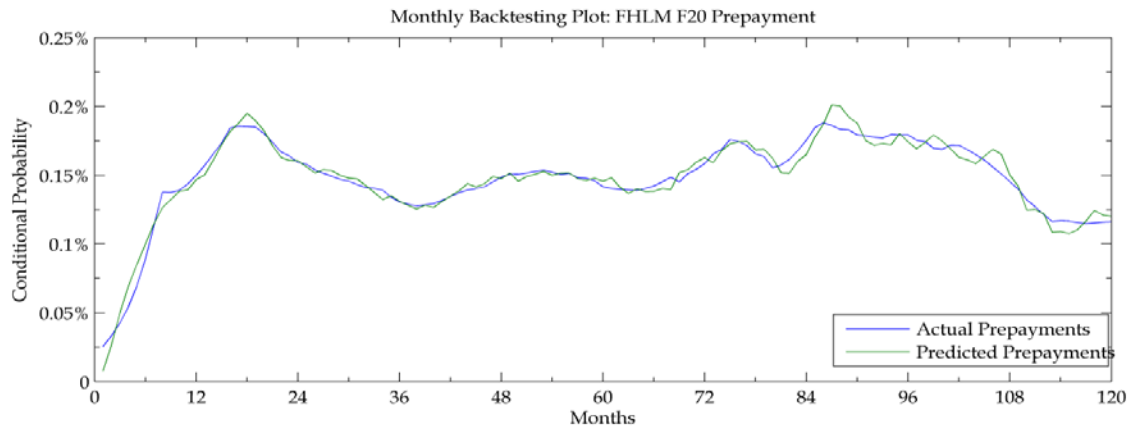
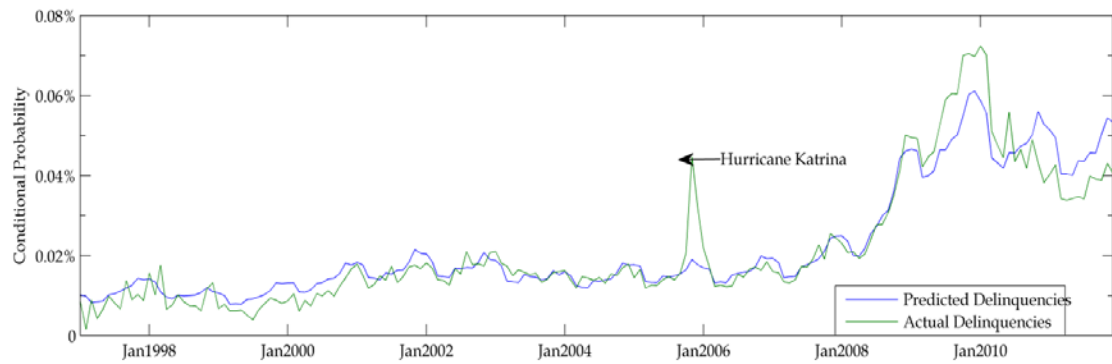
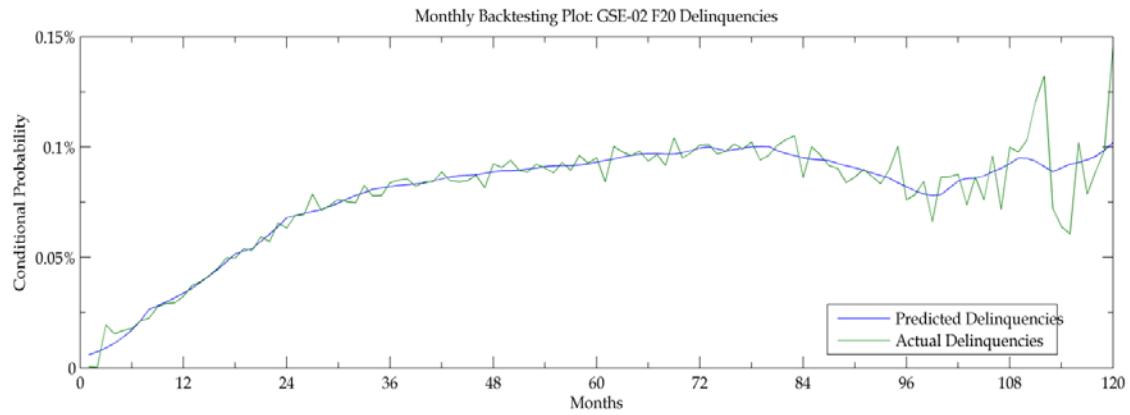
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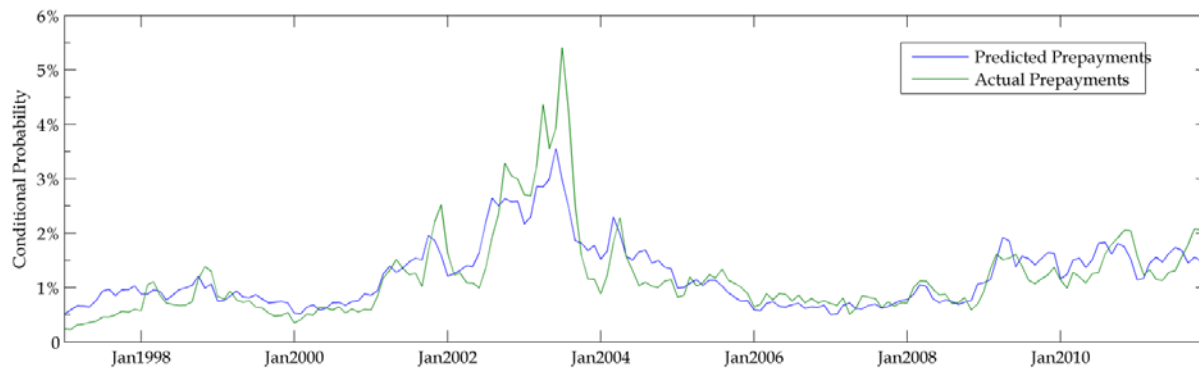
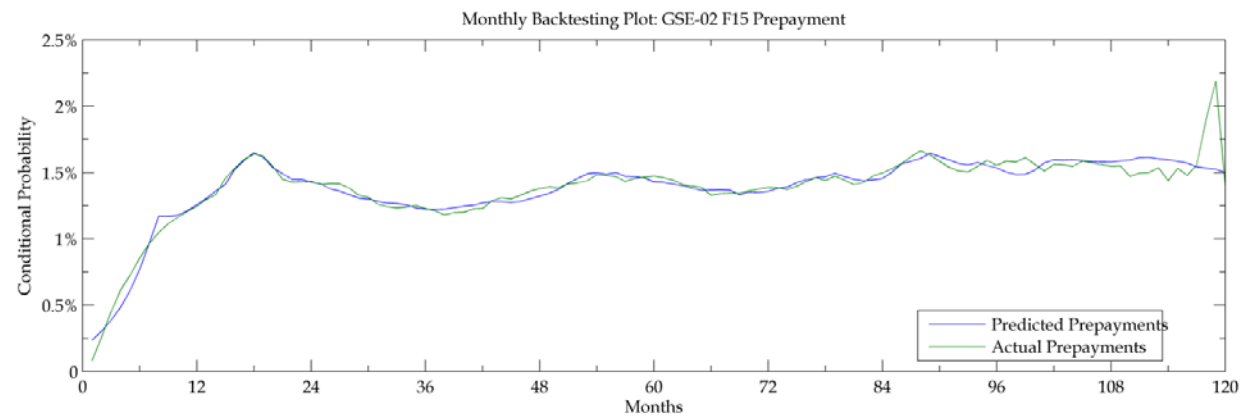
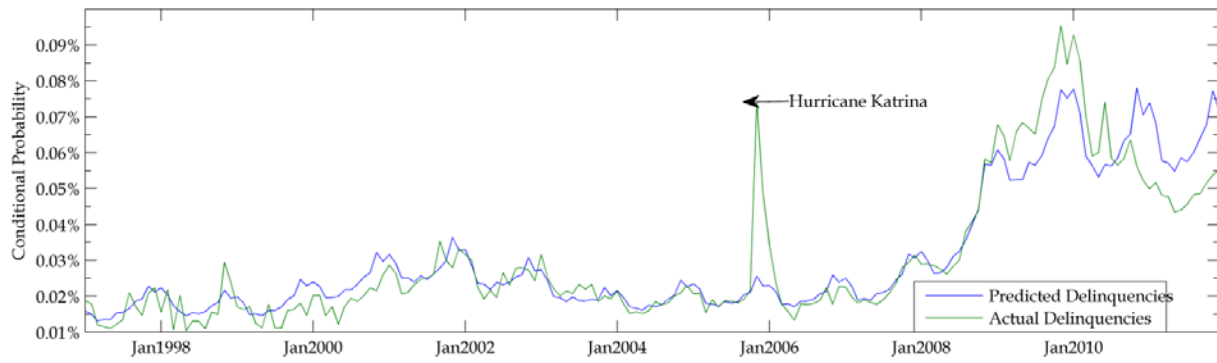
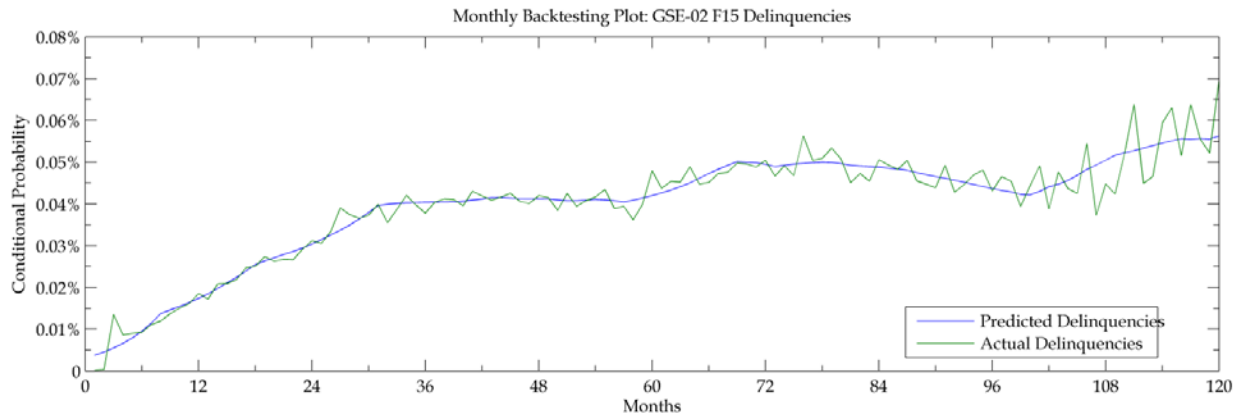
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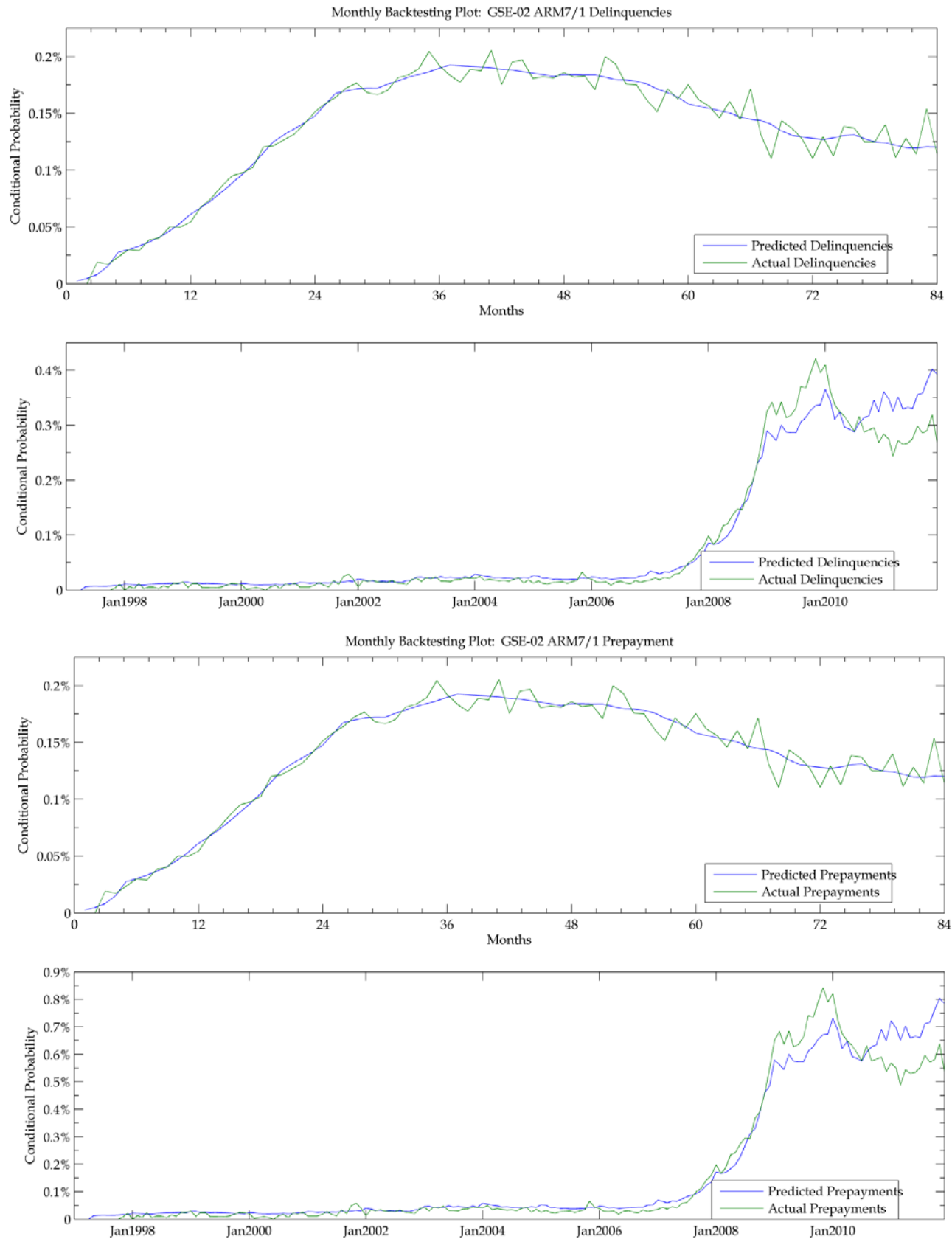
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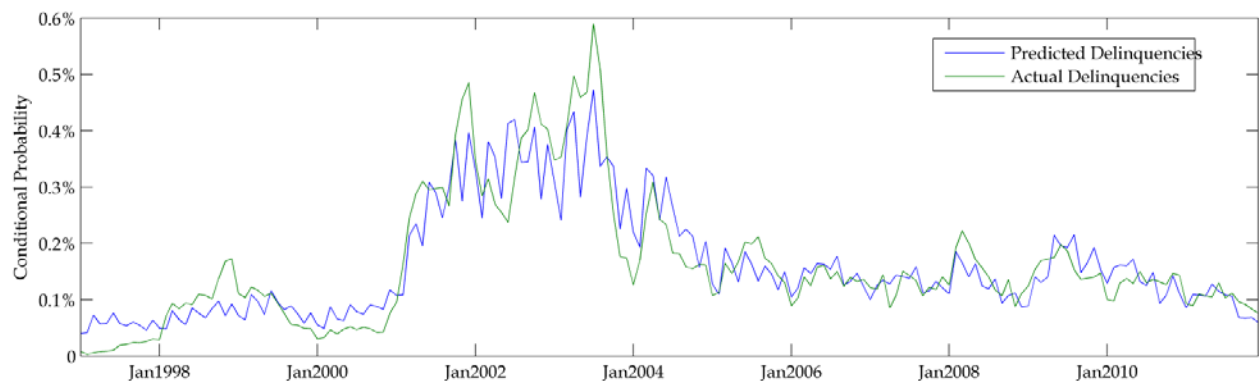
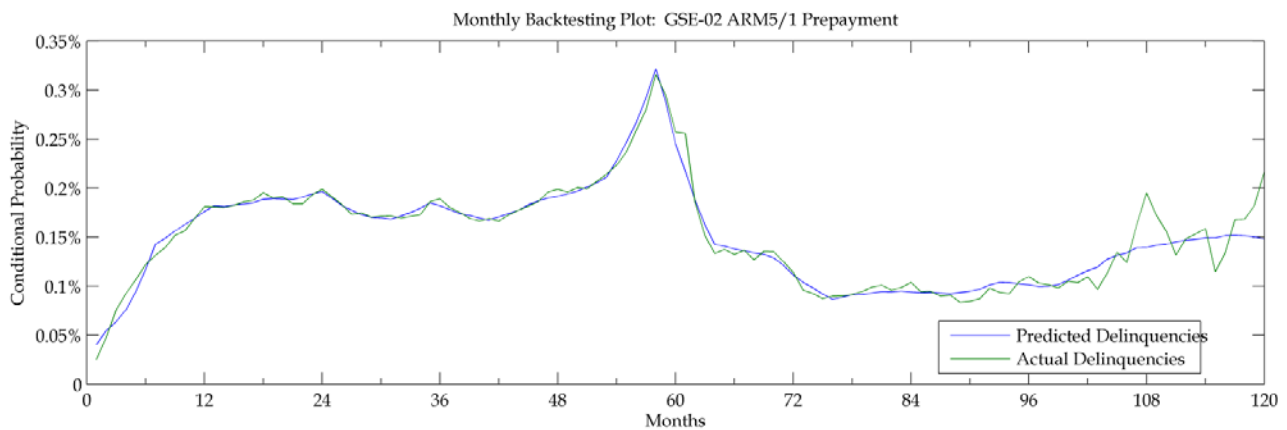
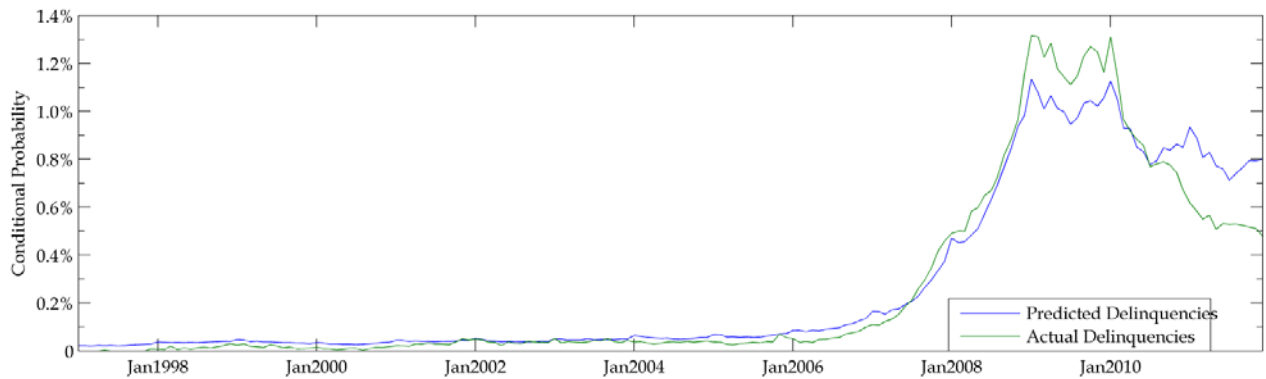
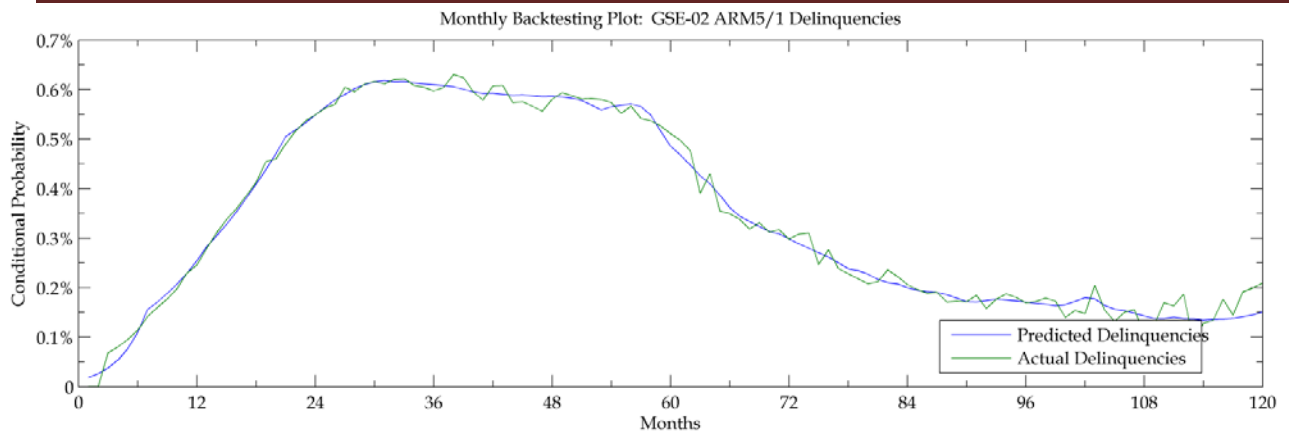
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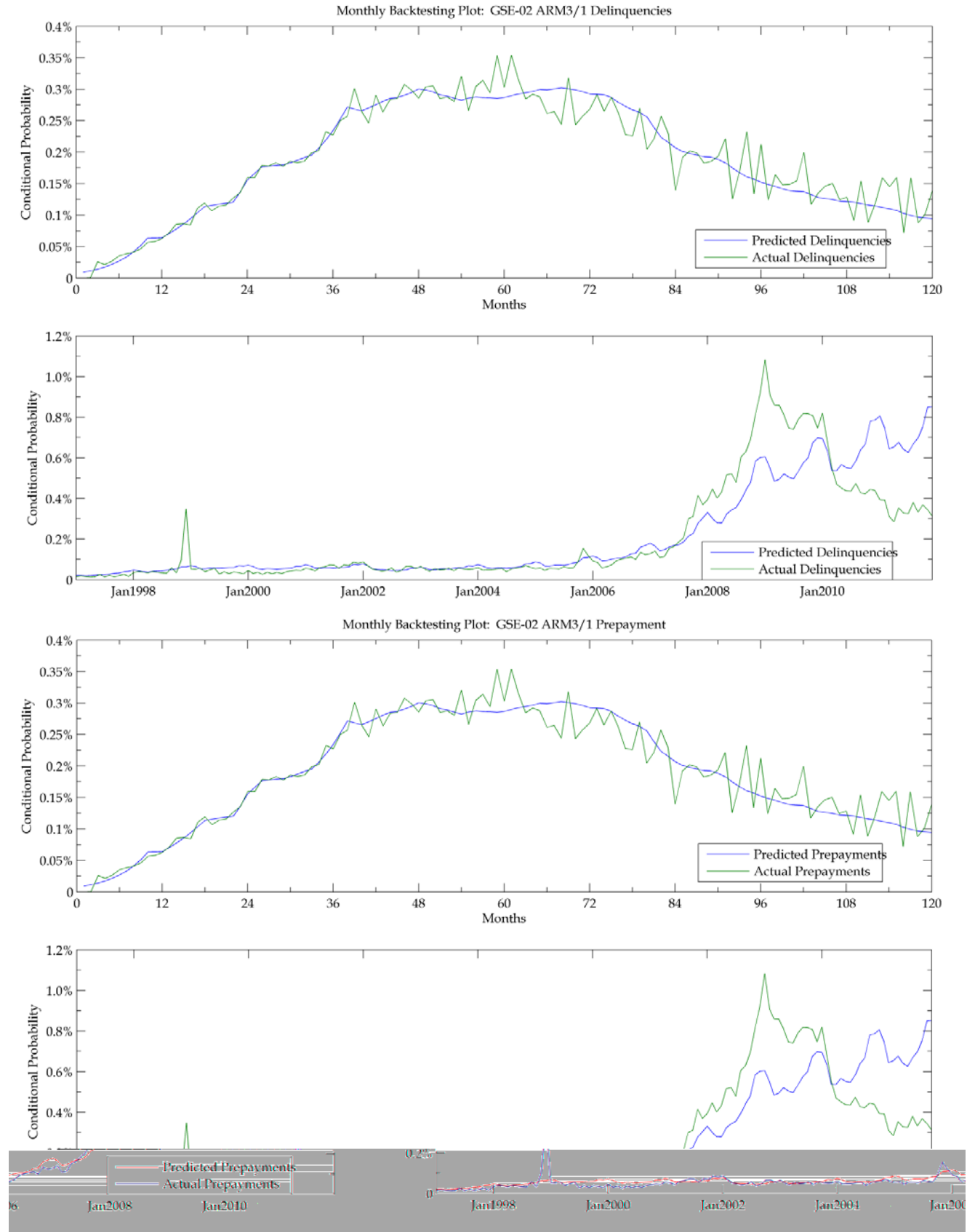
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12. Appendix D: Non-Performing Loan Equation

Parameters

Non-Performing Loan Equations

Multinomial Logit Lifetime Loan Resolutions with Foreclosure Complete as the Control

Variable	Spline Interval		Prepayment			Foreclosure Alternative			Reperformance		
	min	max	Coef.	Std. Err.	z	Coef.	Std. Err.	z	Coef.	Std. Err.	z
Constant			6.8012	0.0817	83.24	-7.1386	0.1800	-39.7	1.9469	0.1290	15.1
Credit Score Spline 1	0	0.623	-3.3696	0.1256	-26.83	3.1252	0.2491	12.55	0.7523	0.2010	3.74
Credit Score Spline 2	0.62	0.661	-8.5704	0.2718	-31.53	0.9142	0.4070	2.25	-6.7018	0.3919	-17.1
Credit Score Spline 3	0.66	0.703	-2.9533	0.2735	-10.8	3.0389	0.3247	9.36	-3.6828	0.3791	-9.71
Credit Score Spline 4	0.7	0.75	0.6599	0.2999	2.2	4.6398	0.2941	15.77	-1.0831	0.4032	-2.69
Credit Score Spline 5	0.75	0.85	5.7309	0.4614	12.42	5.2081	0.4209	12.37	1.8918	0.6039	3.13
Non Owner Occupied			-0.3727	0.0097	-38.48	-0.1870	0.0097	-19.4	-0.4872	0.0139	-34.97
Condominium Structure			0.0951	0.0102	9.32	0.1269	0.0098	12.9	-0.1908	0.0150	-12.72
Manufactured Housing			-0.4123	0.0228	-18.12	-0.5082	0.0409	-12.4	-0.0523	0.0296	-1.77
Planned Urban Dev.			-0.0620	0.0093	-6.64	0.1629	0.0089	18.34	-0.0823	0.0133	-6.2
Judicial State			0.3835	0.0056	68.62	0.5306	0.0074	72.1	0.4851	0.0080	61
MI Coverage % Spline 1	0	0.25	1.0543	0.0309	34.1	-2.3442	0.0398	-58.8	0.1733	0.0466	3.72
MI Coverage % Spline 2	0.25	0.7	-1.8812	0.1211	-15.54	0.0924	0.1711	0.54	-0.5262	0.1933	-2.72
MTM LTV @ F90 Spline 1	0	0.68	-6.0206	0.0418	-143.9	2.2740	0.1348	16.87	-5.5332	0.0503	-110.1
MTM LTV @ F90 Spline 2	0.68	0.82	-5.8659	0.0687	-85.36	3.0179	0.1201	25.13	-5.5557	0.0996	-55.76
MTM LTV @ F90 Spline 3	0.82	0.99	-5.7765	0.0747	-77.31	0.9289	0.0715	12.99	-4.0467	0.1025	-39.47
MTM LTV @ F90 Spline 4	0.99	1.2	-0.5050	0.0581	-8.69	1.5465	0.0284	54.47	-1.7260	0.0686	-25.16
Unemployment Spline 1	0	5.5	-0.1839	0.0047	-38.87	-0.0150	0.0103	-1.46	-0.1296	0.0081	-16.01
Unemployment Spline 2	5.5	7.8	-0.2614	0.0048	-54.54	0.1337	0.0067	19.87	0.2916	0.0068	42.77
Unemployment Spline 3	7.8	10.3	-0.1101	0.0055	-19.87	0.1713	0.0050	34.49	0.1439	0.0062	23.17
Unemployment Spline 4	10.3	14	0.0459	0.0075	6.13	0.1107	0.0047	23.32	0.1886	0.0066	28.44
Orig. UPB Spline 1	0	94	0.0083	0.0002	40.84	0.0094	0.0005	19.81	0.0067	0.0003	23.02
Orig. UPB Spline 2	94	150	0.0029	0.0002	15.77	0.0090	0.0003	31.81	0.0003	0.0003	1.2
Orig. UPB Spline 3	150	232	-0.0031	0.0002	-20.72	0.0044	0.0002	29.05	-0.0013	0.0002	-6.12
Orig. UPB Spline 4	232	360	0.0005	0.0001	4.75	0.0024	0.0001	29.56	0.0003	0.0001	2.08