

# The Collateral Analytics New Credit Risk Model

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## Introduction

The new credit risk model (CRM) recently developed by Collateral Analytics is designed to better predict mortgage performance for new and seasoned individual mortgages and pools of mortgages. The CRM takes advantage of Collateral Analytics' industry-leading Automated Valuation Model (AVM) to evaluate expected defaults and the losses on these defaults. The CRM is responsive to the upcoming Current Expected Credit Loss (CECL) impairment standards for banks.<sup>1</sup> CECL requires that expected losses need to be projected for all loans, not just impaired loans. Therefore, banks and other financial institutions need robust models and credible economic and financial forecasts. To aid in this process, the new CRM includes a wide variety of fixed rate and adjustable mortgages.

The backbone of the model is the estimated default and prepayment models. To help reflect structural and behavioral differences in real estate and mortgage markets, the model's key parameters (relationships) are implemented at the regional level (census divisions). In addition, to help reflect the uniqueness of a fixed rate borrower and an adjustable rate borrower, adjustable and fixed rate mortgage parameters are estimated separately.

The model generates a variety of measures – such as mortgage value, ratio of mortgage value to unpaid balance, Credit Risk Spread (CRS), etc. – based in part on estimates of expected future defaults and the timing of future prepayments (primarily from refinances and moves). In this paper, we will focus on the CRS, which measures the expected annualized cost of default. This cost is broken down into the expected credit loss and the cost of capital needed to insure against a severe or stressed scenario (substantial house price decline).

## Credit Risk Model (CRM) Overview

The new CRM follows the basic structure of the original CRM developed by Collateral Analytics several years ago. The main drivers of defaults and losses are the updated loan to value ratio of the mortgage, borrower credit scores at origination, and labor market conditions. Other factors, such as location and

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<sup>1</sup>These changes are articulated in the Current Expected Credit Loss (CECL) impairment standard through the calculation of the Allowance for Loan and Lease Losses (ALLL). In June of 2016, the Financial Accounting Standards Board (FASB) announced the new requirements, which are scheduled to take effect for all banks in 2021 and Security Exchange Commission (SEC) registrants in 2020.

more detailed characteristics of the loan, also matter. For adjustable rate loans, the characteristics of the loan become more important in at least two regards. First, borrowers select into specific adjustable rate loans for unique reasons that are not observable, but the selection is typically an attempt to keep initial monthly payments lower than the payments on a comparable fixed rate loan. Second, the structure of an adjustable rate loan creates natural points in time where default and prepayment tend to increase substantially. For example, it is typical for an adjustable rate loan to have an initial time period where interest rates are fixed. After this time period, the interest rate on the loan and hence the monthly payment varies on a predetermined frequency. Consider a loan that is at its first reset date (the first time the interest rate can change). If interest rates have gone up since origination, then the borrower will experience an increase in the monthly payment. Even if interest rates have been flat, the borrower may face the same outcome if the initial rate on the loan is a “teaser” that is lower than the fully adjusted rate (index plus margin). At this point in time (when payments increase) the borrower may decide to replace the existing loan through a refinance. The new loan likely has lower monthly payments, at least until the new teaser expires. Alternatively, especially if the borrower cannot refinance into another loan, the borrower may not be able to make the larger payments and enter default. As a result, when interest rates increase or when ARM borrowers have low initial interest rates, prepayments and defaults will spike and increase expected losses and credit risk.

### Examples of Credit Risk Spreads

A compact way to encapsulate all the risk factors is a measure we will call the Credit Risk Spread (CRS). To create the CRS we divide the credit risk charge (expected credit losses plus the cost of capital) by the balance of the loan at origination (for a new mortgage) or the outstanding balance (for a seasoned mortgage). The CRS number is expressed in basis points so a 1 percent CRS is expressed as 100 basis points. To calculate the credit risk charge it is necessary to simulate expected losses. This is done using the parameters from the default, prepayment and losses models. To project the future, we use seven scenarios for house prices – which include expected, pessimistic (or stressed), and optimistic -- as well as projections of interest rates and labor market conditions.

Figure 1 shows the expected CRS for a sample 30-year fixed rate loan in San Diego, California, illustrating the impact of a variety of credit scores (FICO scores at origination) and Loan To Value (LTV) ratios (again at origination). What jumps out is that the risk varies substantially across both of these dimensions in the model. At low LTVs and high credit scores, the CRS is very small and less than 5 basis points. In contrast, high LTV and low credit scores can drive the CRS up to 60 basis points. The higher the LTV, the more sensitive the CRS is to the credit score. These relationships are not linear, highlighting the importance of risks being layered on a mortgage. Figure 2 repeats this analysis but changes the loan, on the same sample property, to a 15-year fixed rate loan. The sample non-linear relationships hold, but the lower risk of a shorter-term mortgage drives the CRS even lower. This reduction likely comes from a faster accumulation of equity through mortgage payments on a 15-year mortgage and the self-selection of certain types of borrowers into this higher monthly payment mortgage.



Figure 3 shifts the focus and projects losses for the same sample property, but now the borrower is using a standard 5/1 Adjustable Rate Mortgage (ARM). For this mortgage, interest rates are fixed for the first 5 years and then adjust every year for the remaining 25 years. The first thing to notice is that the CRS is substantially higher for the 5/1 ARM than for fixed rate mortgages. This reflects both the borrower selection process and the impact of changing interest rates on defaults and prepayments. As we move from very low to very high credit scores the CRS approximately doubles, ranging from approximately 70 basis points to a little over 180 basis points. These results emphasize the need to have separate models for fixed and adjustable rate mortgages, as the CRM does.

Figure 3

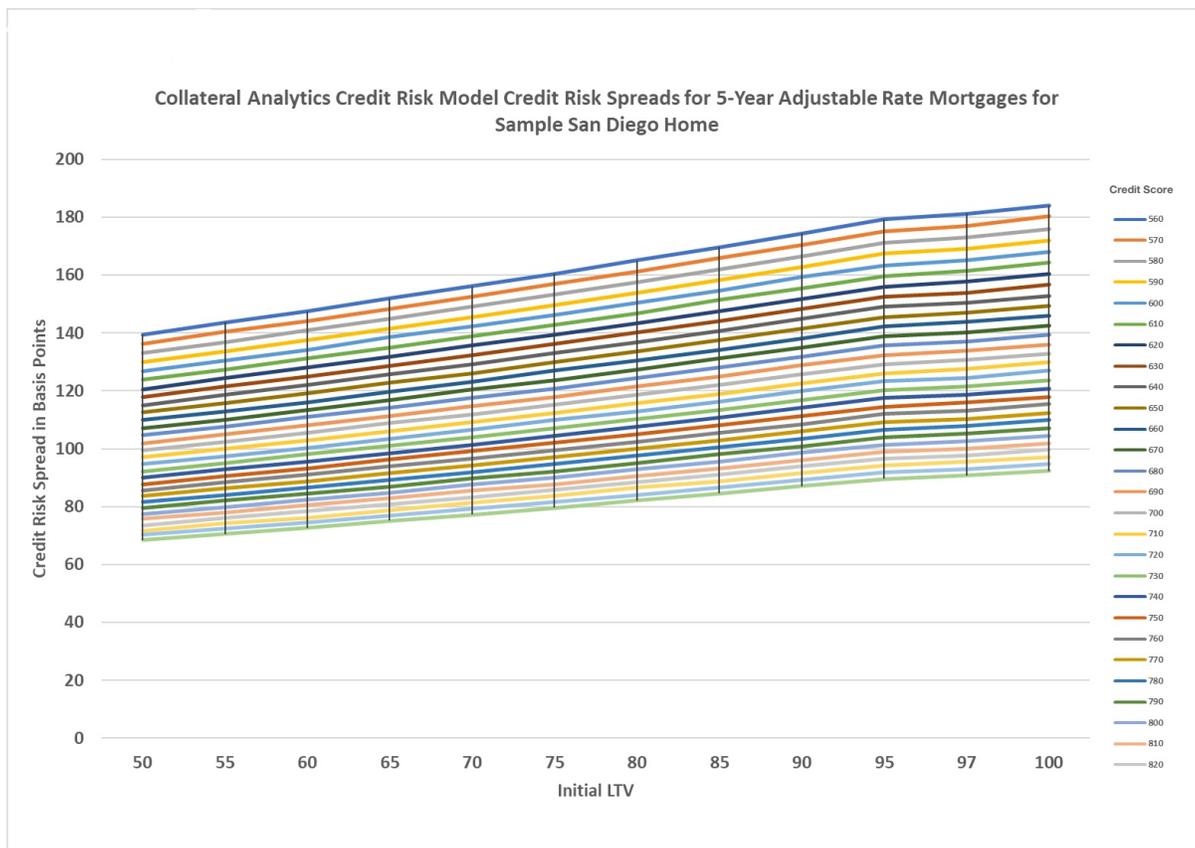
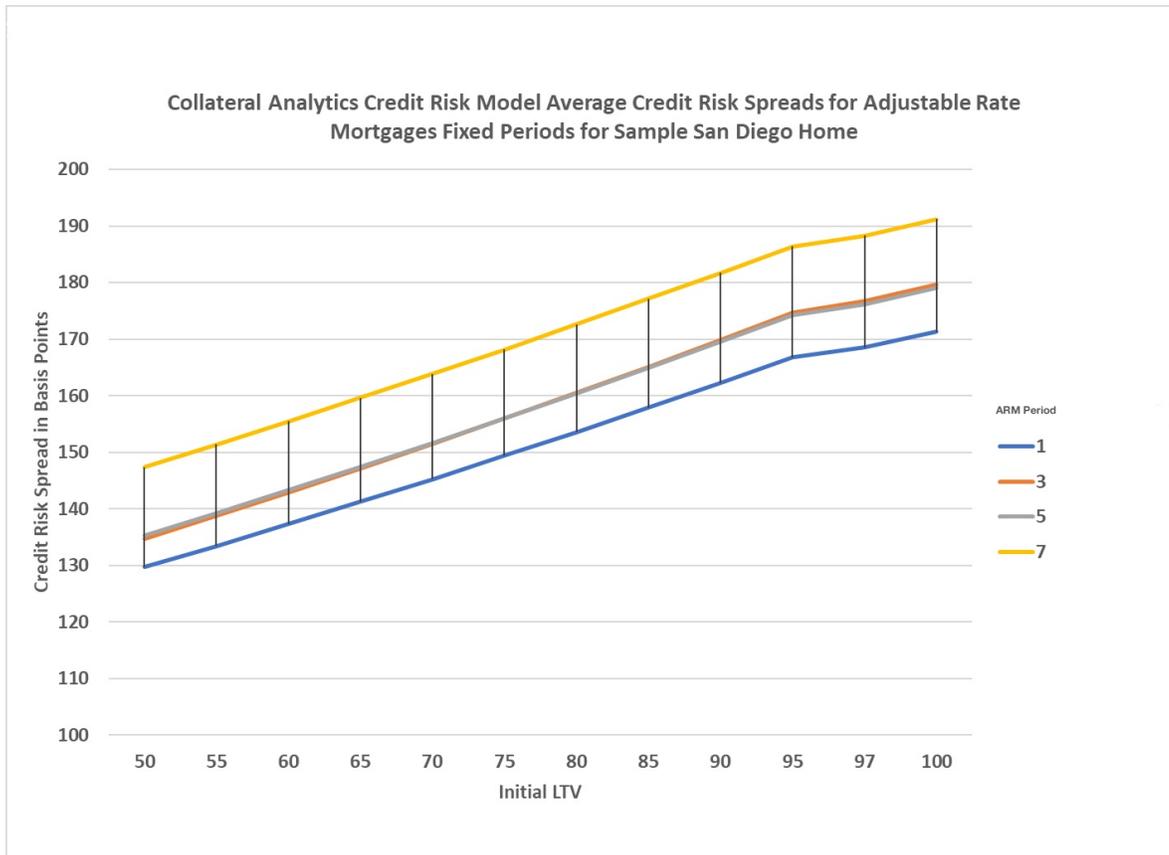


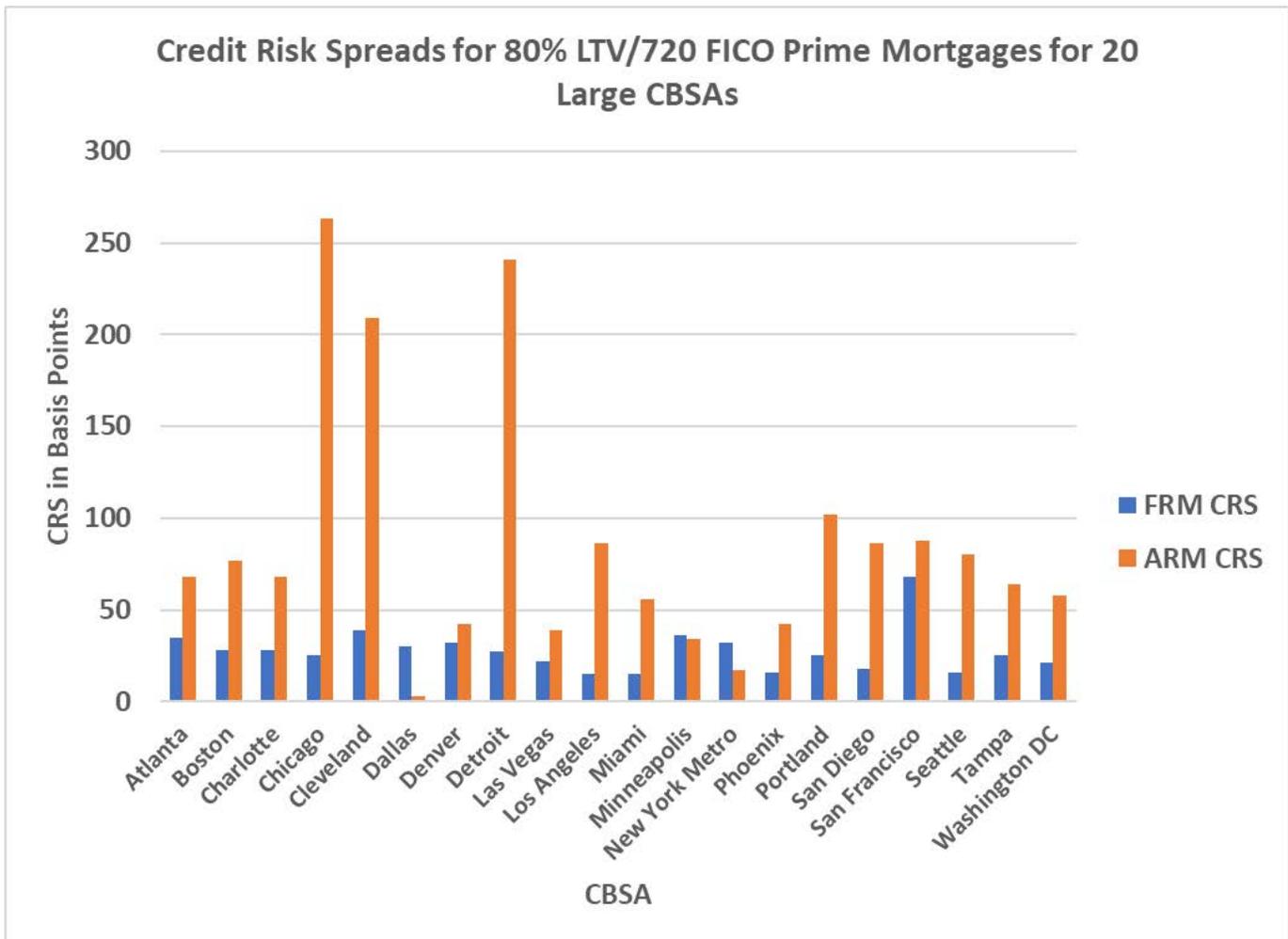
Figure 4 shows how the CRS varies across different initial fixed periods. Adjustable rate loans that start to adjust faster have lower CRSs. Three-year and five-year ARMs are very similar in performance while one-year and 7 or more year ARMs have substantially different default, prepay, and loss profiles – thus driving the CRS.

Figure 4



Another feature of the Collateral Analytics CRM is the ability to highlight variations in credit risk among different markets. Figure 5 shows the CRS values for a benchmark 80% LTV fixed and adjustable rate mortgage with 720 FICO Score for a representative home in each of 20 major CBSAs. These variations reflect historical differences in our default and prepayment models of mortgage performance among these markets as well as what our respective home models forecast for home prices going forward.

Figure 5



### Conclusions

This paper highlights the importance of providing a flexible modeling strategy when estimating risk for adjustable rate loans. The new Collateral Analytics Credit Risk Model (CRM) provides expected performance measures for individual mortgages over their lifetime. The model also provides the same types of risk measures for a pool of mortgages over their lifetime. It takes into consideration the nature of the location of the property and the characteristics of the loan, thus making it an ideal tool for CECL compliance. The risk measures are available for new originations, seasoned loans and pools of loans. embedded in the CRM is Collateral Analytics' leading AVM technology and detailed models of default, prepayment and losses.