



Research Publication

Prepayment Modeling Challenges in the Wake of the 2008 Credit and Mortgage Crisis

William Burns, Ph.D.
Director of Quantitative Research

Abstract

There are five key factors that are considered when refining and maintaining the BondEdge® prepayment model. First, we consider the historical performance of the model. Second, we examine whether the risk measures across a wide range of vintages and coupon ranges are reasonable and consistent. Third, we keep a close eye on macro-economic variables that may influence prepayment behavior. Fourth, we compare our fixed rate mortgage (FRM) index duration against the major index providers. Fifth, we compare our model against the SIFMA dealer median prepayment speeds.

1 Prepayment Model Specification

Every prepayment model is unique; however three factors lie at the core of most models. First and foremost, a prepayment model consists of a given set of functionalities. For example, a prepayment model might contain functionality to either slow down or speed up prepayment projections based on the age of the loans under consideration. Similarly, models might also be sensitive to original loan size, borrowers with larger loan sizes will save more in terms of absolute dollars than borrowers with smaller loans given an equivalent refinancing rates.

Second, the parameterizations for the functionalities mentioned above determine the ultimate behavior of the model. This is best illustrated by considering the financial and housing crisis of 2008. Prior to 2008, a given prepayment model may have forecast high prepayment projections (e.g. in excess of 45% CPR) given a 100 basis point refinancing incentive prior to 2008. This was justified by the economic conditions at the time. Lenders were making loans, even without full documentation of income or assets. In addition, the housing market was strong as measured by home price appreciation and existing home sales.

However in 2008 and 2009, the same prepayment model would not likely have produced the same high prepayment projection given the same 100 basis point refinancing incentive. This is due to the fact that many models received a parameter update during this timeframe to more accurately reflect the economic conditions that applied. Specifically, this timeframe was marked by a weakening housing market, rising levels of unemployment, and tougher lending standards creating a liquidity crisis for bor-

rowers.

Third, pool and loan level data are helpful in determining the true incentive that borrowers have to refinance. Fannie Mae, Freddie Mac, and Ginnie Mae supply monthly updates on the pools they issue or back. Such updates include current pool factor, weighted average loan age, and weighted average maturity, among others.¹

2 Historical Performance

One of the best ways to test the predictive power of a prepayment model using these three factors (i.e. model functionality, model parameterization, and loan characteristics) is to perform an historical analysis. The historical performance of a prepayment model can be measured by comparing projected prepayment rates versus actual prepayment rates. The historical analysis can provide feedback as to whether the prepayment model possesses sufficient functionality to respond to various economic conditions and how a given set of parameter settings of the model project prepay behavior over the passage of time.

As seen in the Figure 1 below, the average 5.00% Fannie Mae 30-year fixed rate mortgage issued in 2005, represented by the BondEdge identifier FN050038, had historic prepayment speeds ranging from about 3.0% CPR in April 2008 to just over 30.0% CPR in July of 2010. An almost imperceptible seasoning profile holds from February 2008 through January 2010, as actual historical prepayments rose modestly from less than 1.0% CPR to about 3.0% CPR. This pattern of seasoning is also visible in the model results.

It is also interesting to note that as the credit crisis hit in 2008, actual prepayment speeds fell to under 6.00% due to falling housing prices and a lack of funding opportunities in the refinancing arena.

The results of an historical comparison can then lead to a parameter update to improve the correlation between the speeds projected by the model and the actual speeds. Typically, the decision to update model parameters will not be based solely on the performance of a narrow set of collateral characteristics, but on a range of coupon rates, and vintage years.

Model stability (i.e. stable model functionality and parameters) is desirable, since it leads to a consistency in calculated risk measures such as option-adjusted spread and

¹For structured deals with collateral backed by either whole loans (WH) or residential mortgage backed securities (RMBS), current collateral information is more difficult to come by since the loans are not associated with Fannie Mae, Freddie Mac, or Ginnie Mae. BondEdge has recently been enhanced to include collateral updates on WH and RMBS collaterals from a leading third party data provider.

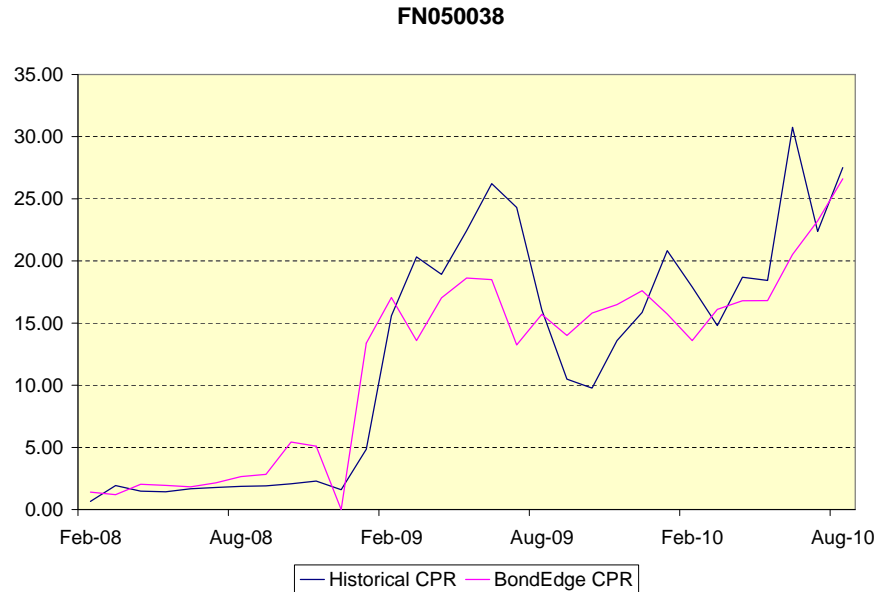


Figure 1: Prepayment comparison of historical speeds versus the BondEdge Prepayment Model for Fannie Mae issued, 30-year amortization, 5.00% Net WAC, 2008 vantage, fixed rate mortgages.

effective duration over time. Consequently, prepayment model parameters tend to be retuned once or twice a year, or when major structural changes occur in the economy which influence borrower behavior. An update history of the BondEdge FRM prepayment model is included within Figure 4 below.

3 Risk Measure Reasonability and Consistency

A prepayment model should be designed to deliver consistent risk measures for each issuer and loan term across the wide range of possible coupon and vintage combinations. For example, Figure 2 below show the relationship between lifetime prepayment speed (in this case % of PSA), option-adjusted spread (OAS), effective duration, and convexity for newly issued Fannie Mae (FNMA) and Ginnie Mae (GNMA) issues with 30-year and 15-year loan terms. This information is available on a monthly basis in the Fixed Rate MBS Report on the BondEdge Private Client Website.

Ensuring that the prepayment model provides consistent results typically means making sure that risk measures produced by the model exhibit reasonably continuous be-

havior across coupons within the same issuer and vintage year. For example, one should expect the effective duration to decrease as the coupon rate increases (for newly issued collateral), since the higher prepayment speeds associated with the higher coupon rates will shorten the life of the security.²

4 Macro-Economic Environment

Since the mortgage and credit crisis of 2008, a number of unusual macro-economic events influenced the way that prepayment models have performed. In response, the prepayment models have been updated to more accurately reflect borrower behavior.

For example, from the end of 2008 through much of 2009, the relationship between primary and secondary mortgage rates³ became unstable (refer below to Figure 3).

Primary rates reflect the mortgage rate that borrowers can actually obtain from lenders at a specific time. One of the best known measures of the primary mortgage rate is through the weekly Primary Mortgage Market Survey® (or PMMS) conducted by Freddie Mac.

Secondary mortgage rates are captured by price dy-

²The inverse relationship between coupon and effective duration may not hold for more seasoned mortgages since they tend exhibit burnout (i.e. a decreased sensitivity to refinancing incentive) as time progresses.

³ *Primary and Secondary Mortgage Rates in Today's Economy*

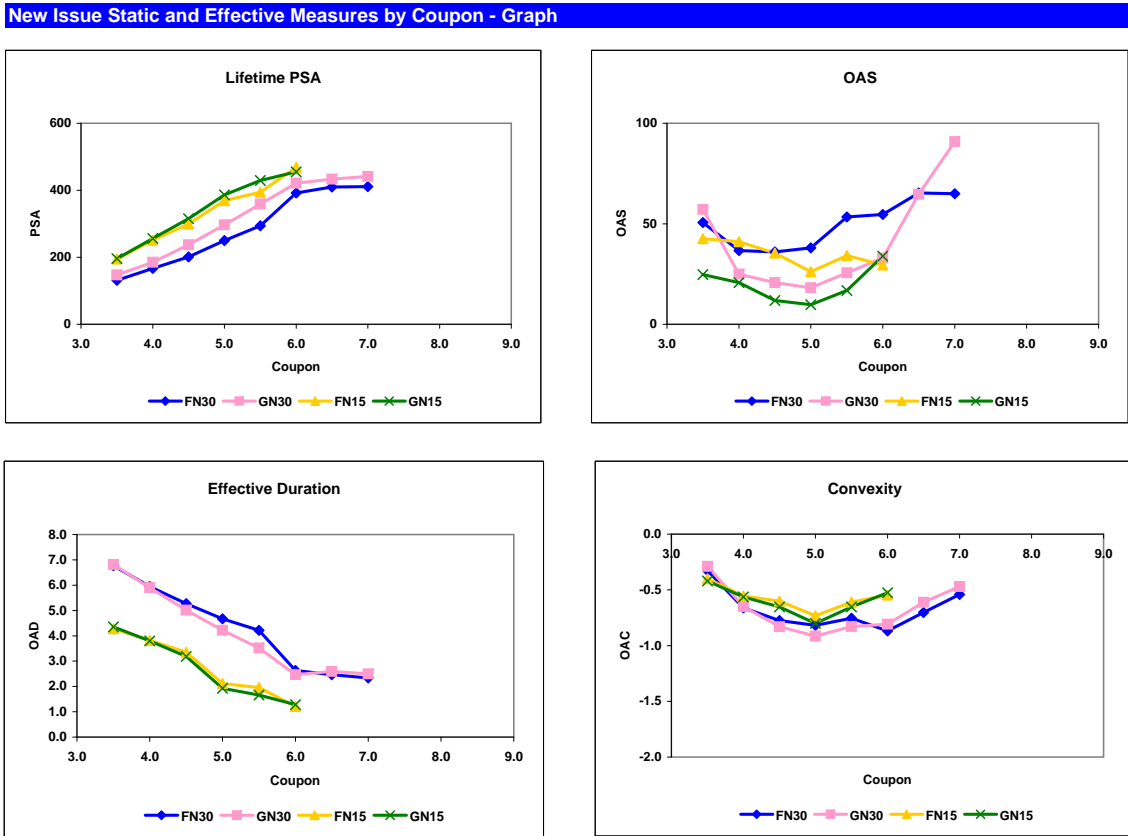


Figure 2: FRM Prepayment Related Risk Measures.

namics within the FRM TBA market. Each and every business day, a current coupon TBA rate (i.e. the coupon rate of a TBA priced at par) can be deduced by interpolating between premium and discount TBA mortgage prices against their coupon rate. A secondary mortgage rate is then obtained by adding a spread to the current coupon rate. Typically, the spread between primary and secondary mortgage rates is between 40 bps - 60 bps. However, in early 2009, the spread rose to 160 bps and remained at about 80 bps as of March 2010.

The instability of the primary and secondary mortgage rates can largely be attributed to the hesitance of banks to extend mortgage loans during the credit crisis. In order to slow down the loan making process, they simply raised their rates to higher levels thus forcing many buyers out of the housing market. Lenders also eliminated certain loan programs geared to reducing monthly payments (e.g. interest-only loans, and high loan-to-value loans, among others).

Many prepayment models use secondary mortgage rates to determine prepayment incentive. Consequently,

such models (or model inputs) had to be adjusted to account for the instability in primary and secondary mortgage rates. Changes were made within BondEdge, as well as many dealer models, to account for the primary-secondary mortgage market behavior.

Other examples of macro-economic factors influencing borrower behavior include: intervention by the Treasury Department, Federal Reserve, as well as decisions made by Fannie Mae and Freddie Mac. The Treasury and Federal Reserve have engaged in various efforts to stabilize the housing markets and restore liquidity to the financial markets. In fact, the Federal Reserve has purchased more than \$1 trillion in Fannie Mae and Freddie Mac mortgage pools, keeping mortgage rates near historic lows. In addition, in order to stave off the collapse of Fannie Mae and Freddie Mac, on September 7, 2008 the Federal Housing Finance Agency (FHFA) announced that Fannie Mae and Freddie Mac were being placed into conservatorship of the FHFA. Fannie Mae and Freddie Mac issued new senior preferred stock and common stock warrants to the Treasury for about 80% of each agency.

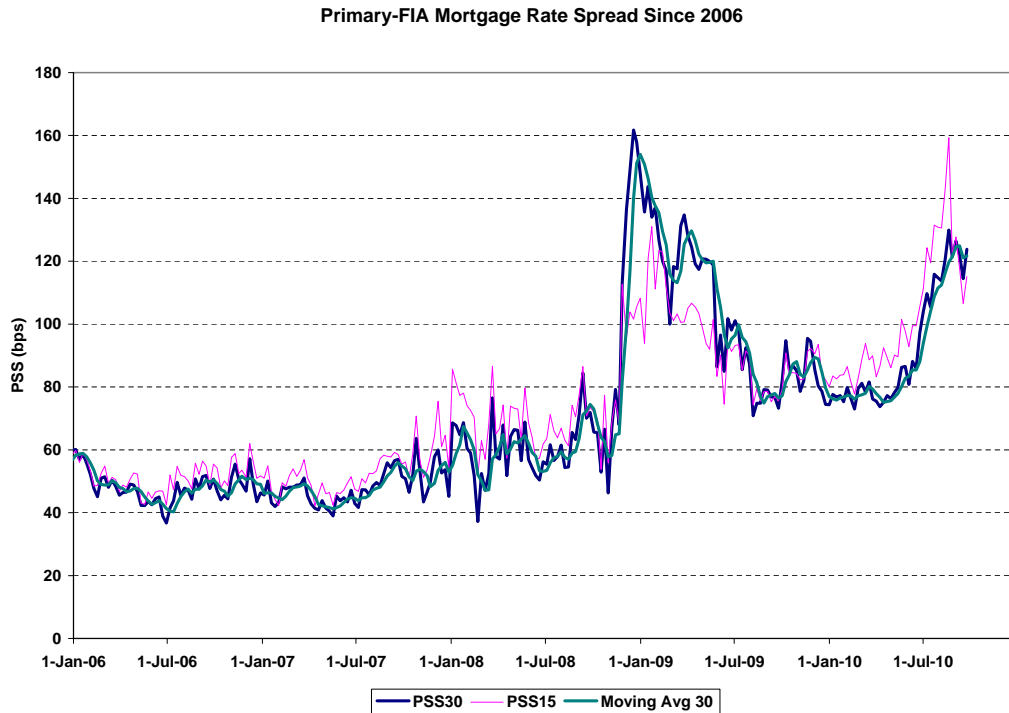


Figure 3: Primary Secondary Mortgage Spreads

Meanwhile, there has been legislative and regulatory pressure on lenders to restate or modify mortgage terms to reduce borrower payments and thereby lower foreclosures. In addition, Fannie Mae and Freddie Mac announced in February 2010 that they would begin to purchase seriously delinquent loans (i.e. loans that are more than 120 days delinquent).

5 Dealer Durations

Each of these actions had a profound impact on the mortgage and lending markets in the United States. In addition, such actions are difficult to quantify within a prepayment model. This left most prepayment model vendors in need of frequent model updates to keep pace with the rapidly evolving market conditions.

As the Figure 4 below shows, the BondEdge prepayment model was adjusted three times since the beginning of 2008. This update frequency is similar to that found for dealer models, although the timing of the updates could obviously differ. After model updates are made, the relationship between any two models will correspondingly change.

The BondEdge prepayment model is not targeted to any one dealer's model, but instead tries to recognize historical patterns, and the street consensus. Figure 4 illustrates the strong correlation between the effective duration based on the BondEdge prepayment model and a sample dealer average since 2008.

6 Dealer Median Speeds

Over the years, dealer median prepayment speeds have been a powerful tool to compare an individual prepayment model against some kind of street consensus. In fact, in the early part of the decade, there were typically as many as ten dealers reporting prepayment projections for constructing medians. However, in the wake of the credit and mortgage crisis, it is common to have only three or four dealers reporting projections. This can make the median somewhat unstable, since it is more likely to resemble a single model rather than a consensus. Also, if just one of the participants drops out for a particular reporting period, the median can jump without any real change in the perceived prepayment risk.

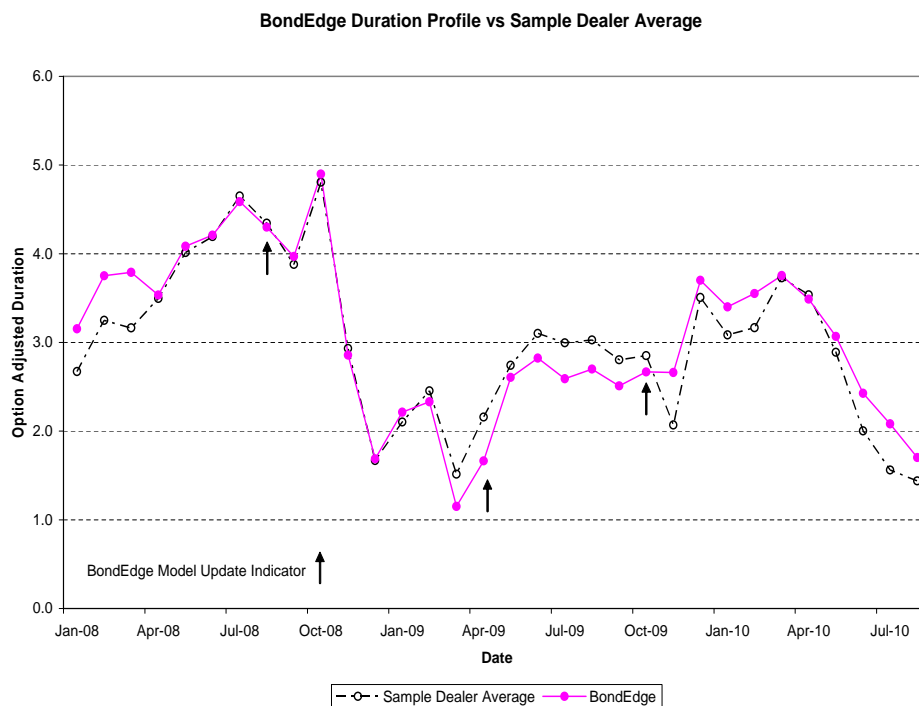


Figure 4: BondEdge Fixed Rate Mortgage Index duration versus a sample dealer average.

Nonetheless, the BondEdge research team still utilizes the SIFMA[®] dealer median prepayment speeds to ensure model reasonability. Such comparisons are available on the BondEdge Private Client Website in the *Fixed Rate MBS Report*. Figures 5 and 6 below provide a comparison of the BondEdge prepayment model versus the SIFMA dealer median for newly issued collateral as of the end of April 2010.

7 Conclusion

It may take a period of years for all of the effects of the mortgage and credit crisis to work through the economy. In addition, we are certain to encounter new economic variables and conditions. For example, the U.S. Congress has passed and the President has signed the Dodd-Frank Financial Reform legislation, which overhauls the financial

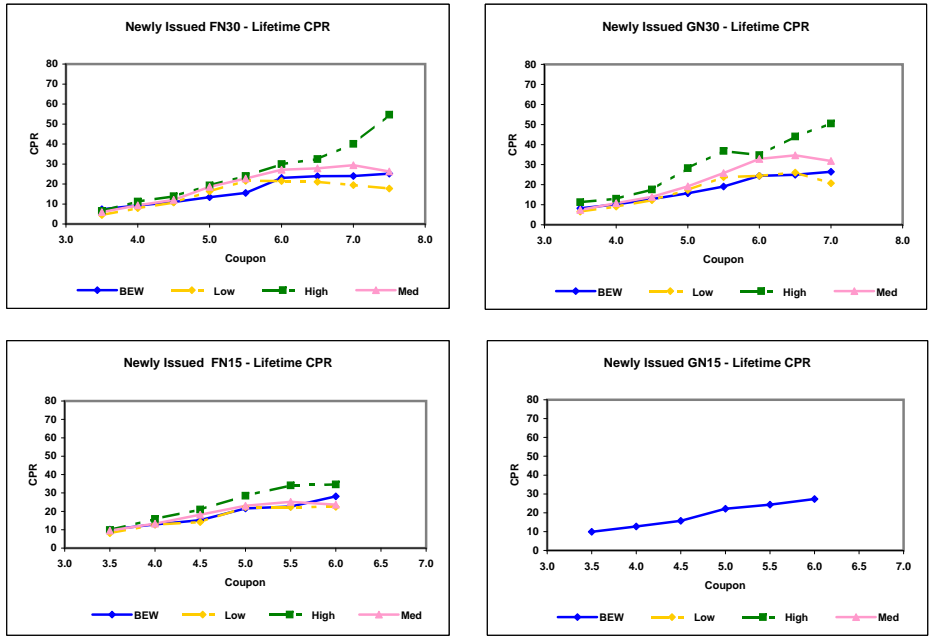
regulatory environment. Meanwhile, the Treasury Department is considering the possible privatization of Fannie Mae and Freddie Mac.⁴ Other macro-economic conditions, such as prolonged periods of high unemployment, or inflation, could affect home price appreciation and the choices that borrowers have to prepay their loans.

Consequently, additional prepayment model updates may be made in the upcoming months and years. As always, we will rely on the five primary metrics discussed above to measure and report upon the performance of the BondEdge prepayment model: historical performance, overall consistency, macro-economic influences, risk measure comparisons against the index providers, and comparisons against dealer median prepayment speeds.

Finally, we welcome your feedback. Please feel free to contact me directly at william.burns@interactivedata.com with any thoughts, questions or concerns.

⁴ By Zachary A. Goldfarb, *Treasury secretary backs Fannie, Freddie reshaping*

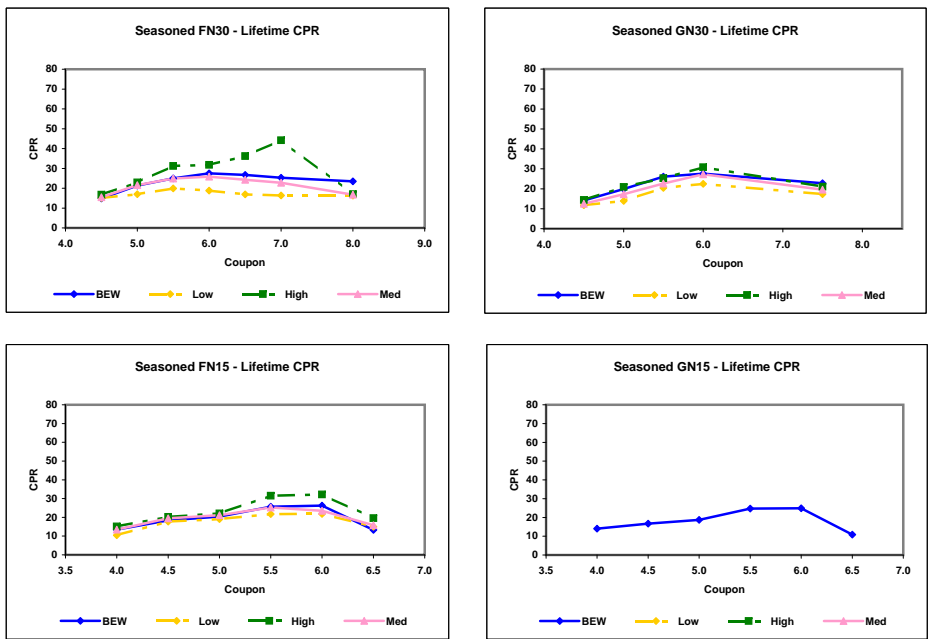
Newly Issued Prepayment Comparison - BondEdge vs. Dealer Median



Dealer Median values redistributed with special permission from SIFMA

Figure 5: SIFMA New Issue Collateral Dealer Median Prepayment Speeds versus the BondEdge Prepayment Model.

Seasoned Prepayment Comparison - BondEdge vs. Dealer Median



Dealer Median values redistributed with special permission from SIFMA

Figure 6: SIFMA Seasoned Collateral Dealer Median Prepayment Speeds versus the BondEdge Prepayment Model.

Interactive Data
Fixed Income Analytics
2901 28th Street, Suite 300
Santa Monica, CA 90405
USA
Tel: 310 479 9715
Fax: 310 479 6333
email: fia.info@interactivedata.com

100 Church Street, 11th Floor
New York, NY 10007
USA
Tel: 212 771 6771
Fax: 212 497 3421
email: fia.info@interactivedata.com

Fitzroy House, 13-17 Epworth Street
London EC2A 4DL
UK
Tel: +44 (0)20 8602 0857
Fax: +44 (0)20 7490 2667
email: fia.info@interactivedata.com

Limitations

This document contains information that is confidential and proprietary and/or trade secrets of Interactive Data Fixed Income Analytics and/or its affiliates, and is not to be published, reproduced, copied, disclosed, or used without the express written consent of Interactive Data Fixed Income Analytics. This document is provided for informational purposes only. The information contained in this document is subject to change without notice and does not constitute any form of warranty, representation, or undertaking. Nothing herein should in any way be deemed to alter the legal rights and obligations contained in agreements between Interactive Data Fixed Income Analytics and/or affiliates and their clients relating to any of the products or services described herein. Nothing herein is intended to constitute legal, tax or other professional advice.

Interactive Data Fixed Income Analytics makes no warranties whatsoever, either express or implied, as to merchantability, fitness for a particular purpose, or any other matter. Without limiting the foregoing, Interactive Data Fixed Income Analytics makes no representation or warranty that any data or information supplied to or by it are complete or free from errors, omissions, or defects.

Interactive DataSM, the Interactive Data logo and BondEdge[®] are either registered service marks service marks of Interactive Data Corporation in the United States and/or other countries. Other products, services, or company names mentioned herein are the property of, and may be the service mark or trademark of, their respective owners.

Interactive Data Fixed Income Analytics is a division of Interactive Data Corporation.