Trumid

Fair Value Model Price Whitepaper

Trumid

Overview

For liquid asset classes, pre-trade transparency is often readily available via real-time, central limit order books and continually ticking transactions. For an asset class like corporate bonds, liquidity is lower and tick data is generally not available. Trumid believes a continuous pricing service that is reliable and objective will improve liquidity by providing a consistent source of pre-trade transparency.

We offer this through our Fair Value Model Price – FVMP for short. It is an adaptive model that produces levels for approximately 22,000 corporate bonds every five minutes based on observations from multiple data sources. The model also delivers a bid-offer that reflects expected transaction costs for each bond, as well as a confidence score for each level. Finally, we produce confidence intervals, which give probabilistic ranges of outcomes for upcoming prints.

The model uses cutting-edge mathematical techniques to achieve its superior performance. With machine learning, Bayesian statistics, structural models of issuer dynamics, and individual bond cashflows, the model outperforms its peers. In particular, FVMP outperforms the MKTX Composite+ bond pricer by 11%, according to a recent whitepaper evaluating its performance. See "FVMP Accuracy and Competitors" for more details.

In this paper, we discuss current pricing methods and Trumid's approach. We also frame what we believe is the best method to assess model performance.

Current Pricing Methods

There are two dominant approaches to intraday corporate bond pricing: matrix pricing and evaluated pricing. Matrix pricing estimates a bond's price based on a group of other bonds with similar attributes but higher observability. Resulting prices are useful for back-of-the-envelope exercises but are generally not precise enough to inform trading. The quality of the estimate depends entirely on the choice of proxy bonds: choose the wrong bonds and get a poor price. This leads to a poorly defined problem which has not been reasonably solved by the industry.

Evaluated pricing (EP) aims to make price estimates more defensible by combining a methodology with human evaluators. Their main job is to apply weights to model inputs to arrive at final levels. They also address complaints when a price is challenged by consumers. A significant shortcoming of EP becomes apparent when one examines the enormity of the corporate bond universe. With over 40,000 active USD-denominated corporate bonds, scalability and consistency become difficult for any human-driven process. The sheer quantity of tradable corporate bonds makes holistically accurate pricing difficult, and even more so when it must be done continuously throughout the day.

FVMP Methodology

FVMP's main objective is to produce bond mids that estimate the next dealer-dealer TRACE print. The model targets intraday trading and is ideally suited for algorithmic trading engines that need a fair mid for estimation purposes. FVMP is used on the Trumid trading platform for numerous purposes and forms its algorithmic core. In conjunction with mids, the model also provides a bid-offer and confidence levels, as described in more detail below.

The model uses machine learning and Bayesian statistics to produce its levels. Highly liquid CUSIPs are mostly observed and reflected by the model, which estimates levels using advanced statistical filtering techniques. Illiquid CUSIPs are mostly priced by inference: other bonds across the issuer complex propagate information across the yield curve. Liquid bonds also benefit from this effect.

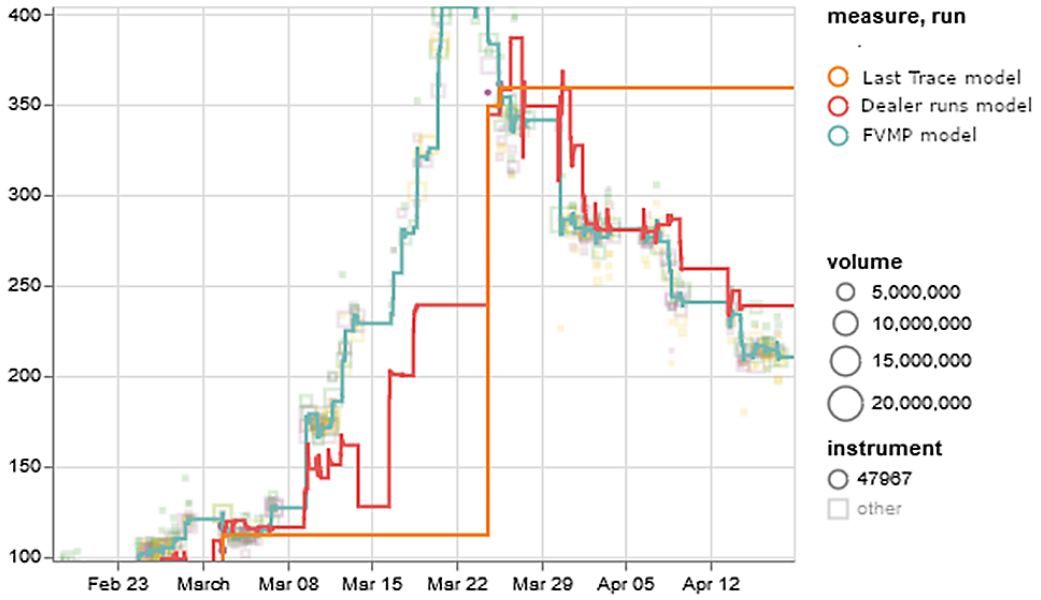

FIGURE 1: A comparison of FVMP vs two naïve models for a REG-S bond. The orange curve simply reports the last TRACE print and is highly stale because the bond is illiquid. The red curve implies its levels from dealer runs. This is an improvement from the TRACE model but still gaps when prints occur. The green curve is the FVMP model, which smoothly interpolates between TRACE prints. In between, it tracks the movement of the issuer curve, as reflected by the square dots representing other bonds of the issuer. In particular, it tracks the registered bond exactly. While this is a simplified example, it extends to all bonds regardless of liquidity and structural relationship.

FVMP's bid-offer and confidence score give shape to a bond's transaction costs and volatility. The bid-offer model estimates the cost a customer will pay when buying and selling vs. a dealer over a short period of time. The confidence score does two things: first, it rates the consistency and recency of observable market data. Second, it gives the probabilistic distribution of the next TRACE print. For any given x, it gives a range of levels such that the next TRACE print will lie in that range with probability x.

Compared with the previously described pricing approaches, FVMP offers several advantages. Matrix pricing suffers from methodological flaws that are impossible to fix. Evaluated pricing admits that its algorithms are not sufficient and need human intervention. It also often aims at conservative or “defensible” pricing which is not necessarily consistent with intraday trading. FVMP on the other hand uses superior, state-of-the-art analytical techniques to produce the full picture of a bond’s behavior without the subjective element of human intervention. It is used every day on the Trumid trading platform to provide a superior trading experience for market participants.

FVMP Accuracy and Competitors

Given the model’s objective of estimating mids that match upcoming dealer-dealer TRACE prints, we benchmark the model to this metric: absolute deviation from those prints. In general, one expects this estimate to get worse over time between prints. Again, FVMP overcomes this issue by using continual inputs across the issuer curve to damp error with exogenous information.

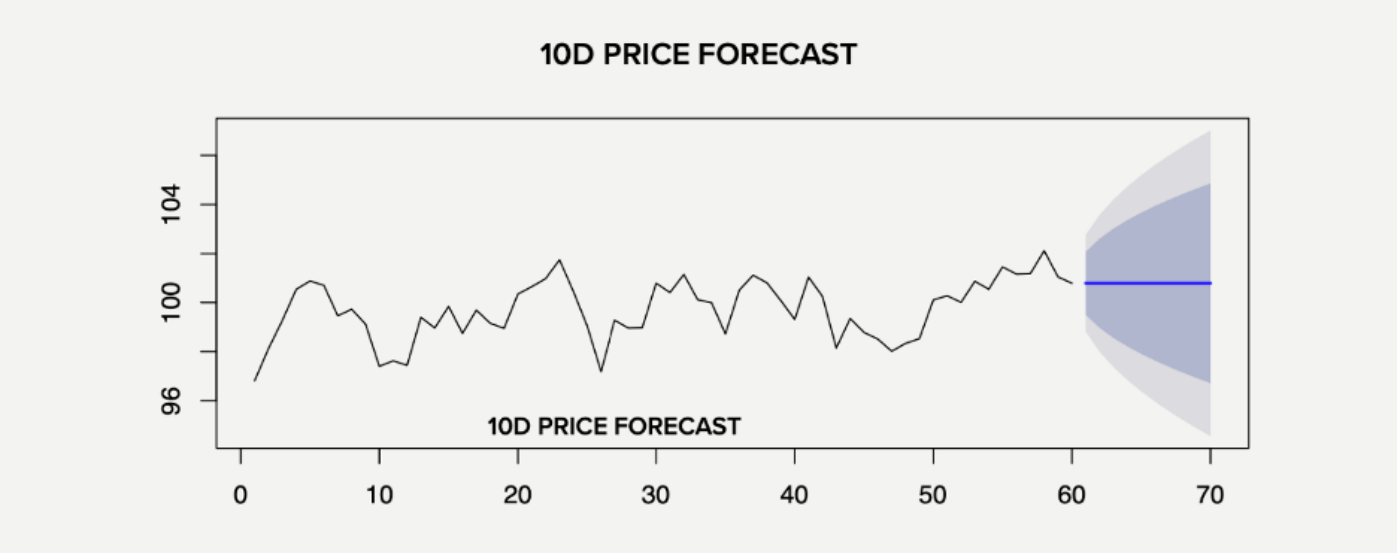

FIGURE 2: Simulated bond price with 10-day price forecast. The uncertainty of the forecast grows over time. As liquidity decreases, the accuracy of event-based pricing degrades quickly. FVMP supplements CUSIP-specific data with information across the curve to produce a more continuous estimate.

FVMP achieves best-in-class performance across the corporate bond universe. In backtesting, the average error is less than the difference between observed buys and sells, and inside dealer markets. The error of course fluctuates over time with market conditions, so we update model performance monthly and post results to our website here (https://www.trumid.com/quantitative-products/).

In fact FVMP outperforms MarketAxess' CP+ by 11%, based on a recent whitepaper[1] evaluating the product. CP+ (or Composite+) is one of the industry's leading corporate bond pricing services. The whitepaper reports a median-absolute-error of $0.09, with further breakdowns of $0.08 for investment grade and $0.15 for high yield bonds. FVMP offered better performance across the board for the same period: $0.08 overall, $0.07 for investment grade, and $0.11 for high yield bonds, or an overall improvement of 11%.

Figure 3 gives a more granular view of recent model performance. See the link above for further details.

FVMP™ Performance

Group	Bond Count[1]	Trade Count	80th percentile AE[2] for period	95th percentile AE[2] for period
All	6,319	31,772	0.29	0.67
Credit Quality				
HIGH YIELD / Distressed[3]	149	1,053	0.61	1.35
HIGH YIELD / Non Distressed	1,509	9,995	0.34	0.78
INVESTMENT GRADE	4,664	20,724	0.24	0.57

FIGURE 3: FVMP performance profile for August of 2020.
1. Quantity of bonds with inter-dealer TRACE prints of at least 1MM during the measurement period.
2. AE: Absolute Error - The absolute difference in points (pts) between TRACE and previous FVMP.
3. Based on the Trumid Platform #Distressed Tag.

Conclusion

Trumid Labs' FVMP provides intraday bond prices that are fully automated and highly accurate, via state of the art mathematical techniques. We supplement outright levels with bid offers, confidence levels and confidence intervals, which give shape to the price of any given bond. The model is under constant use in the platform and forms its algorithmic core, making it subject to constant observation both internally and externally by numerous experts in the industry. Performance compares favorably to published material on competitor products and offers credit markets an objective view on the state of corporate bonds.

[1] https://content.marketaxess.com/sites/default/files/2018-08/MKTX_Composite%2B_whitepaper.pdf