Bond Liquidity Scoring
AI Model

Liquidity Risk Management Analytics

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Overbond

A Changing Landscape

With a multi-year decline in dealer inventories and higher capital requirements, sharp increase in aggregate outstanding debt instruments, and proliferation of riskier instruments like leveraged loans, the subject of bond market liquidity risk has been attracting attention throughout financial institutions, regulators, and policy makers.

Although liquidity risk affects most, if not all, bond market participants, it has a tremendous impact on open-ended mutual funds and several similar product categories, which allow their shareholders to request redemptions at any time. Therefore, effective liquidity risk management is most critical during times of market distress.

Bond Market AI

As the financial services market embraces digital processes and artificial intelligence applications to streamline and automate workflows, bond trading is one of the areas which has a great need to fully embrace the trend. The current fixed income capital market data flows are inefficient in many respects, limiting precision in assigning proper value to credit risk long term. Markets remain heavily reliant on segregated and manual data operations between counterparties and as a consequence, disparate data sets. These disparate data sets cause the market to suffer from information asymmetry and decentralization. As a result, insight from available data is fragmented and disseminated through manual exchanges between counterparties, which furthers creation of disparate data sets and limited view into bond liquidity.

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Regulators Join the Battle

Post global financial crisis, regulators across the world have recognized the significance of creating a safer banking system. A series of regulatory reforms have indeed made most financial institutions more resilient. However, those regulations also resulted in some unintended consequences particularly for the secondary bond market liquidity. These regulations include Basel III, Volcker Rule, Dodd Frank Act – Collateral Requirements, Dodd Frank Act – Clearing, Reporting, and Testing. These regulations caused intermediary cost for banks to be significantly higher. A decline in market liquidity is the natural outcome.

In the recent years, global regulators as well as policy bodies such as the International Monetary Fund has predicted a worst-case scenario, the flood of shareholder redemption orders may damage particular funds, underlying asset markets, and even the financial system itself.

Thus, regulatory agencies and policy bodies are moving in on firms as they consider a wider range of expanded requirements such as:

- Increased data reporting requirements
- Strengthened supervision based on a conceptual framework that parallels banking regulations in many respects
- Meet liquid asset minimums and abide by limits on illiquid assets
- Fees and gates to limit redemptions
- Periodic assessment and review of liquidity risk, including stress testing across a spectrum of market conditions
- Establish “transition plans” (a.k.a. living wills) to transition clients’ assets away from an advisor that suffers a major disruption in their business

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Regulators Join the Battle

As mentioned, post global financial crisis, regulators across the world have recognized the significance of creating a safer banking system. We are therefore taking a closer look into a series of regulatory reforms that have resulted in some unintended consequences focusing on particular effects on the secondary bond market liquidity. Please see below the synopsis analysis on key regulations, including Basel III, Volcker Rule, Dodd Frank Act – Collateral Requirements, Dodd Frank Act – Clearing, Reporting, and Testing.

Basel III: While less levered banks are safer, they are also less incentivized to make a market due to higher capital requirements, especially in the capital-intensive bond markets. The result is a sharp decline in bond trading activities of banks' dealer arms, and subsequently falling market liquidity.

Dodd Frank Act – Collateral Requirements: More collateral will be needed as most transactions require dealers to post initial margin. Secondly, collateral eligibility standards will become much tighter; only high quality and highly liquid assets such as G7 government bonds or major currencies can be used as collateral without any haircut whereas riskier corporate bonds are either ineligible or have to take a haircut. Therefore, banks are becoming more reluctant to hold large amounts of bonds to provide market liquidity.

Volcker Rule: The unintentional outcome on bond markets is that banks are less capable of being a powerful intermediary due to the shrinking bonds inventory. As a result, banks are increasingly acting as an agent to look for buyers when an investor wants to sell his bonds. Not surprisingly, the execution time is longer and big price swings are more frequent, even among the most liquid bond securities such as 10-year US treasury.

Dodd Frank Act – Clearing, Reporting, and Testing: A major reform of Dodd Frank in clearing is that most bilateral trades are cleared mandatorily through a central counterparty. In terms of reporting timing, current T+1 model is replaced with T+0, which means initial margin is to be pre-funded and further increases the demand of collateral for banks. Annual stress testing is also conducted by regulators to ensure banks' balance sheet is robust enough to withstand market crashes.

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Overbond's Comprehensive Liquidity Scoring Model

The Overbond liquidity scoring model incorporates a variety of factors to arrive at a liquidity score for a bond. The model aims to capture and convert various liquidity measures to one unified, succinct score. These factors include but are not limited to:

Liquidity Metric	Relevance
Bid / Ask Spread	Capture the transaction cost of a secondary trade
Volatility of Quotes / Trades	Assess the volatility of trades / quotes over time to capture the resiliency in flow of new quotes for the bond
Number of Quotes / Trades	Assess the breadth of the market
Size of Trade	Assess the number of orders with varying order size
Dealer Count	Indirect measure of market depth that roughly captures the availability of market making for that bond
Trade Clustering	Determine the nature of recent trades to understand if it is a buyers or sellers market for a specific security. (ie. intra-dealer trade, or client buy or sell)
Settlement Data	Capture a larger proportion of a security's transactions done by voice or OTC that is not reflected on electronic venues

Complexity of Liquidity Scoring:

When considering liquidity risk, multiple elements are involved and the classification of the liquidity of portfolio securities is the most important foundation. The portfolio liquidity risk can produce greater actionable conclusions if each instrument is assigned a numerical liquidity score rather than merely being classified as either "illiquid" or "liquid. This is what Overbond is achieving with the Liquidity Scoring Model.

As liquidity can affect every type of asset, it is integral for investors to see how liquidity risk could impact the whole portfolio's net asset value (NAV) under various market conditions. To be able to rank the liquidity of portfolio securities along with a numerical scale, it will help investors gauge in a more accurate quantification of potential impacts on the NAV.

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Back-Testing Simulation for Credit Trading Desk

Overbond partnered with a large European credit trading desk, to conduct an intensive back-test of the AI suite of algorithms for Corporate and Government Bond Intelligence (COBI). Overbond was provided a sample of 830 unique, EUR-denominated fixed income securities and the transactions executed by the credit trading desk during trading sessions between September 2019 and October 2019. The goal of the back-test was to determine logic to recommend bid prices that would be utilized and submitted in a trader's RFQ, without requiring adjustment by the trader, Overbond auto-pricing and auto-execution utilizing Liquidity score as a key delineation of pricing precision in all trading situations.

We defined Mean Absolute Error (MAE) as the absolute value of the difference between a security's COBI Price (AI modeled best executable price) and the desk's execution price at the time of an observable transaction.

Liquidity Tier #	Percentile of Results	MAE Bracket	Recommendation
1	Top 25%	7.6 Cents	Highly Recommended
2	Middle 25%	8.9 Cents	Highly Recommended if MAE below 8.9 Cents
3	Remaining 50%	12.7 Cents	Recommended if MAE below 12.7 Cents

Methodology: Using a dataset of over two years worthy of historic RFQ data from the credit trading desk directly, Overbond engine iterated through all "Accepted" and "Covered" RQF results in the trade-book and performed a Liquidity/Risk analysis on Refinitiv's intraday sample quotes, 24 hours before each trade happened. The Engine then observed the liquidity score of the targeted ISIN after analysis and established a relative threshold of the top 25% of the observations, defined as Tier 1 Liquidity profile.
Using a tiered approach, engine established clustering for the Tier 1 Liquidity profile as well as following 25% of trades naturally falling into Tier 2 profile category, and the subsequent 50% in Tier 3 liquidity profile category. Using a MAE threshold in tandem with Liquidity Score, COBI engine determined which trades were having optimal pricing precision, and therefore recommended for auto-pricing, based on their liquidity score, as a measure of price discovery and confidence from trading volumes, price volatility and other factors that go into liquidity score calculation.

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Results Summary

Of the total universe of 830 sample transactions, the COBI engine with Pricing Model and Liquidity Scoring Model was able to provide executable prices for 502. Of the 502 prices, 211 met the criteria for both pricing precision and liquidity to be recommended as suitable for RFQ auto-pricing without manual trader intervention.



AI Model Explainability:

While employing a curve-builder approach to price ISINs in the secondary bond market we acknowledge that the model will not be precise for 100% for the entire bond universe. Hence, we segregated the bonds based on various measures including liquidity and volatility to identify bonds which can be priced accurately, and which bonds cannot be due to various market behaviors, trading patterns and data availability limitations. The COBI-Pricing model output price for each ISIN has these main-explain ability features attached to it:

Features	Relevance
1. Liquidity Score	Indicates deep liquidity profile of the ISIN, based on bid-ask spread wideness, trade count and trade volume on the day and in recent history, peer ISIN comparisons, OTC flows from settlement layer data, price volatility intra-day and monitoring of the distribution of all corelated factors.
2. Confidence Score	Measures confidence of the modeled COBI-Pricing output price for each ISIN is within a pre-defined threshold, in this case, it was set to be within 10 cents on the price basis
3. Confidence Interval	Same as above but provides a range for trader to consider the high and low point

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Business Impact

Over the past couple of years, we have witnessed profound changes in the fixed income marketplace with counterparties increasingly adopting quantitative investing and liquidity risk monitoring techniques to automate their trading workflows. These include systematic algorithmic trading and liquidity risk management automation, merging of fundamental discretionary and quantitative investment styles, consumption of increasing amounts of alternative data, and adoption of new methods of pricing analysis for fixed income instruments such as AI analytics like Overbond COBI-Pricing algorithm.

Specific use cases for the COBI-Pricing algorithm application are examined to identify business objectives and key benefits below. Overbond client organizations include sell-side institutions with significant trading volumes (200-500 RFQs+ a day per trader). Their innovation groups actively explore new technologies that can serve as the catalyst trading automation and improved risk management, trade flow, pre-trade and post-trade analytics.

AI Application	Business Objectives	Key Benefits
Intelligent automation and enhanced decision-making	• Automate trade flow and liquidity risk monitoring and reporting • Respond to 80-120% more RFQs • Preserve optimal hit ratio • Significantly increase desk P&L • Use auto-pricing models to improve reporting and risk systems	Overbond COBI- Pricing AI models aggregate historical data from multiple sources and optimize pricing for bonds with varying liquidity profiles. Overbond COBI Pricing can enhance users' bond trading workflow by providing precise executable prices in up to 30% more situations when there is no directly observable trading price in the market. Bond trading execution desk revenue can be grown significantly through their access to this insight. COBI-Pricing enables fully automated bond trading workflow with various curve visualizations and front-end trade analytics tools that are natively integrated with trader's desktop. As a dealer, boost your RFQ hit ratio with pricing feed with margin optimization model add-on, discover deep bond liquidity profile, and predict investor behaviour with buy/sell indicators Sell-side credit and rates trades can grow their RFQ response volumes significantly with precision and confidence, growing accordingly desk P&L.

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Implementation Considerations

Institutions considering AI predictive analytics implementation and big-data transformation projects, can employ acceleration utilizing externally calibrated models and market signals. Below are several key considerations and questions for executives in charge of AI roadmap:

1. What is the current state of our fixed income in-house data?
2. What are our data science and engineering capabilities?
3. Are we building AI capabilities to grow revenue or cut cost?
4. How can we redefine the boundaries of our data universe or identify alternative data sources necessary to feed AI engine?
5. Given that AI learning curve is steep where do we begin?
6. How do we create and execute AI proof of concept use cases rapidly?
7. What are key success factors for our AI roadmap?

Custom AI Services
Overbond works with clients to identify and recommend practical AI analytics use cases that are aligned with strategic goals of the financial institution. We help assess current-state AI capabilities, and define roadmap to help clients realise value from AI applications. We manage cross-channel data flows across multiple systems and enable custom font-end visualizations.

Proven Methodology
With our targeted approach and implementation methodology, we quickly demonstrate value of AI analytics to test use cases, enabling client-side change management approach and stakeholder buy-in.

Operational Acceleration
We help clients build and deploy custom AI solutions to deliver proprietary analytics and tangible business outcomes. Our experience combines calibrated models, design patterns, engineering and data science best practices, that accelerate value and reduce implementation risk.

AI Analytics As-a-Service
Overbond helps customers design and oversee mechanisms to optimize and improve existing fixed income credit valuation, issuance and pricing prediction and pre-trade opportunity monitoring using AI. Our team of world-class data scientists and engineers manage an iterative implementation approach from current state assessment to operational handover.

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About Overbond

Overbond specializes in custom AI analytics development for clients implementing trade automation workflows, risk management, portfolio modeling and quantitative finance applications. Overbond supports financial institutions in the AI model development, implementation and validation stages as well as ongoing maintenance.

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