GoldenSource

# A Data-Centric View of Liquidity

Concepts and how they impact control and regulation

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# Introduction

Market liquidity is a market's ability to purchase or sell an asset without causing a material change in the price of the asset. It describes the asset's ability to sell quickly without having to reduce its price. Liquidity is about how big the trade-off is between the speed of the sale and the price it can be sold for. In a liquid market, the trade-off is mild: selling quickly will not reduce the price much. In a relatively illiquid market, selling it quickly will require cutting its price by some amount

## Anatomy of a Market

Markets in their purest form are relatively simple constructs. There are buyers, sellers, ask prices and bid prices. There isn't much more to them than that. Buyers always have to buy at the price the seller is willing to sell at (the ask price). And sellers always have to sell at the price the buyer is willing to buy at (the bid price). These basic concepts apply to anything that is being bought and sold in any market in the world. Financial markets are like any other market. Exactly the same principles apply as apply for the exchange of goods and services in the rest of the economy. The perceived complexity comes from the fact that in financial markets the products that are being sold are less familiar to most people. Exchanging money for widgets in a manufacturing environment is a relatively straight-forward concept. Indeed, exchanging money for a bond or an equity is also a relatively straight-forward concept. But conceptualizing payment for an OTC derivative that transfers interest rate risk from a fund to an investment bank is more difficult. Or when a pension fund manager transfers 50 year inflation rate risk to an investment bank via an inflation swap, the concepts become that bit harder to grasp. They become harder again when non-market practitioners hear that the inflation swap is exposed not just to inflation rate risk but also to interest rate risk because the future cash flows generated by the inflation swap need to be discounted with an interest rate curve. Explaining that the interest rate curve that is used to discount the future cash flows of the swap depends on the collateral posted against the swap, can lead to further confusion[1]. And telling someone who doesn't have experience with derivatives that the asset manager who needs to post collateral has an option to post dollars, sterling or US Treasuries as the collateral amounts, will likely lead to that final bit of confusion. And if it doesn't, it certainly will when you tell him or her that the optionality that the asset manager holds when posting cash or bonds to collateralize to the swap position means he or she has exposure to volatility rates that need to be derived from the market.

Fortunately, the complexity of these concepts need not worry the market data practitioner. It helps if he or she understands them but it's not necessary. All he or she needs to know is the fundamentals of how a market works. i.e. there are buyers, sellers, ask prices, bid prices and, in the case of financial markets, a mid-price, used for valuation purposes. These concepts are illustrated in the diagram below.

[1] A swap that is fully collateralized with margin cash posted on a daily basis should be discounted at the rate of return that the cash would give an investor if he invested it for one day (the overnight rate)


- **Buyers** want to buy at the lowest possible price. **Sellers** want to sell at the highest possible price
- **A Trade** occurs when a buyer agrees to a sellers offer price
- Liquidity is a **Pre-Trade** concept , not a post-trade concept
- There is no such thing as a **Mid Price** in markets. Mid price is a concept used for valuation purposes

## Liquid Versus Illiquid Markets

Markets can be liquid or illiquid. If they are liquid, there is lots of trading going on and their bid-offer[2] continuums as illustrated in the diagrams below are crowded, leading to a small gap between the highest bid and the lowest offer. This gap, whether big or small, is called the bid-offer spread. As you can also see from the diagram below, in an illiquid market the bid-offer continuum is typically sparsely populated, leading to a wide bid-offer spread. In illiquid markets, sellers find it hard to sell and buyers find it hard to buy. When bid-offer spreads are wide enough, mid-price valuations become meaningless and large reserves for bid-offer spreads need to be taken on to the firm's balance sheet.


[2] The terms "offer" and "ask" are analogous in the context of financial markets

## Liquidity Indicators

There are different ways to measure liquidity. The size of the bid-offer spread, the number of trades or quotes in a given time-period, the length of time it takes to exit a position without moving its price. The table below provides an overview of the different types of liquidity indicators there are and the regulations that are relevant to them.

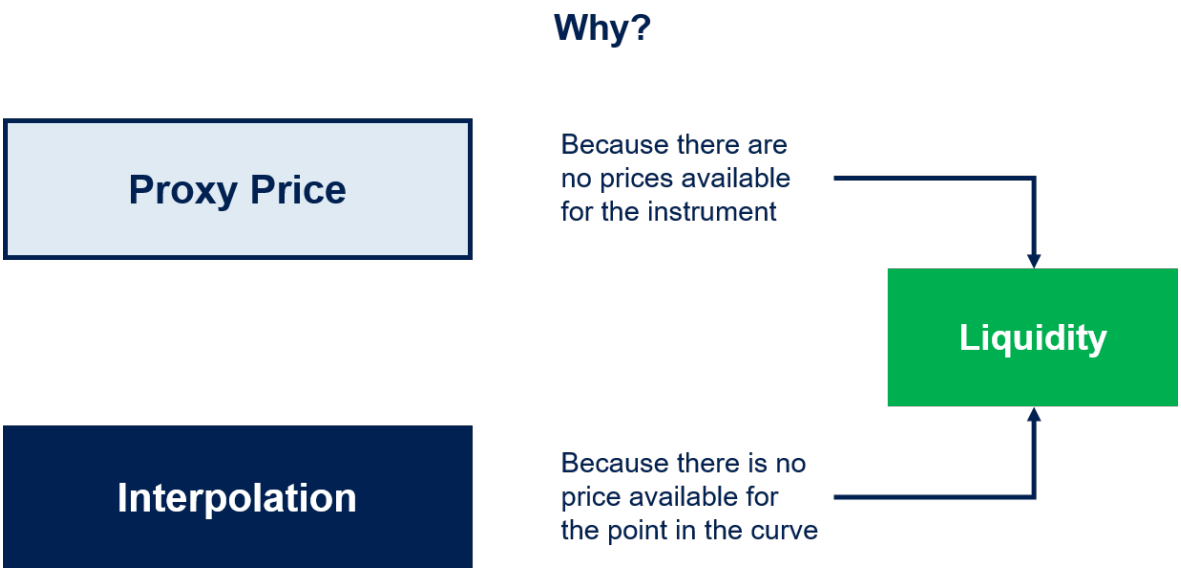
| Liquidity Indicator | Related Regulatory Concept |
|---|---|
| Size of Bid-Offer Spread | N-PORT<br>Bid-Offer Provisioning<br>PRUVAL Close-out Costs AVA |
| Number of ticks in a time period | N-PORT<br>IFRS13 Level 1/2/3 Classifications |
| Market Depth<br>Distribution of price sources | PRUVAL Market Price Uncertainty AVA |
| No of trades in a time period | N-PORT<br>IFRS13<br>IFRS13 Level 1/2/3 Classifications |
| Exit Time for a position | PRUVAL Concentration AVA<br>FRTB ES Liquidity Horizon |
| Liquidity breakdown of fair value balance sheet | N-PORT<br>IFRS13 Level 1/2/3 Classifications |

The table below describes some of the approaches that can be used with GoldenSource's Market Data Solution (MDS) to derive liquidity indicators.

| Liquidity Indicator | Related Regulatory Concept | MDS Functionality |
|---|---|---|
| Size of Bid-Offer Spread | Bid-Offer Provisioning<br>PRUVAL Close-out Costs AVA | Price Types in MDS allow bid and ask curves to be created. Risk Sensitivities can be used to calculate required reserve amounts |
| Number of ticks in a time period | | Tick Filtration solution allows snap times to be defined and tick counts per instrument to be calculated |
| Market Depth<br>Distribution of price sources | PRUVAL Market Price Uncertainty AVA | The standard deviations of the distribution of contributor prices allows a 90% CL MPU AVA to be calculated |
| No of trades in a time period | | (Backward looking view of liquidity). Trade count by instrument in a given period |
| Exit Time for a position | PRUVAL Concentration AVA<br>FRTB ES Liquidity Horizon | Bid-offer spreads can be widened if the number of days to exit a position exceeds 10<br><br>RiskHub time series of market moves using pre-defined Liquidity Horizons allows market risk capital to be calculated using Expected Shortfall calculations |
| Asset Class Taxonomy | IFRS 13 Level 1/2/3 Fair Value Balance Sheet | Use Issue Types to determine Level 1/2/3 Classification |

## Proxy pricing, model pricing and interpolation

Proxy pricing, model pricing and interpolation are methods for deriving prices when there are insufficient bids and asks available in the market to come up with a price that can be used for valuation purposes.




When securities or curve points are illiquid, there are a lot of different ways that proxy / model prices can be derived for them. The use cases described below cover proxy pricing, interpolation and calibration. But they are all doing the same thing; deriving prices where there is insufficient liquidity in the market to get them from contributors. Using combinations of native market data derivation functionality and APIs to 3rd party libraries, a market data system needs to ensure that there is a framework in place that can handle each of these use cases.

**Securities**

- Use one security price as a straight proxy for the illiquid security[3]
- Use % change in a security price as a proxy for the % change in price for the illiquid security
- Use % change in a benchmark index as a proxy for the % change in price for the illiquid security
- Use yield on a bond with similar credit rating, sector and maturity to derive (e.g. using a Quantlib function) the price of the illiquid bond

**Interest Rate Curves**

[3] The "illiquid" security or curve is the security or curve that the market data solution needs to calculate a proxy price / rate for

- Proxy curve = Fixed spread over an existing curve
- Proxy curve (e.g. 6m Libor) = Tenor basis spreads (e.g. 3s6s) added to a base curve (3m Libor)

- Proxy curve (e.g. CHF Libor) = Cross currency basis spreads (e.g. USDCHF xccy basis swaps) added to USD Libor curve to derive a CHF Libor curve
- Proxy curve points where missing curve points are derived using linear interpolation / extrapolation
- Proxy curve points where missing curve points are calculated using a whole curve spline / smoothing (e.g. Cubic spline) interpolation routine