Figure #1: T-Cost, Risk and Time-to-Liquidate Surface

For a given volume of bonds to liquidate:

1. If the PM sells fast to avoid market risk, transaction costs (t-costs) are high.
2. If the risk constraint is relaxed, trading can be spaced out over time, lowering t-costs.
Figure #2: Growth of Electronic Trading in Investment Grade Bonds

US HG MarketAxess v. TRACE ADV

TRACE AVERAGE DAILY VOLUMES (BILLIONS)
MARKETAXESS HG MARKET SHARE (%)
Figure #3: Growth of Electronic Trading in High Yield Bonds

MarketAxess categorizes TRACE data as High Yield only if bonds are so rated. It excludes Non-Rated Bonds. Including Non-Rated Bonds, current ADV is approaching $12bn.
The liquidity of a hypothetical security can be represented as a surface reflecting the interplay of time, cost and volume.

For a given volume to trade, market participants choose a point on the surface to achieve the best possible outcomes by selecting time to trade and an expected cost of liquidation.

Changes in market illiquidity conditions would be reflected by transformations of the surface.

For a given volume (i.e. 8M) the cost of liquidation is:
- 2.33% within 1 day
- Expected t-costs decrease significantly if the trade is executed over more than 1 day

For illustrative purposes only
Figure #5: T-Cost as Function of Volume and Time (With Lower Immediacy)

- In this case, the below surface represents a market with higher t-costs for faster trades (i.e., lower immediacy).
- A higher cost of immediacy does not necessarily translate to a more expensive liquidation or portfolio rebalancing, as trading can still be done in large volumes at low cost when the trades are spaced out over time.

For illustrative purposes only.
### Assets

**Data:**
- Fund Securities / Holdings Data
- Traded Prices and Volumes

**Analytics:**
- SEC Liquidity Classification
- Transaction Cost Models
- Trader Wallets
- Days to Liquidate
- Market Capacity
- Market Liquidity

### Liabilities

**Data:**
- Fund Attributes
- Redemption Terms and Waterfall
- Fund Returns and Flows
- Competitor Flows and Returns
- Transaction Level Flows
- Investor Concentrations

**Analytics:**
- Fund-level Redemption Forecasting
- Discretionary Platform & Investor Behavior

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**Risk Management and Surveillance**

Liquidity Risk Policy & Protocols
Liquidity Risk Targets

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**Operational Processes and Extraordinary Measures**

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For illustrative purposes only
Figure #7: Mutual Fund Redemption Modeling

• A Redemption-at-Risk model can be built utilizing a Neural Network approach, including historical fund level flows, returns and factor exposures, competitor’s flows and returns, along with market levels (such as VIX, yield spreads, etc.) to estimate the probability of extreme redemptions.

• Redemption models allow portfolio managers to proactively adjust positioning to efficiently meet extreme fund flows.

• Training Data: Until 12/31/2015
• Test Data: 01/01/2016 – 12/31/2016

• Probability of redemption larger then 0.61% (13 events in 2016)
• Out of sample performance in 2016: 80.48% of the events forecasted

For illustrative purposes only