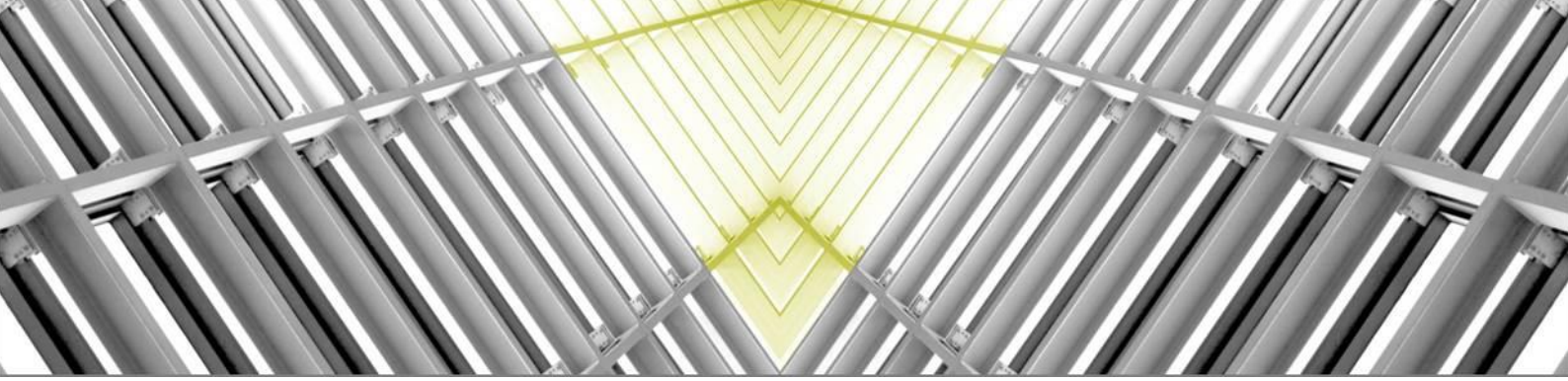

RISKDATA LIQUIDITY RISK

September 2015

RISKDATA
numbers you can count on

Contents

1. Overview

Following UCITS and AIFMD liquidity reporting rules, one should report the portion of the managed portfolio one can liquidate within various timeframes, “without significant impact on market prices”. This latter condition implies certain constraints on the liquidation process, which we can express in terms of maximum selling speed with respect to the Average Daily Volume (ADV) of each position, or in terms of an estimated cost of liquidation resulting from its impact on market prices.

“Liquidation” means unwinding positions, whether long or short, that is, selling long positions and buying back short ones.

Riskdata’s Liquidity Module aims at evaluating the percentage of portfolio that can be liquidated at various horizons, under either selling speed constraints or cost constraints, in both normal and in liquidity-stressed environment market conditions. Liquidity-stressed environment means that the usual estimated Average Daily Volume (ADV) can no longer be used as a reference for asset liquidity and a reduced figure is to be applied. The Module separately reports the liquidity of long positions, short positions and, finally, the aggregated total portfolio.

2. Liquidity profile

2.1. Selling speed constraint

The calculations are made using asset Average Daily Volume (ADV). The results are shown in two tables, for the long positions only, the short positions only, and both long and short positions. The user can select the maximum percentage of the ADV that can be liquidated by the fund among a set of predefined values (5%, 10%, 15% and 20%).

Table 1A: % of portfolio that can be liquidated within a given time horizon, under assumptions of speed constraints

Max %	1 day	2-7 days	8-30 days	31-90 days	91-180 days	181-365 days	> 1 year
5% ADV	X_1%	X_2%	X_3%	X_4%	X_5%	X_6%	X_7%
10% ADV	…						
15% ADV							
20% ADV							

With $X_1 + X_2 + \ldots + X_7 = 100\%$

A reverse table is provided, showing the time necessary to liquidate a given percentage of the portfolio, also for the long positions only, the short positions only, and both long and short positions:

Table 1B: time to liquidate given % of the portfolio, under assumptions of speed constraints

Max %	10%	20%	30%	40%	50%	75%	100%
5% ADV	Y_1 days	Y_2 days	Y_3 days	Y_4 days	Y_5 days	Y_6 days	Y_7 days
10% ADV	…						
15% ADV							
20% ADV							

With $Y_1 \leq Y_2 \leq \ldots \leq Y_7$

NB: clicking on any box of the above tables displays the list of instruments it pertains to.

2.2. Maximum liquidation cost constraint

Calculations are made using asset Average Daily Volume (ADV), as for the selling speed constraint, and also using the asset bid-ask spread and volatility as well as the asset class Kyle Lambda. The user can select the maximum cost of liquidation he is ready to incur among a set of predefined values (1%, 5%, 10% and 20%).

Table 2A: % of portfolio that can be liquidated within a given time horizon, under assumptions of cost constraints

Max Liquidation Cost	1 day	2-7 days	8-30 days	31-90 days	91-180 days	181-365 days	> 1 year
1%	Z_1%	Z_2%	Z_3%	Z_4%	Z_5%	Z_6%	Z_7%
5%	…						
10%							
20%							

Table 2B: time to liquidate a given % of the portfolio, under assumptions of cost constraints

Max Liquidation Cost	10%	20%	30%	40%	50%	75%	100%
1%	V_1 days	V_2 days	V_3 days	V_4 days	V_5 days	V_6 days	V_7 days
5%	…						
10%							
20%							

3. Stress tests

The above tables are provided under normal conditions, and under liquidity-stressed conditions. Stress conditions are determined by a reduction factor applied on the average daily traded volume.

4. Interfaces

RiskData Liquidity Risk analytics are available through:

- Portfolio Designer, RiskData interactive interface,
- Customizable reports produced in batch mode,
- RiskData API that feeds third-party interfaces such as position keeping systems or web platforms.

5. Methodology

5.1. Selling speed constraint

For each position, the "Time to Liquidation" (TTL) is estimated. According to AIFMD recommendations, each position is not split and dispatched over several liquidity buckets, but integrally placed in the bucket corresponding to the necessary time to fully unwind it. Therefore one has:

$$TTL = \frac{|q|}{\theta \times A}$$

Where A is the average daily traded volume (ADV), possibly reduced under stress assumptions and θ is the user-defined maximum percentage of the ADV one can unwind every day, without "significant impact" on the market.

5.2. Estimation of the Average Daily traded Volume

The Average Daily traded Volume (ADV) of each holding in the portfolio is a key element in the computation of its liquidity. Here are indications on its estimation for various asset classes.

Stocks: We return the volume traded on the exchange on which each stock is quoted.

Bonds: We analyze the trading frequency of each bond.

Bonds that are traded more than twice per day in the past 3 months are considered as liquid and their overall ADV is estimated based on the volume in the various exchanges.

For bonds which are traded less than twice per day but more than 3 times a week in the past 3 months, we compute the ADV as we do for liquid bonds and return it divided by a reduction factor of 3.

For bonds that trade less than 3 times a week in the past 3 months, we compute the ADV as we do for liquid bonds and return it divided by a reduction factor of 10.

Futures: For futures on major underlyings (FX, oil, main equity indices, bonds) as well as for CFD's, the ADV is evaluated based on the following formula:

$$ADV = V_{\max} \times \min\left(1, \frac{k}{T}\right)$$

Where T is the time to maturity in months and V_{max} is the ADV of the front future.

This formula is flat for the first k months, and then falls rapidly. k is calibrated based on actual historical data of volumes and of times to maturity.

For CFD's, V_{max} is equal to the underlying stock trading volumes.

Vanilla Options: ADV is evaluated based on a formula taking as inputs the moneyness and the time to maturity. As a function of maturity, we use the same shape as for futures. ADV is maximum for at-the-money options and falls rapidly for either in-the-money or out-of-the-money options.

$$ADV = V_{\max} \times \min\left(1, \frac{k}{T}\right) \times \frac{1}{1 + \alpha x^2}$$

Where x is the moneyness. k and α are parameters calibrated on the actual traded volume. V_{max} is the ADV of the option at-the-money with the shortest time to maturity.

FX: Volumes are taken from the Triennial Central Bank Survey of foreign exchange and derivatives market activity of the Bank for International Settlements.

Exotic Options: They are considered as illiquid, hence ADV = 0 and TTL = 1000.

5.3. Maximum liquidation cost constraint

Evaluating the percentage of portfolio that can be liquidated at various horizons under maximum accepted market price impact of unwinding portfolio positions requires a market price impact model, based on the observed or estimated impact of significant selling or buying orders for each kind of holding.

The impact of placing an order of size q_d on an asset on a given day is equal to:

$$I(q_d) = \min\left(b + \lambda\sigma\frac{q_d}{A}, I_{\max}\right)$$

Where:

$$b = \frac{Ask - Bid}{2P}$$

corresponds to the loss at the 1st transaction, due to the bid-ask spread (actual value observed on the market taken and averaged over several days), relative to the asset price, assuming that we start from the mid-price ½(*Ask* + *Bid*).

$$\lambda\sigma\frac{q_d}{A}$$

corresponds to what is going to be lost each day, due to the market impact of the transaction, i.e. the effect that a market participant has when he/she buys or sells an asset. It is the extent to which the buying or selling action moves the price against the buyer or seller, upward when buying and downward when selling. This market impact is proportional to the uncertainty on the price return σ, measured as being the sum of the daily volatility of the asset and of its bid-ask spread:

$$\sigma = \text{Daily Volatility} + 2b$$

Indeed, in the case of illiquid assets, the volatility is low, due to slowly varying prices, so the uncertainty is dominated by their bid-ask spread, which is large. At variance, for liquid assets, the volatility level is higher and, conversely, the bid-ask spread is lower, so that the volatility term dominates.

I_{max} = maximum liquidation impact: It is a constant that depends on the asset class and on the liquidity. Typically, I_{max} is equal to 50% for illiquid bonds, while it is equal to 5% for AAA government bonds.

The liquidation table under cost constraints is filled in by computing, for each position, the maximum tradable quantity in a day, using the impact formula. Namely, given a cost constraint m, we find the quantity $q_d(m)$ such that $I(q_d(m)) = m$.

If $m < b$ then $q_d(m) = 0$, in other words, one cannot unwind a position, however small, with a cost less than or equal to m. *TTL = 1000 in such case*. If $m \geq I_{max}$ then $q_d(m) = +\infty$, meaning that one can unwind an unlimited amount of the asset without exceeding the cost m. TTL = 1 in such case. In between, we have:

$$q_d(m) = \frac{A}{\lambda\sigma}(m - b)$$

And therefore we have:

$$TTL = \frac{|q|\lambda\sigma}{A(m - b)}$$

About RISKDATA:

Riskdata makes asset managers' life easier with an all-in-one solution that computes any risk indicators for all asset classes with state-of-the-art mathematical models. Our data management team collects and cleanses the data necessary for risk calculations and, as a consequence, implementation is smooth and quick.

With its unique "real-time" computation technology, Riskdata also gives asset managers tools to be smarter: they better understand their risk with complete drill-down capabilities (risk contribution by sector, by country…), and they can run instantaneous pre-trade simulations to measure the impact on VaR or Volatility.

Riskdata was founded in 2000 and the company operates internationally. Clients are buy-side financial institutions mainly based in New York, London, Paris and Frankfurt, ranging start-up Hedge Funds to large Asset Managers.

Riskdata was named "Best Risk Management Solution" at the Wealth & Finance Alternative Investment awards in 2015.

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