LMAX Exchange: **TCA white paper V1.0** - May 2017

TCA metric #4

TCA and *fair* execution.
The metrics that the FX industry must use.

An analysis and comparison of common FX execution quality metrics between 'last look' vs firm liquidity *and* its financial consequences.

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Part II: (i) Execution quality metrics and firm liquidity

In this part we will investigate the underlying mechanisms behind the apparently anomalous limit order fill ratio seen on the sample TPA data set and explain in detail our approach to quantifying the financial value of price improvement and cost of higher execution latency or hold time preparing the ground for the relative TCA calculations in Part III.

During the second half of 2016, while researching what would become this paper, we extended the market and execution quality statistics collected by LMAX Exchange venues. The data in this section is based on insights from statistics collected on our London, Tokyo and New York exchanges supplemented by other third party data sets where noted.

In our sample TPA trade database the overwhelming majority (over 90%) of limit order rejects on LMAX Exchange are cancels caused by price fluctuation/volatility. This observation and the limit order fill ratio result leads to the questions we will address first:

- Why do the flow characteristics in the TPA data set allow for higher fill rates from last look providers?
- Can we observe higher price volatility on LMAX Exchange which may lead to a lower fill ratio for limit orders?
- Are there any order placement strategies that will improve limit order fill rates?

Most importantly we will show why it is worth going to this trouble for traders who are currently satisfied with the nominal fill rates offered by their last look LP.

Box 7

Approach for quantifying the value of execution on firm liquidity

To quantify the value of firm liquidity, the previous analysis of fill ratio, price variation and hold time metrics needs to be developed by:

- Exploring the relationship between higher price volatility and lower limit order fill ratios observed with firm liquidity;
- Understanding order placement strategies that improve limit order fill rates;
- Calculating the value of price improvement;
- Quantifying the cost of higher execution latency or hold time on last look venues.

(i) Market impact

Over the last few months we have discussed early drafts of our results with a variety of industry experts. The anecdotal evidence from comparison with their own experience is that the fill ratios observed for limit orders for all of the last look venues in the TPA data are unusually high, leading to a conjecture that the TPA trade flow was very benign from the perspective of the liquidity providers. In order to prove this theory, we have applied a similar methodology to the majority of FX market makers (see [4] for an example from a leading Non Bank LP) and started the collection of market impact statistics on the LMAX Exchanges.

Our approach to measuring market impact is to calculate the profit and loss of each trade relative to the market mid price at various time points after execution (from milliseconds to

minutes). In normal conditions each trade will instantaneously appear as profitable for the LP (and therefore loss making for the trader) due to the bid-offer spread. The LP's profit will then rise or fall as prices change. Flow is considered to be 'benign' (also described as 'soft' or 'uncorrelated') if it takes a long time before becoming unprofitable from the LP's perspective or remains profitable over the entire measurement horizon. The other extreme is 'toxic' (also described as 'sharp' or 'highly correlated') flow which becomes unprofitable from the LP's perspective over very short time horizons (milliseconds to seconds). Each LP will have their own view as to what time horizons demarcate the boundaries between correlated, average and uncorrelated flow.

We can analyse the net impact of a large number of trades by aggregating the profit or loss at the same post trade measurement times. To allow for trades of different sizes and on different instruments we can express the profit as a fraction of the notional value traded to create a composite market impact. An LP would normally expect profits to decline from the value at trade execution given the directional bias in trading activity (i.e. given a bias towards buying on rising and selling on falling prices, most trades will show a short term deterioration for the LP). The extent and gradient of this decline, and the recovery (if any) of profits over longer time scales characterise the difficulty of servicing a particular trader's flow from the perspective of the LP.

An aggregate trading pattern which remains consistently profitable for the LP, even if it shows some short term decline, provides the LP with the option to hold positions and internalise this trading against other clients or hedge with limited impact on the underlying market, and would usually be considered benign and uncorrelated.

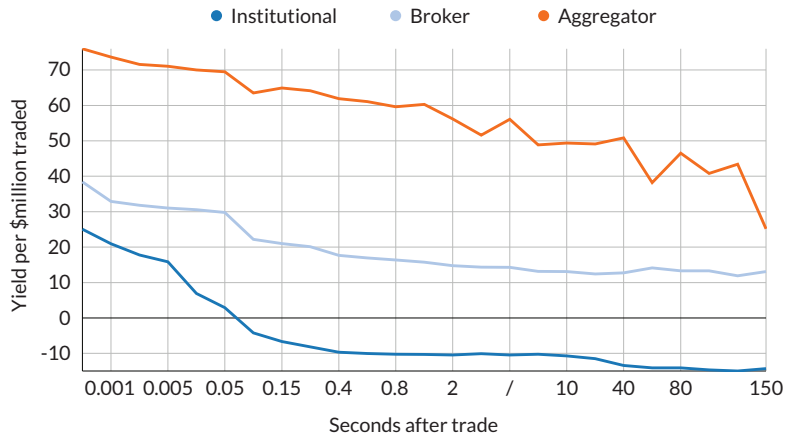

Chart 8: Market impact by profile on LMAX Exchange

Chart 8 shows the market impact for a set of different customer profiles with different flow types on LMAX Exchange London. The three different profiles are;

- **Broker:** Customers of LMAX Exchange Broker
- **Institutional:** Customers of LMAX Exchange MTF
- **Aggregator:** Customers with a similar profile to the TPA

The criteria for each profile are covered in more detail in the section 'Quantifying the value of price improvement' (p. 51).

Part II: (i) Execution quality metrics and firm liquidity

The Aggregator profile flow is very benign with a net positive P&L over all time horizons shown. For this type of flow, last look providers can provide customised very tight pricing. In contrast the LMAX Exchange firm liquidity model of an open anonymous central limit order book which caters for a wide variety of flow types is placed at a natural disadvantage. As a second consequence of the uncorrelated nature of the flow, we would also expect that the reject rates offered by the last look LPs should be very low when compared to other more correlated flow types, as observed previously.

The Aggregator profile flow is, however, not typical of all trading, or indeed all flow through aggregators. More typical average impact profiles for all Broker and Institutional customers on the London exchange are also shown in chart 8 (p. 45), with an expected crossing of the zero point for the Institutional customers at a very familiar number - 100ms.

This answers our first question – for this specific customer profile, one of the LMAX Exchange USPs of the 'same price for everyone' places firm liquidity at a disadvantage to last look where tighter prices can be offered based on the assessment of market impact.

However, even for this profile there are other considerations of the firm liquidity trading model which can offset this head start for last look, and we will now look at the impact of price stability on the particular execution style favoured by this subset of aggregators.

Box 8

Assessment of market impact and differentiated pricing by last look providers

- The analysis of different trading profiles shows that the trade flow from the TPA had minimal market impact;
- Trading strategies with more sensitivity to market impact risk information leakage, potentially resulting in disadvantageous price changes by last look LPs ahead of full execution;
- These strategies benefit from trading on firm liquidity, which does not suffer from pre-execution information leakage.

Contact

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