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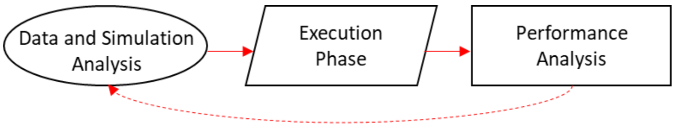
eFX “Explainers” **Algo Execution** Part II

As part of our “Explainers” series, we shed light on the topic of Algo Execution aka. Execution Algorithms (EAs). This issue offers insight into the design and construction of EAs including their development, technical structure and access to liquidity, while bringing to light the challenges faced with their usage.

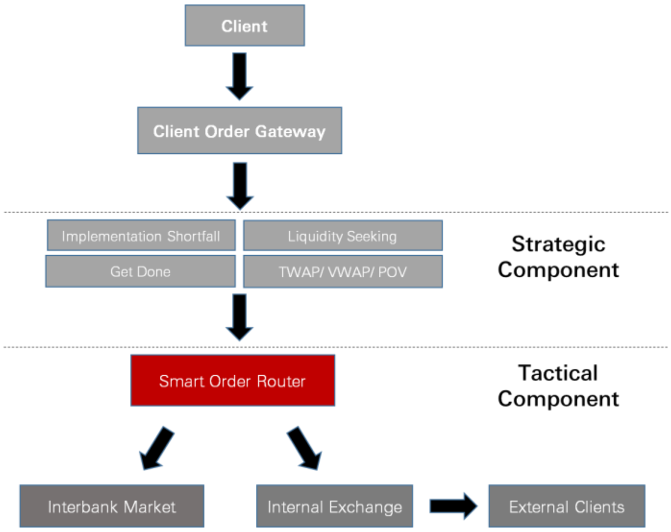
Phases of Algo development



- **Data and Simulation Analysis**: Execution Algorithms build a thorough understanding of the marketplace environment prior to execution including determining access to different liquidity (firm vs. last look liquidity, its location and the potential latencies the algo faces from its decision-making physical base). This analysis includes market impact / slippage analysis, spread expectations and optimal timing determination (e.g. where in the order book to place passive interest for the most optimal fill). Usually, this will include external data as well as the EA’s own proprietary data which is then run through a simulation / back-testing environment, to calibrate optimal parameters for the various execution strategies and market conditions.
- **Execution**: This phase focuses on how best to monitor and perform during the running of an algo, including:
  - Order Splitting: Dividing the parent order into child orders
  - Execution Scheduling: Determining when to release each child order
  - Venue Selection: Choosing where to execute based on liquidity and nature of the venue (Smart Order Router)
  - Price Calculation: Determining acceptable execution ranges and measuring against the algo objective, e.g. slippage vs. the TWAP price thus far
  - Adaptation: Adjusting to changing market conditions, e.g. increased volatility
- **Performance Analysis**: Upon completion of the algo execution, this is an opportunity for the EA provider to review the performance, which may include the measures of the Transaction Cost Analysis (TCA) report and / or other data collated during the running of the algo. These will measure against the classical benchmark of slippage / impact and unexpected behaviours, and consider any feedback provided by the client who has input the algo. External benchmarks of algo performance from providers such as Tradefeedr are also considered. The data and analysis is fed-back in a loop to improve the future performance of the algo.

Technical topology of the Algo infrastructure

- **Strategic Component**: This deals with the objective function for which the EA strategy is optimised (e.g. TWAP, VWAP) and the distribution of full execution amount over time using slices which are then passed on to the SOR.
- **Tactical Component**: The SOR handles the tactical task of optimal allocation among different venues to minimise execution cost taking into consideration price, fill ratio, round trip time etc.



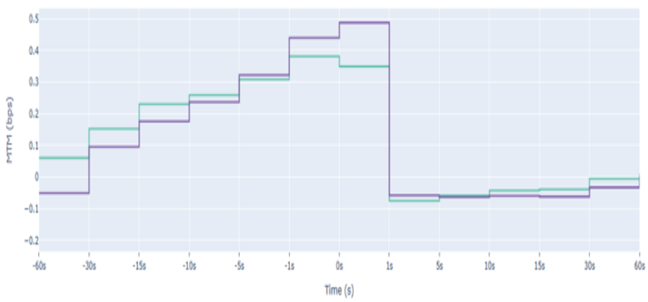
What are the liquidity sources for Algos?

Liquidity has always been a critical factor when it comes to algo performance, largely due to uncertainties around FX liquidity given the following factors:

- De-centralisation
- Firm vs. non-firm liquidity
- Market data throttling and randomisation
- Specifics of liquidity sources – mid-book venues, futures vs. cash and different tick / lot sizes

EA providers constantly monitor the quality of liquidity received over external venues by ensuring reasonable fill ratios which help to reduce opportunity cost and information leakage on misses as well as round trip times to reduce volatility risk caused by latency.

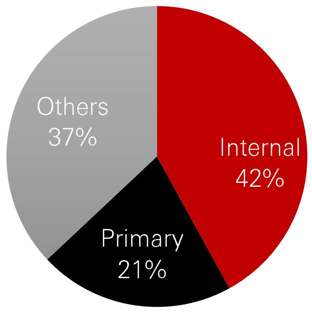
Another important metric to measure the impact of different types of orders is **markouts**. The chart below shows the markouts of Good-Till-Cancelled (GTC) fills over primary venues. There is some evidence of adverse selection where GTC orders are filled at levels which immediately appear disadvantageous based on subsequent price moves.



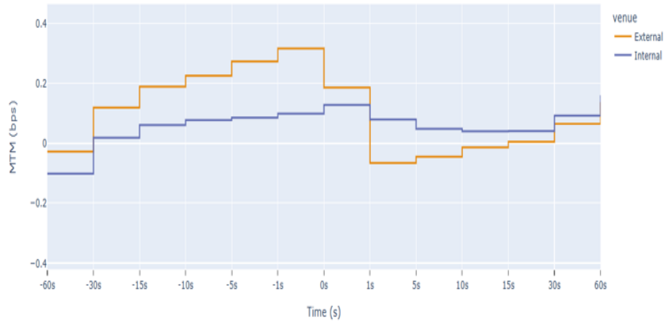
The EA provider will work closely with venues on bespoke liquidity curation where specific counterparties (or sources) are removed if deemed to be disadvantageous to their clients.

Internal liquidity has also been a crucial source of liquidity usually with lower price impact vs. external fills due to less information dissemination. This makes the **internalisation** ratio another critical metric for clients looking to reduce market impact, where internalisation is defined as execution against the bank's internal liquidity by facing various parts of banks' vast FX franchise through different mechanisms.

The chart below shows the volume share of HSBC's execution algos (2025 YTD) via the different **liquidity pools** where internal liquidity is the most prominent.



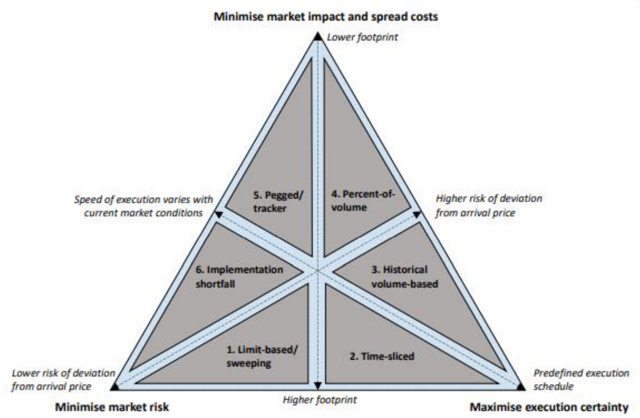
The chart below shows the benefit of internalisaiton with visibly **lower** market impact as well as reduced **adverse selection** vs. external fills based on HSBC's algo executions.



How is optimal execution achieved?

Key trade-offs exist between execution objectives: the "execution algorithm trilemma" (see below, source BIS). The primary goal of EAs is to achieve optimal execution. This concept, however, comprises several competing dimensions and will be defined differently for different users depending on their individual objective functions. While the various types of EAs can accommodate several preferences with respect to execution, no single execution algorithm can optimise all aspects simultaneously.

The execution algorithm trilemma



- **Slippage**: the difference between a fair price benchmark prior to execution and the actual execution price. This difference incorporates both a spread and any market movement between these two moments in time. Execution slippage arises for two reasons: (i) the information content of orders; and (ii) the liquidity absorption of orders, i.e. when an order consumes available liquidity in the opposing direction.

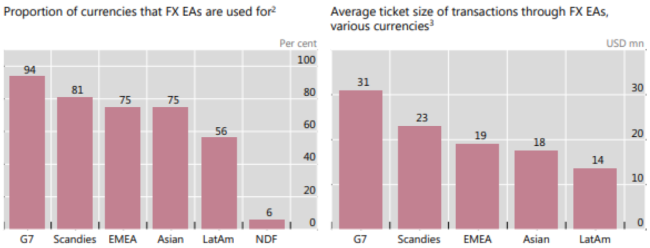
- **Market risk**: the risk arising from fluctuations in market prices over the duration of the execution covering fluctuations in market prices unrelated to the actions of the EA.
- **Opportunity cost**: a measure of the forgone profit or avoided loss of not being able to transact the entire order within the allocated time period.

Therefore, an EA that minimises market risk by executing as swiftly and aggressively as possible will not be able to minimise market impact simultaneously, as this would require a much more passive, and therefore slower execution. Similarly, an EA that seeks to respond dynamically to changing market conditions to optimise the trade-off between market risk and market impact may fail to complete if liquidity conditions are thinner than usual.

What are the limitations and challenges of Algos?

- **Pattern Recognition**: Large algorithmic trades can significantly impact market prices, potentially working against the order if not executed carefully due to information leakage. Other strategies may detect and exploit algo footprints, especially for the more predictive strategies (e.g. TWAP). They can also be potentially reverse engineered which may diminish their edge over time. **Mitigation** of these downsides can be achieved through strategy and configuration choices e.g. use of internal liquidity, passive strategy, avoidance of primary venues etc. Adding randomisation and adaptive elements into the strategy can also reduce the signaling risk.
- **Technical Disruptions**: Algorithmic trading relies on technology, and errors in programming or server failures can lead to unintended and potentially large losses. HSBC's algo systems have automated risk controls in place specifically designed to respond to the impact of extreme market conditions, market disruption or distortion. Depending on the condition detected, these automated system risk controls can either halt the relevant system as a whole (in more extreme situations) or pause activity until conditions normalise. The **kill switches** in our algorithmic trading systems act on all algorithmic functioning, in addition to our range of automated risk controls that act in situations of market volatility which are tailored to the specific functions of our different EAs.
- **Data Dependency**: Algos are only as good as the data they are fed. Poor quality or inaccurate data can lead to flawed trading decisions. Algos often rely on historical data and mathematical models to predict future market movements, which may not accurately reflect future market conditions or account for unexpected events. HSBC algos benefit from data generated from our broad activity in the market from our composite of trading desks. This helps to enhance the performance of our EAs, along with our diverse client base that serves as key source of internal liquidity.
- **High Costs**: Setting up and maintaining an algorithmic trading system can be expensive, requiring significant upfront and ongoing costs.
- **Competition:** As more participants adopt algorithmic trading, the competition for liquidity and best prices can increase, potentially leading to higher transaction costs for some.
- **Regulation and Oversight:** Algorithmic trading is subject to regulatory burdens, which can be complex and resource-consuming to ensure continuous compliance. Given the capacity for significant market movement, often a segregated (EA) team will monitor, in real-time, the algo behaviour and their efficacy in achieving the strategy goal. This also guards against conflicts of interest and ensures market-making desks are not made aware of the ongoing algo executions.
- **Credit Exhaustion:** Large algorithmic trades might result in high credit utilisation and hence impede other lines of business consuming the same credit line.
- **Currency Reach**: Partly driven by need but also due to the more inconsistent nature of liquidity for the lesser pairs, EAs are more prominently used for liquid currencies (see below, source BIS).

Usage of FX execution algorithms across currencies[1] and average trade sizes



[1] G7 currencies: US dollar (USD), euro (EUR), Japanese yen (JPY), pound sterling (GBP), Australian dollar (AUD), Canadian dollar (CAD) and Swiss franc (CHF). [2] Average of providers' responses to the question "Which currencies do clients typically use EAs for?" [3] Average of providers' responses to a question on the average size of clients' tickets in the respective currencies. Ticket sizes for NDFs excluded due to small sample size.

Sources: Markets Committee survey among execution algorithm users and providers; study group calculations.

Is Algo Execution right for you?

To conclude, when to use an EA, the user should consider the following key questions:

- **Why Algo?** As detailed in our eFX Explainer Part I, the user must understand what necessitates / appeals in using an algo (Spread, Liquidity, Size, Anonymity). If these are important conditions / KPIs then EAs could offer an additive improvement to their execution experience.
- **Which Algo?** This can also be another hurdle for the user; to decide upon the strategy (i.e. TWAP, IS etc.) or even selecting the parameters of that chosen strategy (e.g. leniency, whether to use a limit price and so on).
- **Whose Algo?** Despite the rise of several third-party providers of execution analysis, it remains difficult to compare the offerings between providers of EAs, given limited comparable sample points over similar market conditions and usage of numerous evaluation metrics. Each provider will highlight (and possibly offer some evidence), that their algo is the best-on-the-street. Additionally, there will invariably be differences in the implementation between providers for the same namesake strategy.

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