



FIX and algorithmic trading strategies

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A recent milestone in the evolution of electronic trading is the development of automated algorithmic trading strategies. Algorithmic trading may be defined, broadly, as the use of computer programs and sophisticated trading analytics to execute orders according to a pre-defined strategy. In addition to following the strategy, the algorithms take into account market impact costs, transaction costs, opportunity costs and other costs in order to achieve best execution.

Important characteristics of algorithmically traded orders, compared with manual or worked orders, include the following:

- A considerable use of analytic models and rules-based processing to scan the market in real time looking for trading opportunities.
- Use of historical data to identify opportunities that arise when current market trading conditions deviate from historical patterns.
- A tendency to produce, as algorithmic output, a large number of small orders that are placed onto the market directly, or through DMA (Direct Market Access) broker services.
- A need to react quickly to market events and generate actions that feed back into the algorithmic process.
- A tendency to work a large number of related orders concurrently, a process known as program, or portfolio trading. Many algorithms that work for single stocks are increasingly being deployed for program trading. Program trading is currently experiencing substantial growth in volume,

accounting, for example, for up to 40-45% of daily volume on the NYSE.

There are many factors that led to the development of algorithmic trading. Fast connectivity, including the FIX protocol, is one of the important factors but we should also note other important drivers:

1. **An increasing tendency of asset managers and other institutions to measure trading cost impact on fund performance.** This includes visible costs, such as commissions and taxes, and hidden costs, such as market impact, timing and opportunity costs. For large and complex orders the invisible costs can be a significant contributor to the total cost, and will often exceed the visible costs.
2. **A regulatory environment with greater emphasis on best execution practices.** An automated environment is more compliant because each event, or action, on an order or execution can be time stamped, stored and analysed post-trade.
3. **The growth of hedge funds,** which are specifically set up to trade strategies that exploit improvements in connectivity to markets across the world, including cash equity and derivatives markets.
4. **Greater technology sophistication on the buy-side,** which enables them to measure broker and exchange performance and to select brokers based on this performance analysis.

We should note that algorithmic trading is not the solution to every trading problem. Algorithmic trading works well for highly liquid securities in which the quantity to trade is a small percentage of the average daily volume (ADV) and where there are clearly defined execution objectives.

Algorithmic trading is less likely to be suitable for large or illiquid orders. In these cases, a broker intermediated market still adds significant value; for example, where there is a need to search out liquidity that is not already displayed in the market. However, by freeing traders from working small orders, the execution performance for all order sizes is improved because traders can focus on the complex transactions where the significant value resides.

Background

Initially, algorithmic trading tools were developed by large, often international, broker firms and investment

banks. Then hedge funds developed tools and algorithms of their own as technology and market access costs dropped. Over time, these developments found their way into the mainstream and now many buy-side order management system (OMS) vendors include them, or tools which allow them to be built, in their products.

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Since then, many of these tools have become popular and are now part of the standard offering of many large brokers, investment banks and OMS vendors.

Examples

There are many well-established trading algorithms that can be devised and implemented. This article can consider only a very small subset of these algorithms and their possible configurations.

Of the significant algorithms, we could note the following:

1. **Iceberg or hidden orders.** This is a very simple strategy that attempts to release a large order into the market by breaking it into pieces and releasing each piece, known as the tip of the iceberg, at specified times over the trading horizon. The strategy can be used in markets where iceberg or hidden reserve or undisclosed orders are not directly supported by the exchange. Variations on the algorithm can attempt to complete the order within a specific period of time, or to restrict the participation to a percentage of volume.
2. **Volume Weighted Average Price (VWAP) strategy.** The objective of this strategy is to match, or exceed, the VWAP of the stock over a specified time horizon. This is one of the most common trading strategies and is described in detail below.
3. **Arbitrage strategies.** The objective here is to identify price discrepancies between classes, or types, of instruments and a related instrument,

often a derivative security. Examples include futures versus cash markets; index arbitrage and Exchange Traded Funds (ETF) arbitrage are among the most popular.

4. **Spread, or pairs, trading**, where price spreads (differences) between two correlated stocks are observed to exceed a trader-defined threshold and this triggers a linked buy of one with concurrent sell of the other. Later on, when the spread reverts to its historical value, the buys and sells are reversed.
5. **Ratio trading**. This is analogous to the spread trading example, except it is the ratio of the two securities that is monitored, instead of the spread.

In addition to these, there are other strategies that could be defined, and proprietary ones are continually being devised by brokers and institutions. Almost all share the characteristics noted above, especially with regard to real-time event (market data) handling, historical data availability, analytics and DMA order requirements. Moreover, it is possible to combine strategies. For example, when buying and selling each side of a pair, the orders may be sliced into the market using an iceberg-type strategy so as to minimise the market impact.

An important point to note is that, by identifying the essential building blocks of the algorithmic services, it is possible to create generic tools and products that can be used to build many algorithms, not just a single specific algorithm.

Automated VWAP trading strategies

To further advance the argument described above, we consider one of the most common strategies – automated VWAP. Analysing this in detail provides insight into the construction of algorithms in general. It is also useful in its own right.

The objective of the algorithm is to target the stock VWAP over the trading horizon of the order, which might range from a couple of hours to the whole trading day. Many market participants use the VWAP as a measure, or benchmark, of the trading cost over the life of the order. Additionally, the VWAP is sometimes used to measure the performance of traders, but this is an inexact measure and the issues surrounding it, although interesting, fall outside the scope of this article.

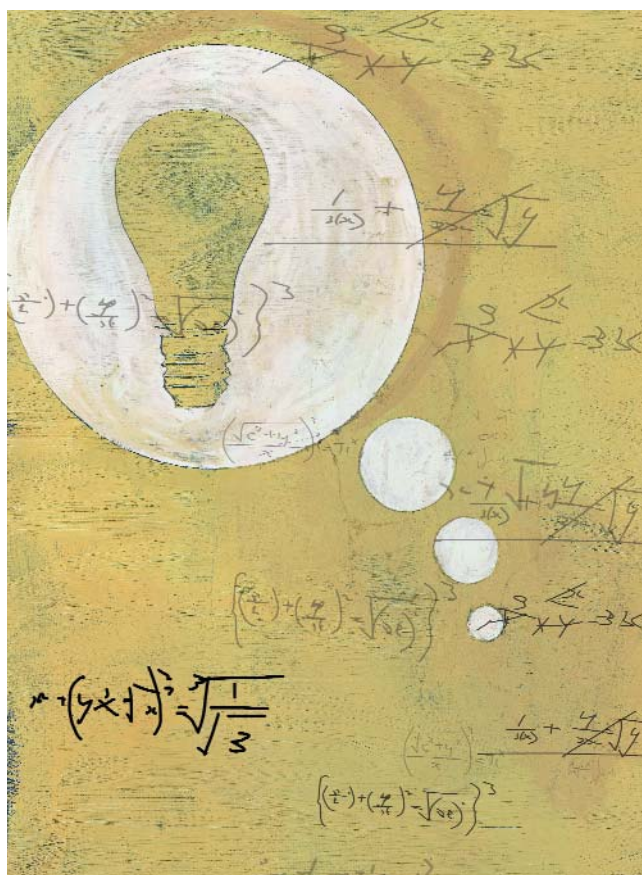
The starting point of the algorithm is to consider the typical daily volume profile of the stock over the trading day. This can be derived from historical data collected over the past 20 or 30 trading days.

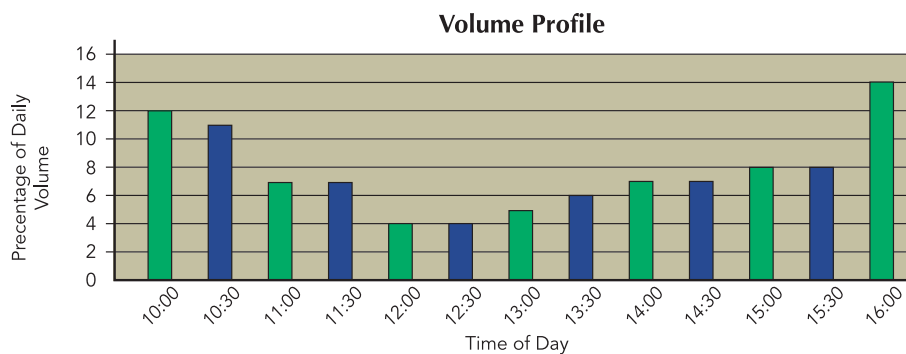
The volume profile divides the trading session into fixed length intervals of time and measures the volume of trading in each interval. For the sake of the discussion, this time is fixed at half an hour.

An example profile is illustrated below for a trading session that starts at 10:00 am and concludes at 16:30 pm.

The strategy is implemented by slicing the original order into pieces in proportion to the volume profile during each half time interval. For example, if the volume profile indicated that 12% of the volume is typically carried out at the open, then the algorithm would split 12% of the order quantity and release it into the trading session open.

There are many complexities of detail in actually implementing the automated VWAP algorithm. We restrict ourselves to noting the following:





1. The trader may believe that the stock price will trend up or down during the trading session.

For example, the stock of an international company, which also trades in a different time zone, may have performed well overnight, or favourable news may have been received overnight. The expiry of futures contracts might be another factor that could influence prices, especially at the close.

In this case, it would be naïve to implement a strict VWAP strategy and we would like to take into account the expected trend. Some algorithms support the concept of a VWAP tilt which allows the standard volume distribution to be adjusted to capture the trends by shifting the distribution towards the open or close. The trend could be up or down, and can be set by the trader as a parameter of the algorithm. Note that if the trader is incorrect about the trend then there is a significant possibility that the VWAP benchmark will not be achieved.

2. It might not be possible to complete the orders in each time interval.

Algorithms must consider specifying an aggressiveness factor to ensure the orders are completed, assuming it is mandatory to complete them in a single session. Often, limiting orders away from the inside market can be tried early on in the algorithm lifecycle and later switched to more aggressive market orders to complete.

In this scenario, current market volume and price data are fed back in to the algorithm and dynamically interact with it, a feature of advanced VWAP algorithms.

3. There is likely to be a need to repeatedly cancel and/or correct (amend) orders generated as a result of the strategy. This could be case where limit prices or quantities are adjusted to reflect the

increasing or decreasing aggressiveness of the algorithm. It is also possible that the algorithm could be cancelled by the user, or otherwise be modified, just like a standard block order.

4. There is a risk that other traders can detect a VWAP trading strategy in action and attempt to trade against it. However, this can be disguised by adding a random small quantity to each split order to disguise the algorithm.

There are several advantages of the VWAP trading strategy. Firstly, the strategy will minimise market impact costs in the absence of any expected trending up or down of the stock price over the strategy horizon. Additionally, the strategy can be used to conceal trading intentions and order size by participating along with the market.

The disadvantages are related to the first point considered above with respect to price trends. If the profile indicated that a high percentage of the volume was executed at the close, and the price trended up throughout the trading session, the VWAP strategy could actually turn out to be quite expensive.

FIX and automated trading strategies

What does the use of automated trading algorithms have to do with the FIX protocol? We have already noted the availability of direct market access connectivity as an enabling technology for algorithmic trading, especially for strategies originating with buy-side institutions, such as hedge funds. In these scenarios, the number of transactions transmitted on the FIX session can be a substantially higher than a standard session.

This increase in transaction volume is a result of changing trading styles and not just of market volumes,

which have, until quite recently, generally been falling or have remained stationary in global markets. Thus brokers, investment banks and exchanges need to be prepared for growth in trade volumes, more so if higher overall trading conditions return. Furthermore, we should note that a high level of cancel and cancel/replace processing would also be a requirement for successfully servicing this flow.

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An alternative to executing the algorithm on the buy-side is to send the order to a broker, together with instructions on how to execute the order. This may still be the most common way of executing algorithmic orders and many brokers now offer this style of trading through their advanced execution service products.

The FIX Protocol offers a number of possibilities:

- 1. Execution instructions, FIX tag ExecInst.** This has the advantage of being an existing tag and many common trading strategies are already accommodated, such as VWAP and percent of volume restrictions. It can be augmented with other fields, including trading session IDs and expiry time, in order to capture time-horizon restrictions.
- 2. Handling instructions, FIX Tag HandInst.** This should specify 'Automated Execution, no Broker Intervention' so that the order is routed to an algorithmic service for automated execution, instead of to the trading desk.
- 3. Text instructions in free format text.** This is the least satisfactory option, because it is difficult to automate routing and processing rules if there is free format text input to process. It must usually be routed to a trader just in case it contains additional instructions that cannot be automatically parsed.

As a general rule, there is more support for algorithmic trading in later versions of the Protocol than in the earlier ones. So, as always, some bilateral agreement must be arranged for those installations still working with version 4.0, 4.1 or 4.2 of the Protocol.

Algorithmic trading risks

With any automated processing there are risks that must be understood before a service can be deployed. The following are some of the risks that should be considered before enabling an automated algorithmic service:

- 1. The algorithm performance might deviate significantly from its benchmark because of unexpected events or trends not anticipated by the algorithm designer.** Hence, it must be possible to track and alert a trader to a deviation from the benchmark using threshold parameters set by the trader.
- 2. The data quality might be inaccurate.** The volume profile might be skewed by an unusually large block print in the sample period, especially for a relatively illiquid stock.
- 3. The algorithm must handle exception events, such as order rejections, and recover them or notify the trader.** Exchange business rules must be observed with respect to order handling and these could vary significantly from one exchange to another.
- 4. Communication links could break and it may be necessary to rapidly and easily cancel a large number of outstanding orders on the exchange.**

It should be noted from this list that any automated algorithm is also, to some extent, a manual algorithm because of the need to actively interact and monitor the algorithm performance throughout its execution lifetime.

Conclusion

Algorithmic trading continues to grow in popularity and has become a mainstream service offered by many brokers and OMS vendors. Algorithmic trading depends critically on fast market access and can produce significant increases in transaction rates, even if overall executed values are fairly static. The FIX Protocol is a significant enabler of this transaction volume and continues to be an important part of the overall picture. These increases in transaction activity are a further significant reason for continuing to invest in automated trading and connectivity technology. **FIX**