Introduction to Algorithmic Trading

Sep 3, 2009
Algorithmic Trading Basics – use GSAT as example

Algorithmic trading refers to the placing of orders into a quantitative model that automatically executes according to the execution strategy or benchmark specified by the user.

Generally (though not necessarily) it involves slicing the order into smaller exchange orders for the purpose of attaining certain timing dictated by the trader, or to reduce market impact.

<table>
<thead>
<tr>
<th>Algorithm</th>
<th>General Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VWAP</td>
<td>Designed to minimize shortfall relative to a Volume-Weighted Average Price benchmark.</td>
</tr>
<tr>
<td>TWAP</td>
<td>Designed to minimize shortfall relative to a Time-Weighted Average Price benchmark.</td>
</tr>
<tr>
<td>Participate</td>
<td>Achieve a user specified percentage of volume while trying to maximize spread capture</td>
</tr>
<tr>
<td>4Cast</td>
<td>Minimize the implementation shortfall by optimizing impact cost versus market risk</td>
</tr>
<tr>
<td>Piccolo</td>
<td>Short-term spread capture for marketable orders</td>
</tr>
<tr>
<td>Sonar</td>
<td>Work order without displaying bids or offers in the market</td>
</tr>
<tr>
<td>Dynamic Scaling</td>
<td>Percentage of volume strategy with adaptive participation rate which allows for increase or decrease of execution speed based on changes in price level</td>
</tr>
<tr>
<td>Peg</td>
<td>Peg to best bid / offer to work passively and maximize spread capture</td>
</tr>
<tr>
<td>Auto Short-Sell</td>
<td>Execute short-sell orders by automatically offering stock at most aggressive offer price given local regulations</td>
</tr>
<tr>
<td>Navigator</td>
<td>Determines which of the GSAT algorithms is appropriate to execute an order given its characteristics</td>
</tr>
<tr>
<td>Timer Iceberg</td>
<td>Work a portion of the total order on the exchange at a specified time interval until the full order is complete</td>
</tr>
</tbody>
</table>
Algorithmic Trading – Value Proposition

• Improve Execution Quality
  • Helps attain consistent, predictable results; faster response to market movement

• Enhanced Productivity
  • Enables increased focus on difficult orders, improves control

• Speed & Information Synthesis
  • Collects vast amount of trading data and looks for trading opportunities

• Minimize Trade Impact
  • Sophistication of algorithms reduces trading pattern recognition and information leakage as a result of larger trade size

• Anonymity from the “Classic” information flow

• Parameters and Customization
  • Algorithms incorporate trader preferences and risk appetite

• Algorithmic logic adjust frequently with market dynamics and regulatory changes
The Changing Equity Market – US Perspective

- 2002: 65% Single-stock full-service
- 2005: 45% Single-stock full-service
- 2007: 25% Single-stock full-service

- 2002: >5% Algorithmic Trading
- 2005: 24% Algorithmic Trading
- 2007: 30% Algorithmic Trading
The portfolio trading, algorithmic trading and DMA buckets may overlap: e.g. portfolio trades may execute algorithmically through DMA.

How to Access – use GSAT as example

GS Electronic Trading

GS Sales Trading

Direct FIX Connection

Portfolio Trading Desk

Bloomberg

Vendor Systems

Fidessa

LATENTZERO

REUTERS

Charles River

ITG

TradingScreen

MetaBit

TORA

Huntsun

MacGregor

REDIPlus

GSAT

FlexTrade

Portware

London Data Services

Eze Castle Software
Pre-Trade Analysis

- The GUIDE is an integrated pre-trade analytical tool in REDIPlus exclusively for the 4CAST algorithm. By adjusting your risk preference ('apply view of alpha'), the trader can optimize and view the expected transaction cost and time horizon before submission. The GUIDE offers several fields and graphical representation of the profile.

- **Risk Aversion**: A representation of the 'strength of alpha' that the client expects to see during the execution horizon. Stronger the expected alpha, higher the RA should be selected.

- **Estimated Trading cost**: An estimate of the cost of executing the order – based on Goldman Sachs historic estimates, which comprise of both time and impact.

- **Stock Volatility cost**: A function of the volatility of the stock during the execution period (based on historic estimates for the relevant time of the day) and the Risk Aversion selected by the client.

- **Estimated Total cost**: A 4cast of the final price (midpoint price + total cost) that the user can expect, given his estimate of volatility (built into the risk aversion).

- **Optimal Trading Duration and Resulting Participation rate**: Expected rate of participation during the suggested execution horizon (based on ADV and stock specific volume profiles).
Pre-Trade Analytic Tool: use GSAT as example
Post-Trade Analytics Reports

Example

The above chart is for illustrative purpose only
Average performance: use GSAT as example

Performance vs. VWAP

<table>
<thead>
<tr>
<th></th>
<th>Participation Orders</th>
<th>VWAP Orders</th>
</tr>
</thead>
<tbody>
<tr>
<td>AU</td>
<td>-15.66855321</td>
<td>-5.190851227</td>
</tr>
<tr>
<td>HK</td>
<td>-7.880201839</td>
<td>5.912865781</td>
</tr>
<tr>
<td>IN</td>
<td>8.798448751</td>
<td>4.306604841</td>
</tr>
<tr>
<td>JP</td>
<td>-4.708278667</td>
<td>-3.783971565</td>
</tr>
<tr>
<td>KR</td>
<td>-6.482683752</td>
<td>-2.400355183</td>
</tr>
<tr>
<td>TW</td>
<td>8.913629585</td>
<td>3.405438189</td>
</tr>
</tbody>
</table>

Performance vs. Arrival

<table>
<thead>
<tr>
<th></th>
<th>Participation Orders</th>
<th>VWAP Orders</th>
</tr>
</thead>
<tbody>
<tr>
<td>AU</td>
<td>-2319407258</td>
<td>-15.72804323</td>
</tr>
<tr>
<td>HK</td>
<td>-5652769503</td>
<td>-43.49656859</td>
</tr>
<tr>
<td>IN</td>
<td>-1029168281</td>
<td>-2100668655</td>
</tr>
<tr>
<td>JP</td>
<td>-4001389896</td>
<td>-15.74954325</td>
</tr>
<tr>
<td>KR</td>
<td>-4386364917</td>
<td>-29.79496711</td>
</tr>
<tr>
<td>TW</td>
<td>-4108071197</td>
<td>-7810096976</td>
</tr>
</tbody>
</table>
Historical performance pattern: use GSAT as example
Sample Trading Interface in EMS

经纪人- 高盛交易部代号
GS: 高接触单股交易
GSPT: 高接触组合交易
GSDA: 低接触交易 (直接和算法交易)

高盛算法交易策略选择
- VWAP
- Participate
- Dynamic Scaling
- Sonar
- AutoShortSell
- 4Cast
- Navigator

经纪人 买/卖 数量 代码 限价 类型 时效
GSDA BY 100,000 3388 HK Equity = 3.500 LMT

Add Order - Strategy Ticket - BANK OF CHINA - H - HKD
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