Algorithmic Market Making Capstone

In our ALGO 2 (Algorithmic Market Making) Case, we introduced participants to algorithmic strategies for a market maker whose job it is to earn the bid-ask spread while providing liquidity to the market for a single stock. That decision case followed another market microstructure case (Liability Trading 4) which introduced multi-venue trading and the associated feebate structure that new exchanges introduced in order to attract liquidity. As a result, in the ALGO2 case, one could strategize both on earning the bid-ask spread and on pursuing rebates by providing competitive limit orders that get filled. We parameterized the ALGO2 Decision Case with a feebate structure that reflected the generous rebates offered by new exchanges at the time.

More recently, the feebate structures have changed as traditional exchanges responded to the competition from new exchanges with the result that both taker fees and maker rebates have decreased. This enhanced algorithmic market-making case updates the feebates, as itemized below, and also provides additional opportunities to earn bid-ask spreads. We have achieved the latter by introducing additional securities and parameterizing the programmed order flow (the ANON liquidity traders) such that the bid-ask spreads are subject to more variable dynamics. As a result, participants should develop a market making algorithm that is able to pursue the most profitable opportunities across securities and over time in an environment in which the potential source of returns from earning the bid-ask spread (versus focusing just on rebates) is enhanced.

The market-making skills developed by practicing our introductory market-making decision case (ALGO2) will be a useful preparation for this enhanced market-making environment. Therefore, participants are encouraged to read the case brief for that ALGO2 case to review the basic market-making strategy. Since you may have already practiced an algorithmic arbitrage strategy in our ALGO1 case, recall that a market making algorithm is considerably more difficult to conceptualize since trading occurs over time (versus arbitrage where all trades occur simultaneously). Capturing a bid-ask spread will require traders to inventory a long (or short) position for an uncertain period of time as they wait for an opposing trade to cover their position. As reviewed in the introductory ALGO2 market-making case, the simplest execution of a market-making strategy is to submit a paired bid and offer and have the two orders filled over time; the trader (algorithm) earns the price differential. When markets aren't trending, this is a reasonably effective strategy.

Algorithmic Market Making Details – ALGO2e

This ALGO2e case is an extension of the RIT ALGO2 Case (Algorithmic Trading 2 - Algorithmic Market Making). In this case, we introduce multiple securities, rather than the single security in ALGO2,

---

Craig Geoffrey, Eric Kang, Tom McCurdy and Marco Salerno prepared this case for the RIT market simulation platform, http://rit.rotman.utoronto.ca/.

which allows participants to develop strategies that are different across securities with different characteristics.

For a full description of the learning objectives, please refer to the ALGO2 case brief. The table below provides a description of the securities.

Security	Active Trade Fee	Passive Trade Rebate
CNR	0.0027	0.0023
RY	-0.0014	-0.0020
AC	0.0015	0.0011

Fees and rebates are applied to all trades based on whether they remove liquidity (active orders) or provide liquidity (passive orders). Market orders or the portion of a limit order that crosses the market immediately remove liquidity. Limit orders (including the portion of a limit order that is not marketable, that is, not immediately executed) provide liquidity. The feebate structures are calibrated to approximate that in a traditional exchange such as the TSX for a cross-listed stock (the CNR security) with a fee charged for removing liquidity and a rebate for providing liquidity, a newer competing exchange such as NASDAQ's CX2 (the RY security) that *pays a rebate* for removing liquidity and *charges a fee* for providing liquidity (represented by the negative signs in front of the fee/rebate amount), and a traditional exchange such as the TSX with a non-cross-listed stock (the AC security) that provides a lower passive trade rebate in the absence of competition.

For example, assume that the top of the limit-order book for AC is currently:

Bid Size	Bid Price	Ask Price	Ask Size
1000	9.99	10.02	1000
1000	9.98	10.05	2000

If a market-making participant submits a limit order to buy 1,500 shares with a limit price of 10.03, s/he will immediately receive 1,000 shares for a price of $10.02 and will be charged $1.50 [=$0.0015×1,000] in fees. The remaining 500 shares will stay in the limit order book (as a bid for 500 shares at $10.03) and will receive a rebate of $0.55 [=$0.0011 x 500] if/when filled.

The markets will be open for 5 minutes (300 seconds) for each replication of the case. As a result of the differences in fees and rebates outlined in the table above, participants are expected to apply market-making strategies across the three different securities. To further challenge strategies and to put emphasis on focusing on earning the bid-ask spread as well as potential rebates, the dynamics of each available security are buffeted by differential liquidity from the programmed order flow such that the dynamics of the available spread will vary across securities and over time.

As noted above, market-making strategies may result in accumulated inventory. As a result, they will be exposed to market risk. As in the introductory ALGO2 case, there is a limit of 5,000 shares per order, and each student is limited to a position of 25,000 shares gross or net. In order to discourage excessive exposure to market risk, trades that would cause a violation of either limit will be rejected.

As in our other RIT ALGO Cases, participants have a choice of using either the REST or the VBA API. The maximum orders per second has been set at 500.