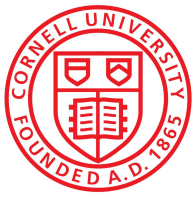

ORIE 5257

Special Topics In Financial Engineering VI

Assignment: Due Date 20^{th} of Nov.

The Request For Quote Process: The Request For Quote (RFQ) process allows market-makers to respond to trade requests from a set of counterparties. A counterparty initiates an RFQ detailing information on the trade request, which will include the bond identifier, the size of the transaction, the side (buy or sell), etc. The RFQ is sent to a selection of market-makers (where the counterparty will choose the optimal list based on past experience, hit-ratios, etc.) Upon receiving the RFQ, a market-maker will quote back a specific price at which the are willing to execute the trade (yet each market-maker is not aware of the competitions' prices). When the counterparty is ready to execute, the market-maker with the best price will win the trade. Of note, the market-maker will then have the other side of the trade and will need to manage the risk (and hedge appropriately).

Assignment Details: In this assignment, each group (of no more than five students) will act as a market-maker. The objective is to create an algorithm that allows the market-maker to: (a) evaluate the probability of winning an RFQ; and (b) set the price of the RFQ so as to maximize the P&L of the market-maker (which is naturally adjusted by the probability of winning the trade).

Specifically, each group will use the *RFQ Historical Data* (created synthetically) in order to complete the following deliverables for this assignment:

1. Create an algorithm to estimate the probability of execution a trade for a given price (and any other feature available in the data). For this section of the assignment, the group will need to:
   (a) Describe the algorithm, the parameters chosen, and the process by which the group decided on the chosen technique and parameter set;
   (b) Critically present the out of sample results using the data in the *RFQ Out Of Sample* tab;
   (c) Describe the shortcomings of the chosen approach and possible ways to improve it.
2. Create an algorithm to provide a quote for a hypothetical RFQ (partially utilizing the algorithm developed in the previous section of the assignment). Specifically, the deliverables are:
   (a) Describe the algorithm, the parameters chosen, and possible deficiencies of the model;
   (b) Plot the probability of getting a fill as a function of the price (distance from mid) for the modal quantity, number of competitors, etc.
   (c) Present the prices which this algorithm computes in response to the RFQs listed in the file *New RFQs* tab. The price is quoted as a *distance from mid* similar to the data presented in previous sections.

The grading of the assignment will be based primarily on the group's write-up (approx. 90%) and partially (the remaining 10%) on how the group ranks in terms of P&L for the RFQs that need to be priced: specifically, once every team has submitted the assignment, we will compute the P&L for each new RFQ. Note that the P&L is not yet know and will only be revealed *after* all the assignments have been submitted: as per RFQs in the real world, the P&L of a trade is not yet known as the market-maker has to firstly win the trade and, secondly, hedge the trade over time at (hopefully) a profit. To mimic the at times unforgiving nature of the market, the groups will be ranked as follows:

- Each RFQ that would incur a loss (i.e. a very competitive price) will automatically earn -1 point and be removed from the list of *eligible RFQ responses*;
- Out of all the remaining *eligible RFQ responses* (i.e. the ones that would have a positive, or at least zero, P&L if executed), only the most competitive price wins the RFQ and earns +1 point;
- Winning RFQs priced at the exact same level will share the point equally, minus an anti-competition penalty of 0.5 of a point (e.g. if three groups have the same winning RFQ price, each will earn $\frac{1}{6}$ of a point);
- Note that RFQ responses can only be given to two decimal figures (and will automatically be rounded if more precision is given).

To summarize:

(i) The assignment is due by late November;

(ii) Each group can be of no less than two and no more than five students;

(iii) Grading is based on the quality of the algorithms and, importantly, on a critical review of the approach taken (as presented in the write-up); in addition, the performance rank of the responses to New RFQs will distinguish each group and form part of the grading process;

(iv) The write-up should be no more than *two* standard A4 pages (in *pdf* format), where providing a concise yet comprehensive write-up is part of the assignment.