Strategy Explanation

In our strategy, we predict the ‘market trend ’each time we meet with a trades message and then invest accordingly with the predicted trend and predicted fair value.

Data we use: Tesla data, file ‘TSLA-TAQ-aug19v2.zip’, which is a combined file of the trades and quotes data. We used the file ‘Tick Data Setup.ipynb’ to do the combination.

1. To predict the ‘market trend’

If we receive a trades message, we look into the last n message we have received before this trades message. We continuously save the last n messages received.

n is the check length for quotes. We used a fixed number of quotes instead of the time length because we believe, nowadays, the market has enough liquidity. We assume that the messages are allocated evenly in the time length and use only the last n message thus we can save the time to retrieve data according to time length.

In our strategy, we set n = 2. Since we found that the number of NBBO quotes messages is less than the amount of trades messages. We assume that there is a lagged effect for the quotes to be the cause of trades. Then we use 2 as the look back period length.

- If there is a trades message in the last n messages. Then we use the tick test to predict the market trend. Since in the paper, we assume that the trade is isolated in a period. If the current trade price > last trade price, then we assume it is a buy trend. On the contrary, it is a sell trend. If they have the same price, then we use the trade’s tick test trend before the last trade.
- If there are no trades in the last n messages. Then we predict the market trade with available quotes data. We use the last n quote since there would be a lagged effect for the quote to be a cause of trade.

2. Invest according to the market trend

Now we have a predicted market trend after we receive a trades message. So for the following quotes messages until the next trades message, we would:

- The market trend is ‘Buy ’and the predicted fair value is higher than the ask price. Then we buy aggressively for all quotes of ask’s amounts.
- The market trend is ‘Buy ’and the predicted fair value is higher than the bid price but lower than the ask price. Then we buy passively for all quotes of bid’s amounts.
- The market trend is ‘Sell ’and the predicted fair value is lower than the bid price. Then we sell aggressively for all quotes of bid’s amounts.
- The market trend is ‘Sell ’and the predicted fair value is lower than the ask price but higher than the bid price. Then we sell passively for all quotes of ask’s amounts.

3. How to calculate the fair value

$$fairvalue = midpoint + halfspread\,(b_{tick}F_{tick} + b_{risk}F_{risk})$$

- The fairvalue is updated each time we meet a trade message. (Fairvalue for the next market trend)
- The midpoint is updated for each NBBO quote. We used the updated midpoint data for the last NBBO quote to calculate fairvalue if we are predicting the trend without quotes. If we are predicting with quotes, then we update the midpoint using the our target last n quote data.
- **Parameters:** tick_window = 20, risk_coef = -0.5, tick_coef =1
- And we use last trading date's NBBO quotes data to calculate the reasonable halfspread.
- We set risk factor to 1 if the total_quantity_filled is higher than 5000 and if it is lower than -5000 we set it -1, otherwise 0.