Homework: The Perfect Market Maker

April 16, 2019

1 Introduction

Here we simulate performance a perfect market maker of Bitcoin in USD terms at Coinbase. Our definition of perfect market maker is someone who participates in the "right" direction as part of *every* trade (of at least a certain size) that happens on the best bid or best offer. Your simulator will start with the following details

- Z: trade data (timestamp, size and price)
- B: book data (timestamp, levels and sizes of bid/offer amounts)
- s: target transaction size
- j: max long position (in Bitcoin)
- k: max short position (in Bitcoin)

It will aggregate all trades happening at the same price and timestamp, and then check for simulated participation. This participation happens if

- the trade price is at the current best bid or offer price,
- trade quantity $q > 4s$
- the new position x satisfies $-k \leq x \leq j$

For convenience, we will assume short sales result in cash payments.

2 Data

Load the data from the class website.

3 Exercise

Write code to find trades and PL of the perfect market maker given the trade and book data provided. For the small sample set you should find the following when $s = 0.01, j = 0.055, k = 0.035$:

time_of_day	Cash	Trade	Position
2018-04-08 17:08:08.293	70.3555	-0.01	-0.01
2018-04-08 17:08:13.472	0.0001	0.01	0.00
2018-04-08 17:08:19.105	70.3556	-0.01	-0.01
2018-04-08 17:08:20.858	0.0002	0.01	0.00
2018-04-08 17:08:23.087	-70.3552	0.01	0.01
2018-04-08 17:08:42.770	-140.7106	0.01	0.02
2018-04-08 17:08:47.415	-211.0660	0.01	0.03
2018-04-08 17:08:49.413	-281.4214	0.01	0.04
2018-04-08 17:08:51.663	-351.7768	0.01	0.05
2018-04-08 17:08:54.890	-281.4213	-0.01	0.04
2018-04-08 17:09:07.259	-211.0658	-0.01	0.03
2018-04-08 17:09:10.259	-281.4212	0.01	0.04
2018-04-08 17:09:14.027	-351.7766	0.01	0.05
2018-04-08 17:09:53.208	-281.4866	-0.01	0.04

4 Analysis

Study strategy performance on the large data sets, with a variety of reasonable s, j, k.