Accumulation Opportunity

April 20, 2021

1 Introduction

Here we assess the feasibility of accumulating large positions while attempting to maintain low trading costs in an electronic market.

2 Data

Load the high-frequency data for all 3 pairs from the class website. The trade and book data has the following structure

2.0.1 Trades

	PriceMillionths	Side	SizeBillionths	received_utc_nanoseconds	timestamp_utc_nanoseconds
0	6778010000	1	1000000	1522449295333023000	1522467291505000000
1	6778000000	-1	1477539010	1522449295397324000	1522467291967000000
579824	6838990000	-1	15500000	1523408805480031000	1523426805463000000
579825	6839000000	1	43900000	1523408811675318000	1523426811618000000

2.0.2 Book

	received_utc_nanoseconds	timestamp_utc_nanoseconds	Bid1PriceMillionths	Ask1PriceMillionths	Bid1SizeBillionths	Ask1SizeBillionths	Mid
0	1522449295295880000	1522467291216000000	6778000000	6778010000	4115343010	1641000000	6.778005e+09
1	1522449295309330000	1522467291330000000	6778000000	6778010000	4113903010	1641000000	6.778005e+09
6858524	1523408811787005000	1523426811770000000	6838990000	6839000000	1881608490	50810309730	6.838995e+09
6858525	1523408812134982000	1523426812119000000	6838990000	6839000000	1881608490	50710309730	6.838995e+09

3 Exercise

Write a simple VWAP participation algorithm that takes a target quantity Q, start time τ_s (also known as *arrival time*) and target participation rate p as parameters, and simulates the accumulation possible for a VWAP algorithm starting at time τ_s, both for buying (positive Q) and for selling (negative Q) in one of the cryptocurrency market data sets provided.

Your simulation function should use actual signed trading volumes to judge simulated accumulation. It should make the conservative assumption that, in a flurry of trades trading through several levels[1], only the worst of those was "qualifying", i.e. available for participation. For example, if you see 7 sells in a row within 0.1 seconds[2] at successively lower prices, you should assume your own sale could have participated only in the seventh (and worst) of those trades.

Assume transaction fees are 50 basis points (0.5% of traded notional) for transactions between crypto-tokens and traditional currencies, and are 10 basis points for trades between cryptotokens.

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[1]As, for example, when a large trade "takes out" several levels of the book.

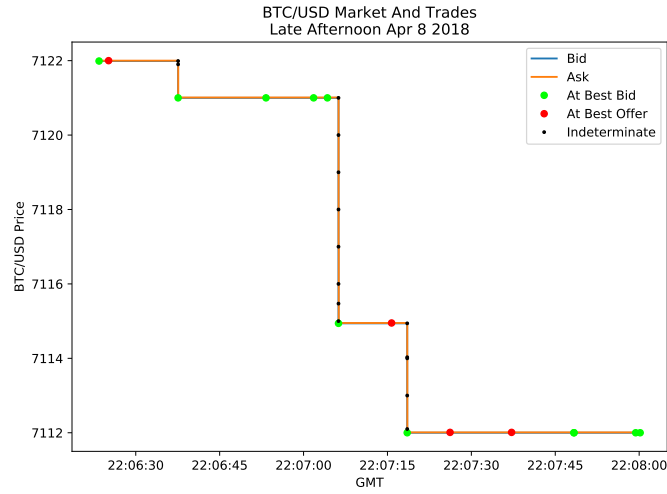[2]Use *timestamp_utc_nanoseconds* for your clocks.

Figure 1: Cases of large sell orders crossing the spread, taking out several levels of resting buy orders.

4 Analysis

Assess and contrast the accumulation opportunities available in cryptotoken markets in 2018, 2019 and 2021. Concentrate on transactions that finish in 1-15 minutes or so, in order to give yourself a nice set of independent instances.

You can consider metrics such as $\frac{\text{Notional}}{\text{Time}}$, trading costs as a proportion of notional, statistical metrics comparing average price of accumulated positions to arrival prices, relationship between Q and the likelihood of completing the entire quantity, and/or deviation from expected accumulation rate.