

[14X030] Introduction to Computational Finance

Exercise series 6

April 4, 2023

General instructions

Each student is expected to upload on Moodle a **zip** file containing:

- A report in **pdf** format to answer exercise questions.
- The code used to generate the results of the report.

Deadline

Upload on Moodle due by : **April 10, 2023 at 11:59 pm.**

First steps

The goal of this series is to implement different execution strategies and to see the different prices we would have obtained on real data. In the following exercises, we consider a fictitious order to **buy 12 million euros**.

We will again use the file `eur_usd_20120101_20120301.txt` (download it on Moodle, series 3) that contains data on the EUR / USD exchange rate for the period of January 1st to March 1st 2012 and has the following data structure:

```
timestamp bid ask
```

Similarly to previous series, load this file and remove the outliers (date in 1970).

Then, pick at random several times from the data (at least twenty). We will use them in the following exercises.

1 TWAP algorithm

- For each of the twenty starting times you picked, simulate the execution of the forementioned order with the TWAP algorithm, using 12 slices executed every 15 minutes.
- Compute the execution prices you got and compare them to the decision prices $\{\text{ask}(t_i), \forall i \in \{1, \dots, 20\}\}$.

2 VWAP algorithm

- Picking the same twenty starting times, simulate the execution of the forementioned order with the VWAP algorithm, using 12 slices executed every 15 minutes. You can use the daily distribution of ticks as historical data to estimate volumes traded in each 15 minutes interval.
- Compute the execution prices you got and compare them to the decision prices and the TWAP prices.

3 Algorithm based on price evolution

Finally, implement an execution algorithm that takes into account the price evolution. For instance, you can split the order in 12 equal slices and trade a slice at each downward directional change δ .

- Picking again the same initial times, compute the execution prices you got with this method and compare them with the ones previously obtained.
- How should you choose δ in order to execute the full order over 3 hours?

Finally, feel free to try out other ideas. If you use price data, make sure not to make use of future prices.