Westminster Business School

7FNCE025W
High Frequency Trading
Individual Assessment (50%)
Due 13:00 UK time @ 20th March 2024

A report on HFT

You are required to prepare a report on Algorithmic and High Frequency Trading. The word limit is 2000 (excluding reference, appendix and python codes). For the report you need to answer the following questions:

1. Given the data in 'FB_20141126.mat', perform data analysis on it. Your description should include the following points:

    a. Midprice;
    b. Microprice;
    c. Spread;
    d. Volume Imbalance.

    (Each question 5 marks; Total 20 marks)

2. The file 'FTSE_sample.mat' contains minute market order (MO) as well as best bid and best ask prices at the end of every minute of a FTSE constituent during the 2008 financial crisis.

    a. Calculate minutely returns of the stock based on mid-price and report summary statistics.
    b. Plot autocorrelation function of minutely order flows up to 20 lags. Analyse your result. Order flow is defined as net MO within each minute.
    c. Regress minutely return on return of previous minute and the contemporaneous order flow. Interpret your regression results and their implications.
    d. Develop a trading strategy based on cumulative order flows of previous 30 minutes. Estimate the cumulative return of your trading strategy.
    e. Compare the return of your strategy and the return of the stock during the whole period. Why do you make (lose) money by implementing this trading strategy?

    (Each question 7 marks; Total 35 marks)

3. This question is based on Glosten-Milgrom (1985) model of information asymmetry in trading. The setting is as follows:

- The market maker(MM) quotes a bid B and ask A at time t=0;

- The security has intrinsic value $V=V_H$ (with probability p) or V_L (with probability $1-p$), $V_H > V_L$;

- At time t=0, traders (including informed traders and liquidity traders) take action S (buy/sell one share of the security from MM).

- The proportion of informed traders is α and the proportion of liquidity trades is $1-\alpha$;

- Informed traders know V at t=0;

- Liquidity traders buy and sell with equal probabilities.

- MM does not know whether the order comes from an informed trader or a liquidity trader.

    a. What are the probabilities that MM receives a coming buy order if $V=V_H$ and $V= V_L$ respectively?
    b. What are the probabilities that MM receives a coming sell order if $V=V_H$ and $V= V_L$ respectively?
    c. According to Bayes Theorem, What is the probability that $V=V_H$ given that MM receives a buy order? What is the probability that $V= V_L$ given that MM receives a buy order?
    d. According to Bayes Theorem, What is the probability that $V=V_H$ given that MM receives a sell order? What is the probability that $V= V_L$ given that MM receives a sell order?
    e. If competition among MMs narrows their profit to 0, which means A equals to the expected value of V if the coming order is to buy (and thus the MM is to sell) , what is A?
    f. If competition among MMs narrows their profit to 0, which means B equals to the expected value of V if the coming order is to sell (and thus the MM is to buy), what is B?
    g. Assume that time is discrete, trading happens sequentially at t=0,1,2,3,4…. After each trade, the MM updates beliefs about V and sets A and B. What is A(k+l) and B(k+l) after k buys and l sells?
    h. If $p=0.2$, $\alpha=0.8$, simulate the case (for at least 50 times) if $V=V_H=2$ (while $V_L=1$). Plot A and B against time.

(Each question 5 marks; Total 40 marks)

Marking Scheme

Your report should be structured as a management report and address the following objectives:

Component	Percentage
Q1	**20%**
Q2	**35%**
Q2	**40%**
Presentation	**5%**

Guidelines

• Present your review in a report format, answering all questions by adopting a professional approach
• Your report should be produced in pdf.
Python should be used for all calculations as necessary.
• To avoid Plagiarism, you must reference your work correctly, i.e any relevant information included must be correctly referenced by quoting paragraphs of any related work done by other authors (e.g. in journal articles and specialist textbooks etc).
• Your analysis should demonstrate an understanding of the underlying theory, its assumptions, limitations, and implementation in an applied context.
• You will also be judged on your ability to make sound business and quantitative financial decisions based on your analysis.

Please submit your completed work by 20th April 2024.
Please submit in a pdf format via the Blackboard link.
Please do not forget to attach your python codes as appendix.

Text for Postgraduate modules
Submission of Coursework
All coursework on this module is submitted via Blackboard only. It will automatically be checked by Turnitin (designed to check for possible plagiarism).
Please do not include your name or student ID in your assignment.

REMEMBER:
It is a requirement that you submit your work in this way. All coursework must be submitted by 1PM on the due date. If you submit your coursework late but within 24 hours or one working day of the specified deadline, 10% of the overall marks available for that element of assessment will be deducted, as a penalty for late submission, except for work which is marked in the range 50 – 59%, in which case the mark will be capped at the pass mark (50%).

If you submit your coursework more than 24 hours or more than one working day after the specified deadline you will be given a mark of zero for the work in question.

The University's mitigating circumstances (MC) procedures relating to the non-submission or late submission of coursework apply to all coursework.