

QF 612 – Quantitative Trading Strategies
Summer 2016
Assignment 1
Due: June 20, 2016

Instructions:

- *This assignment can be done individually or in a team of maximum three persons.*
- *Please attach the relevant R code and provide any output and/or plots to support your answers, giving clear narratives of how those outputs lead you to your stated conclusions.*
- *Turn in your submission as per instructions from Jamie.*

Notes:

Consider the Microsoft transactional data for eight days: Jan 2 – 11 in 2013: MSFT.csv. Use only the data for normal trading hours: 9.30am – 4pm.

Problem 1:

There may be more than one transaction per time stamp due to latency. Use the transaction data after aggregating by time by exchange to answer the following. For each unique time stamp, compute the volume weighted average price and the total volume.

- (a) Plot the price series and comment on its stationarity.
- (b) Use ACF and PACF, identify appropriate ARMA models.
- (c) Compute the returns and check to see if there is no autocorrelation due to market frictions.
- (d) Compute the duration between successive transactions; test if the durations follow exponential distribution; ignore the duration between successive days.
- (e) Is there any dependence in the durations? Characterize the dependence via ARMA models.
- (f) Plot the durations of the transaction times for Mondays and Fridays. Is there any difference in the patterns?

Notice: For next set of problems, we want to aggregate the data into discrete time intervals: 1 min, 5 mins and 1 hour. For each time unit, compute the following:
 For Price: High, Low, Open and Close; Volume weighted average price(VWAP).
 For Volume: Total volume, Number of trades.

Problem 2 For each time interval:

- (a) Plot the VWAP price series and test for its stationarity; Do you identify any intraday patterns?
- (b) Use ACF/PACF to identify appropriate ARMA models.
- (c) Compute the autocorrelation for returns based on VWAP and comment.
- (d) Fit GARCH models for the return variances.

Problem 3

How does the time aggregation of data affect the dependence? Compare the results in Problem 2 with results in Problem 1.

Problem 4 Here we focus on five minute interval data

For each stock do the following: Let x_t denote the number of trades in the

t^{th} 5-minute interval, and y_t as the return between the intervals based on VWAP.

- (a) Consider the bivariate time series (x_t, y_t) . How does y_t vary with x_t ? Are there intraday periodic patterns in (x_t, y_t) ?
- (b) Fit ACD models for the durations and interpret the coefficients.
- (c) Is there any particular exchange that offers higher price?

Problem 5 Quantative Posting

In algorithmic trading, the posting of orders at various points in time during a day must be determined a priori; For 5-min data,

- (a) Plot the volume and check for any seasonal (time of the day) effect.
- (b) Develop a model that can guide investors to predict the orderflow during the course of a day.
- (c) Validate your model with a hold-out sample.