

Assignment 5

The objective of this assignment is for you to gain some familiarity with basic features of the high-frequency return data. You should use the data posted on the canvas site for the S&P 500 ETF labelled the “spider” or SPY. It provides the index values at a one-minute frequency. Use the sample from February 1993 through January of 2023. The data are available both as csv and mat formatted files. Downloading this large file as csv may require a large degree of memory. Contact the T.A., Jose, if you have trouble obtaining the full series.

- 1) Construct the average trading day realized volatility (**RV**) across all trading days over the Feb 1993 – Jan 2023 sample for a variety of underlying sampling frequencies. That is, you should cumulate the daily squared returns from the market open to market close each trading day and then average them across all the trading days. This becomes a measure of the average (unconditional) trading-day return variation across the sample. A reasonable choice is to compute measures for the 1-min, 2-min, 3-min, 5-min, 7-min, 10-min, 15-min, 20-min, 25-min, 30-min, 45-min, and 60-min frequency. If the frequency does not “fit,” so there is a small interval left at the end of the trading day, please just add the squared return for this period to the others for the trading day, i.e., if 5 minutes are left over when sampling each 7-min, then the last term is a squared 5-minute return. Plot the values obtained for the average daily trading day RV as a function of the sampling frequency (1-min up to 60-min, say). This becomes a “vol signature plot.” Does the plot have an approximately “flat” region across some frequencies?
- 2) For each one-minute return across the trading day, please compute the average absolute return across all trading days in the sample for this interval, and repeat for all one-minute intervals in the trading day. Plot the value against the time-of-day from the open until the close of the trading day. This figure represents the intraday volatility pattern.
- 3) Compute the measures in question 2) for each of the first two full years of the sample and for the last two full years of the sample. Please plot them as indicated in question 2).
- 4) Plot the time series of trading day RV measures for the full sample. Do this both for the regular RV measure (cumulative squared returns), but also for the square-root of the trading day RV, and the logarithm of the trading day RV. Compute the auto-correlogram for lags 1 through 20 of these series.