**Final Group Project – FAQ**

**Q1) Covariance Matrix**

Can all covariances be positive?

Answer: Yes, it is possible to have covariances across all pairs of stocks that are positive. Each group has only 40 stocks so it is likely that some groups will have only positive covariances while some groups may find negative covariances.

It is more likely to find negative correlations when we construct a covariance matrix using stock prices and stock returns. However, recall from our lectures that this calculation is not statistically correct or statistically significant for the most part.

When we compute the covariance matrix using a factor model (which is the correct approach to use to estimate covariances) we will find that the large majority of stock pairs will have a positive correlations.

Some, but not all groups, will find differences in covariance signs when comparing the sample covariance matrix (using price data) to the covariance matrix (calculated using factors).

**Question 3) Portfolio Optimization with TCA**

What are the four portfolio A1 & B1 and A2 & B2.

Answer:

The question asks to perform portfolio optimization using the traditional QP optimization approach and our new portfolio optimization approach incorporating TCA.

There are two investment dollar values - $100 million and $500 million.

The traditional portfolio optimization will not provide different weights for different dollar values, so portfolio A1 and A2 should be the same. These portfolios, however, will have different net returns since the share quantities and market impact cost will be different.

The portfolio optimization with TCA will have different optimal portfolios for the $100 million dollar investment and the $500 million dollar investment. Therefore, portfolio B1 & B2 will be different.

The question then asks to compute the net return for each portfolio.

To compute Net Returns for Traditional QP:

* Step 1: Perform Portfolio Optimization using traditional methods. This does not require us to enter the portfolio dollar value into the optimization.
* Step 2: From the optimal weights, compute the expected return and expected risk of the optimal portfolio.
* Step 3: From the optimal weights, compute the share quantities for each stock that will need to be purchased.
* Step 4: Using these share quantities, and you MI equation from Problem #2, compute the expected market impact cost to purchase these share quantities.
* Step 5: Compute Net Return by subtracting the MI Cost from the Expected Return. Please ensure you have consistent units, e.g., all in basis points, or all in percentages.

To compute Net Returns for Portfolio Optimization with TCA:

* Step 1: Perform Portfolio Optimization with TCA by incorporating MI cost into the objective function. In this case, we are maximizing Net Returns.
* Step 2: This requires us to enter the portfolio dollar value into the optimization objective function. Please refer to the Excel Spreadsheet for an example of this optimization.
* Step 3: The optimizer will provide the optimal Share Quantities.
* Step 4: Using these share quantities, and you MI equation from Problem #2, compute the expected market impact cost to purchase these share quantities.
* Step 5: Compute Net Return by subtracting the MI Cost from the Expected Return. Please ensure you have consistent units, e.g., all in basis points, or all in percentages.

**Q4) Volume Forecasting**

In the volume forecasting equation:

How can we determine and ?

Does this formula use a look-forward value that we will not have access to when forecasting volumes?

Answer: The value of and are known at time t when we are estimating the regression coefficients. These values have been found to be significant in many cases and helps to improve the regression R2, etc.

However, when we forecast volume, these values and are not known in advance. The mathematical forecasting equation is taken for period t+1:

To forecast volumes for these periods, we would use our expectation of these changes, or a forecast for these values in the upcoming period, e.g.,

and

A simple and reasonable expectation for these values are that they volatility and SPX price level will remain unchanged in the upcoming month. That is:

Another approach that can be used is to forecast both volatility and SPX price level change. (But this is not necessary for the Final Project – please assume that these values will both be zero for this exercise).

I have used a volatility forecasting model in conjunction with the volume forecasts, and a price forecasting model. Most cases I use expected price change is zero, or I forecast both volatility and price change based on a Monte Carlo sampling technique.

**Error in Excel\_Lecture\_11.xlsm**

In the spreadsheet titled MICRO Strategies, there is an error in Cell K26.

This correct formula should be:

Cell K26 =SQRT(**L11**)\*F17\*SQRT(1/250\*1/3\*F12\*(1-K17)/K17)\*F18

I have reposted the corrected spreadsheet.

**Text Book Error:**

Top of Page 290 = The equation should state to maximize not minimize, e.g.,

Top of Page 292 = The equation should state to maximize not minimize, e.g.,

**MICRO Strategies: AIM / PIM**

There is a little confusion between the AIM and PIM objective functions.

It is important to point out that the mathematics to Maximize a function is identical to Minimizing the negative of the function.

For example,

For AIM we maximize the following:

For PIM, we maximize the negative of the AIM equation because PIM is defined to be the mirror of AIM.

That is,