FINM 25000 **Mark Hendricks**
Summer 2020

Midterm #2

Due on Wednesday, July 5, at 2:00pm.

The Exam requires you to use the data set corresponding to Homework #1, `assetclass_data_monthly_2009.xlsx`

- This file is posted with the midterm, but it is exactly the same as the versions posted with HW#1.
- We **only use the data beginning with 01/31/2012**.
- So be sure to insert code to only select the data starting with 01/31/2012, or even just delete the rows before that.
- You will not use the fund data before 01/31/2012 at all.

Finally, the data is NOT in excess returns—you will need to subtract the "Cash" column from the other columns in order to have excess returns. Everything we do below will be in excess returns.

1 Allocation (50pts)

1. Summary Statistics for the 11 asset class indexes.
   (a) (5pts) After subtracting the cash return to get excess returns, calculate and display the mean and volatility of each asset class index. Annualize the answers.
   (b) (5pts) Which assets have the best and worst Sharpe ratios?
   (c) (5pts) Conceptually, (before even calculating the Tangency portfolio,) why might an asset with a mediocre Sharpe ratio get a large allocation in the tangency portfolio?
   (d) (5pts) Calculate the 5th quantile (5th percentile) of each asset.
2. Tangency portfolio derived from the 11 assets.
   (a) (10pts) Calculate the weights of the tangency portfolio.
   (b) (5pts) What is the scaling factor needed to achieve a mean excess return of 1% per month? That is, to achieve this target what portion of the investor's capital must be put into the tangency portfolio? (What is $\tilde{\delta}$?)
3. Recalculate the tangency portfolio, but instead of using the covariance matrix, use a diagonalized version which zeros out every element off the main diagonal. (So it is just a matrix of the variances, with zeros everywhere else.)
   (a) (10pts) Report the new tangency portfolio weights.
   (b) (5pts) Using a diagonalized covariance matrix is biasing our answer—we theoretically should be using the full covariance matrix. So explain why we might think it is worth using a biased solution. What statistical/mathematical tradeoff is being made here?

2 Performance (35 pts)

1. Suppose we want to invest in "Foreign Equity" but hedge our exposure to "Domestic Equity." Estimate a regression of Foreign Equity (y) on Domestic Equity (x).

   (a) (10pts) Report the α, β, and R-squared.

   (b) (5pts) To implement this investment, you will invest in Foreign Equity. Does your regression indicate you will need to additionally add a long (positive investment) position in Domestic Equity or a short (negative investment) position in Domestic Equity?

   (c) (5pts) Report the Information ratio of Foreign Equity on Domestic Equity.

2. Run a regression of Foreign Equity on every other asset. (So you have 10 regressors.)

   (a) (5pts) Report the α and R-squared statistics.

   (b) (5pts) Which two assets (regressors) have the largest and smallest beta?

   (c) (5pts) Which would have a lower volatility in-sample: implementing the single-asset hedge (previous question) or the multi-asset hedge?
   And out-of-sample?

3 Pricing (15pts)

No further calculation needed for this part—these are conceptual questions.

1. Suppose the CAPM is a perfect pricing model, so that Domestic Equity is the only needed factor in a Linear Factor Pricing Model.

   (a) (5pts) Would the Information Ratio be larger or smaller than what you calculated in the regression above? Explain.

   (b) (5pts) Would the R-squared statistic be higher or lower than what you calculated in the regression above? Explain.

   (c) (5pts) Which would be larger, the Treynor Ratio of the hedged implementation (Foreign Equity net of the Domestic Equity hedge) or the unhedged implementation (Foreign Equity)? Explain.