FINM 36700 **Mark Hendricks**
Autumn 2020

Midterm #1

Due on Wednesday, Nov 4, at 8:30pm.

Please note the following:

- The exam is 120 points.
- You have 2.5 hours to complete the exam.
- For every minute late you submit the exam, you will lose one point.
- You will upload your solution to the Midterm #1 assignment on Canvas, where you downloaded this.
- Your submission should be readable, (the graders can understand your answers,) and it should include all code used in your analysis.
- The exam is open-material, closed-communication.
- If you find any question to be unclear, state your interpretation and proceed.
- The exam will be graded for partial credit.

The Exam requires you to use the data set corresponding to Homework #3, `ff_data.xlsx`

- This file is posted with the midterm, but it is exactly the same as the versions posted with HW#3.
- Tab PORTFOLIOS gives **excess** returns on 25 test portfolios.
- Tab FACTORS gives **excess** returns on 4 factors.
- You do NOT need the data on the risk-free rate. Everything is in excess returns already.

1 True / False (25 pts)

You are graded for your (brief) explanation.

1. (5 pts) The CAPM implies the intercept of time-series regressions is zero and that the intercept of the cross-sectional regression is zero.

2. (5 pts) The Tangency portfolio weights assets in proportion to their Sharpe ratios.

3. (5pts) Suppose we pricing is perfectly modeled by a 2-factor model, but we include a 3rd, unnecessary, factor in our test. The extra, unnecessary, factor will cause pricing errors.

4. (5pts) In a replicating regression, we should include an intercept.

5. (5pts) Suppose we have k risky securities, and an equally weighted portfolio is formed from them. If pairwise correlations across k security returns are less than perfect, an equally weighted portfolio becomes riskless as $k \to \infty$.

2 Short Answer (25 pts)

1. (5pts) Why do we prefer to test Linear Factor Pricing Models on portfolios instead of on individual securities?

2. (5pts) Is the Momentum strategy robust to various construction methods? Explain.

3. (5pts) Suppose we have a security, r . Explain how to construct its information ratio with respect to a benchmark of z.

4. Suppose we wish to replicate a hedge-fund return, r, using three ETF products, z^1, z^2, z^3.

   (a) (5pts) Explain how to calculate the proper amount to invest in each of the three ETFs to achieve optimal correlation to the target hedge-fund.

   (b) (5pts) Suppose you add a 4th ETF, z^4, to the replication, but it is highly correlated to z^3. Do you think it will increase the replication's correlation to the target in-sample? Out of sample?

3 Allocation (30 pts)

1. Summary Statistics for the 25 test assets.

   (a) (5pts) Calculate and display the

   - mean
   - volatility
   - Sharpe ratio

   of each asset.
   Annualize the answers.

2. Tangency portfolio derived from the 25 assets.

   (a) (5pts) Calculate and display the weights of the tangency portfolio.

   (b) (10pts) Calculate and display the mean, vol, and Sharpe ratio of the tangency portfolio.

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) (5pts) Report the new tangency portfolio weights.

   (b) (5pts) Calculate and display the mean, vol, and Sharpe ratio of the diagonalized tangency portfolio.

4 Pricing (40pts)

We will test a Linear Factor Pricing Model on the 25 portfolios in "ff_data.xlsx". We will use 2 factors: MKT (market) and HML (value).

1. Do the time-series test.
   (a) (5pts) Report the mean absolute error (MAE) of the time-series alphas.
   (b) (5pts) Report the r-squared of the regressions.
2. Do the cross-sectional test.
   (a) (5pts) Report the estimated factor premia and compare them to the historic means of the factors.
   (b) (5pts) Report the intercept, and interpret what it means about the pricing model.
   (c) (5pts) Report the r-squared statistic, and interpret what it means about the pricing model.
3. Discuss the evidence against the pricing model...[1]
   (a) (5pts) Point out which evidence from the time-series regressions rejects the model.
   (b) (5pts) Point out which evidence from the cross-sectional regression rejects the model.
4. (5pts) In addition to rejecting the model we tested, do the results above also reject the CAPM? Explain.

[1] Assume that all our results are statistically significant—that this sample really is representative of the population.