FINM 36700 **Mark Hendricks**
Autumn 2020

Midterm #2

Due on Wednesday, Nov 18, 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 #2 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 and #4, `ff_data.xlsx` and `momentum_data.xlsx`.

- These files are posted with the midterm, but they are exactly the same as the versions posted with HW#3 and #4.
- From `ff_data.xlsx`, you need the data in the Tab FACTORS, which gives **excess** returns on 3 factors.
- From `momentum_data.xlsx`, you need the data in the Tab Momentum Factor, which gives **excess** returns on 1 factor.
- You will be using all 4 factors together, so you will need to align them, keeping only the dates shared by both data sets.
- 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. (5pts) Mean-variance optimization of inflation-adjusted returns will give a different answer than mean-variance optimization of nominal (not inflation-adjusted) returns.

2. (5pts) Based on our tests, the compensation for market beta is low relative to what theory implies.

3. (5pts) An extreme momentum construction (using only the top-and-bottom deciles) leads to better performance, as expected by theory.

4. (5pts) A long-short momentum strategy out-performs a long-only momentum strategy because it has a higher mean return due to earning positive returns on both sides, the longs and shorts.

5. (5pts) In the case, DFA improves performance by combining their factor model with fundamental, firm-specific equity analysis.

2 Short Answer (25 pts)

1. (5pts) How did Harvard Management Co. ensure their tangency-portfolio weights would be realistic? What is a drawback of their method?

2. (5pts) Name one way in which Fama and French construct the factors that helps reduce cross-factor correlation.

3. (5pts) One might say DFA is as focused on providing "beta" to investors as they are providing some "alpha". Isn't the point of a managed fund to provide "alpha"? Explain why DFA's product may be valuable even if only providing "beta."

4. (5pts) Given that we can test a Linear Factor Pricing Model using only the time-series regressions of the test securities, what is the use of the cross-sectional regression?

5. (5pts) Based on our analysis of ProShares, name a pro and a con of using a top-down replication strategy to get hedge-fund exposure.

3 Allocation (30 pts)

Here we use the provided excess return data on the 4 factors: MKT, SMB, HML, MOM, provided via "ff_data.xlsx" and "momentum_data.xlsx". (Remember that you do NOT need to use the risk-free rate data, "RF".)

1. (5pts) Calculate and display the following statistics for each of the 4 factors, and be sure to annualize them:

   - mean
   - volatility
   - Sharpe ratio

   Also calculate and display the correlation matrix of the 4 factors. (Don't try to annualize the correlation matrix.)

2. (5pts) Using data through Dec 2010, calculate and display the weights of the tangency portfolio based on these 4 assets.

3. (5pts) Calculate and display the IN-SAMPLE annualized mean, vol, and Sharpe ratio of the tangency portfolio. (i.e. based on the return data through Dec 2010.)

4. (5pts) Calculate and display the OUT-OF-SAMPLE annualized mean, vol, and Sharpe ratio. (i.e. Use the previously calculated tangency portfolio as it performs from Jan 2011 through the end of the sample.)

5. (10pts) Name two reasons that mean-variance optimization is fragile, in the sense that the classic solution does not perform well out-of-sample.

   Are those issues particularly impactful for this example?

4 Hedging & Replication (40pts)

Continue to use the same data from the previous problem. That is, the excess returns on the 4 factors. (Remember they were provided to you as excess returns, so no need to use the risk-free-rate data provided along with those factors.)

1. We want to build a new factor, SMB*, which is just SMB but with exposure to MKT completely hedged out.

   Regress SMB on MKT.

   - Include an intercept.
   - Use the full sample of data, based on the overlapping dates in the Fama-French and momenum data. (i.e. The same data from the previous problem, with dates 1/31/27 to 8/31/20.)

   (a) (10pts) Report alpha, beta, and the r-squared of the regression.

   (b) (5pts) Report the Sharpe Ratio of the new factor, SMB*.

   (c) (5pts) In what specific measure has SMB* optimally hedge the market?

2. Suppose we want to build a new factor, MOM**, which is a replication of MOM, using MKT, SMB, and HML. Regress MOM on MKT, SMB, and HML.

   - Once again, include an intercept.
   - Once again, use the full data sample.

   (a) (10pts) Report alpha, beta, and the r-squared of the regression.

   (b) (5pts) Report the correlation between MOM and MOM**.

3. (5pts) In what statistical sense would our hedge, SMB*, or our replication, MOM**, be worse had we not included intercepts in the regressions?