FINM 25000 **Mark Hendricks**
Summer 2021

Homework #2

Due on Tuesday, July 6, at 6pm CT.

1 Performance Metrics

On Canvas, find the data file, **"industry_equity_data.xlsx"**.

- These are total returns.
- The data includes ETFs which are baskets of stocks within certain industries.
- The data includes SPY, which is an ETF of the entire S&P 500, and we use as our "market" return.
- The data includes several individual equities in technology and finance.

1. For every series, report the *annualized*
   - mean
   - volatility
   - Sharpe ratio

   What stands out about these risk stats? Do the ETF baskets differ substantially from the individual equities (of specific companies?)

2. Drawdown statistics For every series, report the
   - minimum return
   - maximum return
   - maximum drawdown
   - The Value-at-Risk, which can be measured as the 5th percentile of the return series.
   - The Conditional Value-at-Risk[1], which can be estimated as the mean of all returns less than the 5th percentile, (so this will be a negative number.)

   Note that you are not annualizing any of these.

   What stands out about these risk stats? Do the ETF baskets differ substantially from the individual equities (of specific companies?)

[1] also known as Expected Shortfall

3. Regression-based metrics.

   For every series, run a market regression:

   $$r_t^i = \alpha + \beta r_t^m + \epsilon_t$$

   Report the following statistics...

   - the
   - annualized alpha estimate. (Multiply it by 12.)
   - the beta estimate. (No annualization needed.)
   - the regression's R-squared stat.
   - the Treynor ratio.
   - the Information ratio.

   For each statistic, note which security has the highest value.

2 Return Decomposition

Suppose we wanted to mimic the single-company stocks using the industry ETFs, (those starting with "X".) To do so, we simply run a multivariate regression of the k instruments being used to mimic. We can write the regression with the k individual regressors, or with vector notation. Note that the superscripts here are labels, not exponents.

$$\begin{aligned} r_t^i =& \alpha + \beta^1 x_t^1 + \beta^2 x_t^2 + \ldots + \beta^k x_t^k + \epsilon_t \\ & \alpha + \boldsymbol{X_t \beta} + \epsilon_t \end{aligned}$$

For each single-name equity, regress it on all the industry ETFs together. (So it is a regression with 9 regressors.)

1. For each regression, report the estimated alpha and r-squared statistic.
2. Which equity is best replicated with the industry baskets?
3. For each regression, report which regressor has the largest beta. Does this make intuitive sense given the industry the stock is in?
4. Suppose you wanted to mimic (replicate) AAPL using these industry baskets. Use your regression results to explain how to do so.
5. Suppose you wanted to hold AAPL, but hedged of its exposure to the tech industry. How could we figure out the right amount of XLK to hedge per every dollar invested in AAPL?

3 Fama-French Factors

As a preview to the Smart-beta ETF case, let's get familiar with the so-called Fama-French factors. On Canvas, find the data file, **"fama_french_data.xlsx"**.

- You have total returns on 4 Fama-French factors, each of which is a portfolio of returns.

- The final column gives the risk-free rate, (as measured by Treasury bills.)

1. Use the risk-free rate data to convert the four factors into *excess* returns.
2. Calculate and report the performance statistics from 1.1 and 1.2 for each of these 4 factors. (You should be able to re-use your code.) Note that you are just calculating the univariate statistics for each series, you do not need to calculate the regression statistics from 1.3.
3. Use the data from **"industry_equity_data.xlsx"** to get the return for Apple (AAPL) and Goldman Sachs (GS). Subtract the risk-free rate, (RF,) to get these as excess returns. Run the multivariate regression:

$$r_t^i = \alpha + \beta^{\text{mkt}} r_t^{mkt} + \beta^{\text{sml}} r_t^{\text{sml}} + \beta^{\text{hml}} r_t^{\text{hml}} + \beta^{\text{umd}} r_t^{\text{umd}} + \epsilon_t$$

Report the estimated alpha, betas, and r-squared for AAPL. Do the same for GS.