MFE 230G: Homework 2
Due: August 31, 2021

1. Hubert is an analyst following stock XYZ. The stock has a dividend payout ratio of 25% and a 10% return on equity.

    a. Based on just that information, what growth rate would Hubert expect for the stock?
    b. What p/e ratio does this growth rate, and an expected return (y) of 10%, imply?
    c. Instead of the p/e ratio calculated in part b, the stock trades at a p/e multiple of 6. Over the next year the stock remains at a p/e multiple of 6, even though it meets Hubert's expected growth rate. What return does XYZ achieve over the year?

2. Julia works as an analyst, and follows publicly-traded asset management firms. She is particularly interested in ABC Investment Management. She expects ABC's earnings to grow at 10% per year, even with their 50% payout ratio. If the stock were fairly priced, she would expect it to achieve a 14% annual return.

    a. At what p/e ratio does Julia think the stock should trade?
    b. In fact, the stock is trading at 8 times earnings. If it moves to Julia's estimated fair value in 1 year, what return could you achieve by investing in ABC today?
    c. What return would you achieve over the next year if you invested in ABC today, and in a year it remains trading at 8 times earnings? Given that the same mispricing remains, why should this differ from the 14% Julia estimated above?

Problem 3 relies on the same data used in Homework 1: two excel spreadsheets. One, labeled Factor Covariance Matrix-0712 contains a factor covariance matrix (F) for US equities as of the end of July 2012. It includes 68 factors, consisting of 13 styles and 55 industries. The other, labeled US Asset Data-0712-parse contains the factor exposures for 500 US equities, along with other useful information:

- The factor exposures are labeled in the spreadsheet.
- The spreadsheet also includes data on specific risk (srisl), price, market cap (capt) and dividend yield (yld).

3. APT model:

Based on prior research, you have built an APT model, forecasting returns based on some factors in this risk model. Specifically, you forecast:

$$\begin{aligned}\alpha_n = & 2\% \cdot X_{EARNYLD}(n) \\ & +1\% \cdot X_{VALUE}(n) \\ & +3\% \cdot X_{MOMENTUM}(n)\end{aligned}$$

Focusing on the universe of the 25 largest cap stocks (according to the data):

a. What stocks have the highest and lowest alphas? What are these values?

b. Does the benchmark portfolio (the cap-weighted portfolio of these 25 stocks) have zero alpha?

c. Build a fully-invested 2% active risk portfolio, trading off these alphas against active risk relative to the benchmark. What are the largest overweights and underweights? How do they compare to the largest positive and negative alphas. Now calculate the marginal contributions to active risk. Compare the marginal contributions to the asset alphas.

4. You receive monthly alpha forecasts for a stock from 3 sources. Each alpha has the form:

$$\alpha_i(t) = IC_i \cdot \omega \cdot z_i(t) \tag{1}$$

Prior research tells you that source 1 and 2 have information coefficients of 0.1, while source 3 has an information coefficient of 0.09. You also know that sources 1 and 2 are 60% correlated, and each has a correlation with source 3 of only 10%.

a. What is the optimal blend of these three alphas? In other words, find the set of weights, $\{w_i\}$ such that:

$$\alpha_{Optimal} = \sum_{i=1}^{3} w_i \cdot \alpha_i \tag{2}$$

b. What is the information coefficient of the combined alpha?

c. How does that compare to the information coefficient of an equal-weighted combination of the three sources? By equal-weighted, I mean:

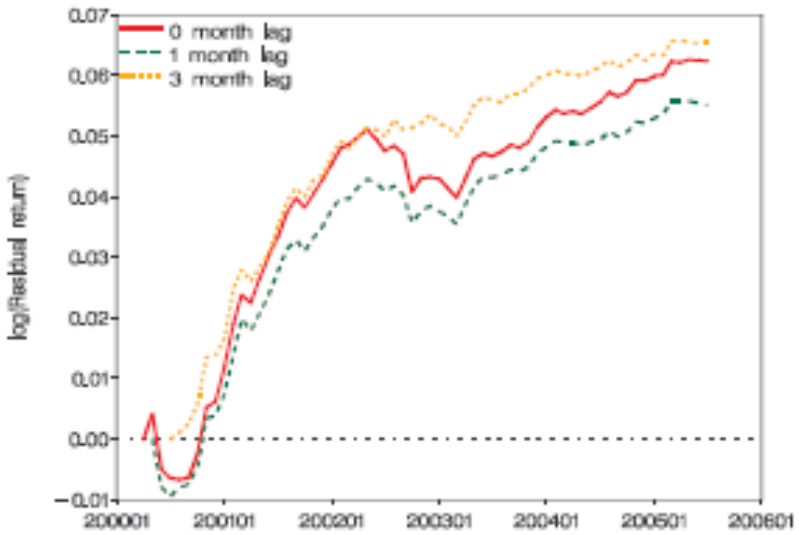
$$\alpha_{Equal} = \sum_{i=1}^{3} \alpha_i \tag{3}$$

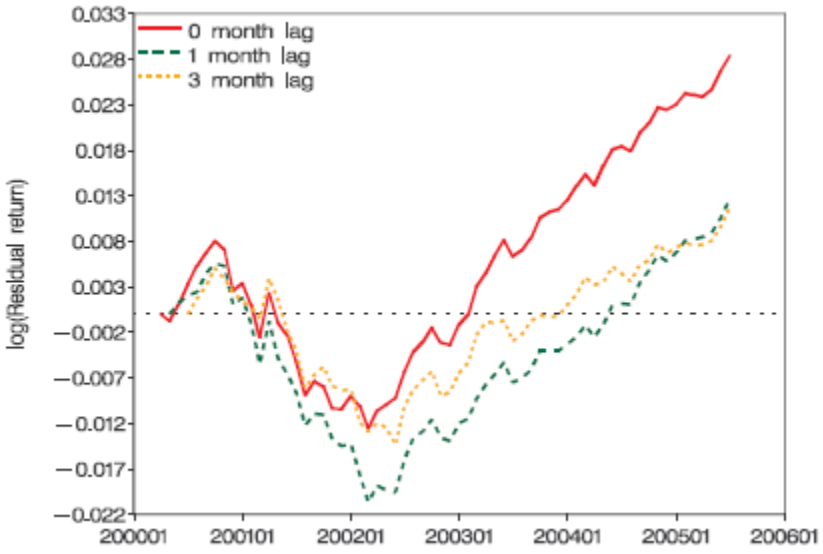
5. You are modeling alphas as a combination of subsequent residual returns (θ), and random noise (Z):

$$\alpha = c_1 \cdot \theta + c_2 \cdot Z \tag{4}$$

The independent random variable, Z, has mean 0 and standard deviation 1. Knowing that your IC=0.05, and that the residual risk is 25%, what are c_1 and c_2? What two conditions do you need to invoke to derive them?

6. You have tested two new investment ideas, and found the following results using the factor portfolio approach to information analysis. The first signal (below) has an overall IR of 1.32, with annual turnover of 409%. The second signal has IR=0.90, with annual turnover of 555%. Based only on this analysis, how (if at all) would you propose using these signals?





Problems 7-9 will refer to the following data on 20 US Largecap stocks as of 8/26/10. We will also post these data on bcourses.

Ticker	Company Name	Active Risk	Broker Rating	Research Service Alpha
AXP	American Express	19.34%	SELL	0.17%
BA	Boeing	13.69%	BUY	2.50%
CVX	Chevron	12.59%	BUY	1.98%
KO	Coca-Cola	12.08%	SELL	-0.66%
DIS	Walt Disney	11.73%	BUY	-0.13%
DOW	Dow Chemical	21.51%	SELL	-2.22%
DD	Du Pont	13.03%	BUY	-1.96%
XOM	Exxon Mobil	11.75%	BUY	-1.93%
GE	General Electric	15.19%	SELL	-3.53%
HPQ	Hewlett-Packard	12.80%	SELL	1.59%
IBM	IBM	11.98%	SELL	0.41%
JNJ	Johnson & Johnson	12.09%	BUY	-4.92%
JPM	JP Morgan	15.36%	SELL	2.11%
MCD	McDonalds	11.91%	BUY	0.55%
MRK	Merck	14.74%	BUY	0.33%
MSFT	Microsoft	12.26%	BUY	-1.34%
MMM	3M	11.65%	BUY	-0.10%
PG	Proctor & Gamble	11.38%	BUY	1.09%
WMT	Walmart	11.77%	SELL	1.99%
WFC	Wells-Fargo	17.69%	SELL	2.49%

MSCI/Barra provides the active risk forecasts. A broker provides buy and sell recommendations. A third-party research service provides annual alpha forecasts independent of the broker recommendations.

You are a mean/variance optimizer looking to maximize:

$$U = \mathbf{h}_{PA}^{T} \cdot \boldsymbol{\alpha} - \lambda \cdot \mathbf{h}_{PA}^{T} \cdot \mathbf{V} \cdot \mathbf{h}_{PA}.$$

Your optimal active holdings are:

$$\mathbf{h}_{PA}^{*} = \frac{1}{2\lambda} \cdot \mathbf{V}^{-1} \cdot \boldsymbol{\alpha}$$

Assuming that active returns are uncorrelated, this simplifies to:

$$h_{PA}(n) = \frac{1}{2\lambda} \cdot \frac{\alpha_n}{\omega_n^2}$$

You use λ=0.125 (or 12.5 in decimal units), since you want alphas with an *IR*=0.5 to lead to 2% active risk.

7. Using the broker ratings, and assigning an $\alpha = 1\%$ for BUY-rated stocks and $\alpha = -1\%$ for SELL-rated stocks, what stock achieves the largest active holding? How large is that holding? What stock represents the largest bet in the portfolio (with "bet" defined as active holding times residual risk)?
8. How do the results from Problem 7 change if instead we assign each stock an alpha, $\alpha = IC \cdot \omega \cdot z$, where we use IC=0.04, and the score, *z*, is ±1, depending on whether the rating is BUY or SELL?
9. Looking now at the alpha forecasts provided by the third-party research service, what intrinsic *IR* and *IC* do they imply? Use two different methods to estimate these quantities. How closely do they match?