Assignment 4

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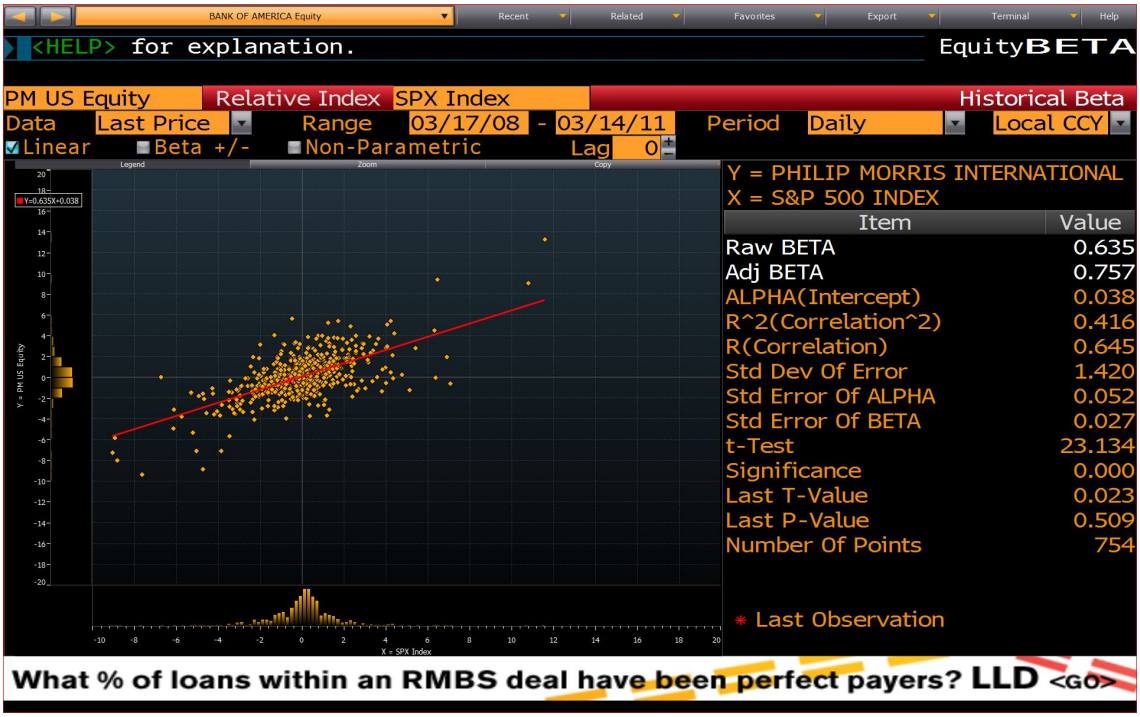
Tuesdays from 1:15PM to 3PM in Extranef 126

1 Problem: Risk-Decomposition (25 points)

Using the Bloomberg screenshot for Philip Morris (PM), compute

1. The annualized idiosyncratic risk of PM
2. The annualized systematic risk of PM
3. The annualized total risk of PM
4. The volatility of the Market portfolio



2 Problem: Estimating betas (50 points)

1. Download daily returns on the Netflix stock from CRSP (Netflix's permno is 89393 use the CRSP daily stock file, i.e. crsp.dsf in your query) and the CRSP value-weighted market return for the 10 years from 2011 to 2021 and short-term t-bill. The CRSP value-weighted market return can be obtained by using

   ```
   select date,vwretd from crsp.dsi
   ```

   in your query. The daily short-term t-bill rate can be obtained by using

   ```
   select caldt, tdyld from crsp.tfz_dly_rf2
   ```

   in your query.

2. Plot the rolling-window estimate of the beta of the stock using six month data-window assuming a risk-free rate is a t-bill rate.

3. To illustrate how sampling variation can generate this pattern, simulate 10 years of data (excess returns) for a stock that satisfies the CAPM equation and has a constant beta equal to the average you estimated over the 10 years for your stock (and using the same market risk-premium).

4. Plot the rolling-window estimate for the beta using the same code as in (2) above but using the simulated data. On the same graph, plot the adjusted beta series (using the Bloomberg formula) and the actual constant beta.

3 Problem: Market equilibrium (25 points)

Consider an economy with 3 risky assets with expected returns

$$\mu = \begin{bmatrix} 0.06 \\ 0.08 \\ 0.10 \end{bmatrix}$$

The variance-covariance matrix of returns is given by

$$\Sigma = \begin{bmatrix} 0.0144 & 0.0015 & 0.002 \\ 0.0015 & 0.0225 & 0.003 \\ 0.002 & 0.003 & 0.04 \end{bmatrix}$$

The risk-free rate is $R_0 = 3\%$.

1. What is the optimal portfolio for a mean-variance investor (call him X) with a risk aversion of $a_X = 4$? Does he borrow or lend?

2. Assuming that the economy is populated only with mean-variance investors, what is the composition of the market portfolio? What is its expected return and standard deviation?

3. How much is the economy-wide aggregate risk aversion implicit in the market portfolio? Interpret this value.

4. Consider now a second mean-variance investor (call her Y) who has the same initial wealth as the investor X. Let's suppose that there are only two investors in this market and that the risk-free asset is in zero net supply.

   (a) what is the position of investor Y in the risk free asset? Interpret your result.

   (b) what is the optimal portfolio of investor Y?

   (c) compute the risk aversion of investor Y (a_Y).