Lecture Notes

* CAPM = Capital Asset Pricing Model
  + The risk-free rate plus beta times the market risk premium
  + Returns of the stock equal to this equation, where returns are any return excess of what you would expect
  + Says that returns are totally dependent on the returns of the market
* In generalized form: Returns = alpha + beta1\*factor1 + beta2\*factor2 + epsilon
  + In the CAPM epsilon is the risk-free rate
* If you have a large number of factors you do not want to keep writing out betax\*factorx so you use matrices and vectors
* Under this usage:
  + Alpha = (n \* 1) matrix
  + B = (m \* k) matrix where m is the beta and k is the factor
* At any given point in time t, there is going to be a value for each beta and subsequent factor
* Omega is a k \* k metrices which is a covariance matrix between k factors
* Covariance is how much one factor moves compared to another factor
  + e.g. we can generalize this to stocks as well where we track how much two stocks move with each other
  + Omega (k \* k) matrix is the covariance matrix
* Conditional moments are what your expected returns are going to be at a given moment
  + Where you just can do alpha + beta \* factor
  + The covariance is going to be phi which is a (m \* m) matrix
* Unconditional moments
  + If we are not sure on a factor at a given moment in time t we can use the mean of your factors
  + If you are not given the conditions of the factors you have to take into account each factors covariance with each other
  + Take beta \* omega \* beta(transposed) = (m \* m)
* Transposing a matrix is when you switch the rows and the columns
* Side note on matrices:
  + If you multiply to matrices A (3 \* 3) \* B (3 \* 5) = C (3 \* 5)
  + The inside numbers of the matrices have to match with each other (thus you have to transpose sometimes)
* Applications of factor models
  + CAPM is still used and a one factor model
    - Not a great model us to evaluate markets either
  + Fama-French 3 Factor Model
    - Wanted to find factors in the market that best predicted the market
    - SMB: market capitalization factor
      * FF said that smaller companies tended to have larger returns
    - HML: high minus low factor
      * The price to book value of the stock
        + Book value is how much a company is worth on paper (accounting wise)
        + Price is the market pricing of the stock the market is willing to pay more for a company because they believe it is going to do better in the future
      * If the P/B value is low then it is considered a value you stock this means that the market and book value general match
      * P/B value is high we consider these growth stocks
      * Value stocks tend to outperform growth stocks
    - In the case of FF3 we say that the factor is created by finding the historical returns of each “subfactor”
      * e.g. average returns of small cap companies minus the average returns of large cap companies
    - FF3 was made a while ago and they decided to make the FF5 model
  + Fama-French 5 Factor Model
    - RMW: robust minus weak
      * profitability measure
      * robust means that you have magnitude and length in your profitability (also variance in your profitability)
      * companies with more robust operating income will do better than weak
    - CMA: conservative minus aggressive
      * companies also invest in themselves, conservative companies are ones that do not invest very much through Capex
      * companies that invest less in themselves do better than those that have reinvestment rates
    - simple to plug these back into our factor model as well we follow the same form as FF3
  + Momentum
    - there are a ton of different ways to see if there is momentum in a stock
    - WML: winners minus losers
      * gauge momentum by tracking how fast that stocks move inside of the market
  + Barra Model (MSCI)
    - has a whole bunch of factors that are outside of the market like interest rates
    - when you hedge you are trying to decrease your reliance on the market movements
    - you can be beta neutral but still be