**Factor Model Notes:**

BRIEFING:

Three types of Factor Models:

1. Macroeconomic Factor Models
   1. Observable Factors
   2. Derived from economics and financial time series data
2. Fundamental Factor Models
   1. Observable Factors
   2. Derived from asset characteristics
3. Statistical Factor Models
   1. Unobservable Factors
   2. Extracted from asset returns

General Form:

* *Rit* is the simple or real return on asset *i* (*i* = 1,…, N) in time period *t* (*t* = 1,…,T)
* *Fkt* is the *kth common factor* (*k* = 1,…,K)
* *Beta* is the factor beta for asset I on the kth factor
* Epsilon is the asset specific factor (noise)

Assumptions:

1. The factor realizations, **f**, are stationary with unconditional moments
   1. Why is this important?
2. Asset specific error terms are uncorrelated with each of the common factors
3. Error terms are serially uncorrelated and uncorrelated across assets at the same time frame
   1. for all i=j and t=s
   2. otherwise
   3. This is because the noise found at one time frame should not play a role on the noise term in another time frame. This isn’t necessarily true in the real world.

MACROECONOMIC FACTOR MODELS:

* **f** = observed economic/financial time series factors
* Econometric Problems:
  + Choice of Factors
  + Estimation of factor betas and residual variances using time series regression
  + Estimate factor covariance matrix from observed history of factors

Sharpe Single Factor Model:

* Sharpe’s single factor model is a macroeconomic factor model that considers one factor to determine an asset’s return: *the market excess return* (over risk-free)
* , K=1
* Since the market excess returns are observable, use time series regression to estimate the parameters beta and variance of the asset
* EXPERIMENT:
  + Let’s look at monthly returns, so each time step is 1 quarter
  + Let’s look at various stocks in the same industry, S&P Telecom Select Industry Index

Fama-French 3-Factor Model: