



Captain America Profit Machine (CAPM)

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Agenda

- Theory: Overview of CAPM and Security Market Line
- Assumptions and Set of Possible Stocks
- Stock Selection
- Calculating Expected Prices
- Beta Hedge
- Returns



Capital Asset Pricing Model (CAPM)

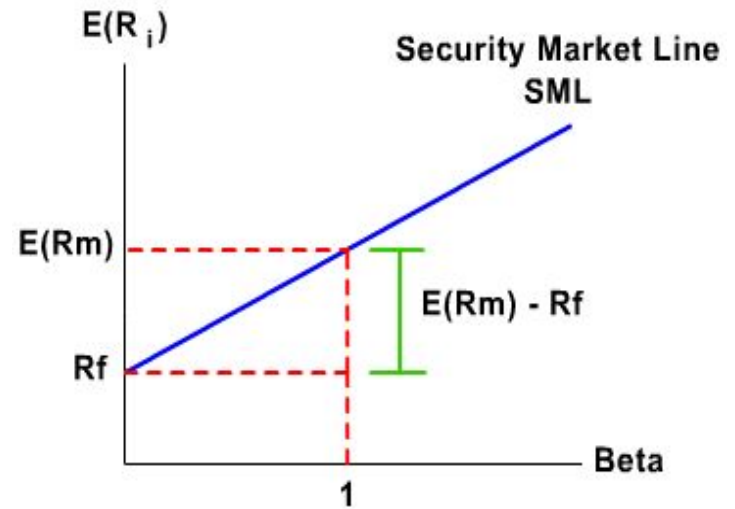
- $R_a = R_f + \beta(R_m - R_f)$
 - R_a = Return of asset
 - R_f = Risk-free rate
 - β = Beta of the security
 - R_m = Expected return of the market



Security Market Line

- Derive the Security Market Line

- Slope is determined by the market risk premium
 - Higher the premium, higher the slope
- All correctly priced assets fall along the SML
- Assets **above** the SML are **undervalued**
 - Market price is lower than it should be
 - Thus, expected return in the market for the asset is too low
- Assets **below** the SML are **overvalued**
 - Market price is higher than it should be
 - Thus, expected return in the market for the asset is too high



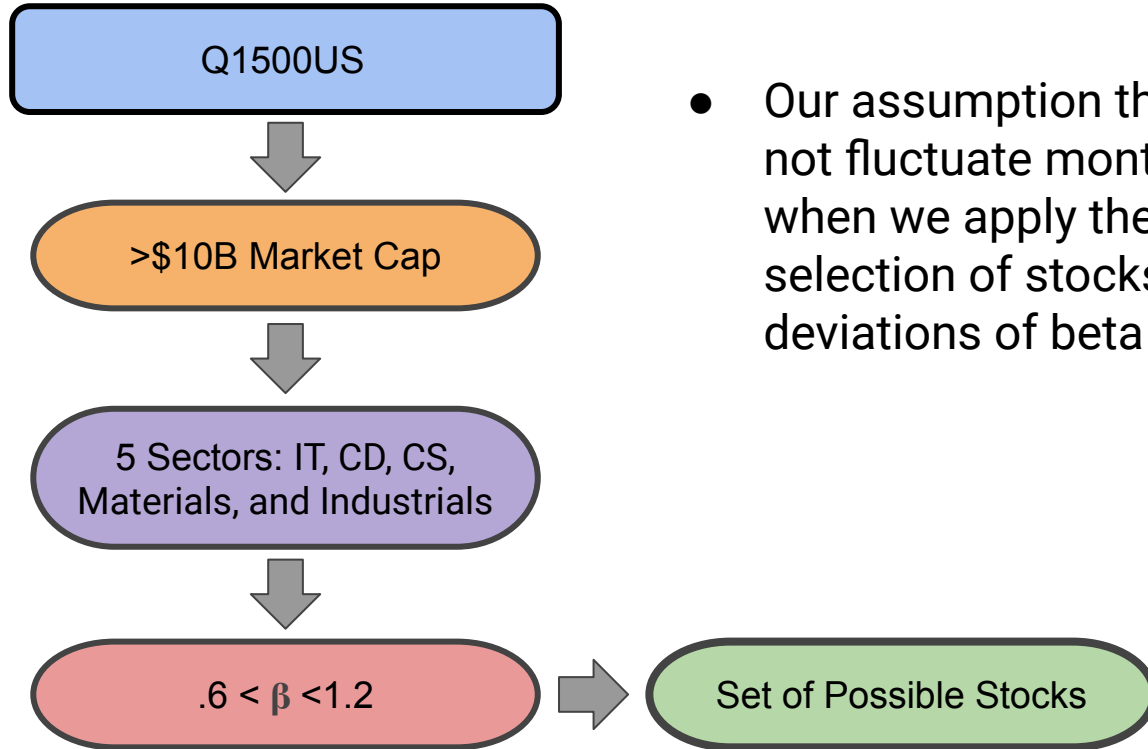
$$R_a = R_f + \beta(R_m - R_f)$$

Assumptions

1. The beta of an equity will not fluctuate much month to month
2. Return of the S&P 500 in the previous month will be the same in the month to follow
3. The monthly risk-free rate is 0.15%

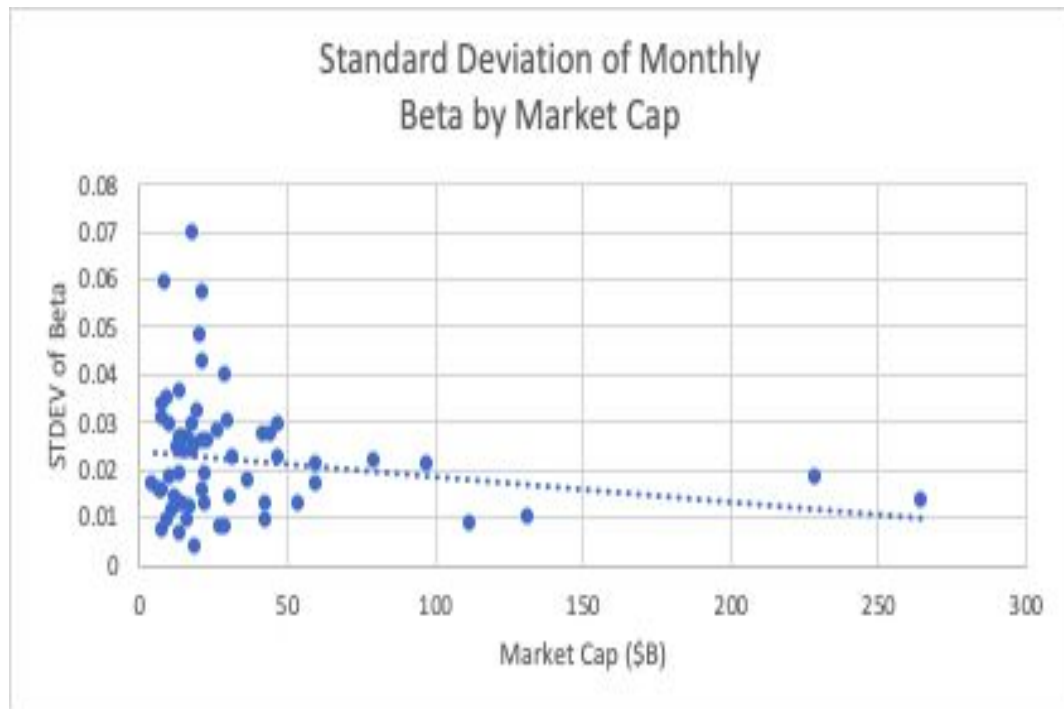


Possible Stock Selection



- Our assumption that the beta of an equity will not fluctuate month to month is supported when we apply the following filters - giving us a selection of stocks with lower standard deviations of beta

Beta Standard Deviation by Market Cap



- Theory
 - Betas have lower standard deviations for companies with small and large market caps
- Our Action
 - Only include equities with market caps over \$10B

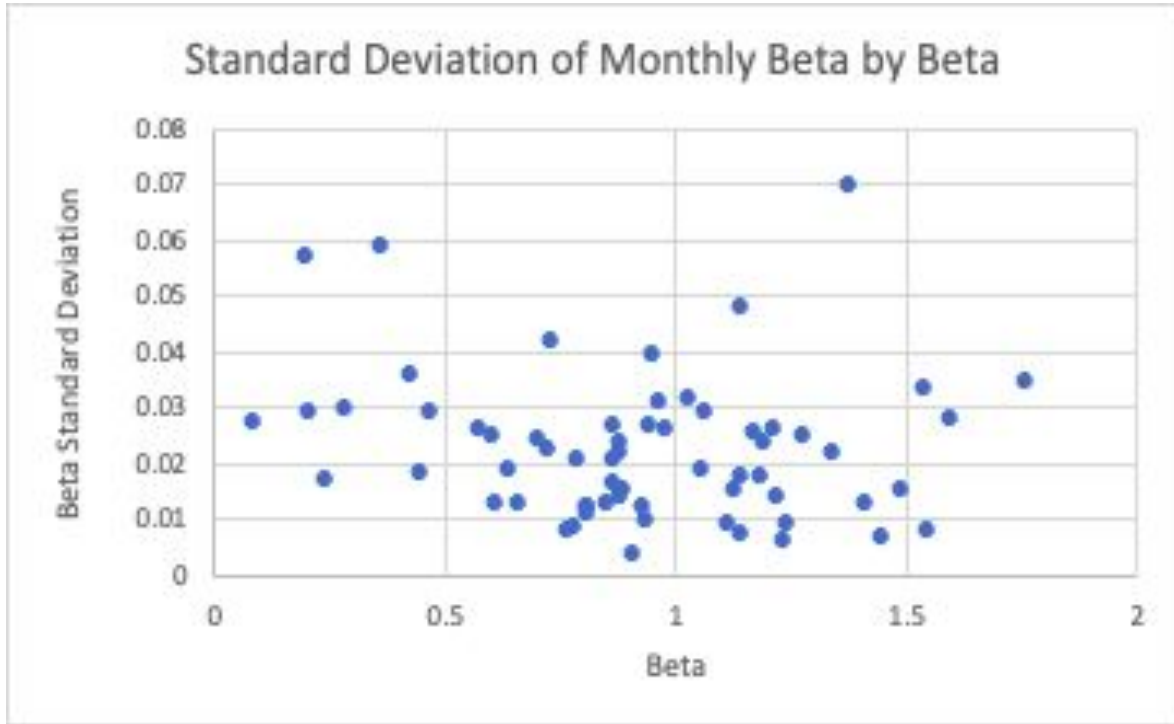
Beta Standard Deviation by Sector

Average Standard Deviation	
Information Technology	0.0146323
Consumer Discretionary	0.0171794
Consumer Staples	0.0174556
Materials	0.0176313
Industrials	0.0193521
Financials	0.0202005
Utilities	0.0234717
Health Care	0.0248539
Communication Services	0.025955
Energy	0.0327615
Real Estate	0.0363134

- Theory
 - Different Sectors have monthly betas that have lower standard deviation than other sectors
- Our Action
 - Choose the 5 sectors with the betas that have the lowest standard deviation

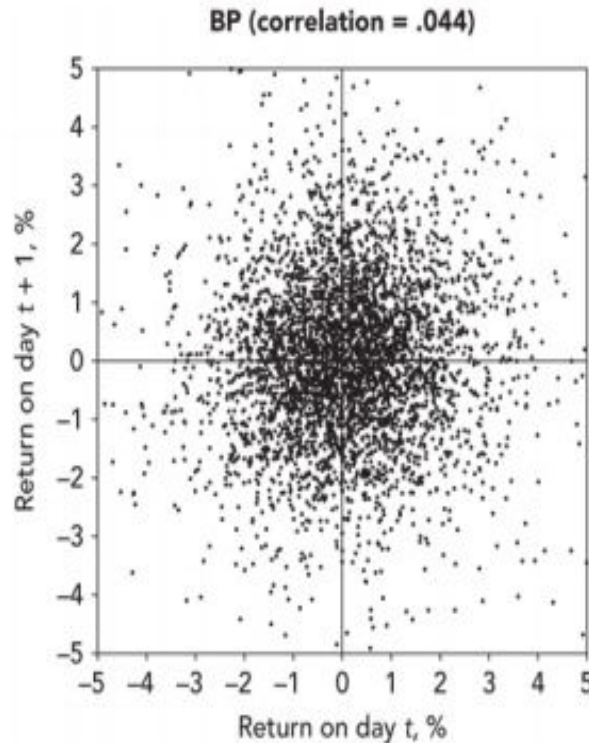
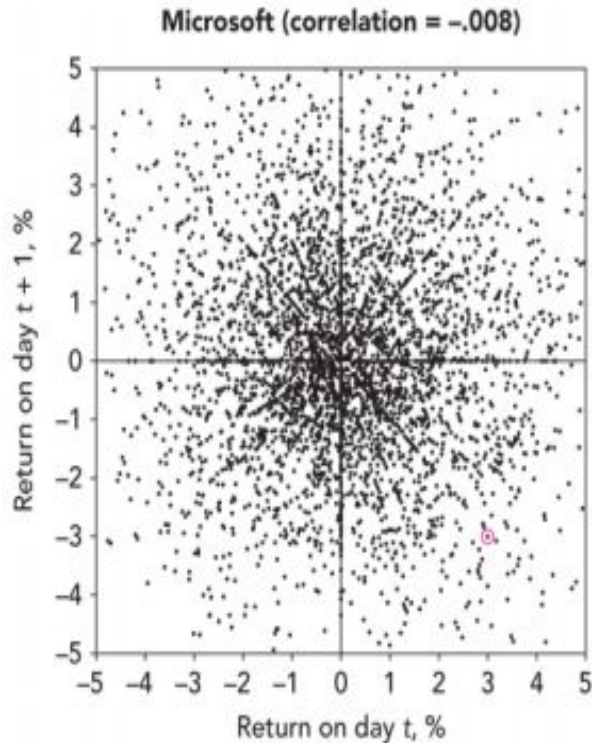


Standard Deviation of Beta by Beta



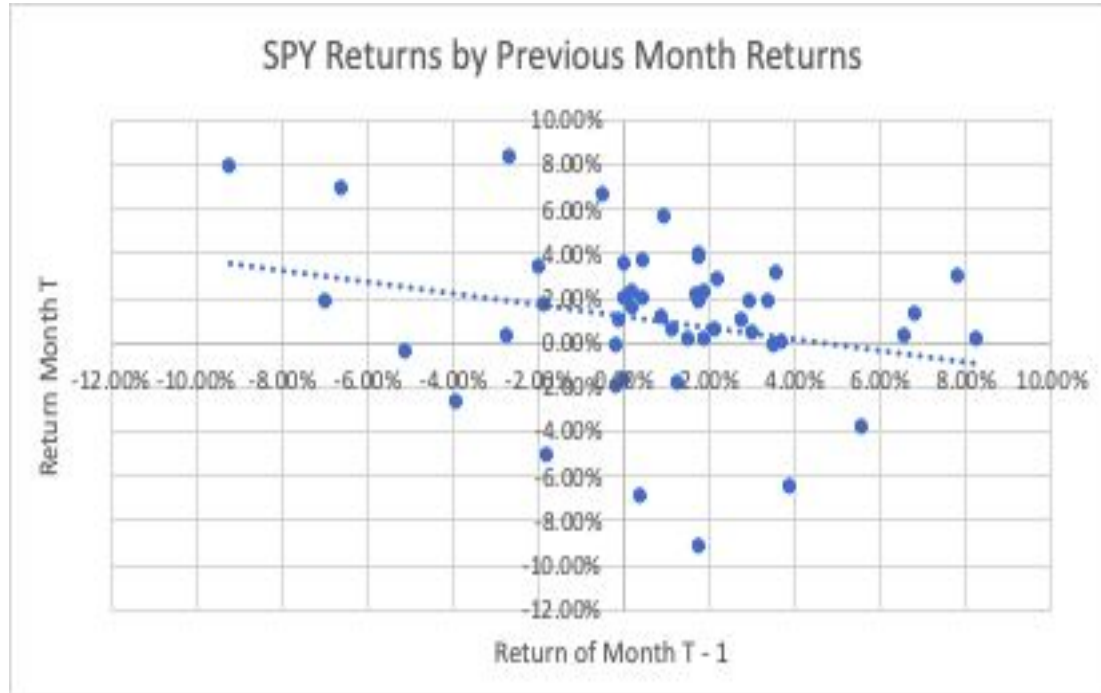
- Theory
 - Betas have higher standard deviations for companies with high betas
- Our Action
 - Only include equities with betas 0.6 \longleftrightarrow 1.2

Assumption - CAPM Return



- Today's return cannot be predicted by yesterday's return
- Let's try this by monthly return!

Assumption - CAPM Return



- Several theories suggest that past returns can be used to predict future returns when looking at larger time intervals like months
- This graph does not support that theory, but we are going to do it anyway!

Calculating Expected Prices

- Risk-free rate is 0.15%
- Step 1: Calculate Market Returns
 - Last Month Market Return = $(\text{Current SPY Price} - \text{Last Month SPY Price}) / \text{Last Month SPY Price}$
- Step 2: Calculate CAPM Returns
 - $\text{CAPMR} = \text{Risk-free rate} + \text{beta}(\text{market return} - \text{risk-free rate})$
 - Based on assumptions, Predicted CAPMR = Last Month CAPMR
- Step 3: Calculate what the stock price should be in 1 month
 - Stock Price in 1 Month = $\text{Stock Price Last Month} \times (1 + \text{CAPMR})^2$



Calculating Expected Prices

Company Name	Sector	Beta	Market Cap	Price 1 Month Ago	Price Now	Return CAPM	What Price Should be in 1 Month
Apple	IT	1.1	\$1 Trillion	\$150	\$160	2%	\$156
Nike	CD	.84	\$140 Billion	\$75	\$82	7%	\$86

Stock Selection

- Step 1: Calculate expected upside or expected downside
 - $(\text{Expected Price in 1 Month} - \text{Current Price}) / \text{Current Price}$
- Step 2: Filter out stocks with expected upside/downside more than 4%
 - Filter out the “winners” and “losers”
 - CAPM assumes the market efficiency so there likely won't be amazing opportunities
- Step 3: Choose stocks to long and stocks to short
 - For each of the 5 sectors, long the equity with the largest upside and short the equity with the largest downside



Beta Hedge

- Step 1: Calculate appropriate hedge for each long/short position
 - Equity Position = $10\% / (1 + \text{beta})$
 - Ex. Long Equity ABC w/ beta 1.5 $\rightarrow 10\% / (1 + 1.5) = 4\%$
 - SPY Position = $10\% - \text{Equity Position}$
 - Short SPY $\rightarrow 10\% - 4\% = 6\%$
- Step 2: Calculate Total Position for Equity and SPY
 - Total Equity Position = $\text{sum}(\text{abs}(\text{Equity Positions}))$
 - Net SPY Position = $\text{sum}(\text{SPY Positions})$
- Step 3: Use multiplier to use all capital available
 - Multiplier = $100 / (\text{Equity Position} + \text{SPY Position})$
 - Each equity position and net SPY position \times multiplier
 - Ex: Total Equity position (45%) and Net SPY Position (5%)
 - Multiplier = $100 / (45 + 5) = 2$
 - Multiply each equity position by 2 (Total position is now 90%)
 - Net SPY position = $5\% \times 2 = 10\%$