Portfolio Theory and CAPM

Welch, Chapters 8 and 9

Motivation

What Is A Portfolio and Why Is It Useful?

- A **portfolio** is simply a specific combination of securities, usually defined by **portfolio weights** that sum to 1:

$$\begin{aligned} \boldsymbol{\omega} &= \{\, \omega_1 \,,\; \omega_2 \,, \ldots, \; \omega_n \,\} \\ \omega_i &= \frac{N_i P_i}{N_1 P_1 + \cdots + \; N_n P_n} \\ 1 &= \omega_1 + \omega_2 + \cdots + \omega_n \end{aligned}$$

- Portfolio weights can sum to 0 (dollar-neutral portfolios), and weights can be positive (long positions) or negative (short positions).
- Assumption: Portfolio weights summarize all relevant information.

Motivation

Why Not Pick The Best Stock Instead of Forming a Portfolio?

- We don't know which stock is best!
- Portfolios provide **diversification**, reducing unnecessary risks.
- Portfolios can enhance performance by focusing bets.
- Portfolios can customize and manage risk/reward trade-offs.

How Do We Construct a "Good" Portfolio?

- What does "good" mean?
- What characteristics do we care about for a given portfolio?
  - Risk and reward
- Investors like higher expected returns
- Investors dislike risk

Do People Dislike Risk and Like Higher Returns?

Do People Dislike Risk and Like Higher Returns?

Do People Dislike Risk and Like Higher Returns?

Motivation

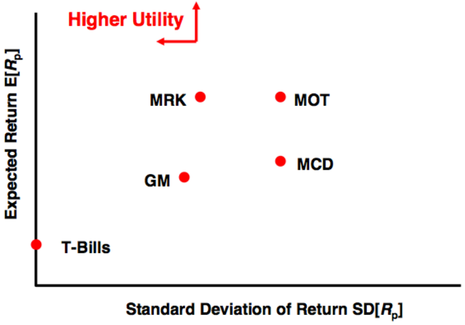
Assumption

- Investors like high expected returns but dislike high volatility
- Investors care only about the expected return and volatility of their overall portfolio
  - Not individual stocks in the portfolio
  - Investors are generally assumed to be well-diversified
- **Key questions:** How much does a stock contribute to the risk and return of a portfolio, and how can we choose portfolio weights to optimize the risk/reward characteristics of the overall portfolio?

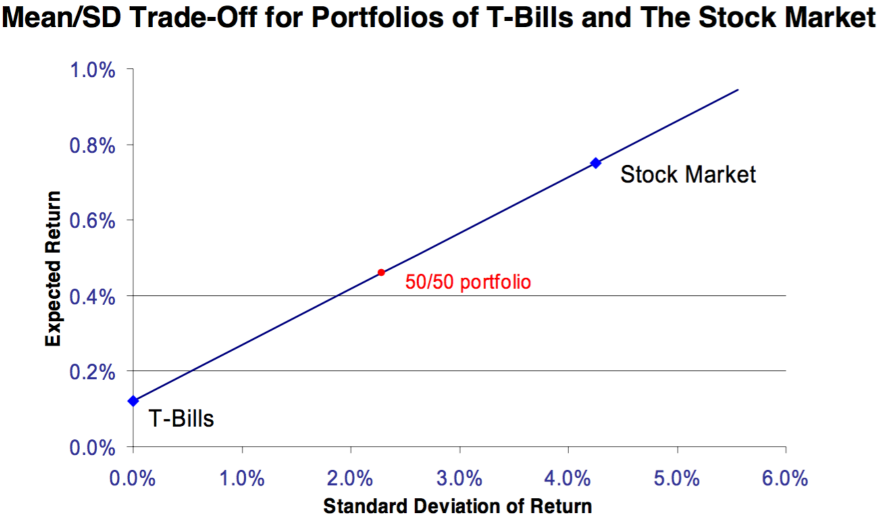
Mean-Variance Analysis

Objective

- Assume investors focus only on the expected return and variance (or standard deviation) of their portfolios: higher expected return is good, higher variance is bad
- Develop a method for constructing optimal portfolios



Mean-Variance Analysis



Statistical Background

- **Mean**

$$\mu_i \equiv E[R_{it}]$$

- **Variance**

$$\sigma_i^2 \equiv E[(R_{it} - \mu_i)^2]$$

- **Standard Deviation**

$$\sigma_i \equiv \sqrt{E[(R_{it} - \mu_i)^2]}$$

How closely do two variables move together?

- **Covariance**

$$Cov[R_{it}, R_{jt}] \equiv E[(R_{it} - \mu_i)(R_{jt} - \mu_j)]]$$

- **Correlation**

$$\rho_{ij} \equiv \frac{E[(R_{it} - \mu_i)(R_{jt} - \mu_j)]}{\sigma_i \sigma_j}$$

Mean-Variance Analysis

Basic Properties of Mean and Variance for Portfolio Returns

$$
\begin{aligned}
R_p &= \omega_1 R_1 + \omega_2 R_2 + ... + \omega_n R_n \\
E[R_p] &= \omega_1 \mu_1 + \omega_2 \mu_2 + ... + \omega_n \mu_n \\
&= \mu_p \quad \text{(Weighted Average)}
\end{aligned}
$$

Mean-Variance Analysis

Basic Properties of Mean and Variance for Portfolio Returns

$$\begin{aligned} R_p &= \omega_1 R_1 + \omega_2 R_2 + \ldots + \omega_n R_n \\ E[R_p] &= \omega_1 \mu_1 + \omega_2 \mu_2 + \ldots + \omega_n \mu_n \\ &= \mu_p \quad \text{(Weighted Average)} \end{aligned}$$

Variance is More Complicated:

$$\begin{aligned} Var[R_p] &= E[(R_p - \mu_p)^2] \\ &= E\left[\Big(\omega_1(R_1 - \mu_1) + \omega_2(R_2 - \mu_2) + \ldots + \omega_n(R_n - \mu_n)\Big)^2\right] \end{aligned}$$

$$\begin{aligned} E[\omega_i \omega_j (R_i - \mu_i)(R_j - \mu_j)] &= \sum_i \sum_j \omega_i \omega_j Cov[R_i, R_j] \\ &= \sum_i \sum_j \omega_i \omega_j \sigma_i \sigma_j \rho_{ij} \end{aligned}$$

Mean-Variance Analysis

Portfolio variance is the weighted sum of all the variances and covariances:

	$\omega_1(R_1-\mu_1)$	$\omega_2(R_2-\mu_2)$	$\cdots$	$\omega_n(R_n-\mu_n)$
$\omega_1(R_1-\mu_1)$	$\omega_1^2\sigma_1^2$	$\omega_1\omega_2\sigma_{12}$	$\cdots$	$\omega_1\omega_n\sigma_{1n}$
$\omega_2(R_2-\mu_2)$	$\omega_2\omega_1\sigma_{21}$	$\omega_2^2\sigma_2^2$	$\cdots$	$\omega_2\omega_n\sigma_{2n}$
$\cdots$	$\vdots$	$\vdots$	$\ddots$	$\vdots$
$\omega_n(R_n-\mu_n)$	$\omega_n\omega_1\sigma_{n1}$	$\omega_n\omega_2\sigma_{n2}$	$\cdots$	$\omega_n^2\sigma_n^2$

- There are n variances, and n^2-n covariances
- Covariances dominate portfolio variance
- Positive covariances increase portfolio variance; negative covariances decrease portfolio variance (diversification)

Mean-Variance Analysis

Consider The Special Case of Two Risky Assets:

$$R_p = \omega_a R_a + \omega_b R_b$$

$$\begin{aligned} \mathrm{E}[R_p] &= \omega_a \mu_a + \omega_b \mu_b \\ \mathrm{Var}[R_p] &= \omega_a^2 \sigma_a^2 + \omega_b^2 \sigma_b^2 + 2\omega_a \omega_b \mathrm{Cov}[R_a, R_b] \\ &= \omega_a^2 \sigma_a^2 + \omega_b^2 \sigma_b^2 + 2\omega_a \omega_b \sigma_a \sigma_b \rho_{ab} \end{aligned}$$

$$\text{Because} \quad \rho_{ab} \equiv \frac{\mathrm{Cov}[R_a, R_b]}{\sigma_a \sigma_b}$$

$$\mathrm{Cov}[R_a, R_b] = \sigma_a \sigma_b \rho_{ab}$$

- As correlation increases, overall portfolio variance increases

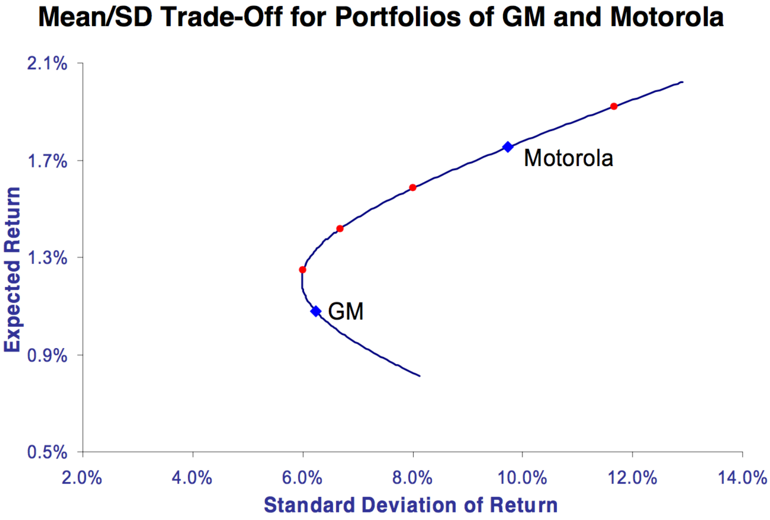
2 Risky Assets

Example: From 1946 – 2001, Motorola had an average monthly return of 1.75% and a std dev of 9.73%. GM had an average return of 1.08% and a std dev of 6.23%. Their correlation is 0.37. How would a portfolio of the two stocks perform?

$$\begin{aligned} \mathrm{E}[R_p] &= \omega_{\mathrm{GM}}\, 1.08 + \omega_{\mathrm{MOT}}\, 1.75 \\ \mathrm{Var}[R_p] &= \omega_{\mathrm{GM}}^2\, 6.23^2 + \omega_{\mathrm{MOT}}^2\, 9.73^2 + \\ & \qquad 2\omega_{\mathrm{GM}}\omega_{\mathrm{MOT}}\, (0.37 \times 6.23 \times 9.73) \end{aligned}$$

w_{Mot}	w_{GM}	$E[R_P]$	$var(R_P)$	$stdev(R_P)$
0	1	1.08	38.8	6.23
0.25	0.75	1.25	36.2	6.01
0.50	0.50	1.42	44.6	6.68
0.75	0.25	1.58	64.1	8.00
1	0	1.75	94.6	9.73
1.25	-0.25	1.92	136.3	11.67

2 Risky Assets



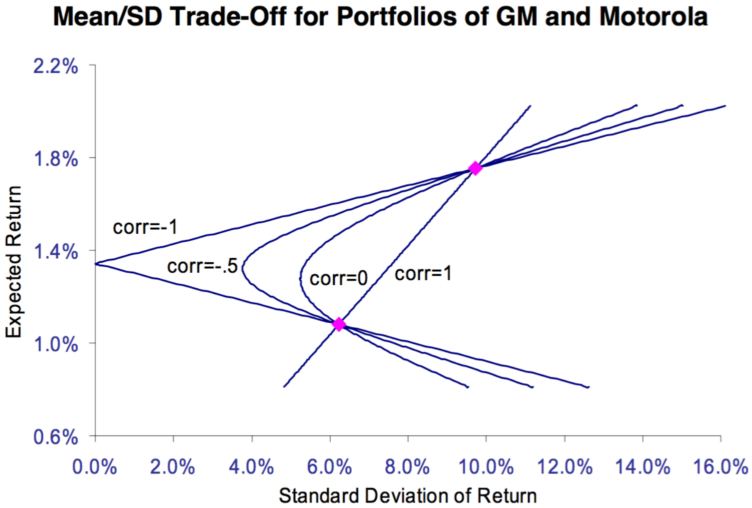
2 Risky Assets

Example (cont): Suppose the correlation between GM and Motorola changes. What if it equals –1.0? 0.0? 1.0?

$$E[R_p] = \omega_{GM} 1.08 + \omega_{MOT} 1.75$$
$$Var[R_p] = \omega_{GM}^2 6.23^2 + \omega_{MOT}^2 9.73^2 + 2\omega_{GM}\omega_{MOT} (\rho_{GM,MOT} \times 6.23 \times 9.73)$$

			Std dev of portfolio		
w_{Mot}	w_{GM}	$E[R_P]$	corr = -1	corr = 0	corr = 1
0	1	1.08%	6.23%	6.23%	6.23%
0.25	0.75	1.25	2.24	5.27	7.10
0.50	0.50	1.42	1.75	5.78	7.98
0.75	0.25	1.58	5.74	7.46	8.85
1	0	1.75	9.73	9.73	9.73

2 Risky Assets



3 Risky assets

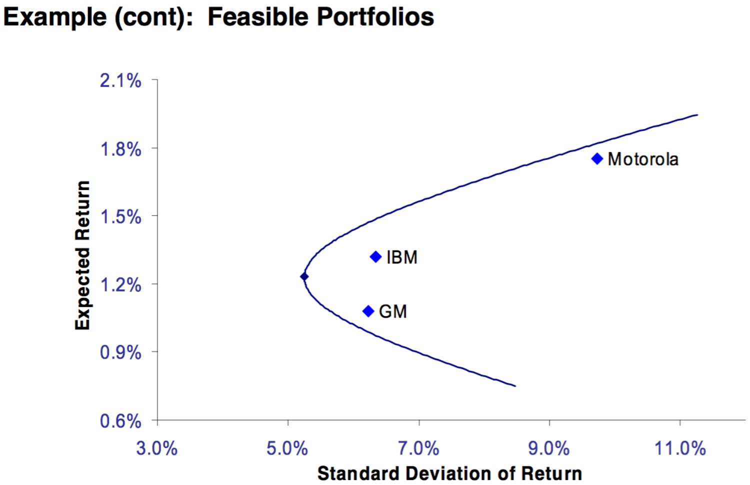
Example: You can invest in any combination of GM, IBM, and MOT. What portfolio would you choose?

			Variance / covariance		
Stock	Mean	Std dev	GM	IBM	Motorola
GM	1.08	6.23	38.80	16.13	22.43
IBM	1.32	6.34	16.13	40.21	23.99
Motorola	1.75	9.73	22.43	23.99	94.63

$$\mathbf{E[R_P]} = (w_{GM} \times 1.08) + (w_{IBM} \times 1.32) + (w_{Mot} \times 1.75)$$

$$\mathbf{var(R_P)} = (w_{GM}{}^2 \times 38.80) + (w_{IBM} \times 40.21) + (w_{Mot}{}^2 \times 94.63) + (2 \times w_{GM} \times w_{IBM} \times 16.13) + (2 \times w_{GM} \times w_{Mot} \times 22.43) + (2 \times w_{IBM} \times w_{Mot} \times 23.99)$$

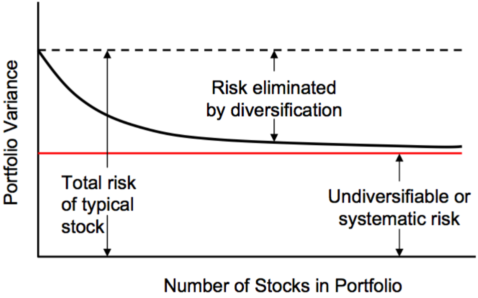
3 Risky assets



Systematic Risk

Eventually, Diversification Benefits Reach A Limit:

- Remaining risk known as **systematic** or **market risk**
- Due to common factors that cannot be diversified
- Example: S&P 500
- Other sources of systematic risk may exist:
  - Credit
  - Liquidity
  - Volatility
  - Business Cycle
  - Value/Growth
- Provides motivation for **linear factor models**



The Efficient Frontier

Given Portfolio Expected Returns and Variances:

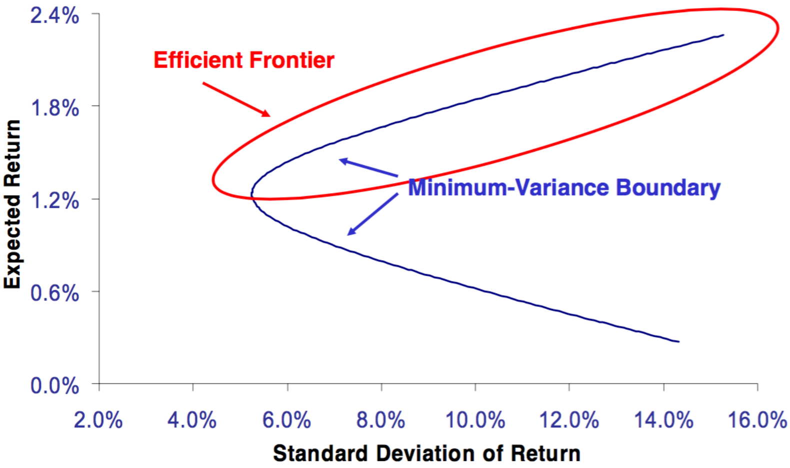
$$\mathsf{E}[R_p] = \omega_1\mu_1 + \cdots + \omega_n\mu_n$$

$$\mathsf{Var}[R_p] = \sum_{i=1}^{n} \omega_i^2\sigma_i^2 + \sum_{i\neq j} \omega_i\omega_j \mathsf{Cov}[R_i, R_j]$$

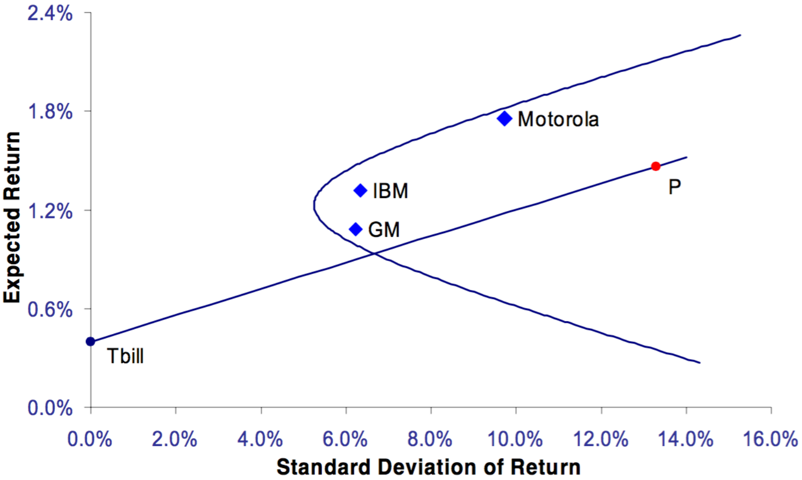
How Should We Choose The Best Weights?

- All feasible portfolios lie inside a bullet-shaped region, called the **minimum-variance boundary or frontier**
- The **efficient frontier** is the top half of the minimum-variance boundary (why?)
- Rational investors should select portfolios from the efficient frontier

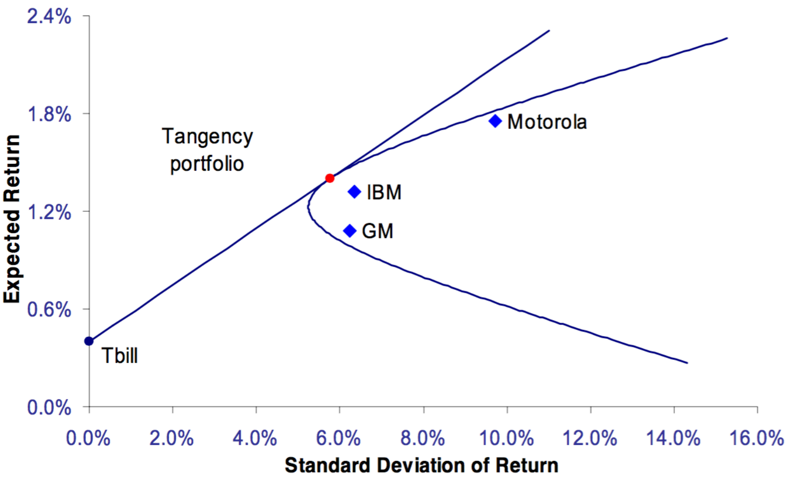
The Efficient Frontier



The Tangency Portfolio



The Tangency Portfolio



The Tangency Portfolio

The Tangency Portfolio

- If there is also a riskless asset (T-Bills), all investors should hold exactly the same stock portfolio!
- All efficient portfolios are combinations of the riskless asset and a unique portfolio of stocks, called the tangency portfolio.*
  - In this case, efficient frontier becomes straight line

* Harry Markowitz, Nobel Laureate

The Tangency Portfolio

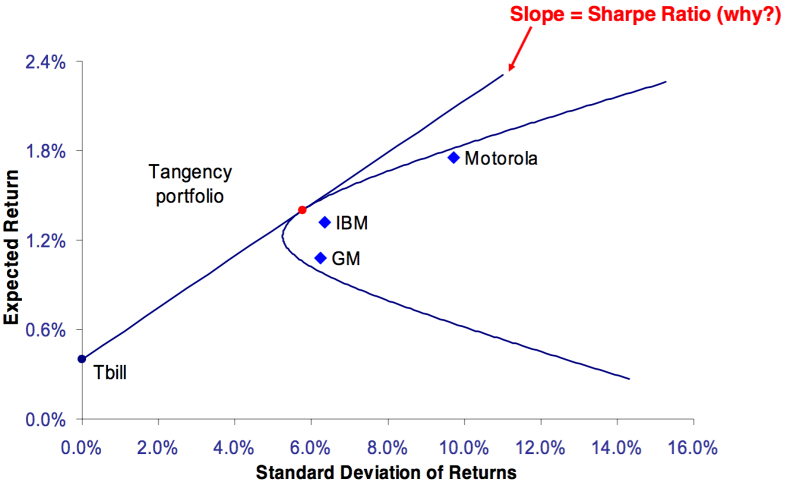
Sharpe ratio

A measure of a portfolio's risk-return trade-off, equal to the portfolio's risk premium divided by its volatility:

$$\text{Sharpe Ratio} \equiv \frac{\mathsf{E}[R_p] - r_f}{\sigma_p} \quad \text{(higher is better!)}$$

- **The tangency portfolio has the highest possible Sharpe ratio of any portfolio**
- Aside: **Alpha** is a measure of a mutual fund's risk-adjusted performance. The tangency portfolio also maximizes the fund's alpha.

The Tangency Portfolio



Key Points

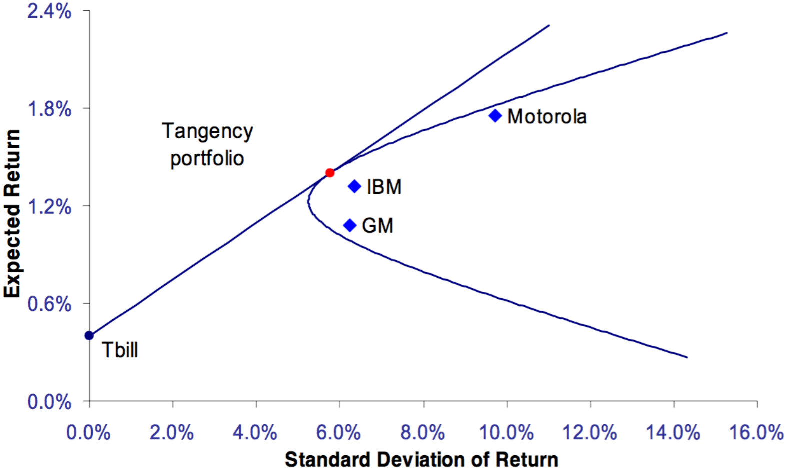
- **Diversification reduces risk.** The standard deviation of a portfolio is always less than the average standard deviation of the individual stocks in the portfolio.
- **In diversified portfolios, covariances among stocks are more important than individual variances.** Only systematic risk matters.
- **Investors should try to hold portfolios on the efficient frontier.** These portfolios maximize expected return for a given level of risk.
- **With a riskless asset, all investors should hold the tangency portfolio.** This portfolio maximizes the trade-off between risk and expected return.

Equilibrium

Risk/Return Trade-Off

- Portfolio risk depends primarily on covariances
  - Not stocks' individual volatilities
- Diversification reduces risk
  - But risk common to all firms cannot be diversified away
- Hold the tangency portfolio M
  - The tangency portfolio has the highest expected return for a given level of risk (i.e., the highest Sharpe ratio)
- Suppose all investors hold the same portfolio M; what must M be?
  - M is the **market portfolio**
- Proxies for the market portfolio: S&P 500, Russell 2000, MSCI, etc.
  - Value-weighted portfolio of broad cross-section of stocks

The Tangency Portfolio



The Capital Market Line

Implications of M as the Market Portfolio

- Efficient portfolios are combinations of the market portfolio and T-Bills
- Expected returns of **efficient portfolios** satisfy:

$$\mathrm{E}[R_p] = R_f + \frac{\sigma_p}{\sigma_m}(\mathrm{E}[R_m] - R_f)$$

- This yields the required rate of return or cost of capital for efficient portfolios!
- Trade-off between risk and expected return
- Multiplier is the ratio of portfolio risk to market risk
- What about other (non-efficient) portfolios?

The Capital Asset Pricing Model

Implications of M as the Market Portfolio

- For any asset, define its **market beta** as:

$$\beta_i \equiv \frac{\mathrm{Cov}[R_i, R_m]}{\mathrm{Var}[R_m]}$$

- Then the Sharpe-Lintner CAPM implies that:

$$\mathrm{E}[R_i] = R_f + \beta_i \left(\mathrm{E}[R_m] - R_f\right)$$

- Risk/reward relation is linear!
- Beta is the correct measure of risk, not sigma (except for efficient portfolios); measures sensitivity of stock to market movements

The Security Market Line

The Security Market Line

$$E[R_i] = R_f + \beta_i (E[R_m] - R_f)$$

- Implications:

$$\beta_i = 1 \Rightarrow E[R_i] = E[R_m]$$
$$\beta_i = 0 \Rightarrow E[R_i] = R_f$$
$$\beta_i < 0 \Rightarrow E[R_i] < R_f \quad \text{(Why?)}$$

The Capital Asset Pricing Model

What About Arbitrary Portfolios of Stocks?

$$
\begin{aligned}
R_p &= \omega_1 R_1 + \cdots + \omega_n R_n \\
\mathrm{Cov}[R_p, R_m] &= \mathrm{Cov}[\omega_1 R_1 + \cdots + \omega_n R_n, R_m] \\
&= \omega_1 \,\mathrm{Cov}[R_1, R_m] + \cdots + \omega_n \mathrm{Cov}[R_n, R_m] \\
\frac{\mathrm{Cov}[R_p, R_m]}{\mathrm{Var}[R_m]} &= \omega_1 \frac{\mathrm{Cov}[R_1, R_m]}{\mathrm{Var}[R_m]} + \cdots + \omega_n \frac{\mathrm{Cov}[R_n, R_m]}{\mathrm{Var}[R_m]} \\
\beta_p &= \omega_1 \beta_1 + \cdots + \omega_n \beta_n
\end{aligned}
$$

- Therefore, for any arbitrary portfolio of stocks:

$$
\mathrm{E}[R_p] = R_f + \beta_p (\mathrm{E}[R_m] - R_f)
$$

The Capital Asset Pricing Model

We Now Have An Expression for the:

- Required rate of return
- Opportunity cost of capital
- Risk-adjusted discount rate

$$\mathsf{E}[R_p] = R_f + \beta_p (\mathsf{E}[R_m] - R_f)$$

- Risk adjustment involves the product of beta and market risk premium
- Where does $E[R_m]$ and R_f come from?

The Capital Asset Pricing Model

Example:

Using monthly returns from 1990 – 2001, you estimate that Microsoft's beta is 1.49 (std err = 0.18) and Gillette's beta is 0.81 (std err = 0.14). If these estimates are a reliable guide going forward, what expected rate of return should you require for holding each stock?

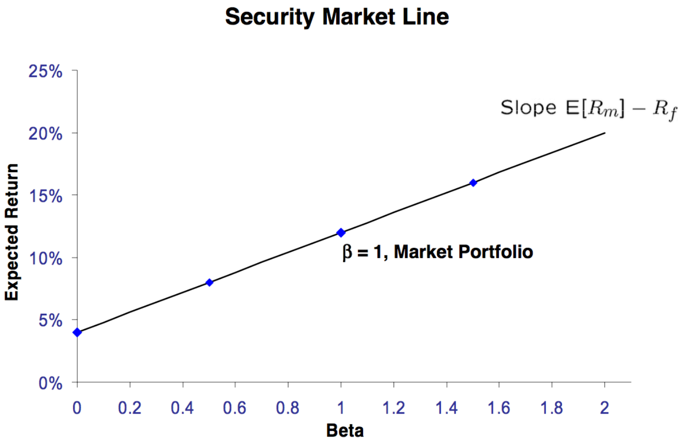
$$\mathsf{E}[R_i] = R_f + \beta_i(\mathsf{E}[R_m] - R_f)$$

$$R_f = 5\% \quad , \quad \mathsf{E}[R_m] - R_f = 6\%$$

$$\mathsf{E}[R_{\mathsf{GS}}] = 0.05 + (0.81 \times 0.06) = 9.86\%$$

$$\mathsf{E}[R_{\mathsf{MSFT}}] = 0.05 + (1.49 \times 0.06) = 13.94\%$$

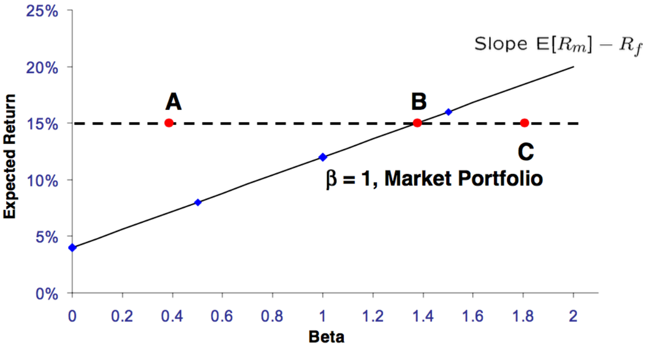
The Capital Asset Pricing Model



The Capital Asset Pricing Model

The Security Market Line Can Be Used To Measure Performance:

- Suppose three mutual funds have the same average return of 15%
- Suppose all three funds have the same volatility of 20%
- Are all three managers equally talented?
- Are all three funds equally attractive?



The Capital Asset Pricing Model

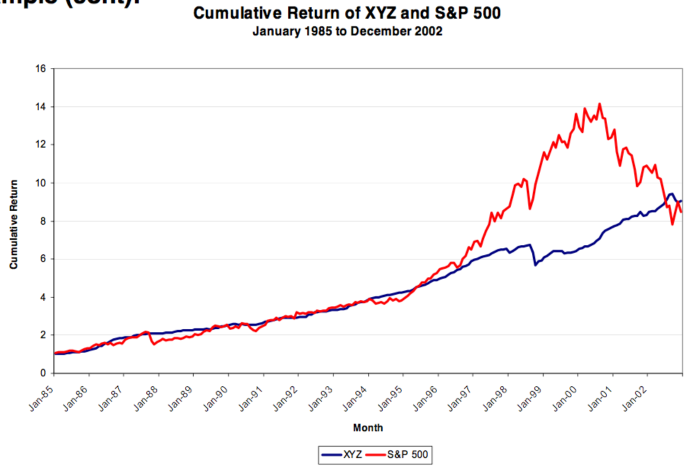
Example:

Hedge fund XYZ had an average annualized return of 12.54% and a return standard deviation of 5.50% from January 1985 to December 2002, and its estimated beta during this period was –0.028. Did the manager exhibit positive performance ability according to the CAPM? If so, what was the manager's alpha?

$$\begin{aligned}
\mathrm{E}[R_i] &= R_f + \beta_i(\mathrm{E}[R_m] - R_f) \\
R_f &= 5\% \quad , \quad \mathrm{E}[R_m] - R_f = 6\% \\
\mathrm{E}[R_{\mathrm{XYZ}}] &= 0.05 + (-0.028 \times 0.06) = 4.83\% \\
\alpha_{\mathrm{XYZ}} &= \mathrm{E}[R_i] - \left\{R_f + \beta_i(\mathrm{E}[R_m] - R_f)\right\} \\
&= 12.54\% - 4.83\% = 7.71\%
\end{aligned}$$

The Capital Asset Pricing Model

Example (cont):



The Arbitrage Pricing Theory

What If There Are Multiple Sources of Systematic Risk?

- Let returns following a multi-factor linear model:

$$R_i - R_f = \alpha_i + \beta_{i1}F_1 + \beta_{i2}F_2 + \cdots + \beta_{iK}F_K + \epsilon$$

$$F_k \equiv \text{Factor } k \text{ excess return}$$

- Then the APT implies the following relation:

$$\text{E}[R_i] - R_f = \beta_{i1}\pi_1 + \beta_{i2}\pi_2 + \cdots + \beta_{iK}\pi_K$$

$$\pi_k \equiv \text{Factor } k \text{ risk premium}$$

- Cost of capital depends on *K* sources of systematic risk

The Arbitrage Pricing Theory

Strengths of the APT

- Derivation does not require market equilibrium (only no-arbitrage)
- Allows for multiple sources of systematic risk, which makes sense

Weaknesses of the APT

- No theory for what the factors should be
- Assumption of linearity is quite restrictive

Implementing the CAPM

Parameter Estimation:

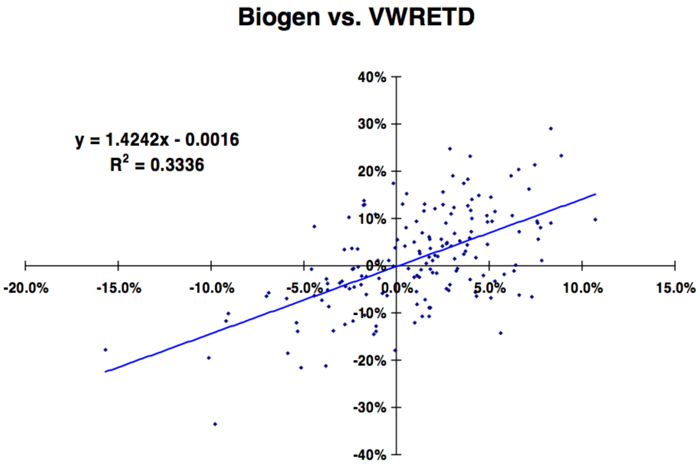
- Security market line must be estimated
- One unknown parameter: β
- Given return history, β can be estimated by linear regression:

$$
\begin{aligned}
\mathsf{E}[R_i] &= R_f + \beta_i(\mathsf{E}[R_m] - R_f) \\
R_i &= R_f + \beta_i(R_m - R_f) + \epsilon \\
R_i - R_f &= \alpha_i + \beta_i(R_m - R_f) + \epsilon \\
\text{CAPM} &\Rightarrow \alpha_i = 0 \\
\text{or } R_i &= \alpha_i + \beta_i R_m + \epsilon \\
\text{CAPM} &\Rightarrow \alpha_i = R_f(1 - \beta_i)
\end{aligned}
$$

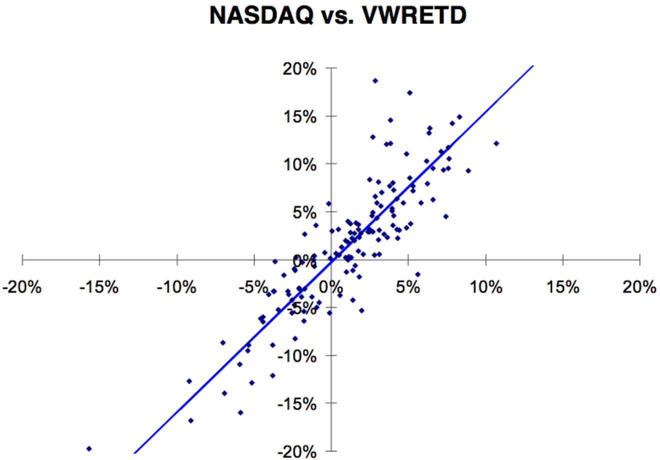
Implementing the CAPM

	A	B	C	D	E	F	G	H	I	J
1	Date	Biogen	Motorola	VWRETD		Biogen Regression				
2	Aug-88	1.9%	-12.5%	-2.8%			beta	intercept	$R_f(1\text{-beta})$	R_f
3	Sep-88	24.5%	3.1%	3.7%		Estimate	1.43	1.6%	-2.1%	5%
4	Oct-88	1.5%	-10.7%	1.8%		Std Err	0.25	1.1%		
5	Nov-88	-11.9%	-2.3%	-1.6%		R2	17.5%	0.13		
6	Dec-88	-3.4%	12.1%	2.1%			33.7	159		
7	Jan-89	29.8%	7.1%	6.6%			0.6	2.7		
8	Feb-89	1.4%	-6.1%	-1.6%						
9	Mar-89	33.3%	-1.6%	2.2%		Estimated	Monthly	Annual		
10	Apr-89	-2.0%	10.6%	4.9%		alpha:	3.7%	45.0%		
11	May-89	16.3%	23.2%	4.0%						
12	Jun-89	-20.2%	-6.3%	-0.5%		Motorola Regression				
13	Jul-89	7.7%	8.1%	7.8%			beta	intercept	$R_f(1\text{-beta})$	R_f
14	Aug-89	10.2%	2.0%	2.2%		Estimate	1.42	-0.2%	-2.1%	5%
15	Sep-89	6.5%	-0.1%	-0.2%		Std Err	0.16	0.7%		
16	Oct-89	5.2%	-3.2%	-2.9%		R2	33.4%	0.08		
17	Nov-89	14.9%	5.6%	1.8%			79.6	159		
18	Dec-89	-3.6%	-0.7%	1.8%			0.6	1.1		
19	Jan-90	-10.4%	-6.4%	-7.0%						
20	Feb-90	5.0%	13.0%	1.5%		Estimated	Monthly	Annual		
21	Mar-90	7.9%	5.6%	2.4%		alpha:	2.0%	23.5%		

Does it Work?


Biogen vs. VWRETD
y = 1.4242x - 0.0016
R2 = 0.3336
40%
30%
20%
10%
0%
-10%
-20%
-30%
-40%
-20.0%
-15.0%
-10.0%
-5.0%
0.0%
5.0%
10.0%
15.0%

Does it Work?



Does it Work?

Market-Cap Portfolios:

Over the past 40 years, the smallest firms (1st decile) had an average monthly return of 1.33% and a beta of 1.40. The largest firms (10th decile) had an average return of 0.90% and a beta of 0.94. During the same time period, the Tbill rate averaged 0.47% and the market risk premium was 0.49%. Are the returns consistent with the CAPM?

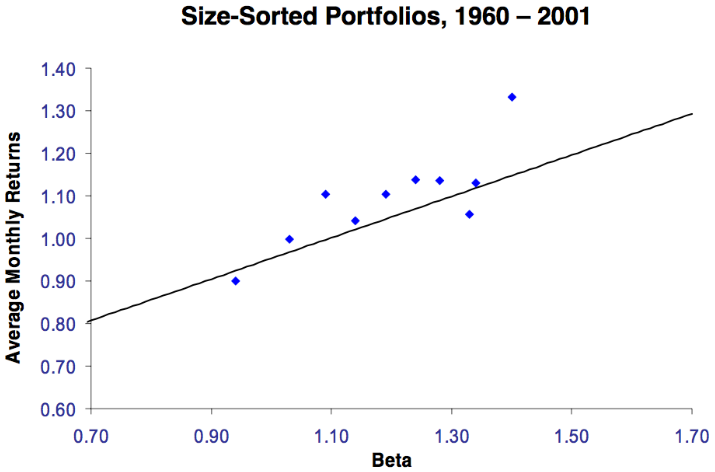
$$E[R_i] = R_f + \beta_i(E[R_m] - R_f)$$

$$R_f = 0.47\% \quad , \quad E[R_m] - R_f = 0.49\%$$

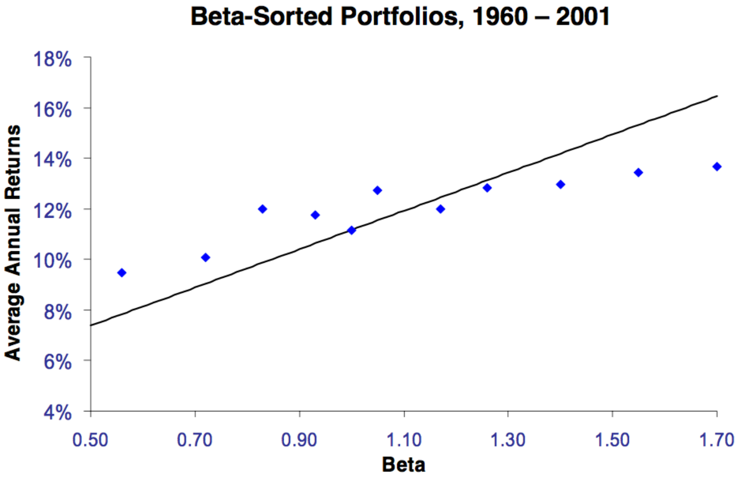
$$E[R_{\text{Large}}] = 0.0047 + (0.94 \times 0.0049) = 0.93\%$$

$$E[R_{\text{Small}}] = 0.0047 + (1.40 \times 0.0049) = 1.16\%$$

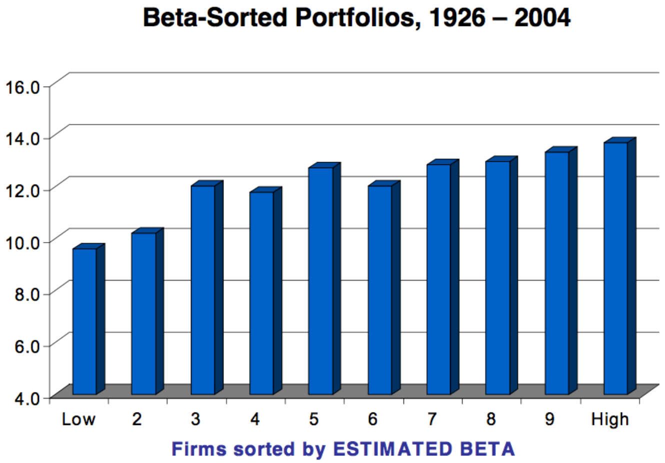
Does it Work?


Size-Sorted Portfolios, 1960 – 2001
Average Monthly Returns
1.40
1.30
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.70
0.90
1.10
1.30
1.50
1.70
Beta

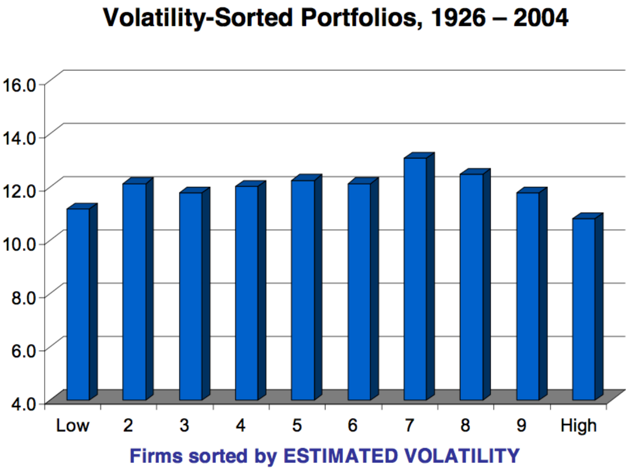
Does it Work?


Beta-Sorted Portfolios, 1960 – 2001
Average Annual Returns
18%
16%
14%
12%
10%
8%
6%
4%
0.50
0.70
0.90
1.10
1.30
1.50
1.70
Beta

Does it Work?


Beta-Sorted Portfolios, 1926 – 2004
16.0
14.0
12.0
10.0
8.0
6.0
4.0
Low
2
3
4
5
6
7
8
9
High
Firms sorted by ESTIMATED BETA

Does it Work?



Volatility-Sorted Portfolios, 1926 – 2004
16.0
14.0
12.0
10.0
8.0
6.0
4.0
Low
2
3
4
5
6
7
8
9
High
Firms sorted by ESTIMATED VOLATILITY

Recent Research

Other Factors Seem To Matter

- Book/Market (Fama and French, 1992)
- Liquidity (Chordia, Roll, and Subrahmanyam, 2000)
- Trading Volume (Lo and Wang, 2006)

But CAPM Still Provides Useful Framework For Applications

- Graham and Harvey (2000): 74% of firms use the CAPM to estimate the cost of capital
- Asset management industry uses CAPM for performance attribution
- Pension plan sponsors use CAPM for risk-budgeting and asset allocation

Key Points

- Tangency portfolio is the market portfolio
- This yields the capital market line (efficient portfolios)

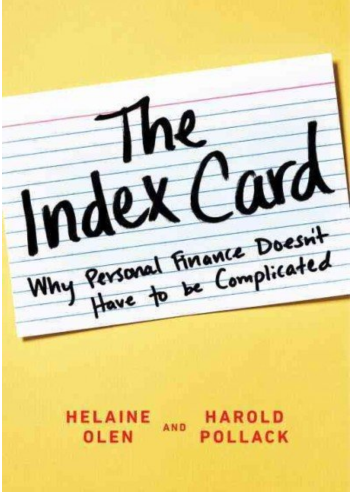
$$E[R_p] = R_f + \frac{\sigma_p}{\sigma_m}(E[R_m] - R_f)$$

- The CAPM generalizes this relationship for any security or portfolio:

$$E[R_i] = R_f + \beta_i (E[R_m] - R_f)$$

- The security market line yields a measure of risk: beta
- This provides a method for estimating a firm's cost of capital
- The CAPM also provides a method for evaluating portfolio managers
  - Alpha is the correct measure of performance, not total return
  - Alpha takes into account the differences in risk among managers
- Empirical research is mixed, but the framework is very useful

Lessons for Personal Finance



Lessons for Personal Finance

- Never Buy or Sell Individual Stocks
  - You're Not Warren Buffett
  - No One On TV or the Internet Knows a Stock's Future
  - If Someone Is So Good At Picking Stocks, Why Share That Information With You?
  - Buy and Hold Them Instead
- Buy Inexpensive, Well-Diversified Indexed Mutual Funds and Exchange-Traded Funds
  - Follow Warren Buffett's Advice: Invest In Index Funds
  - Financial Advisors Don't Achieve Better Returns Than You Can, Though They Charge You To Invest Your Money
  - Beware of Fees
  - When Investing, Simple is Better

Conventional Advice

1. What's your age
2. Subtract that number from 100
3. The answer is the percentage of your assets that should be invested in stocks

Recommended portfolio for a 30-year old:

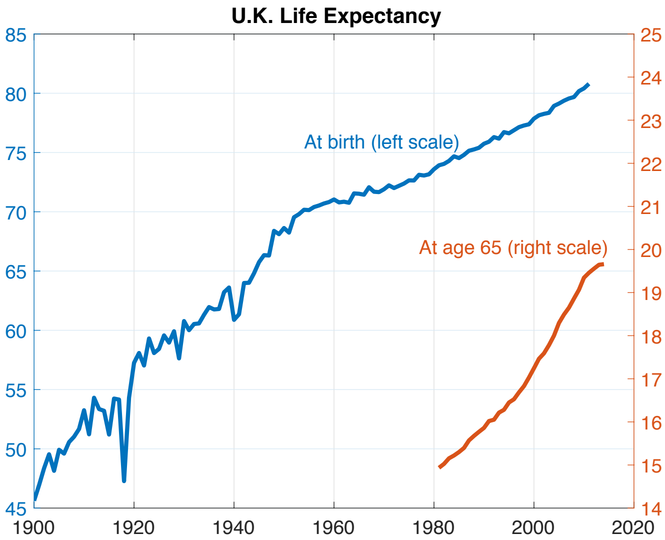
70% Stocks	35% S&P 500 Index Fund	24.50%
	35% FTSE 100 Index Fund	24.50%
	15% small-cap index fund	10.50%
	15% international index fund	10.50%
30% Bonds	100% inflation protected bonds	30%
Total		100%

Lessons for Personal Finance

But before investing, you first need to...

1. Save 10 to 20 percent of your income every month
2. Pay any high interest rate debt first (e.g. credit cards)
3. Build an emergency fund to keep as liquid savings (enough to cover 3 months of living expenses)
4. Max out your Tax-Advantaged Savings Accounts (Pension)

Don't rely only on defined benefit pensions for retirement because they are likely to be less generous over time



Is there a role for active investment?

- The theory emphasizes that the vast majority of people would benefit from this type **passive investment** strategy:
  - Buy and hold well-diversified low cost index funds
  - No expert advice needed! (Other than the one you are receiving today, i.e. not all index funds are created equal)
  - ‘Democratisation of Finance’
- Is there a role for **active investment** strategies?
  - Yes. Someone has to be arbitraging away market inefficiencies.
  - A robust market of competitive active traders is essential
  - Role for investment managers, hedge funds, risk managers...
  - But let them do it with their own money, or your returns will simply go to pay their salaries