New York University
Stern School of Business

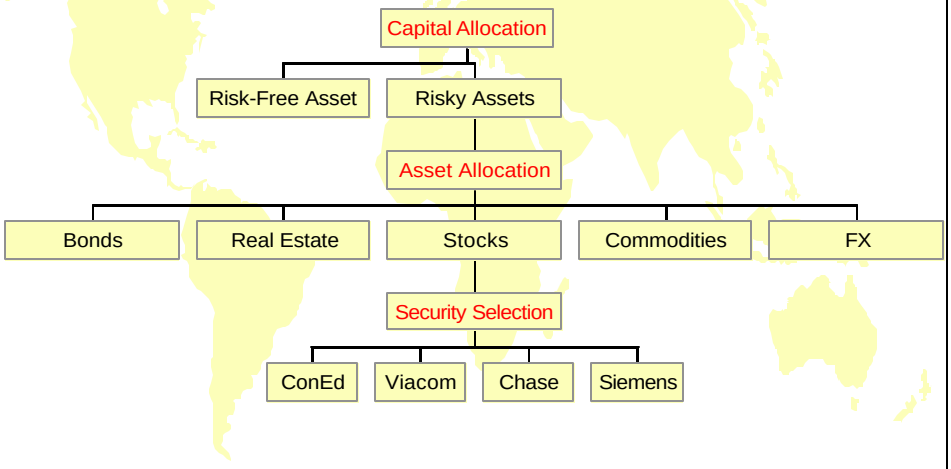
Review

Prof. Ian Giddy
New York University

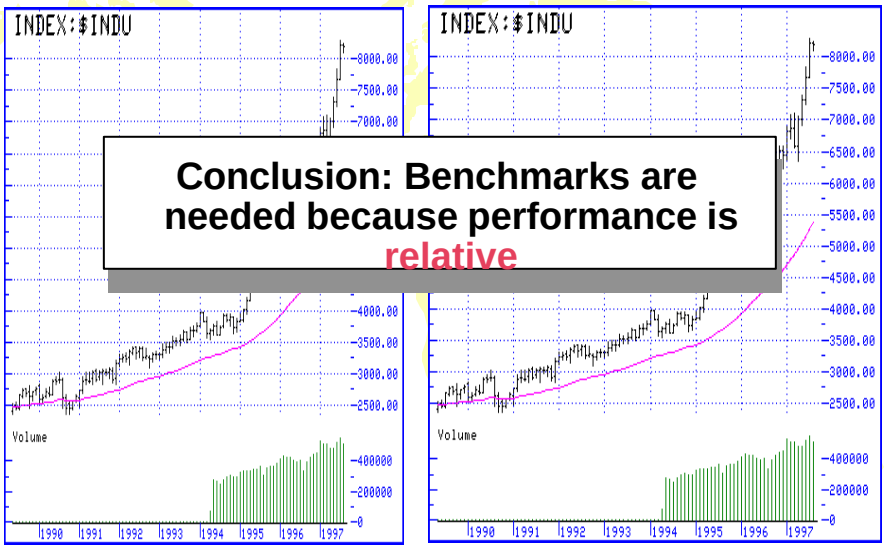
Topics

- ***The Financial Markets***
- ***Time Value of Money and Yields***
- ***Money and Bond Markets***
- ***Risk and Return***
- ***Risk and Diversification***
- ***Valuation and Asset Pricing (CAPM)***
- ***Equity Valuation***
- ***International Financial Markets***
- ***Cash, Futures, FRAs and Swaps***
- ***Options & Applications***
- ***Portfolio Management and Performance Evaluation***

Managing a Portfolio

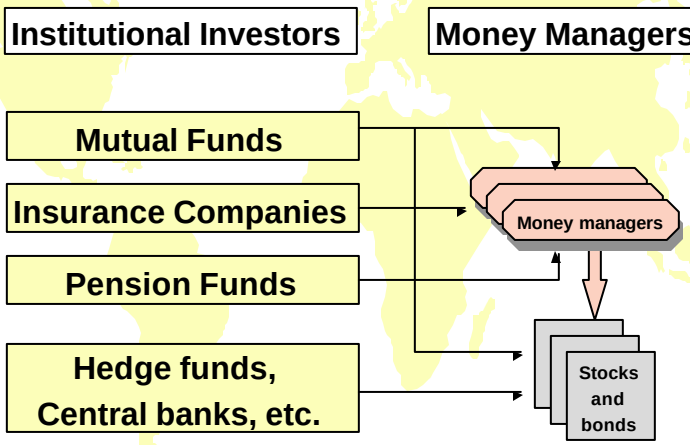


Stocktrak Portfolio: Buy Kellogg?

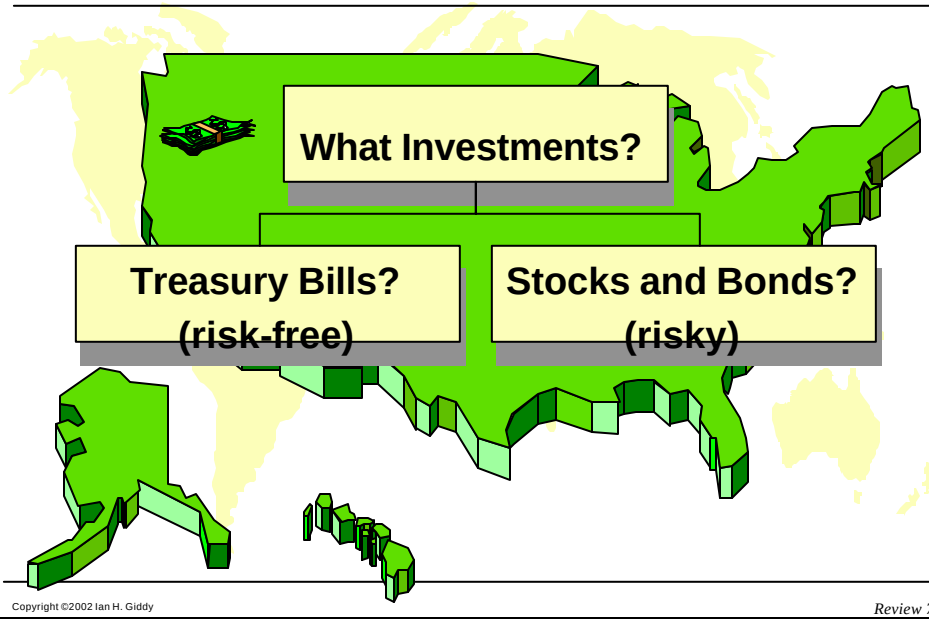


Conclusion: Benchmarks are needed because performance is relative

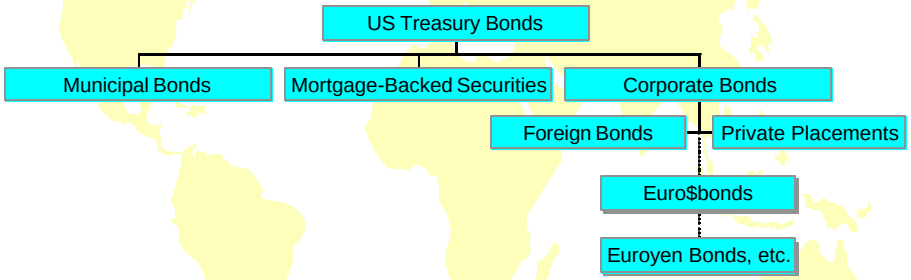
The Players, such as Institutional Investors and Money Managers



The Instruments



Fixed-Income Securities



Prices and Yields of Treasurys

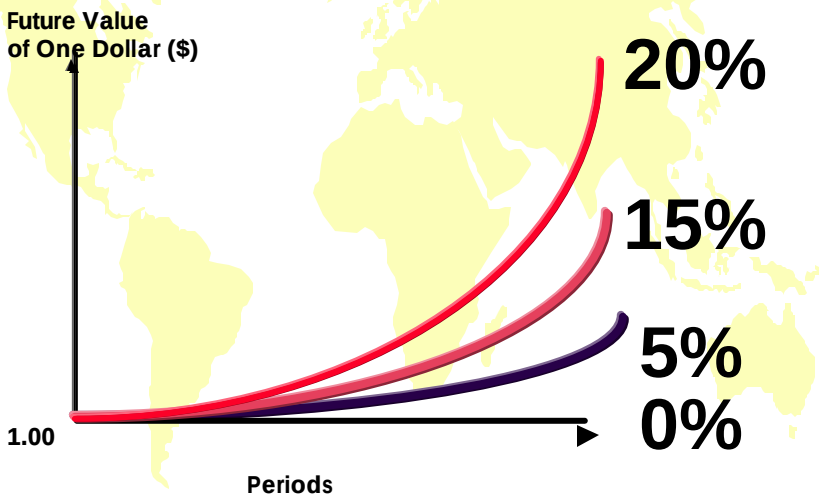
Issue	Coupon	Maturity	Yield	Price	Issue	Coupon	Maturity	Yield	Price
T-NOTE	6.5	10/15/06	4.051	110.998	T-BOND	10	2010C	6.792	120.607
T-BOND	7.625	02-15-2007C	7.158	102.025	T-NOTE	5.75	8/15/10	4.649	107.900
T-NOTE	6.25	2/15/07	4.087	110.278	T-BOND	12.75	11-15-	7.592	133.414
T-NOTE	6.625	5/15/07	4.147	112.247	T-NOTE (OLD 10YR)	5	2/15/11	4.686	102.342
T-NOTE	6.125	8/15/07	4.199	109.878	T-BOND	13.875	2011C	7.714	141.205
T-BOND	7.875	11-15-2007C	6.686	105.857	T-NOTE (10YR)	5	8/15/11	4.666	102.598
T-NOTE	5.5	2/15/08	4.282	106.694	T-BOND	14	11-15-	7.529	145.162
T-NOTE	5.625	5/15/08	4.353	107.216	T-BOND	10.375	11-15-	6.365	131.546
T-BOND	8.375	08-15-2008C	6.598	109.642	T-BOND	12	2013C	6.640	143.454
T-BOND	8.75	11-15-2008C	6.681	111.521	T-BOND	13.25	05-15-	6.717	154.909
T-BOND	9.125	05-15-2009C	6.691	114.291	T-BOND	12.5	08-15-	6.541	151.213
T-NOTE	5.5	5/15/09	4.487	106.448	T-BOND	11.75	11-15-	6.398	146.960
T-NOTE	6	8/15/09	4.536	109.559	T-BOND	11.25	2/15/15	5.127	158.631
T-BOND	10.375	11-15-2009C	7.134	119.649	T-BOND	10.625	8/15/15	5.172	153.408
T-BOND	11.75	02-15-2010C	7.619	125.139	T-BOND	9.875	11/15/15	5.201	146.264
T-NOTE	6.5	2/15/10	4.597	113.054	T-BOND	9.25	2/15/16	5.244	140.019

October 11, 2001

The Yield Curve

bondsonline.com
www.federalreserve.gov/rnd.htm

Time Value



Future Values: Summary

Single amount:
the amount times the *future value of interest factor*, or $FVIF_{k,n}$:

$$FV_{r,n} = PVxFVIF_{r,n} = PVx(1+r)^n$$

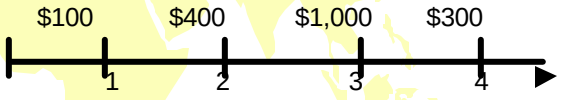
Annuity:
the periodic payment times *the future value of annuity factor*, or $FVIFA_{r,n}$:

$$FVA_{r,n} = PMTxFVIFA_{r,n} = PMTx\frac{(1+r)^n - 1}{r}$$

Present Value (Example: J&J Mexico)

If J&J's new pharmaceuticals facility in Mexico can produce the following dollar profits for the next four years, at a discount rate of 6%, what is the present value of the cash flow stream?

Year	***1***	***2***	***3***	***4***
Cash Flow	***$100***	***$400***	***$1000***	***$300***



$	94.30	$(PVIF_{6\%,1})$ =	.943
	356.00	$(PVIF_{6\%,2})$ =	.890
	840.00	$(PVIF_{6\%,3})$ =	.840
	237.60	$(PVIF_{6\%,4})$ =	.792

$1,527.90 = Present Value of cash flow stream (HP:1,519.24)

Present Values: Summary

Single amount:
the amount times the *present value of interest factor*, or $PVIF_{r,n}$:

$$PV_{r,n} = FVxPVIF_{r,n} = FVx\frac{1}{(1+r)^n}$$

Annuity:
the periodic payment times the *present value of annuity factor*, or $PVIFA_{r,n}$:

$$PVA_{r,n} = PMTxPVIFA_{r,n} = PMTx\frac{1-1/(1+r)^n}{r}$$

Future Values: Summary

Single amount:
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Present Value Of A Perpetuity

$$PV_{\infty} = \frac{PMT}{r}$$

A perpetuity is an annuity that goes on forever...

and (1/r) is the present value interest factor for a perpetuity,

$$PVIFA_{r,\infty} = \frac{1}{r}$$

A Growing Annuity

A growing annuity is one that pays a regular amount that grows at a constant rate each year. A common application is dividends

$$PVGA = PMT(1+g)\left[\frac{1-(1+g)^n/(1+r)^n}{r-g}\right]$$

Example: Gold mine's value

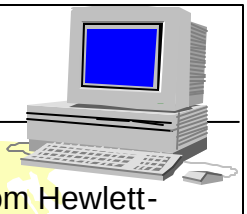
A Growing Perpetuity

A growing perpetuity is one that pays a regular amount that grows at a constant rate each year. A common application is dividends

$$PVGP = \frac{PMT(1+g)}{r-g}$$

Example: Mature company value

Loan Amortization Example



J&J leases $12,000 of computer equipment from Hewlett-Packard. How much would its annual end-of-year payments have to be at a 15% interest rate if the cost must be fully repaid in 3 years?

PVA_3 = $12,000; r = 15%; n = 3

PVA_3 = PMT x $PVIFA_{15\%,3}$

PMT = $PVA_3/PVIFA_{15\%,3}$ = $12,000/2.283

= $5,256.24

Loan Amortization Schedule - A schedule of equal payments to repay a loan. It shows the allocation of each loan payment to interest and principal.

Basic Bond Valuation

$$B_0 = Ix(PVIFA_{r,n}) + Mx(PVIF_n)$$

$$B_0 = \sum_{t=1}^{n} \frac{I}{(1+r)^t} + \frac{M}{(1+r)^n}$$

WHERE:

B_o = value of the bond at time zero

I = annual bond interest in dollars (interest payment)

M = par value of the bond

r_t = required rate of return

n = number of years to maturity

The Zero Approach

- Use zero-coupon rates to value each cash flow - then add them!

$$B_0 = \frac{C}{(1+z_1)^1} + \frac{C}{(1+z_2)^2} + \ldots + \frac{M}{(1+z_n)^n}$$

- Where can we get the *z*'s? One place is from the Treasury strip market.

Bond Lego

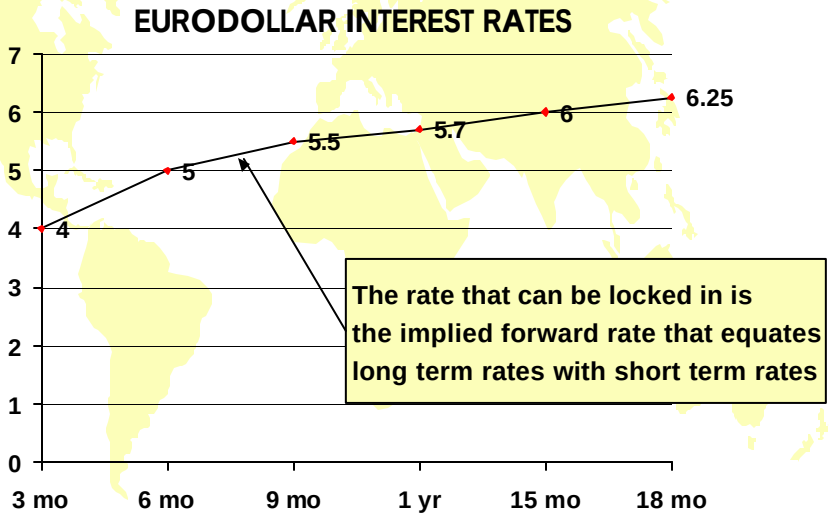
A Treasury Note
as quoted in the *Wall Street Journal* Monday, July 24, 1995

Rate	Maturity, Mo/Yr	Bid Asked	Ask Yld.
6	Dec 97	99:29 99:31	6.01

- To value this bond, break it up into its component cash flows - e.g. 1st coupon of (5 3/4)/2 in Feb 1996, and so on...
- Then use zero's to see what each is worth, and add the total.

In general, breaking up a security into its component parts is an excellent path to valuation.

Forward Interest Rates



Calculating Implied Forward Rates

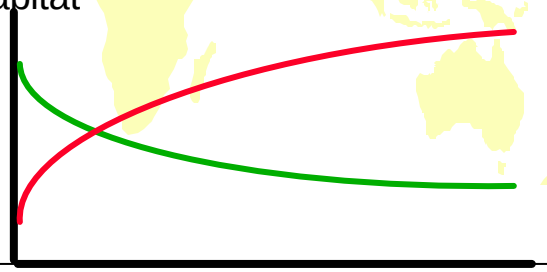
I can buy a 2-year note or buy a 1-year note and reinvest it at some "forward" rate *f*:

$(1+y_2)^2=(1+y_1)(1+f)$

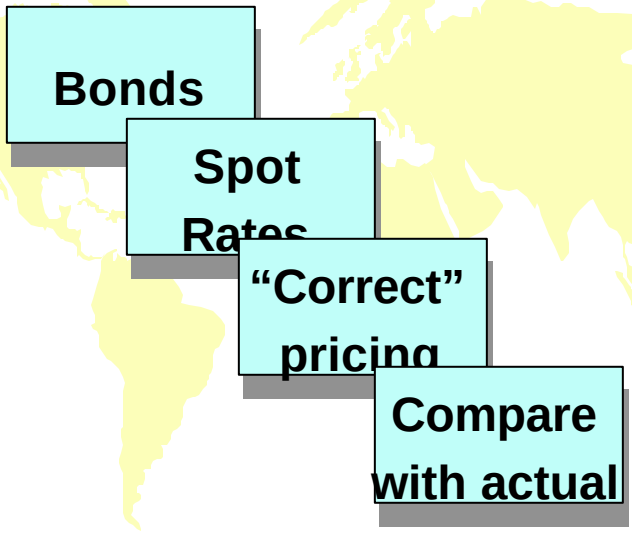
Find *f*!

Theories of Term Structure

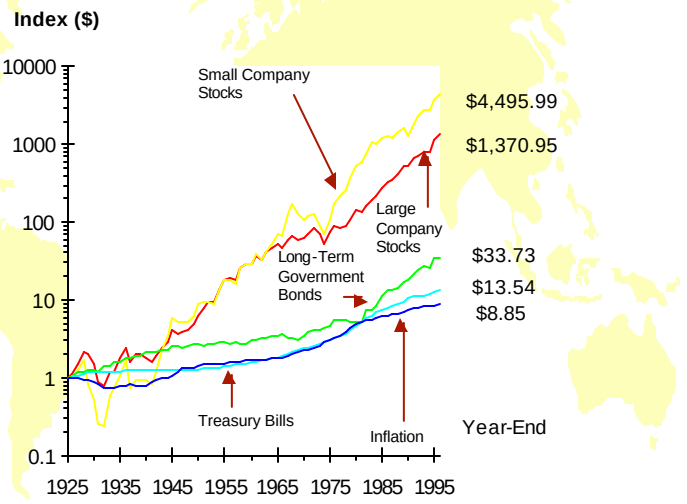
- Expectations
- Liquidity Preference
  - ◆Upward bias over expectations
- Market Segmentation
  - ◆Preferred Habitat



Identifying Undervalued Securities



A $1 Investment in Different Types of Portfolios: 1926-1996



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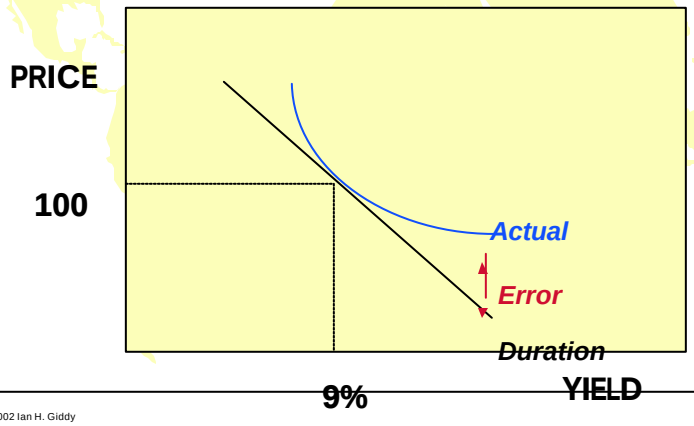
Bond Price Changes: Actual vs. Duration-Based

There's an error in duration-based estimation, because duration is linear.



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Calculating Duration: MacCauley and Modified

$$D_{MAC} = \sum_{t=1}^{n} \frac{tCF_t / (1+r)^t}{P}$$

$$D_{MOD} = \%\Delta P = \frac{dP}{P} = -\frac{D}{(1+r/m)}$$

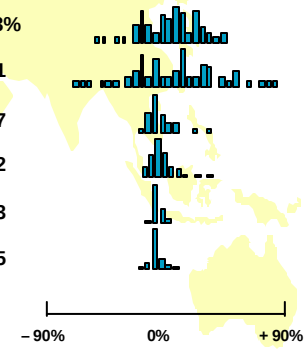
Portfolio Duration

Assets (each $10m):	Fixed liabilities:
◆ 1-year E$ deposit	◆ $10m 3 years
◆ 5-year, 6% T-note Duration=4.3	◆ $15m 5 years
◆ 9-year Strip	◆ $5m 7 years

- Asset Duration = .33(1)+.33(4.3)+.33(9)
- Liab Duration = .33(3)+.50(5)+.17(7)
  - *Net duration is 4.77-4.67 = 0.10*

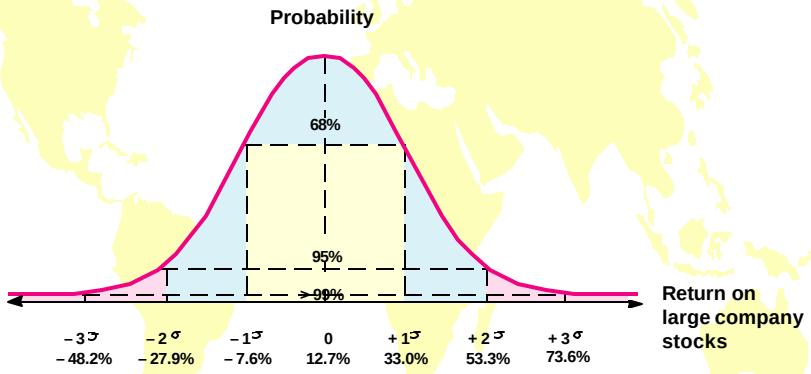
Returns, Standard Deviations, and Frequency Distributions: 1926-1996

Series	Average Annual Return	Standard Deviation	Distribution
Large Company Stocks	12.7%	20.3%	
Small Company Stocks	17.7	34.1	
Long-Term Corporate Bonds	6.0	8.7	
Long-Term Government Bonds	5.4	9.2	
U.S. Treasury Bills	3.8	3.3	
Inflation	3.2	4.5	

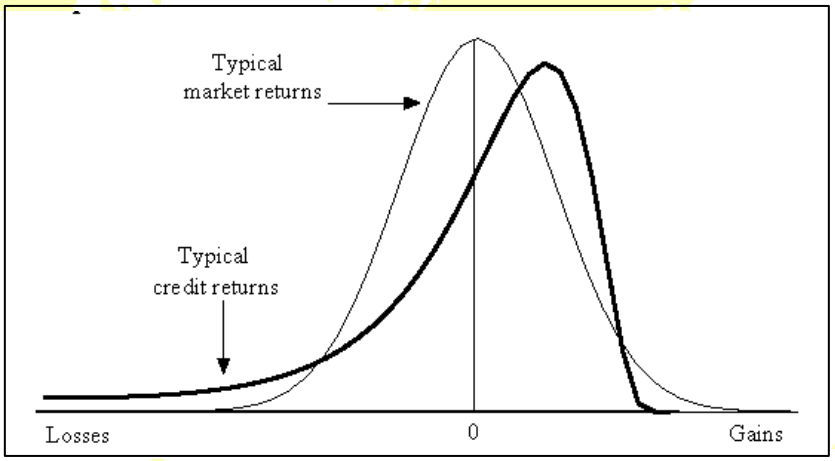


Source: © *Stocks, Bonds, Bills, and Inflation 1997 Yearbook*™, Ibbotson Associates, Inc., Chicago (annually updates work by Roger G. Ibbotson and Rex A. Sinquefield). All rights reserved.

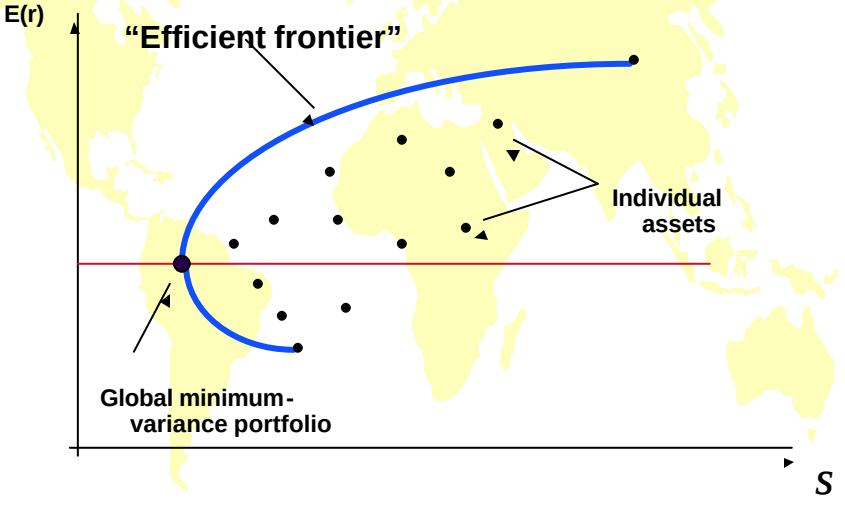
The Normal Distribution



Credit Risk versus Market Risk



Portfolio Optimization



Measuring Portfolio Return and Risk

The *portfolio return* $E(R_p)$ is:

$$E(R_p) = (w_1 k_1)+(w_2 k_2)+ \ldots (w_n k_n) = \sum w_j k_j$$

where w_j = weight of asset j, k_j = return on asset j

The variance of a 2-asset portfolio is:

$$s_P^2 = w_A^2 s_A^2 + w_B^2 s_B^2 + 2 w_A w_B r_{AB} s_A s_B$$

where w_A and w_B are the weights of A and B in the portfolio.

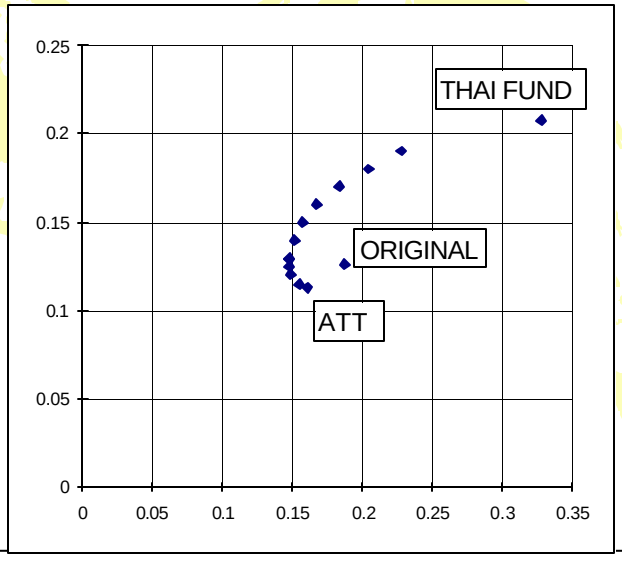
Case Study: A Portfolio

	Weight	E(R)	Std Dev
GPU	0	0.1267	0.1715
Teledyne	0.25	0.1396	0.2893
Kodak	0.25	0.1402	0.3082
Thai Fund	0	0.2075	0.3278
Merck	0	0.1781	0.341
ATT	0.5	0.1126	0.1606
TOTAL	1		

Portfolio Risk Computation

	CORRELATION MATRIX						
	STD DEV	GPU	Teled	Kodak	Thai F	Merck	ATT
GPU	0.1715	1					
Teledyne	0.2893	0.44	1				
Kodak	0.3082	0.17	0.65	1			
Thai Fund	0.3278	0.22	0.44	0.24	1		
Merck	0.341	0.35	0.15	0.13	0.03	1	
ATT	0.1606	0.68	0.4	0.43	0.23	0.6327	1
Portfolio Variance						3.48%	
Portfolio Std Deviation						**18.66%**	

Plotting the Efficient Frontier

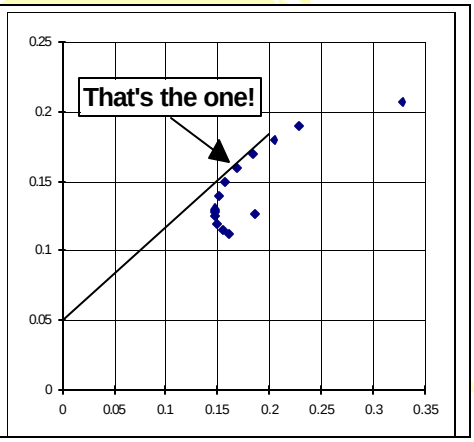


Finding the Optimal Portfolio: Computations

Given the Risk-Free rate is: **5.00%**

OPTIMAL PORTFOLIOS

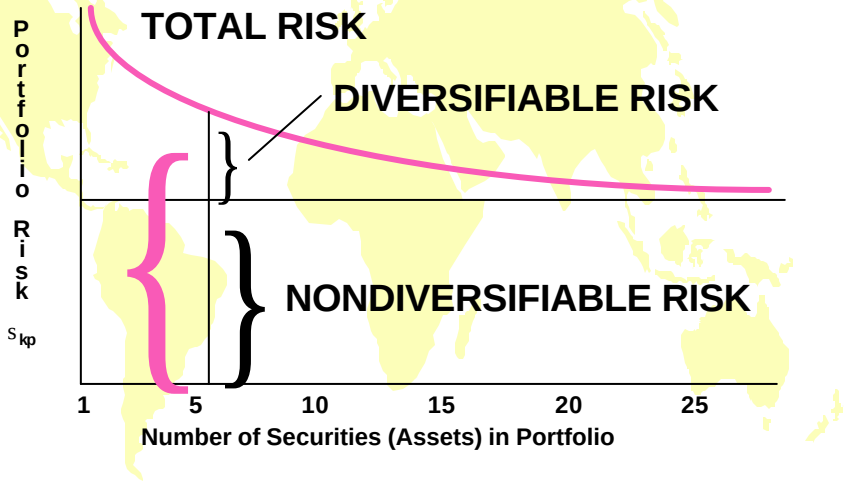
	Return	Std. Dev.	Risk Premium	Ratio RP/SD
GPU	11.26%	0.1606	6.26%	0.390
	11.50%	0.1548	6.50%	0.420
	12.00%	0.1494	7.00%	0.469
	12.50%	0.1475	7.50%	0.508
MIN RISK	12.83%	0.1471	7.83%	0.532
	13.00%	0.1472	8.00%	0.543
	14.00%	0.1509	9.00%	0.596
	15.00%	0.1572	10.00%	0.636
	16.00%	0.168	11.00%	**0.655**
	17.00%	0.184	12.00%	0.652
	18.00%	0.2045	13.00%	0.636
	19.00%	0.2282	14.00%	0.613
THAI	20.75%	0.3278	15.75%	0.480



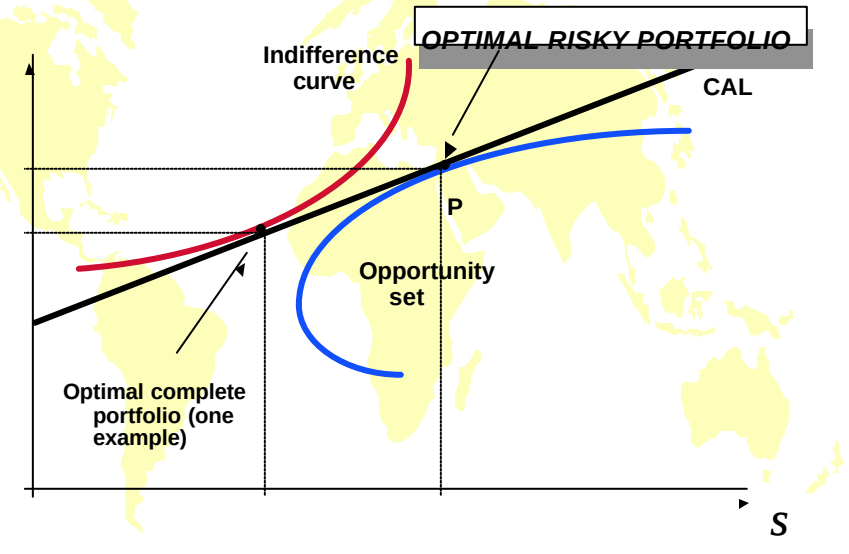
Equity Risk and Return

- Investors diversify, because you get a better return for a given risk.
- There is a fully-diversified “market portfolio” that we should all choose
- The risk of an individual asset can be measured by how much risk it adds to the “market portfolio.”

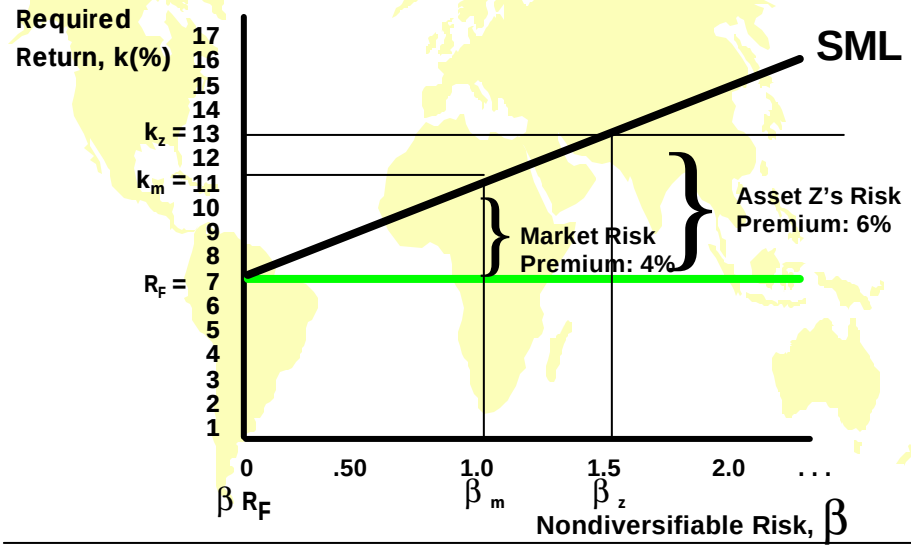
Types of Risk



Optimal Overall Portfolio



Security Market Line



The Equation for the CAPM

$$k_j = R_F + \beta_j (k_m - R_F)$$

where:

k_j = Required return on asset j;

R_F = Risk-free rate of return

β_j = Beta Coefficient for asset j;

k_m = Market return

The term $[\beta_j(k_m - R_F)]$ is called the risk premium and $(k_m - R_F)$ is called the market risk premium

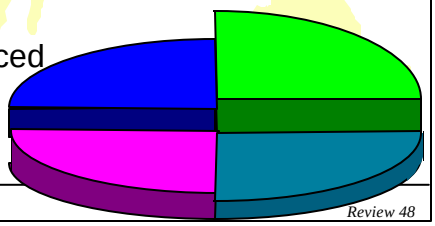
Diversification and Asset Pricing: Summary

- Investors diversify, because you get a better return for a given risk.
- There is a fully-diversified "market portfolio" that we should all choose
- The risk of an individual asset can be measured by how much risk it adds to the "market portfolio"
- The CAPM tells us how the required return relates to the relevant risk.

Value is Not Price

- What is Intrinsic Value?
  - Self assigned Value
  - Variety of models are used for estimation
- Market Price
  - What stock can be sold for or bought at
- Trading Signal
  - IV > MP Buy
  - IV < MP Sell or Short Sell
  - IV = MP Hold or Fairly Priced

More, less, or same as market portfolio?



Equity Valuation: From the Balance Sheet

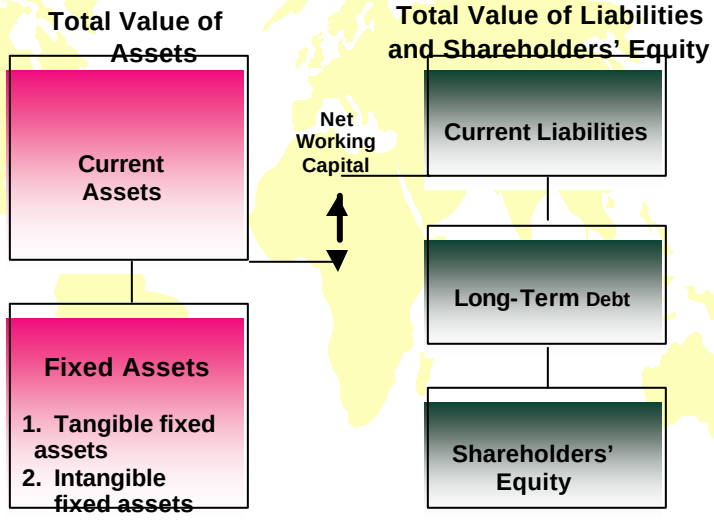
Value of Assets
- Book
- Liquidation
- Replacement

Value of Liabilities
- Book
- Market

Value of Equity

Valuation approach depends on the purpose:
- Liquidation/breakup?
- Going independent concern
- Takeover/change in control?

The Balance Sheet



Dividend Discount Model

$$V_0 = \frac{D_1}{(1+k)^1} + \frac{D_2}{(1+k)^2} \ldots + \frac{D_N + P_N}{(1+k)^N}$$

- P_N = the expected sales price for the stock at time N
- N = the specified number of years the stock is expected to be held

No Growth Model: Example

$$V_o = \frac{D}{k}$$

$E_1 = D_1 = \$5.00$

$k = .15$

$V_0 = \$5.00 / .15 = \$33.33$

Constant Growth Model: Example

$$Vo = \frac{D_o(1+g)}{k-g}$$

E_1 = \$5.00 b = 40% k = 15%

(1-b) = 60% D_1 = \$3.00 g = 8%

V_0 = 3.00 / (.15 - .08) = \$42.86

Shifting Growth Rate Model: Example

D_0 = \$2.00 g_1 = 20% g_2 = 5%

k = 15% T = 3 D_1 = 2.40

D_2 = 2.88 D_3 = 3.46 D_4 = 3.63

$V_0 = D_1/(1.15) + D_2/(1.15)^2 + D_3/(1.15)^3 +$
$D_4 / (.15 - .05) ((1.15)^3$

V_0 = 2.09 + 2.18 + 2.27 + 23.86 = \$30.40

Ratios May Have Meaning

- Gordon Growth Model: $P_0 = \frac{DPS_1}{r - g_n}$
- Dividing both sides by the earnings,

$$\frac{P_0}{EPS_0} = PE = \frac{\text{Payout Ratio} * (1 + g_n)}{r - g_n}$$

- Dividing both sides by the book value of equity,

$$\frac{P_0}{BV_0} = PBV = \frac{ROE * \text{Payout Ratio} * (1 + g_n)}{r - g_n}$$

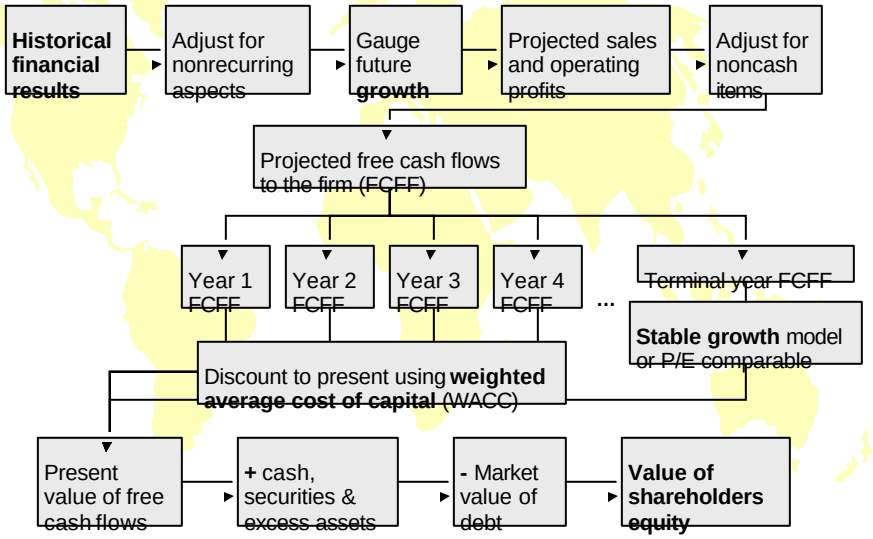
- If the return on equity is written in terms of the retention ratio and the expected growth rate

$$\frac{P_0}{BV_0} = PBV = \frac{ROE - g_n}{r - g_n}$$

- Dividing by the Sales per share,

$$\frac{P_0}{Sales_0} = PS = \frac{\text{Profit Margin} * \text{Payout Ratio} * (1 + g_n)}{r - g_n}$$

Valuing a Firm with DCF: An Illustration

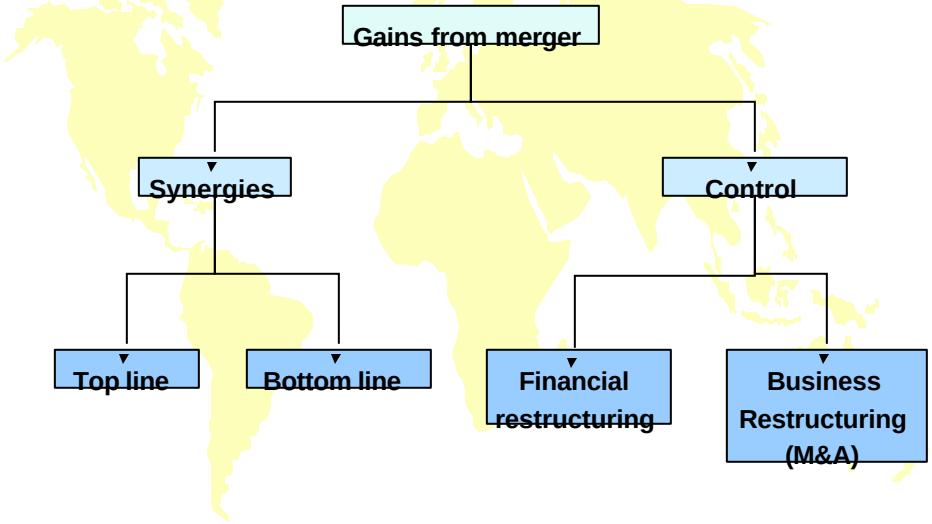


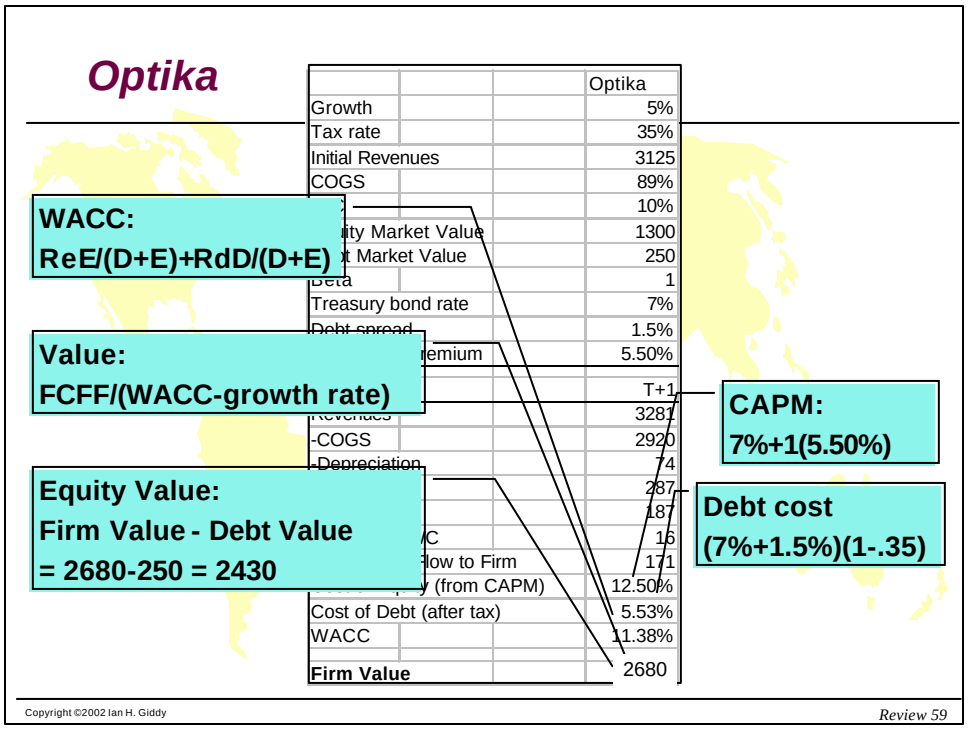
Valuation in Acquisitions

Rationale: Firm A should merge with Firm B if [Value of AB > Value of A + Value of B + Cost of transaction]

- Synergy
  - Top-line
  - Bottom-line
- Control
  - Divestitures
  - Financial restructuring

The Gains From an Acquisition




Optika
Optika
Growth 5%
Tax rate 35%
Initial Revenues 3125
COGS 89%
10%
ity Market Value 1300
t Market Value 250
Beta 1
Treasury bond rate 7%
Debt spread 1.5%
emium 5.50%
T+1
3281
-COGS 2920
-Depreciation 74
287
187
C 16
low to Firm 171
(from CAPM) 12.50%
Cost of Debt (after tax) 5.53%
WACC 11.38%
Firm Value 2680
WACC: ReE/(D+E)+RdD/(D+E)
Value: FCFF/(WACC-growth rate)
Equity Value: Firm Value - Debt Value = 2680-250 = 2430
CAPM: 7%+1(5.50%)
Debt cost (7%+1.5%)(1-.35)
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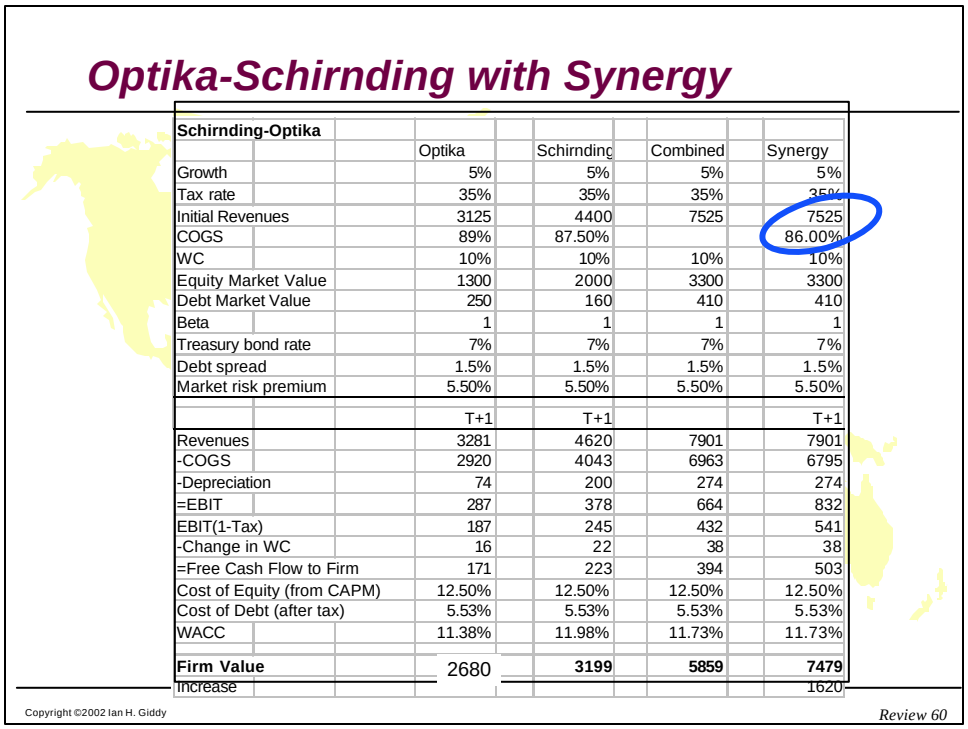
Optika-Schirnding with Synergy
Schirnding-Optika
Optika
Schirndinc
Combined
Synergy
Growth 5% 5% 5% 5%
Tax rate 35% 35% 35% 35%
Initial Revenues 3125 4400 7525 7525
COGS 89% 87.50% 86.00%
WC 10% 10% 10% 10%
Equity Market Value 1300 2000 3300 3300
Debt Market Value 250 160 410 410
Beta 1 1 1 1
Treasury bond rate 7% 7% 7% 7%
Debt spread 1.5% 1.5% 1.5% 1.5%
Market risk premium 5.50% 5.50% 5.50% 5.50%
T+1 T+1 T+1
Revenues 3281 4620 7901 7901
-COGS 2920 4043 6963 6795
-Depreciation 74 200 274 274
=EBIT 287 378 664 832
EBIT(1-Tax) 187 245 432 541
-Change in WC 16 22 38 38
=Free Cash Flow to Firm 171 223 394 503
Cost of Equity (from CAPM) 12.50% 12.50% 12.50% 12.50%
Cost of Debt (after tax) 5.53% 5.53% 5.53% 5.53%
WACC 11.38% 11.98% 11.73% 11.73%
Firm Value 2680 3199 5859 7479
Increase 1620
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What's a Company Worth? Alternative Models

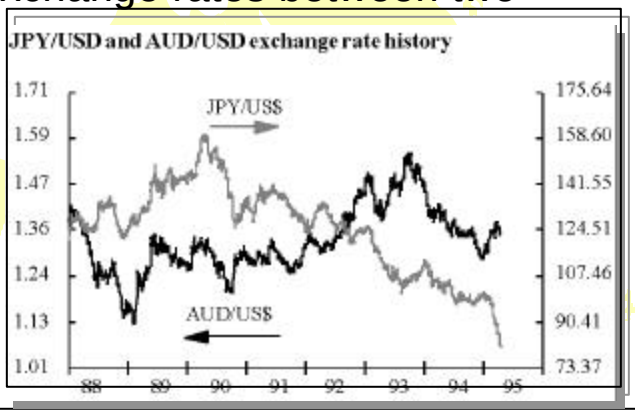
- The options approach
  - ◆Option to expand
  - ◆Option to abandon
- Creation of key resources that another company would pay for
  - ◆Patents or trademarks
  - ◆Teams of employees
  - ◆Customers
- *Examples?*

Lycos

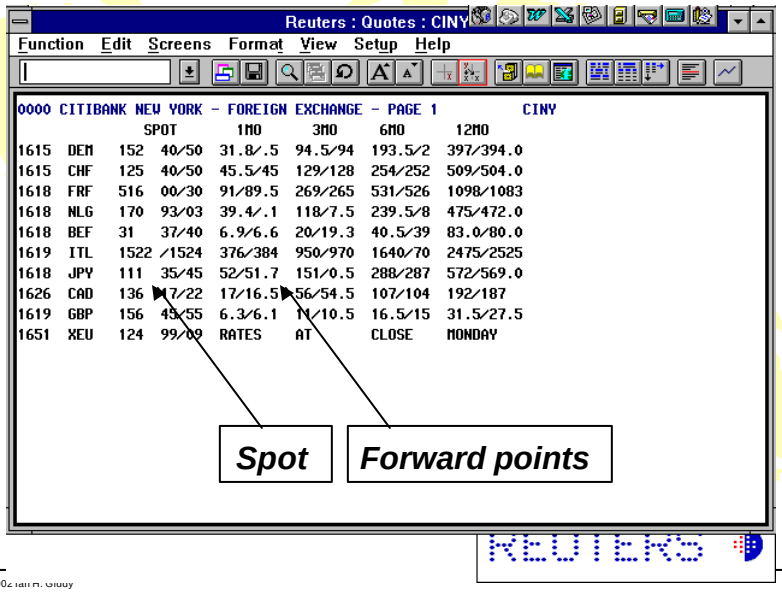
Messageclick.com

International

- *Exchange Rate Risk* is the risk arising from fluctuating exchange rates between two currencies



Foreign Exchange Quotations

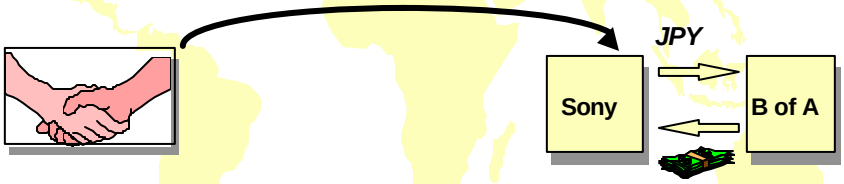


Exchange Rates

Currency	How quoted	Spot (2 business days)	Forward (90 days)
British pounds (GBP)	US$ per GBP	1.632	1.617
Japanese yen (JPY)	Yen per US$	117.5	116.3

A Typical Forward Contract

- We agree today to pay a certain price for a currency in the future



Interest-Rate Parity

$1 (1 + /$_{E\$}$) = ($1/ S$_t$)(1 + /$_{EBP}$) F^n_t

where S_t is the spot exchange rate (dollars per British Pound) and F^n_t is the forward rate.

to a close approximation,

(/$_{E\$}$ - /$_{EBP}$) = [(Ft$_n$ - S$_t$)/S$_t$] (365/n) 100

Interest-rate differential = forward premium or discount

Returns with FX

$(1 + r_{US}) = (1 + r_{FM})\ (1 + r_{FX})$

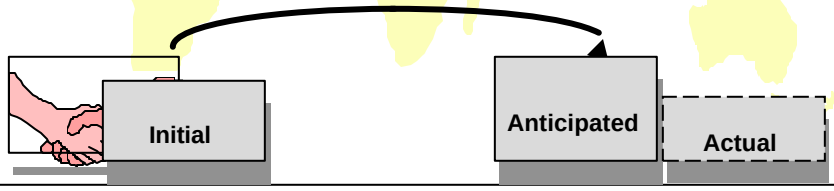
r_{US} = return on the foreign investment in US Dollars

r_{FM} = return on the foreign market in local currency

r_{FX} = return on the foreign exchange

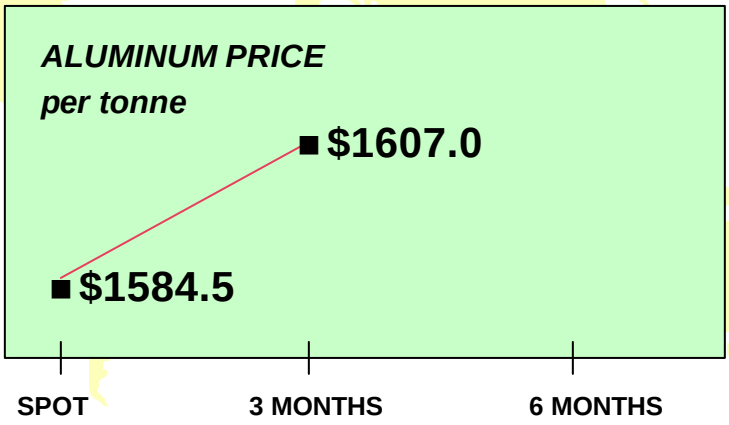
Hedging International Equity Investments

- Buy foreign equity and hedge the anticipated future value, P+E(r)?
- Use short-term, value-adjusted, roll-over hedges?
- Do nothing, because equities bear no currency sign?

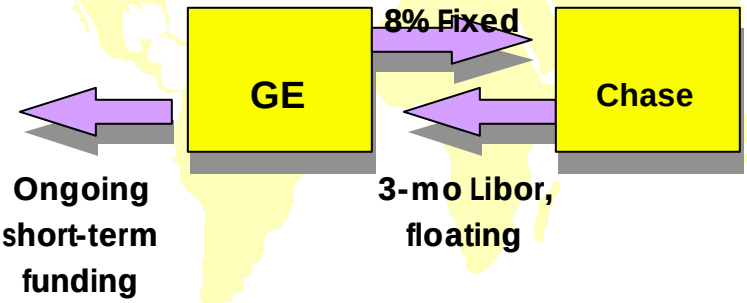


Commodities: Spot and Forward

How can Coke's canners cap their can costs?



Swaps



Cost-of-Carry Theory Applied to Stock Futures

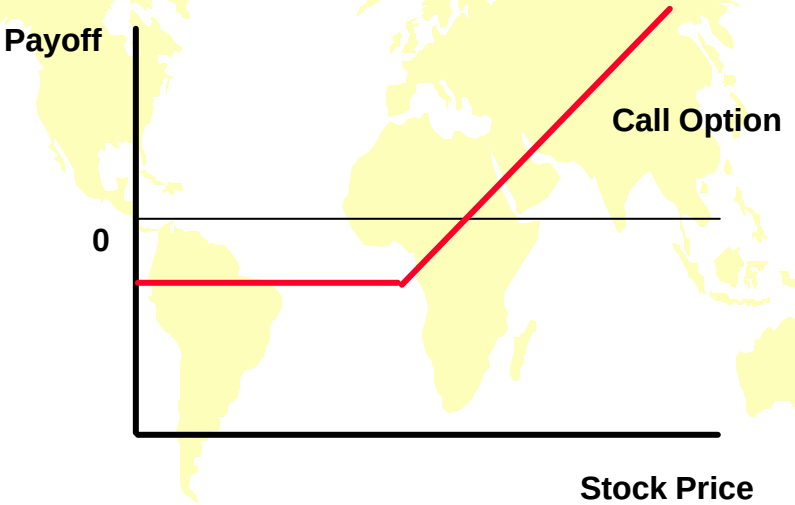
Stock that pays no cash dividend

- ◆no storage costs
- ◆no seasonal patterns in prices

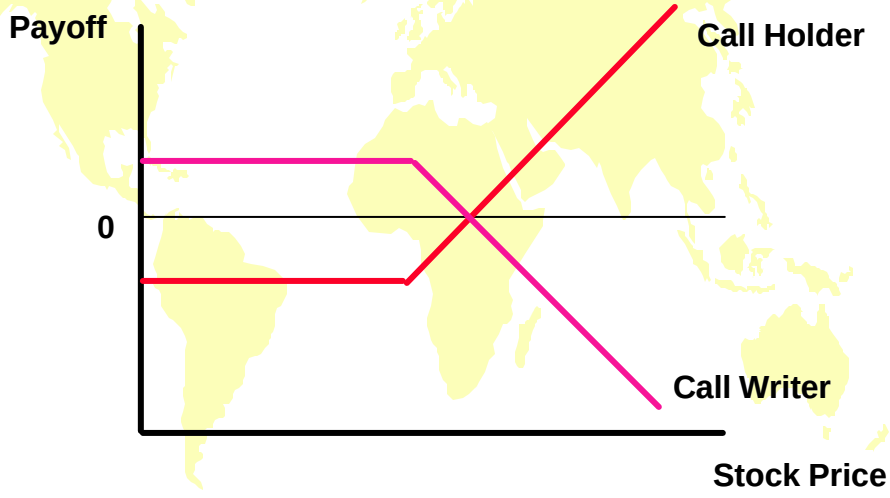
Strategy 1: Buy the stock now and hold it until time T

Strategy 2: Put funds aside today to perform on a futures contract for delivery at time T that is acquired today

Options



Payoff Profiles for Calls



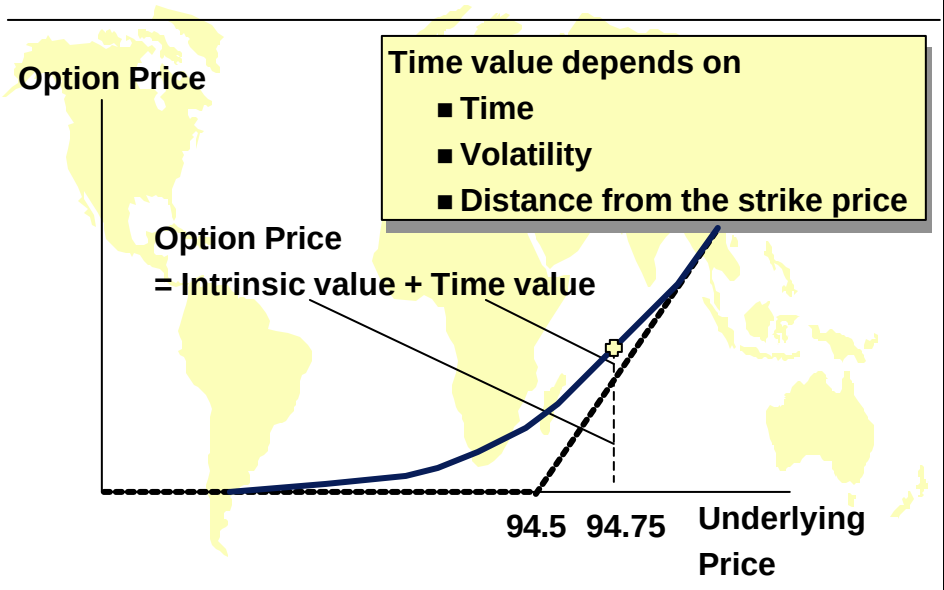
Arbitrage & Put Call Parity

Since the payoff on a combination of a long call and a short put are equivalent to leveraged equity, the prices must be equal.

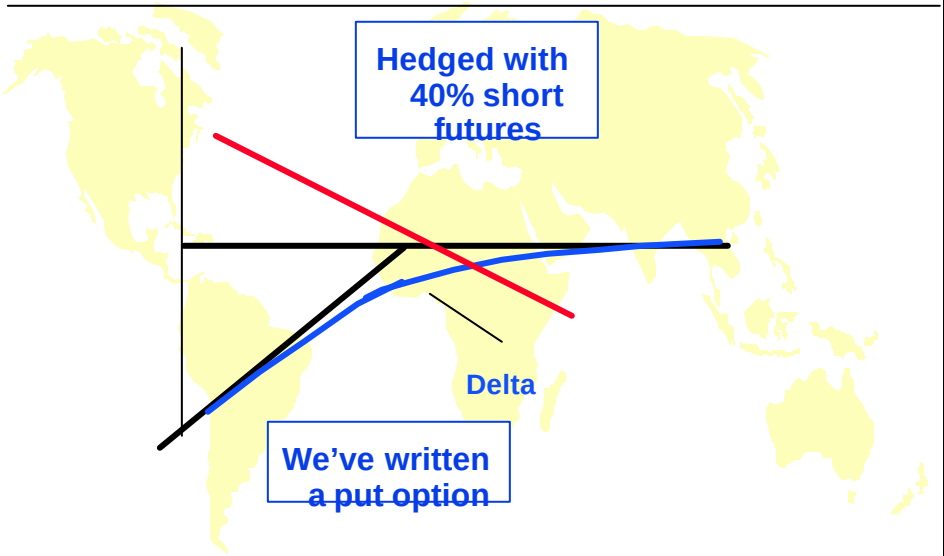
$$C - P = S_0 - X / (1 + r_f)^T$$

If the prices are not equal arbitrage will be possible

Option Pricing



Trading Options: Delta Hedging



Goal: Understand Options' Sensitivity

An option trader has a portfolio of options with different deltas, gammas, etc. The goal is to discover the sensitivities of the portfolio to changes in rates, time, volatility, etc, and to neutralize them.

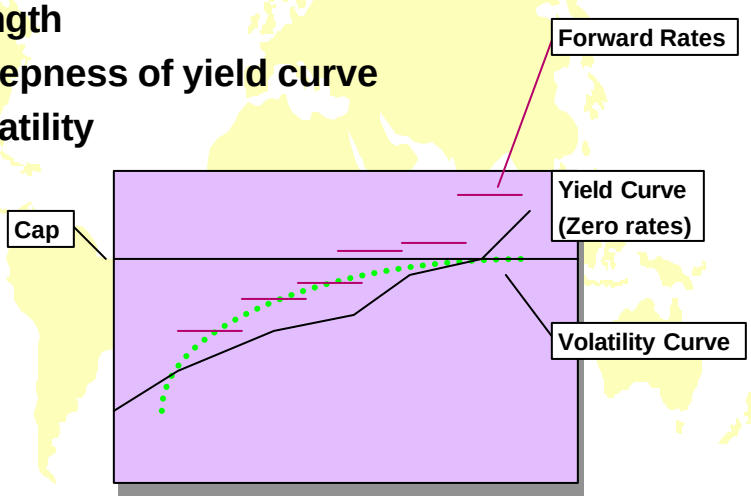
	Greek	Measures
D	Delta	Sensitivity of portfolio value to change in price of the underlying asset
G	Gamma	Sensitivity of delta to change in price of underlying asset
q	Theta	Sensitivity of portfolio value to change in time
L	Lambda (Vega)	Sensitivity of portfolio value to change in volatility
R	Rho	Sensitivity of portfolio to change in interest rate

Option Applications

- *Cap:* Agreement to compensate buyer when interest rate exceeds a specified ceiling.
- *Floor:* Agreement to compensate buyer when interest rate falls below a specified floor.
- *Collar:* A simultaneous purchase of a cap and sale of a floor. Net cost is the price of the cap less the value of the floor. Example:
  - If LIBOR > 12% cap, bank pays borrower the difference
  - If LIBOR < 4% floor, borrower pays bank the difference
- *Swaption:* Option on a swap.

Factors Influencing Cap Prices

- **Length**
- **Steepness of yield curve**
- **Volatility**



Convertibles, Warrants, and Other Hybrids

- Convertible Securities
- Stock-Purchase Warrants
- Structured Notes

General principle: security can be valued as a portfolio of two or more instruments

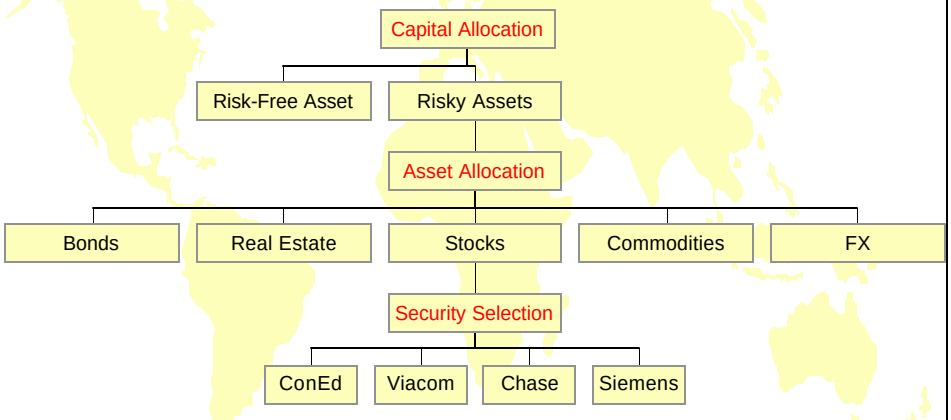
Breaking Down a Convertible: Kodak

- At the end of 2001, Kodak (EK) had a 5.25% convertible bond, coming due in 2009, trading at $1300. The face value was $1000. It also had straight bonds, with the same maturity, trading in December 2001 at a yield of 8.4%.
  - What's the straight bond component worth?
  - What's the convertible option worth?
  - Assume the conversion ratio is 24, and Kodak stock is priced at $51. How would you determine whether the investor is overpaying?

Breaking Up is Easy to Do

Breaking a Convertible Bond Down	
Coupon rate on Convertible Bond =	5.25%
Market Interest Rate on Straight Bond of same Risk =	8.40%
Price of Convertible Bond =	1300
Maturity of Convertible Bond =	8
Value of Straight Bond Portion =	$ 821.70
Value of Conversion Option =	$ 478.30
Conversion ratio	24
Stock price	51
Intrinsic value	1224
Time value	$ 76.00
Value of option depends on volatility	

Capital Allocation



Portfolio Performance Evaluation

- How well did the portfolio do?
- How do we adjust for risk, to compare different managers?
- Why?
  - Risk
  - Timing
  - Asset allocation
  - Security selection

Performance Evaluation Measures

- Sharpe's measure

The portfolio's average excess return per unit of total risk

- Treynor's measure

The portfolio's average excess return per unit of systematic risk

- Jensen's measure

The excess of the portfolio's return over that predicted by the CAPM

- Appraisal ratio

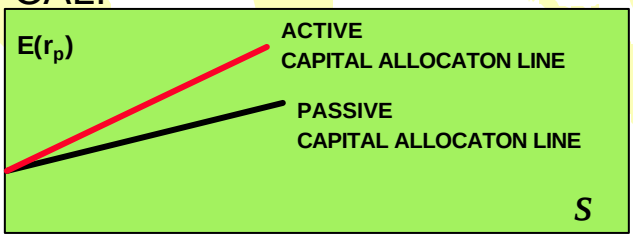
Portfolio's abnormal return per unit of risk that could be diversified by holding a market index portfolio

Performance Attribution

- Asset allocation choices
  - Broad market allocations: equity, bonds, etc.
  - Industry choices
  - Security selection
- Evaluation: compare the portfolio returns at each level with returns on the appropriate index (benchmark portfolio or passive strategy)

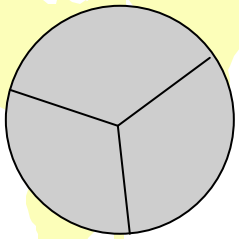
Active Portfolio Management

- Stock-picking and active portfolio management must pay, else the market would not be efficient!
- The optimal risky portfolio maximizes the reward-to-variability ratio; the slope of the CAL:



Conclusion: Hold Three Things

- Risk-free asset
- Passive portfolio
- Active portfolio



Ian Giddy

NYU Stern School of Business
44 West 4th St, NY 10012, USA
Tel 212-998-0426; Fax 212-995-4233
ian.giddy@nyu.edu
http://giddy.org