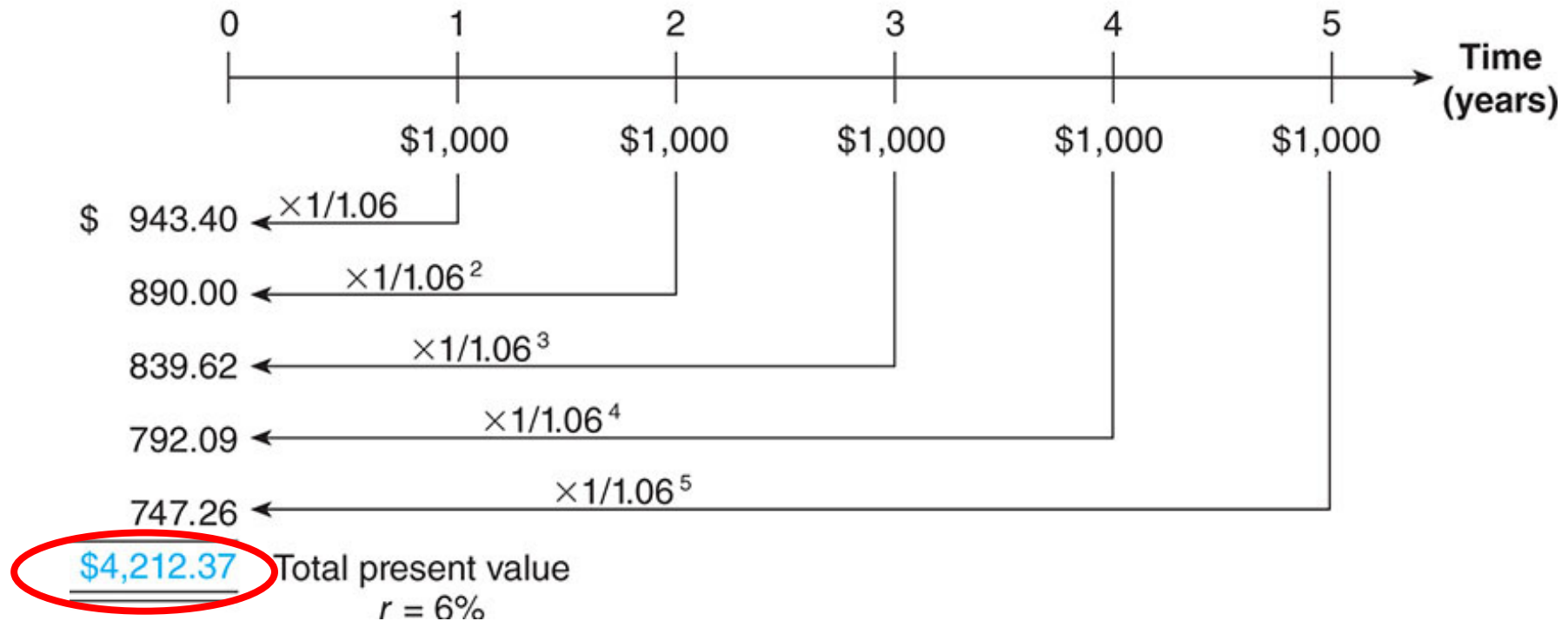


Ch. 2 Discount Rates

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DISCOUNT RATES

What is the present value of an investment that will pay \$1,000 at the end of every year for the next 5 years assuming a 6% discount rate?



ESTIMATING THE REQUIRED RETURN ON AN EQUITY INVESTMENT

Capital Asset Pricing Model (CAPM)

Multifactor Models

- Fama–French model
- Pastor–Stambaugh model
- Macroeconomic models
 - Statistical models

Build-Up Method

CAPITAL ASSET PRICING MODEL (CAPM)

$$E(R_i) = R_F + \beta_i [E(R_M) - R_F],$$

- Where

- $E(R_i)$ = Required return on equity for security i
- R_F = Current expected risk-free return
- β_i = Beta of security i
- $E(R_M)$ = Expected return on the market portfolio
- $E(R_M) - R_F$ = Equity risk premium

Risk-free rate = 4% Market risk premium = 7%
Stock A beta = 1.3

$$= 4\% + [7\% \times 1.3]$$

$$= 4\% + 9.1\%$$

$$= 13.1\%$$

- Assumptions

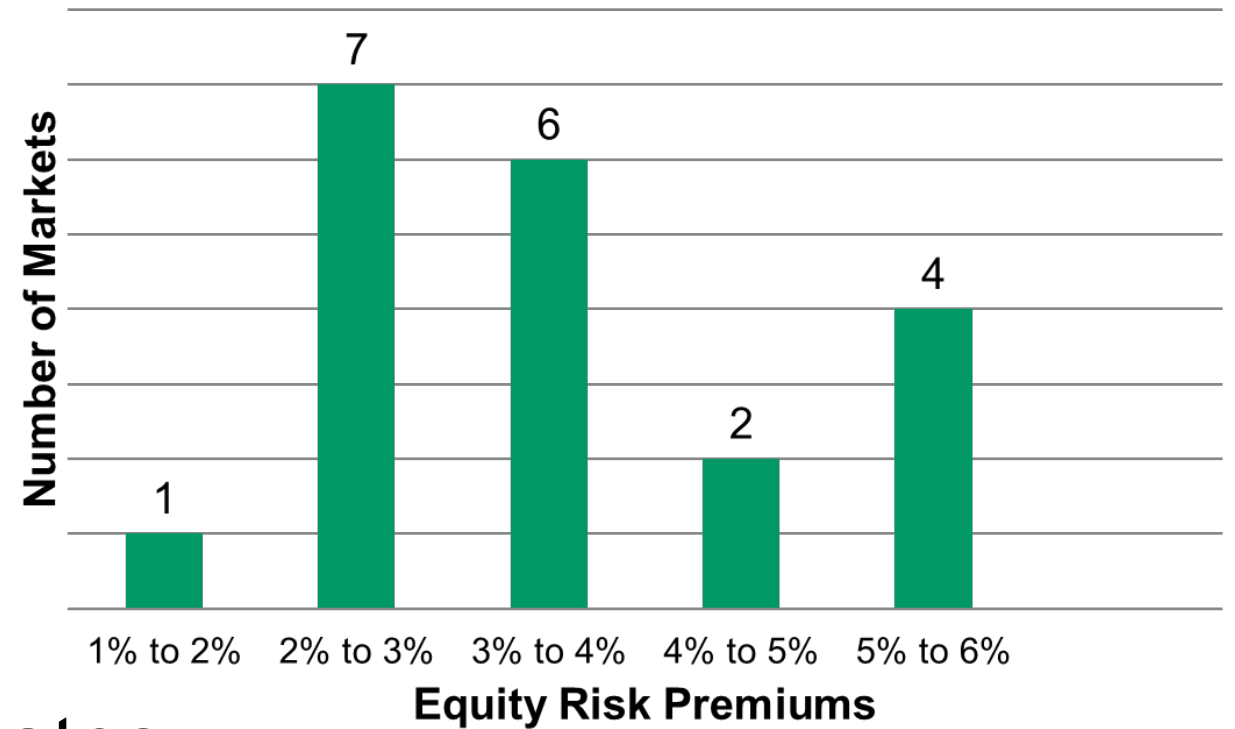
- Investors are risk averse
- Investment is based on mean–variance optimization
- Relevant risk is systematic risk

EQUITY RISK PREMIUM ESTIMATES

- Historical Estimates

- Forward-Looking Estimates

- Gordon growth model estimates
- Macroeconomic model estimates
- Survey estimates



ISSUES IN USING HISTORICAL EQUITY RISK PREMIUM ESTIMATES

- Length of Sample Period
 - Balancing long-term and short-term considerations
- Observation intervals
 - Daily, Weekly, or Monthly
- Geometric vs. Arithmetic Mean
 - Geometric mean reflects future value more accurately
- Choice of Risk-Free Return
 - Long-term or Short-term Treasuries, Swap Rates
- Survivorship Bias
 - Using returns from surviving firms artificially inflates estimates of return

BETA ESTIMATION ISSUES

Choice of Market Index

- S&P 500 Index and NYSE Composite are common choices in the United States

Length & Frequency of Data

- Five years of monthly data is most common choice

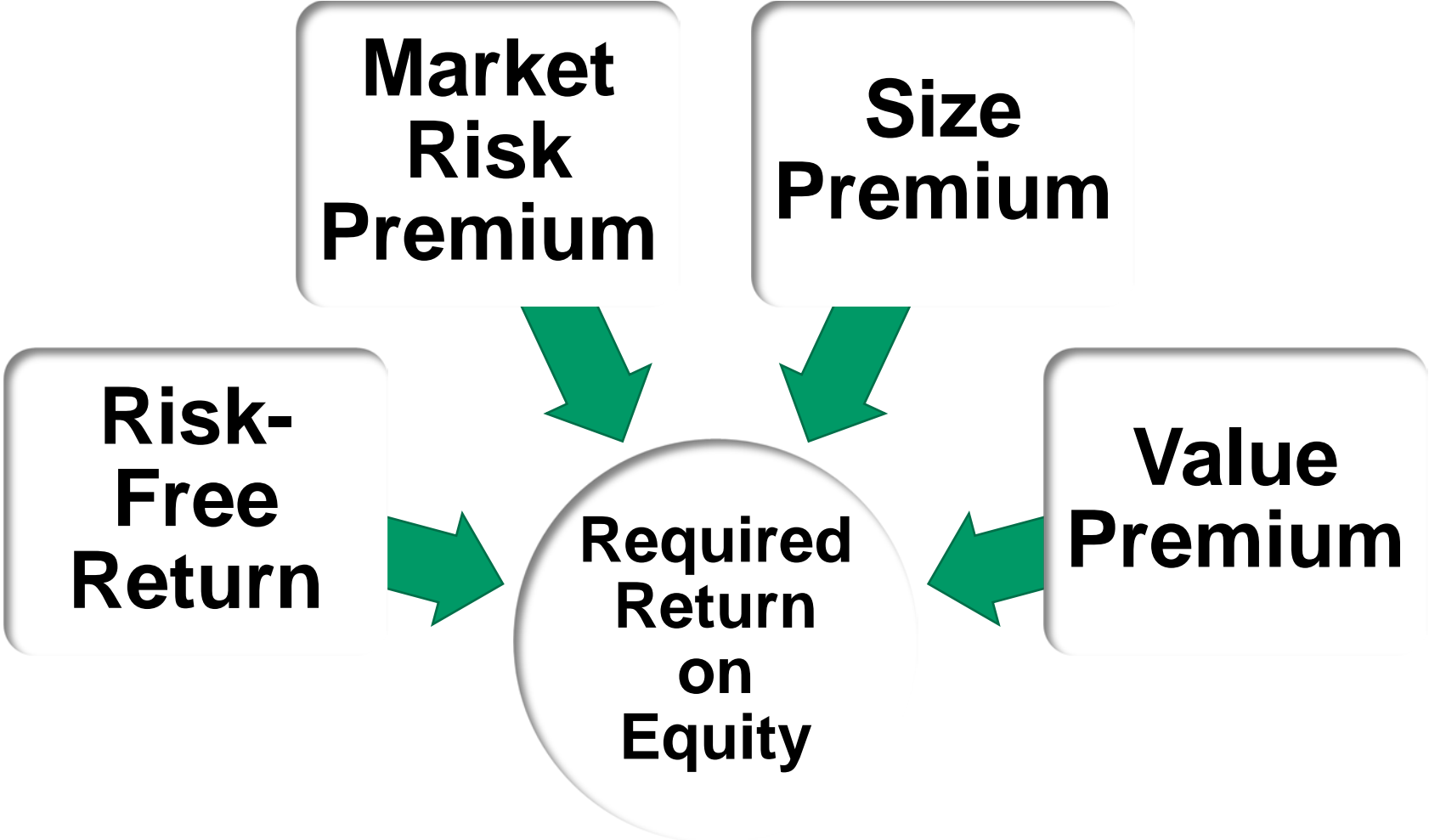
Adjusted Betas

- Betas move towards 1.0 over time

Levered vs Unlevered Beta

- Adjust comparable betas for leverage

MULTIFACTOR MODELS:
FAMA-FRENCH MODEL



FAMA–FRENCH MODEL

$$r_i = R_F + \beta_i^{mkt} \text{RMRF} + \beta_i^{size} \text{SMB} + \beta_i^{value} \text{HML},$$

- where
 - SMB = The return to small stocks minus the return to large stocks
 - β^{size} = The sensitivity of security i to movements in small stocks
 - HML = The return to value stocks minus the return to growth stocks
 - β^{value} = The sensitivity of security i to movements in value stocks

PASTOR–STAMBAUGH MODEL

$$r_i = R_F + \beta_i^{mkt} \text{RMRF} + \beta_i^{size} \text{SMB} + \beta_i^{value} \text{HML} + \beta_i^{liq} \text{LIQ},$$

- where
 - LIQ = The return to illiquid stocks minus the return to liquid stocks
 - β^{liq} = The sensitivity of security i to movements in illiquid stocks

EXAMPLE: FAMA–FRENCH MODEL

Risk-free rate 3.0%

Equity risk premium 5.0%

Beta 1.20

Size premium 2.2%

Size beta 0.12

Value premium 3.8%

Value beta 0.34

$$\begin{aligned}r_i &= R_F + \beta_i^{mkt} \text{RMRF} + \beta_i^{size} \text{SMB} + \beta_i^{value} \text{HML} \\ &= 3\% + 1.20(5\%) + 0.12(2.2\%) + 0.34(3.8\%) \\ &= 10.56\%\end{aligned}$$

MODEL DISCOUNT RATES IN EXCEL

BUILD-UP METHOD: BOND YIELD PLUS RISK PREMIUM METHOD

Required Return on Equity

YTM on
Long-term
Corporate
Debt



Equity Risk
Premium

Equity risk premium

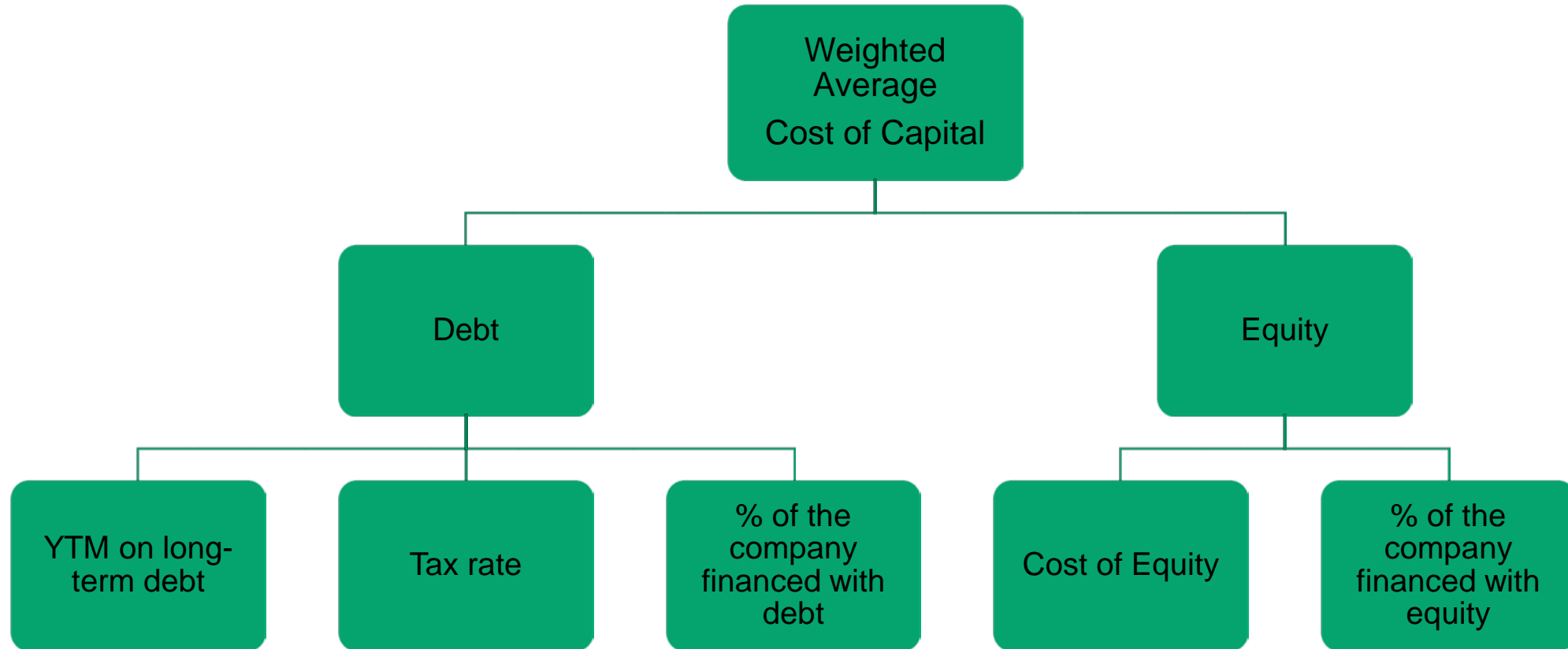
5.0%

YTM of long-term bond

6.1%

= 11.1%

WEIGHTED AVERAGE COST OF CAPITAL (WACC)



WEIGHTED AVERAGE COST OF CAPITAL

$$\frac{\text{MVD}}{\text{MVD} + \text{MVCE}} r_d (1 - \text{Tax rate}) + \frac{\text{MVCE}}{\text{MVD} + \text{MVCE}} r_e$$

- **Where**

- MVD = Current market value of debt
- MVCE = Current market value of common equity
- r_d = Before-tax cost of debt (which is transformed into the after-tax cost by multiplying it by $1 - \text{Tax rate}$)
- r_e = Cost of equity

EXAMPLE: WEIGHTED AVERAGE COST OF CAPITAL

Risk-free rate	3.0%	$r_e = R_F + \beta_i [E(R_m) - R_F]$
Equity risk premium	5.0%	$r_e = 3\% + 1.2(5\%) = 9.0\%$
Beta	1.20	
YTM of long-term bond	6.1%	
Debt/Total capital	40%	
Tax rate	30%	

$$\text{WACC} = \frac{\text{MVD}}{\text{MVD} + \text{MVCE}} r_d (1 - \text{Tax rate}) + \frac{\text{MVCE}}{\text{MVD} + \text{MVCE}} r_e$$

$$= 0.40(6.1\%)(1 - 0.30) + 0.60(9.0\%)$$

$$= 7.11\%$$

CHOICE OF DISCOUNT RATE

Cash Flow to the Firm

- WACC

Cash Flow to Equity = Dividends

- Required return on equity
- CAPM, Fama French, Build Up