

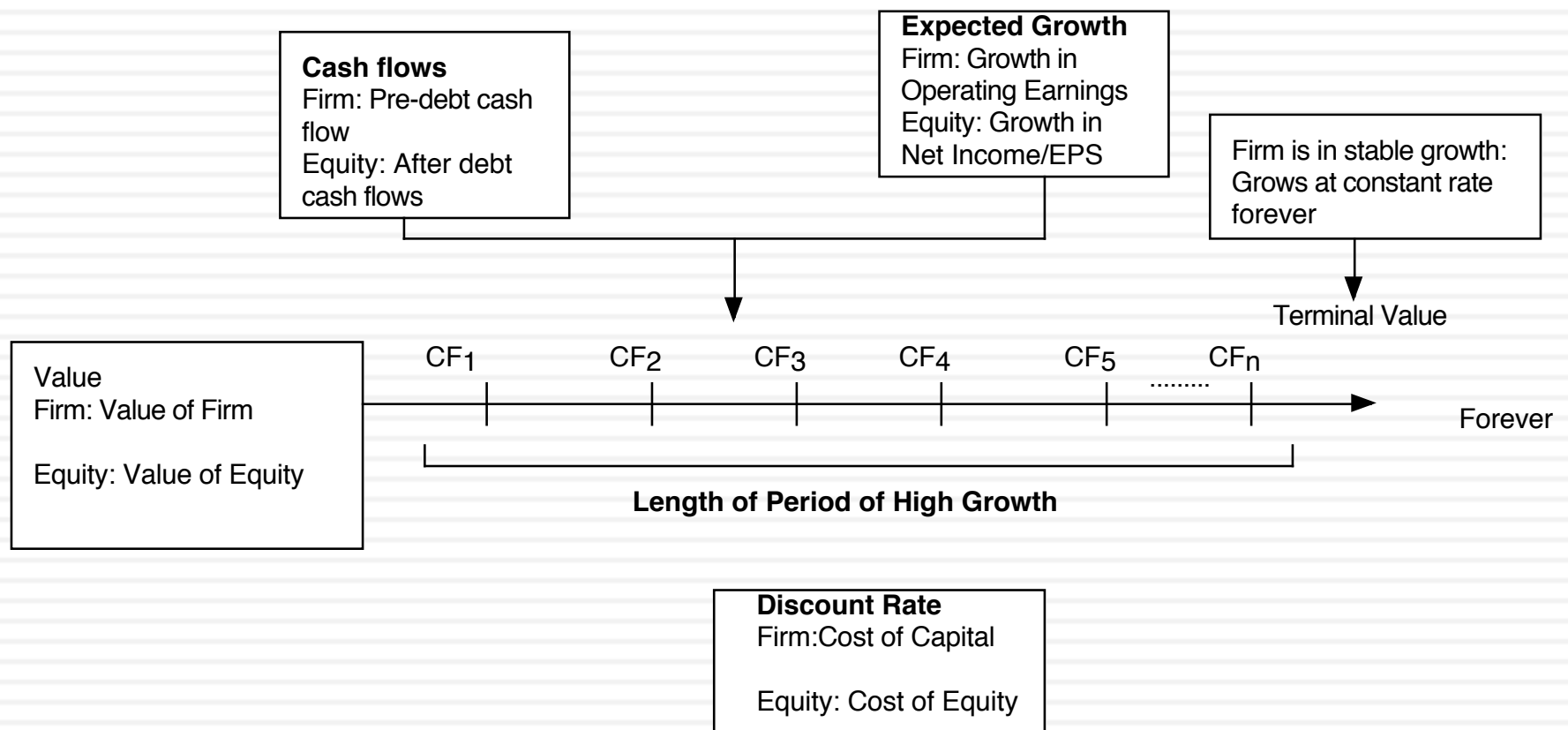
13

DCF: First Steps

Generic DCF Valuation Model

14

DISCOUNTED CASHFLOW VALUATION



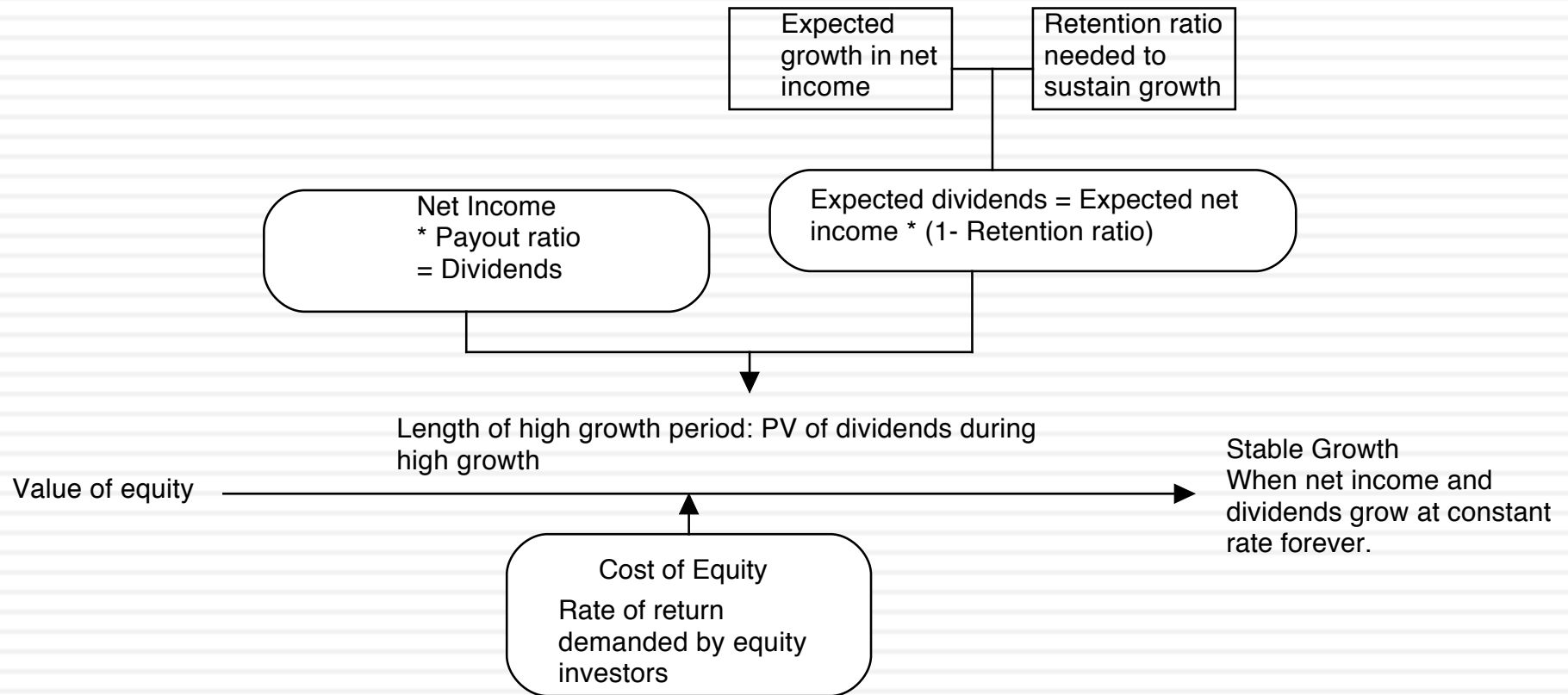
Same ingredients, different approaches...

15

Input	Dividend Discount Model	FCFE (Potential dividend) discount model	FCFF (firm) valuation model
Cash flow	Dividend	Potential dividends = FCFE = Cash flows after taxes, reinvestment needs and debt cash flows	FCFF = Cash flows before debt payments but after reinvestment needs and taxes.
Expected growth	In equity income and dividends	In equity income and FCFE	In operating income and FCFF
Discount rate	Cost of equity	Cost of equity	Cost of capital
Steady state	When dividends grow at constant rate forever	When FCFE grow at constant rate forever	When FCFF grow at constant rate forever

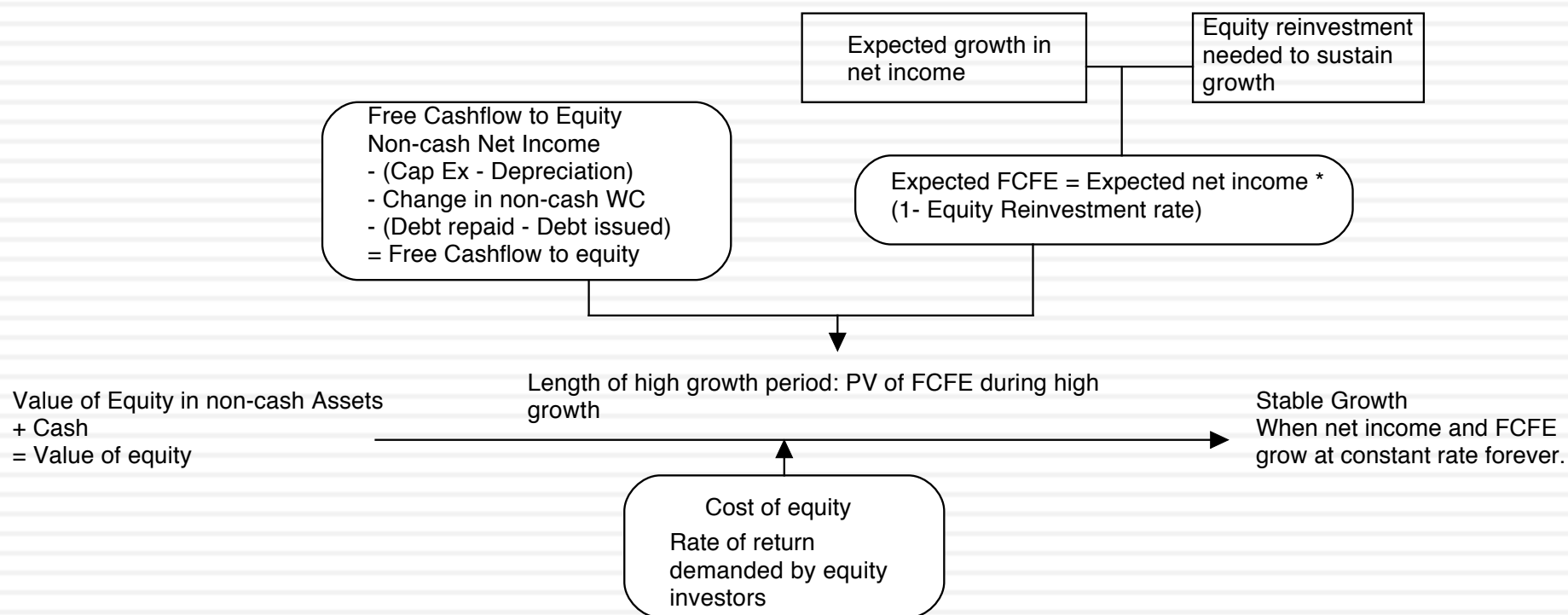
Start easy: The Dividend Discount Model

16



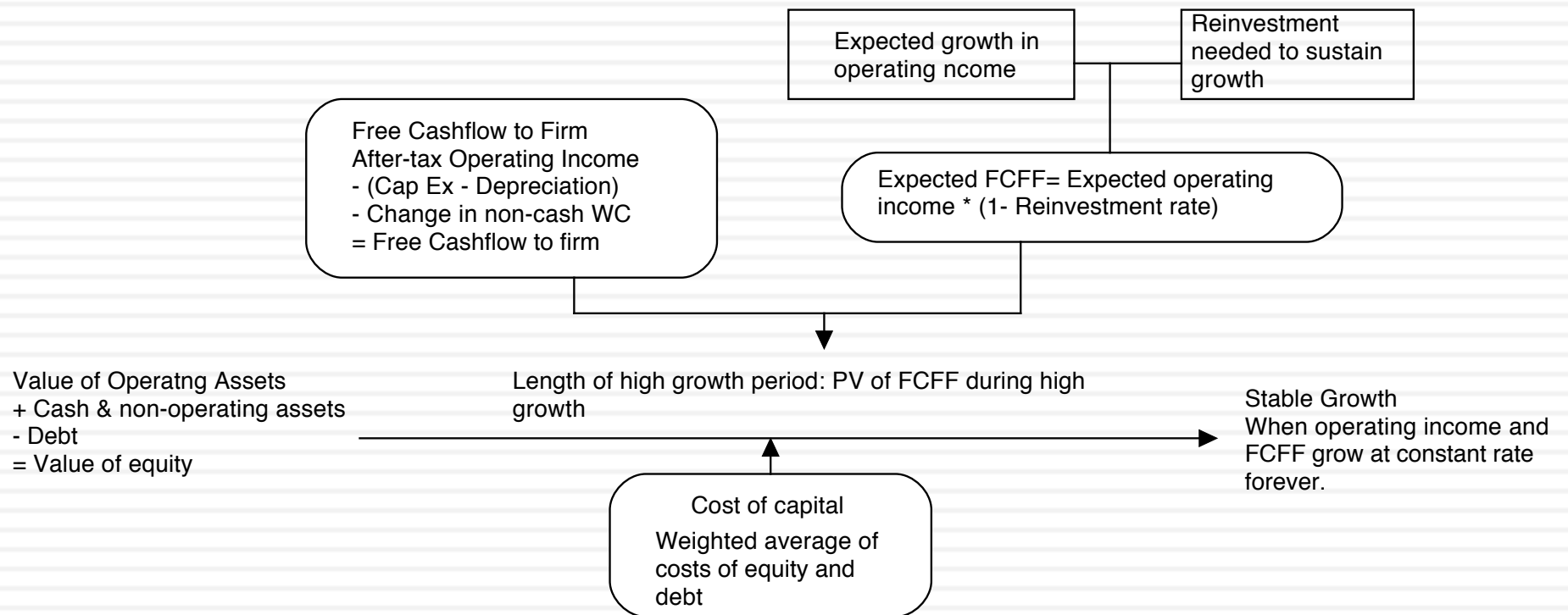
Moving on up: The “potential dividends” or FCFE model

17



To valuing the entire business: The FCFF model

18



19

DCF: The Process

Start with the past

Cash flow to Firm

Revenues * Operating Margin
= Operating Income

* (1- tax rate) Tax Effect

- (Cap Ex - Depreciation) Reinvestment

- Change in non-cash WC

= Free Cash flow to Firm

- * How quickly is the firm growing?
- * How efficiently is it growing?
- * How profitable is the firm?

Forecast future cashflows

If margins & returns are stable

Expected growth in operating income = Reinvestment Rate * Return on Invested Capital

FCFF = After-tax Oper. Income (1 - Reinvestment Rate)

If margins & returns are changing

1. Estimate revenue growth & future revenues

2. Estimate operating margins over time

3. Estimate reinvestment based on revenues

FCFF = After tax Operating Income - Reinvestment

Apply Closure

Firm is mature

Cashflow/Earnings grow at constant rate forever (g_n)

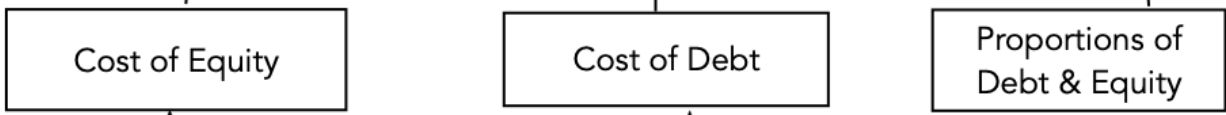
Terminal Value = $FCFF_{n+1} / (r - g_n)$

Value of Operating Assets
+ Cash
+ Non-operating Assets
- Debt
= Value of Equity

Adjust for risk of failure
= Probability of failure * Value of Equity in failure



Discount back at Cost of Capital, which can change over time..



Long term rate at which you can borrow money, today
(Riskfree Rate + Default Spread) (1- tax rate)

Return required by "marginal" investors, given perceived risk in equity investment

Riskfree Rate
- Default free & long term
- In same currency and in same terms as cash flows

+

Relative Risk Measure (Beta)

X

Equity Risk Premium

Business Mix

Financial Leverage

Operating Locations

Adjust for operating risk in cashflows

The Sequence

21

1. Get a handle on the past and the cross-section: While the past is the past (and should have little relevance in determining value), you can get clues about the future by looking at what your firm has done in the past, and what other companies in the business are doing now.
2. Risk and Discount Rates: Traditional financial theory (unfortunately) has put too much of a focus on risk and discount rates, but they do remain ingredients in valuing a company.
3. Estimate growth and future cash flows: This is where the rubber meets the road in valuation. Estimating future cash flows is never easy, should not be mechanical and should be built around your story.
4. Apply Closure to cash flows: Since you cannot estimate cash flows forever, you need to find a way to bring your valuation to closure.
5. Tie up loose ends: Check to see what else in your business needs to be valued or adjusted for to get to value per share.

22

Discount Rates

The D in the DCF..

Estimating Inputs: Discount Rates

23

- While discount rates obviously matter in DCF valuation, they don't matter as much as most analysts think they do.
- At an intuitive level, the discount rate used should be consistent with both the riskiness and the type of cashflow being discounted.
 - Equity versus Firm: If the cash flows being discounted are cash flows to equity, the appropriate discount rate is a cost of equity. If the cash flows are cash flows to the firm, the appropriate discount rate is the cost of capital.
 - Currency: The currency in which the cash flows are estimated should also be the currency in which the discount rate is estimated.
 - Nominal versus Real: If the cash flows being discounted are nominal cash flows (i.e., reflect expected inflation), the discount rate should be nominal

Risk in the DCF Model

24

Expectation of cash flows across all scenarios, good and bad. Incorporates all risks that affect the asset / business.

$$\frac{\text{Expected Cash Flows}}{\text{Risk Adjusted Discount Rate}}$$

Discount rate should reflect the risk perceived by the marginal investor in the company

$$\boxed{\text{Risk Adjusted Cost of equity}} = \boxed{\text{Risk free rate in the currency of analysis}} + \boxed{\text{Relative risk of company/equity in question}} \times \boxed{\text{Equity Risk Premium required for average risk equity}}$$

Not all risk is created equal...

25

- Estimation versus Economic uncertainty
 - ▣ Estimation uncertainty reflects the possibility that you could have the “wrong model” or estimated inputs incorrectly within this model.
 - ▣ Economic uncertainty comes the fact that markets and economies can change over time and that even the best models will fail to capture these unexpected changes.
- Micro uncertainty versus Macro uncertainty
 - ▣ Micro uncertainty refers to uncertainty about the potential market for a firm’s products, the competition it will face and the quality of its management team.
 - ▣ Macro uncertainty reflects the reality that your firm’s fortunes can be affected by changes in the macro economic environment.
- Discrete versus continuous uncertainty
 - ▣ Discrete risk: Risks that lie dormant for periods but show up at points in time. (Examples: A drug working its way through the FDA pipeline may fail at some stage of the approval process or a company in Venezuela may be nationalized)
 - ▣ Continuous risk: Risks changes in interest rates or economic growth occur continuously and affect value as they happen.

Risk and Cost of Equity: The role of the marginal investor

26

- Not all risk counts: While the notion that the cost of equity should be higher for riskier investments and lower for safer investments is intuitive, what risk should be built into the cost of equity is the question.
- Risk through whose eyes? While risk is usually defined in terms of the variance of actual returns around an expected return, risk and return models in finance assume that the risk that should be rewarded (and thus built into the discount rate) in valuation should be the risk perceived by the marginal investor in the investment
- The diversification effect: Most risk and return models in finance also assume that the marginal investor is well diversified, and that the only risk that he or she perceives in an investment is risk that cannot be diversified away (i.e, market or non-diversifiable risk). In effect, it is primarily economic, macro, continuous risk that should be incorporated into the cost of equity.

The Cost of Equity: Competing “Market Risk” Models

27

Model	Expected Return	Inputs Needed
CAPM	$E(R) = R_f + \beta (R_m - R_f)$	Riskfree Rate Beta relative to market portfolio Market Risk Premium
APM	$E(R) = R_f + \sum \beta_j (R_j - R_f)$	Riskfree Rate; # of Factors; Betas relative to each factor Factor risk premiums
Multi factor	$E(R) = R_f + \sum \beta_j (R_j - R_f)$	Riskfree Rate; Macro factors Betas relative to macro factors Macro economic risk premiums
Proxy	$E(R) = a + \sum \beta_j Y_j$	Proxies Regression coefficients

Classic Risk & Return: Cost of Equity

28

- In the CAPM, the cost of equity:
Cost of Equity = Riskfree Rate + Equity Beta * (Equity Risk Premium)
- In APM or Multi-factor models, you still need a risk free rate, as well as betas and risk premiums to go with each factor.
- To use any risk and return model, you need
 - A risk free rate as a base
 - A single equity risk premium (in the CAPM) or factor risk premiums, in the the multi-factor models
 - A beta (in the CAPM) or betas (in multi-factor models)

29

Discount Rates I

The Riskfree Rate

The Risk Free Rate: Laying the Foundations

30

- On a riskfree investment, the actual return is equal to the expected return. Therefore, there is no variance around the expected return.
- For an investment to be riskfree, then, it has to have
 - ▣ No default risk
 - ▣ No reinvestment risk
- ▣ It follows then that if asked to estimate a risk free rate:
 1. Time horizon matters: Thus, the riskfree rates in valuation will depend upon when the cash flow is expected to occur and will vary across time.
 2. Currencies matter: A risk free rate is currency-specific and can be very different for different currencies.
 3. Not all government securities are riskfree: Some governments face default risk and the rates on bonds issued by them will not be riskfree.

Test 1: A riskfree rate in US dollars!

31

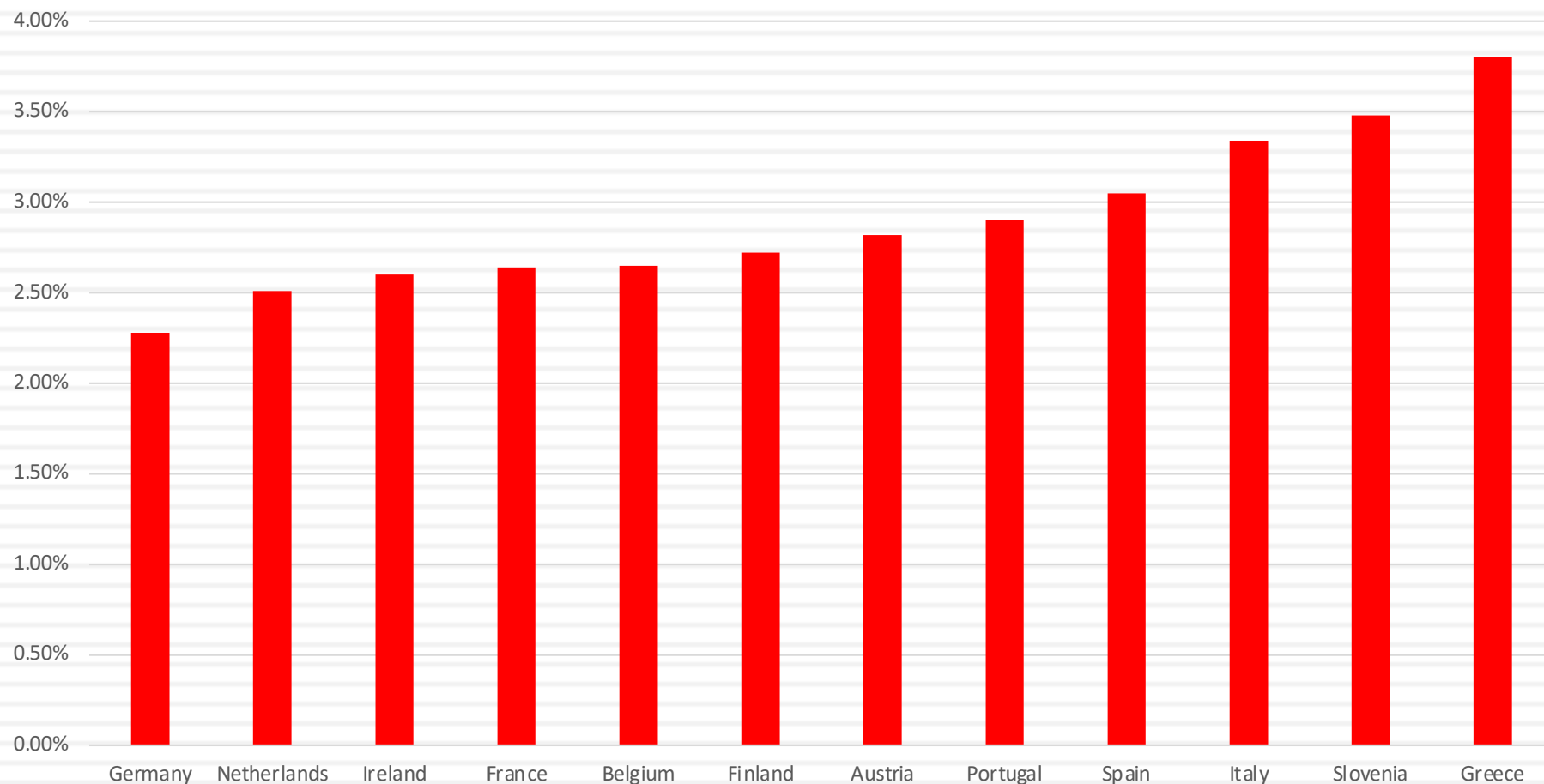
- In valuation, we estimate cash flows forever (or at least for very long time periods). The right risk free rate to use in valuing a company in US dollars would be
 - a. A three-month Treasury bill rate (4.42%)
 - b. A ten-year Treasury bond rate (3.88%)
 - c. A thirty-year Treasury bond rate (3.97%)
 - d. A TIPs (inflation-indexed treasury) rate (1.53%)
 - e. The highest of these numbers
 - f. The lowest of these numbers
 - g. Other (Specify)

What are we implicitly assuming about the US treasury when we use any of the treasury numbers?

Test 2: A Riskfree Rate in Euros?

32

Government Bond Rates: 10-year Euro bonds



Test 3: A Riskfree Rate in Indian Rupees

33

- The Indian government had 10-year Rupee bonds outstanding, with a yield to maturity of about 7.18% on January 1, 2024.
- In January 2024, the Indian government had a local currency sovereign rating of Baa3. The typical default spread (over a default free rate) for Baa3 rated country bonds in early 2024 was 2.39%. The risk free rate in Indian Rupees is
 - a. The yield to maturity on the 10-year bond (7.18%)
 - b. The yield to maturity on the 10-year bond + Default spread (9.57%)
 - c. The yield to maturity on the 10-year bond – Default spread (4.78%)
 - d. None of the above

Sovereign Default Spread: Three paths to the same destination...

34

- Sovereign dollar or euro denominated bonds: Find sovereign bonds denominated in US dollars, issued by an emerging sovereign.
 - ▣ Default spread = Emerging Govt Bond Rate (in US \$) – US Treasury Bond rate with same maturity.
- CDS spreads: Obtain the traded value for a sovereign Credit Default Swap (CDS) for the emerging government.
 - ▣ Default spread = Sovereign CDS spread (with perhaps an adjustment for CDS market frictions).
- Sovereign-rating based spread: For countries which don't issue dollar denominated bonds or have a CDS spread, you have to use the average spread for other countries with the same sovereign rating.

Approach 1: Default spread from Government Bonds

Country	\$ Bond Rate	Riskfree Rate	Default Spread
	\$ Bonds		
Peru	5.36%	3.88%	1.48%
Brazil	5.75%	3.88%	1.87%
Colombia	5.25%	3.88%	1.37%
Poland	4.39%	3.88%	0.51%
Turkey	7.10%	3.88%	3.22%
Mexico	4.75%	3.88%	0.87%
Russia	11.55%	3.88%	7.67%
	Euro Bonds		
Bulgaria	3.50%	2.03%	1.47%

Approach 2: CDS Spreads – January 2024

36

Country	12/31/23	CDS Spread net of US	Country	12/31/23	CDS Spread net of US	Country	12/31/23	CDS Spread net of US
Abu Dhabi	0.75%	0.17%	Greece	1.28%	0.70%	Panama	2.31%	1.73%
Algeria	1.70%	1.12%	Guatemala	2.68%	2.10%	Peru	1.37%	0.79%
Angola	7.82%	7.24%	Hong Kong	0.60%	0.02%	Philippines	1.18%	0.60%
Argentina	46.19%	45.61%	Hungary	1.95%	1.37%	Poland	1.06%	0.48%
Australia	0.26%	0.00%	Iceland	0.88%	0.30%	Portugal	0.75%	0.17%
Austria	0.27%	0.00%	India	0.99%	0.41%	Qatar	0.83%	0.25%
Bahrain	2.74%	2.16%	Indonesia	1.32%	0.74%	Romania	2.31%	1.73%
Belgium	0.33%	0.00%	Iraq	5.14%	4.56%	Russia	NA	NA
Brazil	2.39%	1.81%	Ireland	0.41%	0.00%	Rwanda	5.53%	4.95%
Bulgaria	1.47%	0.89%	Israel	1.57%	0.99%	Saudi Arabia	0.85%	0.27%
Cameroon	9.14%	8.56%	Italy	1.34%	0.76%	Senegal	6.89%	6.31%
Canada	0.44%	0.00%	Japan	0.43%	0.00%	Serbia	2.86%	2.28%
Chile	1.15%	0.57%	Kazakhstan	1.76%	1.18%	Slovakia	0.60%	0.02%
China	0.99%	0.41%	Kenya	7.04%	6.46%	Slovenia	0.76%	0.18%
Colombia	2.74%	2.16%	Korea	0.37%	0.00%	South Africa	3.16%	2.58%
Costa Rica	3.11%	2.53%	Kuwait	0.83%	0.25%	Spain	0.78%	0.20%
Croatia	1.34%	0.76%	Latvia	0.94%	0.36%	Sri Lanka	59.36%	NA
Cyprus	1.11%	0.53%	Lebanon	NA	NA	Sweden	0.28%	0.00%
Czech Republic	0.56%	0.00%	Lithuania	0.90%	0.32%	Switzerland	0.22%	0.00%
Denmark	0.24%	0.00%	Malaysia	0.86%	0.28%	Thailand	0.65%	0.07%
Dubai	1.10%	0.52%	Mexico	1.68%	1.10%	Tunisia	9.78%	9.20%
Ecuador	52.74%	52.16%	Mongolia	4.02%	3.44%	Turkey	3.86%	3.28%
Egypt	10.13%	9.55%	Morocco	1.90%	1.32%	Ukraine	NA	NA
El Salvador	8.40%	7.82%	Namibia	2.10%	1.52%	United Kingdom	0.51%	0.00%
Estonia	0.60%	0.02%	Netherlands	0.24%	0.00%	United States	0.58%	0.00%
Ethiopia	32.31%	31.73%	New Zealand	0.29%	0.00%	Uruguay	1.14%	0.56%
Finland	0.34%	0.00%	Nicaragua	4.89%	4.31%	Venezuela	11.25%	10.67%
France	0.43%	0.00%	Nigeria	6.44%	5.86%	Vietnam	1.84%	1.26%
Gabon	6.85%	6.27%	Norway	0.24%	0.00%			
Germany	0.29%	0.00%	Oman	1.92%	1.34%			

Approach 3: Typical Default Spreads: January 2024

37

S&P Sovereign Rating	Moody's Sovereign Rating	Default Spread
AAA	Aaa	0.00%
AA+	Aa1	0.44%
AA	Aa2	0.54%
AA-	Aa3	0.65%
A+	A1	0.77%
A	A2	0.92%
A-	A3	1.31%
BBB+	Baa1	1.74%
BBB	Baa2	2.07%
BBB-	Baa3	2.39%
BB+	Ba1	2.73%
BB	Ba2	3.28%
BB	Ba3	3.92%
B+	B1	4.90%
B	B2	5.99%
B-	B3	7.08%
CCC+	Caa1	8.17%
CCC	Caa2	9.81%
CCC-	Caa3	10.90%
CC+	Ca1	12.25%
CC	Ca2	14.00%
CC-	Ca3	15.00%
C+	C1	15.75%
C	C2	16.75%
C-	C3	18.00%

Asw

Getting to a risk free rate in Brazilian Reais on January 1, 2024

38

- The Brazilian government bond rate in nominal reais on January 1, 2024, was 10.35%. To get to a riskfree rate in nominal reais, we can use one of three approaches.
 - Approach 1: Government Bond spread
 - Default Spread = Brazil \$ Bond Rate – US T.Bond Rate = 5.75% - 3.88% = 1.87%
 - Riskfree rate in \$R = 10.35% - 1.87% = 8.48%
 - Approach 2: The CDS Spread
 - The CDS spread for Brazil, adjusted for the US CDS spread was 1.81%.
 - Riskfree rate in \$R = 10.35% - 1.81% = 8.54%
 - Approach 3: The Rating based spread
 - Brazil has a Ba2 local currency rating from Moody's. The default spread for that rating is 3.28%
 - Riskfree rate in \$R = 10.35% - 3.28% = 7.07%

Test 4: A Real Riskfree Rate

39

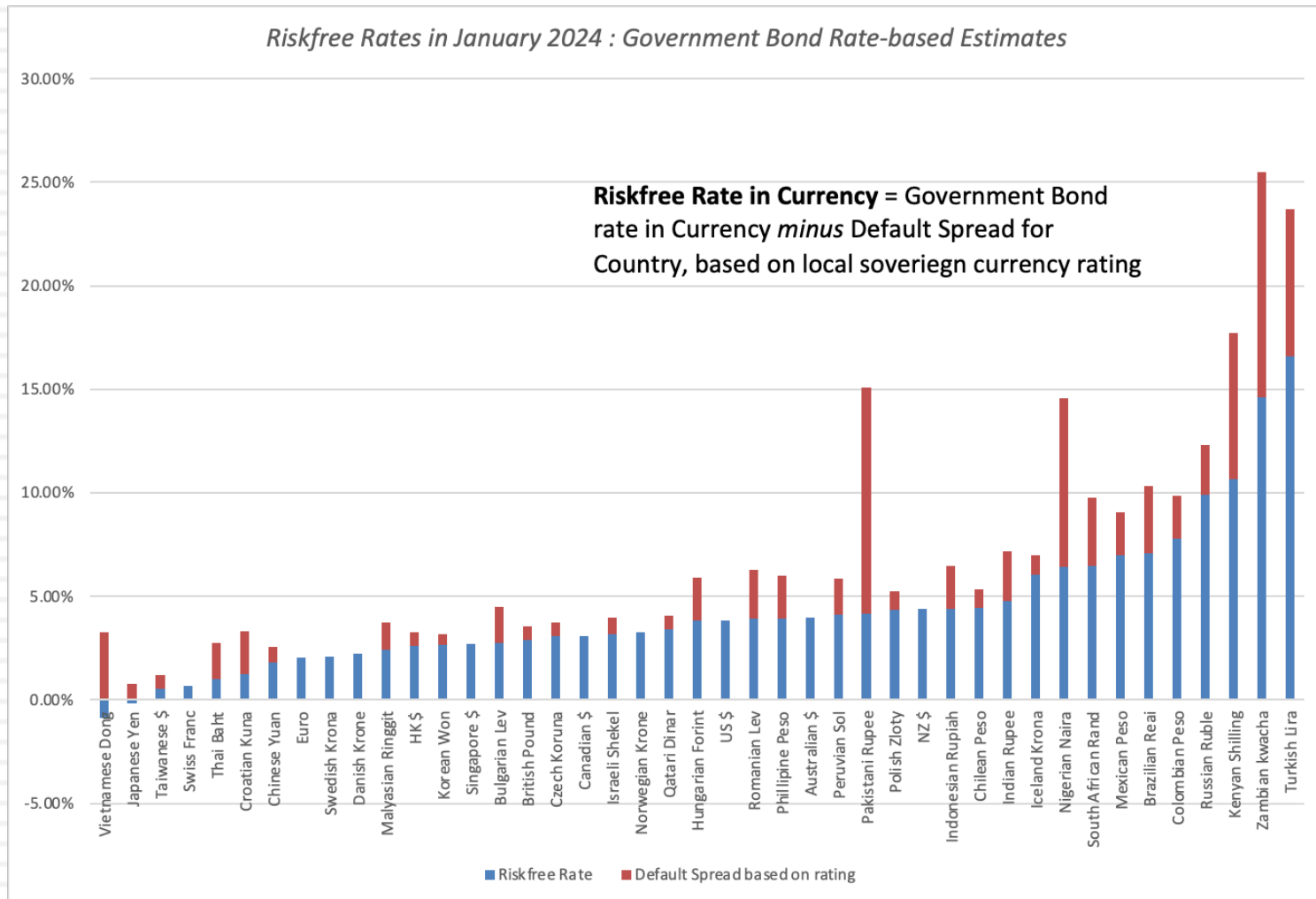
- In some cases, you may want a riskfree rate in real terms (in real terms) rather than nominal terms.
- To get a real riskfree rate, you would like a security with no default risk and a guaranteed real return. Treasury indexed securities offer this combination.
- In January 2024, the yield on a 10-year indexed treasury bond was 1.80%. Which of the following statements would you subscribe to?
 - a. This (1.80%) is the real riskfree rate to use, if you are valuing US companies in real terms.
 - b. This (1.80%) is the real riskfree rate to use, anywhere in the world

Explain.

Why do risk free rates vary across currencies?

January 2024 Risk free rates

40



Or across time...

