13 DCF: First Steps

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Discounted Cash Flow Valuation: The Steps

- 1. Estimate the discount rate or rates to use in the valuation
 - 1. Discount rate can be either a cost of equity (if doing equity valuation) or a cost of capital (if valuing the firm)
 - 2. Discount rate can be in nominal terms or real terms, depending upon whether the cash flows are nominal or real
 - 3. Discount rate can vary across time.
- 2. Estimate the current earnings and cash flows on the asset, to either equity investors (CF to Equity) or to all claimholders (CF to Firm)
- 3. Estimate the future earnings and cash flows on the firm being valued, generally by estimating an expected growth rate in earnings.
- 4. Estimate when the firm will reach "stable growth" and what characteristics (risk & cash flow) it will have when it does.
- 5. Choose the right DCF model for this asset and value it.

Generic DCF Valuation Model

DISCOUNTED CASHFLOW VALUATION



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Same ingredients, different approaches...

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



Moving on up: The "potential dividends" or FCFE model





To valuing the entire business: The FCFF model







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Adjust for operating risk in cashflows

The Sequence

- <u>Risk and Discount Rates</u>: 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.
- 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.
- 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.
- <u>Apply Closure to cash flows</u>: Since you cannot estimate cash flows forever, you need to find a way to bring your valuation to closure.
- 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.



The D in the DCF..

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Estimating Inputs: Discount Rates

- 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.
 - <u>Currency</u>: The currency in which the cash flows are estimated should also be the currency in which the discount rate is estimated.
 - <u>Nominal versus Real</u>: 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

Expectation of cash flows across all scenarios, good and bad. Incorporates all risks that affect the asset / business.						
Expected Cash Flows						
Risk Adjusted Discount Rate						
Discount rate should reflect the risk perceived by the marginal investor in the company						
Risk Adjusted Cost of equity = Risk curre	free rate in the ency of analysis	+	Relative risk of company/equity in questiion	x	Equity Risk Premium required for average risk equity	

Not all risk is created equal...

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

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- 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

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

Classic Risk & Return: Cost of Equity

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- □ 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)

30 Discount Rates I

The Riskfree Rate

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The Risk Free Rate: Laying the Foundations

- 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:
- <u>Time horizon matters</u>: Thus, the riskfree rates in valuation will depend upon when the cash flow is expected to occur and will vary across time.
- 2. <u>Currencies matter</u>: A risk free rate is currency-specific and can be very different for different currencies.
- 3. <u>Not all government securities are riskfree</u>: 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!

- 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 (0.06%)
 - b. A ten-year Treasury bond rate (1.51%)
 - c. A thirty-year Treasury bond rate (2.0%)
 - d. A TIPs (inflation-indexed treasury) rate (0.15%)
 - e. None of the above

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

Test 2: A Riskfree Rate in Euros?



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Test 3: A Riskfree Rate in Indian Rupees

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- The Indian government had 10-year Rupee bonds outstanding, with a yield to maturity of about 6.45% on January 1, 2022.
- In January 2022, 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 2022 was 1.87%. The risk free rate in Indian Rupees is
 - a. The yield to maturity on the 10-year bond (6.45%)
 - b. The yield to maturity on the 10-year bond + Default spread (8.32%)
 - c. The yield to maturity on the 10-year bond Default spread (4.58%)
 - d. None of the above

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

- 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.
- <u>CDS spreads</u>: 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.

Local Currency Government Bond Rates – January 2022

Currency	Govt Bond Rate 12/31/21	Currency	Govt Bond Rate 12/31/21	Currency	Govt Bond Rate 12/31/21
Australian \$	1.67%	Indian Rupee	6.45%	Qatari Dinar	2.11%
Brazilian Reai	10.31%	Indonesian Rupiah	1.02%	Romanian Lev	5.21%
British Pound	0.97%	Israeli Shekel	1.02%	Russian Ruble	8.42%
Bulgarian Lev	0.70%	Japanese Yen	0.07%	Singapore \$	1.67%
Canadian \$	1.43%	Kenyan Shilling	12.55%	South African Rand	9.35%
Chilean Peso	5.72%	Korean Won	2.26%	Swedish Krona	0.21%
Chinese Yuan	2.85%	Malyasian Ringgit	3.59%	Swiss Franc	-0.14%
Colombian Peso	8.14%	Mexican Peso	7.56%	Taiwanese \$	0.69%
Croatian Kuna	0.63%	Nigerian Naira	12.61%	Thai Baht	1.95%
Czech Koruna	2.98%	Norwegian Krone	1.72%	Turkish Lira	23.33%
Danish Krone	0.10%	NZ \$	2.33%	US \$	1.51%
Euro	-0.18%	Pakistani Rupee	11.54%	Vietnamese Dong	2.12%
НК \$	1.45%	Peruvian Sol	5.87%	Zambian kwacha	31.50%
Hungarian Forint	4.58%	Phillipine Peso	4.90%		
Iceland Krona	4.15%	Polish Zloty	3.66%		

Approach 1: Default spread from Government Bonds

Country	\$ Bond Rate	Riskfree Rate	Default Spread			
	\$ Bonds					
Peru	3.66%	1.51%	2.15%			
Brazil	3.70%	1.51%	2.19%			
Colombia	2.33%	1.51%	0.82%			
Poland	1.80%	1.51%	0.29%			
Turkey	5.43%	1.51%	3.92%			
Mexico	2.01%	1.51%	0.50%			
Russia	2.48%	1.51%	0.97%			
	Euro Bonds					
Bulgaria	1.00%	-0.18%	1.18%			

Approach 2: CDS Spreads – January 2022

Country	1/1/22	CDS Spread	Country	1/1/22	CDS Spread	Country	1/1/22	CDS Spread
		net of US	-		net of US	-		net of US
Abu Dhabi	0.77%	0.58%	Greece	1.69%	1.50%	Panama	1.26%	1.07%
Algeria	1.10%	0.91%	Guatamela	2.06%	1.87%	Peru	1.31%	1.12%
Angola	5.94%	5.75%	Hong Kong	0.41%	0.22%	Philippines	0.92%	0.73%
Argentina	23.32%	23.13%	Hungary	0.69%	0.50%	Poland	0.68%	0.49%
Australia	0.23%	0.04%	Iceland	0.73%	0.54%	Portugal	0.56%	0.37%
Austria	0.19%	0.00%	India	1.44%	1.25%	Qatar	0.74%	0.55%
Bahrain	3.40%	3.21%	Indonesia	1.36%	1.17%	Romania	1.24%	1.05%
Belgium	0.21%	0.02%	Iraq	5.63%	5.44%	Russia	1.70%	1.51%
Brazil	2.91%	2.72%	Ireland	0.27%	0.08%	Rwanda	3.36%	3.17%
Bulgaria	0.81%	0.62%	Israel	0.72%	0.53%	Saudi Arabia	0.88%	0.69%
Cameroon	3.56%	3.37%	Italy	1.41%	1.22%	Senegal	2.66%	2.47%
Canada	0.28%	0.09%	Japan	0.33%	0.14%	Serbia	1.37%	1.18%
Chile	1.25%	1.06%	Kazakhstan	0.99%	0.80%	Slovakia	0.63%	0.44%
China	0.74%	0.55%	Kenya	4.44%	4.25%	Slovenia	0.87%	0.68%
Colombia	2.77%	2.58%	Korea	0.35%	0.16%	South Africa	2.85%	2.66%
Costa Rica	3.92%	3.73%	Kuwait	0.86%	0.67%	Spain	0.60%	0.41%
Croatia	1.11%	0.92%	Latvia	0.74%	0.55%	Sri Lanka	19.69%	19.50%
Cyprus	0.74%	0.55%	Lebanon	NA	NA	Sweden	0.19%	0.00%
Czech Republic	0.47%	0.28%	Lithuania	0.79%	0.60%	Switzerland	0.11%	0.00%
Denmark	0.15%	0.00%	Malaysia	0.81%	0.62%	Thailand	0.52%	0.33%
Dubai	1.33%	1.14%	Mexico	1.58%	1.39%	Tunisia	8.82%	8.63%
Ecuador	7.57%	7.38%	Morocco	1.32%	1.13%	Turkey	5.51%	5.32%
Egypt	5.74%	5.55%	Netherlands	0.19%	0.00%	Ukraine	6.17%	5.98%
El Salvador	18.33%	18.14%	New Zealand	0.21%	0.02%	United Kingdom	0.18%	0.00%
Estonia	0.85%	0.66%	Nicaragua	4.36%	4.17%	United States	0.19%	0.00%
Ethiopia	20.40%	20.21%	Nigeria	5.53%	5.34%	Uruguay	1.46%	1.27%
Finland	0.20%	0.01%	Norway	0.19%	0.00%	Venezuela	NA	NA
France	0.34%	0.15%	Oman	3.19%	3.00%	Vietnam	1.56%	1.37%
Germany	0.18%	0.00%	Pakistan	3.67%	3.48%	Zambia	NA	NA

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Approach 3: Typical Default Spreads: January 2022

S&P Sovereign Rating	Moody's Sovereign Rating	Default Spread
AAA	Aaa	0.00%
AA+	Aa1	0.34%
AA	Aa2	0.42%
AA-	Aa3	0.51%
A+	A1	0.60%
A	A2	0.72%
A-	A3	1.02%
BBB+	Baa1	1.36%
BBB	Baa2	1.62%
BBB-	Baa3	1.87%
BB+	Ba1	2.13%
BB	Ba2	2.56%
BB	Ba3	3.06%
B+	B1	3.83%
В	B2	4.68%
В-	B3	5.53%
CCC+	Caa1	6.38%
CCC	Caa2	7.66%
CCC-	Caa3	8.51%
CC+	Ca1	10.21%
CC	Ca2	12.88%
CC-	Ca3	14.50%
C+	C1	15.50%
C	C2	17.00%
C-	C3	19.00%

Getting to a risk free rate in a currency: Example

- The Brazilian government bond rate in nominal reais on January 1, 2022, was 10.31%. To get to a riskfree rate in nominal reais, we can use one of three approaches.
 - □ Approach 1: Government Bond spread
 - The 2032 Brazil bond, denominated in US dollars, has a spread of 2.19% over the US treasury bond rate.
 - Riskfree rate in \$R = 10.31% 2.19% = 8.12%
 - □ Approach 2: The CDS Spread
 - The CDS spread for Brazil, adjusted for the US CDS spread was 2.72%.
 - Riskfree rate in \$R = 10.31% 2.72% = 7.59%
 - □ Approach 3: The Rating based spread
 - Brazil has a Ba2 local currency rating from Moody's. The default spread for that rating is 2.56%
 - Riskfree rate in \$R = 10.31% 2.56% = 7.75%

Test 4: A Real Riskfree Rate

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- 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 2022, the yield on a 10-year indexed treasury bond was 0.15%. Which of the following statements would you subscribe to?
 - a. This (0.15%) is the real riskfree rate to use, if you are valuing US companies in real terms.
 - b. This (0.15%) is the real riskfree rate to use, anywhere in the world

Explain.