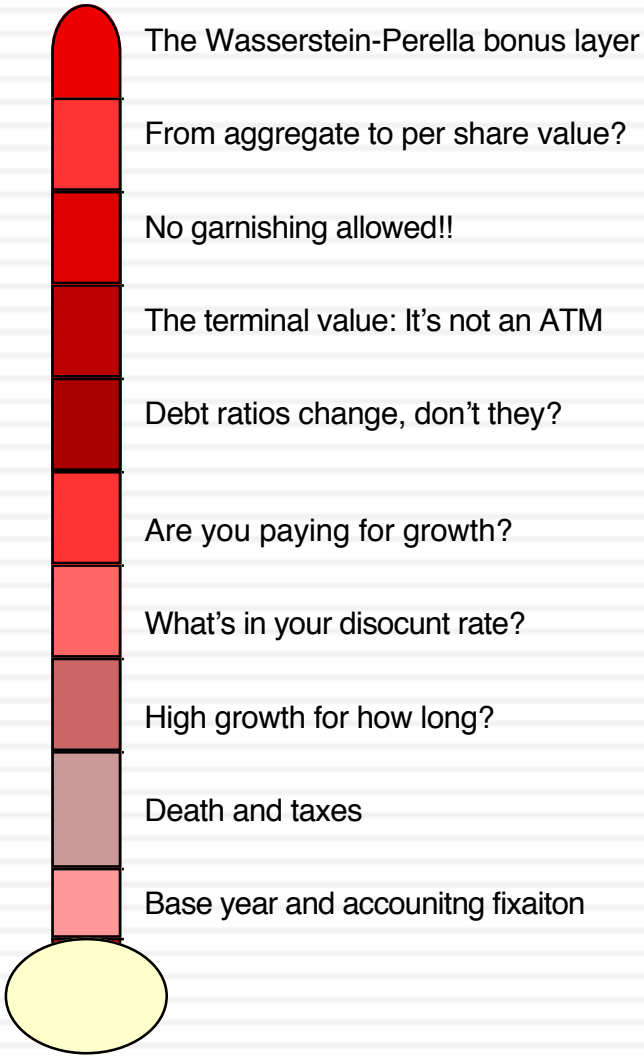
DANTE MEETS DCF: VALUATION SINS AND REDEMPTION

"It ain't over till its over" Yogi Berra

Back to the very beginning: Approaches to Valuation

- **Discounted Cashflow Valuation**, where we try (sometimes desperately) to estimate the intrinsic value of an asset by using a mix of theory, guesswork and prayer.
- **Relative valuation**, where we pick a group of assets, attach the name "comparable" to them and tell a story.
- **Contingent claim valuation**, where we take the valuation that we did in the DCF valuation and divvy it up between the potential thieves (equity) and the victims of this crime (lenders)

Dante meets DCF: Nine layers of valuation hell.. And a bonus layer..



Layer 1: Base Year fixation….

- You are valuing Exxon Mobil, using the financial statements of the firm from 2008. The following provides the key numbers:

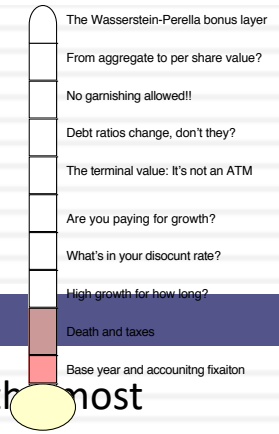
Revenues	$477 billion
EBIT (1-t)	$ 58 billion
Net Cap Ex	$ 3 billion
Chg WC	$ 1 billion
FCFF	$ 54 billion

- The cost of capital for the firm is 8% and you use a very conservative stable growth rate of 2% to value the firm. The market cap for the firm is $373 billion and it has $ 10 billion in debt outstanding.

  a. How under or over valued is the equity in the firm?

  b. Would you buy the stock based on this valuation? Why or why not?

Layer 2: Taxes and Value

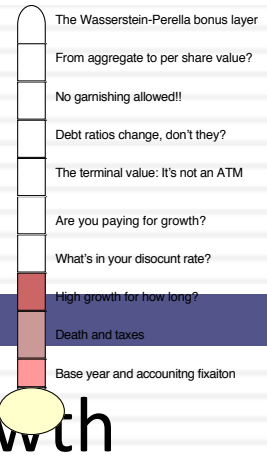


- Assume that you have been asked to value a company and have been provided with the most recent year's financial statements:

EBITDA	140
- DA	40
EBIT	100
Interest exp	20
Taxable income	80
Taxes	32
Net Income	48

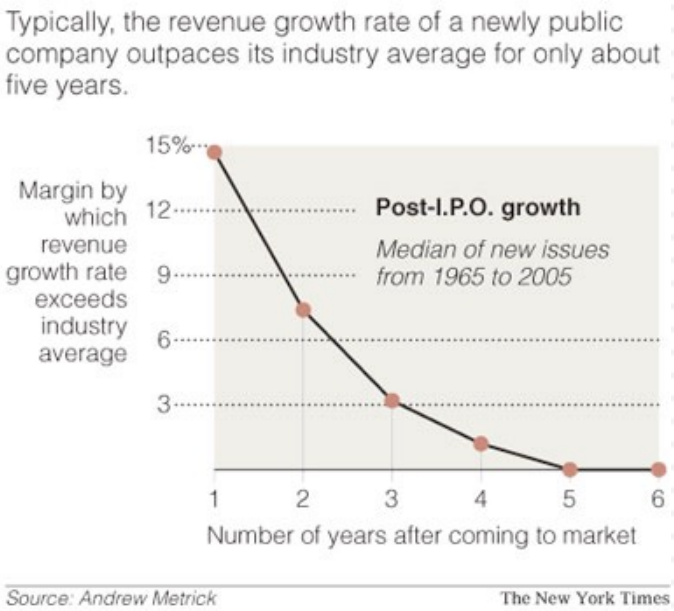
Free Cash flow to firm
EBIT (1- tax rate)
-(Cap Ex – Depreciation)
- Change in non-cash WC
=FCFF

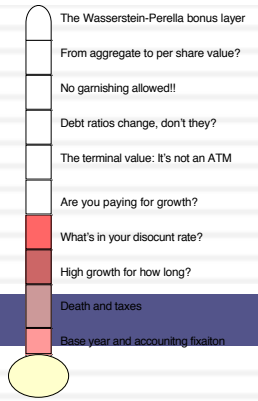
- Assume also that cash flows will be constant and that there is no growth in perpetuity. What is the free cash flow to the firm?
  a. 88 million (Net income + Depreciation)
  b. 108 million (EBIT – taxes + Depreciation)
  c. 100 million (EBIT (1-tax rate)+ Depreciation)
  d. 60 million (EBIT (1- tax rate))
  e. 48 million (Net Income)
  f. 68 million (EBIT – Taxes)



Layer 3: High Growth for how long…

- Assume that you are valuing a young, high growth firm with great potential, just after its initial public offering. How long would you set your high growth period?
- < 5 years
- 5 years
- 10 years
- >10 years





Layer 4: The Cost of Capital

- The cost of capital for Chippewa Technologies, a US technology firm with 20% of its revenues from Brazil, has been computed using the following inputs:

Cost of equity = Riskfree Rate + Beta (ERP) + Small firm premium = **14%**

= 5% + 1.20 (5%) + 3%

Replaced current T.Bond rate of 3% with normalized rate of 5%

"Adjusted" Beta from Bloomberg

Both from Ibbotson data base, derived from 1926-2008 data
ERP: Stocks - T.Bonds (Arithmetic average)
Small firm: Smal stocks - Overall market

Cost of capital = Cost of equity (Equity/ (Debt + Equity)) + Cost of debt (1- tax rate) (Debt/ (Debt + Equity)

= 14% (1000/2000) + 3% (1-.30) (1000/2000) = **8.05%**

From above

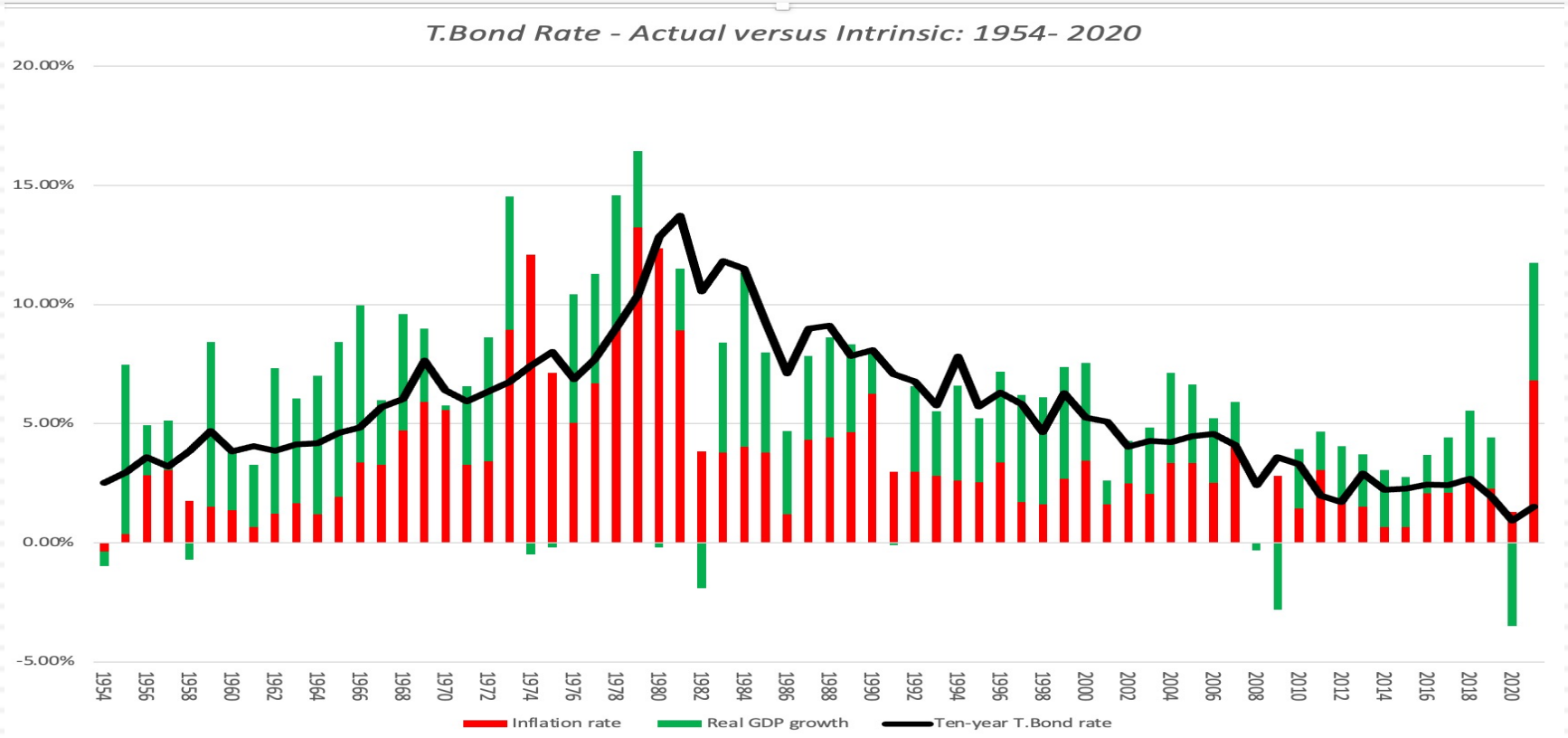
Used market value of equity

Company is not rated and has no bonds. Used book interest rate = Int exp/ BV of debt

Used effective tax rate of 30%

To be conservative, counted all liabilities, other than equity, as debt and used book value.

Some perspective on risk free rates



	Ten-year T.Bond rate	Inflation rate	Real GDP growth	Intrinsic riskfree rate
1954-2021	5.59%	3.55%	2.94%	6.50%
1954-1980	5.83%	4.49%	3.50%	7.98%
1981-2008	6.88%	3.26%	3.04%	6.30%
2011-2021	2.25%	1.76%	1.70%	3.46%

The Equity Risk Premium: The ubiquitous historical risk premium

- The historical premium is the premium that stocks have historically earned over riskless securities.
- While the users of historical risk premiums act as if it is a fact (rather than an estimate), it is sensitive to
  - How far back you go in history…
  - Whether you use T.bill rates or T.Bond rates
  - Whether you use geometric or arithmetic averages.
- For instance, looking at the US:

	Arithmetic Average		Geometric Average	
	Stocks - T. Bills	Stocks - T. Bonds	Stocks - T. Bills	Stocks - T. Bonds
1928-2021	8.49%	6.71%	6.69%	5.13%
Std Error	2.05%	2.17%		
1972-2021	8.04%	5.47%	6.70%	4.47%
Std Error	2.44%	2.76%		
2012-2021	16.47%	14.39%	15.89%	14.00%
Std Error	3.88%	4.59%		

An Alternative Approach

In 2021, earnings recovered almost entirely from the 2020 collapse and dividends & buybacks surged as well.

Base year cash flow (last 12 mths)
Dividends (TTM): 59.20
+ Buybacks (TTM): 88.05
= Cash to investors (TTM): **147.24**

Expected earnings/cashflow growth in next 5 years
Analysts were on target in 2021, with estimated earnings of 206.38 for the year. They were projecting compunded annual growth rate of 6.47% a year for next five years.

Modified Payout
This computation assumes that the payout ratio stays constant over time. If you assume that it changes to a sustainable level (given stable growth & ROE), the implied ERP = 4.90%

Actual numbers | Forecasted numbers

	2019	2020	*LTM*	*2021E*	1	2	3	4	5
Expected Earnings	157.18	139.76	190.34	206.38	219.74	233.96	249.11	265.23	282.40
Cash payout as % of earnings	146.31	118.66	77.36%	77.36%	77.36%	77.36%	77.36%	77.36%	77.36%
Dividends + Buybacks =	93.08%	84.90%	147.24	159.65	$169.99	$180.99	$192.71	$205.18	$218.46

Earnings and Cash flows grow @1.51% (set equal to risk free rate) a year forever.

S&P 500 on 1/1/22= **4766.18**

$$4766.18 = \frac{169.99}{(1+r)} + \frac{180.99}{(1+r)^2} + \frac{192.71}{(1+r)^3} + \frac{205.18}{(1+r)^4} + \frac{218.46}{(1+r)^5} + \frac{218.46\,(1.0151)}{(r-.0151)(1+r)^5}$$

The last term in this equation is the expected index level at the end of year 5 (capturing price appreciation)

Solve for r

You can solve for this r either iteratively or using the solver function in Excel

r = Implied Expected Return on Stocks = 5.75%

Minus

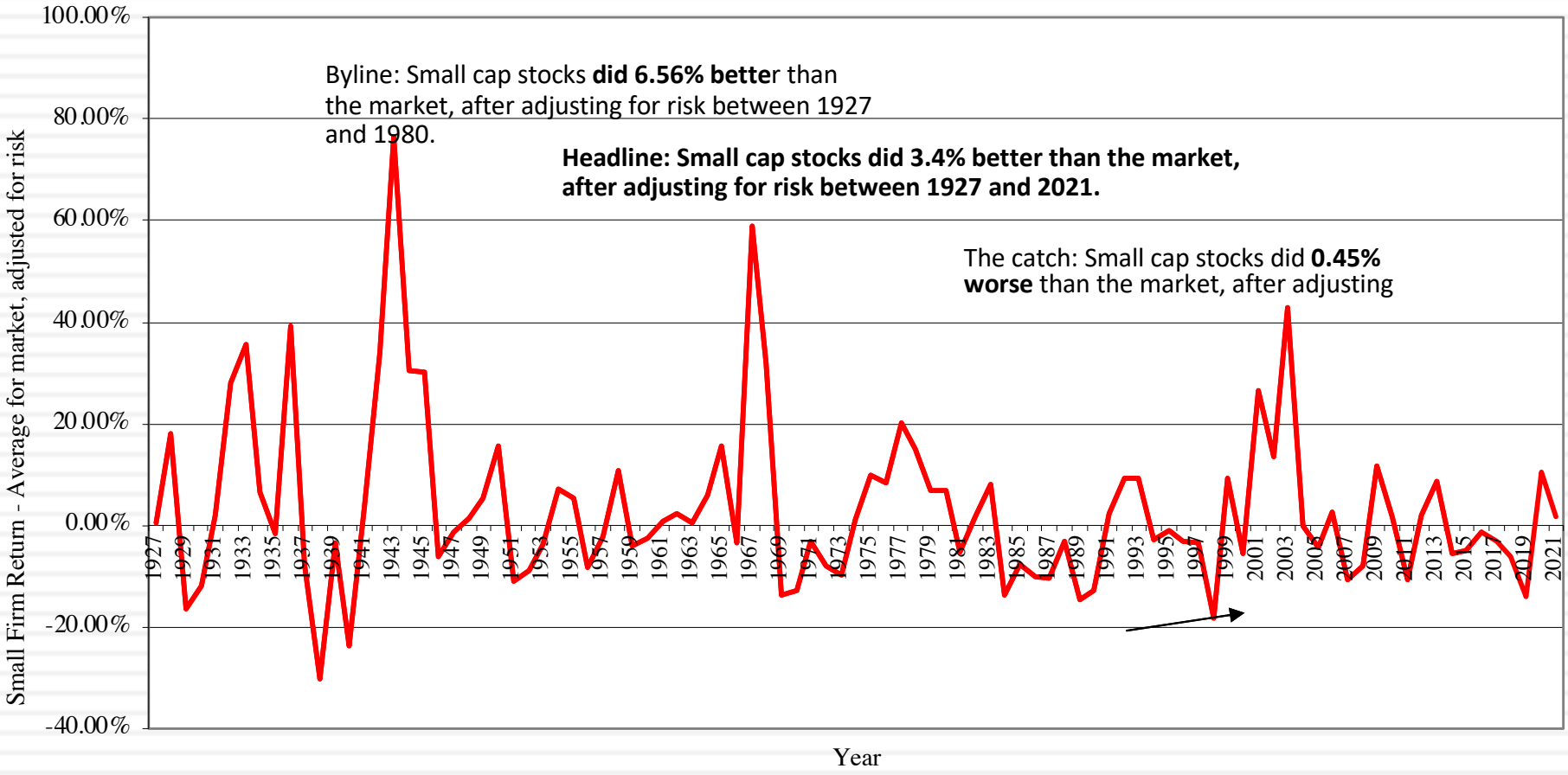
Risk free rate = T.Bond rate on 1/1/22= 1.51%

Equals

Implied Equity Risk Premium (1/1/22) = 5.75% - 1.51% = 4.24%

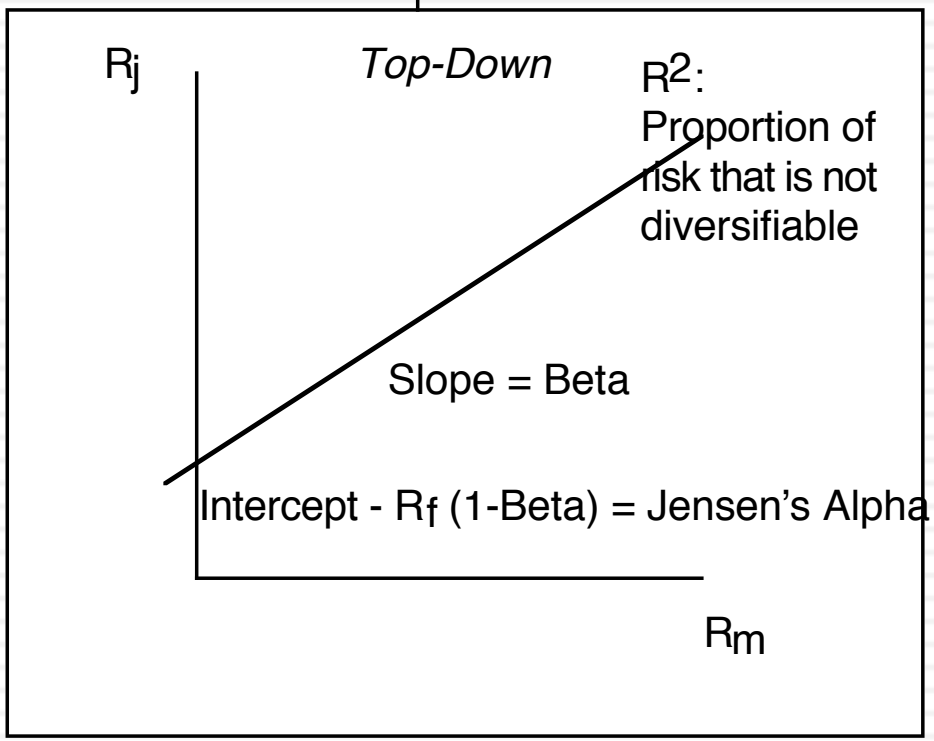
What small cap premium?

Small Firm Premium over time- 1927 -2021



Beta: Regression vs Bottom Up

Beta of Equity



Bottom-up

1. Identify businesses that firm is in.
2. Take weighted average of the unlevered betas of other firms in the business
3. Compute the levered beta using the firm's current debt to equity ratio:

$$\beta_l = \beta_u [1 + (1\text{-tax rate}) (\text{Debt/Equity})]$$

The Correct Cost of Capital for Chippewa

Input	*What was used…*	*What should have been used…*
Riskfree Rate	Corrected treasury bond rate = 5%	Actual treasury bond rate = 3%
Beta	Bloomberg adjusted beta = 1.20	Sector average adjusted beta = 1.60 (Based on small cap companies in sector)
Equity Risk Premium	Ibbotson premium =5%	Updated implied ERP = 6.5%
Other adjustments to cost of equity	Small cap premium = 3%	No small cap premium Country risk adjustment = $Lambda_{Brazil}$ * Brazil CRP = 0.26*6.77% = 2.28%
Cost of equity	5%+ 1.2 (5%) + 3% = 14%	3% + 1.6 (6.5%) + 2.28% = 15.68%
Cost of debt (pre-tax)	3%	3%+6% (based on synthetic rating)=9%
Tax rate	Effective tax rate =30%	Marginal tax rate = 40%
Cost of debt (after-tax)	3% (1-.3) = 2.1%	9% (1-.4) = 5.4%
Debt ratio	Book ratio: Liabilities=50% Equity=50%	Market ratio: Interest bearing debt = 30%; Equity= 70%
Cost of capital	14% (.5) + 2.1% (.5) = 8.05%	15.68% (.7) + 5.4% (.3) = 12.60%

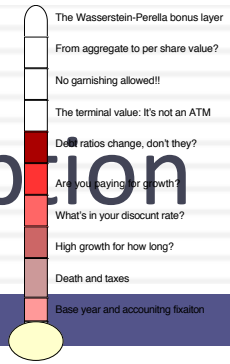
Layer 5: The price of growth..

- You are looking at the projected cash flows provided by the management of the firm, for use in valuation

Year	Current	1	2	3	4
Growth rate		10%	10%	10%	10%
Revenues	$100.00	$110.00	$121.00	$133.10	$146.41
EBIT (1-t)	$30.00	$33.00	$36.30	$39.93	$43.92
+ Depreciation	$15.00	$16.50	$18.15	$19.97	$21.96
- Cap Ex	$18.00	$19.80	$21.78	$23.96	$26.35
- Chg in WC	$3.00	$3.30	$3.63	$3.99	$4.39
FCFF	$24.00	$26.40	$29.04	$31.94	$35.14

- What questions would you raise about the forecasts?

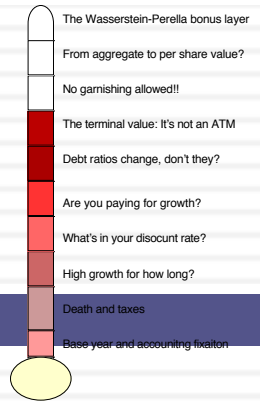
Layer 6: The "fixed debt ratio" assumption



- You have been asked to value Hormel Foods, a firm which currently has the following cost of capital:
  - Cost of capital = 7.31% (.9) + 2.36% (.1) = 6.8%
- You believe that the target debt ratio for this firm should be 30%. What will the cost of capital be at the target debt ratio?

- Which debt ratio (and cost of capital) should you use in valuing this company?

Layer 7: The Terminal Value



- The best way to compute terminal value is to

a. Use a stable growth model and assume cash flows grow at a fixed rate forever

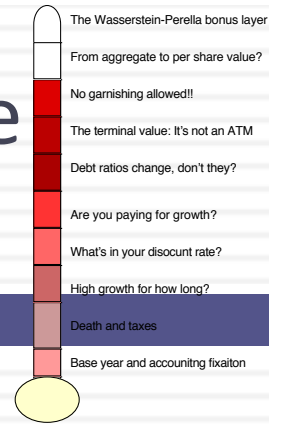
b. Use a multiple of EBITDA or revenues in the terminal year

c. Use the estimated liquidation value of the assets

- You have been asked to value a business. The business expects to $ 120 million in after-tax earnings (and cash flow) next year and to continue generating these earnings in perpetuity. The firm is all equity funded and the cost of equity is 10%; the riskfree rate is 3% and the ERP is 7%. What is the value of the business?

- Assume now that you were told that the firm can grow earnings at 2% a year forever. Estimate the value of the business.

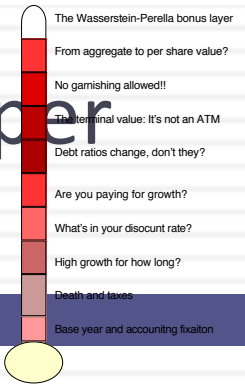
Layer 8. From firm value to equity value: The Garnishing Effect…



- For a firm with consolidated financial statements, you have discounted free cashflows to the firm at the cost of capital to arrive at a firm value of $ 100 million. The firm has
  - A cash balance of $ 15 million
  - Debt outstanding of $ 20 million
  - A 5% holding in another company: the book value of this holding is $ 5 million. (Market value of equity in this company is $ 200 million)
  - Minority interests of $ 10 million on the balance sheet
- What is the value of equity in this firm?

- How would your answer change if you knew that the firm was the target of a lawsuit it is likely to win but where the potential payout could be $ 100 million if it loses?

Layer 9. From equity value to equity value per share



- You have valued the equity in a firm at $ 200 million. Estimate the value of equity per share if there are 10 million shares outstanding..

- How would your answer change if you were told that there are 2 million employee options outstanding, with a strike price of $ 20 a share and 5 years left to expiration?

Layer 10. The final circle of hell…

Exhibit 8

KENNECOTT COPPER CORPORATION

PROJECTED CARBORUNDUM COMPANY FINANCIAL DATA ADJUSTED TO REFLECT THE ACQUISITION OF CARBORUNDUM BY KENNNECOTT AT A PRICE OF $66 PER SHARE, 1977–1987

($ millions except for per share and ratio data)

	1977 Unadjusted	Adjustments[a]	1977 Adjusted	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Income statement													
Sales	$717.6			$790.1	$885.9	$1,005.2	$1,129.9	$1,265.5	$1,392.1	$1,531.3	$1,684.4	$1,852.8	$2,038.1
Net income (before adjustments)	38.4			43.1	50.7	60.1	70.6	84.7	93.2	102.5	112.7	124.0	136.4
Interest adjustment[a]	0			6.5	7.8	8.5	9.2	9.8	10.7	11.7	12.8	14.0	15.4
Goodwill adjustment[a]	0			2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Plant write-up adjustment[a]	0			2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
Net income (after adjustments)	$38.4			$31.8	$38.1	$ 46.8	$ 56.6	$ 70.1	$ 77.7	$ 86.0	$ 95.1	$ 105.2	$ 116.2
Balance sheet													
Working capital	$198.8	+ 37.0 + 100.0 − 140.0	$195.8	$202.9	$223.0	$248.1	$274.2	$302.8	$329.3	$358.6	$390.7	$426.1	$465.0
Property, plant, and equipment	181.8	+ 124.0	305.8	334.2	367.4	384.6	400.1	411.6	437.5	466.6	499.1	535.6	576.1
Goodwill	0	+ 80.0	80.0	78.0	76.0	74.0	72.0	70.0	68.0	66.0	64.0	62.0	60.0
Total assets	584.3	+ 201.0	785.3	824.0	889.9	948.4	1,007.0	1,065.8	1,135.5	1,213.1	1,299.0	1,394.6	1,500.3
Long-term debt	86.2	+ 100.0	186.2	220.9	238.8	252.9	266.8	280.1	297.7	317.5	339.4	363.9	391.0
Shareholders' equity	309.0	+ 101.0	410.0	410.1	443.5	469.7	495.4	520.2	553.0	589.6	630.3	675.7	726.0
Total capital	395.2	+ 201.0	596.2	631.0	682.3	722.6	762.2	800.3	850.7	907.1	969.7	1,039.6	1,117.0
Capital sources													
Profit retentions				$ 0.1	$33.4	$26.2	$25.7	$24.8	$32.8	$36.6	$40.7	$45.4	$50.3
Capital contributed by Kennecott				—	—	—	—	—	—	—	—	—	—
Debt financing (net)				34.7	17.9	14.1	13.9	13.3	17.6	19.8	21.9	24.5	27.1
Total capital added				$34.8	$51.3	$40.3	$39.6	$38.1	$50.4	$56.4	$62.6	$69.9	$77.4
Key financial ratios													
Growth rate in sales (%)	16.9			10.1	12.1	13.5	12.4	12.0	10.0	10.0	10.0	10.0	10.0
Sales/assets	1.23			0.96	1.00	1.06	1.12	1.19	1.23	1.26	1.30	1.33	1.36
Profit/sales	.054			0.040	0.043	0.047	0.050	0.055	0.056	0.056	0.056	0.057	0.057
Assets/net worth	1.89			2.01	2.01	2.02	2.03	2.05	2.05	2.06	2.06	2.06	2.07
Profit/net worth	.124			0.078	0.086	0.100	0.114	0.135	0.141	0.146	0.151	0.156	0.160
Cash flow to Kennecott													
Acquisition of Carborundum			$(550.0)										
Dividends to Kennecott[e]			140.0	$31.7	$ 4.7	$20.6	$30.9	$45.3	$44.9	$49.4	$54.4	$59.8	$ 65.9
Utilization of Kennecott tax loss carryforwards[g]			—	20.0	20.0	—	—	—	—	—	—	—	—
Tax shelter from plant write-up adj.[a]				2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
Terminal value at 10 times earnings[h]													1,044.9
Net cash flow			$(410.0)	$54.5	$27.5	$23.4	$33.7	$48.1	$47.7	$52.2	$57.2	$62.6	$1,113.6

Assumptions:

[a]Kennecott would pay $550 million to acquire Carborundum's equity which had a book value of $309 million. The $241 million in excess of purchase price over book value of assets acquired would be allocated as follows: (a) $37.0 million would be added to inventory to reflect the replacement cost of inventories; (b) $11.0 million would be added to land to reflect the market value of land; (c) $113 million would be added to net plant and equipment to reflect the depreciated replacement cost of plant and equipment; and (d) $80 million would be added to goodwill. Immediately following the acquisition of Carborundum, Carborundum borrows $100 million and then pays a $140 million dividend to Kennecott. This dividend is financed with the $100 million plus $40 million of Carborundum's excess cash.

[b]Interest at the rate of 10% (5% after taxes) is paid on the difference between the amount of Carborundum debt outstanding in Exhibit 8 and the amount of debt assumed to be outstanding in Exhibit 5. In Exhibit 8, it is assumed that Carborundum will have 35% debt in its total capital structure after 1977.

[c]The $80 million of goodwill created as a result of the acquisition is amortized over 40 years. This expense is not tax-deductible.

[d]The $113 million write-up of plant and equipment is depreciated over a 20-year life, providing a reduction in profit after taxes and an increase in cash flow equal to ($113/20) x .5. It is assumed that this added cash flow is paid to Kennecott as dividends.

[e]Dividends to Kennecott equal the difference between Carborundum's net profit (after adjustment) and the profit retention requirements needed to support Carborundum's growth.

[f]The utilization of $40 million of tax loss carry-forwards and investment tax credit carryforwards available to Kennecott are assumed to be utilized as a result of the Carborundum acquisition and that these would expire unutilized without the acquisition.

[g]Carborundum is assumed to be sold at the end of ten years at a price equal to ten times earnings. The proceeds from this sale, $1,162 million, are reduced by $117.1 million as a result of taxes on the capital gain of $1,162—$726. Carborundum's net worth at 12/31/87 is assumed to be $726 million.

Sources: Exhibit 5 and casewriter projections.

	Cost of Equity	Cost of Capital
Kennecott Corp (Acquirer)	13.0%	10.5%
Carborandum (Target)	16.5%	12.5%

Valuation is simple. We choose to make it complex!

Value of growth

The future cash flows will reflect expectations of how quickly earnings will grow in the future (as a positive) and how much the company will have to reinvest to generate that growth (as a negative). The net effect will determine the value of growth. The expected cash flow is computed as net of taxes and reinvestment:

Expected Cash Flow = $E(CF_n)$ = Expected After-tax Operating Income in year n - Reinvestment in year n

Cash flows from existing assets

The base earnings will reflect the earnings power of the existing assets of the firm, net of taxes and any reinvestment needed to sustain the base earnings.

$$Value\ of\ Business = \frac{E(CF_1)}{(1+r)} + \frac{E(CF_2)}{(1+r)^2} + \frac{E(CF_3)}{(1+r)^3} \ldots + \frac{Terminal\ Value_n}{(1+r)^n}$$

Terminal Value

This is the value that you attach to the business at the end of high growth. It can be a liquidation or going concern value.

$$Going\ Concern\ Value_n = \frac{E(CF_{n+1})}{r-g}$$

Cost of Capital

The cost of capital can be affected by the tax code, if it tilts towards debt over equity or vice versa. In much of the world, debt creates a tax benefit, because interest is tax deductible and the tax savings are at the margin (at the marginal tax rate).

Risk adjusted Discount Rate = r = Cost of capital = Cost of Equity (Equity/(Debt+Equity) + Cost of Debt (1-t) (Debt/(Debt+Equity)

$Going\ Concern\ Va$

But here's why valuation fails – The Bermuda Triangle of Valuation