2. What if something goes wrong?
The Downside Risk

□ **Sensitivity to Assumptions**

A. "What if" analysis

   The optimal debt ratio is a function of our inputs on operating income, tax rates and macro variables. We could focus on one or two key variables – operating income is an obvious choice – and look at history for guidance on volatility in that number and ask what if questions.

B. "Economic Scenario" Approach

   We can develop possible scenarios, based upon macro variables, and examine the optimal debt ratio under each one. For instance, we could look at the optimal debt ratio for a cyclical firm under a boom economy, a regular economy and an economy in recession.

□ **Constraint on Bond Ratings/ Book Debt Ratios**

Alternatively, we can put constraints on the optimal debt ratio to reduce exposure to downside risk. Thus, we could require the firm to have a minimum rating, at the optimal debt ratio or to have a book debt ratio that is less than a "specified" value.

Aswath Damodaran

Disney's Operating Income: History

Year	EBIT	% Change in EBIT	Year	EBIT	% Change in EBIT
1987	$756		2001	$2,832	12.16%
1988	$848	12.17%	2002	$2,384	-15.82%
1989	$1,177	38.80%	2003	$2,713	13.80%
1990	$1,368	16.23%	2004	$4,048	49.21%
1991	$1,124	-17.84%	2005	$4,107	1.46%
1992	$1,287	14.50%	2006	$5,355	30.39%
1993	$1,560	21.21%	2007	$6,829	27.53%
1994	$1,804	15.64%	2008	$7,404	8.42%
1995	$2,262	25.39%	2009	$5,697	-23.06%
1996	$3,024	33.69%	2010	$6,726	18.06%
1997	$3,945	30.46%	2011	$7,781	15.69%
1998	$3,843	-2.59%	2012	$8,863	13.91%
1999	$3,580	-6.84%	2013	$9,450	6.62%
2000	$2,525	-29.47%			

Standard deviation in %
change in EBIT = 19.17%

Recession	Decline in Operating Income
2009	Drop of 23.06%
2002	Drop of 15.82%
1991	Drop of 22.00%
1981-82	Increased by 12%
Worst Year	Drop of 29.47%

Aswath Damodaran

63

Disney: Safety Buffers?

EBIT drops by	EBIT	Optimal Debt ratio
0%	$10,032	40%
10%	$9,029	40%
20%	$8,025	40%
30%	$7,022	40%
40%	$6,019	30%
50%	$5,016	30%
60%	$4,013	20%

Aswath Damodaran

Constraints on Ratings

- Management often specifies a 'desired rating' below which they do not want to fall.
- The rating constraint is driven by three factors
  - it is one way of protecting against downside risk in operating income (so do not do both)
  - a drop in ratings might affect operating income
  - there is an ego factor associated with high ratings
- Caveat: Every rating constraint has a cost.
  - The cost of a rating constraint is the difference between the unconstrained value and the value of the firm with the constraint.
  - Managers need to be made aware of the costs of the constraints they impose.

Ratings Constraints for Disney

- At its optimal debt ratio of 40%, Disney has an estimated rating of A.

- If managers insisted on a AA rating, the optimal debt ratio for Disney is then 30% and the cost of the ratings constraint is fairly small:

    Cost of AA Rating Constraint = Value at 40% Debt – Value at 30% Debt = $153,531 m – $147,835 m = $ 5,696 million

- If managers insisted on a AAA rating, the optimal debt ratio would drop to 20% and the cost of the ratings constraint would rise:

    Cost of AAA rating constraint = Value at 40% Debt – Value at 20% Debt = $153,531 m – $141,406 m = $ 12,125 million

Aswath Damodaran

3. What if you do not buy back stock..

- The optimal debt ratio is ultimately a function of the underlying riskiness of the business in which you operate and your tax rate.

- Will the optimal be different if you invested in projects instead of buying back stock?
  - No. As long as the projects financed are in the same business mix that the company has always been in and your tax rate does not change significantly.
  - Yes, if the projects are in entirely different types of businesses or if the tax rate is significantly different.

Extension to a family group company: Tata Motor's Optimal Capital Structure

Debt Ratio	Beta	Cost of Equity	Bond Rating	Interest rate on debt	Tax Rate	Cost of Debt (after-tax)	WACC	Enterprise Value
0%	0.8601	12.76%	Aaa/AAA	9.22%	32.45%	6.23%	12.76%	1,286,997₹
10%	0.9247	13.22%	Aa2/AA	9.52%	32.45%	6.43%	12.54%	1,333,263₹
20%	1.0054	13.80%	A3/A-	10.12%	32.45%	6.84%	12.41%	1,363,774₹
30%	1.1092	14.55%	B2/B	15.32%	32.45%	10.35%	13.29%	1,185,172₹
40%	1.2475	15.54%	Caa/CCC	17.57%	32.45%	11.87%	14.07%	1,061,143₹
50%	1.4412	16.93%	Ca2/CC	18.32%	32.45%	12.38%	14.65%	984,693₹
60%	1.7610	19.23%	Ca2/CC	18.32%	30.18%	12.79%	15.37%	904,764₹
70%	2.3749	23.65%	C2/C	19.32%	24.53%	14.58%	17.30%	741,800₹
80%	3.5624	32.19%	C2/C	19.32%	21.46%	15.17%	18.58%	663,028₹
90%	7.1247	57.81%	C2/C	19.32%	19.08%	15.63%	19.85%	599,379₹

Tata Motors looks like it is over levered (29% actual versus 20% optimal), perhaps because it is drawing on the debt capacity of other companies in the Tata Group.

Extension to a firm with volatile earnings: Vale's Optimal Debt Ratio

Debt Ratio	Beta	Cost of Equity	Bond Rating	Interest rate on debt	Tax Rate	Cost of Debt (after-tax)	WACC	Enterprise Value
0%	0.8440	8.97%	Aaa/AAA	5.15%	34.00%	3.40%	8.97%	$98,306
10%	0.9059	9.43%	Aaa/AAA	5.15%	34.00%	3.40%	8.83%	$100,680
20%	0.9833	10.00%	Aaa/AAA	5.15%	34.00%	3.40%	8.68%	$103,171
30%	**1.0827**	**10.74%**	**A1/A+**	**5.60%**	**34.00%**	**3.70%**	**8.62%**	**$104,183**
40%	1.2154	11.71%	A3/A-	6.05%	34.00%	3.99%	8.63%	$104,152
50%	1.4011	13.08%	B1/B+	10.25%	34.00%	6.77%	9.92%	$85,298
60%	1.6796	15.14%	B3/B-	12.00%	34.00%	7.92%	10.81%	$75,951
70%	2.1438	18.56%	B3/B-	12.00%	34.00%	7.92%	11.11%	$73,178
80%	3.0722	25.41%	Ca2/CC	14.25%	34.00%	9.41%	12.61%	$62,090
90%	5.8574	45.95%	Ca2/CC	14.25%	34.00%	9.41%	13.06%	$59,356

	Last 12 months	-1	-2	-3	Average
Revenues	$48,469	$48,058	$61,123	$47,343	$51,248
EBITDA	$19,861	$17,662	$34,183	$26,299	$24,501
EBIT	$15,487	$13,346	$30,206	$23,033	$20,518
Pre-tax operating margin	31.95%	27.77%	49.42%	48.65%	39.45%

Replacing Vale's current operating income with the average over the last three years pushes up the optimal to 50%.

Optimal Debt Ratio for a young, growth firm: Baidu

Debt Ratio	Beta	Cost of Equity	Bond Rating	Interest rate on debt	Tax Rate	Cost of Debt (after-tax)	WACC	Enterprise Value
0%	1.3021	12.54%	Aaa/AAA	4.70%	25.00%	3.53%	12.54%	$337,694
10%	1.4106	13.29%	A3/A-	5.60%	25.00%	4.20%	12.38%	$343,623
20%	1.5463	14.23%	Ca2/CC	13.80%	25.00%	10.35%	13.45%	$306,548
30%	1.7632	15.74%	Caa/CCC	14.80%	17.38%	12.23%	14.68%	$272,853
40%	2.0675	17.85%	D2/D	16.30%	11.83%	14.37%	16.46%	$235,510
50%	2.4810	20.72%	D2/D	16.30%	9.47%	14.76%	17.74%	$214,337
60%	3.1012	25.02%	D2/D	16.30%	7.89%	15.01%	19.02%	$196,657
70%	4.1350	32.20%	D2/D	16.30%	6.76%	15.20%	20.30%	$181,672
80%	6.2024	46.54%	D2/D	16.30%	5.92%	15.34%	21.58%	$168,808
90%	12.4049	89.59%	D2/D	16.30%	5.26%	15.44%	22.86%	$157,646

The optimal debt ratio for Baidu is between 0 and 10%, close to its current debt ratio of 5.23%, and much lower than the optimal debt ratios computed for Disney, Vale and Tata Motors.

Aswath Damodaran

Extension to a private business Optimal Debt Ratio for Bookscape

Debt value of leases = $12,136 million (only debt)

Estimated market value of equity = Net Income * Average PE for Publicly Traded Book Retailers = 1.575 * 20 = $31.5 million

Debt ratio = 12,136/(12,136+31,500) = 27.81%

Debt Ratio	Total Beta	Cost of Equity	Bond Rating	Interest rate on debt	Tax Rate	Cost of Debt (after-tax)	WACC	Enterprise Value
0%	1.3632	10.25%	Aaa/AAA	3.15%	40.00%	1.89%	10.25%	$37,387
10%	1.4540	10.75%	Aaa/AAA	3.15%	40.00%	1.89%	9.86%	$39,416
20%	1.5676	11.37%	A1/A+	3.60%	40.00%	2.16%	9.53%	$41,345
30%	1.7137	12.18%	A3/A-	4.05%	40.00%	2.43%	9.25%	$43,112
40%	1.9084	13.25%	Caa/CCC	11.50%	40.00%	6.90%	10.71%	$35,224
50%	2.2089	14.90%	Ca2/CC	12.25%	37.96%	7.60%	11.25%	$32,979
60%	2.8099	18.20%	C2/C	13.25%	29.25%	9.37%	12.91%	$27,598
70%	3.7466	23.36%	C2/C	13.25%	25.07%	9.93%	13.96%	$25,012
80%	5.6198	33.66%	C2/C	13.25%	21.93%	10.34%	15.01%	$22,869
90%	11.4829	65.91%	D2/D	14.75%	17.51%	12.17%	17.54%	$18,952

The firm value is maximized (and the cost of capital is minimized) at a debt ratio of 30%. At its existing debt ratio of 27.81%, Bookscape is at its optimal.
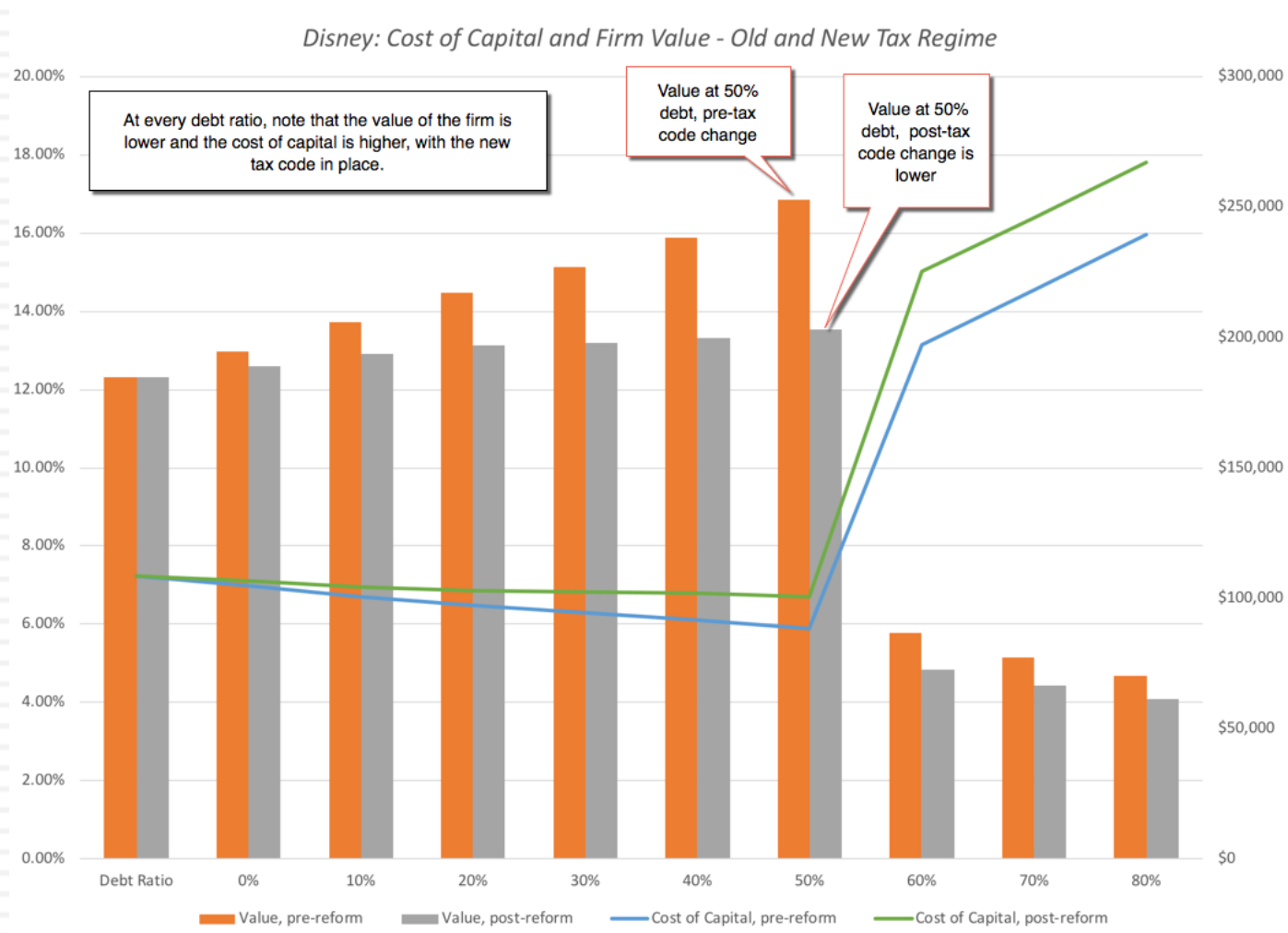
Aswath Damodaran

The US Tax Reform Act of 2017: Effects on the Optimal Debt Ratio

- Change in marginal tax rate: The marginal federal tax rate for US companies on US income has been lowered from 35% to 21%. **Holding all else constant, that will lower the optimal debt ratio for all firms.**

- Limits on interest tax deduction: Companies can deduct interest expenses only up to 30% of EBITDA (until 2022) and 30% of EBIT (after 2022). That will add a constraint to the tax savings from debt. In the cost of capital calculation, it will show up in the tax rate that you use to compute your after-tax cost of debt, lowering the tax rate from the marginal if interest expenses> 30% of EBITDA:

  Tax rate if Interest Expense> 30% of EBITDA
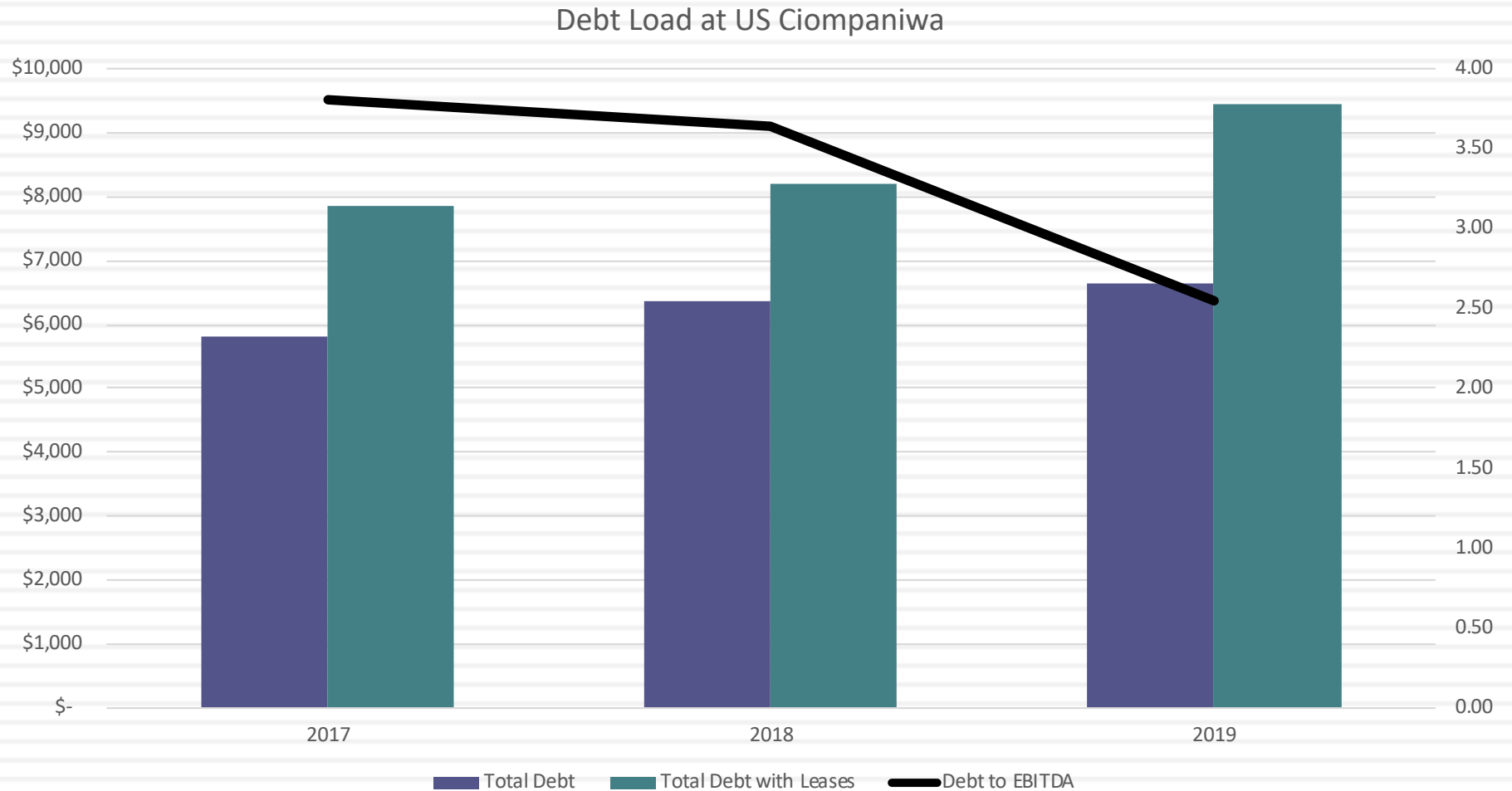
  = Marginal Tax rate * (.30*EBITDA)/ Interest Expense

Effect on tax code on Debt Impact: Disney in 2018

Disney: Cost of Capital and Firm Value - Old and New Tax Regime

At every debt ratio, note that the value of the firm is lower and the cost of capital is higher, with the new tax code in place.

Value at 50% debt, pre-tax code change

Value at 50% debt, post-tax code change is lower

Aswath Damodaran

73

Are US companies delivering?

Debt Load at US Ciompaniwa

Aswath Damodaran

Limitations of the Cost of Capital approach

☐ <u>It is static</u>: The most critical number in the entire analysis is the operating income. If that changes, the optimal debt ratio will change.

☐ <u>It ignores indirect bankruptcy costs</u>: The operating income is assumed to stay fixed as the debt ratio and the rating changes.

☐ <u>Beta and Ratings</u>: It is based upon rigid assumptions of how market risk and default risk get borne as the firm borrows more money and the resulting costs.

Aswath Damodaran

II. Enhanced Cost of Capital Approach

- <u>Distress cost affected operating income</u>: In the enhanced cost of capital approach, the indirect costs of bankruptcy are built into the expected operating income. As the rating of the firm declines, the operating income is adjusted to reflect the loss in operating income that will occur when customers, suppliers and investors react.

- <u>Dynamic analysis</u>: Rather than look at a single number for operating income, you can draw from a distribution of operating income (thus allowing for different outcomes).

Aswath Damodaran

Estimating the Distress Effect- Disney

Rating	Drop in EBITDA (Low)	Drop in EBITDA (Medium)	Drop in EBITDA (High)
To A	No effect	No effect	2.00%
To A-	No effect	2.00%	5.00%
To BBB	5.00%	10.00%	15.00%
To BB+	10.00%	20.00%	25.00%
To B-	15.00%	25.00%	30.00%
To C	25.00%	40.00%	50.00%
To D	30.00%	50.00%	100.00%

Aswath Damodaran

The Optimal Debt Ratio with Indirect Bankruptcy Costs

Debt Ratio	Beta	Cost of Equity	Bond Rating	Interest rate on debt	Tax Rate	Cost of Debt (after-tax)	WACC	Enterprise Value
0%	0.9239	8.07%	Aaa/AAA	3.15%	36.10%	2.01%	8.07%	$122,633
10%	0.9895	8.45%	Aaa/AAA	3.15%	36.10%	2.01%	7.81%	$134,020
20%	1.0715	8.92%	Aaa/AAA	3.15%	36.10%	2.01%	7.54%	$147,739
30%	1.1769	9.53%	Aa2/AA	3.45%	36.10%	2.20%	7.33%	$160,625
40%	1.3175	10.34%	A2/A	3.75%	36.10%	2.40%	7.16%	$172,933
50%	1.5573	11.72%	C2/C	11.50%	31.44%	7.88%	9.80%	$35,782
60%	1.9946	14.24%	Caa/CCC	13.25%	22.74%	10.24%	11.84%	$25,219
70%	2.6594	18.07%	Caa/CCC	13.25%	19.49%	10.67%	12.89%	$21,886
80%	3.9892	25.73%	Caa/CCC	13.25%	17.05%	10.99%	13.94%	$19,331
90%	7.9783	48.72%	Caa/CCC	13.25%	15.16%	11.24%	14.99%	$17,311

The optimal debt ratio stays at 40% but the cliff becomes much steeper.

Aswath Damodaran

Extending this approach to analyzing Financial Service Firms

□ Interest coverage ratio spreads, which are critical in determining the bond ratings, have to be estimated separately for financial service firms; applying manufacturing company spreads will result in absurdly low ratings for even the safest banks and very low optimal debt ratios.

□ It is difficult to estimate the debt on a financial service company's balance sheet. Given the mix of deposits, repurchase agreements, short-term financing, and other liabilities that may appear on a financial service firm's balance sheet, one solution is to focus only on long-term debt, defined tightly, and to use interest coverage ratios defined using only long-term interest expenses.

□ Financial service firms are regulated and have to meet capital ratios that are defined in terms of book value. If, in the process of moving to an optimal market value debt ratio, these firms violate the book capital ratios, they could put themselves in jeopardy.

Aswath Damodaran

Capital Structure for a bank:
A Regulatory Capital Approach

□ Consider a bank with $ 100 million in loans outstanding and a book value of equity of $ 6 million. Furthermore, assume that the regulatory requirement is that equity capital be maintained at 5% of loans outstanding. Finally, assume that this bank wants to increase its loan base by $ 50 million to $ 150 million and to augment its equity capital ratio to 7% of loans outstanding.

Loans outstanding after Expansion = $ 150 million

Equity after expansion = 7% of $150 = $10.5 million

Existing Equity = $ 6.0 million

New Equity needed = $ 4.5 million

□ Your need for "external" equity as a bank/financial service company will depend upon

a. Your growth rate: Higher growth -> More external equity

b. Existing capitalization vs Target capitalization: Under capitalized -> More external equity

c. Current earnings: Less earnings -> More external equity

d. Current dividends: More dividends -> More external equity

Aswath Damodaran

Deutsche Bank's Financial Mix

	Current	1	2	3	4	5
Asset Base	439,851 €	453,047 €	466,638 €	480,637 €	495,056 €	509,908 €
Capital ratio	15.13%	15.71%	16.28%	16.85%	17.43%	18.00%
Tier 1 Capital	66,561 €	71,156 €	75,967 €	81,002 €	86,271 €	91,783 €
Change in regulatory capital		4,595 €	4,811 €	5,035 €	5,269 €	5,512 €
Book Equity	76,829 €	81,424 €	86,235 €	91,270 €	96,539 €	102,051 €
ROE	-1.08%	0.74%	2.55%	4.37%	6.18%	8.00%
Net Income	-716 €	602 €	2,203 €	3,988 €	5,971 €	8,164 €
- Investment in Regulatory Capital		4,595 €	4,811 €	5,035 €	5,269 €	5,512 €
FCFE		-3,993 €	-2,608 €	-1,047 €	702 €	2,652 €

The cumulative FCFE over the next 5 years is -4,294 million
Euros. Clearly, it does not make the sense to pay dividends or
buy back stock.

Financing Strategies for a financial institution

☐ The Regulatory minimum strategy: In this strategy, financial service firms try to stay with the bare minimum equity capital, as required by the regulatory ratios. In the most aggressive versions of this strategy, firms exploit loopholes in the regulatory framework to invest in those businesses where regulatory capital ratios are set too low (relative to the risk of these businesses).

☐ The Self-regulatory strategy: The objective for a bank raising equity is not to meet regulatory capital ratios but to ensure that losses from the business can be covered by the existing equity. In effect, financial service firms can assess how much equity they need to hold by evaluating the riskiness of their businesses and the potential for losses.

☐ Combination strategy: In this strategy, the regulatory capital ratios operate as a floor for established businesses, with the firm adding buffers for safety where needed..

Determinants of the Optimal Debt Ratio:
1. The marginal tax rate

☐ The primary benefit of debt is a tax benefit. The higher the marginal tax rate, the greater the benefit to borrowing:

Tax Rate	Disney	Vale	Tata Motors	Baidu	Bookscape
0%	0%	0%	0%	0%	0%
10%	20%	0%	0%	0%	10%
20%	40%	0%	10%	10%	30%
30%	40%	30%	20%	10%	30%
40%	40%	40%	20%	10%	30%
50%	40%	40%	20%	10%	30%

Aswath Damodaran

2. Pre-tax Cash flow Return

Company	EBITDA	EBIT	Enterprise Value	EBITDA/EV	EBIT/EV	Optimal Debt	Optimal Debt Ratio
Disney	$12,517	$10,032	$133,908	9.35%	7.49%	$55,136	40.00%
Vale	$20,167	$15,667	$112,352	17.95%	13.94%	$35,845	30.00%
Tata Motors	250,116₹	166,605₹	1,427,478₹	17.52%	11.67%	325,986₹	20.00%
Baidu	¥13,073	¥10,887	¥342,269	3.82%	3.18%	¥35,280	10.00%
Bookscape	$4,150	$2,536	$42,636	9.73%	5.95%	$13,091	30.00%

Higher cash flows, as a percent of value, give you a higher debt capacity, though less so in emerging markets with substantial country risk.

Aswath Damodaran

3. Operating Risk

- ☐ Firms that face more risk or uncertainty in their operations (and more variable operating income as a consequence) will have lower optimal debt ratios than firms that have more predictable operations.

- ☐ Operating risk enters the cost of capital approach in two places:

  - ◘ Unlevered beta: Firms that face more operating risk will tend to have higher unlevered betas. As they borrow, debt will magnify this already large risk and push up costs of equity much more steeply.

  - ◘ Bond ratings: For any given level of operating income, firms that face more risk in operations will have lower ratings. The ratings are based upon normalized income.

Aswath Damodaran

4. The only macro determinant: Equity vs Debt Risk Premiums

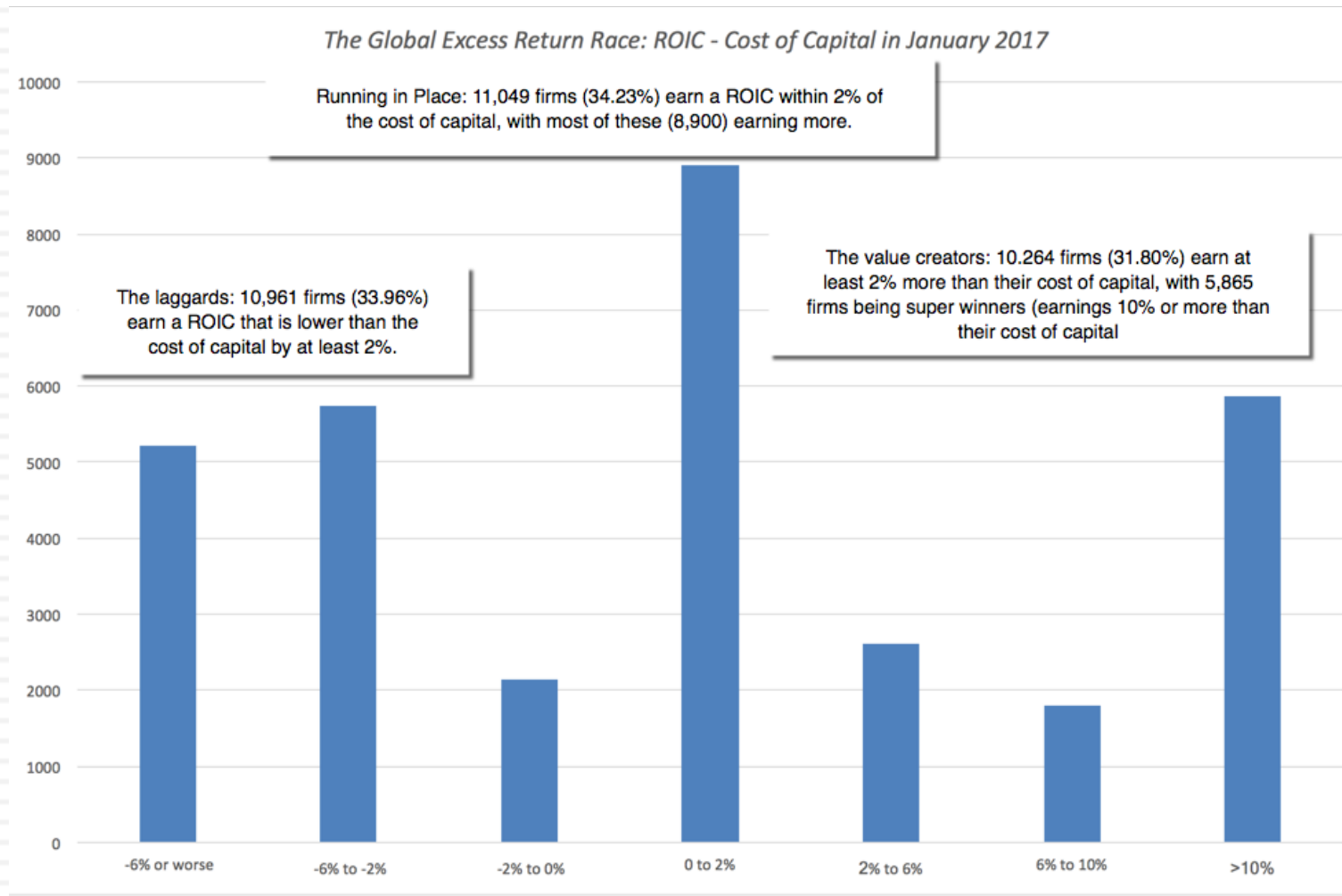*Figure 16: Equity Risk Premiums and Bond Default Spreads*
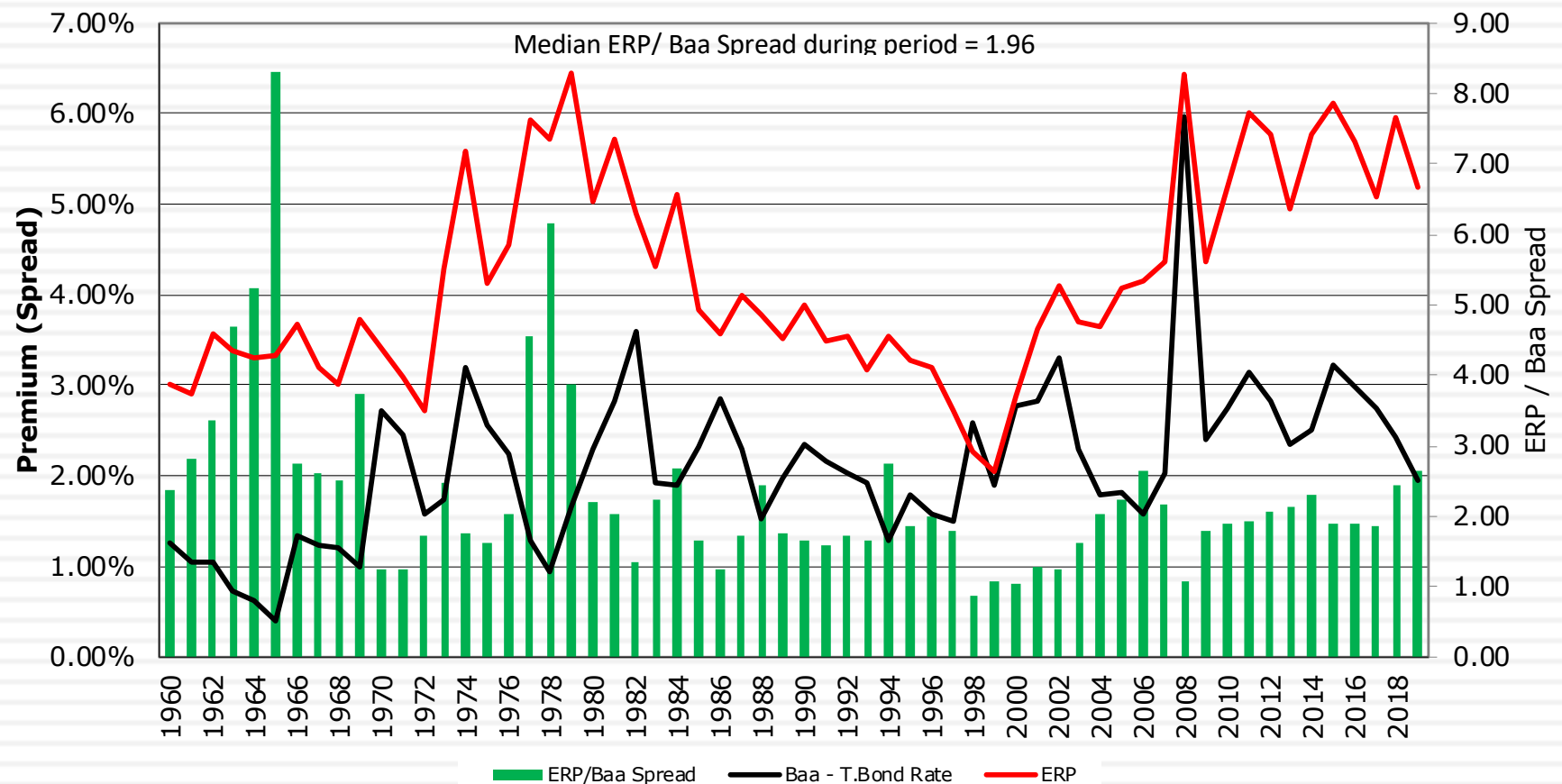
⧗ Application Test: Your firm's optimal financing mix

- Using the optimal capital structure spreadsheet provided:

  1. Estimate the optimal debt ratio for your firm

  2. Estimate the new cost of capital at the optimal

  3. Estimate the effect of the change in the cost of capital on firm value

  4. Estimate the effect on the stock price

- In terms of the mechanics, what would you need to do to get to the optimal immediately?

Return Spreads Globally....

The Global Excess Return Race: ROIC - Cost of Capital in January 2017

Running in Place: 11,049 firms (34.23%) earn a ROIC within 2% of the cost of capital, with most of these (8,900) earning more.

The laggards: 10,961 firms (33.96%) earn a ROIC that is lower than the cost of capital by at least 2%.

The value creators: 10.264 firms (31.80%) earn at least 2% more than their cost of capital, with 5,865 firms being super winners (earnings 10% or more than their cost of capital

Categories (x-axis): -6% or worse, -6% to -2%, -2% to 0%, 0 to 2%, 2% to 6%, 6% to 10%, >10%

III. The APV Approach to Optimal Capital Structure

☐ In the adjusted present value approach, the value of the firm is written as the sum of the value of the firm without debt (the unlevered firm) and the effect of debt on firm value

Firm Value = Unlevered Firm Value + (Tax Benefits of Debt - Expected Bankruptcy Cost from the Debt)

☐ The optimal dollar debt level is the one that maximizes firm value

Aswath Damodaran

Implementing the APV Approach

□ Step 1: Estimate the unlevered firm value. This can be done in one of two ways:

  ◻ Estimating the unlevered beta, a cost of equity based upon the unlevered beta and valuing the firm using this cost of equity (which will also be the cost of capital, with an unlevered firm)

  ◻ Alternatively, Unlevered Firm Value = Current Market Value of Firm - Tax Benefits of Debt (Current) + Expected Bankruptcy cost from Debt

□ Step 2: Estimate the tax benefits at different levels of debt. The simplest assumption to make is that the savings are perpetual, in which case

  ◻ Tax benefits = Dollar Debt * Tax Rate

□ Step 3: Estimate a probability of bankruptcy at each debt level, and multiply by the cost of bankruptcy (including both direct and indirect costs) to estimate the expected bankruptcy cost.

Aswath Damodaran

Estimating Expected Bankruptcy Cost

- ☐ Probability of Bankruptcy
  - ◘ Estimate the synthetic rating that the firm will have at each level of debt
  - ◘ Estimate the probability that the firm will go bankrupt over time, at that level of debt (Use studies that have estimated the empirical probabilities of this occurring over time - Altman does an update every year)

- ☐ Cost of Bankruptcy
  - ◘ The direct bankruptcy cost is the easier component. It is generally between 5-10% of firm value, based upon empirical studies
  - ◘ The indirect bankruptcy cost is much tougher. It should be higher for sectors where operating income is affected significantly by default risk (like airlines) and lower for sectors where it is not (like groceries)

Aswath Damodaran

Ratings and Default Probabilities: Results from Altman study of bonds

Rating	Likelihood of Default
AAA	0.07%
AA	0.51%
A+	0.60%
A	0.66%
A-	2.50%
BBB	7.54%
BB	16.63%
B+	25.00%
B	36.80%
B-	45.00%
CCC	59.01%
CC	70.00%
C	85.00%
D	100.00%

Altman estimated these probabilities by looking at bonds in each ratings class ten years prior and then examining the proportion of these bonds that defaulted over the ten years.

Aswath Damodaran

Disney: Estimating Unlevered Firm Value

Current Value of firm = $121,878+ $15,961   = $ 137,839

 - Tax Benefit on Current Debt = $15,961 * 0.361   = $ 5,762

 + Expected Bankruptcy Cost = 0.66% * (0.25 * 137,839) = $ 227

Unlevered Value of Firm =   = $ 132,304

- Cost of Bankruptcy for Disney = 25% of firm value

- Probability of Bankruptcy = 0.66%, based on firm's current rating of A

- Tax Rate = 36.1%

Disney: APV at Debt Ratios

Debt Ratio	$ Debt	Tax Rate	Unlevered Firm Value	Tax Benefits	Bond Rating	Probability of Default	Expected Bankruptcy Cost	Value of Levered Firm
0%	$0	36.10%	$132,304	$0	AAA	0.07%	$23	$132,281
10%	$13,784	36.10%	$132,304	$4,976	Aaa/AAA	0.07%	$24	$137,256
20%	$27,568	36.10%	$132,304	$9,952	Aaa/AAA	0.07%	$25	$142,231
30%	$41,352	36.10%	$132,304	$14,928	Aa2/AA	0.51%	$188	$147,045
40%	$55,136	36.10%	$132,304	$19,904	A2/A	0.66%	$251	$151,957
50%	$68,919	36.10%	$132,304	$24,880	B3/B-	45.00%	$17,683	$139,501
60%	$82,703	36.10%	$132,304	$29,856	C2/C	59.01%	$23,923	$138,238
70%	$96,487	32.64%	$132,304	$31,491	C2/C	59.01%	$24,164	$139,631
80%	$110,271	26.81%	$132,304	$29,563	Ca2/CC	70.00%	$28,327	$133,540
90%	$124,055	22.03%	$132,304	$27,332	Caa/CCC	85.00%	$33,923	$125,713

The optimal debt ratio is 40%, which is the point at which firm value is maximized.

Aswath Damodaran

IV. Relative Analysis

- The "safest" place for any firm to be is close to the industry average

- Subjective adjustments can be made to these averages to arrive at the right debt ratio.
  - Higher tax rates -> Higher debt ratios (Tax benefits)
  - Lower insider ownership -> Higher debt ratios (Greater discipline)
  - More stable income -> Higher debt ratios (Lower bankruptcy costs)
  - More intangible assets -> Lower debt ratios (More agency problems)

Aswath Damodaran

Comparing to industry averages

Company	Debt to Capital Ratio		Net Debt to Capital Ratio		Comparable group	Debt to Capital Ratio		Net Debt to Capital Ratio	
	Book value	Market value	Book value	Market value		Book value	Market value	Book value	Market value
Disney	22.88%	11.58%	17.70%	8.98%	US Entertainment	39.03%	15.44%	24.92%	9.93%
Vale	39.02%	35.48%	34.90%	31.38%	Global Diversified Mining & Iron Ore (Market cap> $1 b)	34.43%	26.03%	26.01%	17.90%
Tata Motors	58.51%	29.28%	22.44%	19.25%	Global Autos (Market Cap> $1 b)	35.96%	18.72%	3.53%	0.17%
Baidu	32.93%	5.23%	20.12%	2.32%	Global Online Advertising	6.37%	1.83%	-27.13%	-2.76%

Aswath Damodaran

Getting past simple averages

Step 1: Run a regression of debt ratios on the variables that you believe determine debt ratios in the sector. For example,

> Debt Ratio = a + b (Tax rate) + c (Earnings Variability) + d (EBITDA/Firm Value)

Check this regression for statistical significance (t statistics) and predictive ability (R squared)

Step 2: Estimate the values of the proxies for the firm under consideration. Plugging into the cross sectional regression, we can obtain an estimate of predicted debt ratio.

Step 3: Compare the actual debt ratio to the predicted debt ratio.

Aswath Damodaran

Applying the Regression Methodology: Global Auto Firms

- Using a sample of 56 global auto firms, we arrived at the following regression:

Debt to capital = 0.09 + 0.63 (Effective Tax Rate) + 1.01 (EBITDA/ Enterprise Value) - 0.93 (Cap Ex/ Enterprise Value)

- The R squared of the regression is 21%. This regression can be used to arrive at a predicted value for Tata Motors of:

Predicted Debt Ratio = 0.09 + 0.63 (0.252) +1.01 (0.1167) - 0.93 (0.1949) = .1854 or 18.54%

- Based upon the capital structure of other firms in the automobile industry, Tata Motors should have a market value debt ratio of 18.54%. It is over levered at its existing debt ratio of 29.28%.

Aswath Damodaran

Extending to the entire market

- Using 2014 data for US listed firms, we looked at the determinants of the market debt to capital ratio. The regression provides the following results –

DFR =   0.27 - 0.24 ETR -0.10 g– 0.065 INST -0.338 CVOI+ 0.59 E/V

(15.79)   (9.00)   (2.71)   (3.55)   (3.10)   (6.85)

DFR = Debt / (Debt + Market Value of Equity)

ETR = Effective tax rate in most recent twelve months

INST = % of Shares held by institutions

CVOI = Std dev in OI in last 10 years/ Average OI in last 10 years

E/V   = EBITDA/ (Market Value of Equity + Debt- Cash)

The regression has an **R-squared of 8%.**

Applying the Regression

- Disney had the following values for these inputs in 2014. Estimate the optimal debt ratio using the debt regression.

  Effective Tax Rate (ETR)   = 31.02%

  Expected Revenue Growth   = 6.45%

  Institutional Holding % (INST)   = 70.2%

  Coeff of Variation in OI (CVOI)   = 0.0296

  EBITDA/Value of firm (E/V)   = 9.35%

Optimal Debt Ratio

= 0.27 - 0.24 (.3102) -0.10 (.0645)– 0.065 (.702) -0.338 (.0296)+ 0.59 (.0935)

= 0.1886 or 18.86%

- What does this optimal debt ratio tell you?

- Why might it be different from the optimal calculated using the weighted average cost of capital?

Aswath Damodaran

Summarizing the optimal debt ratios...

	Disney	Vale	Tata Motors	Baidu
Actual Debt Ratio	11.58%	35.48%	29.28%	5.23%
Optimal				
I. Operating income	35.00%	—	-	
II. Standard Cost of capital	40.00%	30.00% (actual) 50.00% (normalized)	20.00%	10.00%
III. Enhanced Cost of Capital	40.00%	30.00% (actual) 40.00% (normalized)	10.00%	10.00%
IV. APV	40.00%	30.00%	20.00%	20.00%
V. Comparable				
To industry	28.54%	26.03%	18.72%	1.83%
To market	18.86%	—	-	

Aswath Damodaran