

Debt and Value: Beyond Miller-Modigliani

Aswath Damodaran

Stern School of Business

The fundamental question: Does the mix of debt and equity affect the value of a business?

Assets		Liabilities	
Existing Investments Generate cashflows today Includes long lived (fixed) and short-lived (working capital) assets	Assets in Place	Debt	Fixed Claim on cash flows Little or No role in management <i>Fixed Maturity</i> <i>Tax Deductible</i>
Expected Value that will be created by future investments	Growth Assets	Equity	Residual Claim on cash flows Significant Role in management <i>Perpetual Lives</i>

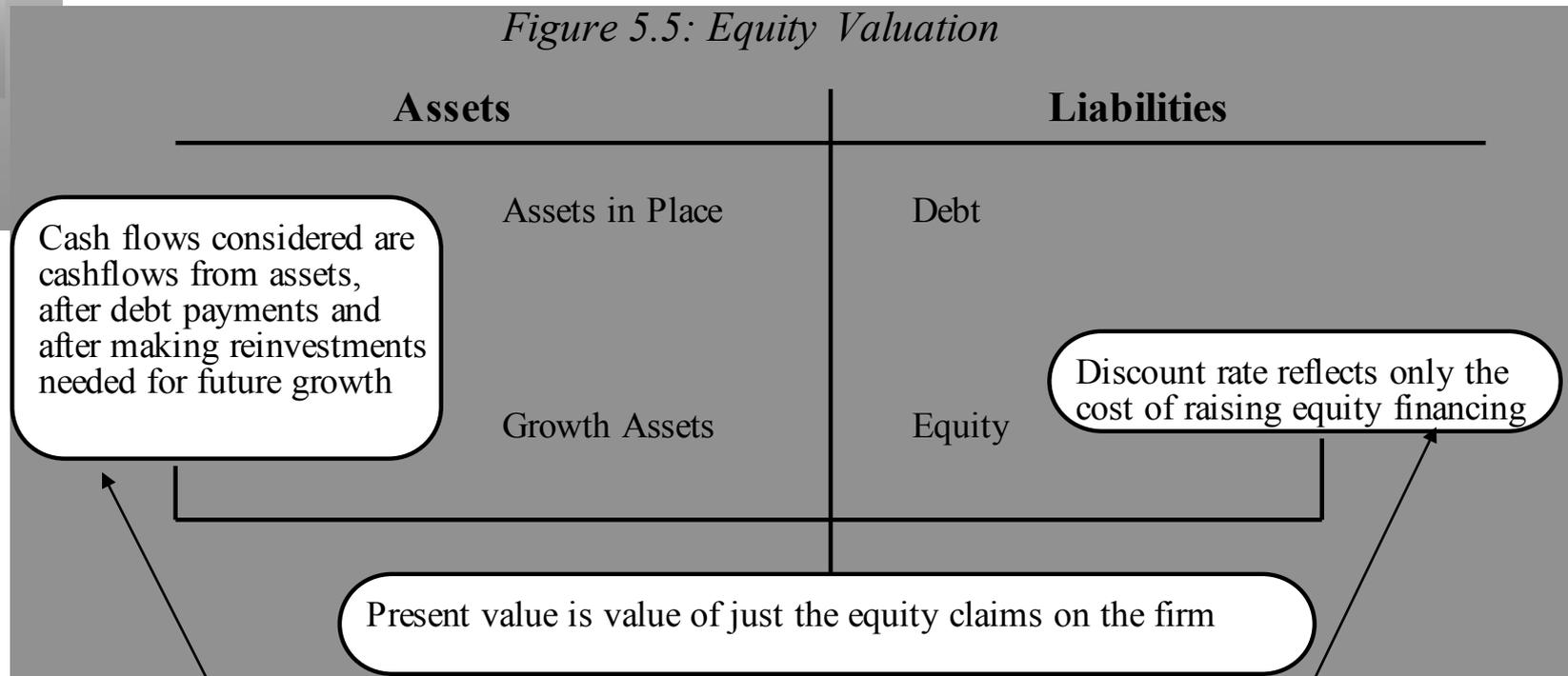
Different Value? ←

→ Different Financing Mix?

Debt and Value in Equity Valuation

Will the value of equity per share increase as debt increases?

Figure 5.5: Equity Valuation



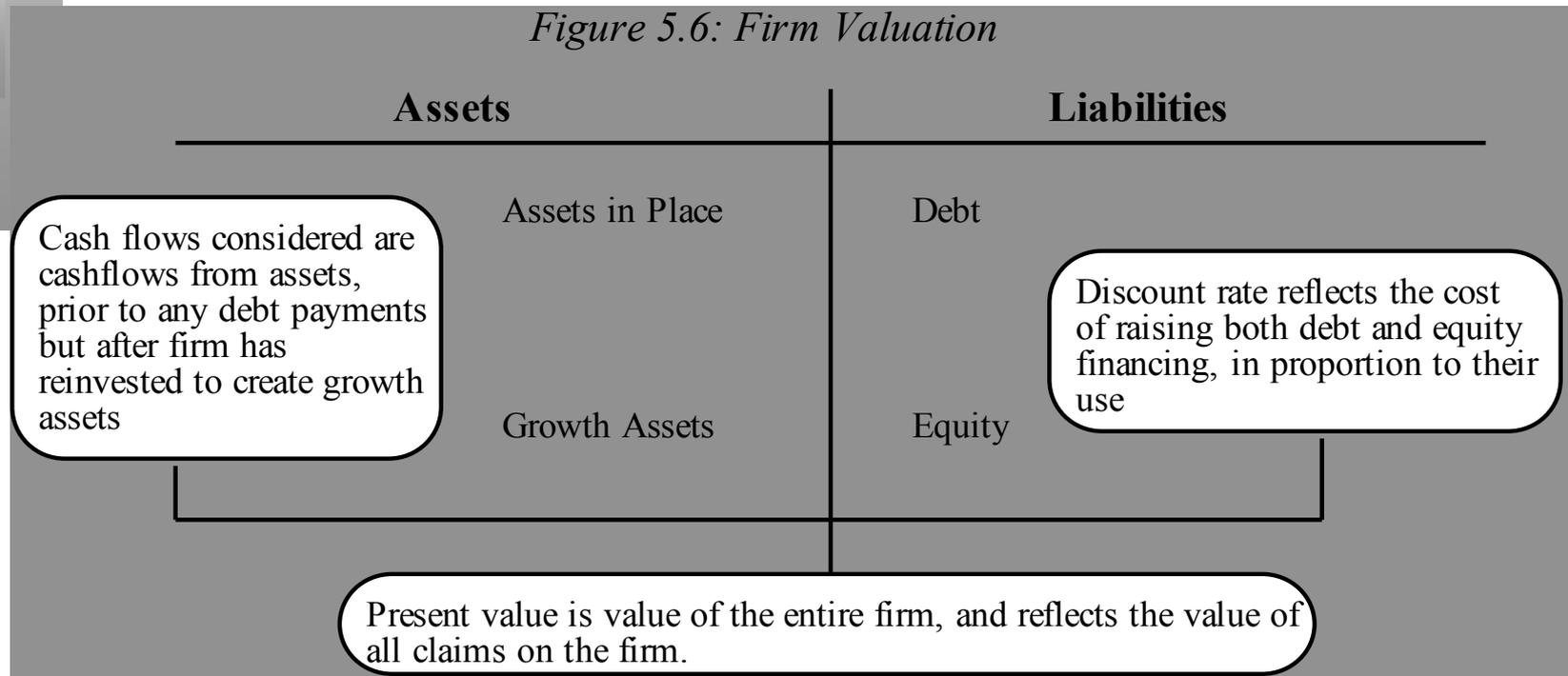
Changing debt will change cash flows to equity

As debt increases, equity will become riskier and cost of equity will go up.

Debt and Value in Firm Valuation

Will the value of operating assets increase as debt goes up?

Figure 5.6: Firm Valuation



Cash flows are before debt payments;
Should not be affected by debt (or should it?)

Effects of debt show up in cost of capital. If it goes down, value should increase.

A basic proposition about debt and value

- For debt to affect value, there have to be tangible benefits and costs associated with using debt instead of equity.
 - If the benefits exceed the costs, there will be a gain in value to equity investors from the use of debt.
 - If the benefits exactly offset the costs, debt will not affect value
 - If the benefits are less than the costs, increasing debt will lower value

Debt: The Basic Trade Off

Advantages of Borrowing

1. Tax Benefit:

Higher tax rates --> Higher tax benefit

2. Added Discipline:

Greater the separation between managers and stockholders --> Greater the benefit

Disadvantages of Borrowing

1. Bankruptcy Cost:

Higher business risk --> Higher Cost

2. Agency Cost:

Greater the separation between stockholders & lenders --> Higher Cost

3. Loss of Future Financing Flexibility:

Greater the uncertainty about future financing needs --> Higher Cost

A Hypothetical Scenario

- (a) There are no taxes
- (b) Managers have stockholder interests at heart and do what's best for stockholders.
- (c) No firm ever goes bankrupt
- (d) Equity investors are honest with lenders; there is no subterfuge or attempt to find loopholes in loan agreements
- (e) Firms know their future financing needs with certainty

What happens to the trade off between debt and equity? How much should a firm borrow?

The Miller-Modigliani Theorem

- In an environment, where there are no taxes, default risk or agency costs, capital structure is irrelevant.
- The value of a firm is independent of its debt ratio and the cost of capital will remain unchanged as the leverage changes.

But here is the real world...

- In a world with taxes, default risk and agency costs, it is no longer true that debt and value are unrelated.
- In fact, increasing debt can increase the value of some firms and reduce the value of others.
- For the same firm, debt can increase value up to a point and decrease value beyond that point.

Tools for assessing the effects of debt

- The Cost of Capital Approach: The optimal debt ratio is the one that minimizes the cost of capital for a firm.
- The Adjusted Present Value Approach: The optimal debt ratio is the one that maximizes the overall value of the firm.
- The Sector Approach: The optimal debt ratio is the one that brings the firm closer to its peer group in terms of financing mix.
- The Life Cycle Approach: The optimal debt ratio is the one that best suits where the firm is in its life cycle.

I. The Cost of Capital Approach

- Value of a Firm = Present Value of Cash Flows to the Firm, discounted back at the cost of capital.
- If the cash flows to the firm are held constant, and the cost of capital is minimized, the value of the firm will be maximized.

Measuring Cost of Capital

- It will depend upon:
 - (a) the components of financing: Debt, Equity or Preferred stock
 - (b) the cost of each component
- In summary, the cost of capital is the cost of each component weighted by its relative market value.

$$\text{WACC} = \text{Cost of Equity} \left(\frac{\text{Equity}}{\text{Debt} + \text{Equity}} \right) + \text{After-tax Cost of debt} \left(\frac{\text{Debt}}{\text{Debt} + \text{Equity}} \right)$$

What is debt...

- General Rule: Debt generally has the following characteristics:
 - Commitment to make fixed payments in the future
 - The fixed payments are tax deductible
 - Failure to make the payments can lead to either default or loss of control of the firm to the party to whom payments are due.
- Using this principle, you should include the following in debt
 - All interest bearing debt, short as well as long term
 - The present value of operating lease commitments

Estimating the Market Value of Debt

- The market value of interest bearing debt can be estimated:
 - In 2004, Disney had book value of debt of 13,100 million, interest expenses of \$666 million, a current cost of borrowing of 5.25% and an weighted average maturity of 11.53 years.

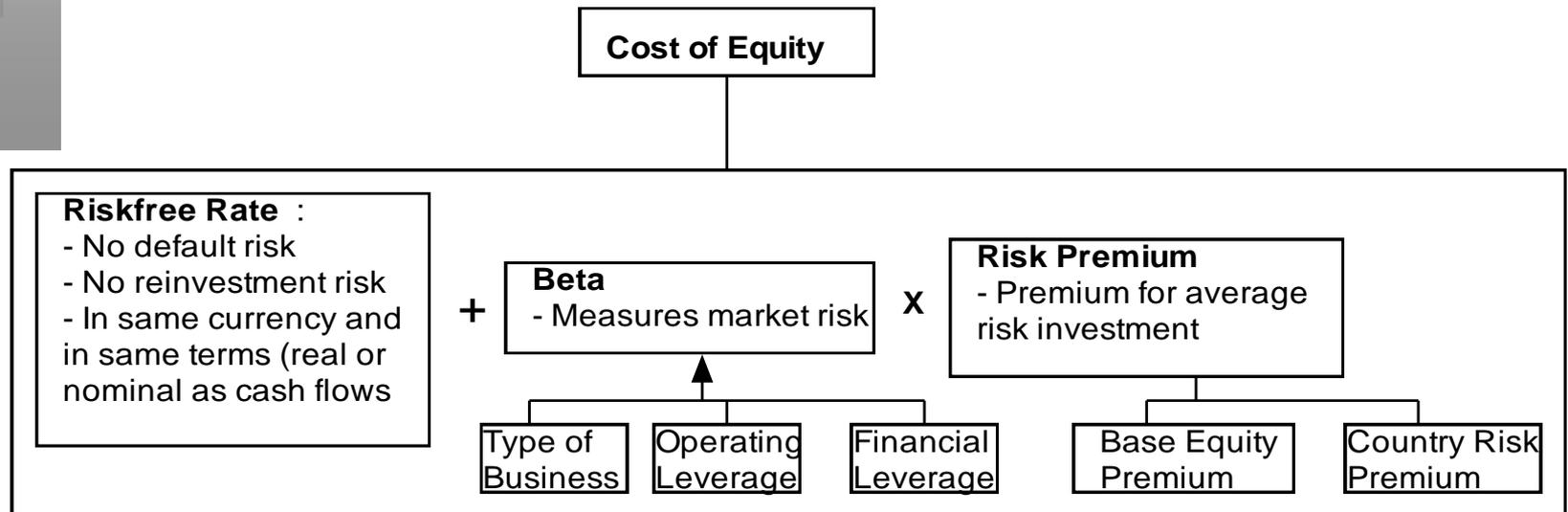
Estimated MV of Disney Debt =

$$666 \left[\frac{1 - \frac{1}{(1.0525)^{11.53}}}{.0525} \right] + \frac{13,100}{(1.0525)^{11.53}} = \$12,915 \text{ million}$$

Year	Commitment	Present Value
1	\$ 271.00	\$ 257.48
2	\$ 242.00	\$ 218.46
3	\$ 221.00	\$ 189.55
4	\$ 208.00	\$ 169.50
5	\$ 275.00	\$ 212.92
6-9	\$ 258.25	\$ 704.93
Debt Value of leases =		\$ 1,752.85

- Debt outstanding at Disney = \$12,915 + \$ 1,753= \$14,668 million

Estimating the Cost of Equity



What the cost of debt is and is not..

- The cost of debt is
 - The rate at which the company can borrow long term today
 - Composed of the riskfree rate and a default spread
 - Corrected for the tax benefit it gets for interest payments.
$$\text{Cost of debt} = k_d = \text{Long Term Borrowing Rate}(1 - \text{Tax rate})$$
 - Which tax rate should you use?
- The cost of debt is not
 - the interest rate at which the company obtained the debt that it has on its books.

Current Cost of Capital: Disney

■ Equity

- Cost of Equity = Riskfree rate + Beta * Risk Premium
 $= 4\% + 1.25 (4.82\%) = 10.00\%$
- Market Value of Equity = \$55.101 Billion
- Equity/(Debt+Equity) = 79%

■ Debt

- After-tax Cost of debt =(Riskfree rate + Default Spread) (1-t)
 $= (4\%+1.25\%) (1-.373) = 3.29\%$
- Market Value of Debt = \$ 14.668 Billion
- Debt/(Debt +Equity) = 21%

- Cost of Capital = ~~10.00%~~(.79)+3.29%(.21) = 8.59%

$$\frac{55.101}{(55.101+14.668)}$$

Mechanics of Cost of Capital Estimation

1. Estimate the Cost of Equity at different levels of debt:

Equity will become riskier -> Beta will increase -> Cost of Equity will increase.

Estimation will use levered beta calculation

2. Estimate the Cost of Debt at different levels of debt:

Default risk will go up and bond ratings will go down as debt goes up -> Cost of Debt will increase.

To estimating bond ratings, we will use the interest coverage ratio (EBIT/Interest expense)

3. Estimate the Cost of Capital at different levels of debt

4. Calculate the effect on Firm Value and Stock Price.

Estimating Cost of Equity

Unlevered Beta = 1.0674 (Bottom up beta based upon Disney's businesses)

Market premium = 4.82%

T.Bond Rate = 4.00%

Tax rate=37.3%

<i>Debt Ratio</i>	<i>D/E Ratio</i>	<i>Levered Beta</i>	<i>Cost of Equity</i>
0.00%	0.00%	1.0674	9.15%
10.00%	11.11%	1.1418	9.50%
20.00%	25.00%	1.2348	9.95%
30.00%	42.86%	1.3543	10.53%
40.00%	66.67%	1.5136	11.30%
50.00%	100.00%	1.7367	12.37%
60.00%	150.00%	2.0714	13.98%
70.00%	233.33%	2.6291	16.67%
80.00%	400.00%	3.7446	22.05%
90.00%	900.00%	7.0911	38.18%

The Ratings Table

<i>Interest Co verage Ratio</i>	<i>Rati n g</i>	<i>Typical de fault spread</i>	<i>Market inte rest rat e on d ebt</i>
> 8.5	AAA	0.35%	4.35%
6.50 - 6.50	AA	0.50%	4.50%
5.50 - 6.50	A+	0.70%	4.70%
4.25 - 5.50	A	0.85%	4.85%
3.00 - 4.25	A-	1.00%	5.00%
2.50 - 3.00	BBB	1.50%	5.50%
2.05 - 2.50	BB+	2.00%	6.00%
1.90 - 2.00	BB	2.50%	6.50%
1.75 - 1.90	B+	3.25%	7.25%
1.50 - 1.75	B	4.00%	8.00%
1.25 - 1.50	B-	6.00%	10.00%
0.80 - 1.25	CCC	8.00%	12.00%
0.65 - 0.80	CC	10.00%	14.00%
0.20 - 0.65	C	12.00%	16.00%
< 0.20	D	20.00%	24.00%

Bond Ratings, Cost of Debt and Debt Ratios

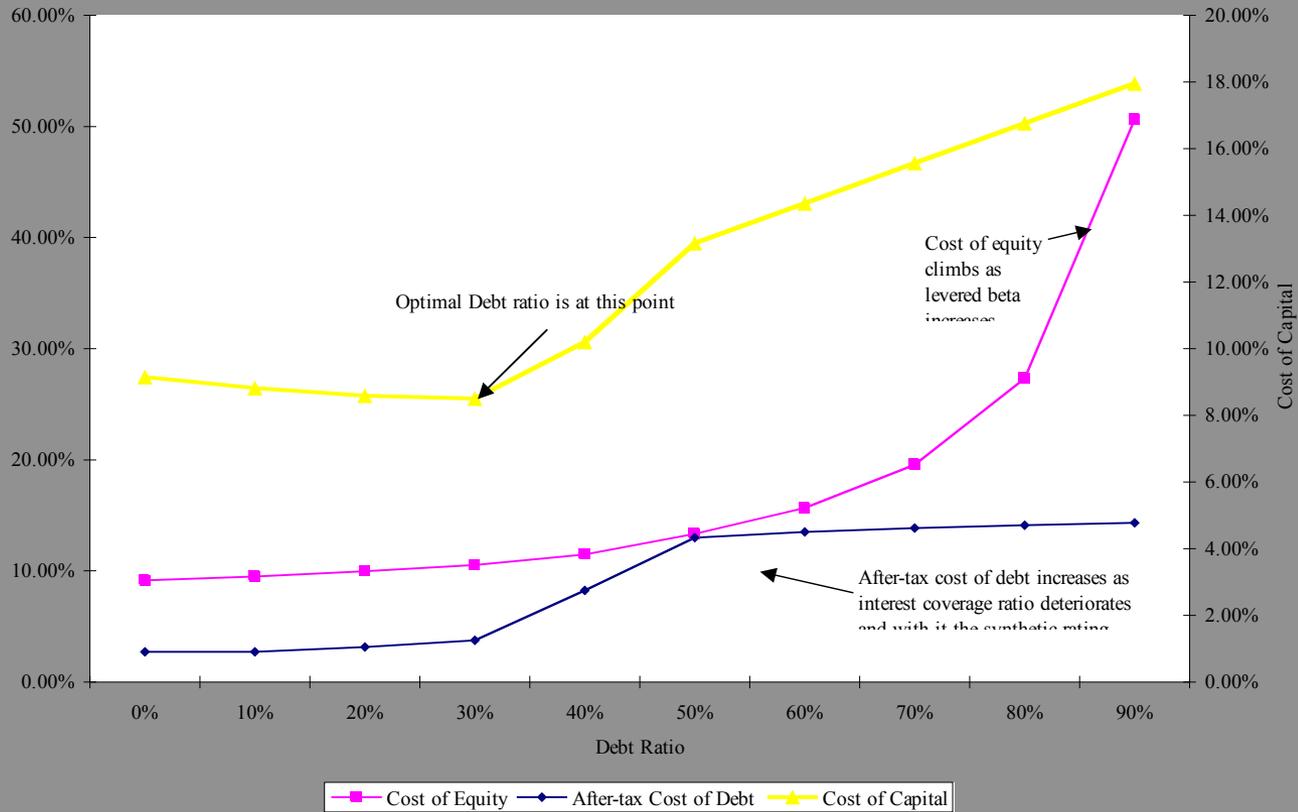
<i>Debt Ratio</i>	<i>Debt</i>	<i>Interest expense</i>	<i>Interest Coverage Ratio</i>	<i>Bond Rating</i>	<i>Interest rate on debt</i>	<i>Tax Rate</i>	<i>Cost of Debt (after -tax)</i>
0%	\$0	\$0	•	AAA	4.35%	37.3 0 %	2.73%
10%	\$6,9 77	\$303	9.24	AAA	4.35%	37.3 0 %	2.73%
20%	\$13, 9 54	\$698	4.0 2	A-	5.00%	37.3 0 %	3.14%
30%	\$20, 9 31	\$1,2 5 6	2.23	BB+	6.00%	37.3 0 %	3.76%
40%	\$27, 9 08	\$3,3 4 9	0.84	CCC	12.0 0 %	31.2 4 %	8.25%
50%	\$34, 8 85	\$5,5 8 2	0.50	C	16.0 0 %	18.7 5 %	13.0 0 %
60%	\$41, 8 61	\$6,6 9 8	0.42	C	16.0 0 %	15.6 2 %	13.5 0 %
70%	\$48, 8 38	\$7,8 1 4	0.36	C	16 .0 0 %	13.3 9 %	13.8 6 %
80%	\$55, 8 15	\$8,9 3 0	0.31	C	16.0 0 %	11.7 2 %	14.1 3 %
90%	\$62, 7 92	\$10, 0 47	0.28	C	16.0 0 %	10.4 1 %	14.3 3 %

Disney's Cost of Capital Schedule

Debt Ratio	Cost of Equity	Cost of Debt (after-tax)	Cost of Capital
0%	9.15%	2.73%	9.15%
10%	9.50%	2.73%	8.83%
20%	9.95%	3.14%	8.59%
30%	10.53%	3.76%	8.50%
40%	11.50%	8.25%	10.20%
50%	13.33%	13.00%	13.16%
60%	15.66%	13.50%	14.36%
70%	19.54%	13.86%	15.56%
80%	27.31%	14.13%	16.76%
90%	50.63%	14.33%	17.96%

Disney: Cost of Capital Chart

Figure 8.3: Disney Cost of Capital at different Debt Ratios



Effect on Firm Value

- Firm Value before the change = $55,101 + 14,668 = \$ 69,769$
 - WACC_b = 8.59% Annual Cost = $\$69,769 * 8.59\% = \$5,993$ million
 - WACC_a = 8.50% Annual Cost = $\$69,769 * 8.50\% = \$5,930$ million
 - Δ WACC = 0.09% Change in Annual Cost = $\$ 63$ million
- If there is no growth in the firm value, (Conservative Estimate)
 - Increase in firm value = $\$63 / .0850 = \$ 741$ million
 - Change in Stock Price = $\$741 / 2047.6 = \0.36 per share
- If we assume a perpetual growth of 4% in firm value over time,
 - Increase in firm value = $\$63 / (.0850 - .04) = \$ 1,400$ million
 - Change in Stock Price = $\$1,400 / 2,047.6 = \$ 0.68$ per share

Implied Growth Rate obtained by

Firm value Today = $FCFF(1+g)/(WACC-g)$: Perpetual growth formula

$\$69,769 = \$1,722(1+g)/(.0859-g)$: Solve for $g \rightarrow$ Implied growth = 5.98%

Determinants of Optimal Debt Ratios

■ Firm Specific Factors

- 1. Tax Rate
 - Higher tax rates - - > Higher Optimal Debt Ratio
 - Lower tax rates - - > Lower Optimal Debt Ratio
- 2. Pre-Tax Returns on Firm = (Operating Income) / MV of Firm
 - Higher Pre-tax Returns - - > Higher Optimal Debt Ratio
 - Lower Pre-tax Returns - - > Lower Optimal Debt Ratio
- 3. Variance in Earnings [Shows up when you do 'what if' analysis]
 - Higher Variance - - > Lower Optimal Debt Ratio
 - Lower Variance - - > Higher Optimal Debt Ratio

■ Macro-Economic Factors

- 1. Default Spreads
 - Higher - - > Lower Optimal Debt Ratio
 - Lower - - > Higher Optimal Debt Ratio

II. 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
- $\text{Firm Value} = \text{Unlevered Firm Value} + (\text{Tax Benefits of Debt} - \text{Expected Bankruptcy Cost from the Debt})$
- The optimal dollar debt level is the one that maximizes firm value

Implementing the APV Approach

- Step 1: Estimate the unlevered firm value. This can be done in one of two ways:
 1. 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)
 2. Alternatively, $\text{Unlevered Firm Value} = \text{Current Market Value of Firm} - \text{Tax Benefits of Debt (Current)} + \text{Expected Bankruptcy cost from Debt}$
- 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
 - $\text{Tax benefits} = \text{Dollar Debt} * \text{Tax Rate}$
- 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.

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	37.30%	\$64,556	\$0	AAA	0.01%	\$2	\$64,555
10%	\$6,979	37.30%	\$64,556	\$2,603	AAA	0.01%	\$2	\$67,158
20%	\$13,958	37.30%	\$64,556	\$5,206	A-	1.41%	\$246	\$69,517
30%	\$20,937	37.30%	\$64,556	\$7,809	BB+	7.00%	\$1,266	\$71,099
40%	\$27,916	31.20%	\$64,556	\$8,708	CCC	50.00%	\$9,158	\$64,107
50%	\$34,894	18.72%	\$64,556	\$6,531	C	80.00%	\$14,218	\$56,870
60%	\$41,873	15.60%	\$64,556	\$6,531	C	80.00%	\$14,218	\$56,870
70%	\$48,852	13.37%	\$64,556	\$6,531	C	80.00%	\$14,218	\$56,870
80%	\$55,831	11.70%	\$64,556	\$6,531	C	80.00%	\$14,218	\$56,870
90%	\$62,810	10.40%	\$64,556	\$6,531	C	80.00%	\$14,218	\$56,870

III. Relative Analysis

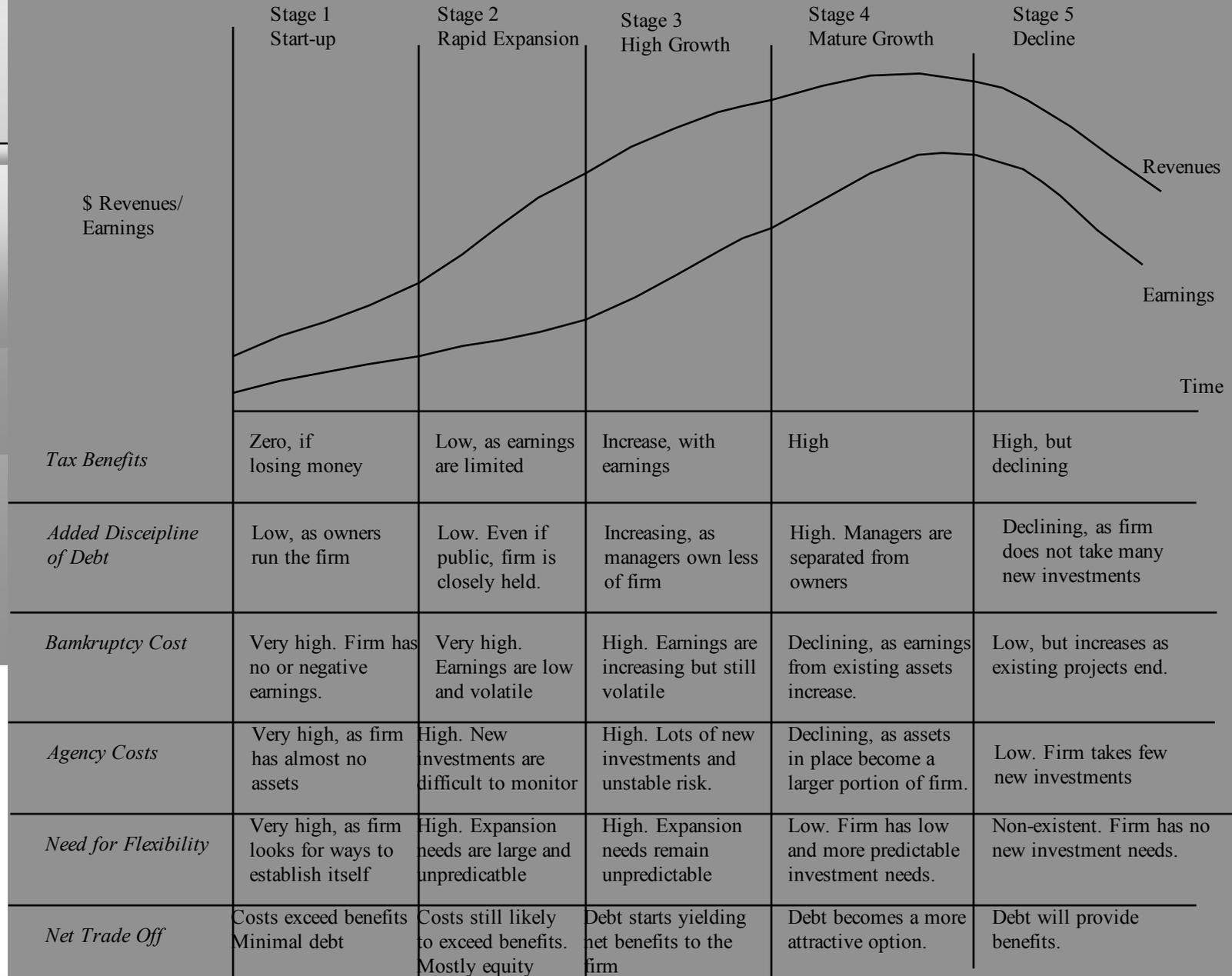
I. Industry Average with Subjective Adjustments

- 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)

Comparing to industry averages

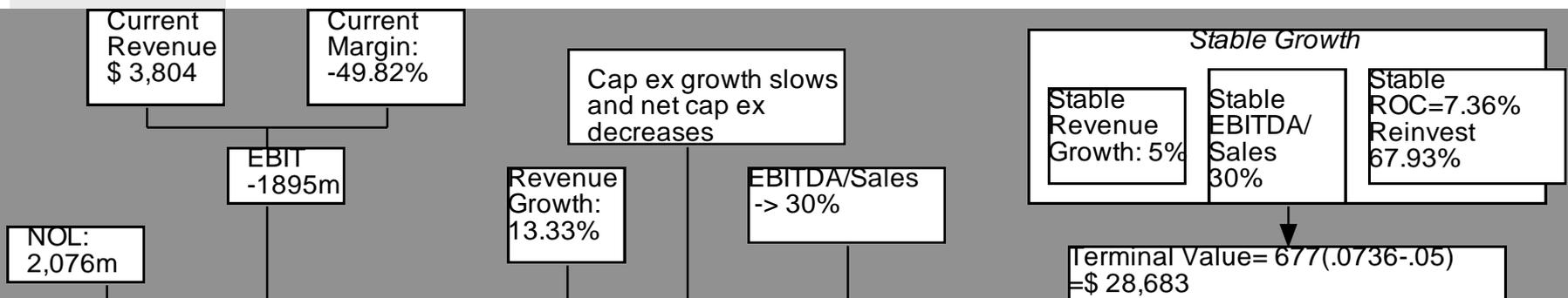
	<i>Disney</i>	<i>Entertainment</i>	<i>Aracruz</i>	<i>Paper and Pulp (Emerging Market)</i>
Market Debt Ratio	21.02%	19.56%	30.82%	27.71%
Book Debt Ratio	35.10%	28.86%	43.12%	49.00%

IV. The Debt-Equity Trade off and Life Cycle



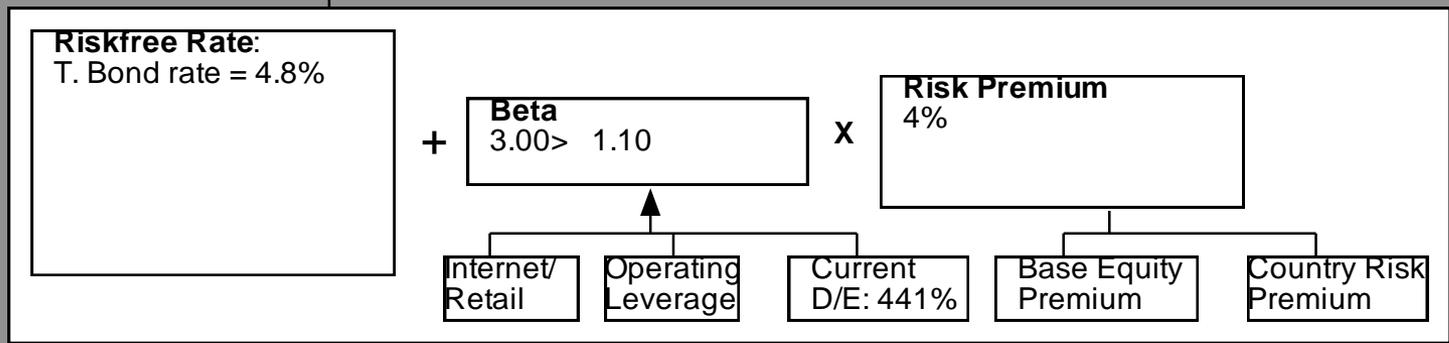
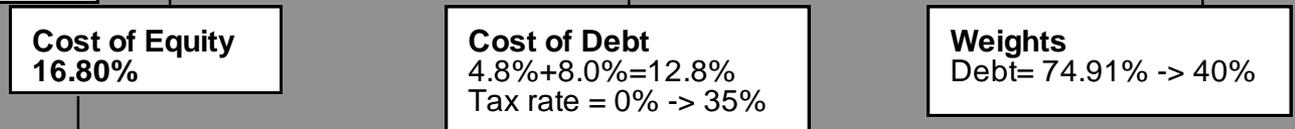
Concern 1: Changing Debt Ratios and Firm Value

- In some cases, you may expect the debt ratio to change in predictable ways over the next few years. You have two choices:
 - Use a target debt ratio for the entire valuation and assume that the transition to the target will be relatively painless and easy.
 - Use year-specific debt ratios, with appropriate costs of capital, to value the firm.
- In many leveraged buyout deals, it is routine to overshoot in the initial years (have a debt ratio well above the optimal) and to use asset sales and operating cash flows to bring the debt down to manageable levels. The same can be said for distressed firms with too much debt: a combination of operating improvements and debt restructuring is assumed to bring the debt ratio down.



Revenues	\$3,804	\$5,326	\$6,923	\$8,308	\$9,139	\$10,053	\$11,058	\$11,942	\$12,659	\$13,292	Term. Year
EBITDA	(\$95)	\$ 0	\$346	\$831	\$1,371	\$1,809	\$2,322	\$2,508	\$3,038	\$3,589	\$13,902
EBIT	(\$1,675)	(\$1,738)	(\$1,565)	(\$1,272)	\$320	\$1,074	\$1,550	\$1,697	\$2,186	\$2,694	\$ 4,187
EBIT (1-t)	(\$1,675)	(\$1,738)	(\$1,565)	(\$1,272)	\$320	\$1,074	\$1,550	\$1,697	\$2,186	\$2,276	\$ 3,248
+ Depreciation	\$1,580	\$1,738	\$1,911	\$2,102	\$1,051	\$736	\$773	\$811	\$852	\$894	\$ 939
- Cap Ex	\$3,431	\$1,716	\$1,201	\$1,261	\$1,324	\$1,390	\$1,460	\$1,533	\$1,609	\$1,690	\$ 2,353
- Chg WC	\$ 0	\$46	\$48	\$42	\$25	\$27	\$30	\$27	\$21	\$19	\$ 20
FCFF	(\$3,526)	(\$1,761)	(\$903)	(\$472)	\$22	\$392	\$832	\$949	\$1,407	\$1,461	\$ 677
		1	2	3	4	5	6	7	8	9	10
Beta	3.00	3.00	3.00	3.00	3.00	2.60	2.20	1.80	1.40	1.00	Forever
Cost of Equity	16.80%	16.80%	16.80%	16.80%	16.80%	15.20%	13.60%	12.00%	10.40%	8.80%	
Cost of Debt	12.80%	12.80%	12.80%	12.80%	12.80%	11.84%	10.88%	9.92%	8.96%	6.76%	
Debt Ratio	74.91%	74.91%	74.91%	74.91%	74.91%	67.93%	60.95%	53.96%	46.98%	40.00%	
Cost of Capital	13.80%	13.80%	13.80%	13.80%	13.80%	12.92%	11.94%	10.88%	9.72%	7.98%	

Value of Op Assets	\$ 5,530
+ Cash & Non-op	\$ 2,260
= Value of Firm	\$ 7,790
- Value of Debt	\$ 4,923
= Value of Equity	\$ 2,867
- Equity Options	\$ 14
Value per share	\$ 3.22



Global Crossing
November 2001
Stock price = \$1.86

Concern 2: The Going Concern Assumption

- Traditional valuation techniques are built on the assumption of a going concern, I.e., a firm that has continuing operations and there is no significant threat to these operations.
 - In discounted cashflow valuation, this going concern assumption finds its place most prominently in the terminal value calculation, which usually is based upon an infinite life and ever-growing cashflows.
 - In relative valuation, this going concern assumption often shows up implicitly because a firm is valued based upon how other firms - most of which are healthy - are priced by the market today.
- When there is a significant likelihood that a firm will not survive the immediate future (next few years), traditional valuation models may yield an over-optimistic estimate of value.

Estimating the probability of distress...

- Global Crossing has a 12% coupon bond with 8 years to maturity trading at \$ 653. To estimate the probability of default (with a treasury bond rate of 5% used as the riskfree rate):

$$653 = \sum_{t=1}^{t=8} \frac{120(1 - \pi_{Distress})^t}{(1.05)^t} + \frac{1000(1 - \pi_{Distress})^8}{(1.05)^8}$$

- Solving for the probability of bankruptcy, we get
 - With a 10-year bond, it is a process of trial and error to estimate this value. The solver function in excel accomplishes the same in far less time.

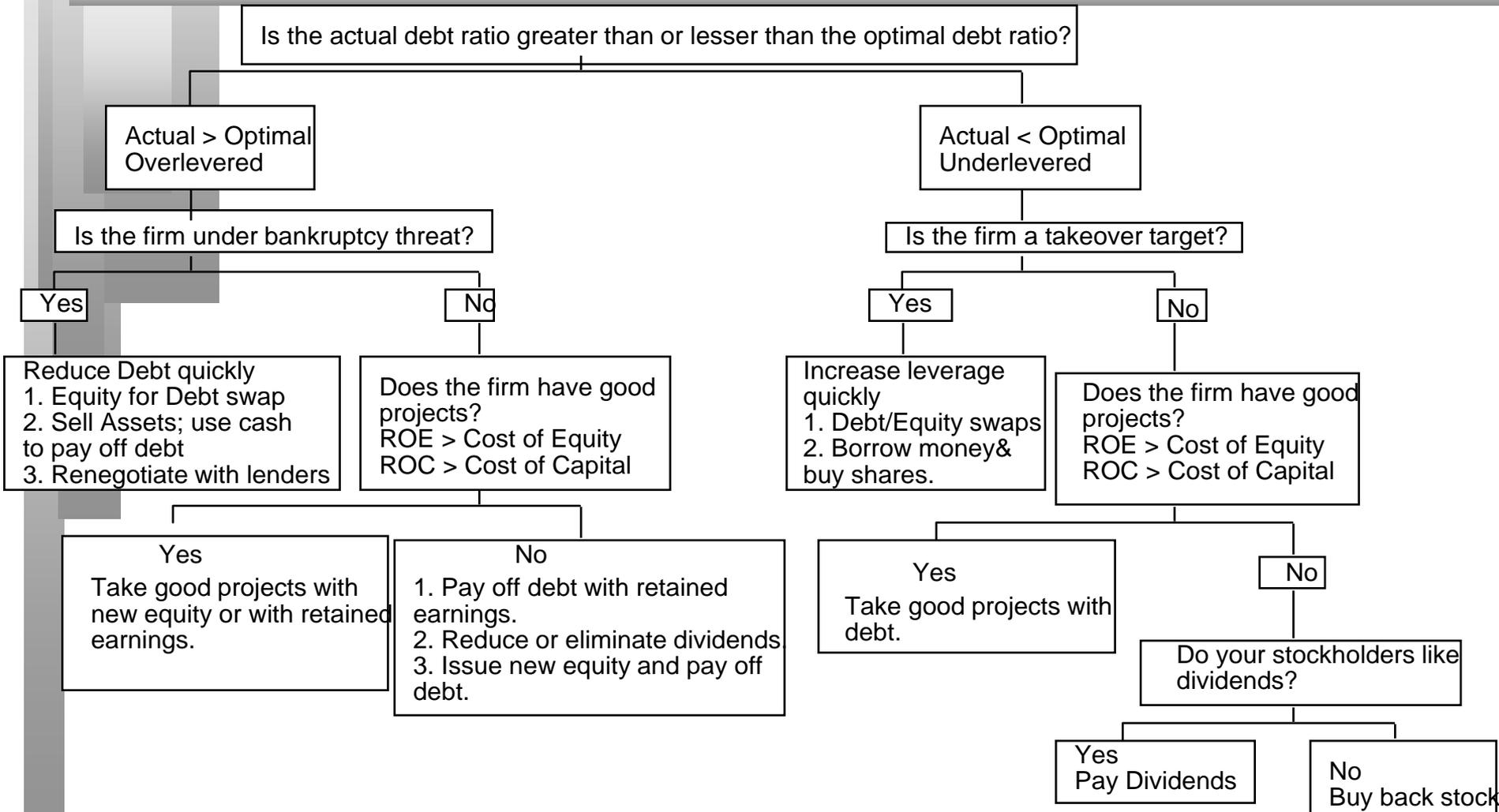
$$\pi_{Distress} = \text{Annual probability of default} = 13.53\%$$

- To estimate the cumulative probability of distress over 10 years:
- Cumulative probability of surviving 10 years = $(1 - .1353)^{10} = 23.37\%$
- Cumulative probability of distress over 10 years = $1 - .2337 = .7663$ or 76.63%

Valuing Global Crossing with Distress

- Probability of distress
 - Cumulative probability of distress = 76.63%
- Distress sale value of equity
 - Book value of capital = \$14,531 million
 - Distress sale value = 25% of book value = $.25 * 14531 = \$3,633$ million
 - Book value of debt = \$7,647 million
 - Distress sale value of equity = \$ 0
- Distress adjusted value of equity
 - Value of Global Crossing = $\$3.22 (1-.7663) + \$0.00 (.7663) = \$ 0.75$

A Framework for Getting to the Optimal



Disney: Applying the Framework

Is the actual debt ratio greater than or lesser than the optimal debt ratio?

Actual > Optimal
Overlevered

Actual < Optimal
Underlevered

Is the firm under bankruptcy threat?

Is the firm a takeover target?

Yes

No

Yes

No

Reduce Debt quickly
1. Equity for Debt swap
2. Sell Assets; use cash to pay off debt
3. Renegotiate with lenders

Does the firm have good projects?
ROE > Cost of Equity
ROC > Cost of Capital

Increase leverage quickly
1. Debt/Equity swaps
2. Borrow money & buy shares.

Does the firm have good projects?
ROE > Cost of Equity
ROC > Cost of Capital

Yes
Take good projects with new equity or with retained earnings.

No
1. Pay off debt with retained earnings.
2. Reduce or eliminate dividends
3. Issue new equity and pay off debt.

Yes
Take good projects with debt.

No
Do your stockholders like dividends?

Yes
Pay Dividends

No
Buy back stock

In conclusion: Debt matters in valuation. It can both create and destroy value..

Assets		Liabilities	
Existing Investments Generate cashflows today Includes long lived (fixed) and short-lived (working capital) assets	Assets in Place	Debt	Fixed Claim on cash flows Little or No role in management <i>Fixed Maturity</i> <i>Tax Deductible</i>
Expected Value that will be created by future investments	Growth Assets	Equity	Residual Claim on cash flows Significant Role in management <i>Perpetual Lives</i>

Different Value? ←

→ Different Financing Mix?