

Application Test: Your firm's optimal financing mix

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- 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?

III. The APV Approach to Optimal Capital Structure

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- 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

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- 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.

Estimating Expected Bankruptcy Cost

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- 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)

Ratings and Default Probabilities: Results from Altman study of bonds

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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.

Disney: Estimating Unlevered Firm Value

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$$\begin{aligned}\text{Current Value of firm} &= \$121,878 + \$15,961 &&= \$ 137,839 \\ - \text{Tax Benefit on Current Debt} &= \$15,961 * 0.361 &&= \$ 5,762 \\ + \text{Expected Bankruptcy Cost} &= 0.66\% * (0.25 * 137,839) &&= \$ 227 \\ \text{Unlevered Value of Firm} &= &&= \$ 132,304\end{aligned}$$

- I will assume the following parameters for Disney:
 - 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

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<i>Debt Ratio</i>	<i>\$ Debt</i>	<i>Tax Rate</i>	<i>Unlevered Firm Value</i>	<i>Tax Benefits</i>	<i>Bond Rating</i>	<i>Probability of Default</i>	<i>Expected Bankruptcy Cost</i>	<i>Value of Levered Firm</i>
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.

IV. Relative Analysis

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- The “safest” place for any firm to be is close to the industry average. Me-tooism is a survival mechanism, and pushes managers towards peer group behavior.
- 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

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<i>Company</i>	<i>Debt to Capital Ratio</i>		<i>Net Debt to Capital Ratio</i>		<i>Comparable group</i>	<i>Debt to Capital Ratio</i>		<i>Net Debt to Capital Ratio</i>	
	<i>Book value</i>	<i>Market value</i>	<i>Book value</i>	<i>Market value</i>		<i>Book value</i>	<i>Market value</i>	<i>Book value</i>	<i>Market value</i>
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%

Getting past simple averages

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

$$\text{Debt Ratio} = a + b (\text{Tax rate}) + c (\text{Earnings Variability}) + d (\text{EBITDA/Firm Value})$$

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 crosssectional regression, we can obtain an estimate of predicted debt ratio.

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

Applying the Regression Methodology: Global Auto Firms

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

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

- 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%.

Extending to the entire market

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- 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 –

$$\text{DFR} = 0.27 - 0.24 \text{ ETR} - 0.10 g - 0.065 \text{ INST} - 0.338 \text{ CVOI} + 0.59 \text{ E/V}$$

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

$$\text{DFR} = \text{Debt} / (\text{Debt} + \text{Market Value of Equity})$$

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

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- 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%

Coefficient 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?

Summarizing the optimal debt ratios...

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	<i>Disney</i>	<i>Vale</i>	<i>Tata Motors</i>	<i>Baidu</i>
<i>Actual Debt Ratio</i>	11.58%	35.48%	29.28%	5.23%
<i>Optimal</i>				
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%	—	-	

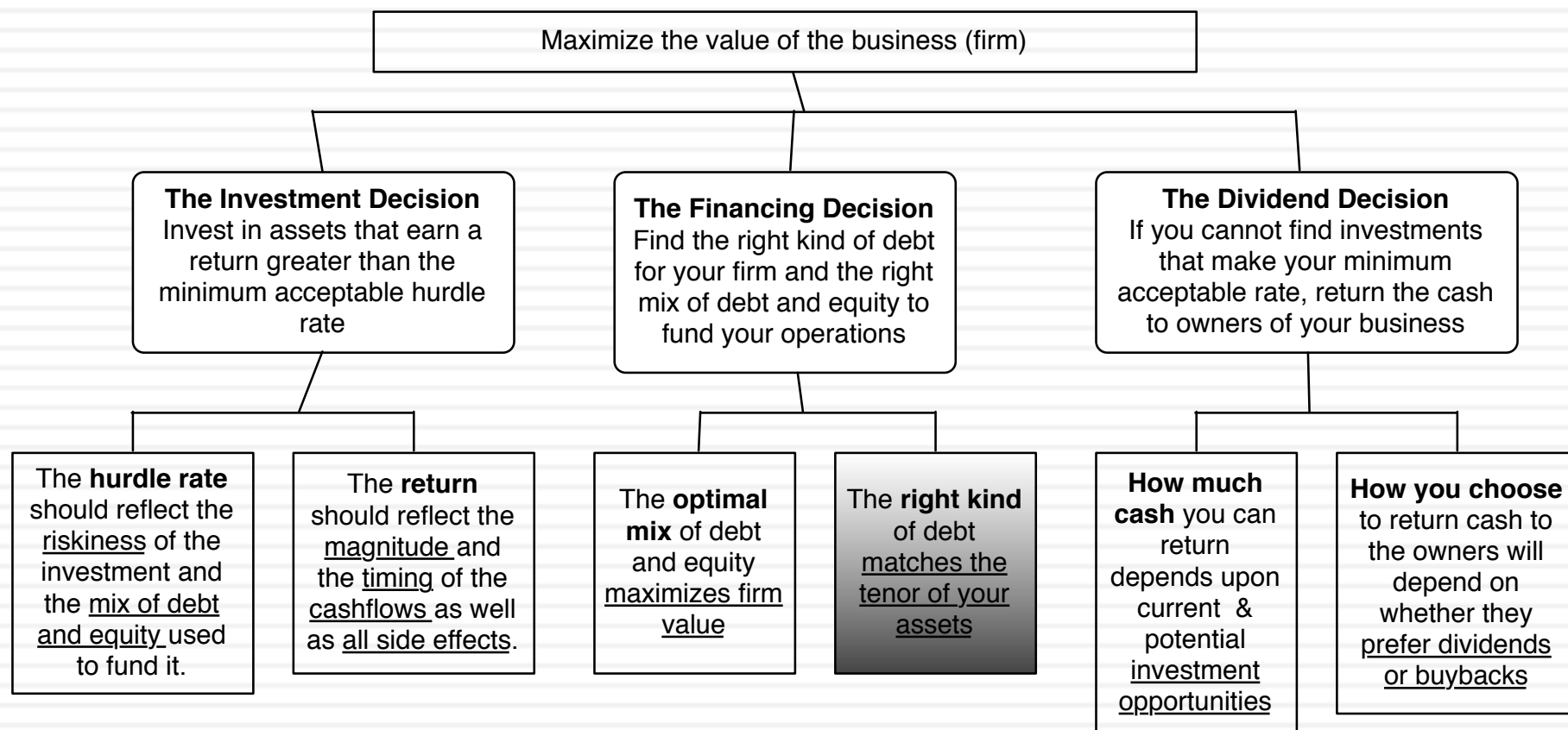


GETTING TO THE OPTIMAL: TIMING AND FINANCING CHOICES

You can take it slow.. Or perhaps not...

Back to the Big Picture!

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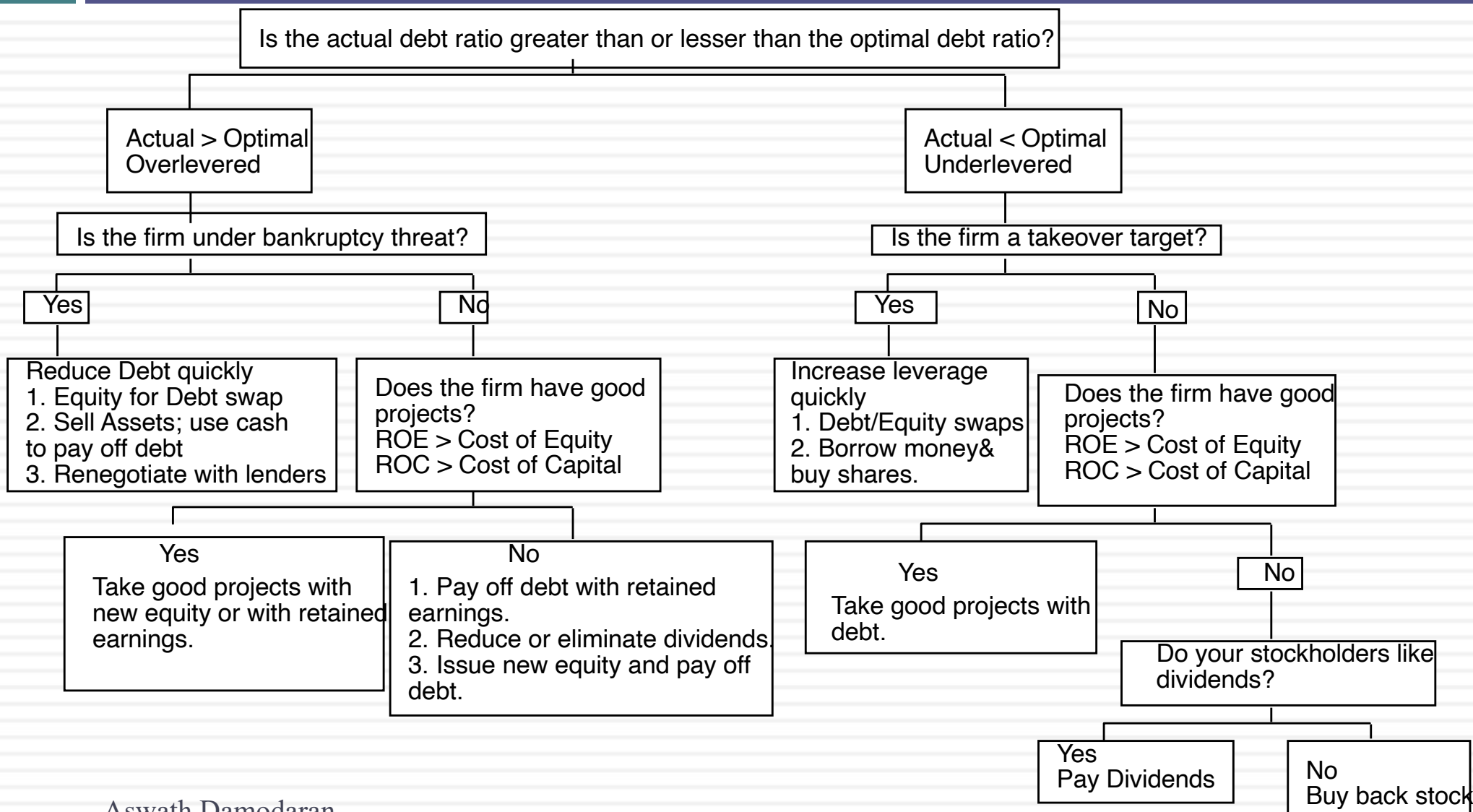
Now that we have an optimal.. And an actual.. What next?

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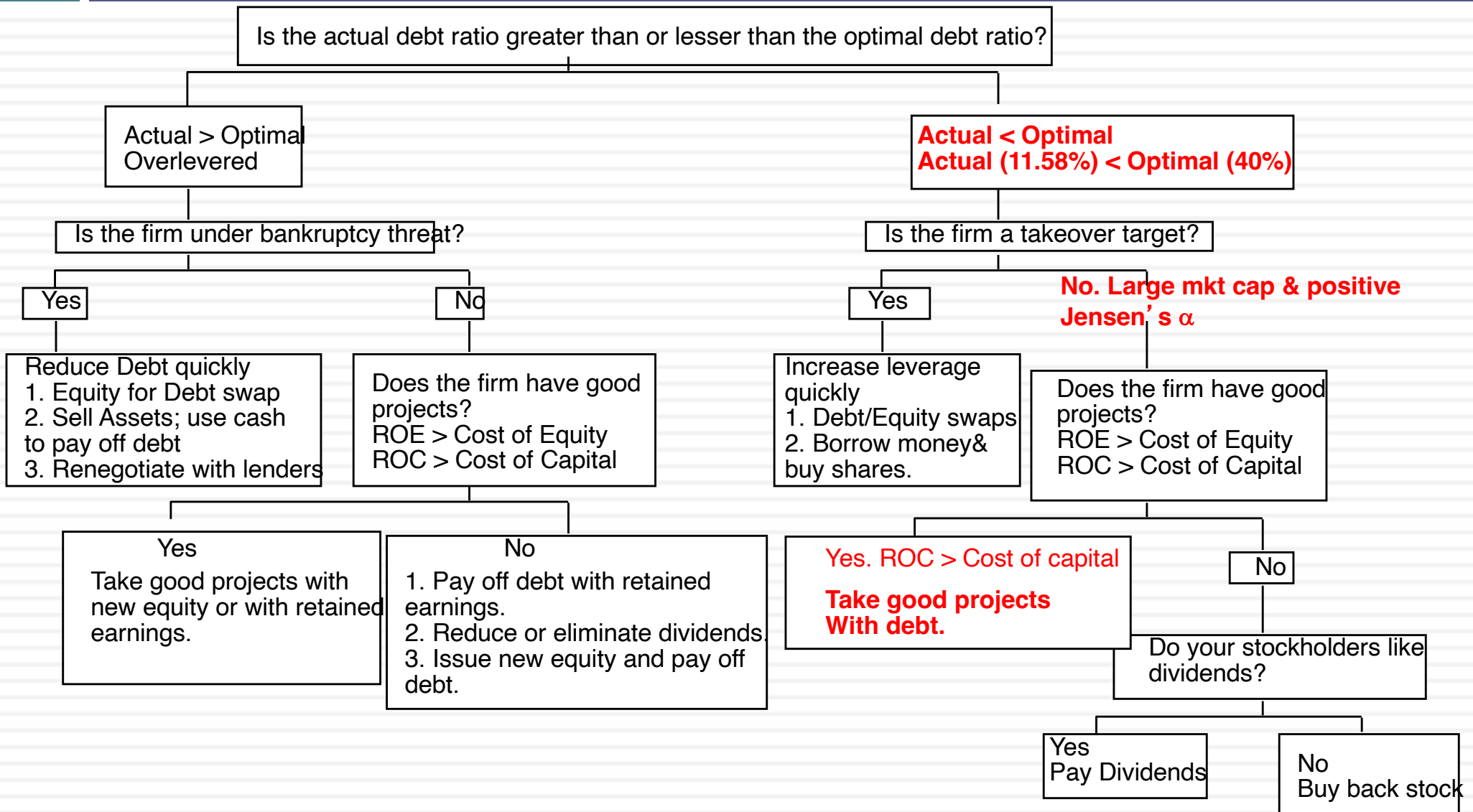
- At the end of the analysis of financing mix (using whatever tool or tools you choose to use), you can come to one of three conclusions:
 1. The firm has the right financing mix
 2. It has too little debt (it is under levered)
 3. It has too much debt (it is over levered)
- The next step in the process is
 - Determining whether to move to the optimal (is it worth the move and disruption, if the value change is small?)
 - If you decide to move, how quickly or gradually the firm should move to its optimal?
 - Assuming that it does, the right kind of financing to use in making this adjustment..

A Framework for Getting to the Optimal

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Disney: Applying the Framework



Application Test: Getting to the Optimal

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- Based upon your analysis of both the firm's capital structure and investment record, what path would you map out for the firm?
 - a. Immediate change in leverage
 - b. Gradual change in leverage
 - c. No change in leverage
- Would you recommend that the firm change its financing mix by
 - a. Paying off debt/Buying back equity
 - b. Take projects with equity/debt

The Mechanics of Changing Debt Ratio quickly...

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To decrease the debt ratio

Sell operating assets and use cash to pay down debt.

Issue new stock to retire debt or get debt holders to accept equity in the firm.

Assets	Liabilities
Cash	Debt
Operating Assets in place	Equity
Growth Assets	
<i>Sell operating assets and use cash to buy back stock or pay or special dividend</i>	<i>Borrow money and buy back stock or pay a large special dividend</i>

To increase the debt ratio

The mechanics of changing debt ratios over time... gradually...

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- To change debt ratios over time, you use the same mix of tools that you used to change debt ratios gradually:
 - Dividends and stock buybacks: Dividends and stock buybacks will reduce the value of equity.
 - Debt repayments: will reduce the value of debt.
- The complication of changing debt ratios over time is that firm value is itself a moving target.
- If equity is fairly valued today, the equity value should change over time to reflect the expected price appreciation:
 - Expected Price appreciation = Cost of equity – Dividend Yield
 - Debt will also change over time, in conjunction as firm value changes.

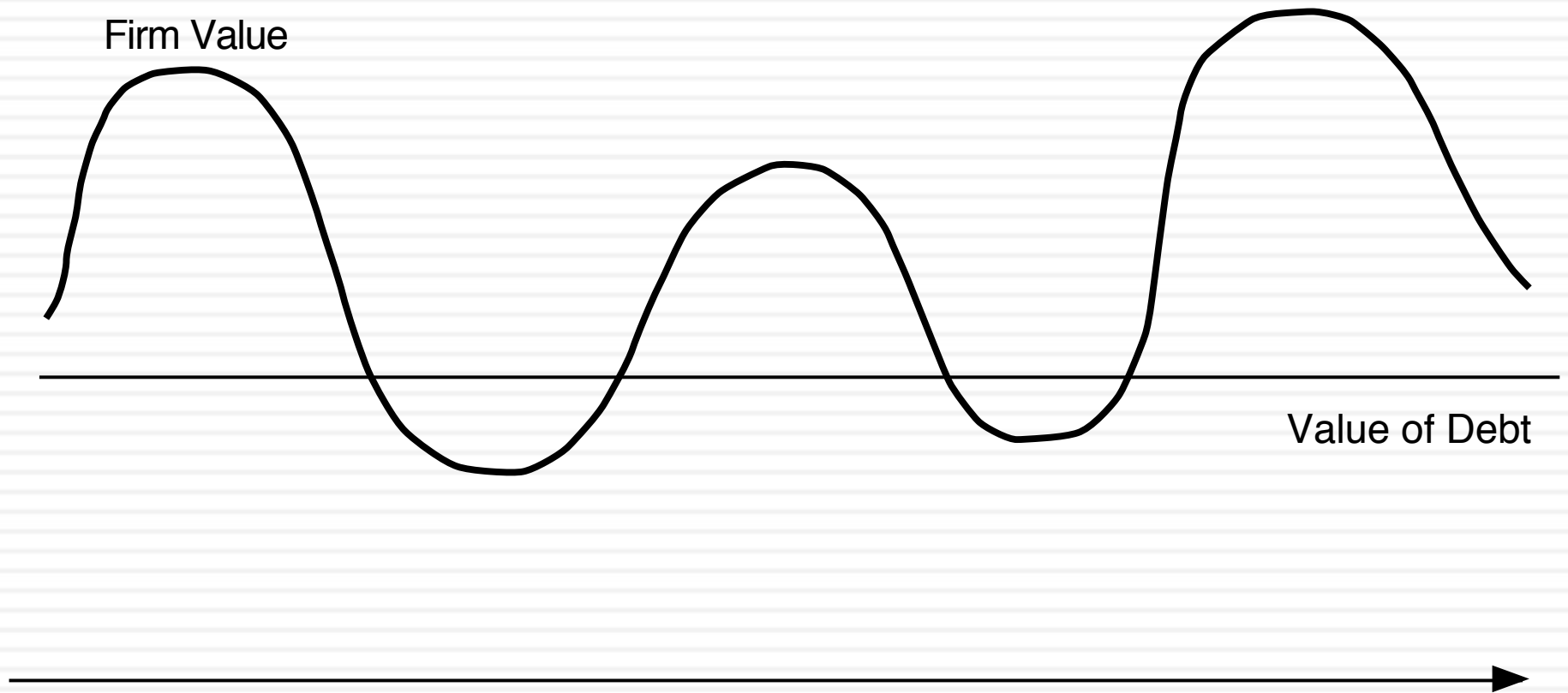
Designing Debt: The Fundamental Principle

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- The objective in designing debt is to make the cash flows on debt match up as closely as possible with the cash flows that the firm makes on its assets.
- By doing so, we reduce our risk of default, increase debt capacity and increase firm value.
- In essence, we are making debt look and behave like equity, in terms of flexibility.

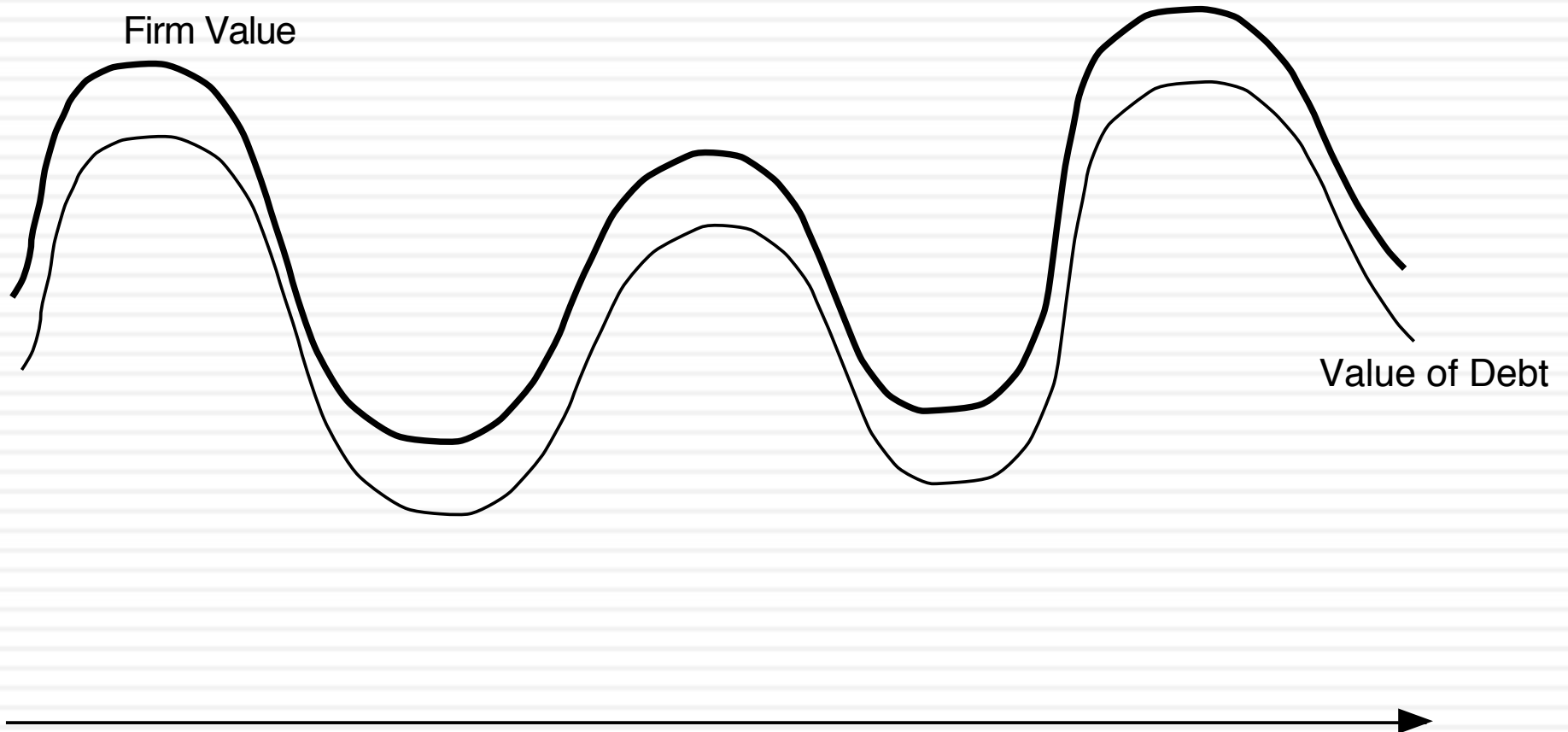
Firm with mismatched debt

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Firm with matched Debt

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Design the perfect financing instrument

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- The perfect financing instrument will
 - ▣ Have all of the tax advantages of debt
 - ▣ While preserving the flexibility offered by equity

