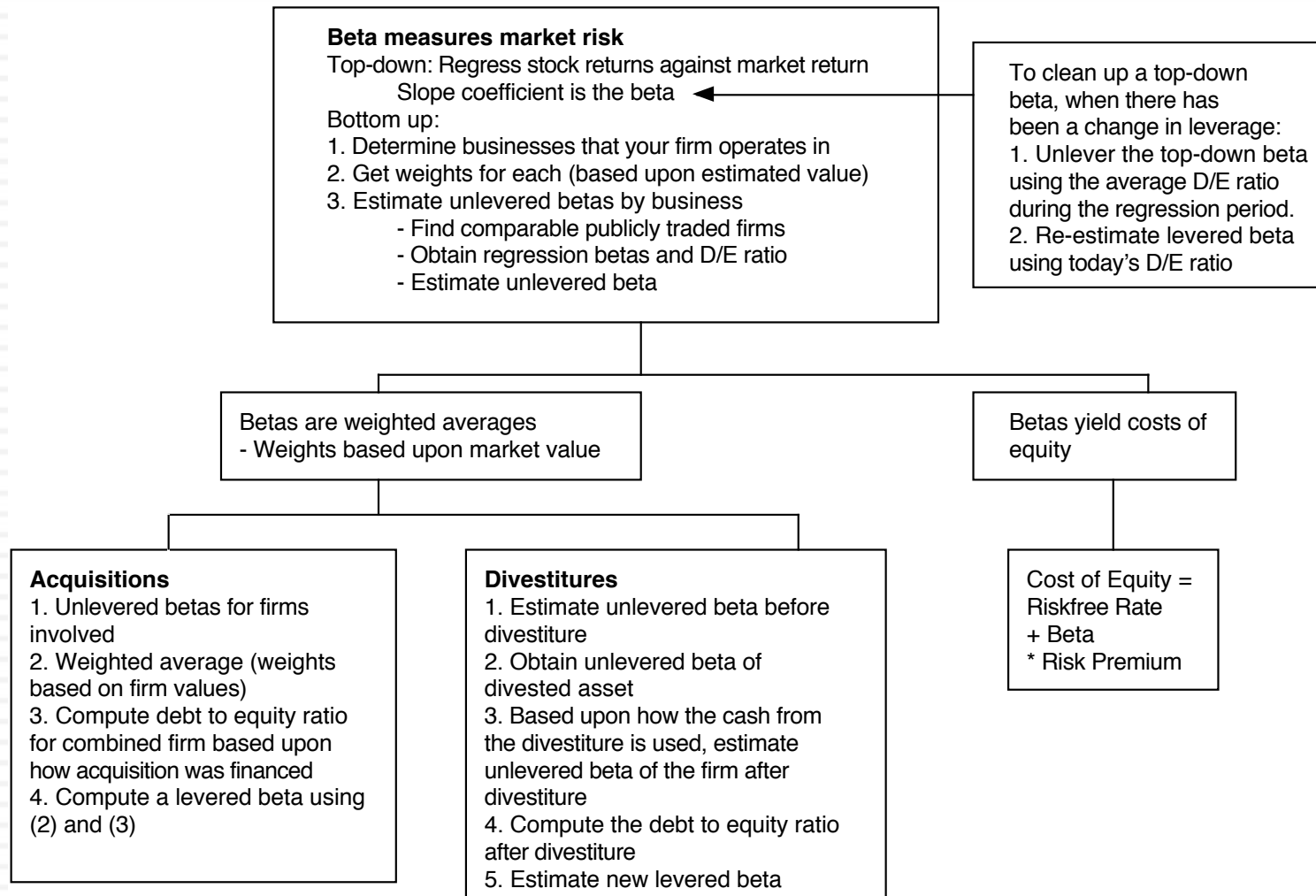




## FINAL REVIEW

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

# The mechanics of beta



# From beta to cost of equity

- To get from beta to cost of equity, you need two other inputs – a risk free rate and an equity risk premium:  
Cost of Equity = Risk free Rate + Beta (Equity Risk Premium)
- The risk free rate has to be in the currency that you choose to do the analysis in.
  - ▣ If the currency has a default-free government issuing long term bond, use the government bond rate.
  - ▣ If the currency is issued by a government with default risk, you need to net the default spread for that government from the government bond rate.
- The equity risk premium should reflect the countries you operate it, with weights reflecting your exposure; the weights can be revenues or operation based.

# Beta & Cost of Equity Calculation: An Example

- Sumi Inc. is an all-equity funded company that is incorporated in Thailand but gets a large portion of its revenue in the US, while operating in two businesses: steel and chemicals. You have been provided the geographic and business breakdown for the value of the company in the table below (in millions of US\$):

Country	Steel	Chemicals	ERP for Country
US	\$800	\$200	5.00%
Thailand	\$400	\$100	7.25%
Unlevered beta for business	1.20	0.90	

The US treasury bond rate is 2.5% and the Thai US\$ Government bond rate is 4.5%. Estimate the cost of equity for the company in US dollar terms.

# Cost of equity calculation

- Risk free Rate = 2.5%

- ▣ What if you had been asked to compute cost of equity in Baht?

- Beta

<i>Business</i>	<i>Unlevered beta</i>	<i>Value</i>	<i>Weights</i>
Steel	1.2	\$1,200	80%
Chemicals	0.9	\$300	20%
Company	1.14	\$1,500	

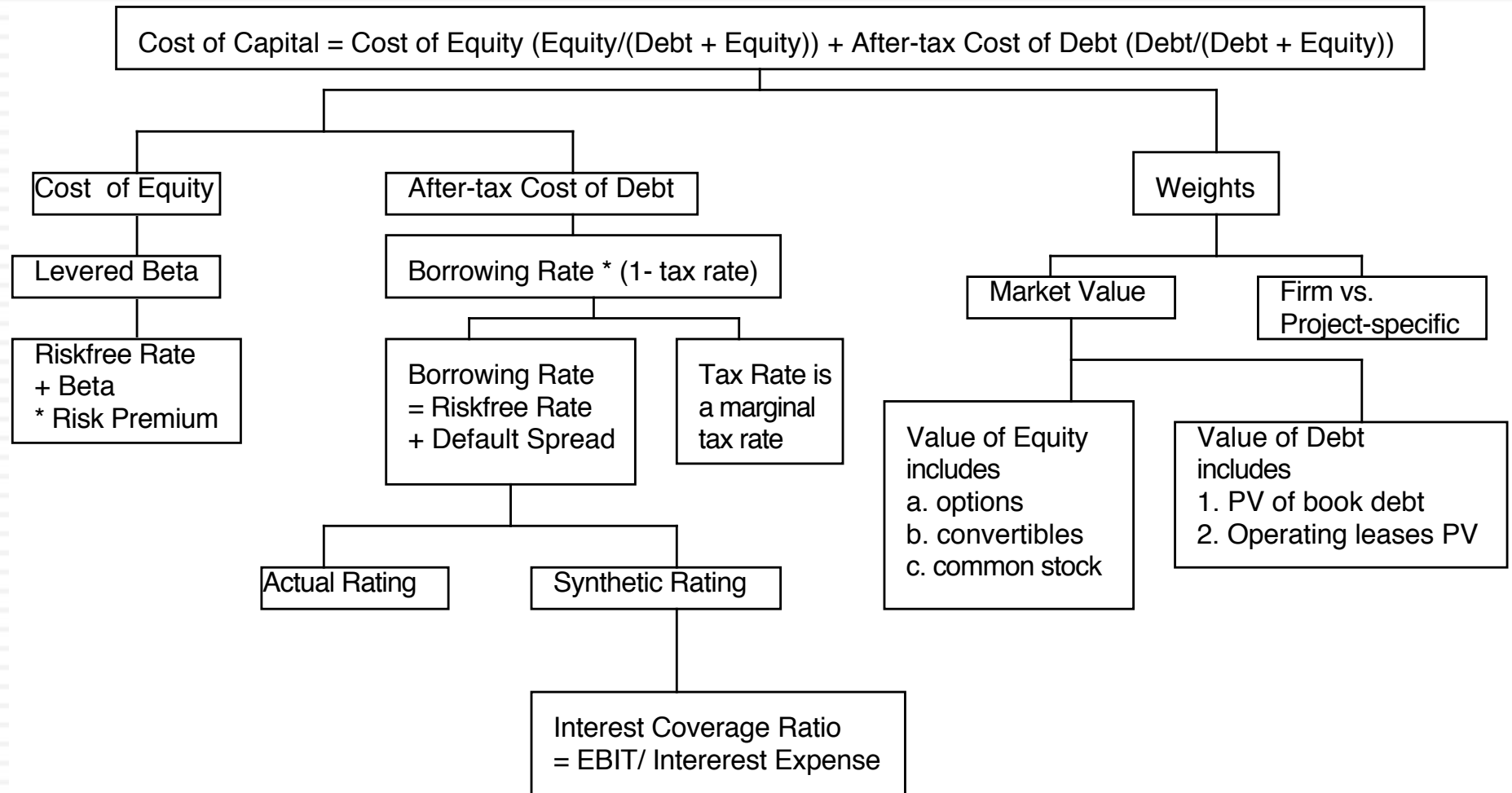
$$\text{Levered Beta} = 1.14 (1 + (1-t) (0)) = 1.14$$

- ERP

<i>Country</i>	<i>Value</i>	<i>Weight</i>	<i>ERP</i>
US	\$1,000	66.67%	5.00%
Thailand	\$500	33.33%	7.25%
Company			5.7500%

- Cost of Equity = 2.5% + 1.14 (5.75%) = 9.055%

# Cost of Capital



# An Example

- Collins Inc. is a publicly traded company with a market capitalization (market value of equity) of \$900 million and \$100 million in interest-bearing debt. You have computed a cost of capital for the company based on this mix:

	Market Value (inUS\$)	% of Capital	Cost of component
Debt	\$100.00	10.00%	3.00% (after tax)
Equity	\$900.00	90.00%	9.00%
Capital	\$1,000.00	100.00%	8.400%

Reviewing your calculations, you realize that while the unlevered beta (used to estimate a levered beta and a cost of equity) and cost of debt estimates are right, you forgot to capitalize lease commitments, which amount to \$120 million a year, each year for the next ten years. If you capitalize leases (and treat them as debt), estimate the correct cost of capital for the company. (The riskfree rate is 3%, the equity risk premium is 5% and the marginal tax rate is 40%)

# The Solution

- Start with the existing debt ratio and back out unlevered beta
  - ▣ Debt/Equity = 10/90
  - ▣ Levered Beta = 1.20 (Solve  $9\% = 3\% + \text{Beta} * 5\%$ )
  - ▣ Unlevered Beta =  $1.20 / (1 + (1 - .40) (10/90)) = 1.125$
- Convert leases to debt
  - ▣ Pre-tax cost of debt = 5% (After-tax cost = 3%)
  - ▣ PV of leases = PV of \$120 million for 10 years @5% = \$927
- Lever beta back up at new debt ratio
  - ▣ Levered beta =  $1.125 (1 + (1 - .4) (1027/900)) = 1.89$
  - ▣ Cost of equity =  $3\% + 1.89 (5\%) = 12.47\%$
- Compute new cost of capital
  - ▣ Debt to Capital =  $1027 / (1027 + 900) = 53.29\%$
  - ▣ Cost of capital =  $12.47\% (.4671) + 3\% (.5329) = 7.43\%$



# Is this a good project

## Cash Flows

Cash Flow to Firm  
=  $EBIT(1-t)$   
+ Deprecn & Amort  
- Capital Maintenance  
- Change in Non-cash WC

NPV  
= PV of Cash flow to Firm  
at the Cost of Capital  
- Investment in Project  
Accept if  $>0$

IRR  
: Discount rate that makes  
PV of cash flow to firm equal  
to the Investment in project  
Compare to Cost of Capital

Cash Flow to Equity  
= Net Income  
+ Deprecn & Amort  
- Capital Maintenance  
- Change in Non-cash WC  
- Principal Repaid  
+ New Debt Issues

NPV  
= PV of Cash flow to Equity  
at the Cost of Equity  
- Equity Investment in  
Project  
Accept if  $>0$

IRR  
: Discount rate that makes  
PV of cash flow to equity  
equal to the Equity  
Investment in project  
Compare to Cost of Equity

## Earnings

After-tax Operating  
Earnings (EBIT (1-t))

Return on Capital  
=  $EBIT(1-t) / \text{Capital Invested}$

Return Spread  
=  $ROC - \text{Cost of Capital}$

EVA  
=  $\text{Return Spread} * \text{Capital Invested}$

Net income

Return on Equity  
=  $\text{Net Income} / \text{Equity Invested}$

Return Spread  
=  $ROE - \text{Cost of Equity}$

Equity EVA  
=  $\text{Return Spread} * \text{Equity Invested}$

# An Example

- You have been asked to estimate the NPV of an investment in a new 3-year venture for a telecom firm.
  - ▣ The initial investment is expected to be \$1 billion and will be depreciated straight line over three years to a salvage value of \$100 million at the end of the third year.
  - ▣ During the three years, working capital is expected to be 15% of revenues and the investment has to be made at the start of each year; it can be fully salvaged at the end of the project.
  - ▣ The cost of capital for the investment is 9% and the tax rate is 30%.
  - ▣ The project is expected to have the following revenues and EBITDA for the next 3 years (in millions of dollars)

	1	2	3
Revenues	\$1,000.00	\$1,200.00	\$1,500.00
EBITDA	\$300.00	\$400.00	\$600.00

- Calculate the NPV of this project.

# The Solution

	0	1	2	3
Revenues		\$1,000.00	\$1,200.0	\$1,500.0
EBITDA		\$300.00	\$400.00	\$600.00
- DA		\$300.00	\$300.00	\$300.00
EBIT		\$0.00	\$100.00	\$300.00
- Taxes		\$0.00	\$30.00	\$90.00
EBIT (1-t)		\$0.00	\$70.00	\$210.00
+ Depreciation		\$300.00	\$300.00	\$300.00
- Cap Ex	\$1,000.00			-\$100.00
- Chg in WC	\$150.00	\$30.00	\$45.00	-\$225.00
FCFF	-\$1,150.00	\$270.00	\$325.00	\$835.00
PV of CF	-\$1,150.00	\$247.71	\$273.55	\$644.77
<b>NPV</b>	<b>\$ 16.03</b>			

# Another Example

- Underpaid at your job, you are considering becoming an Uber driver. While you believe that you can make \$12/hour after taxes and vehicle maintenance costs, driving 800 hours a year, you also recognize that you will need to buy a more expensive car (than the one you would normally buy) and that the car will not last as long, if you drive for Uber:

	Without Uber	With Uber
Cost of car	\$15000	\$25000
Car life (in years)	5	3
Salvage value (at end of life)	\$5,000	\$4,000
Depreciation method	None	Straight line for tax purposes

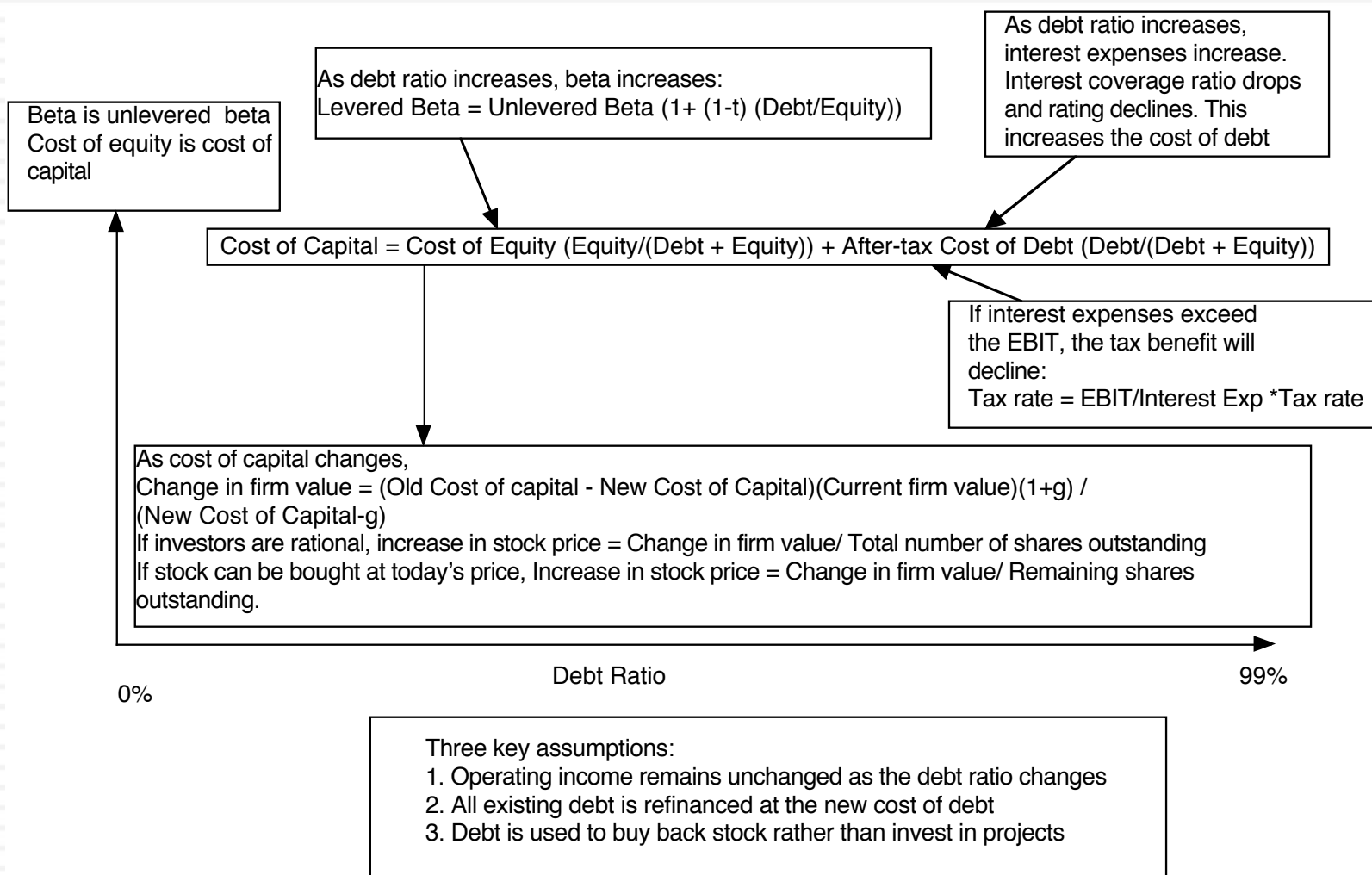
- If your tax rate is 40% and your discount rate is 8%, estimate the annual after-tax income you will earn as an Uber driver, with the incremental car costs factored in. (You can assume that your income will stay constant over time, as will the car related costs in this table)

# The solution

Number of hours driven per year =	800
Annual income (net of fuel and maintenance costs) =	\$ 9,600
Discount Rate =	8.00%
Additional car cost (see below) =	\$ (2,764)
Annual income net of car cost =	\$ 6,836
Income earned per hour	\$ 8.54

	Without Uber	With Uber
Cost of car	\$15000	\$25000
Years of life	5	3
Salvage value	\$5,000	\$4,000
Depreciation	None	Straight line
NPV of car (without Uber) =	-\$11,597.08	-\$14,608.80
Annual cost	\$ (2,905)	\$ (5,669)

# Leverage and Cost of Capital



# An Example

- Maxim Enterprises currently has the following capital structure (with associated costs):

	Market Value	Cost of Component (after taxes)
Debt =	\$400.00	2.40%
Equity =	\$600.00	9.30%
Capital	\$1000.00	6.54%

- The company is expected to generate \$48 million in operating income next year and face a marginal tax rate of 40% on taxable income.
- If Maxim borrows \$400 million and buys back stock, you believe that this will double the pre-tax cost of debt. Estimate the cost of capital for the firm after the recapitalization. (The risk free rate is 3% and the equity risk premium is 5%.)

# The Solution

Current cost of debt (pre-tax)	4%
Current beta = (Solve $9.3\% = 3\% + \text{Beta} * 5\%$ )	1.2600
New Debt =	800
New Interest rate =	0.08
New Interest expense =	\$64
Tax rate (for use on cost of debt) = $40\% * (48/64) =$	30.00%
New Equity=	200
Unlevered beta =	0.9
New beta =	3.42
New cost of equity =	20.100%
New cost of debt =	5.60%
Cost of capital =	8.50%



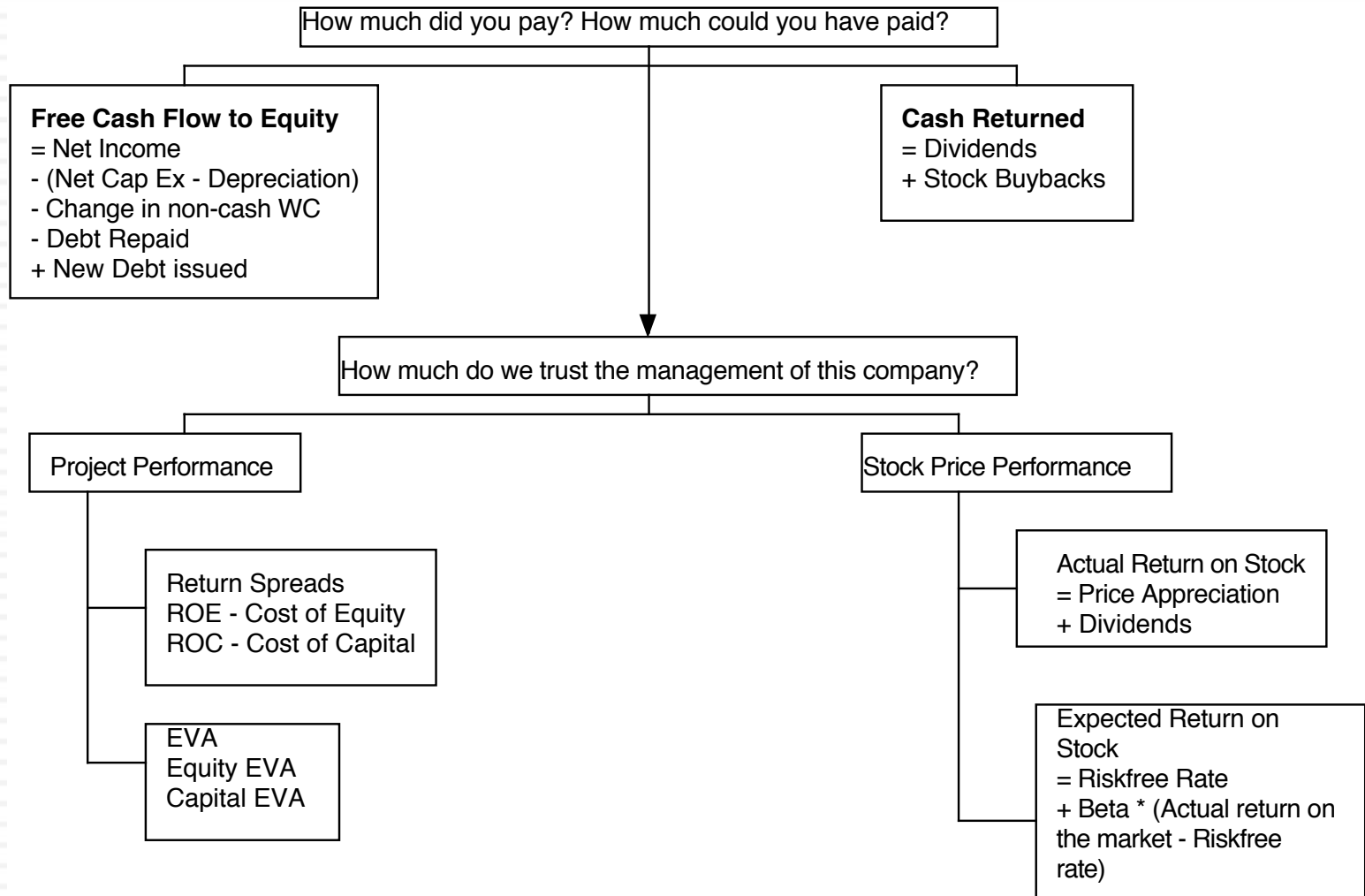
# Another Example

- Conway Inc. has 125 million shares, trading at \$8/share, no debt and a cost of equity of 9%.
- You believe that if the company is able to borrow \$400 million and buy back shares, the cost of capital will drop to 8%.
- If there is no growth in the savings (from a lower cost of capital) and the shares are bought back at \$10/share, estimate the value per share for the remaining shares after the buyback.

# The solution

Current Share Price	8
Number of shares outstanding	125
Current cost of equity =	9.00%
New cost of equity =	8.00%
Borrowing	400
Buyback price	\$10
After buyback	
Old firm value =	1000
Change in firm value = $1000 (.09-.08)/.08 =$	125
New firm value =	1125
New Debt =	400
New Equity =	725
Shares outstanding after buyback	85
Value per share after buyback	\$ 8.53

# The Dividend Framework



# An Example

- Roslyn Inc. is a small, publicly traded company that had revenues of \$250 million in the most recent year, while breaking even (a profit of zero).
- Currently, the company has total working capital of \$35 million, which includes a cash balance of \$25 million. The table below provides estimates of revenues and net profit margins for the company, for the next five years.

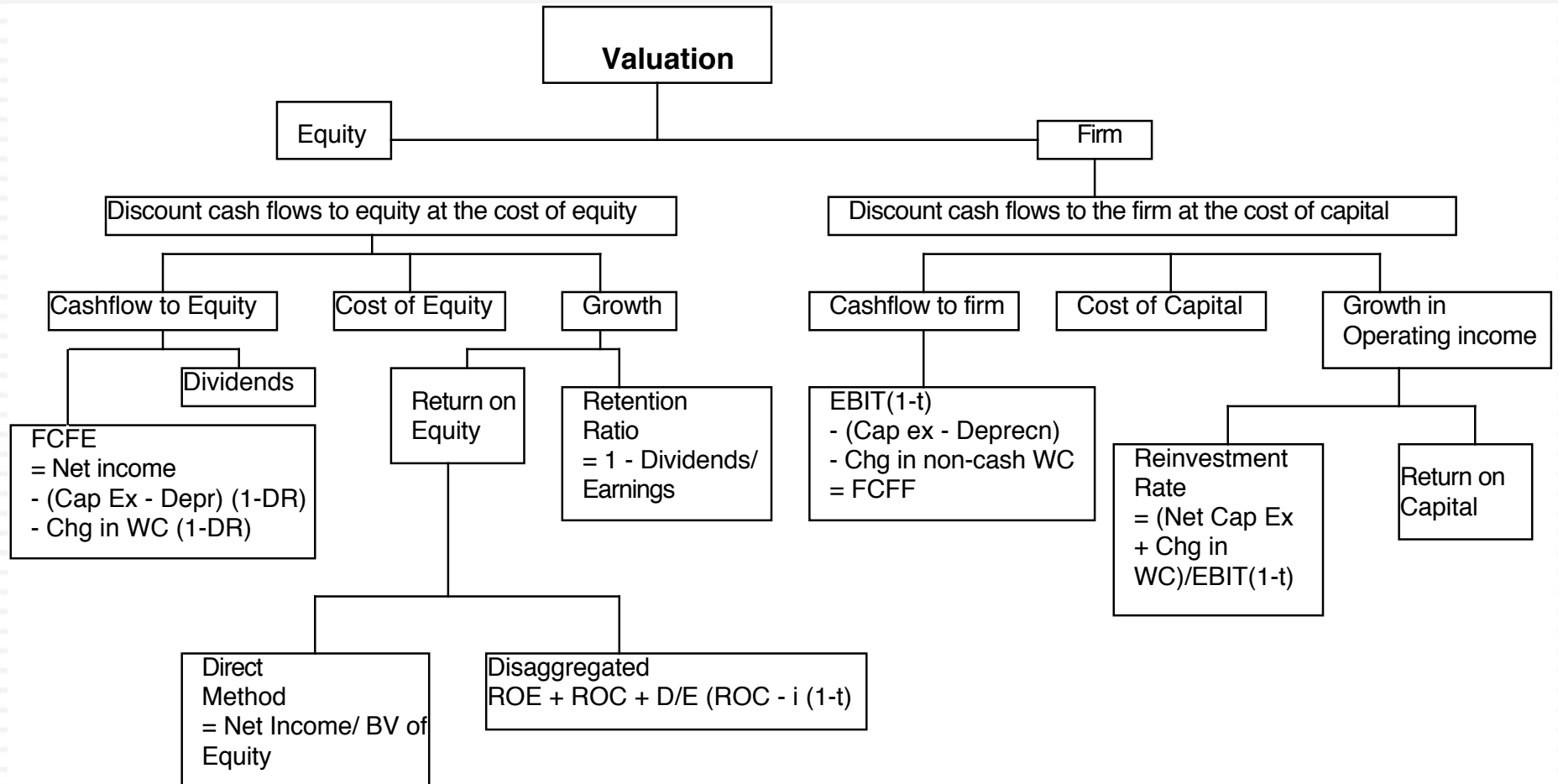
Year	1	2	3	4	5
Revenue (in millions)	\$750.00	\$1,000.00	\$1,200.00	\$1,350.00	\$1,500.00
Net Profit Margin	2%	3%	4%	5%	6%

- The company plans to keep its non-cash working capital, as a percent of revenues, constant for the next five years and has no significant capital expenditures or depreciation over that period.
- If the company plans to return no cash in years 1 and 2, and pay out 40% of net income as dividends in years 3-5, estimate how much of a cash balance it will have at the end of year 5.

# The Solution

	Most recent year	1	2	3	4	5
Revenues	250	\$ 750.00	\$ 1,000.00	\$ 1,200.00	\$ 1,350.00	\$ 1,500.00
Net Margin	0%	2%	3%	4%	5%	6%
Net Income		\$15.00	\$30.00	\$48.00	\$67.50	\$90.00
Change in NC working capital		\$20.00	\$10.00	\$8.00	\$6.00	\$6.00
<b>FCFE</b>		<b>-\$5.00</b>	<b>\$20.00</b>	<b>\$40.00</b>	<b>\$61.50</b>	<b>\$84.00</b>
Dividends				\$19.20	\$27.00	\$36.00
<b>Cash Balance</b>	<b>\$25.00</b>	<b>\$20.00</b>	<b>\$40.00</b>	<b>\$60.80</b>	<b>\$95.30</b>	<b>\$143.30</b>
Total NC Working Capital	\$10.00	\$30.00	\$40.00	\$48.00	\$54.00	\$60.00

# Valuation Mechanics



# A Valuation Example

- You are trying to value Hollow Inc. and have estimated the following cash flows for the firm for its high growth period:

	Last year	1	2	3
<b>Growth Rate</b>		7.5%	7.5%	7.5%
<b>EBIT (1-t)</b>	\$100.00	\$107.50	\$115.56	\$124.23
<b>+ Depreciation</b>	\$20.00	\$21.50	\$23.22	\$25.08
<b>- Cap Ex</b>	\$80.00	\$86.00	\$92.88	\$100.31
<b>FCFF</b>	\$40.00	\$43.00	\$45.90	\$49.00
<b>Cost of capital</b>		10%	10%	10%

- After year 3, Hollow Inc. is expected to be a mature firm, growing 2.5% a year in perpetuity with a cost of capital of 8%. If the company will earn the same return on capital (as it is expected to earn in years 1-3) in perpetuity, estimate the terminal value of the firm, i.e., the value of the firm at the of year 3.

# The Solution

	<i>Last year</i>	<i>1</i>	<i>2</i>	<i>3</i>
Expected Growth Rate		7.5%	7.5%	7.5%
EBIT (1-t)	\$100.00	\$107.50	\$115.56	\$124.23
+ Depreciation	\$20.00	\$21.50	\$23.22	\$25.08
- Cap Ex	\$80.00	\$86.00	\$92.88	\$100.31
FCFF	\$40.00	\$43.00	\$45.90	\$49.00
Cost of capital		10%	10%	10%

Reinvestment Rate = 60%

Return on capital =  $g / \text{Reinvestment Rate} = 7.5\% / 60\% = 12.5\%$

Expected growth rate in perpetuity	2.50%
Expected reinvestment rate in perpetuity = $g / \text{ROC} = 2.5\% / 12.5\%$	20%
EBIT(1-t) in year 4	\$127.33
FCFF in year 4 =	\$101.86
Terminal Value = $\$101.86 / (.08 - .025) =$	\$ 1,852.15

Year	<i>1</i>	<i>2</i>	<i>3</i>
CF	\$43.00	\$45.90	\$49 + \$1852.15 = \$1,901.15
PV	\$39.09	\$37.94	\$1,428.36
Value today @ 10%	\$1,505.39		



	<b>Dividend Discount Model</b>	<b>FCFE Discount Model</b>	<b>Firm Valuation Model</b>
Earnings base	Net Income	Net Income	After-tax Operating Income
Reinvestment	Whatever is not paid out as dividends	Equity portion of Net Cap ex and Change in working capital = $(1-DR) (\text{Cap Ex} - \text{Depreciation} + \text{Change in WC})$	Net cap ex and Change in Working Capital = $(\text{Cap Ex} - \text{Depreciation} + \text{Change in WC})$
Cashflow	Dividends	FCFE = Net Income - $(1-DR) (\text{Cap Ex} - \text{Depreciation} + \text{Change in WC})$	FCFF = EBIT (1-tax rate) - $(\text{Cap Ex} - \text{Depreciation} + \text{Change in WC})$
Discount Rate	Cost of equity	Cost of equity	Cost of capital
How much is invested?	Retention Ratio = $1 - (\text{Dividends}/\text{Earnings})$	Equity Reinvestment Rate (ERR) = $(1-DR) (\text{Cap Ex} - \text{Depreciation} + \text{Change in WC}) / \text{Net Income}$	Reinvestment Rate (RR) = $(\text{Cap Ex} - \text{Depreciation} + \text{Change in WC}) / \text{EBIT} (1-t)$
How well?	ROE = Net Income/ BV of Equity	ROE = Net Income/ BV of Equity	ROC = EBIT (1-t)/ (BV of Equity +BV of Debt-Cash)
Expected Growth	Retention Ratio * ROE	ERR * ROE	RR * ROC
In terminal year	<ol style="list-style-type: none"> <li>1. Adjust cost of equity</li> <li>2. Estimate stable ROE</li> <li>3. Compute stable payout ratio = <math>1 - g / \text{ROE}</math></li> <li>4. Estimate terminal value of equity = Stable Payout ratio * <math>\text{Net Income}_{n+1} / (K_e - g)</math></li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust cost of equity</li> <li>2. Estimate stable ROE</li> <li>3. Compute stable ERR = <math>g / \text{ROE}</math></li> <li>4. Estimate terminal value of equity = <math>(1 - \text{ERR}) * \text{Net Income}_{n+1} / (K_e - g)</math></li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust cost of capital</li> <li>2. Estimate stable ROC</li> <li>3. Compute stable RIR = <math>g / \text{ROC}</math></li> <li>4. Estimate terminal value of firm = <math>(1 - \text{RIR}) * \text{EBIT}(1-t)_{n+1} / (K_c - g)</math></li> </ol>
To value equity	Discount dividends and terminal value of equity back at cost of equity	Discount FCFE and terminal value of equity back at cost of equity. (If interest expense from cash excluded from net income, add back cash).	Discount FCFF and terminal value of firm back at cost of capital. Add cash and non-operating assets and subtract out debt.
To value equity per share		Subtract out value of equity options and divide by number of shares outstanding.	Subtract out value of equity options and divide by number of shares outstanding.