LIVING WITH NOISE: INVESTING IN THE FACE OF UNCERTAINTY

Aswath Damodaran

http://www.damodaran.com

Uncertainty is a feature, not a bug.

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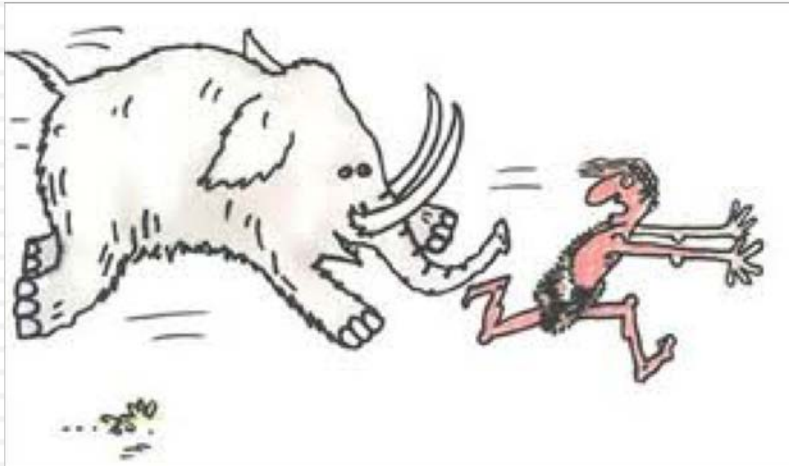
And we deal with uncertainty as humans always have…

- <u>Divine Intervention</u>: Praying for intervention from a higher power is the oldest and most practiced risk management system of all.

- <u>Paralysis & Denial</u>: When faced with uncertainty, some of us get paralyzed. Accompanying the paralysis is the hope that if you close your eyes to it, the uncertainty will go away

- <u>Mental short cuts (rules of thumb)</u>: Behavioral economists note that investors faced with uncertainty adopt mental short cuts that have no basis in reality. And here is the clincher. More intelligent people are more likely to be prone to this.

- <u>Herding</u>: When in doubt, it is safest to go with the crowd.. The herding instinct is deeply engrained and very difficult to fight.

- <u>Outsourcing</u>: Assuming that there are experts out there who have the answers does take a weight off your shoulders, even if those experts have no idea of what they are talking about.

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Categorizing and Responding to uncertainty

I. Estimation versus Economic Uncertainty

- Estimation versus Economic uncertainty
  - Estimation uncertainty reflects the possibility that you could have the "wrong model" or estimated inputs incorrectly within this model.
  - Economic uncertainty comes from real sources: that markets and economies can change over time and that even the best medals will fail to capture these unexpected changes.

- Estimation uncertainty can be mitigated by doing your homework, collecting more data or building better models, but economic uncertainty is here to stay.

II. Micro versus Macro Uncertainty

□ **Micro uncertainty versus Macro uncertainty**

  ◻ Micro uncertainty refers to uncertainty about the firm you are valuing and its business model - the potential market or markets for its products, the competition it will face and the quality of its management team.

  ◻ Macro uncertainty reflects the reality that your firm's fortunes can be affected by changes in the macro economic environment –the strength of the economy, the level of interest rates and the price of risk (equity and debt).

□ **Micro uncertainty can be mitigated or even eliminated by diversifying across companies but macro uncertainty will remain even in the most diversified portfolios.**
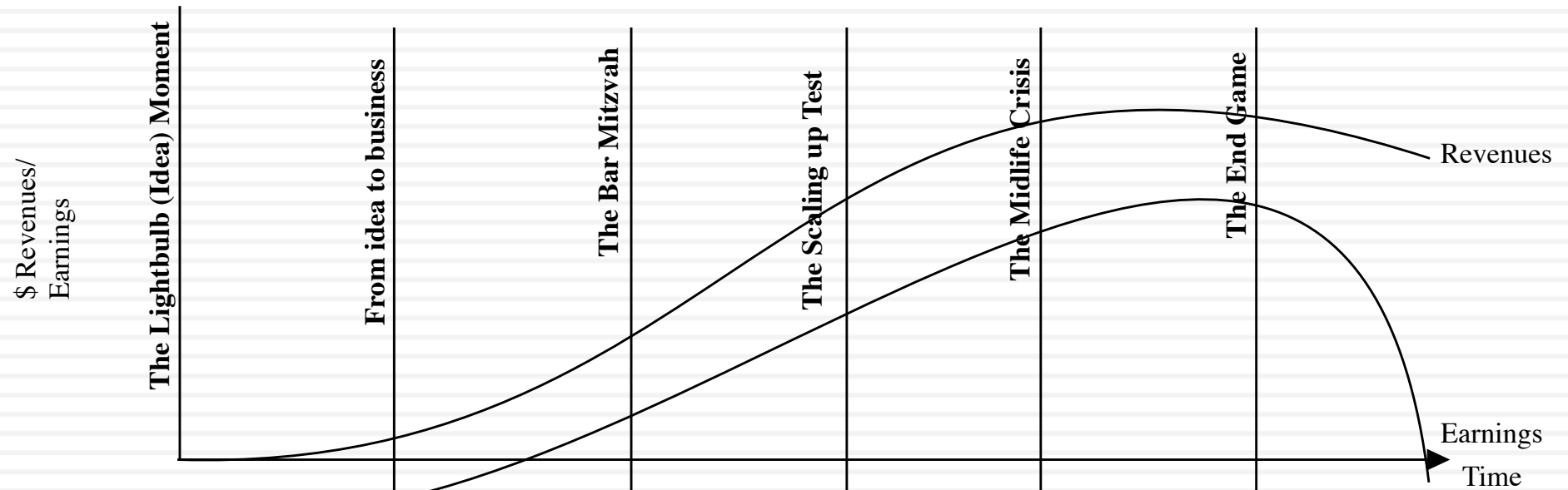
III. Discrete versus Continuous Uncertainty

□ Discrete versus continuous uncertainty

  ◘ Some events that you are uncertain about are discrete. Thus, a biotechnology firm with a new drug working its way through the FDA pipeline may see the drug fail at some stage of the approval process. In the same vein, a company in Venezuela or Argentina may worry about nationalization risk.

  ◘ Most uncertainties, though, are continuous. Thus, changes in interest rates or economic growth occur continuously and affect value as they happen.

□ In valuation, we are better at dealing with continuous risks than with discrete risks. In fact, discount rate risk adjustment models are designed for continuous risk.

A Corporate Life Cycle View of Uncertainty with examples

The Evolution of Uncertainty

	The Lightbulb (Idea) Moment	From idea to business	The Bar Mitzvah	The Scaling up Test	The Midlife Crisis	The End Game	
							Revenues
							Earnings
							Time

Growth stage	Stage 1 Start-up	Stage 2 Young Growth	Stage 3: High Growth	Stage 4 Mature Growth	Stage 5 Mature Stable	Stage 6 Decline
Uncertainty about	Does the idea have potential?	Is there a business model for the idea to be commercialized?	Will the business model generate profits?	Can the business be scaled up?	Can the business be defended?	Will management face reality?
Type & Magnitude	*High & company specific*					*Low & sector or macro driven*

3M: A Pre-crisis valuation

Current Cashflow to Firm
EBIT(1-t)= 5344 (1-**.35**)= 3474
- Nt CpX= 350
- Chg WC 691
= FCFF 2433
Reinvestment Rate = 1041/3474
=29.97%
Return on capital = 25.19%

Reinvestment Rate
30%

Expected Growth in EBIT (1-t)
.30*.25=.075
7.5%

Return on Capital
25%

Stable Growth
g = 3%; Beta = 1.10;
Debt Ratio= 20%; Tax rate=35%
Cost of capital = 6.76%
ROC= 6.76%;
Reinvestment Rate=3/6.76=44%

Terminal Value$_5$= 2645/(.0676-.03) = 70,409

First 5 years

Op. Assets 60607
+ Cash: 3253
- Debt 4920
=Equity 58400

Value/Share $ 83.55

Year	1	2	3	4	5	Term Yr
EBIT (1-t)	$3,734	$4,014	$4,279	$4,485	$4,619	$4,758
- Reinvestment	$1,120	$1,204	$1,312	$1,435	$1,540 ,	$2,113
= FCFF	$2,614	$2,810	$2,967	$3,049	$3,079	$2,645

Cost of capital = 8.32% (0.92) + 2.91% (0.08) = 7.88%

On September 12, 2008, 3M was trading at $70/share

Cost of Equity
8.32%

Cost of Debt
(3.72%+.75%)(1-.35)
= 2.91%

Weights
E = 92% D = 8%

Riskfree Rate:
Riskfree rate = 3.72%

Beta
1.15

X

Risk Premium
4%

Unlevered Beta for Sectors: 1.09

D/E=8.8%
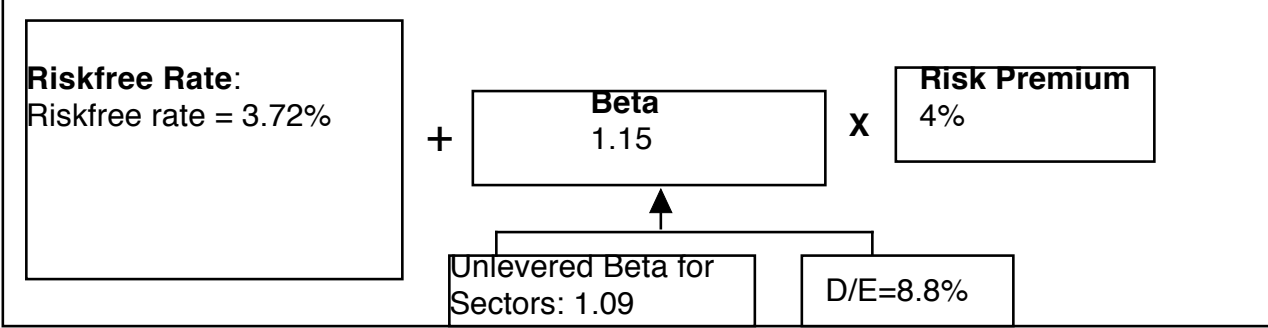
Tata Motors: April 2010

Current Cashflow to Firm
EBIT(1-t) :   Rs 20,116
- Nt CpX   Rs 31,590
- Chg WC   Rs   2,732
= FCFF   - Rs 14,205
Reinv Rate = (31590+2732)/20116 = 170.61%; Tax rate = 21.00%
Return on capital = 17.16%

Average reinvestment rate from 2005-09: 179.59%; without acquisitions: 70%

Reinvestment Rate
70%

Expected Growth from new inv.
.70*.1716=0.1201

Return on Capital 17.16%

Stable Growth
g = 5%; Beta = 1.00
Country Premium= 3%
Cost of capital = 10.39%
Tax rate = 33.99%
ROC= 10.39%;
Reinvestment Rate=g/ROC
=5/ 10.39= 48.11%

Terminal Value$_5$= 23493/(.1039-.05) = Rs 435,686

Rs Cashflows

Op. Assets Rs210,813
+ Cash: 11418
+ Other NO   140576
- Debt   109198
=Equity   253,628

Value/Share Rs 614

Year	1	2	3	4	5	6	7	8	9	10	
EBIT (1-t)	22533	25240	28272	31668	35472	39236	42848	46192	49150	51607	45278
- Reinvestment	15773	17668	19790	22168	24830	25242	25138	24482	23264	21503	21785
FCFF	6760	7572	8482	9500	10642	13994	17711	21710	25886	30104	23493

Discount at Cost of Capital (WACC) = 14.00% (.747) + 8.09% (0.253) = 12.50%

Growth declines to 5% and cost of capital moves to stable period level.

Cost of Equity 14.00%

Cost of Debt
(5%+ 4.25%+3)(1-.3399)
= 8.09%

Weights
E = 74.7% D = 25.3%

On April 1, 2010
Tata Motors price = Rs 781

Riskfree Rate:
Rs Riskfree Rate= 5%

+

Beta
1.20

X

Mature market premium
4.5%

+
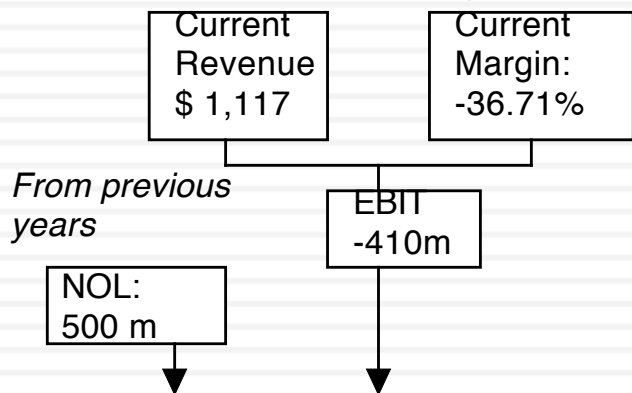
Lambda
0.80

X

Country Equity Risk Premium
4.50%

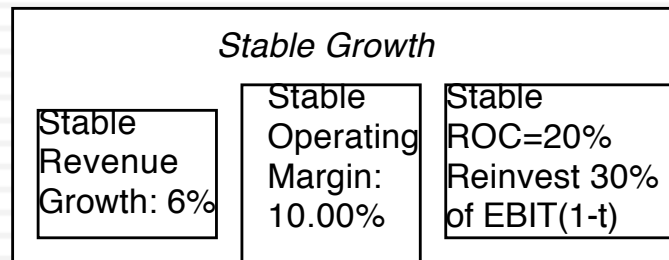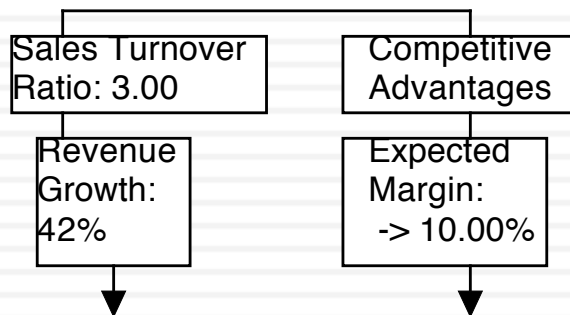Unlevered Beta for Sectors: 1.04

Firm's D/E Ratio: 33%

Country Default Spread 3%

X

Rel Equity Mkt Vol 1.50

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9a. Amazon in January 2000

Current Revenue $ 1,117

Current Margin: -36.71%

Sales to capital ratio and expected margin are retail industry average numbers

Stable Growth

Stable Revenue Growth: 6%

Stable Operating Margin: 10.00%

Stable ROC=20% Reinvest 30% of EBIT(1-t)

From previous years

EBIT -410m

Sales Turnover Ratio: 3.00

Competitive Advantages

NOL: 500 m

Revenue Growth: 42%

Expected Margin: -> 10.00%

Terminal Value= 1881/(.0961-.06) =52,148

Value of Op Assets $ 15,170
+ Cash $ 26
= Value of Firm $14,936
- Value of Debt $ 349
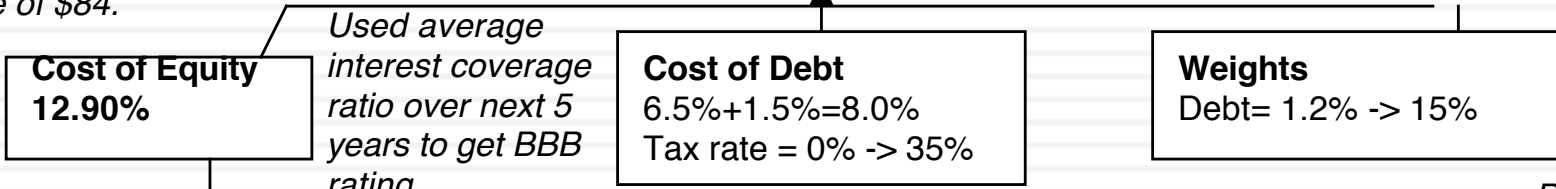= Value of Equity $14,847
- Equity Options $ 2,892
Value per share $ 35.08

All existing options valued as options, using current stock price of $84.

											Term. Year
Revenue Growth	150.00%	100.00%	75.00%	50.00%	30.00%	25.20%	20.40%	15.60%	10.80%	6.00%	6%
Revenues	$ 2,793	$ 5,585	$ 9,774	$ 14,661	$ 19,059	$ 23,862	$ 28,729	$ 33,211	$ 36,798	$ 39,006	$ 41,346
Operating Margin	-13.35%	-1.68%	4.16%	7.08%	8.54%	9.27%	9.64%	9.82%	9.91%	9.95%	10.00%
EBIT	-$373	-$94	$407	$1,038	$1,628	$2,212	$2,768	$3,261	$3,646	$3,883	$4,135
EBIT(1-t)	-$373	-$94	$407	$871	$1,058	$1,438	$1,799	$2,119	$2,370	$2,524	$2,688
- Reinvestment	$600	$967	$1,420	$1,663	$1,543	$1,688	$1,721	$1,619	$1,363	$961	$155
FCFF	-$931	-$1,024	-$989	-$758	-$408	-$163	$177	$625	$1,174	$1,788	$1,881
	1	2	3	4	5	6	7	8	9	10	

Forever

	1	2	3	4	5	6	7	8	9	10
Cost of Equity	12.90%	12.90%	12.90%	12.90%	12.90%	12.42%	11.94%	11.46%	10.98%	10.50%
Cost of Debt	8.00%	8.00%	8.00%	8.00%	8.00%	7.80%	7.75%	7.67%	7.50%	7.00%
After-tax cost of debt	8.00%	8.00%	8.00%	6.71%	5.20%	5.07%	5.04%	4.98%	4.88%	4.55%
Cost of Capital	12.84%	12.84%	12.84%	12.83%	12.81%	12.13%	11.62%	11.08%	10.49%	9.61%

Amazon was trading at $84 in January 2000.

Cost of Equity 12.90%

Used average interest coverage ratio over next 5 years to get BBB rating.

Cost of Debt
6.5%+1.5%=8.0%
Tax rate = 0% -> 35%

Weights
Debt= 1.2% -> 15%

Pushed debt ratio to retail industry average of 15%.

Dot.com retailers for firrst 5 years
Convetional retailers after year 5

Riskfree Rate: T. Bond rate = 6.5%

+

Beta 1.60 -> 1.00

X

Risk Premium 4%

Internet/ Retail

Operating Leverage

Current D/ E: 1.21%

Base Equity Premium

Country Risk Premium
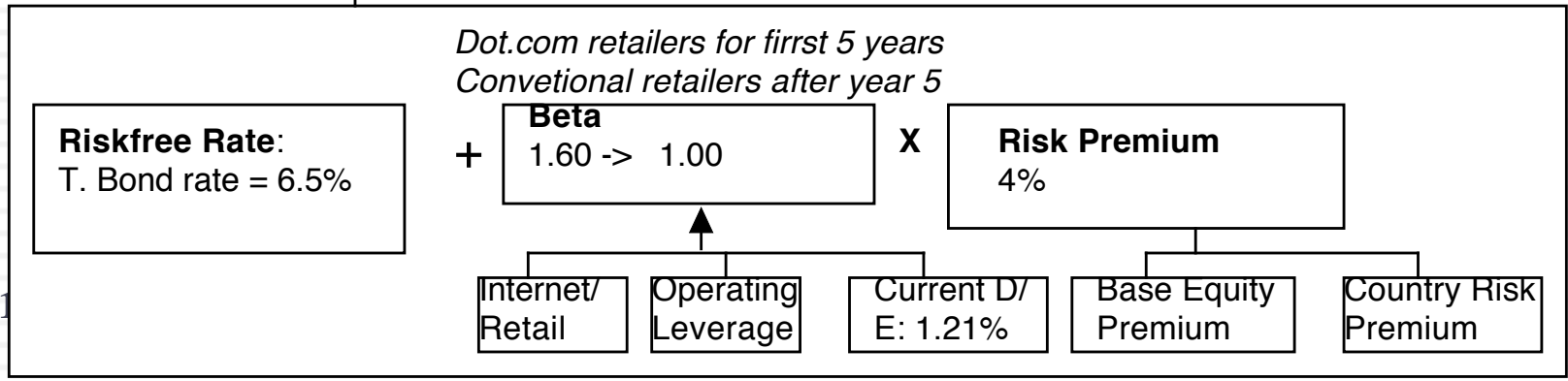
Twitter Pre-IPO Valuation: October 27, 2013

Starting numbers

	Last 10K	Trailing 12 month
Revenues	$316.93	$534.46
Operating income	-$77.06	-$134.91
Adjusted Operating Income		$7.67
Invested Capital		$955.00
Adjusted Operatng Margin		1.44%
Sales/ Invested Capital		0.56
Interest expenses	$2.49	$5.30

Revenue growth of 51.5% a year for 5 years, tapering down to 2.5% in year 10

Pre-tax operating margin increases to 25% over the next 10 years

Sales to capital ratio of 1.50 for incremental sales

Stable Growth
g = 2.5%; Beta = 1.00;
Cost of capital = 8%
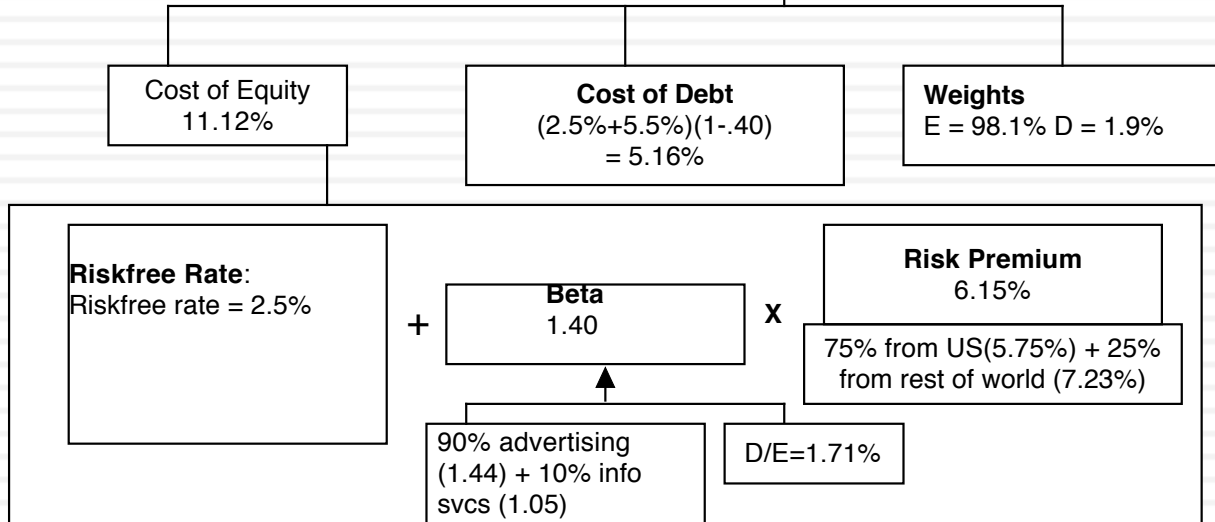ROC= **12%**;
Reinvestment Rate=2.5%/12% = 20.83%

Terminal Value$_{10}$= 1466/(.08-.025) = $26,657

		1	2	3	4	5	6	7	8	9	10
Revenues		$ 810	$1,227	$1,858	$2,816	$4,266	$6,044	$7,973	$9,734	$10,932	$11,205
Operating Income		$ 31	$ 75	$ 158	$ 306	$ 564	$ 941	$1,430	$1,975	$ 2,475	$ 2,801
Operating Income after tax		$ 31	$ 75	$ 158	$ 294	$ 395	$ 649	$ 969	$1,317	$ 1,624	$ 1,807
- Reinvestment		$ 183	$ 278	$ 421	$ 638	$ 967	$1,186	$1,285	$1,175	$ 798	$ 182
FCFF		$(153)	$ (203)	$ (263)	$ (344)	$ (572)	$ (537)	$ (316)	$ 143	$ 826	$ 1,625

Operating assets	$9,705
+ Cash	321
+ IPO Proceeds	1295
- Debt	214
Value of equity	11,106
- Options	713
Value in stock	10,394
/ # of shares	582.46
Value/share	$17.84

Terminal year (11)
EBIT (1-t)	$ 1,852
- Reinvestment	$ 386
FCFF	$ 1,466

Cost of capital decreases to 8% from years 6-10

Cost of capital = 11.12% (.981) + 5.16% (.019) = 11.01%

Cost of Equity
11.12%

Cost of Debt
(2.5%+5.5%)(1-.40)
= 5.16%

Weights
E = 98.1% D = 1.9%

Riskfree Rate:
Riskfree rate = 2.5%

+

Beta
1.40

X

Risk Premium
6.15%

75% from US(5.75%) + 25% from rest of world (7.23%)

90% advertising (1.44) + 10% info svcs (1.05)

D/E=1.71%

Forecasting in the face of uncertainty. A test:

□ In which of these two cities would you find it easier to forecast the weather?

Weather changeability for Honolulu, Hawaii

Temperature	Last Month	Last Year	Precipitation	Last Month	Last Year
Average change in high temperature day-to-day	1.7°	1.2°	Chance of dry day after a precip day	67%	81%
Average change in low temperature day-to-day	1.5°	2.0°	Chance of precip day after a dry day	7%	13%

Weather changeability for Epping, North Dakota

Temperature	Last Month	Last Year	Precipitation	Last Month	Last Year
Average change in high temperature day-to-day	8.5°	7.7°	Chance of dry day after a precip day	50%	65%
Average change in low temperature day-to-day	7.1°	8.6°	Chance of precip day after a dry day	38%	20%

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But the payoff is greatest where there is the most uncertainty...

Weather changeability for Honolulu, Hawaii

Temperature	Last Month	Last Year
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Chance of dry day after a precip day	67%	81%
Chance of precip day after a dry day	7%	13%

Further changeability analysis »

Weather forecast accuracy for Honolulu, Hawaii

Last Month		Last Year	
MeteoGroup	88.44%	MeteoGroup	88.50%
Persistence	81.80%	CustomWeather	85.87%
CustomWeather	78.23%	AccuWeather	81.82%
The Weather Channel	73.12%	The Weather Channel	81.56%
AccuWeather	69.89%	Persistence	80.44%
Weather Underground	62.10%	Weather Underground	67.07%
National Weather Service	48.39%	National Weather Service	59.90%
Foreca	44.35%	Foreca	57.52%
WeatherBug	32.26%	WeatherBug	37.09%

Weather changeability for Epping, North Dakota

Temperature	Last Month	Last Year
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Chance of dry day after a precip day	50%	65%
Chance of precip day after a dry day	38%	20%

Further changeability analysis »

Weather forecast accuracy for Epping, North Dakota

Last Month		Last Year	
MeteoGroup	62.50%	MeteoGroup	66.97%
Foreca	61.61%	The Weather Channel	66.73%
The Weather Channel	61.31%	AccuWeather	64.86%
AccuWeather	60.42%	WeatherBug	64.80%
Weather Underground	56.85%	Foreca	62.75%
WeatherBug	56.17%	CustomWeather	62.70%
National Weather Service	54.76%	National Weather Service	62.64%
CustomWeather	54.46%	Weather Underground	61.38%
Persistence	38.01%	Persistence	44.09%

2004 Best Places Rank
210
280
350
420
490
560
630
700

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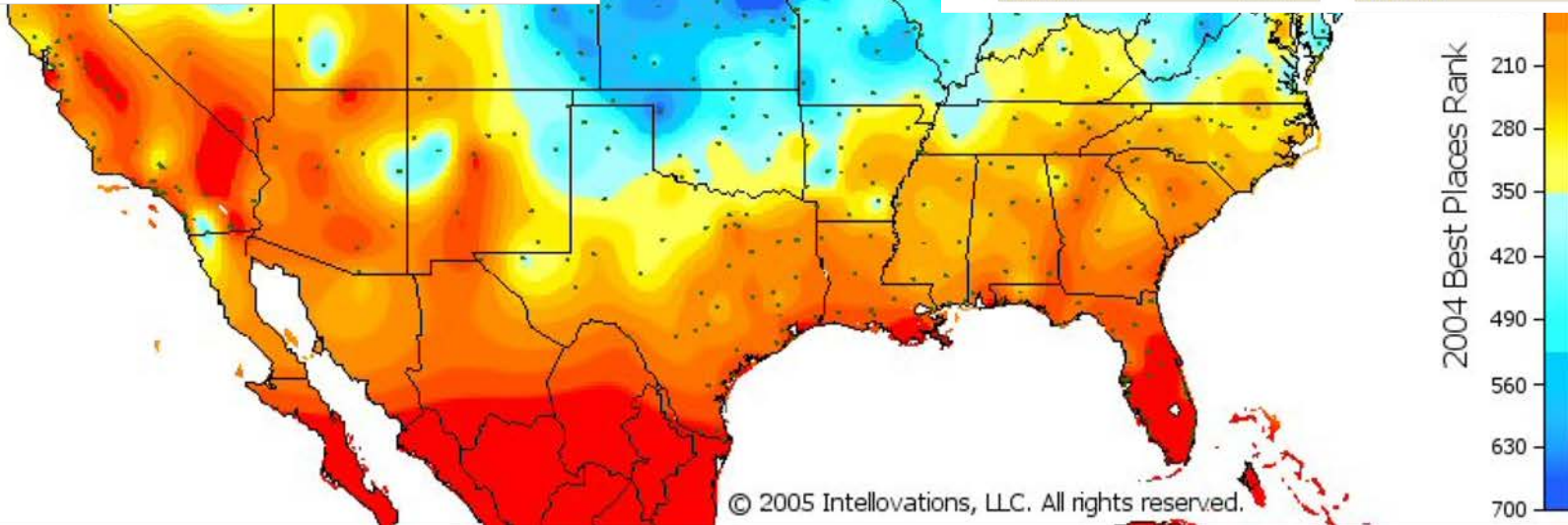
Assessing uncertainty…

- Rank the four firms in terms of uncertainty (least to most) in your estimate:
  - ☐ 3M in 2007
  - ☐ Tata Motors in 2010
  - ☐ Amazon in 2000
  - ☐ Twitter in 2013

- With each company, specify the type of uncertainty that you face:

Company	Estimation or Economic	Micro or Macro	Discrete or Continuous
3M (2007)			
Tata Motors (2010)			
Amazon (2000)			
Twitter (2013)			

Dealing with uncertainty

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Ten suggestions for dealing with uncertainty…

1. Start with a story that you tie to numbers
2. Less is more (the rule on detail….) (Revenue & margin forecasts) and build in internal checks on reasonableness… (reinvestment and ROC)
3. Use the offsetting principle (risk free rates & inflation at Tata Motors)
4. Draw on economic first principles (Terminal value at all the companies)
5. Use the "market" as a crutch (equity risk premiums, country risk premiums)
6. Use the law of large numbers (Beta for all companies
7. Don't let the discount rate become the receptacle for all uncertainties.
8. Confront uncertainty, if you can
9. Don't look for precision
10. You can live with mistakes, but bias will kill you…

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1. Tell a story

Favored Tools
- Accounting statements
- Excel spreadsheets
- Statistical Measures
- Pricing Data

Favored Tools
- Anecdotes
- Experience (own or others)
- Behavioral evidence

A Good Valuation

The Numbers People ←——————————→ The Narrative People

Illusions/Delusions
1. Precision: Data is precise
2. Objectivity: Data has no bias
3. Control: Data can control reality

Illusions/Delusions
1. Creativity cannot be quantified
2. If the story is good, the investment will be.
3. Experience is the best teacher

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Story versus Numbers: The Life Cycle

Growth stage	Stage 1 Start-up	Stage 2 Young Growth	Stage 3: High Growth	Stage 4 Mature Growth	Stage 5 Mature Stable	Stage 6 Decline
All Narrative						**All Numbers**
Narrative drivers	How big is the narrative?	How plausible is the narrative?	How profitable is the narrative?	How scalable is the narrative?	How sustainable is the narrative?	Is there a happy ending?

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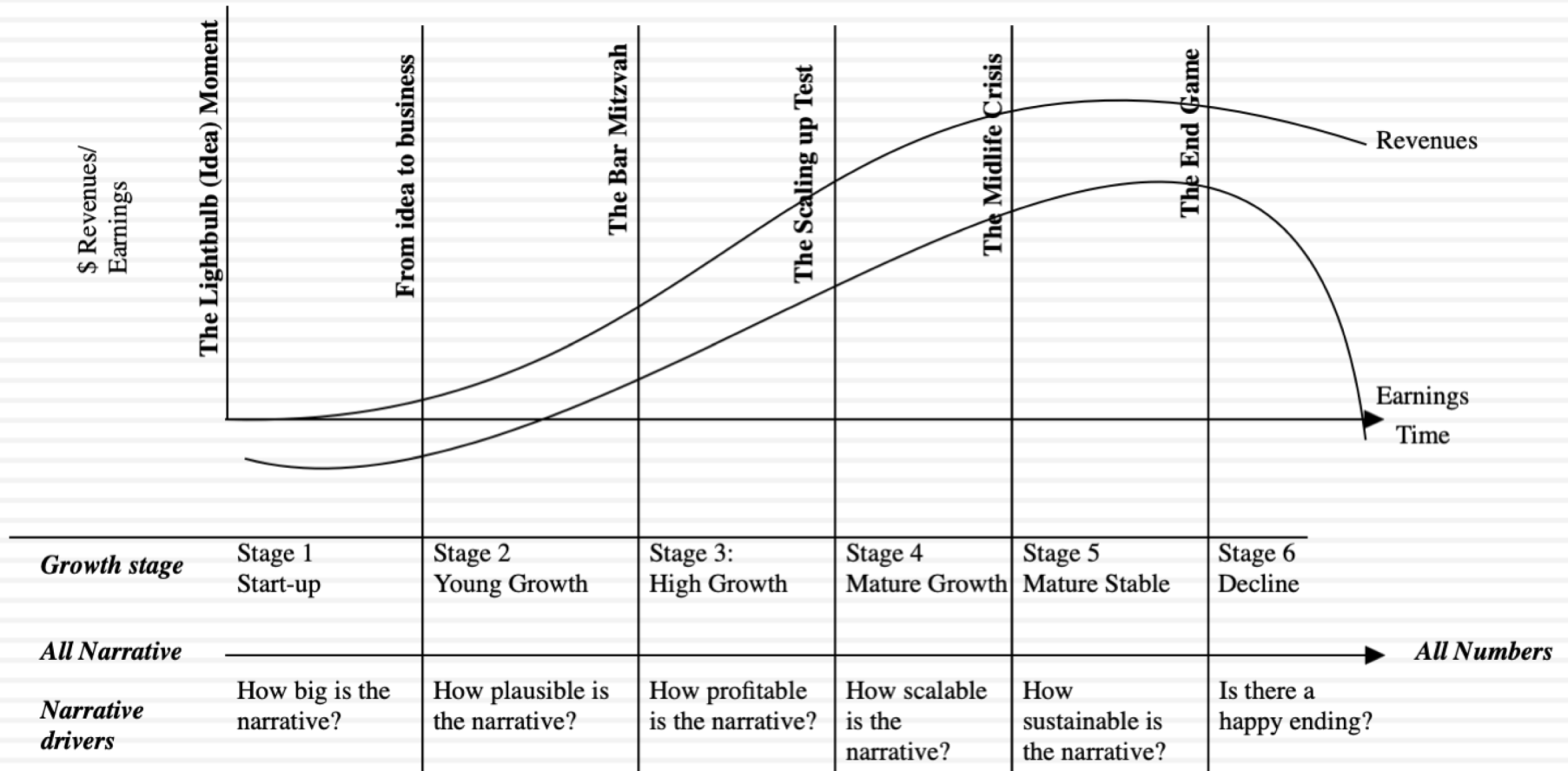
My Amazon Story in 2000: A Field of Dreams, General Retail Company

- <u>A Field of Dreams Company</u>: Amazon would build revenues first, before going for profits -> High revenue growth + Low margins in early years.

- <u>In retail</u>: Amazon would grow its presence across retail, but would not venture into the discount retail space.

- <u>With no failure risk</u>: Amazon would be able to raise capital from markets to cover its cash flow needs, as it grew. (It was the peak of the dot com boom).

- <u>And superb management</u>: That would let it navigate its way from tiny retailer to global presence.

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My Twitter story in 2013

- <u>An Online Advertising company</u>: While the platform is a social media platform, Twitter will make its revenues primarily from online advertising.

- <u>With lots of users</u>: Its biggest plus is that it has 240 millions users.

- <u>But a secondary choice for most advertisers</u>: While Twitter's format (character limit of 140), has allowed it to attract lots of users, it makes it unsuited as a primary advertising venue, because users don't stay on the platform for long.

- But a <u>highly profitable business</u>, if it makes it to steady state.

- <u>With a chance of failure</u>, in the case of a market crisis.

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2. Less is more

- The principle of parsimony: When faced with uncertainty, go for less detail, rather than more. That may sound counterintuitive, but here is why it makes sense:
  - You have a better shot at estimating an aggregate number, rather than individual numbers (Examples: Forecast the operating margin rather than individual operating expenses, total working capital instead of individual working capital items)
  - Estimation requires information and trying to estimate individual items, in the absence of information, is not only frustrating but an exercise in futility.
- Auto pilot rules: The uncertainty you face will increase as you go forward in time (it is much more difficult to estimate year 5 than year 1). Thus, it is best to create simple algorithms that estimate year-specific numbers as you go further out in time.

The Amazon Forecasts

Year	Revenue Growth	Sales	Operating Margin	EBIT	EBIT (1-t)
Tr 12 mths		$1,117	-36.71%	-$410	-$410
1	150.00%	$2,793	-13.35%	-$373	-$373
2	100.00%	$5,585	-1.68%	-$94	-$94
3	75.00%	$9,774	4.16%	$407	$407
4	50.00%	$14,661	7.08%	$1,038	$871
5	30.00%	$19,059	8.54%	$1,628	$1,058
6	25.20%	$23,862	9.27%	$2,212	$1,438
7	20.40%	$28,729	9.64%	$2,768	$1,799
8	15.60%	$33,211	9.82%	$3,261	$2,119
9	10.80%	$36,798	9.91%	$3,646	$2,370
10	6.00%	$39,006	9.95%	$3,883	$2,524
TY	6.00%	$41,346	10.00%	$4,135	$2,688

Use "auto pilot" approaches to estimate future years

Principle of parsimony: Estimate fewer inputs when faced with uncertainty.

And build in "internal" checks for reasonableness…

Year	Revenues	Δ Revenue	Sales/Cap	Δ Investment	Invested Capital		EBIT (1-t)	Imputed ROC
Tr 12 mths	$1,117				$	487	-$410	
1	$2,793	$1,676	3.00	$559	$	1,045	-$373	-76.62%
2	$5,585	$2,793	3.00	$931	$	1,976	-$94	-8.96%
3	$9,774	$4,189	3.00	$1,396	$	3,372	$407	20.59%
4	$14,661	$4,887	3.00	$1,629	$	5,001	$871	25.82%
5	$19,059	$4,398	3.00	$1,466	$	6,467	$1,058	21.16%
6	$23,862	$4,803	3.00	$1,601	$	8,068	$1,438	22.23%
7	$28,729	$4,868	3.00	$1,623	$	9,691	$1,799	22.30%
8	$33,211	$4,482	3.00	$1,494	$	11,185	$2,119	21.87%
9	$36,798	$3,587	3.00	$1,196	$	12,380	$2,370	21.19%
10	$39,006	$2,208	3.00	$736	$	13,116	$2,524	20.39%
TY	$41,346	$2,340	NA		Assumed to be =			20.00%

Check total revenues, relative to the market that it serves… Your market share obviously cannot exceed 100% but there may be tighter constraints.

Are the margins and imputed returns on capital 'reasonable' in the outer years?

3. Use consistency tests…

□ While you can not grade a valuation on "correctness" (since different analysts can make different assumptions about growth and risk), you can grade it on consistency.

□ For a valuation to be consistent, your estimates of cash flows have to be consistent with your discount rate definition.

  ◻ Equity versus Firm: If the cash flows being discounted are cash flows to equity, the appropriate discount rate is a cost of equity. If the cash flows are cash flows to the firm, the appropriate discount rate is the cost of capital.

  ◻ Currency: The currency in which the cash flows are estimated should also be the currency in which the discount rate is estimated.

  ◻ Nominal versus Real: If the cash flows being discounted are nominal cash flows (i.e., reflect expected inflation), the discount rate should be nominal

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Tata Motors: In Rupees and US dollars

$(1.125)*(1.01/1.04)-1 = .0925$

	In Indian Rupees	In US $
Risk free Rate	5.00%	2.00%
Expected inflation rate	4.00%	1.00%
Cost of capital - High Growth - Stable Growth	 12.50% 10.39%	 9.25% 7.21%
Expected growth rate - High Growth - Stable Growth	 12.01% 5.00%	 8.78% 2.00%
Return on Capital - High Growth - Stable Growth	 17.16% 10.39%	 13.78% 7.21%
Value per share	Rs 614	$12.79/share (roughly Rs 614 at current exchange rate)

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4. Draw on economic first principles and mathematical limits…

- When doing valuation, you are free to make assumptions about how your company will evolve over time in the market that it operates, but you are not free to violate first principles in economics and mathematics.

- Put differently, there are assumptions in valuation that are either mathematically impossible or violate first laws of economics and cannot be ever justified.

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And the "excess return" effect...

Stable growth rate	3M	Tata Motors	Amazon	Twitter
0%	$70,409	435,686₹	$26,390	$23,111
1%	$70,409	435,686₹	$28,263	$24,212
2%	$70,409	435,686₹	$30,595	$25,679
3%	$70,409	435,686₹	$33,594	
4%		435,686₹	$37,618	
5%		435,686₹	$43,334	
			$52,148	
Riskfree rate	3.72%	5%	6.60%	2.70%
ROIC	6.76%	10.39%	20%	12.00%
Cost of capital	6.76%	10.39%	9.61%	8.00%

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5. Use the market as a crutch... ERP as an illustration

Base year cash flow (last 12 mths)
Dividends (TTM): 48.12
+ Buybacks (TTM): 60.16
= Cash to investors (TTM): **108.28**

Expected cashflow growth in next 5 years
Cash flow growth = Top down analyst estimate of earnings growth for S&P 500 = 7.05%

	Last 12 months	1	2	3	4	5	Terminal Year
Expected Earnings	124.94	133.75	143.18	153.27	164.08	175.64	179.88
Expected Dividends + Buybacks =	108.28	$ 115.91	$ 124.08	$ 132.83	$ 142.19	$ 152.22	155.88

Earnings and Cash flows grow @2.41% (set equal to risk free rate) a year forever.

S&P 500 on 1/1/18= **2673.61**

$$2673.61 = \frac{115.91}{(1+r)} + \frac{124.08}{(1+r)^2} + \frac{132.82}{(1+r)^3} + \frac{142.19}{(1+r)^4} + \frac{152.22}{(1+r)^5} + \frac{152.22\,(1.0241)}{(r-0.0241)(1+r)^5}$$

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

Solve for r

r = Implied Expected Return on Stocks = 7.49%

Minus

Risk free rate = T.Bond rate on 1/1/18= 2.41%

Equals

Implied Equity Risk Premium (1/1/18) = 7.49% - 2.41% = **5.08%**

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Extending to country risk premium...

- Assume that the equity risk premium for the US and other mature equity markets is 5.8%.

- To estimate the additional risk premium for an emerging market, you can start with a country default spread, using one of two approaches:
  - Default spread, given the country's bond rating (estimated either by looking at a US$ or Euro government bond issued by that country)
  - CDS spread for the country, from the market

- Adjusted for equity risk: The country equity risk premium is based upon the volatility of the market in question relative to U.S market.
  - Total equity risk premium = Default Spread$_{Country}$* ($\sigma_{Country\ Equity}$ / $\sigma_{Country\ Bond}$)
  - Standard Deviation in Bovespa = 30%
  - Standard Deviation in Brazilian government bond= 20%
  - Default spread for Brazil= 1.75%
  - Additional risk premium for Brazil = 1.75% (30/20) = 2.63%

Western Europe

Country	Rating	ERP	CRP
Andorra	Baa2	7.27%	2.19%
Austria	Aa1	5.54%	0.46%
Belgium	Aa3	5.78%	0.70%
Cyprus	Ba3	9.23%	4.15%
Denmark	Aaa	5.08%	0.00%
Finland	Aa1	5.54%	0.46%
France	Aa2	5.65%	0.57%
Germany	Aaa	5.08%	0.00%
Greece	Caa2	15.46%	10.38%
Guernsey	Aa3	5.78%	0.70%
Iceland	A3	6.46%	1.38%
Ireland	A2	6.06%	0.98%
Isle of Man	Aa2	5.65%	0.57%
Italy	Baa2	7.27%	2.19%
Jersey	Aa3	5.78%	0.70%
Liechtenstein	Aaa	5.08%	0.00%
Luxembourg	Aaa	5.08%	0.00%
Malta	A3	6.46%	1.38%
Netherlands	Aaa	5.08%	0.00%
Norway	Aaa	5.08%	0.00%
Portugal	Ba1	7.96%	2.88%
Spain	Baa2	7.27%	2.19%
Sweden	Aaa	5.08%	0.00%
Switzerland	Aaa	5.08%	0.00%
Turkey	Ba1	7.96%	2.88%
United Kingdom	Aa2	5.65%	0.57%
Western Europe		6.01%	0.93%

North America

Country	Rating	ERP	CRP
Canada	Aaa	5.08%	0.00%
United States	Aaa	5.08%	0.00%
North America		5.08%	0.00%

		ERP	CRP
Caribbean		11.39%	6.31%

Latin America

Country	Rating	ERP	CRP
Argentina	B2	11.42%	6.34%
Belize	B3	12.58%	7.50%
Bolivia	Ba3	9.23%	4.15%
Brazil	Ba2	8.54%	3.46%
Chile	Aa3	5.78%	0.70%
Colombia	Baa2	7.27%	2.19%
Costa Rica	Ba2	8.54%	3.46%
Ecuador	B3	12.58%	7.50%
El Salvador	Caa1	13.72%	8.64%
Guatemala	Ba1	7.96%	2.88%
Honduras	B1	10.27%	5.19%
Mexico	A3	6.46%	1.38%
Nicaragua	B2	11.42%	6.34%
Panama	Baa2	7.27%	2.19%
Paraguay	Ba1	7.96%	2.88%
Peru	A3	6.46%	1.38%
Suriname	B1	10.27%	5.19%
Uruguay	Baa2	7.27%	2.19%
Venezuela	Caa3	16.60%	11.52%
Latin America		8.63%	3.55%

Africa

Country	ERP	CRP
Angola	11.42%	6.34%
Botswana	6.06%	0.98%
Burkina Faso	11.42%	6.34%
Cameroon	11.42%	6.34%
Cape Verde	11.42%	6.34%
Congo (DR)	12.58%	7.50%
Congo (Rep of)	15.46%	10.38%
Côte d'Ivoire	9.23%	4.15%
Egypt	12.58%	7.50%
Ethiopia	10.27%	5.19%
Gabon	12.58%	7.50%
Ghana	12.58%	7.50%
Kenya	10.27%	5.19%
Morocco	7.96%	2.88%
Mozambique	16.60%	11.52%
Namibia	7.96%	2.88%
Nigeria	11.42%	6.34%
Rwanda	11.42%	6.34%
Senegal	9.23%	4.15%
South Africa	7.62%	2.54%
Swaziland	5.08%	11.42%
Tunisia	10.27%	5.19%
Uganda	11.42%	6.34%
Zambia	12.58%	7.50%
Africa	**10.63%**	**5.58%**

E. Europe

Country	Rating	ERP	CRP
Albania	B1	10.27%	5.19%
Armenia	B1	10.27%	5.19%
Azerbaijan	Ba2	8.54%	3.46%
Belarus	Caa1	13.72%	8.64%
Bosnia	B3	12.58%	7.50%
Bulgaria	Baa2	7.27%	2.19%
Croatia	Ba2	8.54%	3.46%
Czech Republic	A1	5.89%	0.81%
Estonia	A1	5.89%	0.81%
Georgia	Ba2	8.54%	3.46%
Hungary	Baa3	7.62%	2.54%
Kazakhstan	Baa3	7.62%	2.54%
Kyrgyzstan	B2	11.42%	6.34%
Latvia	A3	6.46%	1.38%
Lithuania	A3	6.46%	1.38%
Macedonia	Ba3	9.23%	4.15%
Moldova	B3	12.58%	7.50%
Montenegro	B1	10.27%	5.19%
Poland	A2	6.06%	0.98%
Romania	Baa3	7.62%	2.54%
Russia	Ba1	7.96%	2.88%
Serbia	Ba3	9.23%	4.15%
Slovakia	A2	6.06%	0.98%
Slovenia	Baa1	6.92%	1.84%
Tajikistan	B3	7.96%	2.88%
Ukraine	Caa2	15.46%	10.38%
E. Europe		7.75%	2.69%

Middle East

Country	Rating	ERP	CRP
Abu Dhabi	Aa2	5.65%	0.57%
Bahrain	B1	10.27%	5.19%
Iraq	Caa1	13.72%	8.64%
Israel	A1	5.89%	0.81%
Jordan	B1	10.27%	5.19%
Kuwait	Aa2	5.65%	0.57%
Lebanon	B3	12.58%	7.50%
Oman	Baa2	7.27%	2.19%
Qatar	Aa3	5.78%	0.70%
Ras Al Khaimah	A2	6.06%	0.98%
Saudi Arabia	A1	5.89%	0.81%
Sharjah	A3	6.46%	1.38%
United Arab Emirates	Aa2	5.65%	0.57%
Middle East		6.69%	1.61%

Country	PRS	ERP	CRP	Country	PRS	ERP	CRP
Algeria	62.3	12.58%	7.50%	Malawi	61.3	13.73%	8.65%
Brunei	76.3	6.06%	0.98%	Mali	60.8	13.73%	8.65%
Gambia	59.3	15.46%	10.38%	Myanmar	63.8	12.58%	7.50%
Guinea	58.3	15.46%	10.38%	Niger	53.7	18.91%	13.83%
Guinea-Bissau	63.8	12.58%	7.50%	Sierra Leone	54.3	18.91%	13.83%
Guyana	68.5	9.23%	4.15%	Somalia	52	18.91%	13.83%
Haiti	61.8	13.73%	8.65%	Sudan	48	25.32%	20.24%
Iran	73.3	7.27%	2.19%	Syria	47	25.32%	20.24%
Korea, D.P.R.	56	16.60%	11.52%	Tanzania	63.3	12.58%	7.50%
Liberia	53	18.91%	13.83%	Togo	61	13.73%	8.65%
Libya	62	13.73%	8.65%	Yemen, Republic	49.3	25.32%	20.24%
Madagascar	64.5	11.42%	6.34%	Zimbabwe	58.5	15.46%	10.38%

Asia

Country	Rating	ERP	CRP
Bangladesh	Ba3	9.23%	4.15%
Cambodia	B2	11.42%	6.34%
China	A1	5.89%	0.81%
Fiji	Ba3	9.23%	4.15%
Hong Kong	Aa2	5.65%	0.57%
India	Baa2	7.27%	2.19%
Indonesia	Baa3	7.62%	2.54%
Japan	A1	5.89%	0.81%
Korea	Aa2	5.65%	0.57%
Macao	Aa3	5.78%	0.70%
Malaysia	A3	6.46%	1.38%
Mauritius	Baa1	6.92%	1.84%
Mongolia	Caa1	13.72%	8.64%
Pakistan	B3	12.58%	7.50%
Papua New Guinea	B2	11.42%	6.34%
Philippines	Baa2	7.27%	2.19%
Singapore	Aaa	5.08%	0.00%
Sri Lanka	B1	10.27%	5.19%
Taiwan	Aa3	5.78%	0.70%
Thailand	Baa1	6.92%	1.84%
Vietnam	B1	10.27%	5.19%
Asia		6.27%	1.19%

Australia & New Zealand

Country	Rating	ERP	CRP
Australia	Aaa	5.08%	0.00%
Cook Islands	B1	10.27%	5.19%
New Zealand	Aaa	5.08%	0.00%
Australia & New Zealand		5.08%	0.00%

Red #: Country risk premium
Regional #: GDP weighted average

6. Draw on the law of large numbers...

- The law of large numbers: The "law of large numbers" is one of several theorems expressing the idea that as the number of trials of a random process increases, the percentage difference between the expected and actual values goes to zero.

- The average is your friend: In pragmatic terms, when faced with uncertainty on an input, you are better off using an average (over time or across companies) than using the actual number.

To illustrate: A single regression beta is noisy…
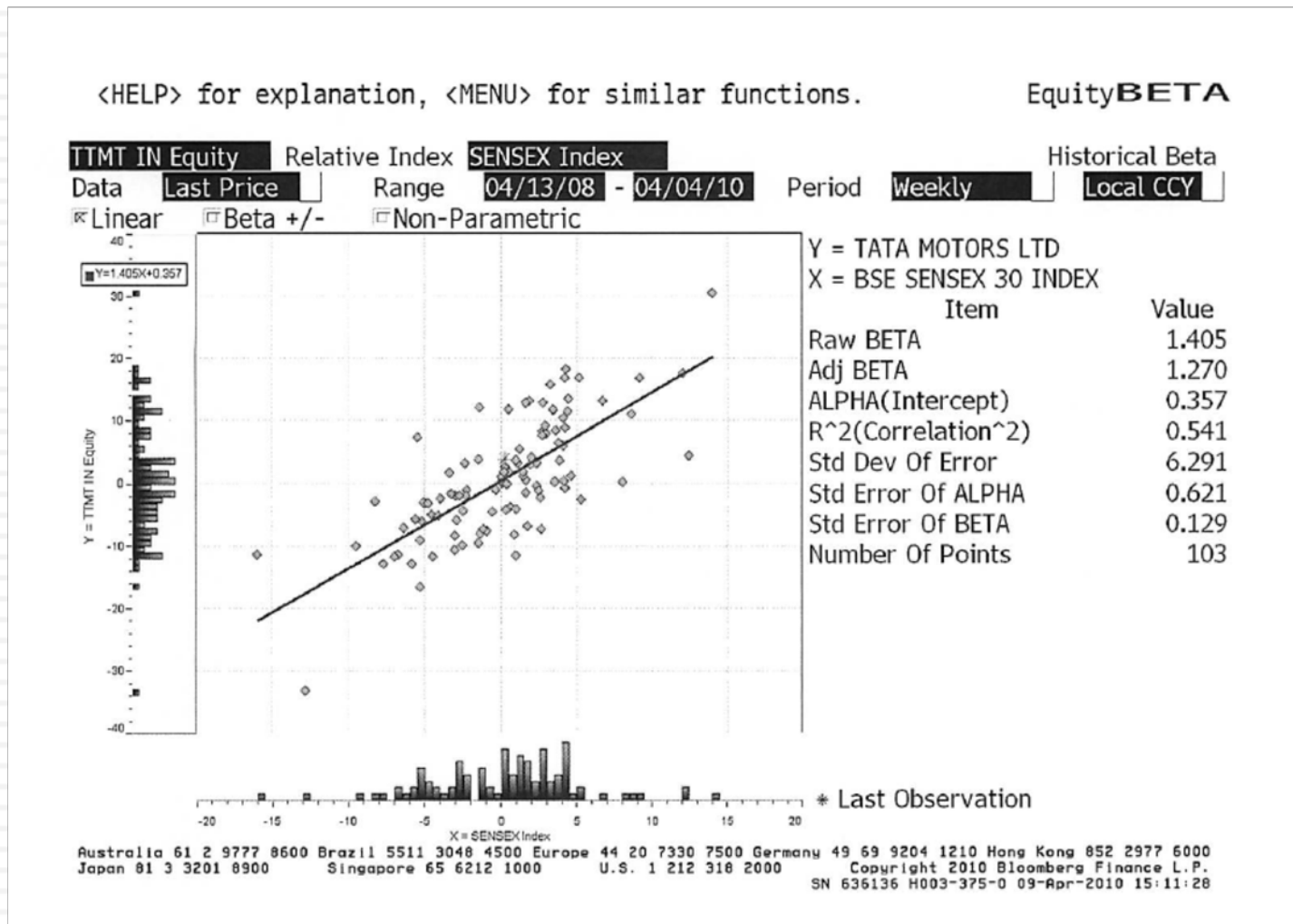
But an average beta across companies is not…

- There are 111 publicly traded companies, globally in the automobile business.
  - Average beta across companies = 1.22
  - Average D/E ratio across companies = 35%
  - Average tax rate across companies = 30%
  - Unlevered beta for automobile company = 1.22 / (1+ (1-.30)(.35)) = 0.98
  - Standard error on "average" beta = 0.26/Sq root of 111 = 0.025
- To estimate the beta for Tata Motors
  - Unlevered beta for automobile company = 0.98
  - D/E ratio for Tata Motors = 33.87%
  - Marginal tax rate in India = 33.99%
  - Levered beta = 0.98 (1+ (1-.3399)(.3387)) = 1.20

Another illustration: Normalizing earnings for Tata Motors

- Tata Motors, like most cyclical companies, has had volatile earnings over time. It reported after-tax operating income of Rs 13,846 million in the most recent fiscal year on revenues of Rs 265,868 million.

- To normalize the earnings, you can start with the history of prior year's earnings. Between 2004 and 2008, Tata Motors earned an average after tax operating margin of 9.58% on revenues and paid 21% of its income in taxes.

- Applying the average pre-tax margin to the revenues in the most recent fiscal year yields a "normalized" operating income, which can then be used to estimate an after
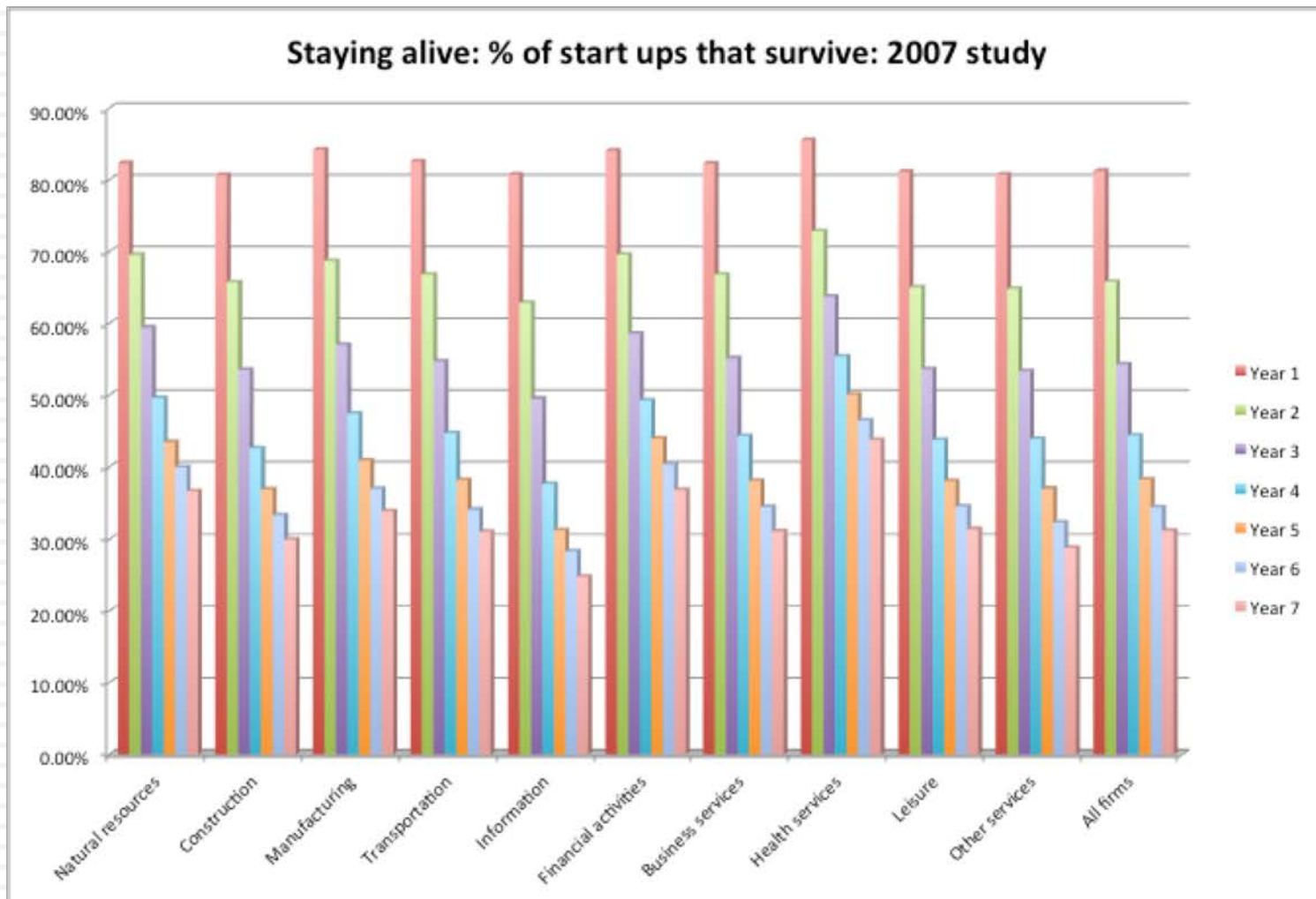
    Normalized operating income = 265,868*.0958 = Rs 25,465 m

    Normalized after-tax EBIT = 25465 (1-.21) = Rs 20,116 m

- Note that neither working capital nor net cap ex were normalized, since they did not have the same degree of volatility.

7. Don't let the discount rate become the receptacle for all your uncertainty…

Staying alive: % of start ups that survive: 2007 study

Aswath Damodaran

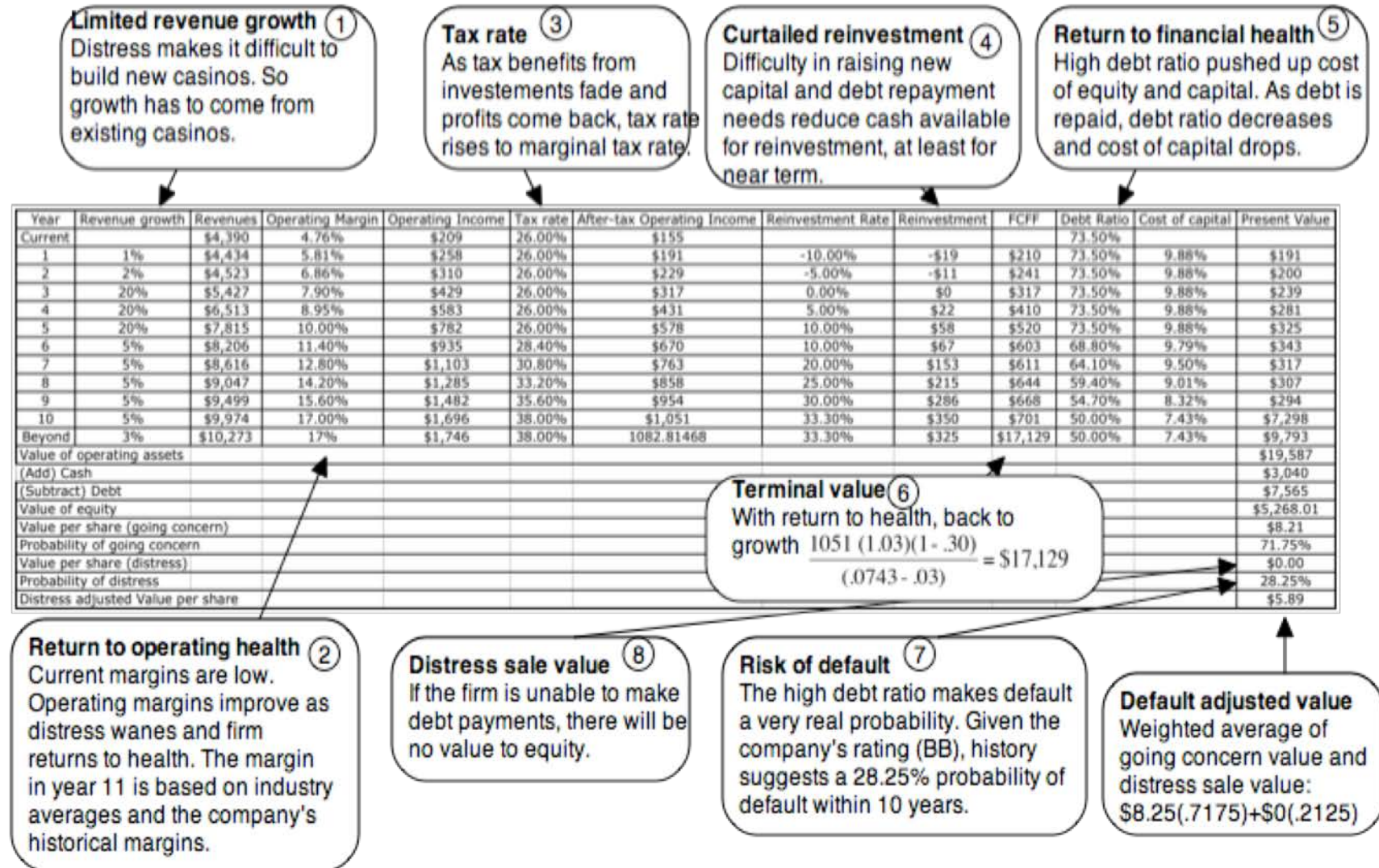# Contrasting ways of dealing with survival risk…

- The Venture Capital approach: In the venture capital approach, you hike the "discount rate" well above what would be appropriate for a going concern and then use this "target" rate to discount your "exit value" (which is estimated using a multiple and forward earnings).
    - Value = (Forward Earnings in year n * Exit multiple)/ $(1+ \text{target rate})^n$

- The decision tree approach:
    - Value the business as a "going concern", with a rate of return appropriate for a "going concern".
    - Estimate the probability of survival (and failure) and the value of the business in the event of failure.
    - Value = Going concern value (Probability of survival) + Liquidation value (Probability of failure)

Generalizing to other "truncation" risks

- Default risk for a "distressed" company: For firms that have substantial debt, there is the possibility of default. In default, you will receive a liquidation value for your assets in place, that may not reflect their going concern value, and will lose any "growth asset" value.
  - Value = Going concern value (1- Probability of default) + Liquidation value (Probability of default)
- Nationalization risk: The primary cost of being nationalized is that what you receive for your business from the nationalizing authority is less than the fair value of the business.
  - Value = Going concern value (1- Probability of nationalization) + Liquidation value (Probability of nationalization)

Exhibit 8.2: Valuing a Distressed firm: Las Vegas Sands in early 2009

Las Vegas Sands owns and operates the Venetian Casino and Sands Convention Center in Las Vegas and the Sands Macau Casino in Macau, China. While the revenues increased from $1.75 billion in 2005 to $4.39 billion in 2008 and it had two other casinos in development - it ran into significant financial trouble in the last quarter of 2008. Fears about whether the firm would be able to meet its debt obligations pushed down both stock prices (almost 90%) and bond prices (about 40%) in 2008.

Limited revenue growth (1)
Distress makes it difficult to build new casinos. So growth has to come from existing casinos.

Tax rate (3)
As tax benefits from investements fade and profits come back, tax rate rises to marginal tax rate.

Curtailed reinvestment (4)
Difficulty in raising new capital and debt repayment needs reduce cash available for reinvestment, at least for near term.

Return to financial health (5)
High debt ratio pushed up cost of equity and capital. As debt is repaid, debt ratio decreases and cost of capital drops.

Year	Revenue growth	Revenues	Operating Margin	Operating Income	Tax rate	After-tax Operating Income	Reinvestment Rate	Reinvestment	FCFF	Debt Ratio	Cost of capital	Present Value
Current		$4,390	4.76%	$209	26.00%	$155				73.50%		
1	1%	$4,434	5.81%	$258	26.00%	$191	-10.00%	-$19	$210	73.50%	9.88%	$191
2	2%	$4,523	6.86%	$310	26.00%	$229	-5.00%	-$11	$241	73.50%	9.88%	$200
3	20%	$5,427	7.90%	$429	26.00%	$317	0.00%	$0	$317	73.50%	9.88%	$239
4	20%	$6,513	8.95%	$583	26.00%	$431	5.00%	$22	$410	73.50%	9.88%	$281
5	20%	$7,815	10.00%	$782	26.00%	$578	10.00%	$58	$520	73.50%	9.88%	$325
6	5%	$8,206	11.40%	$935	28.40%	$670	10.00%	$67	$603	68.80%	9.79%	$343
7	5%	$8,616	12.80%	$1,103	30.80%	$763	20.00%	$153	$611	64.10%	9.50%	$317
8	5%	$9,047	14.20%	$1,285	33.20%	$858	25.00%	$215	$644	59.40%	9.01%	$307
9	5%	$9,499	15.60%	$1,482	35.60%	$954	30.00%	$286	$668	54.70%	8.32%	$294
10	5%	$9,974	17.00%	$1,696	38.00%	$1,051	33.30%	$350	$701	50.00%	7.43%	$7,298
Beyond	3%	$10,273	17%	$1,746	38.00%	1082.81468	33.30%	$325	$17,129	50.00%	7.43%	$9,793
Value of operating assets												$19,587
(Add) Cash												$3,040
(Subtract) Debt												$7,565
Value of equity												$5,268.01
Value per share (going concern)												$8.21
Probability of going concern												71.75%
Value per share (distress)												$0.00
Probability of distress												28.25%
Distress adjusted Value per share												$5.89

Terminal value (6)
With return to health, back to growth $\dfrac{1051\,(1.03)(1-.30)}{(.0743-.03)} = \$17,129$

Return to operating health (2)
Current margins are low. Operating margins improve as distress wanes and firm returns to health. The margin in year 11 is based on industry averages and the company's historical margins.

Distress sale value (8)
If the firm is unable to make debt payments, there will be no value to equity.

Risk of default (7)
The high debt ratio makes default a very real probability. Given the company's rating (BB), history suggests a 28.25% probability of default within 10 years.

Default adjusted value
Weighted average of going concern value and distress sale value:
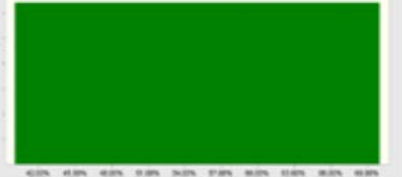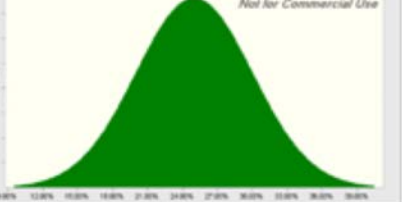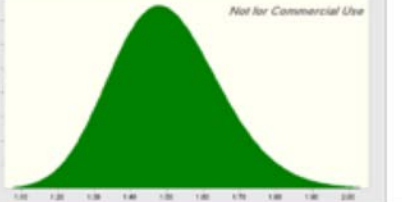$8.25(.7175)+$0(.2125)

8. Confront uncertainty, if you can...

- In standard valuation, you are forced to make point estimates for inputs where you are uncertain about values. In statistical terms, you are being asked to compress a probability distribution about a variable into an expected value. You then obtain a single estimate of value, based upon your base case or expected values.

- In a simulation, you can enter distributions for variables, rather than point estimates. Rather than obtain a single estimate of value, you get a distribution of values, which can provide you with substantially more information than a single valuation.

Revisiting the Twitter valuation

Revenue Growth Rate
Distribution: Uniform
Expected Value = 55%
Minimum Value: 40%
Maximum Value: 70%

Target Operating Margin
Distribution: Normal
Expected Value = 25%
Standard Deviation = 5%

Sales to Capital Ratio
Distribution: Lognormal
Expected value: 1.50
Standard deviation: 0.15

Cost of Capital
Distribution: Triangular
Expected value: 11.22%
Minimum value: 10.02%
Maximum value: 12.22%

Aswath Damodaran

With the consequences for equity value…

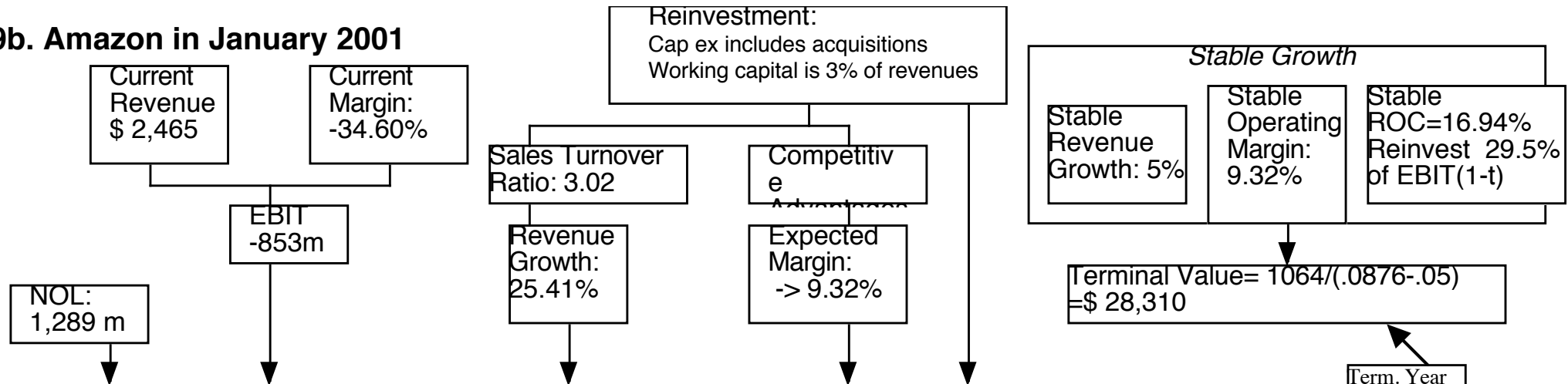| Percentile	Forecast values
0%	($1,279.18)
10%	$5,121.73
20%	$6,264.92
30%	$7,267.34
40%	$8,336.73
50%	$9,554.16
60%	$10,971.39
70%	$12,643.68
80%	$14,771.24
90%	$17,757.35
100%	$38,864.54

Aswath Damodaran
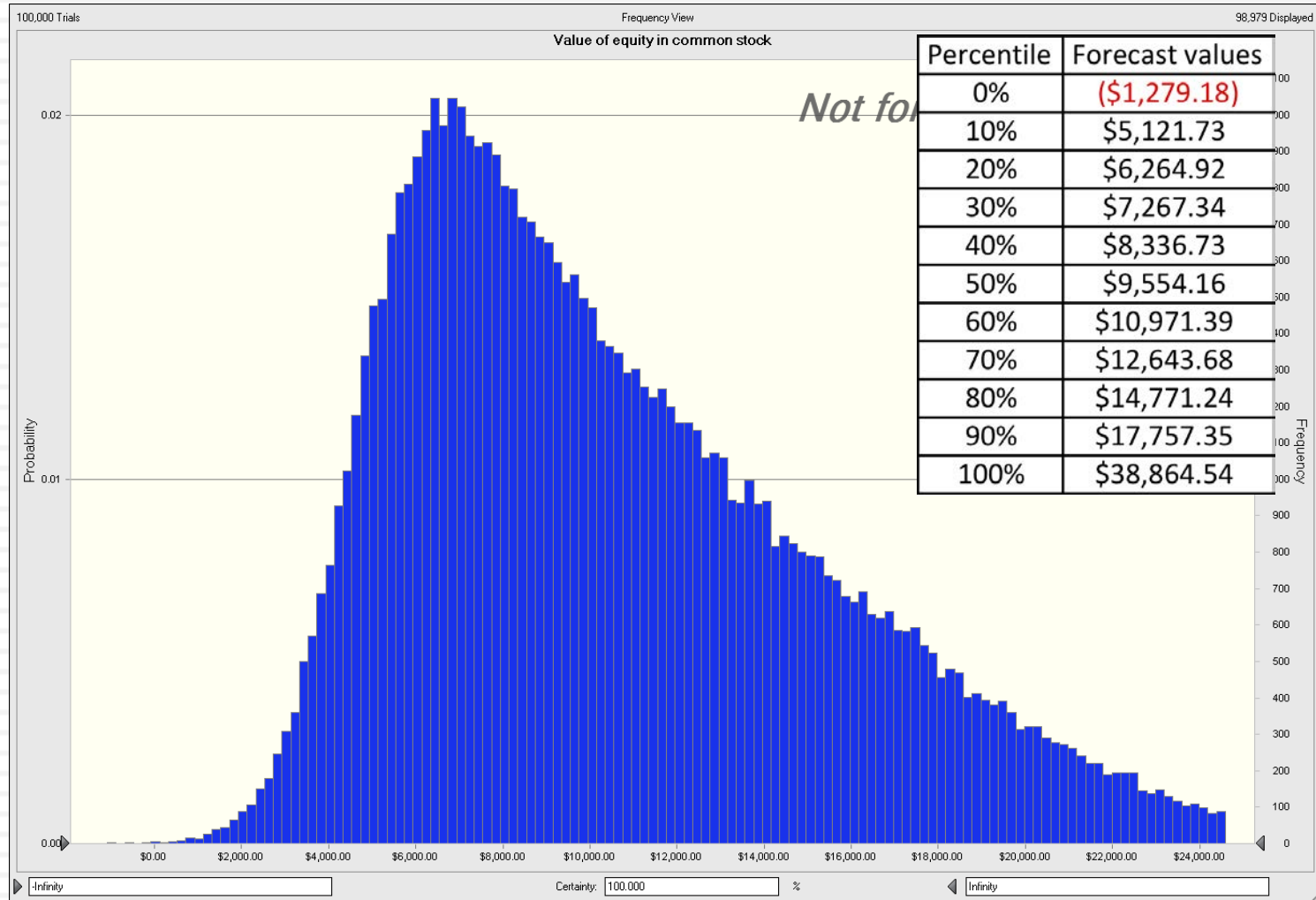
9. Don't look for precision..

□ No matter how careful you are in getting your inputs and how well structured your model is, your estimate of value will change both as new information comes out about the company, the business and the economy.

□ As information comes out, you will have to adjust and adapt your model to reflect the information. Rather than be defensive about the resulting changes in value, recognize that this is the essence of risk.

Aswath Damodaran

9b. Amazon in January 2001

Current Revenue $ 2,465	Current Margin: -34.60%

EBIT -853m

NOL: 1,289 m

Reinvestment:
Cap ex includes acquisitions
Working capital is 3% of revenues

Sales Turnover Ratio: 3.02

Competitive Advantages

Revenue Growth: 25.41%

Expected Margin: -> 9.32%

Stable Growth

Stable Revenue Growth: 5%	Stable Operating Margin: 9.32%	Stable ROC=16.94% Reinvest 29.5% of EBIT(1-t)

Terminal Value= 1064/(.0876-.05) =$ 28,310

	1	2	3	4	5	6	7	8	9	10	Term. Year
Revenues	$4,314	$6,471	$9,059	$11,777	$14,132	$16,534	$18,849	$20,922	$22,596	$23,726	$24,912
EBIT	-$545	-$107	$347	$774	$1,123	$1,428	$1,692	$1,914	$2,087	$2,201	$2,302
EBIT(1-t)	-$545	-$107	$347	$774	$1,017	$928	$1,100	$1,244	$1,356	$1,431	$1,509
- Reinvestment	$612	$714	$857	$900	$780	$796	$766	$687	$554	$374	$ 445
FCFF	-$1,157	-$822	-$510	-$126	$237	$132	$333	$558	$802	$1,057	$1,064

Value of Op Assets	$ 8,789
+ Cash & Non-op	$ 1,263
= Value of Firm	$10,052
- Value of Debt	$ 1,879
= Value of Equity	$ 8,173
- Equity Options	$ 845
Value per share	$ 20.83

	1	2	3	4	5	6	7	8	9	10	Forever
Debt Ratio	27.27%	27.27%	27.27%	27.27%	27.27%	24.81%	24.20%	23.18%	21.13%	15.00%	
Beta	2.18	2.18	2.18	2.18	2.18	1.96	1.75	1.53	1.32	1.10	
Cost of Equity	13.81%	13.81%	13.81%	13.81%	13.81%	12.95%	12.09%	11.22%	10.36%	9.50%	
AT cost of debt	10.00%	10.00%	10.00%	10.00%	9.06%	6.11%	6.01%	5.85%	5.53%	4.55%	
Cost of Capital	12.77%	12.77%	12.77%	12.77%	12.52%	11.25%	10.62%	9.98%	9.34%	8.76%	

Cost of Equity **13.81%**	**Cost of Debt** 6.5%+3.5%=10.0% Tax rate = 0% -> 35%	**Weights** Debt= 27.3% -> 15%

Riskfree Rate: T. Bond rate = 5.1%

+

Beta 2.18-> 1.10

X

Risk Premium 4%
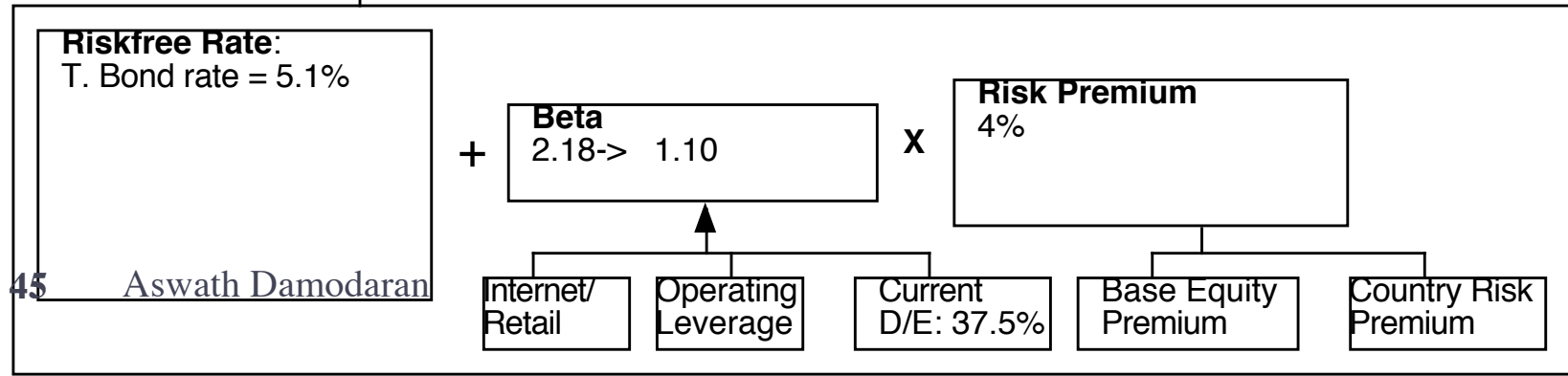
Amazon.com January 2001 Stock price = $14

Internet/ Retail	Operating Leverage	Current D/E: 37.5%	Base Equity Premium	Country Risk Premium

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To illustrate: Your mistakes versus market mistakes..

Aswath Damodaran
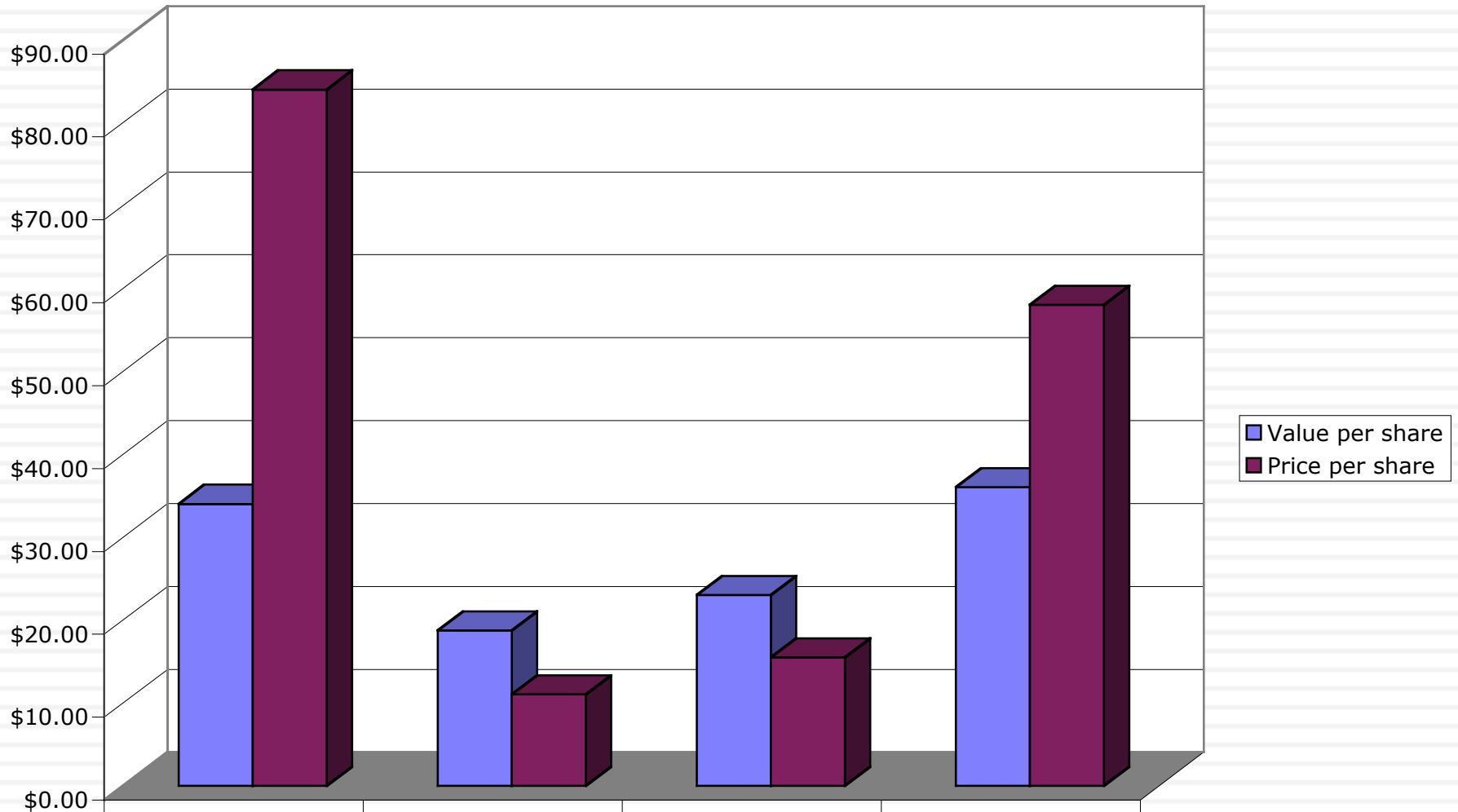
The Greatest (and most Feared) Disruptive Platform in History

Amazon will complete its metaphorsis from being a retail company to one that can take its competitive advantages - access to capital & willingness to lose money for long periods, while disrupting and changing the status quo - to any business that it targets, giving it the potential for high revenue growth on top of already-large revenues. It will be able to use the pricing power it accumulates in each business it is in, to increase profit margins, partly through economies of scale and partly through higher prices. Its low debt ratio and divergent business mix give it a low cost of capital.

The Assumptions

	Base year	Years 1-5	Years 6-10		After year 10	Link to story
Revenues (a)	$ 208,125	15.00% →	3.00%		3.00%	Expanding into new businessses
Operating margin (b)	7.71%	7.71% →	12.50%		12.50%	Economies of scale and pricing power increase margins
Tax rate	20.20%	20.20% →	24.00%		24.00%	Converging on a global tax rate of 25%
Reinvestment (c)		Sales to capital ratio 5.95		RIR =	30.00%	Big payoffs from investing in technology and content
Return on capital	15.24%	Marginal ROIC =	89.16%		10.00%	The last man standing...
Cost of capital (d)		7.97% →	7.50%		7.50%	Low debt & diverse business mix

The Cash Flows

	Revenues	Operating Margin	EBIT		EBIT (1-t)		Reinvestment		FCFF	
1	$ 239,344	8.67%	$	20,753	$	16,560	$	5,249	$	11,311
2	$ 275,245	9.63%	$	26,501	$	21,147	$	6,037	$	15,110
3	$ 316,532	10.59%	$	33,506	$	26,736	$	6,942	$	19,794
4	$ 364,012	11.54%	$	42,017	$	33,527	$	7,983	$	25,544
5	$ 418,614	12.50%	$	52,327	$	41,754	$	9,181	$	32,573
6	$ 471,359	12.50%	$	58,920	$	46,568	$	8,869	$	37,699
7	$ 519,438	12.50%	$	64,930	$	50,825	$	8,084	$	42,741
8	$ 559,954	12.50%	$	69,994	$	54,258	$	6,813	$	47,446
9	$ 590,191	12.50%	$	73,774	$	56,628	$	5,084	$	51,544
10	$ 607,897	12.50%	$	75,987	$	57,750	$	2,977	$	54,773
Terminal year	$ 626,134	12.50%	$	78,267	$	59,483	$	17,845	$	41,638

The Value

Terminal value	$	925,287	
PV(Terminal value)	$	435,438	
PV (CF over next 10 years)	$	206,707	
Value of operating assets =	$	642,144	
Adjustment for distress	$	-	Probability of failure = 0.00%
- Debt & Mnority Interests	$	45,435	
+ Cash & Other Non-operating assets	$	27,050	
Value of equity	$	623,759	
- Value of equity options	$	-	
Number of shares		497.00	
Value per share	$	1,255.05	Stock was trading at = $1,970.19

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10. You can make mistakes, but try to keep bias out..

- When you are wrong on individual company valuations, as you inevitably will be, recognize that while those mistakes may cause the value to be very different from the price for an individual company, the mistakes should average out across companies.
    - Put differently, if you are an investor, you have can make the "law of large numbers" work for you by diversifying across companies, with the degree of diversification increasing as uncertainty increases.
- If you are "biased" on individual company valuations, your mistakes will not average out, no matter how diversified you get.
- Bottom line: You are better off making large mistakes and being unbiased than making smaller mistakes, with bias.

Aswath Damodaran