UNCERTAINTY IN PROJECT ANALYSIS: WHAT CAN WE DO?

- Based on our expected cash flows and the estimated cost of capital, the proposed theme park looks like a very good investment for Disney. Which of the following may affect your assessment of value?
  a. Revenues may be over estimated (crowds may be smaller and spend less)
  b. Actual costs may be higher than estimated costs
  c. Tax rates may go up
  d. Interest rates may rise
  e. Risk premiums and default spreads may increase
  f. All of the above
- How would you respond to this uncertainty?
  a. Will wait for the uncertainty to be resolved
  b. Will not take the investment
  c. Ask someone else (consultant, boss, colleague) to make the decision
  d. Ignore it.
  e. Other

ONE SIMPLISTIC SOLUTION: SEE HOW QUICKLY YOU CAN GET YOUR MONEY BACK...

- If your biggest fear is losing the billions that you invested in the project, one simple measure that you can compute is the number of years it will take you to get your money back.

Year	Cash Flow	Cumulated CF	PV of Cash Flow	Cumulated DCF
0	-$2,000	-$2,000	-$2,000	-$2,000
1	-$1,000	-$3,000	-$922	-$2,922
2	-$859	-$3,859	-$730	-$3,652
3	-$267	-$4,126	-$210	-$3,862
4	$340	-$3,786	$246	-$3,616
5	$466	-$3,320	$311	-$3,305
6	$516	-$2,803	$317	-$2,988
7	$555	-$2,248	$314	-$2,674
8	$615	-$1,633	$321	-$2,353
9	$681	-$952	$328	-$2,025
10	$715	-$237	$317	-$1,708
11	$729	$491	$298	-$1,409
12	$743	$1,235	$280	-$1,129
13	$758	$1,993	$264	-$865
14	$773	$2,766	$248	-$617
15	$789	$3,555	$233	-$384
16	$805	$4,360	$219	-$165
17	$821	$5,181	$206	$41

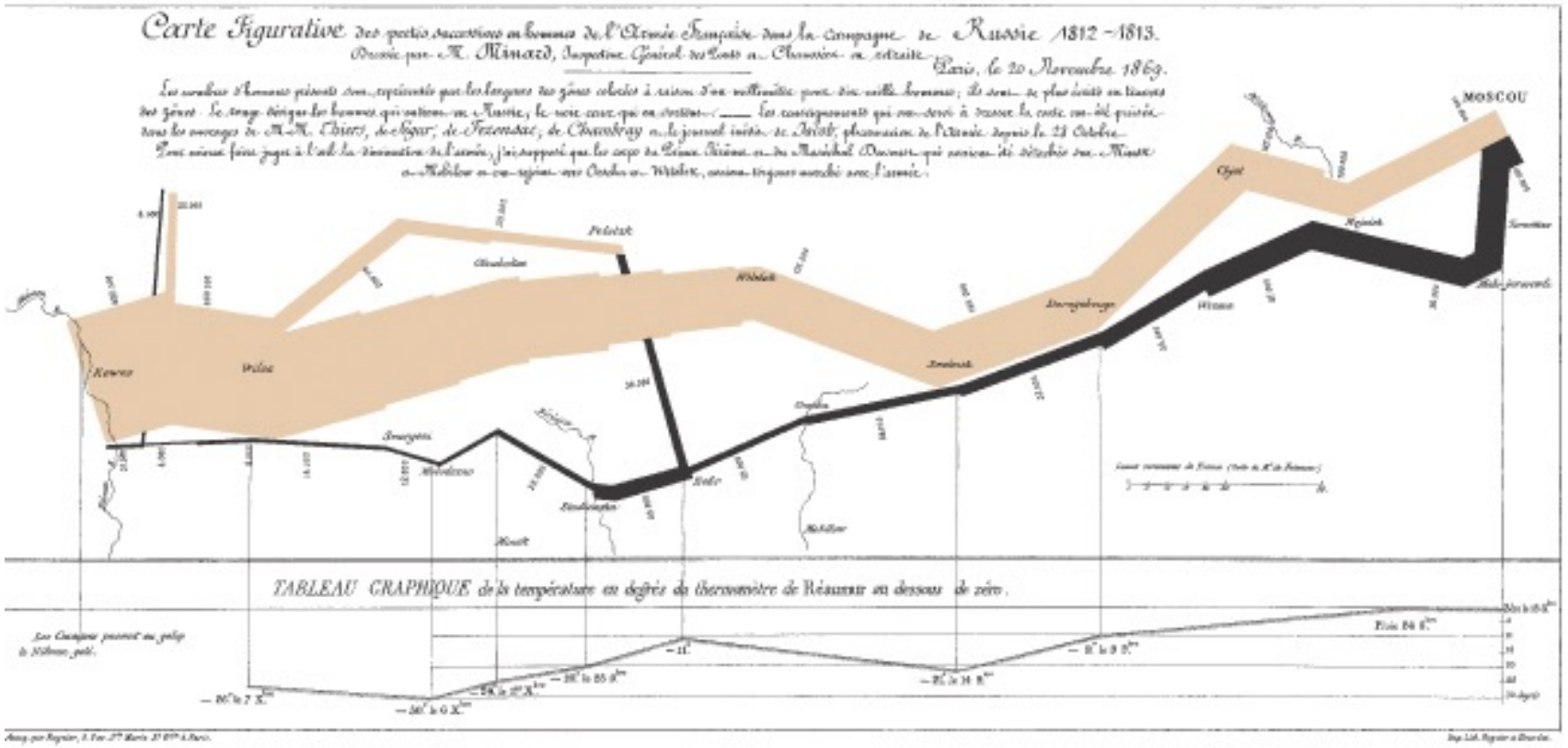
Payback = 10.3 years

Discounted Payback = 16.8 years

A SLIGHTLY MORE SOPHISTICATED APPROACH: SENSITIVITY ANALYSIS & WHAT-IF QUESTIONS...

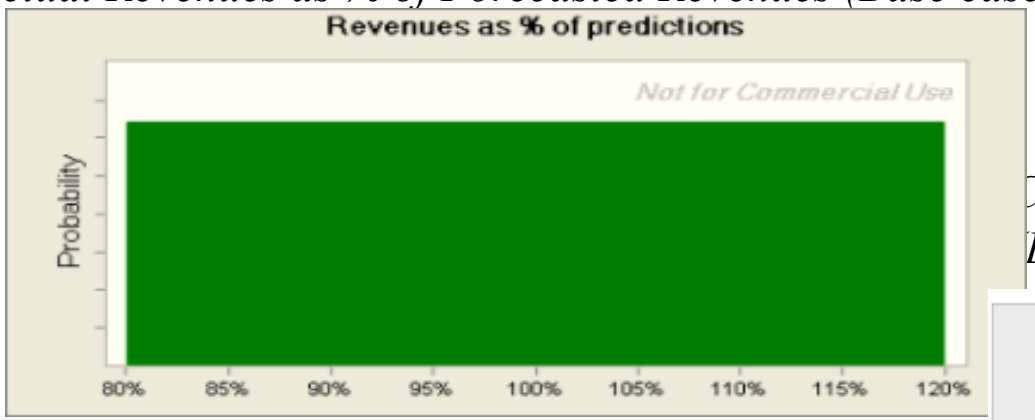
- The NPV, IRR and accounting returns for an investment will change as we change the values that we use for different variables.
- One way of analyzing uncertainty is to check to see how sensitive the decision measure (NPV, IRR..) is to changes in key assumptions. While this has become easier and easier to do over time, there are caveats that we would offer.
- **Caveat 1**: When analyzing the effects of changing a variable, we often hold all else constant. In the real world, variables move together.
- **Caveat 2**: The objective in sensitivity analysis is that we make better decisions, not churn out more tables and numbers.
  - **Corollary 1:** Less is more. Not everything is worth varying…
  - **Corollary 2**: A picture is worth a thousand numbers (and tables).

AND HERE IS A REALLY GOOD PICTURE...

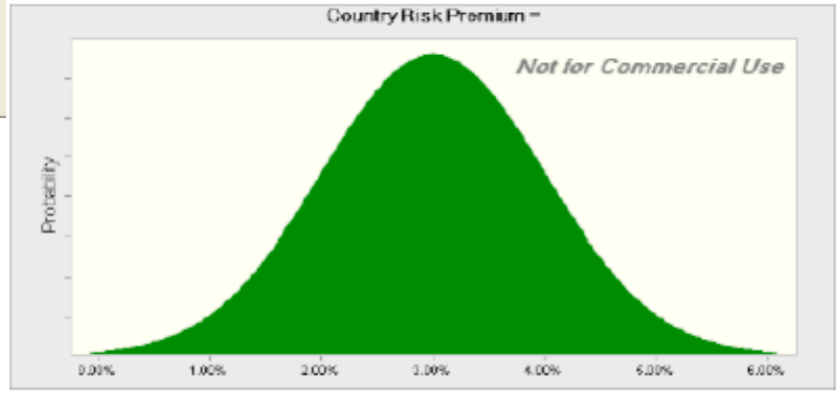


THE FINAL STEP UP: INCORPORATE PROBABILISTIC ESTIMATES.. RATHER THAN EXPECTED VALUES..

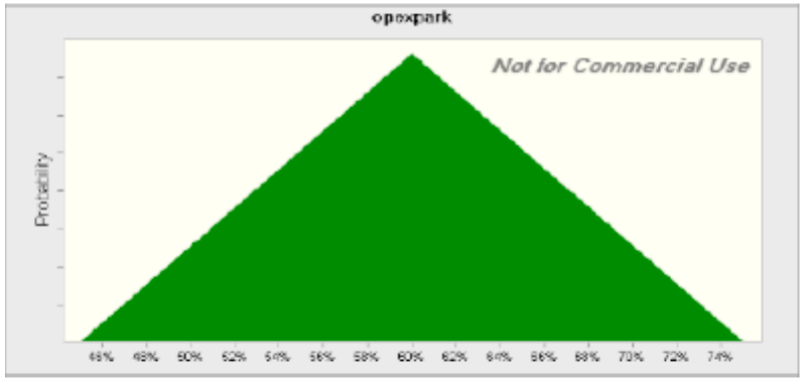
Actual Revenues as % of Forecasted Revenues (Base case = 100%)



Country Risk Premium (Base Case = 3% (Brazil))

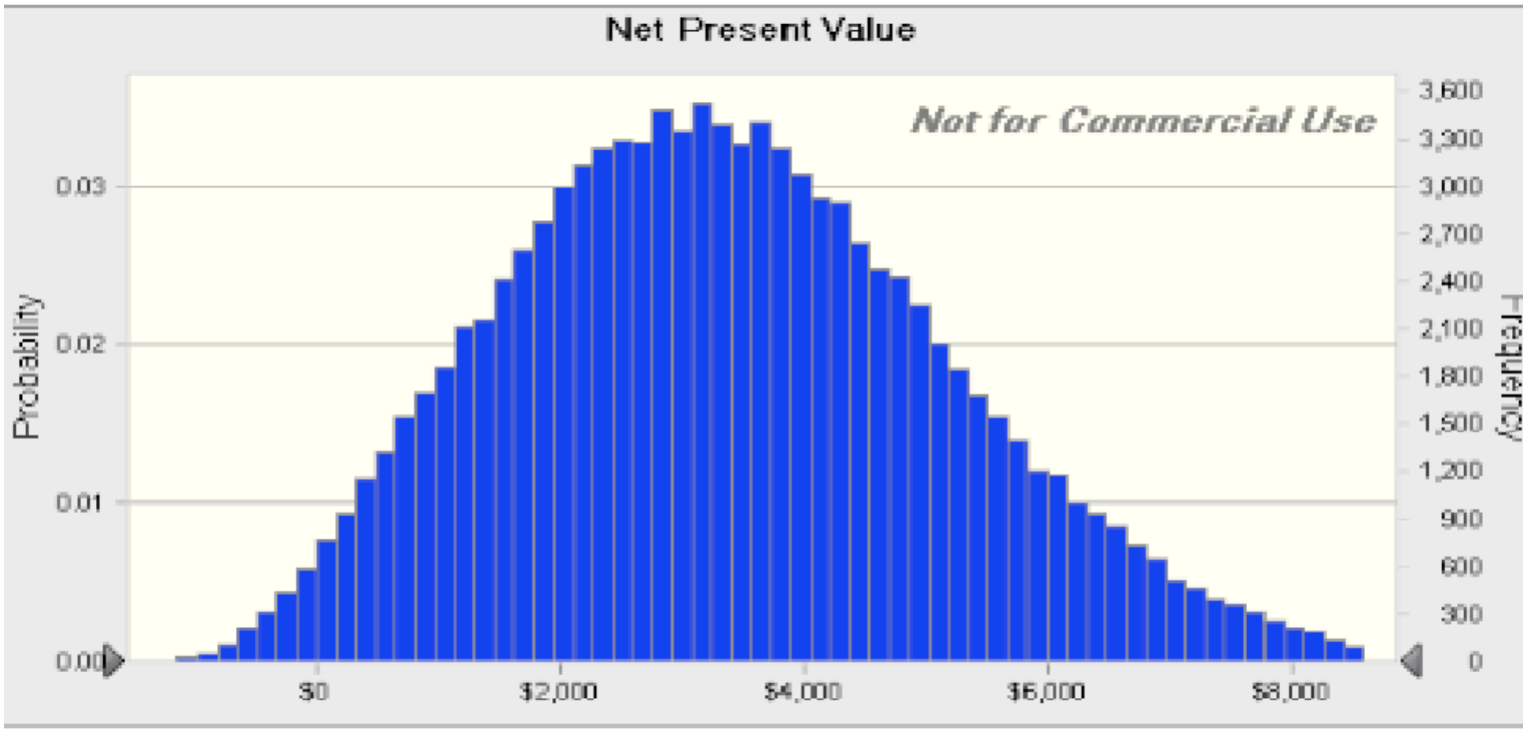


Operating Expenses at Parks as % of Revenues (Base Case = 60%)



THE RESULTING SIMULATION...

Average = $3.40 billion
Median = $3.28 billion



NPV ranges from -$1 billion to +$8.5 billion. NPV is negative 12% of the time.

YOU ARE THE DECISION MAKER...

- Assume that you are the person at Disney who is given the results of the simulation. **The average and median NPV are close to your base case values of $3.29 billion.**
- However, there is a 12% probability that the project could have a negative NPV and that the NPV could be a large negative value? How would you use this information?
  a. I would accept the investment and print the results of this simulation and file them away to show that I exercised due diligence.
  b. I would reject the investment, because it is too risky (there is a 10% chance that it could be a bad project)
  c. Other

DISNEY+: A STREAMING EXPERIMENT

- In 2020, Disney focused much of its attention and spending on Disney +, its subscription-based competitor to Netflix.
- While the initial selling point for Disney+ was the immense content that Disney controlled, it became very clear early on (with the Mandalorian) that to get new subscribers, Disney would have to create new exclusive content.
  - Given that Disney could not and did not want to compete with Netflix on sheer volume, it had to compensate by spending more on its new shows, many of which were based off either the Star Wars or Marvel franchises.
  - Even with this constraint in place, Disney doubled its content spending because of Disney+, effectively

A NEW MARVEL TV SERIES

- Assume that Disney is considering a new 8-episode series that will spin off a Marvel character series, and expects each episode to cost $25 million. (Mandalorian cost $15 million/episode and Wandavision cost $25 million/episode).
- It is planning to offer it only to Disney+ subscribers.
  a. What are the benefits to Disney from adding this series?
  b. How would you go about estimating whether it is getting these promised benefits?
  c. Is there a way you can come to a NPV assessment?

EQUITY ANALYSIS: THE PARALLELS

- The investment analysis can be done entirely in equity terms, as well. The returns, cashflows and hurdle rates will all be defined from the perspective of equity investors.
- If using accounting returns,
  - Return will be Return on Equity (ROE) = Net Income/BV of Equity
  - ROE has to be greater than cost of equity
- If using discounted cashflow models,
  - Cashflows will be cashflows after debt payments to equity investors
  - Hurdle rate will be cost of equity

A VALE IRON ORE MINE IN CANADA INVESTMENT OPERATING ASSUMPTIONS

- The mine will **require an initial investment of $1.25 billion** and is expected to have a production capacity of 8 million tons of iron ore, once established. It will be **depreciated over ten years, using double declining balance depreciation, down to a salvage value of $250 million** at the end of ten years.
- The mine will start production midway through the next year, producing 4 million tons of iron ore for year 1, with production increasing to 6 million tons in year 2 and leveling off at 8 million tons thereafter (until year 10). **The price, in US dollars per ton of iron ore is currently $100 and is expected to keep pace with inflation for the life of the plant.**
- The **variable cost of production, including labor, material and operating expenses, is expected to be $45/ton of iron ore produced and there is a fixed cost of $125 million in year 1**. Both costs, which will grow at the inflation rate of 2% thereafter.
- The **working capital requirements are estimated to be 20% of total revenues**, and the investments have to be made at the beginning of each year. At the end of the tenth year, it is anticipated that the entire working capital will be salvaged.
- Vale's corporate tax rate of 34% will apply to this project as well.

FINANCING ASSUMPTIONS

- **Vale plans to borrow $0.5 billion** at its current cost of debt of 4.05% (based upon its rating of A-), using a ten-year term loan (where the loan will be paid off in equal annual increments).
- The breakdown of the payments each year into interest and principal are:

Year	Beginning Debt	Interest expense	Principal Repaid	Total Payment	Ending Debt
1	$500.00	$20.25	$41.55	$61.80	$458.45
2	$458.45	$18.57	$43.23	$61.80	$415.22
3	$415.22	$16.82	$44.98	$61.80	$370.24
4	$370.24	$14.99	$46.80	$61.80	$323.43
5	$323.43	$13.10	$48.70	$61.80	$274.73
6	$274.73	$11.13	$50.67	$61.80	$224.06
7	$224.06	$9.07	$52.72	$61.80	$171.34
8	$171.34	$6.94	$54.86	$61.80	$116.48
9	$116.48	$4.72	$57.08	$61.80	$59.39
10	$59.39	$2.41	$59.39	$61.80	$0.00

THE HURDLE RATE

- The **analysis is done US dollar terms and to equity investors.** Thus, the hurdle rate has to be a US $ cost of equity.
- In the earlier section, we estimated costs of equity, debt and capital in US dollars and $R for Vale's iron ore business.

Business	*Cost of equity*	*After-tax cost of debt*	*Debt ratio*	*Cost of capital (in US$)*	*Cost of capital (in $R)*
Metals & Mining	11.35%	2.67%	35.48%	8.27%	15.70%
Iron Ore	**11.13%**	**2.67%**	**35.48%**	**8.13%**	**15.55%**
Fertilizers	12.70%	2.67%	35.48%	9.14%	16.63%
Logistics	10.29%	2.67%	35.48%	7.59%	14.97%
Vale Operations	11.23%	2.67%	35.48%	8.20%	15.62%

NET INCOME: VALE IRON ORE MINE

	1	2	3	4	5	6	7	8	9	10
Production (millions of tons)	4.00	6.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
* Price per ton	102	104.04	106.12	108.24	110.41	112.62	114.87	117.17	119.51	121.9
= Revenues (millions US$)	$408.00	$624.24	$848.97	$865.95	$883.26	$900.93	$918.95	$937.33	$956.07	$975.20
- Variable Costs	$180.00	$275.40	$374.54	$382.03	$389.68	$397.47	$405.42	$413.53	$421.80	$430.23
- Fixed Costs	$125.00	$127.50	$130.05	$132.65	$135.30	$138.01	$140.77	$143.59	$146.46	$149.39
- Depreciation	$200.00	$160.00	$128.00	$102.40	$81.92	$65.54	$65.54	$65.54	$65.54	$65.54
EBIT	-$97.00	$61.34	$216.37	$248.86	$276.37	$299.91	$307.22	$314.68	$322.28	$330.04
- Interest Expenses	$20.25	$18.57	$16.82	$14.99	$13.10	$11.13	$9.07	$6.94	$4.72	$2.41
Taxable Income	-$117.25	$42.77	$199.56	$233.87	$263.27	$288.79	$298.15	$307.74	$317.57	$327.63
- Taxes	($39.87)	$14.54	$67.85	$79.51	$89.51	$98.19	$101.37	$104.63	$107.97	$111.40
= Net Income (millions US$)	-$77.39	$28.23	$131.71	$154.35	$173.76	$190.60	$196.78	$203.11	$209.59	$216.24
Book Value and Depreciation										
Beg. Book Value	$1,250.00	$1,050.00	$890.00	$762.00	$659.60	$577.68	$512.14	$446.61	$381.07	$315.54
- Depreciation	$200.00	$160.00	$128.00	$102.40	$81.92	$65.54	$65.54	$65.54	$65.54	$65.54
+ Capital Exp.	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
End Book Value	$1,050.00	$890.00	$762.00	$659.60	$577.68	$512.14	$446.61	$381.07	$315.54	$250.00
- Debt Outstanding	$458.45	$415.22	$370.24	$323.43	$274.73	$224.06	$171.34	$116.48	$59.39	$0.00
End Book Value of Equity	$591.55	$474.78	$391.76	$336.17	$302.95	$288.08	$275.27	$264.60	$256.14	$250.00

A ROE ANALYSIS

Year	Net Income	Beg. BV: Assets	Depreciation	Capital Expense	Ending BV: Assets	BV of Working Capital	Debt	BV: Equity	Average BV: Equity	ROE
0		$0.00	$0.00	$1,250.00	$1,250.00	$81.60	$500.00	$831.60		
1	($77.39)	$1,250.00	$200.00	$0.00	$1,050.00	$124.85	$458.45	$716.40	$774.00	-10.00%
2	$28.23	$1,050.00	$160.00	$0.00	$890.00	$169.79	$415.22	$644.57	$680.49	4.15%
3	$131.71	$890.00	$128.00	$0.00	$762.00	$173.19	$370.24	$564.95	$604.76	21.78%
4	$154.35	$762.00	$102.40	$0.00	$659.60	$176.65	$323.43	$512.82	$538.89	28.64%
5	$173.76	$659.60	$81.92	$0.00	$577.68	$180.19	$274.73	$483.13	$497.98	34.89%
6	$190.60	$577.68	$65.54	$0.00	$512.14	$183.79	$224.06	$471.87	$477.50	39.92%
7	$196.78	$512.14	$65.54	$0.00	$446.61	$187.47	$171.34	$462.74	$467.31	42.11%
8	$203.11	$446.61	$65.54	$0.00	$381.07	$191.21	$116.48	$455.81	$459.27	44.22%
9	$209.59	$381.07	$65.54	$0.00	$315.54	$195.04	$59.39	$451.18	$453.50	46.22%
10	$216.24	$315.54	$65.54	$0.00	$250.00	$0.00	$0.00	$250.00	$350.59	61.68%
Average ROE over the ten-year period =										31.36%

US $ ROE of 31.36% is greater than

Vale Iron Ore US$ Cost of Equity of 11.13%

FROM PROJECT ROE TO FIRM ROE

- As with the earlier analysis, where we used return on capital and cost of capital to measure the overall quality of projects at firms, we can compute return on equity and cost of equity to pass judgment on whether firms are creating value to its equity investors.
- Specifically, we can compute the return on equity (net income as a percentage of book equity) and compare to the cost of equity. The return spread is then:
  - Equity Return Spread = Return on Equity – Cost of equity
- This measure is particularly useful for financial service firms, where capital, return on capital and cost of capital are difficult measures to nail down. For non-financial service firms, it provides a secondary (albeit a more volatile measure of performance). While it usually provides the same general result that the excess return computed from return on capital, there can be cases where the two measures diverge.
- Applied to Disney in 2013, for example, here is what we get:
  - ROE in 2013 = Net Income in 2013 / Book Value of Equity in 2013 = 14.62%
  - Cost of Equity for Disney = 8.52%

AN INCREMENTAL CF ANALYSIS

	0	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Net Income		($77.39)	$28.23	$131.71	$154.35	$173.76	$190.60	$196.78	$203.11	$209.59	$216.24
+ Depreciation & Amortization		$200.00	$160.00	$128.00	$102.40	$81.92	$65.54	$65.54	$65.54	$65.54	$65.54
- Capital Expenditures	$750.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
- Change in Working Capital	$81.60	$43.25	$44.95	$3.40	$3.46	$3.53	$3.60	$3.68	$3.75	$3.82	($195.04)
- Debt Repayments		$41.55	$43.23	$44.98	$46.80	$48.70	$50.67	$52.72	$54.86	$57.08	$59.39
+ Salvage Value of mine											$250.00
Cashflow to Equity	($831.60)	$37.82	$100.05	$211.33	$206.48	$203.44	$201.86	$205.91	$210.04	$214.22	$667.42

The equity portion of my initial investment

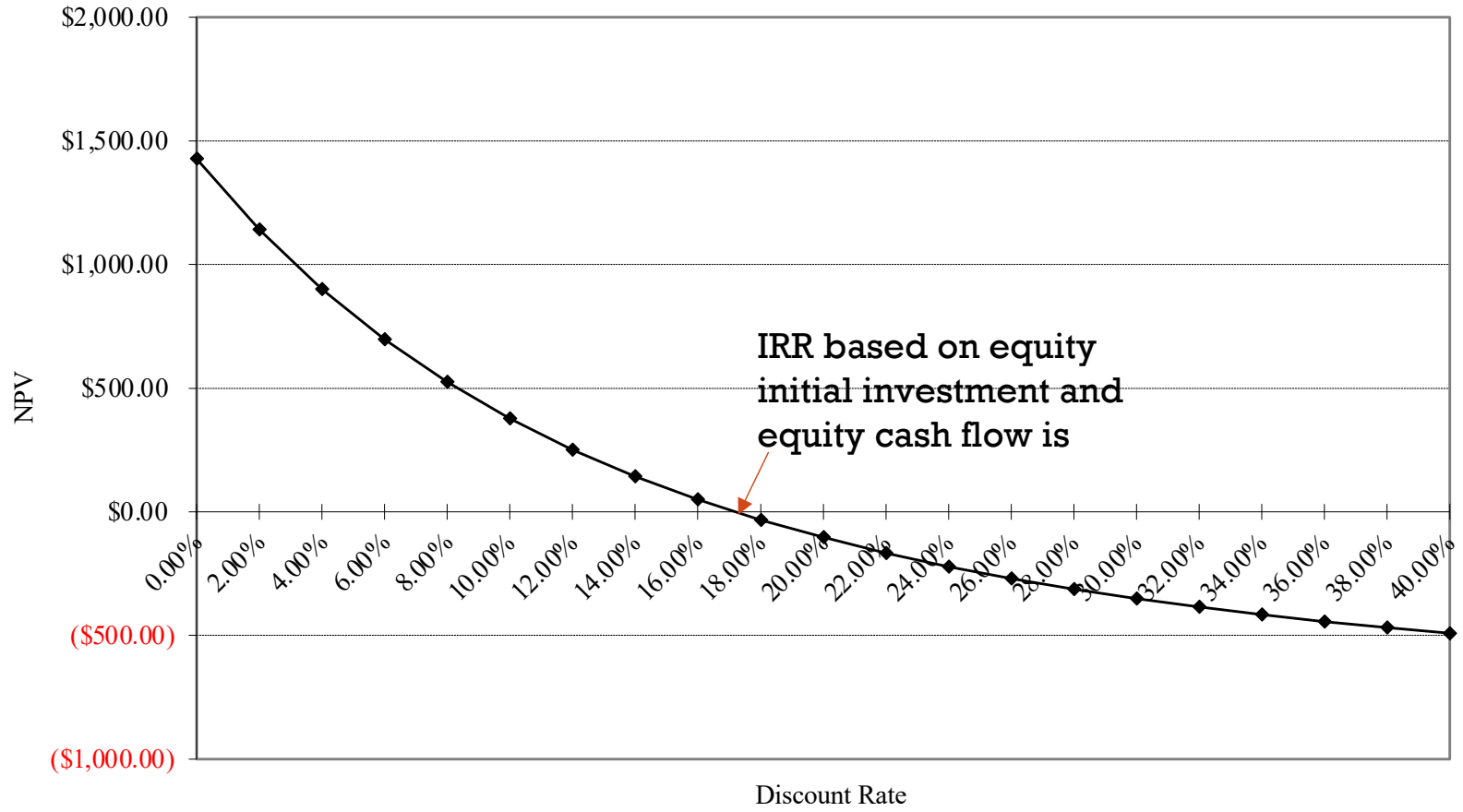
AN EQUITY NPV

Discounted at US$ cost of equity of 11.13% for Vale's iron ore business

Year	Cash flow to equity	PV @11.13%
0	-$831.60	-$831.60
1	$37.82	$34.03
2	$100.05	$81.02
3	$211.33	$153.99
4	$206.48	$135.40
5	$203.44	$120.04
6	$201.86	$107.18
7	$205.91	$98.39
8	$210.04	$90.31
9	$214.22	$82.89
10	$667.42	$232.38
NPV		$304.04

AN EQUITY IRR

Figure 5.6: NPV Profile on Equity Investment in Iron Ore Mine- Vale



REAL VERSUS NOMINAL ANALYSIS

- In computing the NPV of the plant, we estimated US $ cash flows and discounted them at the US $ cost of equity.
- We could have estimated the cash flows in real terms (with no inflation) and discounted them at a real cost of equity. Would the answer be different?

a. Yes

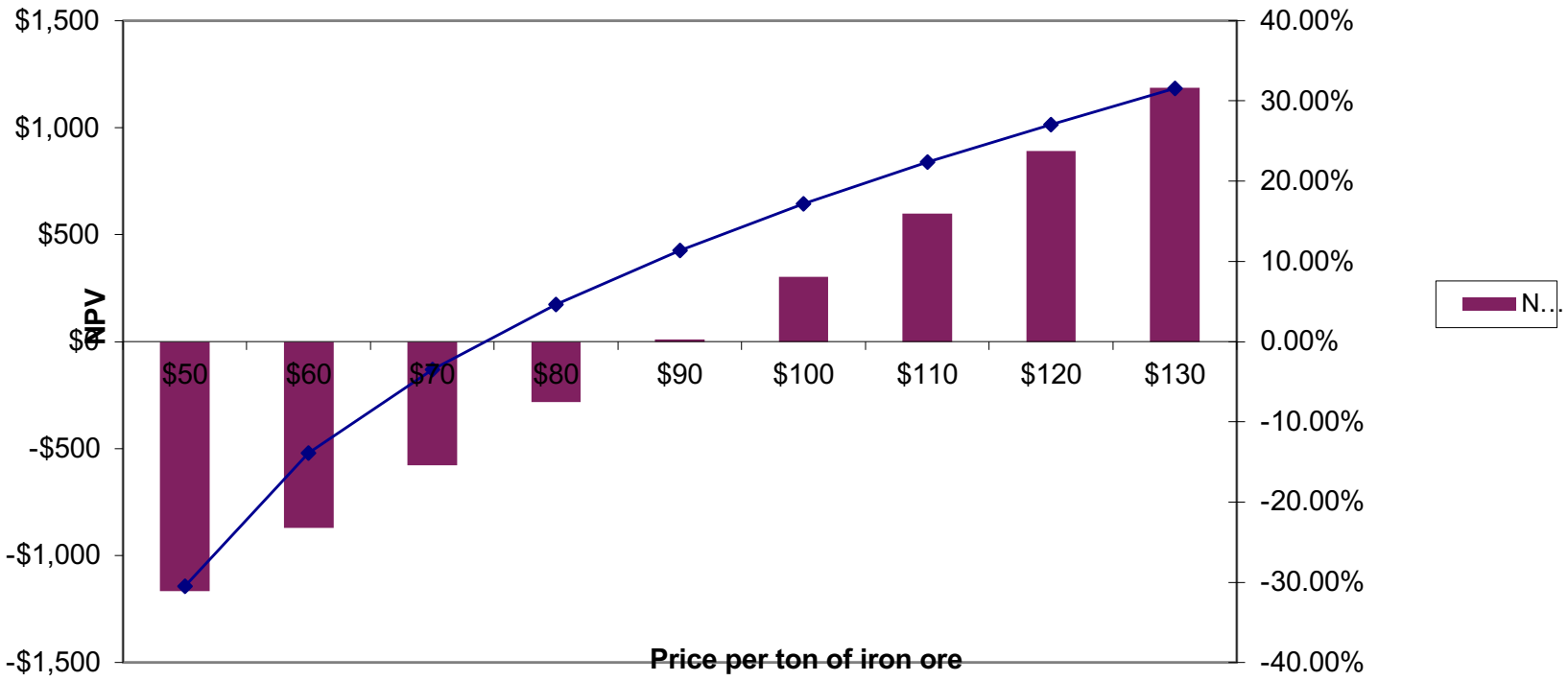
b. No

- Explain.

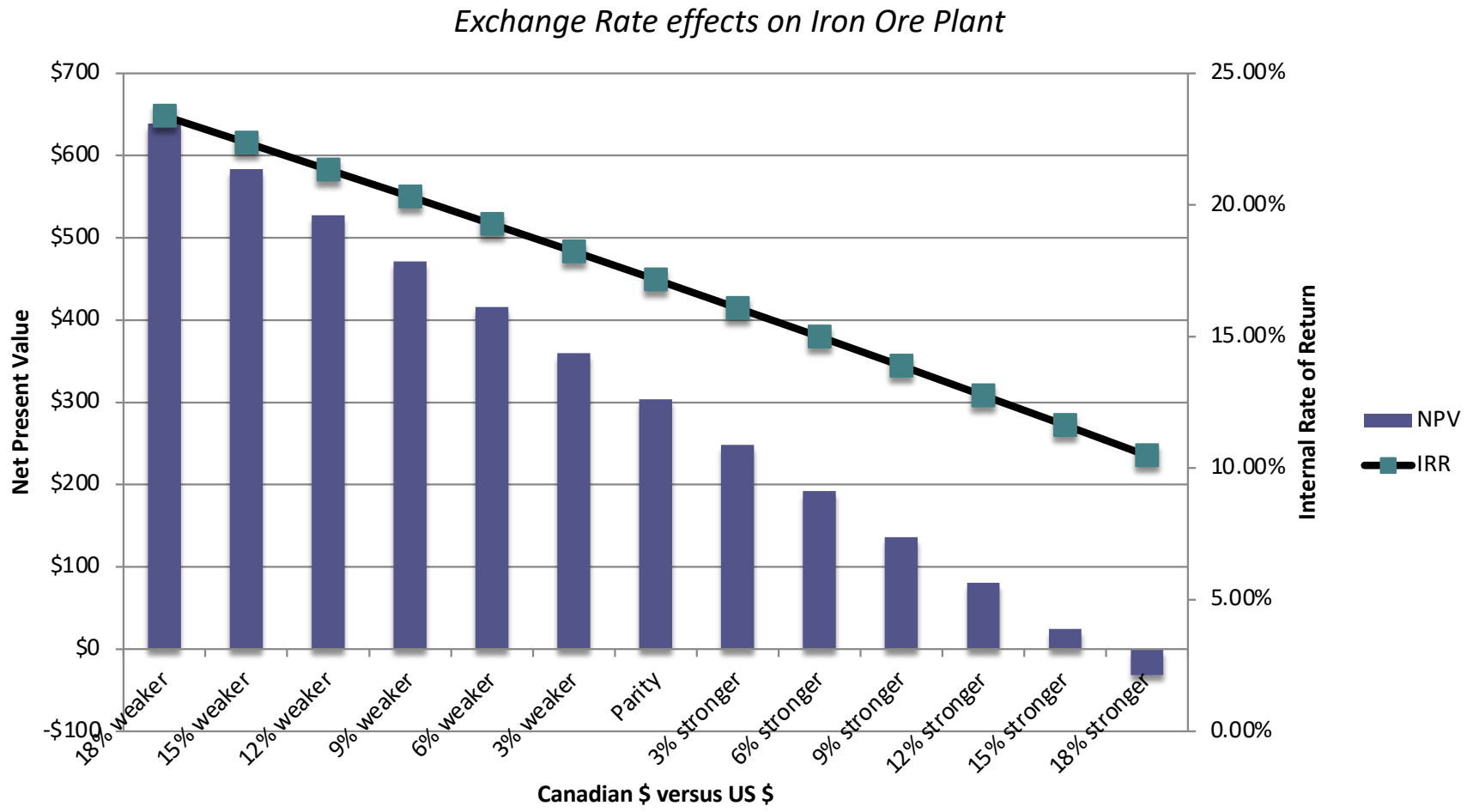
DEALING WITH MACRO UNCERTAINTY: THE EFFECT OF IRON ORE PRICE

- Like the Disney Theme Park, the Vale Iron Ore Mine's actual value will be buffeted as the variables change. The biggest source of variability is an external factor –the price of iron ore.

Vale Paper Plant: Effect of Changing Iron Ore Prices



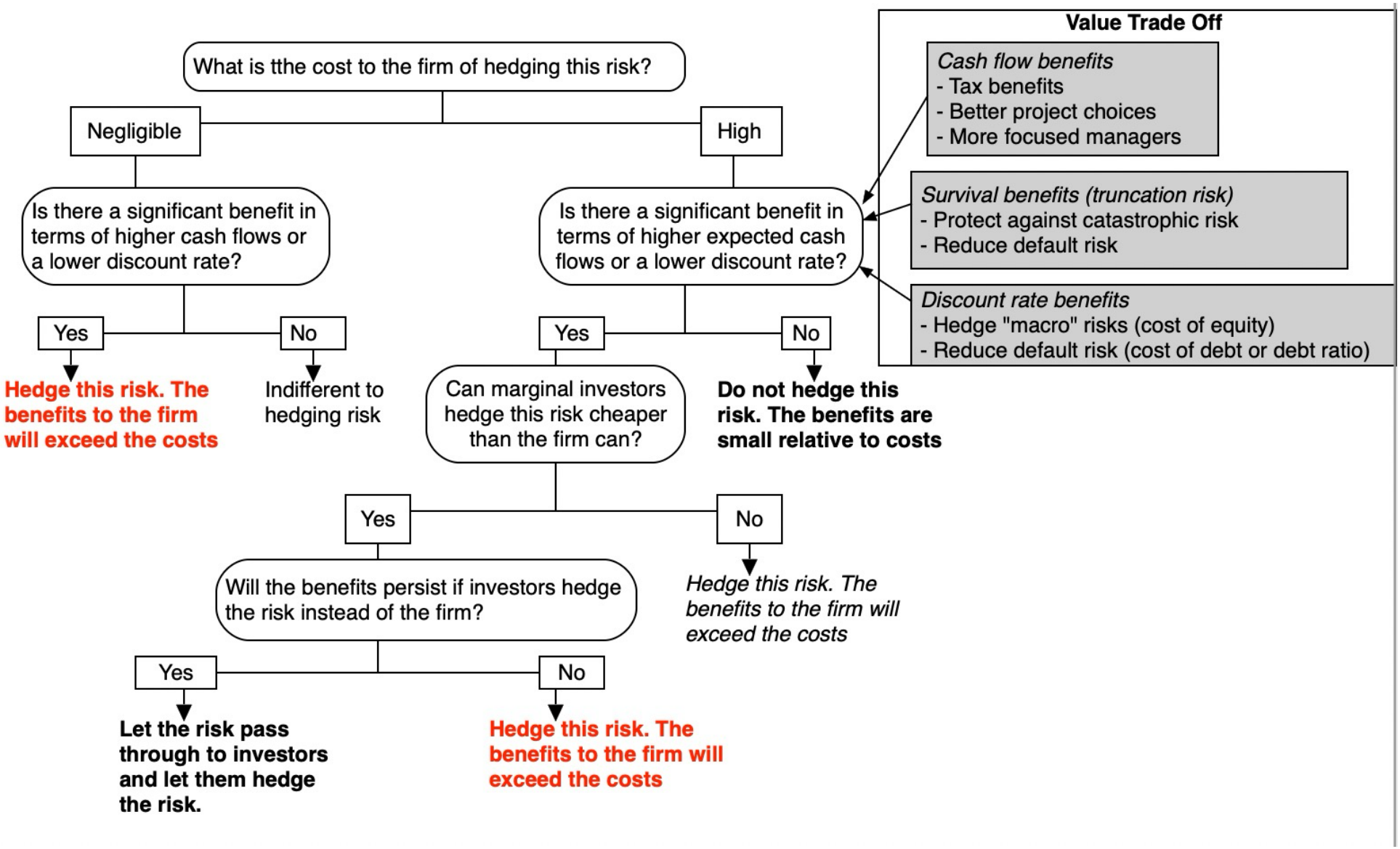
AND EXCHANGE RATES...



SHOULD YOU HEDGE?

- The value of this mine is very much a function iron ore prices. There are futures, forward and option markets iron ore that Vale can use to hedge against price movements. Should it?
  a. Yes
  b. No
- Explain.
- The value of the mine is also a function of exchange rates. There are forward, futures and options markets on currency. Should Vale hedge against exchange rate risk?
  a. Yes
  b. No
- Explain.
- On the last question, would your answer have been different if the mine were in Brazil.
  a. Yes
  b. No

To hedge or not to hedge?



ACQUISITIONS AND PROJECTS

- An **acquisition is an investment/project like any other** and all of the rules that apply to traditional investments should apply to acquisitions as well. In other words, for an acquisition to make sense:
  - It should have positive NPV. The present value of the expected cash flows from the acquisition should exceed the price paid on the acquisition.
  - The IRR of the cash flows to the firm (equity) from the acquisition > Cost of capital (equity) on the acquisition
- In estimating the cash flows on the acquisition, we should **count in any possible cash flows from synergy.**
- The discount rate to assess the present value should be based upon the risk of the investment (target company) and not the entity considering the investment (acquiring company).

TATA MOTORS AND HARMAN INTERNATIONAL

- Harman International is a publicly traded US firm that manufactures high end audio equipment. Tata Motors is an automobile company, based in India.
- Tata Motors is considering an acquisition of Harman, with an eye on using its audio equipment in its Indian automobiles, as optional upgrades on new cars.

ESTIMATING THE COST OF CAPITAL FOR THE ACQUISITION (NO SYNERGY)

- **Currency**: Estimated in US $, since cash flows will be estimated in US $.
- **Beta**: Harman International is an electronic company and we use the unlevered beta (1.17) of electronics companies in the US.
- **Equity Risk Premium**: Computed based on Harman's operating exposure:

	Revenues: 2012-13 (in millions)	ERP	Weight	Weight *ERP
United States	$1,181	5.50%	27.48%	1.51%
Germany	$1,482	5.50%	34.48%	1.90%
Rest of Europe	$819	7.02%	19.06%	1.34%
Asia	$816	7.27%	18.99%	1.38%
Harman	*$4,298*		*100.00%*	*6.13%*

- **Debt ratio & cost of debt**: Tata Motors plans to assume the existing debt of Harman International and to preserve Harman's existing debt ratio. Harman currently has a debt (including lease commitments) to capital ratio of 7.39% (translating into a debt to equity ratio of 7.98%) and faces a pre-tax cost of debt of 4.75% (based on its BBB- rating).
- Levered Beta = 1.17 (1+ (1-.40) (.0798)) = 1.226
- Cost of Equity= 2.75% + 1.226 (6.13%) = 10.26%

Cost of Capital = 10.26% (1-.0739) + 4.75% (1-.40) (.0739) = 9.67%

ESTIMATING CASHFLOWS- FIRST STEPS

- **Operating Income**: The firm reported operating income of $201.25 million on revenues of $4.30 billion for the year. Adding back non-recurring expenses (restructuring charge of $83.2 million in 2013) and adjusting income for the conversion of operating lease commitments to debt, we estimated an adjusted operating income of $313.2 million. The firm paid 18.21% of its income as taxes in 2013 and we will use this as the effective tax rate for the cash flows.
- **Reinvestment**: Depreciation in 2013 amounted to $128.2 million, whereas capital expenditures and acquisitions for the year were $206.4 million. Non-cash working capital increased by $272.6 million during 2013 but was 13.54% of revenues in 2013.

BRINGING IN GROWTH

- We will assume that Harman International is a mature firm, growing 2.75% in perpetuity.
- We assume that revenues, operating income, capital expenditures and depreciation will all grow 2.75% for the year and that the non-cash working capital remain 13.54% of revenues in future periods.

	2013	2014
Revenues	$4,297.80	$4,415.99
Operating income	$313.19	$321.80
Tax rate	18.21%	18.21%
After-tax Operating income	$256.16	$263.21
+ Depreciation	$128.20	$131.73
- Capital Expenditures	$206.40	$212.08
- Change in non-cash WC	$272.60	$16.01
Cash flow to the firm	-$94.64	$166.85

VALUE OF HARMAN INTERNATIONAL: BEFORE SYNERGY

- Earlier, we estimated the cost of capital of 9.67% as the right discount rate to apply in valuing Harman International and the cash flow to the firm of $166.85 million for 2014 (next year), assuming a 2.75% growth rate in revenues, operating income, depreciation, capital expenditures and total non-cash working capital. We also assumed that these cash flows would continue to grow 2.75% a year in perpetuity.

$$\text{Value of Operating Assets} = \frac{\text{Expected Cashflow to the firm next year}}{\text{(Cost of Capital - Stable growth rate)}}$$

$$= \frac{\$166.85}{(.0967 - .0275)} = \$2,476 \text{ million}$$

- Adding the cash balance of the firm ($515 million) and subtracting out the existing debt ($313 million, including the debt value of leases) yields the value of equity in the firm:
  - Value of Equity = $2,476 + $ 515 - $313 million = $2,678 million
- The market value of equity in Harman in November 2013 was $5,428 million. To the extent that Tata Motors pays the market price, it will have to generate benefits from synergy that exceed $2750 million.