Breaking out G&A Costs into fixed and variable components: A simple example

- Assume that you have a time series of revenues and G&A costs for a company.

Year	Revenues	G&A Costs
1	$1,000	$250
2	$1,200	$270
3	$1,500	$300

  - What percentage of the G&A cost is variable?

To Time-Weighted Cash Flows

- Incremental cash flows in the earlier years are worth more than incremental cash flows in later years.
- In fact, cash flows across time cannot be added up. They have to be brought to the same point in time before aggregation.
- This process of moving cash flows through time is
  - discounting, when future cash flows are brought to the present
  - compounding, when present cash flows are taken to the future

Present Value Mechanics

Cash Flow Type	Discounting Formula	Compounding Formula
1. Simple CF	$CF_n / (1+r)^n$	$CF_0 (1+r)^n$
2. Annuity	$A\left[\frac{1 - \frac{1}{(1+r)^n}}{r}\right]$	$A\left[\frac{(1+r)^n - 1}{r}\right]$
3. Growing Annuity	$A(1+g)\left[\frac{1 - \frac{(1+g)^n}{(1+r)^n}}{r-g}\right]$	
4. Perpetuity	A/r	
5. Growing Perpetuity	Expected Cashflow next year/(r-g)	

Discounted cash flow measures of return

- **Net Present Value (NPV)**: The net present value is the sum of the present values of all cash flows from the project (including initial investment).
  - NPV = Sum of the present values of all cash flows on the project, including the initial investment, with the cash flows being discounted at the appropriate hurdle rate (cost of capital, if cash flow is cash flow to the firm, and cost of equity, if cash flow is to equity investors)
  - Decision Rule: Accept if NPV > 0
- **Internal Rate of Return (IRR):** The internal rate of return is the discount rate that sets the net present value equal to zero. It is the percentage rate of return, based upon incremental time-weighted cash flows.
  - Decision Rule: Accept if IRR > hurdle rate

Closure on Cash Flows

- In a project with a finite and short life, you would need to compute a salvage value, which is the expected proceeds from selling all of the investment in the project at the end of the project life. It is usually set equal to book value of fixed assets and working capital
- In a project with an infinite or very long life, we compute cash flows for a reasonable period, and then compute a terminal value for this project, which is the present value of all cash flows that occur after the estimation period ends..
- Assuming the project lasts forever, and that cash flows after year 10 grow 2% (the inflation rate) forever, the present value at the end of year 10 of cash flows after that can be written as:
  - Terminal Value in year 10= CF in year 11/(Cost of Capital - Growth Rate)

    =715 (1.02) /(.0846-.02) = $ 11,275 million

Which yields a NPV of..

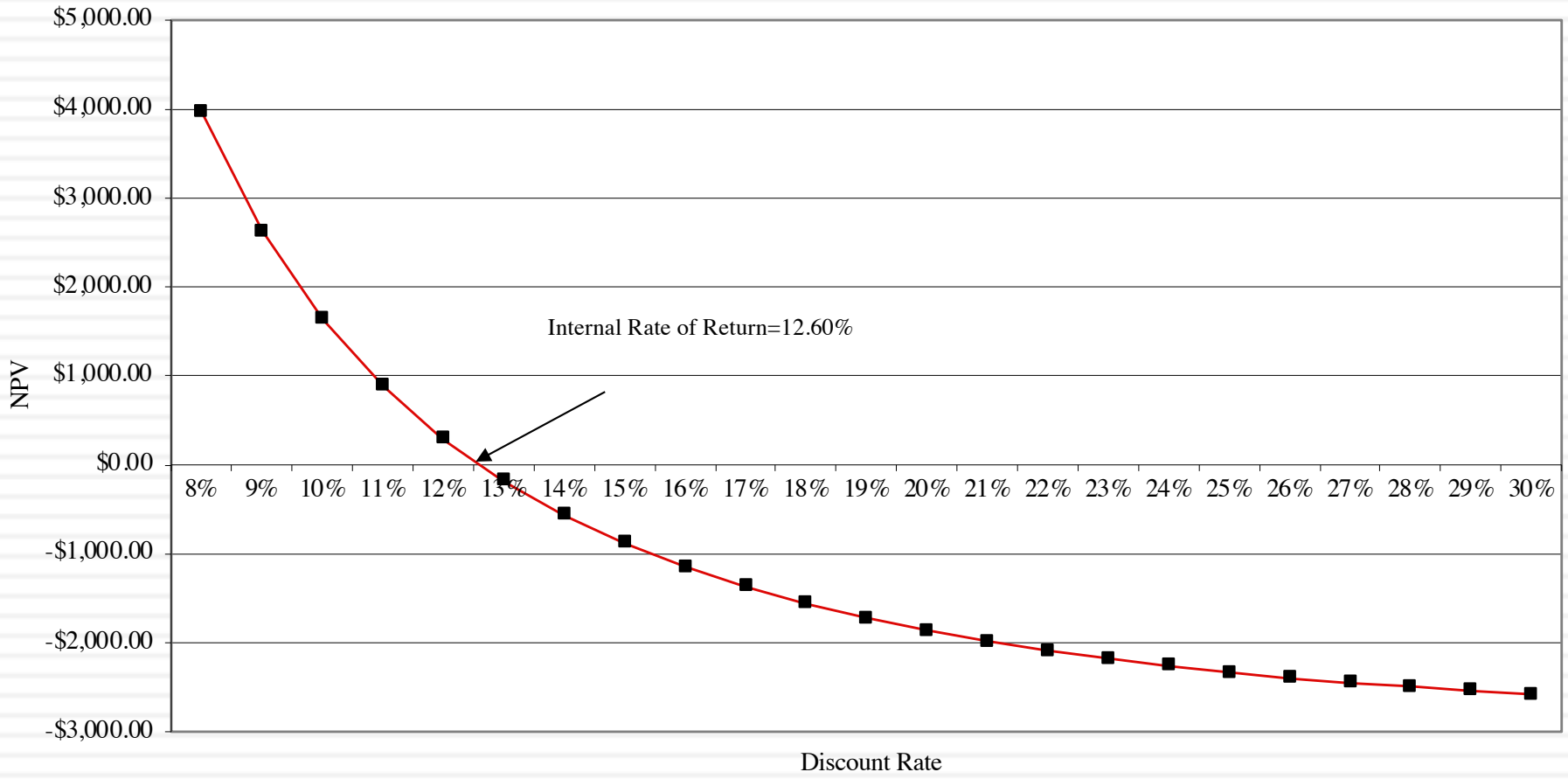
Year	Annual Cashflo	Terminal Value	Present Value
0	-$2,000		-$2,000
1	-$1,000		-$922
2	-$859		-$730
3	-$267		-$210
4	$340		$246
5	$466		$311
6	$516		$317
7	$555		$314
8	$615		$321
9	$681		$328
10	$715	$11,275	$5,321
			$3,296

Discounted at Rio Disney cost of capital of 8.46%

Which makes the argument that..

- The project should be accepted. The positive net present value suggests that the project will add value to the firm, and earn a return in excess of the cost of capital.
- By taking the project, Disney will increase its value as a firm by $3,296 million.

The IRR of this project



The IRR suggests..

- The project is a good one. Using time-weighted, incremental cash flows, this project provides a return of 12.60%. This is greater than the cost of capital of 8.46%.
- The IRR and the NPV will yield similar results most of the time, though there are differences between the two approaches that may cause project rankings to vary depending upon the approach used. They can yield different results, especially why comparing across projects because
  - A project can have only one NPV, whereas it can have more than one IRR.
  - The NPV is a dollar surplus value, whereas the IRR is a percentage measure of return. The NPV is therefore likely to be larger for "large scale" projects, while the IRR is higher for "small-scale" projects.
  - The NPV assumes that intermediate cash flows get reinvested at the "hurdle rate", which is based upon what you can make on investments of comparable risk, while the IRR assumes that intermediate cash flows get reinvested at the "IRR".

Does the currency matter?

- The analysis was done in dollars. Would the conclusions have been any different if we had done the analysis in Brazilian Reais?
  a. Yes
  b. No

The ‘‘Consistency Rule” for Cash Flows

- The cash flows on a project and the discount rate used should be defined in the same terms.
  - If cash flows are in dollars ($R), the discount rate has to be a dollar ($R) discount rate
  - If the cash flows are nominal (real), the discount rate has to be nominal (real).
- If consistency is maintained, the project conclusions should be identical, no matter what cash flows are used.

Disney Theme Park: Project Analysis in $R

- The inflation rates were assumed to be 9% in Brazil and 2% in the United States. The $R/dollar rate at the time of the analysis was 2.35 $R/dollar.
- The expected exchange rate was derived assuming purchasing power parity.
  - Expected Exchange Rate$_t$ = Exchange Rate today * $(1.09/1.02)^t$
- The expected growth rate after year 10 is still expected to be the inflation rate, but it is the 9% $R inflation rate.
- The cost of capital in $R was derived from the cost of capital in dollars and the differences in inflation rates:

$$\text{\$R Cost of Capital} = (1+\text{US \$ Cost of Capital})\frac{(1+\text{Exp Inflation}_{\text{Brazil}})}{(1+\text{Exp Inflation}_{\text{US}})} - 1$$

$$= (1.0846)\,(1.09/1.02) - 1 = 15.91\%$$

Disney Theme Park: $R NPV

Expected Exchange Rate$_t$ = Exchange Rate today * $(1.09/1.02)^t$

Discount at $R cost of capital = (1.0846) (1.09/1.02) – 1 = 15.91%

Year	Cashflow ($)	$R/$	Cashflow ($R)	Present Value
0	-R$ 2,000.00	R$ 2.35	-R$ 4,700.00	-R$ 4,700.00
1	-R$ 1,000.00	R$ 2.51	-R$ 2,511.27	-R$ 2,166.62
2	-R$ 859.03	R$ 2.68	-R$ 2,305.29	-R$ 1,715.95
3	-R$ 267.39	R$ 2.87	-R$ 766.82	-R$ 492.45
4	R$ 340.22	R$ 3.06	R$ 1,042.63	R$ 577.68
5	R$ 466.33	R$ 3.27	R$ 1,527.21	R$ 730.03
6	R$ 516.42	R$ 3.50	R$ 1,807.31	R$ 745.36
7	R$ 555.08	R$ 3.74	R$ 2,075.89	R$ 738.63
8	R$ 614.95	R$ 4.00	R$ 2,457.65	R$ 754.45
9	R$ 681.46	R$ 4.27	R$ 2,910.36	R$ 770.81
10	R$ 11,989.85	R$ 4.56	R$ 54,719.84	R$ 12,503.50
				R$ 7,745.43

NPV = R$ 7,745/2.35= $ 3,296 Million

NPV is equal to NPV in dollar terms

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?
  - Revenues may be over estimated (crowds may be smaller and spend less)
  - Actual costs may be higher than estimated costs
  - Tax rates may go up
  - Interest rates may rise
  - Risk premiums and default spreads may increase
  - All of the above
- How would you respond to this uncertainty?
  - Will wait for the uncertainty to be resolved
  - Will not take the investment
  - Ask someone else (consultant, boss, colleague) to make the decision
  - Ignore it.
  - 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

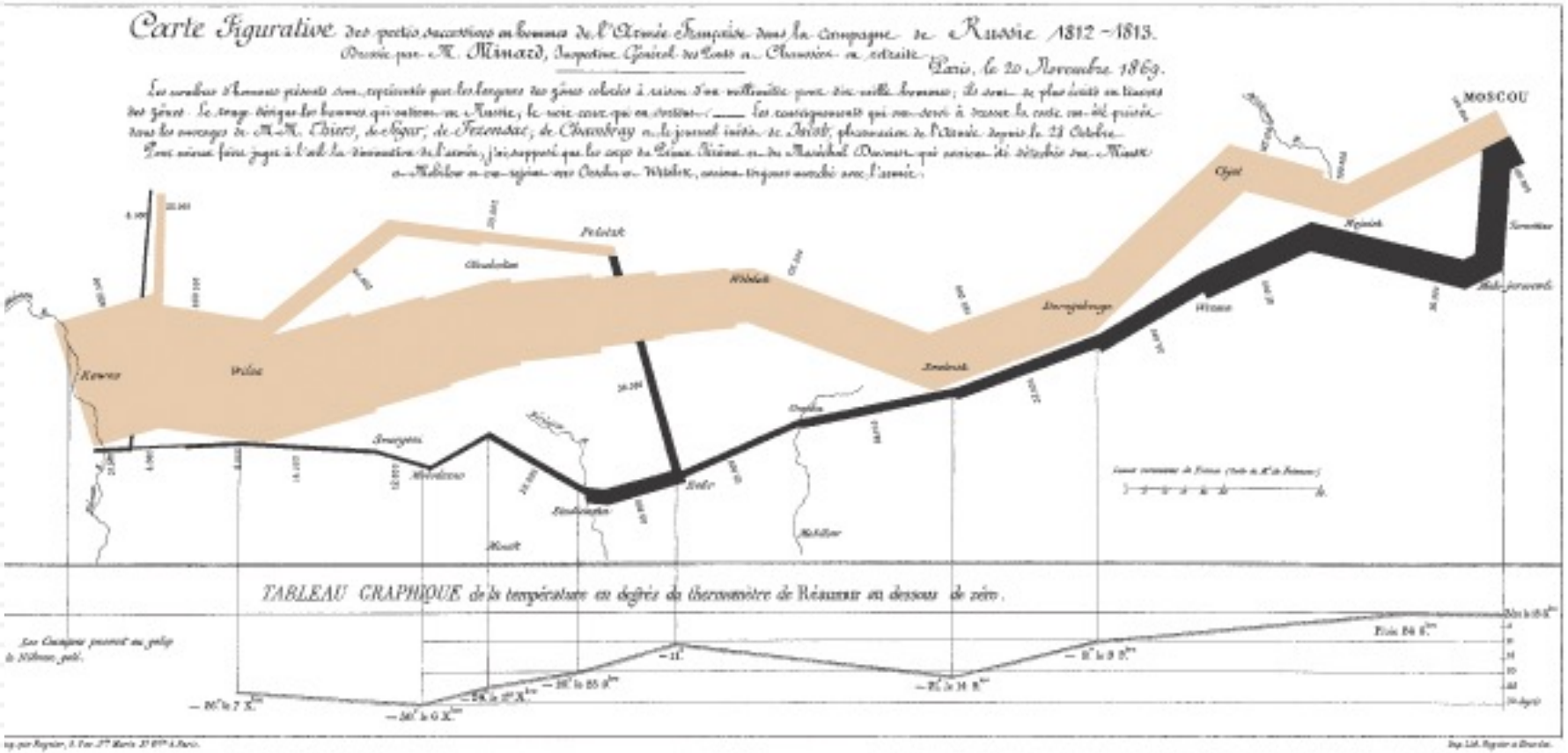
Payback = 10.3 years

Discounted Payback = 16.8 years

A slightly more sophisticated approach: Sensitivity Analysis & What-if Questions…

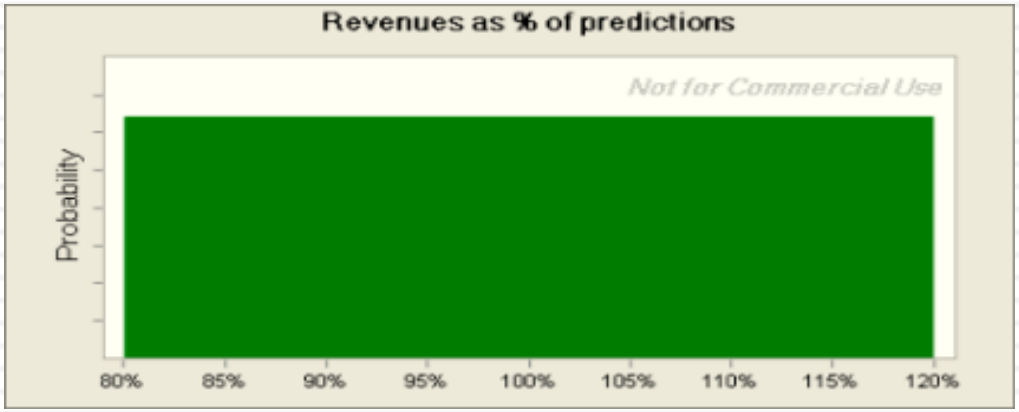
- The NPV, IRR and accounting returns for an investment will change as we change the values that we use for different variables.
- One way of analyzing uncertainty is to check to see how sensitive the decision measure (NPV, IRR..) is to changes in key assumptions. While this has become easier and easier 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…

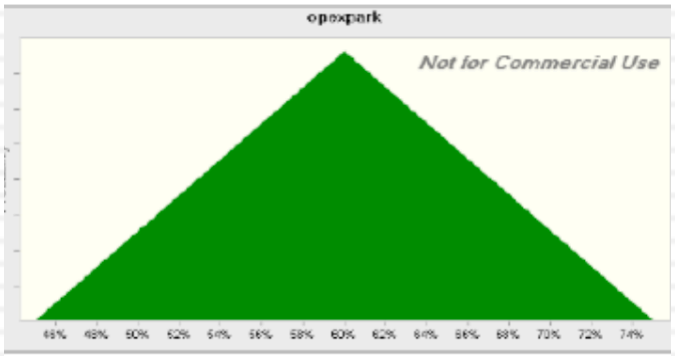


The final step up: Incorporate probabilistic estimates.. Rather than expected values..

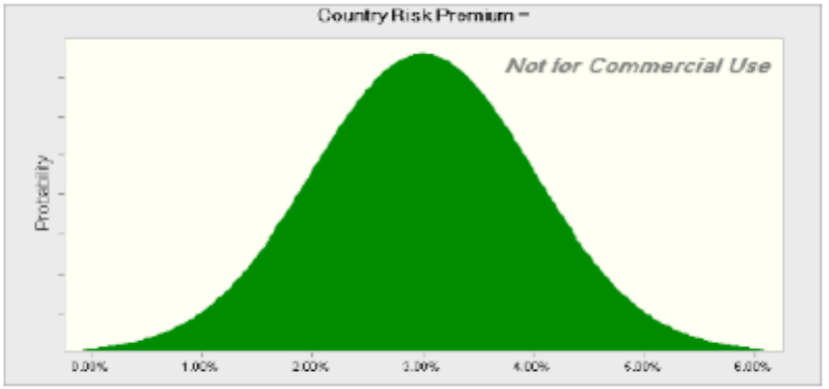
Actual Revenues as % of Forecasted Revenues (Base case = 100%)



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

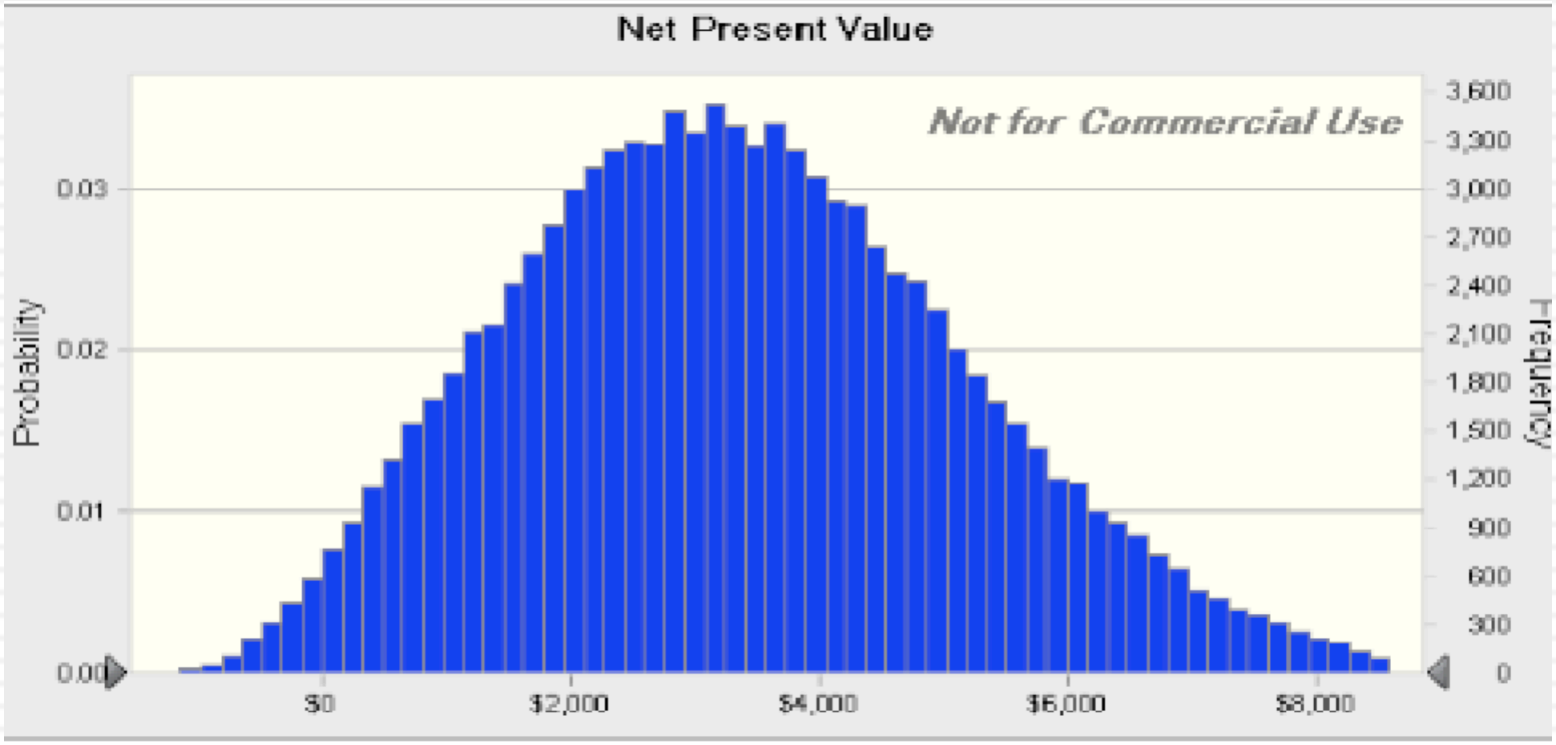


Country Risk Premium (Base Case = 3% (Brazil))



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 10% 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?
  - I would accept the investment and print the results of this simulation and file them away to show that I exercised due diligence.
  - I would reject the investment, because it is too risky (there is a 10% chance that it could be a bad project)
  - Other

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

1. 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. The initial investment of $1.25 billion 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.
2. 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.
3. 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 costs will be in Canadian dollars, but the expected values are converted into US dollars, assuming that the current parity between the currencies (1 Canadian $ = 1 US dollar) will continue, since interest and inflation rates are similar in the two currencies.
4. 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.
5. 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 provided below:

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%