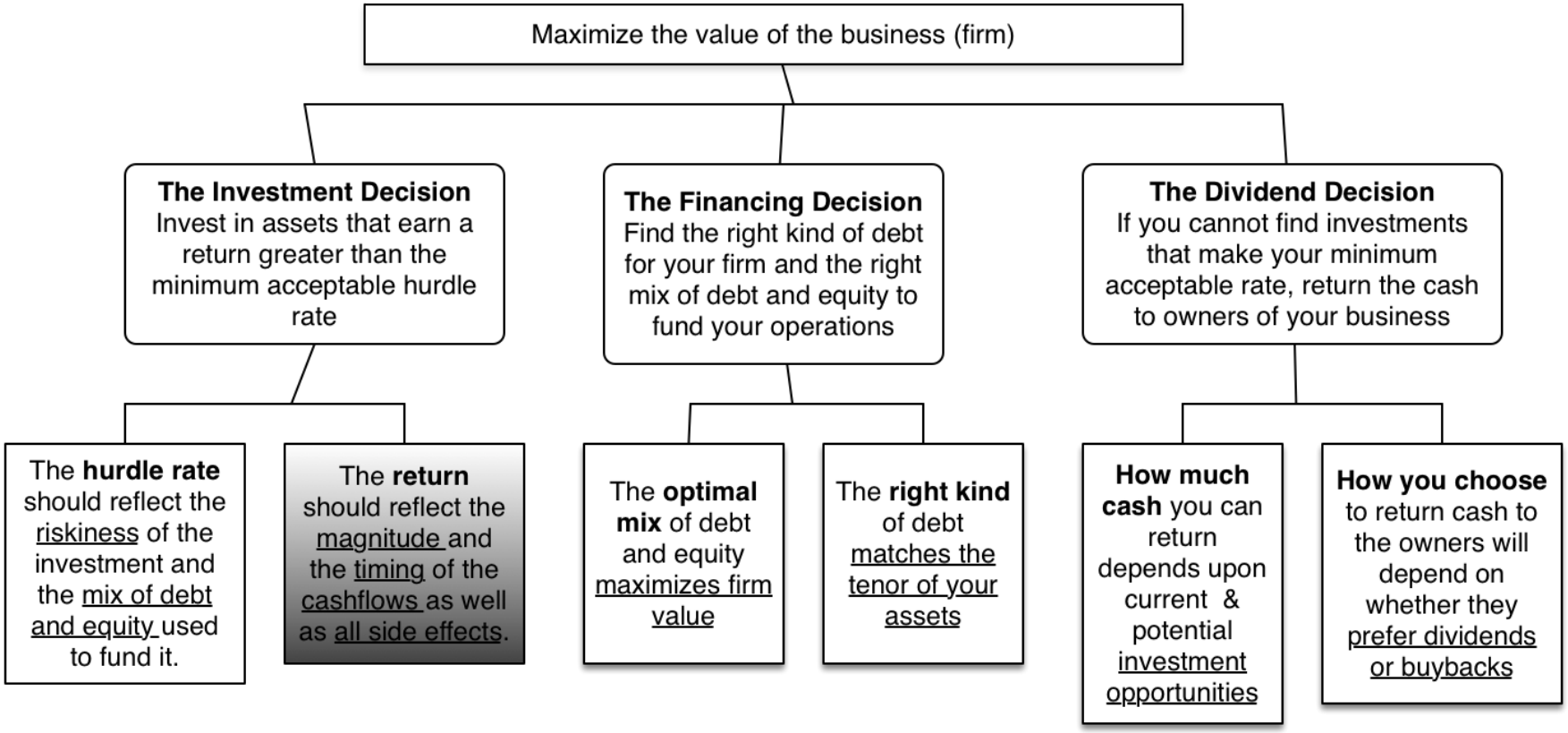
MEASURING INVESTMENT RETURNS I: THE MECHANICS OF INVESTMENT ANALYSIS

"Show me the money"

From Jerry Maguire

Aswath Damodaran

FIRST PRINCIPLES



MEASURES OF RETURN: EARNINGS VERSUS CASH FLOWS

- Principles Governing Accounting Earnings Measurement
  - **Accrual Accounting**: Show revenues when products and services are sold or provided, not when they are paid for. Show expenses associated with these revenues rather than cash expenses.
  - **Operating versus Capital Expenditures**: Only expenses associated with creating revenues in the current period should be treated as operating expenses. Expenses that create benefits over several periods are written off over multiple periods (as depreciation or amortization)
- To get from accounting earnings to cash flows, you have to:
  - add back non-cash expenses (like depreciation)
  - subtract out cash outflows which are not expensed (such as capital expenditures)
  - make accrual revenues and expenses into cash revenues and expenses (by considering changes in working capital).

MEASURING RETURNS RIGHT: THE BASIC PRINCIPLES

- Use **cash flows rather than earnings.** You cannot spend earnings.
- Use **"incremental" cash flows** relating to the investment decision, i.e., cashflows that occur as a consequence of the decision, rather than total cash flows.
- Use **"time weighted"** returns, i.e., value cash flows that occur earlier more than cash flows that occur later.

The Return Mantra: "Time-weighted, Incremental Cash Flow Return"

SETTING THE TABLE: WHAT IS AN INVESTMENT/PROJECT?

- An investment/project can range the spectrum from big to small, money making to cost saving:
  - **Major strategic decisions** to enter new areas of business or new markets.
  - **Acquisitions of other firms** are projects as well, notwithstanding attempts to create separate sets of rules for them.
  - **Decisions on new ventures** within existing businesses or markets.
  - **Decisions that may change the way existing ventures** and projects are run.
  - **Decisions on how best to deliver a service** that is necessary for the business to run smoothly.
- Put in broader terms, every choice made by a firm can be framed as an investment.

HERE ARE FIVE EXAMPLES...

- At Disney,
  - **Rio Disney**: Consider whether Disney should invest in its first theme parks in South America. These parks will require us to consider the effects of country risk and currency issues in project analysis.
  - **A New Show for Disney Plus**: An exercise where estimating the benefits is difficult to do, since it is in the form of keeping existing subscribers or adding new ones
- **New iron ore mine for Vale**: This is an iron ore mine that Vale is considering in Western Labrador, Canada.
- **An Online Store for Bookscape**: Bookscape is evaluating whether it should create an online store to sell books. While it is an extension of their basis business, it will require different investments (and potentially expose them to different types of risk).
- **Acquisition of Harman by Tata Motors**: A cross-border bid by Tata for Harman International, a publicly traded US firm that manufactures high-end audio equipment, with the intent of upgrading the audio upgrades on Tata Motors' automobiles. This investment will allow us to examine currency and risk issues in such a transaction.

EARNINGS VERSUS CASH FLOWS: A DISNEY THEME PARK

- The theme parks to be built near Rio, modeled on Euro Disney in Paris and Disney World in Orlando.
- The complex will include
  - A "Magic Kingdom" to be constructed, beginning immediately, and becoming operational at the beginning of the second year
  - A second theme park modeled on Epcot Center at Orlando to be constructed in the second and third year and becoming operational at the beginning of the fourth year.
- The earnings and cash flows are estimated in nominal U.S. Dollars.

KEY ASSUMPTIONS ON START UP AND CONSTRUCTION

- Disney **has already spent $0.5 Billion** researching the proposal and getting the necessary licenses for the park; none of this investment can be recovered if the park is not built. This expenditure has been **capitalized and will be depreciated** straight line over ten years to a salvage value of zero.
- Disney will face **substantial construction costs**, if it chooses to build the theme parks.
  - The cost of constructing Magic Kingdom **will be $3 billion**, with $ 2 billion to be spent right now, and $1 Billion to be spent one year from now.
  - The cost of constructing Epcot II **will be $ 1.5 billion**, with $ 1 billion to be spent at the end of the second year and $0.5 billion at the end of the third year.
  - These investments will be depreciated based upon a depreciation schedule in the tax code, where depreciation will be different each year.

KEY REVENUE ASSUMPTIONS

- Revenue estimates for the parks and resort properties (in millions)

Year	*Magic Kingdom*	*Epcot II*	*Resort Properties*	*Total*
1	$0	$0	$0	$0
2	$1,000	$0	$250	$1,250
3	$1,400	$0	$350	$1.750
4	$1,700	$300	$500	$2.500
5	$2,000	$500	$625	$3.125
6	$2,200	$550	$688	$3,438
7	$2,420	$605	$756	$3,781
8	$2,662	$666	$832	$4,159
9	$2,928	$732	$915	$4,575
10	$2,987	$747	$933	$4,667

KEY EXPENSE ASSUMPTIONS

- The operating expenses are assumed to be **60% of the revenues** at the parks, and **75% of revenues** at the resort properties.
- Disney will also allocate corporate general and administrative costs to this project, based upon revenues
  - The **G&A allocation will be 15% of the revenues** each year.
  - It is worth noting that a recent analysis of these expenses found that **only one-third of these expenses are variable** (and a function of total revenue) and that two-thirds are fixed.

DEPRECIATION AND CAPITAL MAINTENANCE

Year	*Depreciation as % of Book Value*	*Capital Maintenance as % of Depreciation*
1	0.00%	0.00%
2	12.50%	50.00%
3	11.00%	60.00%
4	9.50%	70.00%
5	8.00%	80.00%
6	8.00%	90.00%
7	8.00%	100.00%
8	8.00%	105.00%
9	8.00%	110.00%
10	8.00%	110.00%

- The capital maintenance expenditures are low in the early years, when the parks are still new but increase as the parks age.

OTHER ASSUMPTIONS

- Disney will have to maintain non-cash working capital (primarily consisting of inventory at the theme parks and the resort properties, netted against accounts payable) of **5% of revenues**, with the investments being made at the end of each year.
- The income from the investment will be taxed at Disney's **marginal tax rate of 36.1%.**

LAYING THE GROUNDWORK: BOOK CAPITAL, WORKING CAPITAL AND DEPRECIATION

	0	1	2	3	4	5	6	7	8	9	10
Book Value of Pre-project inv	*$500*	*$450*	*$400*	*$350*	*$300*	*$250*	*$200*	*$150*	*$100*	*$50*	*$0*
Depreciation: Pre-Project		$50	$50	$50	$50	$50	$50	$50	$50	$50	$50
Magic Kingdom	$2,000	$1,000	$0	$0	$0	$0	$0	$0	$0	$0	$0
Epcot Rio	$0	$0	$1,000	$500	$0	$0	$0	$0	$0	$0	$0
Capital Maintenance		$0	$188	$252	$276	$258	$285	$314	$330	$347	$350
- Depreciation on fixed assets		$0	$375	$419	$394	$322	$317	$314	$314	$316	$318
Book Value of new Fixed Assets	*$2,000*	*$3,000*	*$3,813*	*$4,145*	*$4,027*	*$3,962*	*$3,931*	*$3,931*	*$3,946*	*$3,978*	*$4,010*
Book Value of Working Capital			$63	$88	$125	$156	$172	$189	$208	$229	$233
Total Capital Invested in Project	$2,500	$3,450	$4,275	$4,582	$4,452	$4,368	$4,302	$4,270	$4,254	$4,257	$4,243

12.5% of book value at end of prior year ($3,000)

STEP 1: ESTIMATE ACCOUNTING EARNINGS ON PROJECT

	0	1	2	3	4	5	6	7	8	9	10
Magic Kingdom - Revenues		$0	$1,000	$1,400	$1,700	$2,000	$2,200	$2,420	$2,662	$2,928	$2,987
Epcot Rio - Revenues		$0	$0	$0	$300	$500	$550	$605	$666	$732	$747
Resort & Properties - Revenues		$0	$250	$350	$500	$625	$688	$756	$832	$915	$933
Total Revenues			**$1,250**	**$1,750**	**$2,500**	**$3,125**	**$3,438**	**$3,781**	**$4,159**	**$4,575**	**$4,667**
Magic Kingdom – Direct Expenses		$0	$600	$840	$1,020	$1,200	$1,320	$1,452	$1,597	$1,757	$1,792
Epcot Rio – Direct Expenses		$0	$0	$0	$180	$300	$330	$363	$399	$439	$448
Resort & Property – Direct Expenses		$0	$188	$263	$375	$469	$516	$567	$624	$686	$700
Total Direct Expenses			**$788**	**$1,103**	**$1,575**	**$1,969**	**$2,166**	**$2,382**	**$2,620**	**$2,882**	**$2,940**
Depreciation & Amortization		$50	$425	$469	$444	$372	$367	$364	$364	$366	$368
Allocated G&A Costs		$0	$188	$263	$375	$469	$516	$567	$624	$686	$700
Operating Income		**-$50**	**-$150**	**-$84**	**$106**	**$315**	**$389**	**$467**	**$551**	**$641**	**$658**
Taxes		-$18	-$54	-$30	$38	$114	$141	$169	$199	$231	$238
Operating Income after Taxes		-$32	-$96	-$54	$68	$202	$249	$299	$352	$410	$421

AND THE ACCOUNTING VIEW OF RETURN

Year	After-tax Operating Income	BV of pre-project investment	BV of fixed assets	BV of Working capital	BV of Capital	Average BV of Capital	ROC(a)	ROC(b)
0		500	2000	0	$2,500			
1	-$32	$450	$3,000	$0	$3,450	$2,975	-1.07%	-1.28%
2	-$96	$400	$3,813	$63	$4,275	$3,863	-2.48%	-2.78%
3	-$54	$350	$4,145	$88	$4,582	$4,429	-1.22%	-1.26%
4	$68	$300	$4,027	$125	$4,452	$4,517	1.50%	1.48%
5	$202	$250	$3,962	$156	$4,368	$4,410	4.57%	4.53%
6	$249	$200	$3,931	$172	$4,302	$4,335	5.74%	5.69%
7	$299	$150	$3,931	$189	$4,270	$4,286	6.97%	6.94%
8	$352	$100	$3,946	$208	$4,254	$4,262	8.26%	8.24%
9	$410	$50	$3,978	$229	$4,257	$4,255	9.62%	9.63%
10	$421	$0	$4,010	$233	$4,243	$4,250	9.90%	9.89%
Average							4.18%	4.11%

(a) Based upon average book capital over the year
(b) Based upon book capital at the start of each year

WHAT SHOULD THIS RETURN BE COMPARED TO?

- The computed return on capital on this investment is about 4.18%. To make a judgment on whether this is a sufficient return, we need to compare this return to a "hurdle rate". Which of the following is the right hurdle rate? Why or why not?
  a. The riskfree rate of 2.75% (T. Bond rate)
  b. The cost of equity for Disney as a company (8.52%)
  c. The cost of equity for Disney theme parks (7.09%)
  d. The cost of capital for Disney as a company (7.81%)
  e. The cost of capital for Disney theme parks (6.61%)
  f. None of the above

SHOULD THERE BE A RISK PREMIUM FOR FOREIGN PROJECTS?

- The **exchange rate risk should be diversifiable risk** (and hence should not command a premium) if
  - the company has projects in many countries (or)
  - the investors in the company are globally diversified.
  - For Disney, exchange rate risk should not affect the cost of capital used. Consequently, we would not adjust the cost of capital for Disney's investments in other mature markets (Germany, UK, France)
- The **same diversification argument can also be applied against some political risk**, which would mean that it too should not affect the discount rate.
  - There are **aspects of political risk especially in emerging markets that will be difficult to diversify** and may affect the cash flows, by reducing the expected life or cash flows on the project.
  - For Disney, **this is the risk that we are incorporating into the cost of capital** when it invests in Brazil (or any other emerging market)

ESTIMATING A HURDLE RATE FOR RIO DISNEY

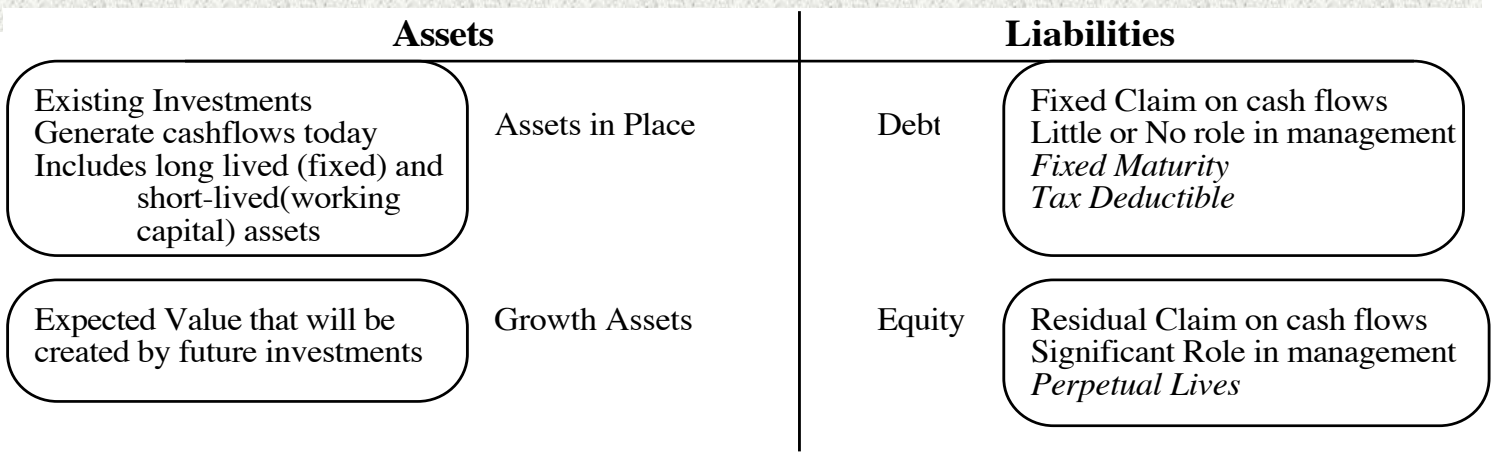
- We **estimated a cost of capital of 6.61%** for the Disney theme park business, using a bottom-up levered beta of 0.7537 for the business.
  - This cost of equity may not adequately reflect the additional risk associated with the theme park being in an emerging market.
  - The concern we would have with using this cost of equity for this project is that it may not adequately reflect the additional risk associated with the theme park being in an emerging market (Brazil).
- We first computed the Brazil country risk premium (by multiplying the default spread for Brazil by the relative equity market volatility) and then re-estimated the cost of equity:
  - Country risk premium for Brazil = 5.5%+ 3% = 8.5%
  - Cost of Equity in US$= 2.75% + 0.7537 (8.5%) = 9.16%
- Using this estimate of the cost of equity, Disney's theme park debt ratio of 10.24% and its after-tax cost of debt of 2.40% (see chapter 4), we can estimate the cost of capital for the project:
  - Cost of Capital in US$ = 9.16% (0.8976) + 2.40% (0.1024) = 8.46%

WOULD LEAD US TO CONCLUDE THAT...

- Do not invest in this park. The return on capital of 4.18% is lower than the cost of capital for theme parks of 8.46%; This would suggest that the project should not be taken.
- Given that we have computed the average over an arbitrary period of 10 years, while the theme park itself would have a life greater than 10 years, would you feel comfortable with this conclusion?
  a. Yes
  b. No

A TANGENT: FROM NEW TO EXISTING INVESTMENTS: ROC FOR THE ENTIRE FIRM

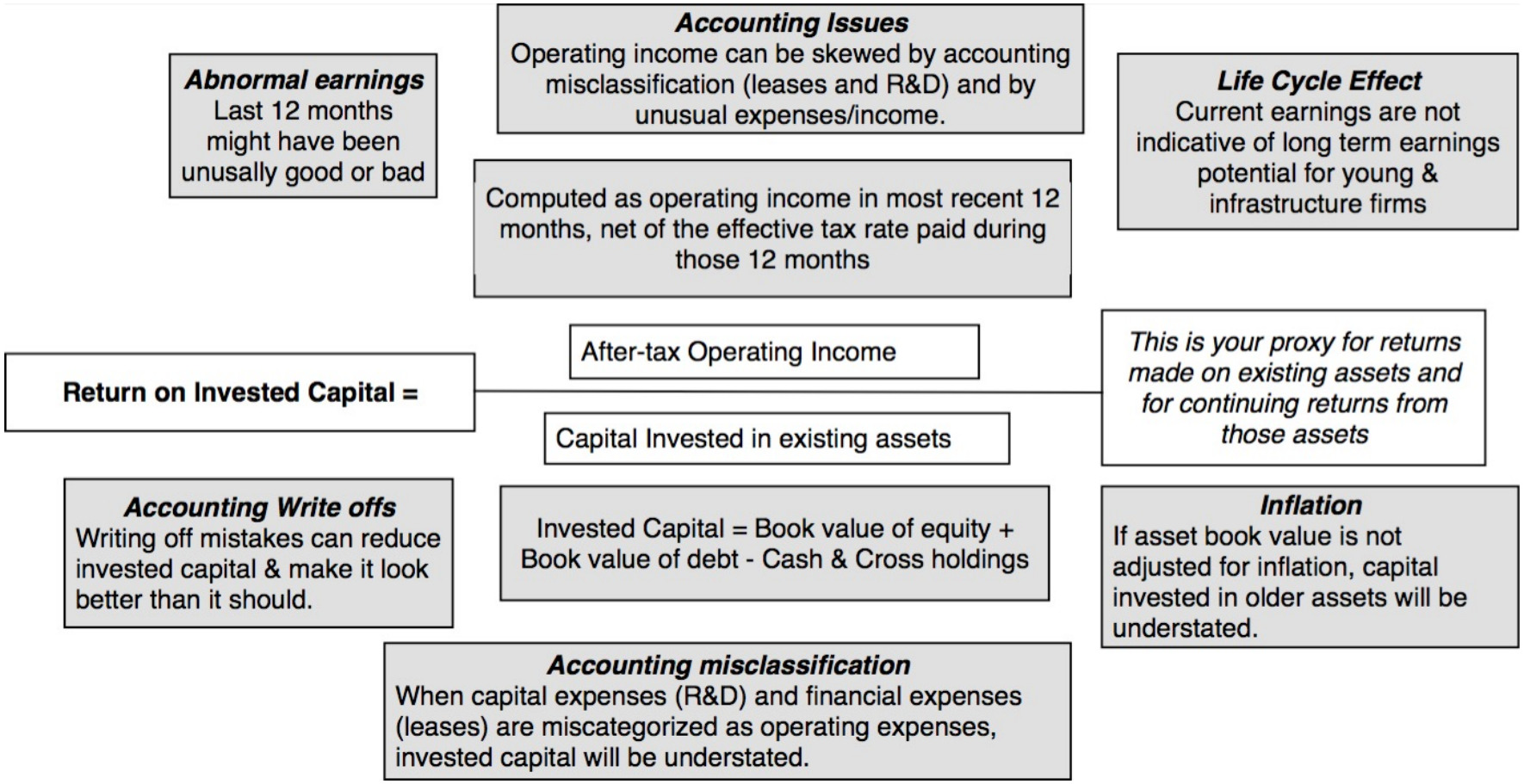
How "good" are the existing investments of the firm?



Measuring ROC for existing investments..

Company	*EBIT (1-t)*	*BV of Debt*	*BV of Equity*	*Cash*	*BV of Capital*	*Return on Capital*	*Cost of Capital*	*ROC - Cost of Capital*
Disney	$6,920	$16,328	$41,958	$3,387	$54,899	12.61%	7.81%	4.80%
Vale	$12,432	$49,246	$75,974	$5,818	$119,402	10.41%	8.20%	2.22%
Baidu	¥9,111	¥13,561	¥27,215	¥10,456	¥30,320	30.05%	12.42%	17.63%
Tata Motors	120,905₹	471,489₹	330,056₹	225,562₹	575,983₹	20.99%	11.44%	9.55%
Bookscape	$1,775	$12,136	$8,250	$1,250	$19,136	9.28%	10.30%	-1.02%

THE RETURN ON CAPITAL IS AN ACCOUNTING NUMBER, THOUGH, AND THAT SHOULD SCARE YOU.



RETURN SPREADS GLOBALLY....

Region	# firms	ROE	COE	% of firms with ROE>COE	ROIC	WACC	% of firms with ROIC>WACC	% of firms with ROIC-WACC>5%	% of firms with ROIC-WACC<5%
Africa and Middle East	2,423	7.55%	10.98%	32.03%	4.77%	9.33%	25.05%	16.59%	83.41%
Australia & NZ	1,798	-12.08%	8.51%	18.19%	-11.59%	8.36%	19.24%	13.68%	86.32%
Canada	2,791	-20.66%	8.64%	11.64%	-18.59%	8.41%	12.54%	8.10%	91.90%
China	7,504	4.34%	10.07%	23.87%	3.36%	8.94%	25.49%	15.27%	84.73%
EU & Environs	5,925	6.73%	9.83%	33.96%	5.48%	8.59%	33.59%	24.76%	75.24%
Eastern Europe & Russia	325	10.17%	10.38%	34.46%	4.32%	9.17%	26.46%	16.31%	83.69%
India	4,446	8.32%	11.12%	34.14%	5.61%	9.90%	29.94%	19.50%	80.50%
Japan	4,020	7.14%	10.05%	33.23%	7.15%	8.62%	41.32%	26.87%	73.13%
Latin America & Caribbean	984	9.28%	12.30%	35.37%	7.37%	9.76%	35.98%	24.19%	75.81%
Small Asia	9,876	5.19%	10.86%	25.65%	3.81%	9.37%	23.78%	14.14%	85.86%
UK	1,125	1.47%	9.71%	29.16%	4.76%	8.74%	37.16%	28.80%	71.20%
United States	6,481	2.64%	8.80%	26.68%	0.05%	7.91%	23.59%	17.74%	82.26%
Global	47,698	4.93%	9.92%	27.54%	3.73%	8.68%	27.12%	18.02%	81.98%

APPLICATION TEST: ASSESSING INVESTMENT QUALITY

- For the most recent period for which you have data, compute the after-tax return on capital earned by your firm, where after-tax return on capital is computed to be
  - After-tax ROC = EBIT (1-tax rate)/ (BV of debt + BV of Equity-Cash)previous year
- For the most recent period for which you have data, compute the return spread earned by your firm:
  - Return Spread = After-tax ROC - Cost of Capital
- Follow up by
  - Examining the reasons why your company earns the excess return (positive or negative) that it does
  - Evaluating whether the company will continue to earn similar excess returns in the future

THE CASH FLOW VIEW OF THIS PROJECT..

	0	1	2	3	4	5	6	7	8	9	10
After-tax Operating Income		-$32	-$96	-$54	$68	$202	$249	$299	$352	$410	$421
+ Depreciation & Amortization	$0	$50	$425	$469	$444	$372	$367	$364	$364	$366	$368
- Capital Expenditures	$2,500	$1,000	$1,188	$752	$276	$258	$285	$314	$330	$347	$350
- Change in Non-cash Working Capital		$0	$63	$25	$38	$31	$16	$17	$19	$21	$5
Cashflow to firm	**($2,500)**	**($982)**	**($921)**	**($361)**	**$198**	**$285**	**$314**	**$332**	**$367**	**$407**	**$434**

To get from income to cash flow, we

I. added back all non-cash charges such as depreciation. Tax benefits:

II. subtracted out the capital expenditures

III. subtracted out the change in non-cash working capital

THE DEPRECIATION TAX BENEFIT

- While depreciation reduces taxable income and taxes, it is a non-cash expense. The benefit of depreciation is therefore the tax benefit. In general, the tax benefit from depreciation can be written as:
  - Tax Benefit = Depreciation * Tax Rate
- Disney Theme Park: Depreciation tax savings (Tax rate = 36.1%)

	1	2	3	4	5	6	7	8	9	10
Depreciation	$50	$425	$469	$444	$372	$367	$364	$364	$366	$368
Tax Bendfits from Depreciation	$18	$153	$169	$160	$134	$132	$132	$132	$132	$133

- **Proposition 1**: The tax benefit from depreciation and other non-cash charges is greater, the higher your tax rate.
- **Proposition 2**: Non-cash charges that are not tax deductible (such as amortization of goodwill) and thus provide no tax benefits have no effect on cash flows.

DEPRECIATION METHODS

- Broadly categorizing, depreciation methods can be classified as straight line or accelerated methods. In straight line depreciation, the capital expense is spread evenly over time, In accelerated depreciation, the capital expense is depreciated more in earlier years and less in later years.
- Assume that you made a large investment this year, and that you are choosing between straight line and accelerated depreciation methods. Which will result in higher net income this year?
  a. Straight Line Depreciation
  b. Accelerated Depreciation
- Which will result in higher cash flows this year?
  a. Straight Line Depreciation
  b. Accelerated Depreciation

THE CAPITAL EXPENDITURES EFFECT

- Capital expenditures are not treated as accounting expenses but they are cash outflows.
- Capital expenditures can generally be categorized into two groups
  - **New (or Growth) capital expenditures** are capital expenditures designed to create new assets and future growth
  - **Maintenance capital expenditures** refer to capital expenditures designed to keep existing assets.
  - Both initial and maintenance capital expenditures reduce cash flows
- The **need for maintenance capital expenditures will increase with the life of the project.** In other words, a 25-year project will require more maintenance capital expenditures than a 2-year project.

TO CAP EX OR NOT TO CAP EX?

- Assume that you run a movie/TV streaming business, and that you have an expense this year of $ 100 million from acquiring new subscribers, by offering them special deals and free access. Your accountant tells you that you can expense this item or capitalize and depreciate it over three years. Which will have a more positive effect on income?
  a. Expense it
  b. Capitalize and Depreciate it
- Which will have a more positive effect on cash flows?
  a. Expense it
  b. Capitalize and Depreciate it

THE WORKING CAPITAL EFFECT

- Intuitively, money invested in inventory or in accounts receivable cannot be used elsewhere. It, thus, represents a drain on cash flows
- To the degree that some of these investments can be financed using supplier credit (accounts payable), the cash flow drain is reduced.
- Investments in working capital are thus cash outflows
  - Any increase in working capital reduces cash flows in that year
  - Any decrease in working capital increases cash flows in that year
- To provide closure, working capital investments need to be salvaged at the end of the project life.
- **Proposition 1**: The failure to consider working capital in a capital budgeting project will overstate cash flows on that project and make it look more attractive than it really is.
- **Proposition 2**: Other things held equal, a reduction in working capital requirements will increase the cash flows on all projects for a firm.

THE INCREMENTAL CASH FLOWS ON THE PROJECT

	0	1	2	3	4	5	6	7	8	9	10
After-tax Operating Income		-$32	-$96	-$54	$68	$202	$249	$299	$352	$410	$421
+ Depreciation & Amortization	$0	$50	$425	$469	$444	$372	$367	$364	$364	$366	$368
- Capital Expenditures	$2,500	$1,000	$1,188	$752	$276	$258	$285	$314	$330	$347	$350
- Change in non-cash Working Capital		$0	$63	$25	$38	$31	$16	$17	$19	$21	$5
Cashflow to firm	($2,500)	($982)	($921)	($361)	$198	$285	$314	$332	$367	$407	$434
+ Pre-project investment (sunk)	$500										
- Pre-project Depreciation * tax rate		$18	$18	$18	$18	$18	$18	$18	$18	$18	$18
+ Non-incremental Allocated Expense (1-t)		$0	$80	$112	$160	$200	$220	$242	$266	$292	$298
Incremental Cash flow to the firm	($2,000)	($1,000)	($860)	($267)	$340	$467	$516	$555	$615	$681	$715

$ 500 million has already been spent & $ 50 million in depreciation will exist anyway

2/3rd of allocated G&A is fixed. Add back this amount (1-t) Tax rate = 36.1%

A MORE DIRECT WAY OF GETTING TO INCREMENTAL CASH FLOWS

	0	1	2	3	4	5	6	7	8	9	10
Revenues		$0	$1,250	$1,750	$2,500	$3,125	$3,438	$3,781	$4,159	$4,575	$4,667
Direct Expenses		$0	$788	$1,103	$1,575	$1,969	$2,166	$2,382	$2,620	$2,882	$2,940
Incremental Depreciation		$0	$375	$419	$394	$322	$317	$314	$314	$316	$318
Incremental G&A		$0	$63	$88	$125	$156	$172	$189	$208	$229	$233
Incremental Operating Income		$0	$25	$141	$406	$678	$783	$896	$1,017	$1,148	$1,175
- Taxes		$0	$9	$51	$147	$245	$283	$323	$367	$415	$424
Incremental after-tax Operating income		$0	$16	$90	$260	$433	$500	$572	$650	$734	$751
+ Incremental Depreciation		$0	$375	$419	$394	$322	$317	$314	$314	$316	$318
- Capital Expenditures	$2,000	$1,000	$1,188	$752	$276	$258	$285	$314	$330	$347	$350
- Change in non-cash Working Capital		$0	$63	$25	$38	$31	$16	$17	$19	$21	$5
Cashflow to firm	**($2,000)**	**($1,000)**	**($859)**	**($267)**	**$340**	**$466**	**$516**	**$555**	**$615**	**$681**	**$715**

SUNK COSTS

- **What is a sunk cost?** Any expenditure that has already been incurred and cannot be recovered (even if a project is rejected) is called a sunk cost.
  - A test market for a consumer product and R&D expenses for a drug (for a pharmaceutical company) would be good examples.
- **The sunk cost rule**: When analyzing a project, sunk costs should not be considered since they are not incremental.
- **A Behavioral Aside**: It is a well-established finding in psychological and behavioral research that managers find it almost impossible to ignore sunk costs.

TEST MARKETING AND R&D: THE QUANDARY OF SUNK COSTS

- A consumer product company has spent $ 100 million on test marketing. Looking at only the incremental cash flows (and ignoring the test marketing), the project looks like it will create $25 million in value for the company. Should it take the investment?
  a. Yes
  b. No
- Now assume that every investment that this company has shares the same characteristics (Sunk costs > Value Added). The firm will clearly not be able to survive. What is the solution to this problem?

ALLOCATED COSTS

- Firms allocate costs to individual projects from a centralized pool (such as general and administrative expenses) based upon some characteristic of the project (sales is a common choice, as is earnings)
  - For large firms, these allocated costs can be significant and result in the rejection of projects
  - To the degree that these costs are not incremental (and would exist anyway), this makes the firm worse off.
- Thus, it is only the incremental component of allocated costs that should show up in project analysis.

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	CFn / (1+r)n	CF0 (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
- Inte**rnal Rate of Return (IRR):** The internal rate of return is the discount rate that makes the net present value equal 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

- **Salvage Value**: 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 often set equal to book value of fixed assets and working capital
- **Terminal Value**: 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..

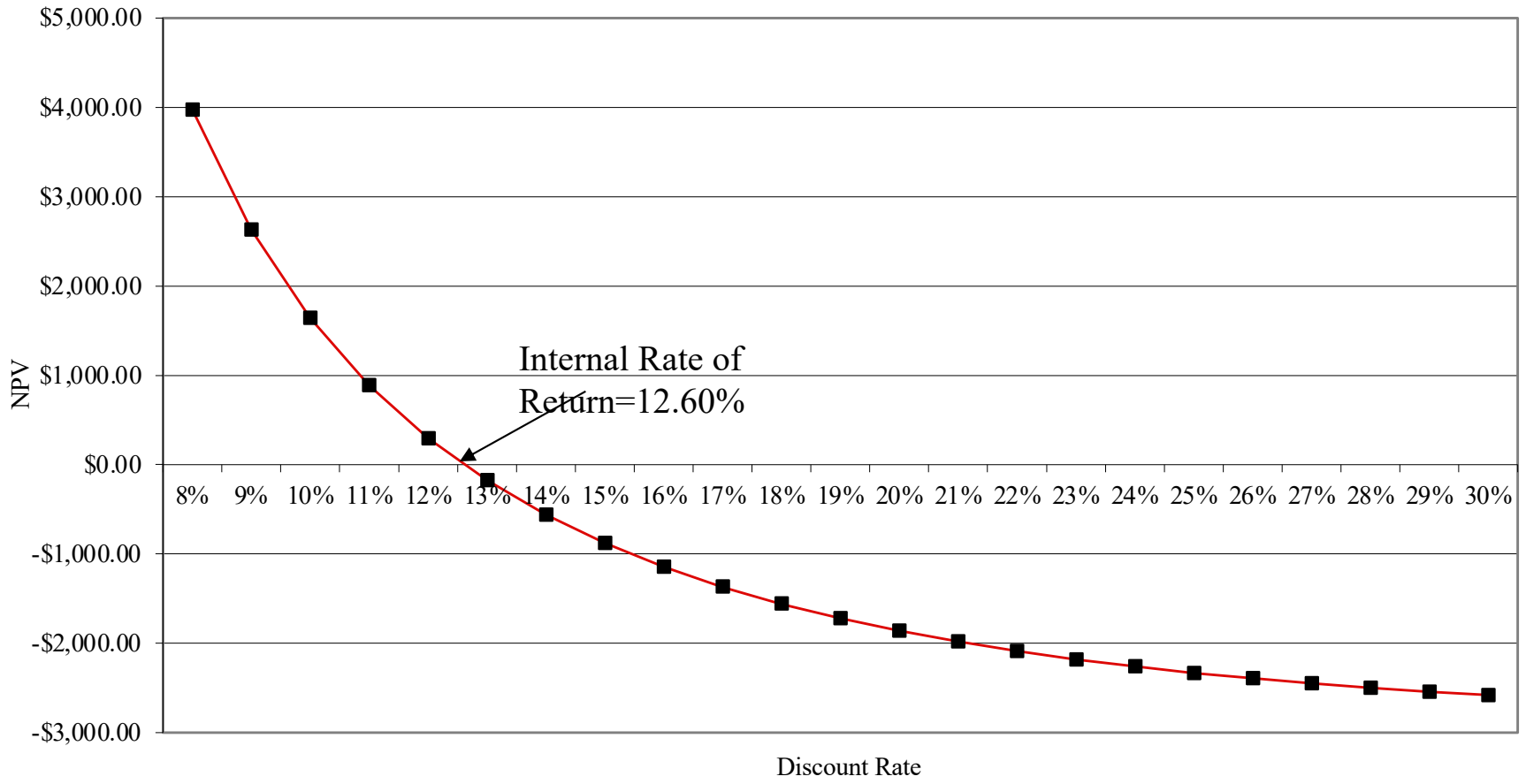
Year	Annual Cashflo	Terminal Value	Present Value
0	-$2,000		-$2,000
1	-$1,000		-$922
2	-$859		-$730
3	-$267		-$210
4	$340		$246
5	$466		$311
6	$516		$317
7	$555		$314
8	$615		$321
9	$681		$328
10	$715	$11,275	$5,321
			$3,296

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.
  - Will the market price increase by the same amount? Why or why not?

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 Rio Disney Theme Park analysis was done in dollars, even though the project will be based in Brazil and will have cash flows primarily in Brazilian Reais.
- Would your assessment of the project 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:
  - $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?
  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

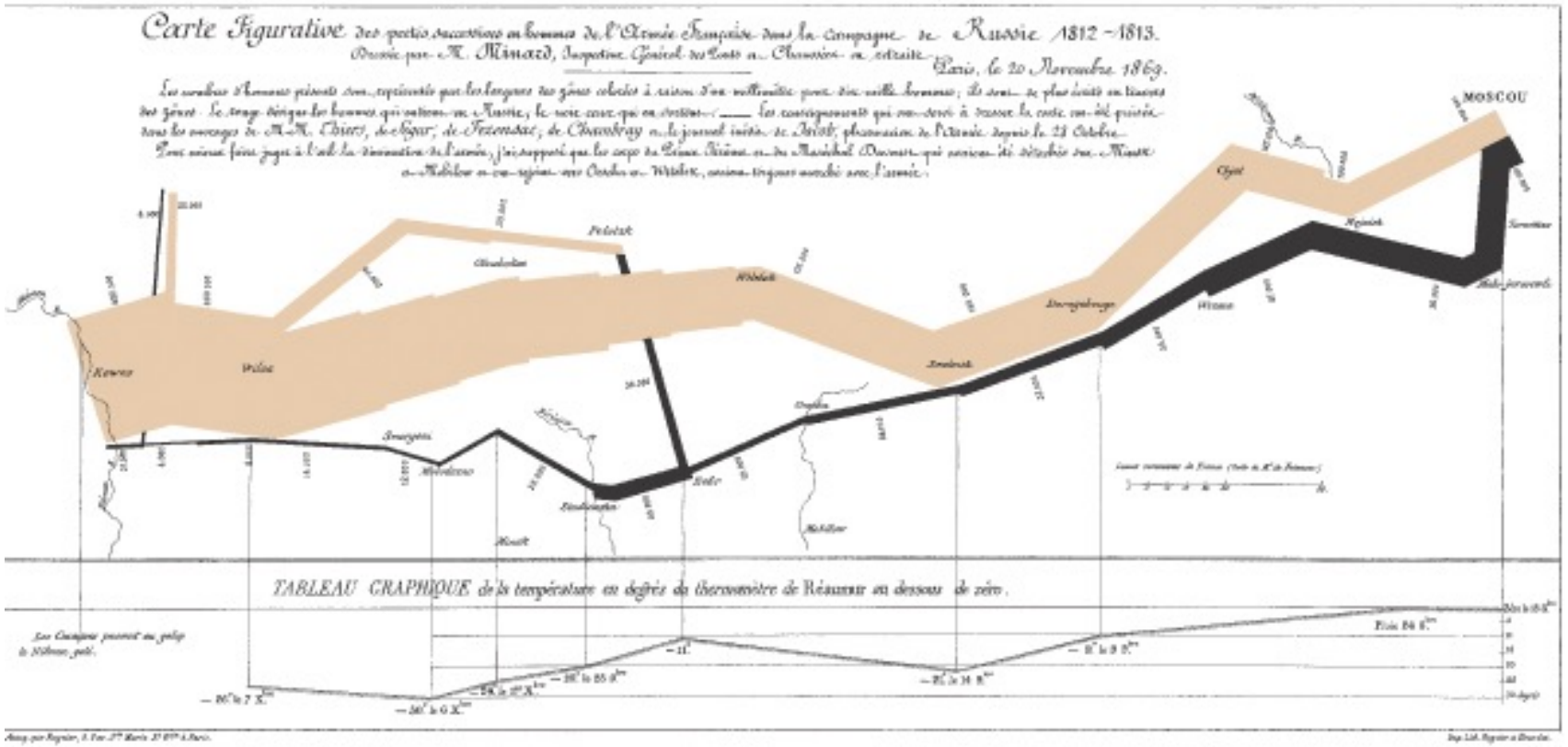
Payback = 10.3 years

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).

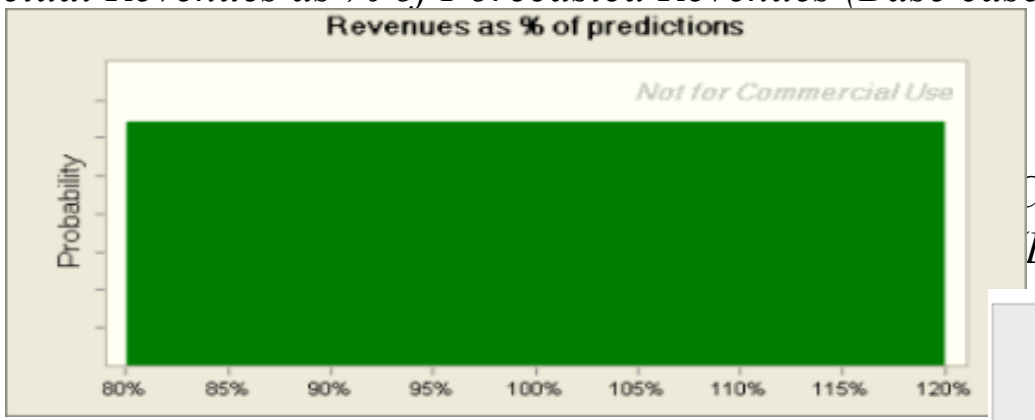
AND HERE IS A REALLY GOOD PICTURE...



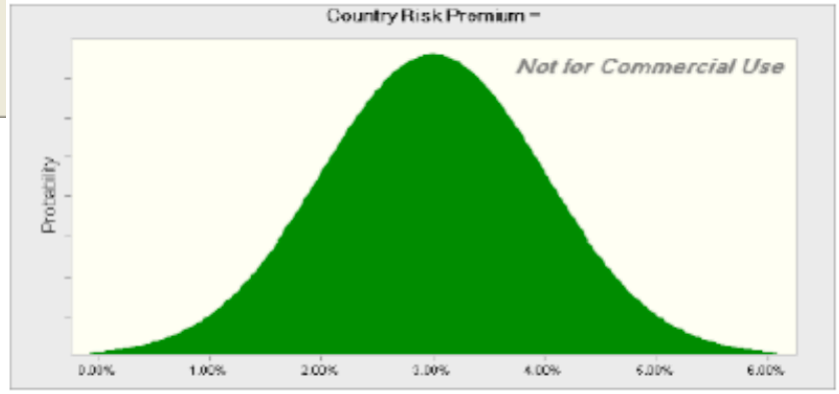
Aswath Damodaran

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

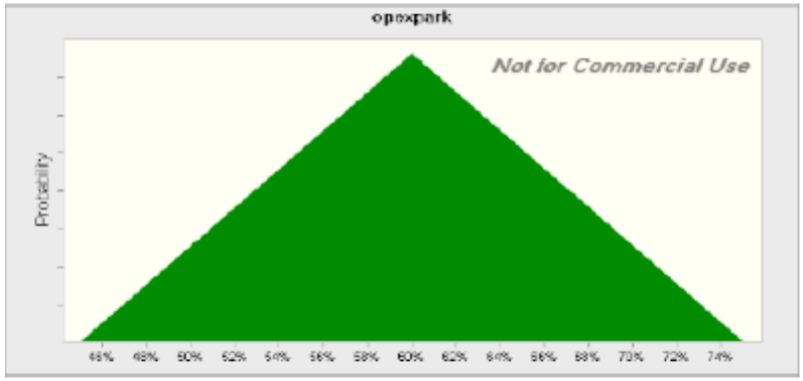
Actual Revenues as % of Forecasted Revenues (Base case = 100%)



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

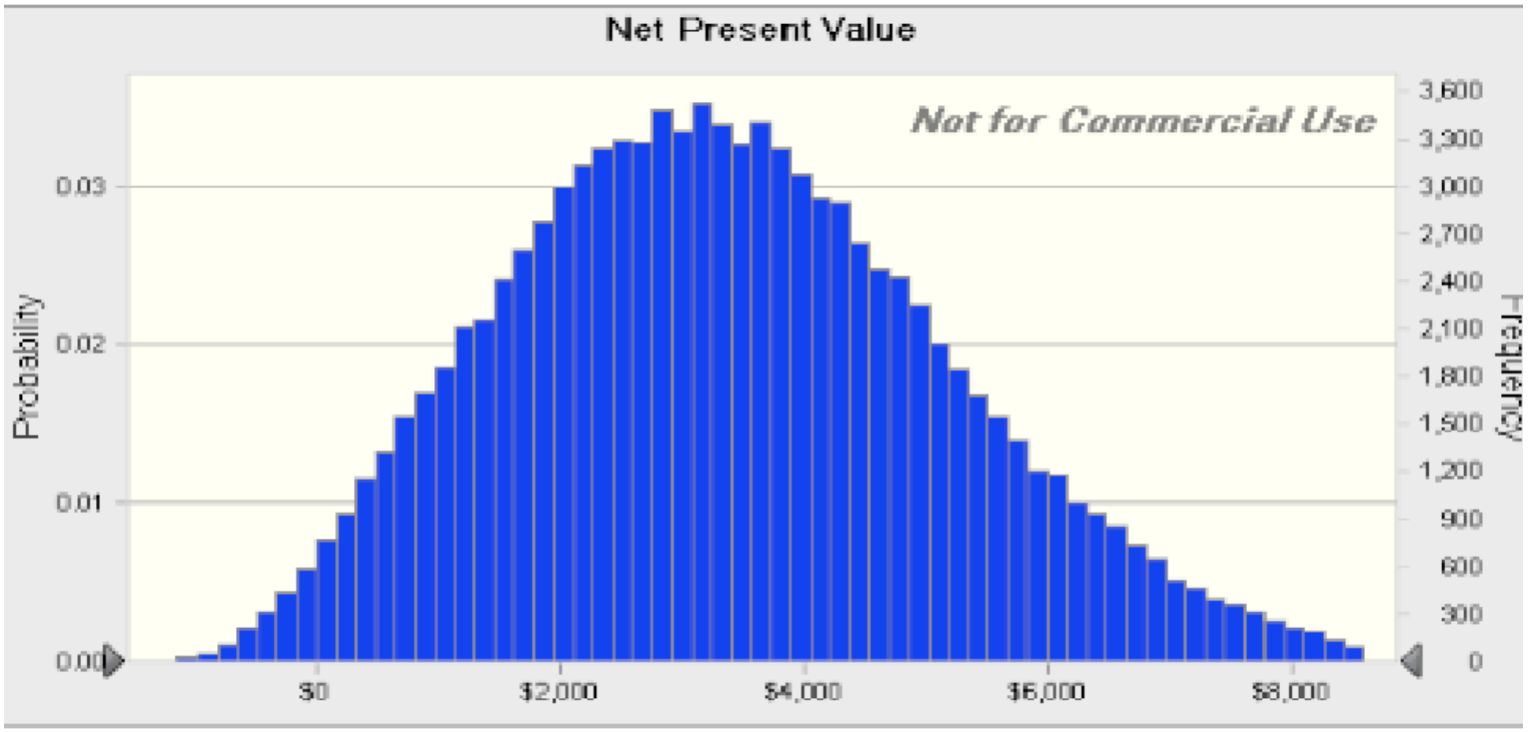


Operating Expenses at Parks as % of Revenues (Base Case = 60%)



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

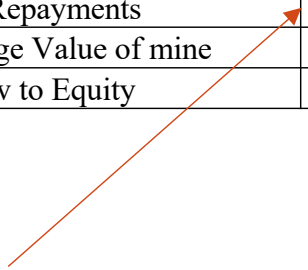
Vale Iron Ore US$ Cost of Equity of 11.13%

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

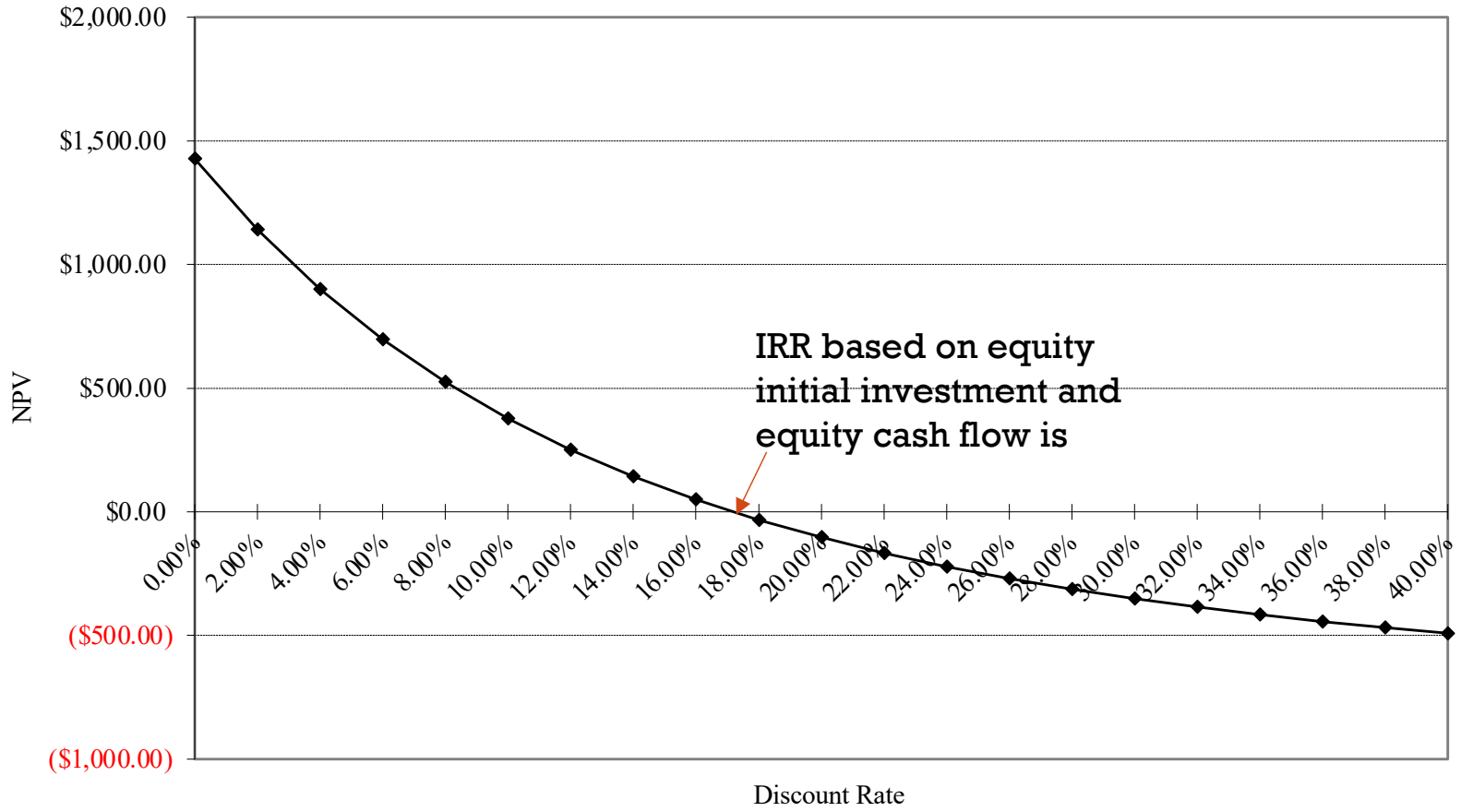
AN EQUITY NPV

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

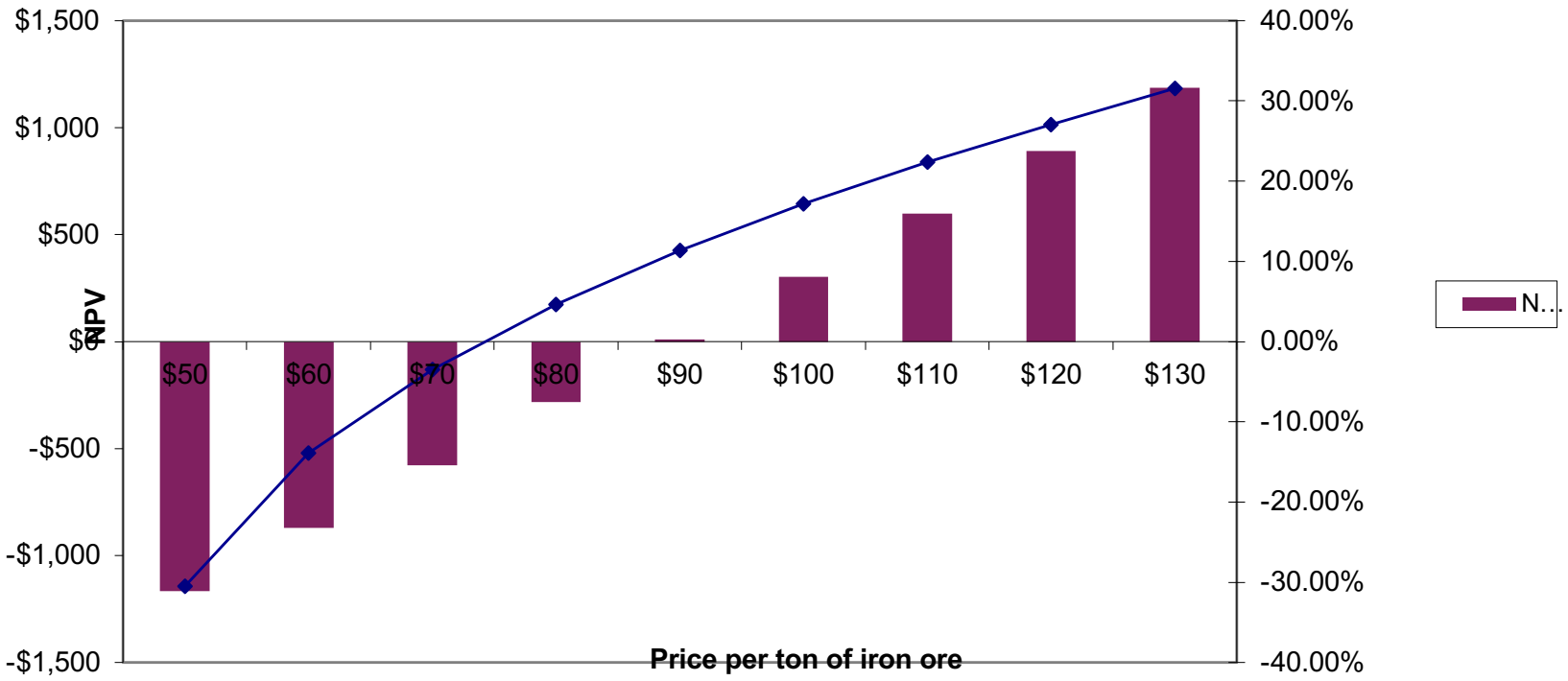
b. No

- Explain.

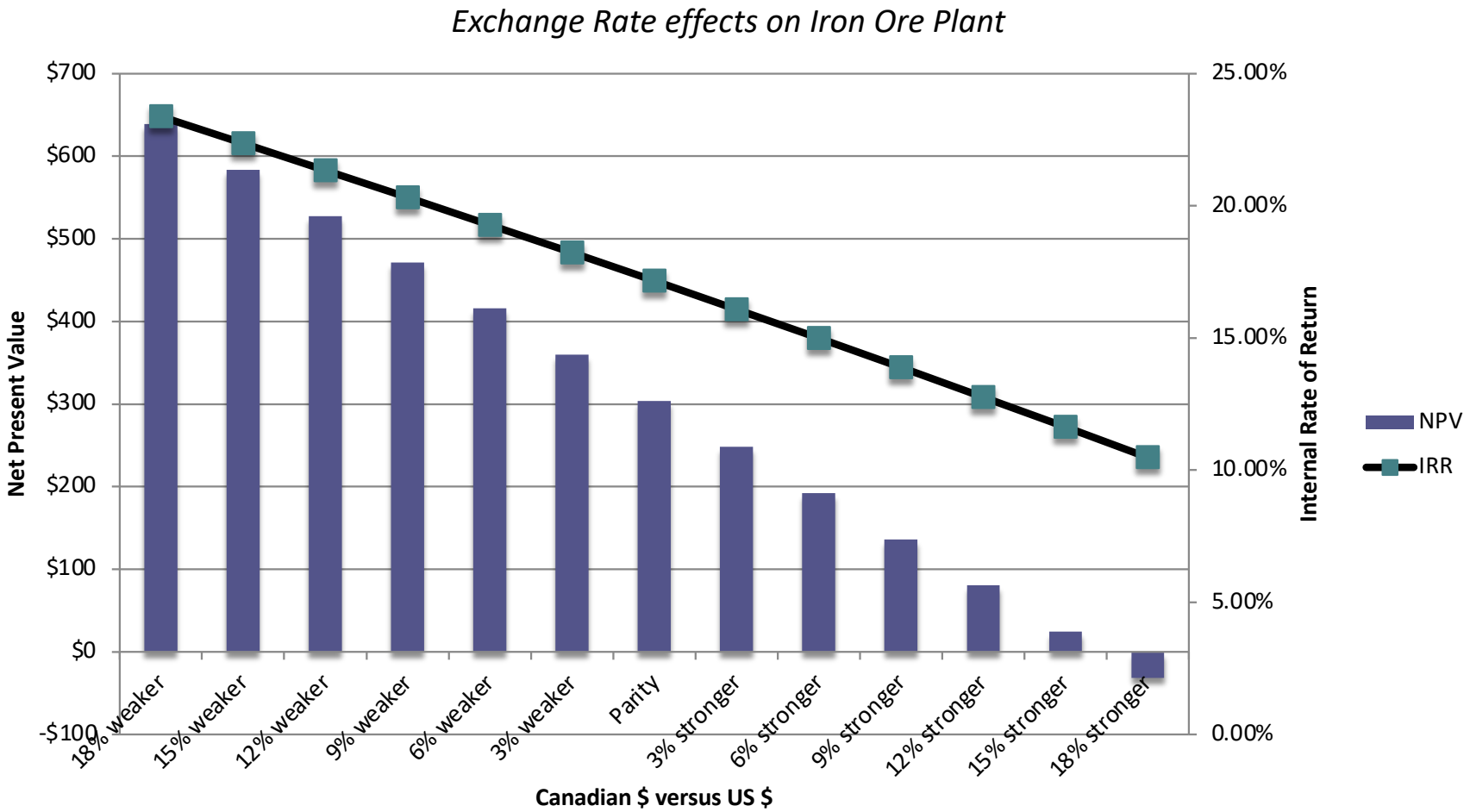
DEALING WITH MACRO UNCERTAINTY: THE EFFECT OF IRON ORE PRICE

- 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



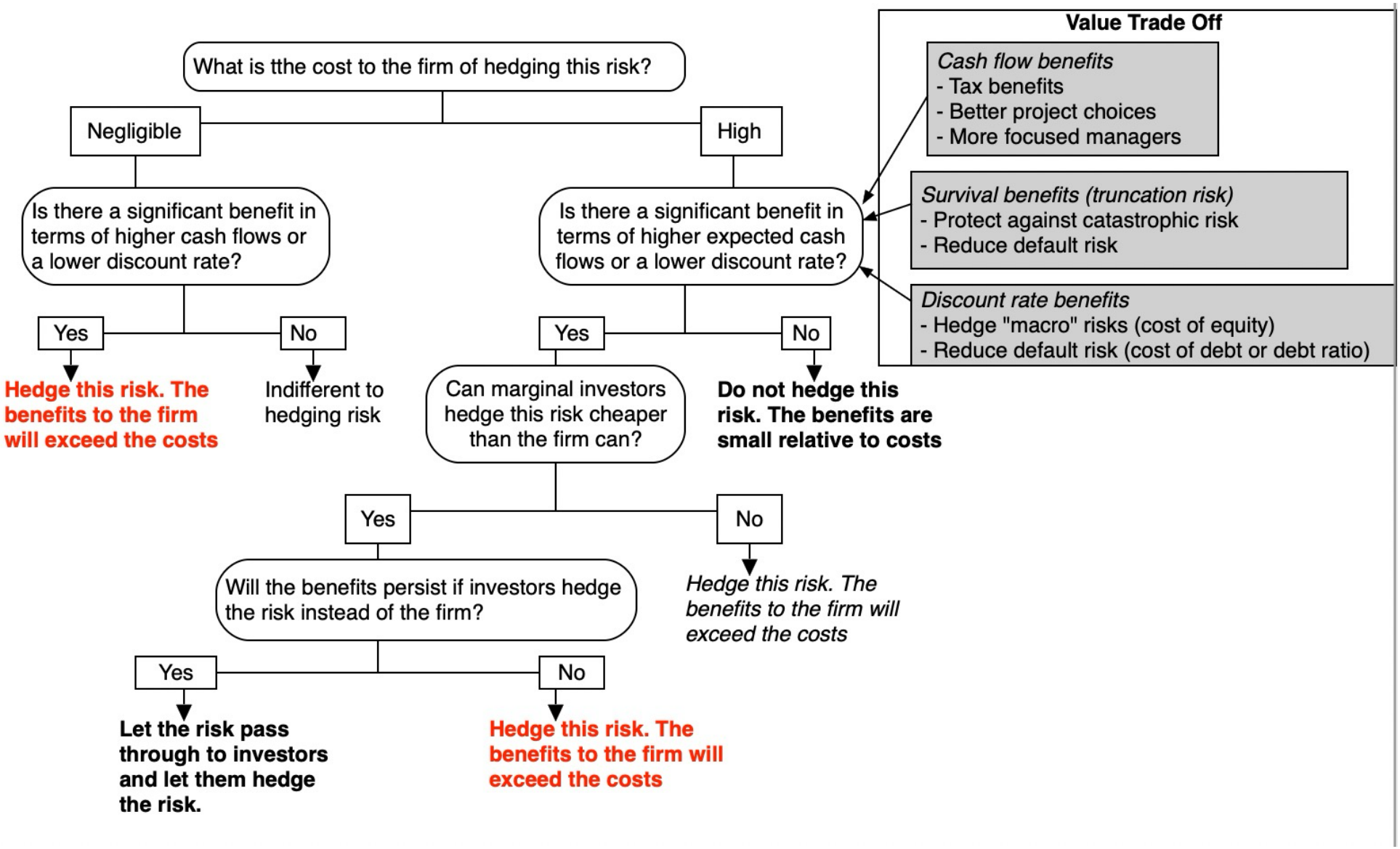
AND EXCHANGE RATES...



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.

MEASURING INVESTMENT RETURNS II. INVESTMENT INTERACTIONS, OPTIONS AND REMORSE...

Life is too short for regrets, right?

INDEPENDENT INVESTMENTS ARE THE EXCEPTION...

- In all of the examples we have used so far, the investments that we have analyzed have stood alone. Thus, our job was a simple one. Assess the expected cash flows on the investment and discount them at the right discount rate.
- In the real world, most investments are not independent. Taking an investment can often mean rejecting another investment at one extreme (mutually exclusive) to being locked in to take an investment in the future (pre-requisite).
- More generally, accepting an investment can create side costs for a firm's existing investments in some cases and benefits for others.

I. MUTUALLY EXCLUSIVE INVESTMENTS

- We have looked at how best to assess a stand-alone investment and concluded that a good investment will have positive NPV and generate accounting returns (ROC and ROE) and IRR that exceed your costs (capital and equity).
- In some cases, though, firms may have to choose between investments because
  - **They are mutually exclusive**: Taking one investment makes the other one redundant because they both serve the same purpose
  - **The firm has limited capital** and cannot take every good investment (i.e., investments with positive NPV or high IRR).
- Using the two standard discounted cash flow measures, NPV and IRR, can yield different choices when choosing between investments.

COMPARING PROJECTS WITH THE SAME (OR SIMILAR) LIVES..

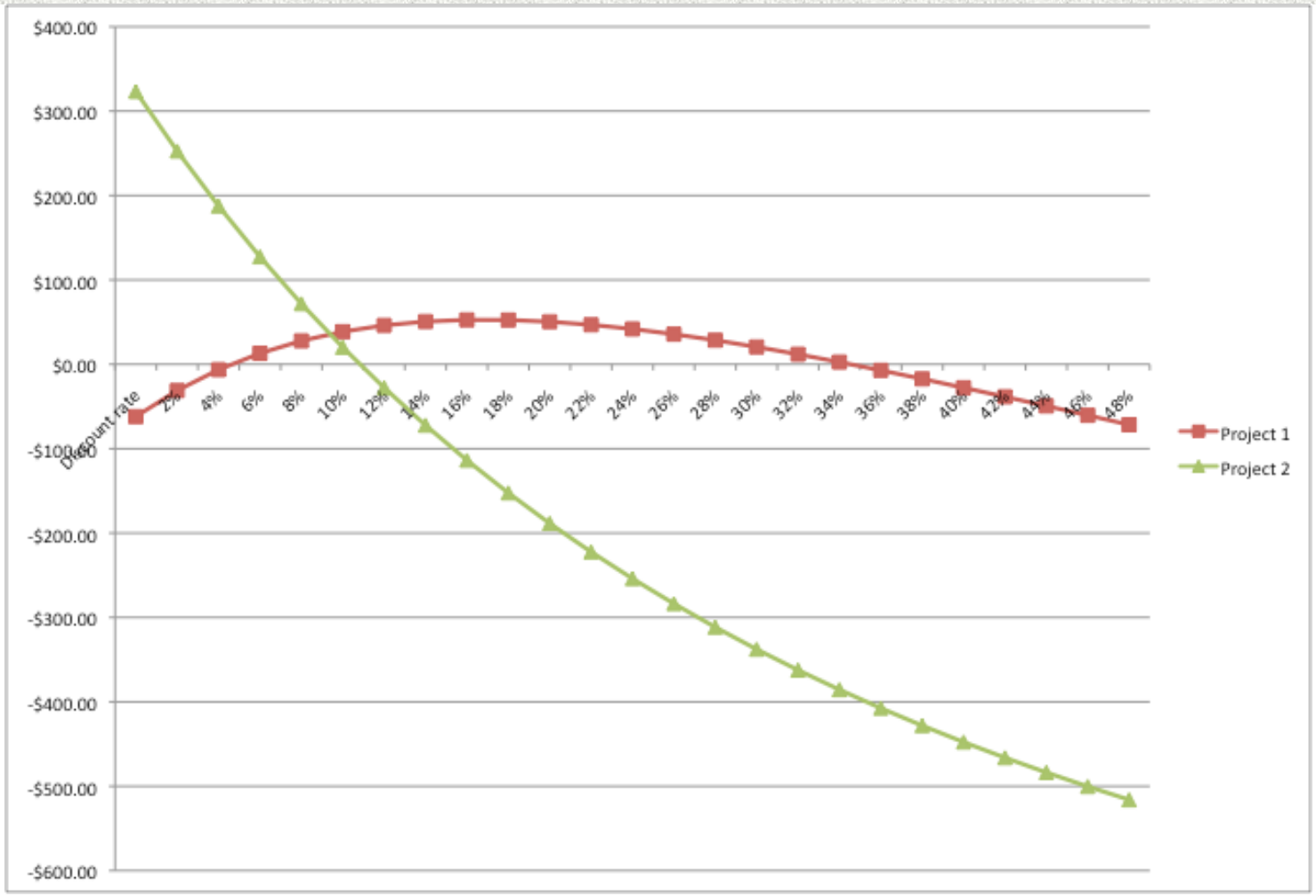
- When comparing and choosing between investments with the same lives, we can
  - Compute the accounting returns (ROC, ROE) of the investments and pick the one with the higher returns
  - Compute the NPV of the investments and pick the one with the higher NPV
  - Compute the IRR of the investments and pick the one with the higher IRR
- While it is easy to see why accounting return measures can give different rankings (and choices) than the discounted cash flow approaches, you would expect NPV and IRR to yield consistent results since they are both time-weighted, incremental cash flow return measures.

CASE 1: IRR VERSUS NPV

- Consider two projects with the following cash flows:

Year	Project 1 CF	Project 2 CF
0	-1000	-1000
1	800	200
2	1000	300
3	1300	400
4	-2200	500

PROJECT'S NPV PROFILE



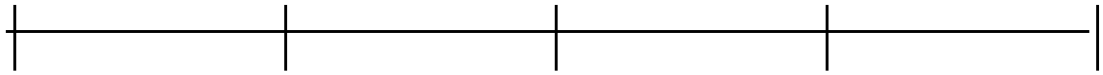
WHAT DO WE DO NOW?

- **Project 1 has two internal rates of return.** The first is 6.60%, whereas the second is 36.55%. Project 2 has one internal rate of return, about 12.8%.
- Why are there two internal rates of return on project 1?
- If your cost of capital is 12%, which investment would you accept?
  a. Project 1
  b. Project 2
- Explain.

CASE 2: NPV VERSUS IRR

Project A

Cash Flow $ 350,000 $ 450,000 $ 600,000 $ 750,000

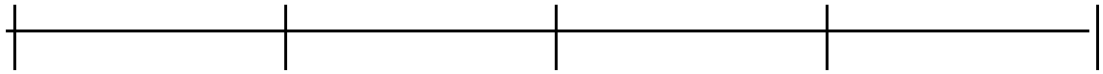


Investment $ 1,000,000

NPV = $467,937
IRR= 33.66%

Project B

Cash Flow $ 3,000,000 $ 3,500,000 $ 4,500,000 $ 5,500,000



Investment $ 10,000,000

NPV = $1,358,664
IRR=20.88%

WHICH ONE WOULD YOU PICK?

- Assume that you can pick only one of these two projects. Your choice will clearly vary depending upon whether you look at NPV or IRR. You have enough money currently on hand to take either. Which one would you pick?
  a. Project A. It gives me the bigger bang for the buck and more margin for error.
  b. Project B. It creates more dollar value in my business.
- If you pick A, what would your biggest concern be?
- If you pick B, what would your biggest concern be?

CAPITAL RATIONING, UNCERTAINTY AND CHOOSING A RULE

- If a business has limited access to capital, has a stream of surplus value projects and faces more uncertainty in its project cash flows, it is much more likely to use IRR as its decision rule.
  - Small, high-growth companies and private businesses are much more likely to use IRR.
- If a business has substantial funds on hand, access to capital, limited surplus value projects, and more certainty on its project cash flows, it is much more likely to use NPV as its decision rule.
- As firms go public and grow, they are much more likely to gain from using NPV.