

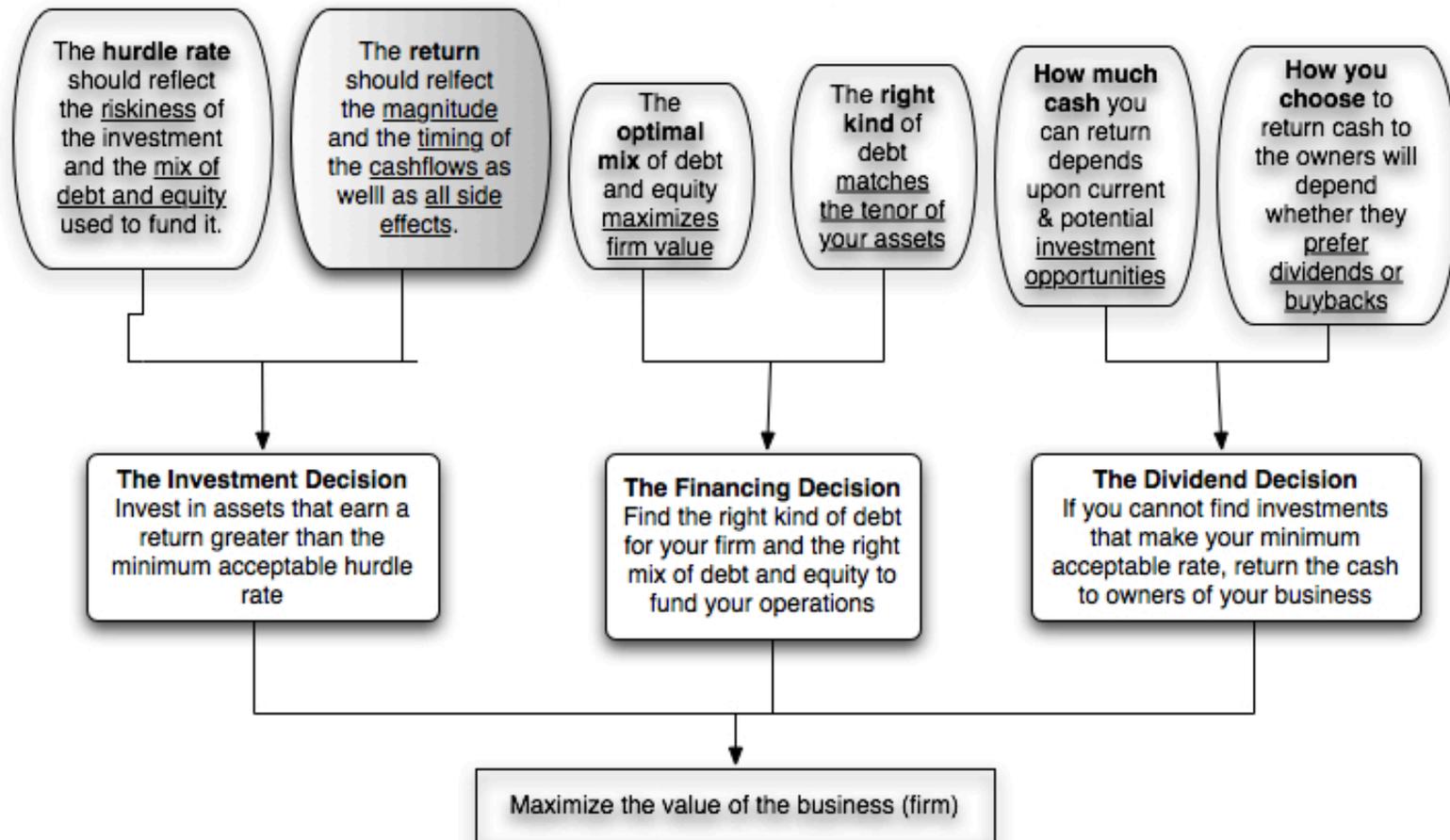
# Measuring Investment Returns I: The Mechanics of Investment Analysis

“Show me the money”

from *Jerry Maguire*

# First Principles

## Chapters 5 & 6: Measuring Returns on Investments



# Measures of return: earnings versus cash flows

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- 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)
  - you have to subtract out cash outflows which are not expensed (such as capital expenditures)
  - you have to make accrual revenues and expenses into cash revenues and expenses (by considering changes in working capital).

## Measuring Returns Right: The Basic Principles

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- 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?

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- 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 four examples...

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- Rio Disney: We will consider whether Disney should invest in its first theme parks in South America. These parks, while similar to those that Disney has in other parts of the world, will require us to consider the effects of country risk and currency issues in project analysis.
- New Paper Plant for Aracruz: Aracruz, as a paper and pulp company, is examining whether to invest in a new paper plant in Brazil.
- 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 Sentient by Tata Chemicals: Sentient is a US firm that manufactures chemicals for the food processing business. This cross-border acquisition by Tata Chemicals will allow us to examine currency and risk issues in such a transaction.

## Earnings versus Cash Flows: A Disney Theme Park

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- 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, and 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

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- 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.
- 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.
- 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.

## 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

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- 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

<i>Year</i>	<i>Depreciation as % of Book Value</i>	<i>Capital Maintenance as % of Depreciation</i>
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

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- 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 38%.

## Laying the groundwork: Book Capital, Working Capital and Depreciation

	0	1	2	3	4	5	6	7	8	9	10
Capital Expenditures											
Pre-Project investments	\$500										
<b>Depreciation: Pre-Project</b>		<b>\$50</b>	<b>\$50</b>	<b>\$50</b>	<b>\$50</b>	<b>\$50</b>	<b>\$50</b>	<b>\$50</b>	<b>\$50</b>	<b>\$50</b>	<b>\$50</b>
Magic Kingdom: Construction	\$2,000	\$1,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Epcot Rio: Construction	\$0	\$0	\$1,000	\$500	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Capital Maintenance		\$0	\$188	\$252	\$276	\$258	\$285	\$314	\$330	\$347	\$350
<b>Depreciation on fixed assets</b>		<b>\$0</b>	<b>\$375</b>	<b>\$419</b>	<b>\$394</b>	<b>\$322</b>	<b>\$317</b>	<b>\$314</b>	<b>\$314</b>	<b>\$316</b>	<b>\$318</b>
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

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
<b>Total Revenues</b>			<b>\$1,250</b>	<b>\$1,750</b>	<b>\$2,500</b>	<b>\$3,125</b>	<b>\$3,438</b>	<b>\$3,781</b>	<b>\$4,159</b>	<b>\$4,575</b>	<b>\$4,667</b>
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
<b>Total Direct Expenses</b>			<b>\$788</b>	<b>\$1,103</b>	<b>\$1,575</b>	<b>\$1,969</b>	<b>\$2,166</b>	<b>\$2,382</b>	<b>\$2,620</b>	<b>\$2,882</b>	<b>\$2,940</b>
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
<b>Operating Income</b>		<b>(\$50)</b>	<b>(\$150)</b>	<b>(\$84)</b>	<b>\$106</b>	<b>\$315</b>	<b>\$389</b>	<b>\$467</b>	<b>\$551</b>	<b>\$641</b>	<b>\$658</b>
Taxes		(\$19)	(\$57)	(\$32)	\$40	\$120	\$148	\$178	\$209	\$244	\$250
<b>Operating Income after Taxes</b>		<b>(\$31)</b>	<b>(\$93)</b>	<b>(\$52)</b>	<b>\$66</b>	<b>\$196</b>	<b>\$241</b>	<b>\$290</b>	<b>\$341</b>	<b>\$397</b>	<b>\$408</b>

## And the Accounting View of Return

■ a

Year	After-tax Operating Income	Book value of				Average BV of Capital	ROC (a)	ROC (b)
		Pre-project investment	Fixed assets	Working capital	Total Capital			
0		\$500	\$2,000	\$0	\$2,500		NA	NA
1	-\$31	\$450	\$3,000	\$0	\$3,450	\$2,975	-1.04%	-1.24%
2	-\$93	\$400	\$3,813	\$63	\$4,275	\$3,863	-2.41%	-2.70%
3	-\$52	\$350	\$4,145	\$88	\$4,582	\$4,429	-1.18%	-1.22%
4	\$66	\$300	\$4,027	\$125	\$4,452	\$4,517	1.46%	1.44%
5	\$196	\$250	\$3,962	\$156	\$4,368	\$4,410	4.43%	4.39%
6	\$241	\$200	\$3,931	\$172	\$4,302	\$4,335	5.57%	5.52%
7	\$290	\$150	\$3,931	\$189	\$4,270	\$4,286	6.76%	6.74%
8	\$341	\$100	\$3,946	\$208	\$4,254	\$4,262	8.01%	8.00%
9	\$397	\$50	\$3,978	\$229	\$4,257	\$4,255	9.34%	9.34%
10	\$408	\$0	\$4,010	\$233	\$4,243	\$4,250	9.61%	9.59%
Average							4.05%	3.99%

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

## What should this return be compared to?

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- The computed return on capital on this investment is about 4%. 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?
  - The riskfree rate of 3.5% (T. Bond rate)
  - The cost of equity for Disney as a company (8.91%)
  - The cost of equity for Disney theme parks (8.20%)
  - The cost of capital for Disney as a company (7.51%)
  - The cost of capital for Disney theme parks (6.62%)
  - None of the above

## Should there be a risk premium for foreign projects?

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- The exchange rate risk should be diversifiable risk (and hence should not command a premium) if

- the company has projects in a large number of countries (or)
- the investors in the company are globally diversified.

For Disney, this 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. However, 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 did estimate a cost of equity of 6.62% for the Disney theme park business, using a bottom-up levered beta of 0.7829 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 only 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).

$$\text{Country risk premium for Brazil} = 2.50\% (34/21.5) = 3.95\%$$

$$\text{Cost of Equity in US\$} = 3.5\% + 0.7829 (6\% + 3.95\%) = 11.29\%$$

We multiplied the default spread for Brazil (2.50%) by the relative volatility of Brazil's equity index to the Brazilian government bond. (34%/21.5%)

- Using this estimate of the cost of equity, Disney's theme park debt ratio of 35.32% and its after-tax cost of debt of 3.72% (see chapter 4), we can estimate the cost of capital for the project:

$$\text{Cost of Capital in US\$} = 11.29\% (0.6468) + 3.72\% (0.3532) = 8.62\%$$

## Would lead us to conclude that...

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- Do not invest in this park. The **return on capital of 4.05%** is lower than the **cost of capital for theme parks of 8.62%**; 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?

Assets		Liabilities
Existing Investments Generate cashflows today Includes long lived (fixed) and short-lived (working capital) assets	Assets in Place	Debt Fixed Claim on cash flows Little or No role in management <i>Fixed Maturity</i> <i>Tax Deductible</i>
Expected Value that will be created by future investments	Growth Assets	Equity Residual Claim on cash flows Significant Role in management <i>Perpetual Lives</i>

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	\$4,359	\$16,892	\$30,753	\$3,670	\$43,975	9.91%	7.51%	2.40%
Aracruz	R\$ 379	R\$ 3,090	R\$ 5,361	R\$ 22	R\$ 8,430	4.49%	10.63%	-6.14%
Bookscape	\$2.15	\$9.59	\$6.00	\$0.40	\$15.59	13.76%	14.90%	-1.14%
Tata Chemicals	INR 4,134	INR 12,614	INR 23,928	INR 725	INR 36,542	11.31%	11.44%	-0.12%

## Old wine in a new bottle.. Another way of presenting the same results...

- The key to value is earning excess returns. Over time, there have been attempts to restate this obvious fact in new and different ways. For instance, Economic Value Added (EVA) developed a wide following in the the 1990s:

$$\text{EVA} = (\text{ROC} - \text{Cost of Capital}) (\text{Book Value of Capital Invested})$$

- The excess returns for the four firms can be restated as follows:

Company	ROC - Cost of Capital	BV of Capital	EVA
Disney	2.40%	\$43,975	\$1,057
Aracruz	-6.14%	R\$ 8,430	-R\$ 517
Bookscape	-1.14%	\$15.59	-\$0.18
Deutsche Bank	NMF	NMF	NMF
Tata Chemicals	-0.12%	INR 36,542	-INR 45

## Application Test: Assessing Investment Quality

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- 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

$$\text{After-tax ROC} = \text{EBIT} (1 - \text{tax rate}) / (\text{BV of debt} + \text{BV of Equity-Cash})_{\text{previous year}}$$

- For the most recent period for which you have data, compute the return spread earned by your firm:

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

- For the most recent period, compute the EVA earned by your firm

$$\text{EVA} = \text{Return Spread} * ((\text{BV of debt} + \text{BV of Equity-Cash})_{\text{previous year}})$$

## The cash flow view of this project..

	0	1	2	3	4	5	6	7	8	9	10
Operating Income		-\$50	-\$150	-\$84	\$106	\$315	\$389	\$467	\$551	\$641	\$658
Taxes		-\$19	-\$57	-\$32	\$40	\$120	\$148	\$178	\$209	\$244	\$250
Operating Income after Taxes		-\$31	-\$93	-\$52	\$66	\$196	\$241	\$290	\$341	\$397	\$408
+ Depreciation & Amortization		\$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 Working Capital	\$0	\$0	\$63	\$25	\$38	\$31	\$16	\$17	\$19	\$21	\$5
Cash flow to Firm	-\$2,500	-\$981	-\$918	-\$360	\$196	\$279	\$307	\$323	\$357	\$395	\$422

To get from income to cash flow, we

- added back all non-cash charges such as depreciation
- subtracted out the capital expenditures
- subtracted out the change in non-cash working capital

# The Depreciation Tax Benefit

- While depreciation reduces taxable income and taxes, it does not reduce the cash flows.
- The benefit of depreciation is therefore the tax benefit. In general, the tax benefit from depreciation can be written as:

$$\text{Tax Benefit} = \text{Depreciation} * \text{Tax Rate}$$

*Disney Theme Park: Depreciation tax savings (Tax rate = 38%)*

	1	2	3	4	5	6	7	8	9	10
Depreciation	\$50	\$425	\$469	\$444	\$372	\$367	\$364	\$364	\$366	\$368
Depreciaton * t	\$19	\$162	\$178	\$169	\$141	\$139	\$138	\$138	\$139	\$140

**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

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- 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

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- Capital expenditures are not treated as accounting expenses but they do cause 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

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- Assume that you run your own software business, and that you have an expense this year of \$ 100 million from producing and distribution promotional CDs in software magazines. 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

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- 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.

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

## The incremental cash flows on the project

	0	1	2	3	4	5	6	7	8	9	10
Operating Income		-\$50	-\$150	-\$84	\$106	\$315	\$389	\$467	\$551	\$641	\$658
Taxes		-\$19	-\$57	-\$32	\$40	\$120	\$148	\$178	\$209	\$244	\$250
Operating Income after Taxes		-\$31	-\$93	-\$52	\$66	\$196	\$241	\$290	\$341	\$397	\$408
+ Depreciation & Amortization		\$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 Working Capital	\$0	\$0	\$63	\$25	\$38	\$31	\$16	\$17	\$19	\$21	\$5
Cash flow to Firm	-\$2,500	-\$981	-\$918	-\$360	\$196	\$279	\$307	\$323	\$357	\$395	\$422
+ Pre-Project Investment	500										
- Pre-project Deprecn * t		\$19	\$19	\$19	\$19	\$19	\$19	\$19	\$19	\$19	\$19
+ Fixed G&A (1-t)		\$0	\$78	\$109	\$155	\$194	\$213	\$234	\$258	\$284	\$289
Incremental Cash flow to Firm	-\$2,000	-\$1,000	-\$859	-\$270	\$332	\$454	\$501	\$538	\$596	\$660	\$692

2/3rd of allocated G&A is fixed.  
Add back this amount (1-t)  
Tax rate = 38%

## 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
#NAME?		\$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	\$10	\$53	\$154	\$258	\$298	\$340	\$386	\$436	\$447
Incremental after-tax Operating income		\$0	\$16	\$87	\$252	\$420	\$485	\$555	\$630	\$712	\$729
+ 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)	(\$860)	(\$270)	\$332	\$453	\$502	\$538	\$596	\$660	\$692

# Sunk Costs

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- 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.
- 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

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- 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?
  - Yes
  - 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

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- 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

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- 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

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- 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

1. Simple CF

2. Annuity

3. Growing Annuity

4. Perpetuity

5. Growing Perpetuity

## Discounting Formula

$$CF_n / (1+r)^n$$

$$A \left[ \frac{1 - \frac{1}{(1+r)^n}}{r} \right]$$

$$A(1+g) \left[ \frac{1 - \frac{(1+g)^n}{(1+r)^n}}{r-g} \right]$$

$$A/r$$

Expected Cashflow next year/(r-g)

## Compounding Formula

$$CF_0 (1+r)^n$$

$$A \left[ \frac{(1+r)^n - 1}{r} \right]$$

## 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  $IRR > \text{hurdle rate}$

## 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=  $CF \text{ in year } 11 / (\text{Cost of Capital} - \text{Growth Rate})$   
 $= 692 (1.02) / (.0862 - .02) = \$ 10,669 \text{ million}$

Which yields a NPV of..

Discounted at Rio Disney cost  
of capital of 8.62%

Year	Annual Cashflow	Terminal Value	Present Value
0	-\$2,000		-\$2,000
1	-\$1,000		-\$921
2	-\$860		-\$729
3	-\$270		-\$211
4	\$332		\$239
5	\$453		\$300
6	\$502		\$305
7	\$538		\$302
8	\$596		\$307
9	\$660		\$313
10	\$692	\$10,669	\$4,970
Net Present Value =			\$2,877

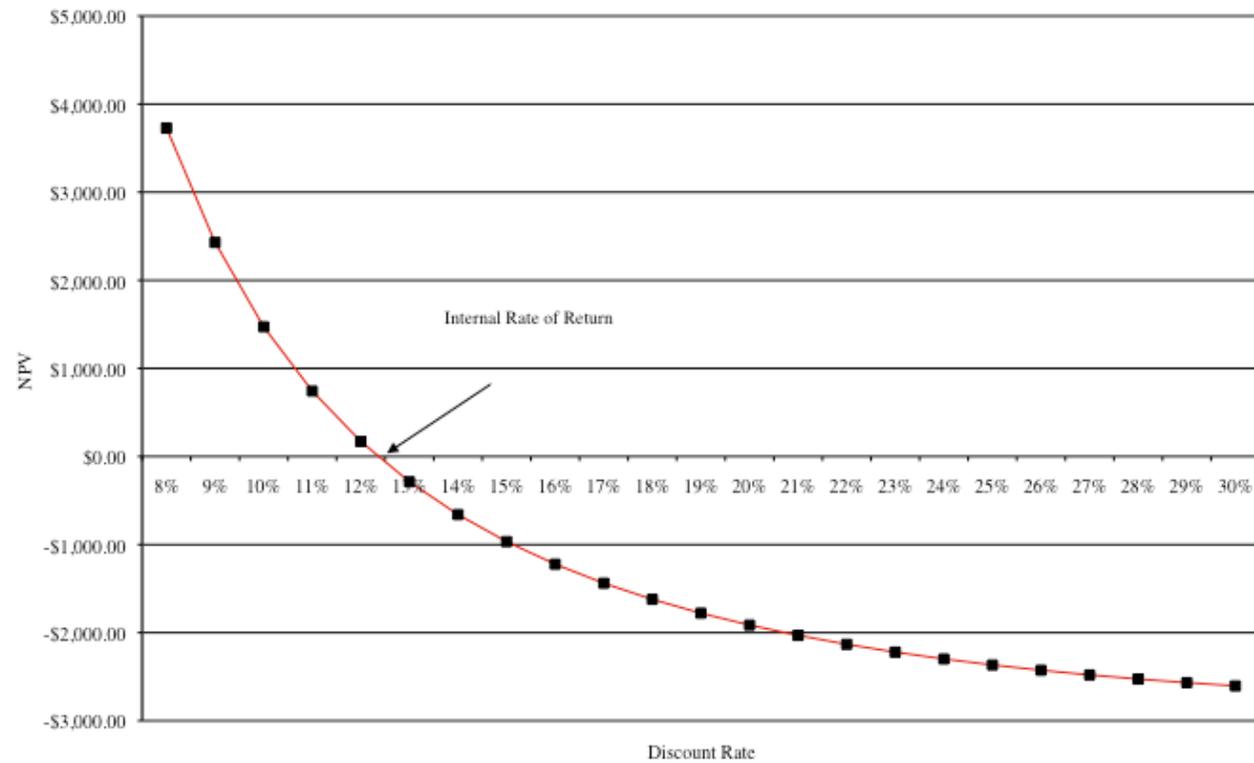
Which makes the argument that..

---

- **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 \$2,877 million.

# The IRR of this project

Figure 5.5: NPV Profile for Disney Theme Park



## The IRR suggests..

---

- **The project is a good one.** Using time-weighted, incremental cash flows, this project provides a return of 12.35%. This is greater than the cost of capital of 8.62%.
- 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.

## 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 7% in Brazil and 2% in the United States. The \$R/dollar rate at the time of the analysis was 2.04 \$R/dollar.
- The expected exchange rate was derived assuming purchasing power parity.  
Expected Exchange Rate<sub>t</sub> = Exchange Rate today \* (1.07/1.02)<sup>t</sup>
- The expected growth rate after year 10 is still expected to be the inflation rate, but it is the 7% \$R inflation rate.
- The cost of capital in \$R was derived from the cost of capital in dollars and the differences in inflation rates:

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

$$= (1.0862) (1.07/1.02) - 1 = 13.94\%$$

## Disney Theme Park: \$R NPV

Discount  
back at  
13.94%

Year	Cashflow (\$)	R\$/\$	Cashflow (R\$)	Present Value
0	-\$ 2,000.00	R\$ 2.04	-R\$ 4,080.00	-R\$ 4,080.00
1	-\$ 1,000.00	R\$ 2.14	-R\$ 2,140.00	-R\$ 1,878.14
2	-\$ 859.50	R\$ 2.24	-R\$ 1,929.49	-R\$ 1,486.19
3	-\$ 270.06	R\$ 2.35	-R\$ 635.98	-R\$ 429.92
4	\$ 332.50	R\$ 2.47	R\$ 821.40	R\$ 487.32
5	\$ 453.46	R\$ 2.59	R\$ 1,175.12	R\$ 611.87
6	\$ 501.55	R\$ 2.72	R\$ 1,363.46	R\$ 623.06
7	\$ 538.06	R\$ 2.85	R\$ 1,534.43	R\$ 615.39
8	\$ 595.64	R\$ 2.99	R\$ 1,781.89	R\$ 627.19
9	\$ 659.64	R\$ 3.14	R\$ 2,070.10	R\$ 639.48
10	\$ 11,360.86	R\$ 3.29	R\$ 37,400.49	R\$ 10,139.72
				R\$ 5,869.78

$$\text{NPV} = \text{R\$ } 5,870 / 2.04 = \$ 2,877 \text{ Million}$$

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) Ignore it.
  - d) Other

## One simplistic (but effective) 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	-\$921	-\$2,921
2	-\$860	-\$3,860	-\$729	-\$3,649
3	-\$270	-\$4,130	-\$211	-\$3,860
4	\$332	-\$3,797	\$239	-\$3,621
5	\$453	-\$3,344	\$300	-\$3,321
6	\$502	-\$2,842	\$305	-\$3,016
7	\$538	-\$2,304	\$302	-\$2,714
8	\$596	-\$1,708	\$307	-\$2,407
9	\$660	-\$1,049	\$313	-\$2,093
10	\$692	-\$357	\$303	-\$1,790
11	\$706	\$350	\$284	-\$1,506
12	\$720	\$1,070	\$267	-\$1,239
13	\$735	\$1,804	\$251	-\$988
14	\$749	\$2,554	\$236	-\$753
15	\$764	\$3,318	\$221	-\$531
16	\$780	\$4,097	\$208	-\$324
17	\$795	\$4,892	\$195	-\$129
18	\$811	\$5,703	\$183	\$55
19	\$827	\$6,531	\$172	\$227
20	\$844	\$7,374	\$162	\$388

Payback = 10.5 years →

Discounted Payback  
= 17.7 years

## A slightly more sophisticated approach: Sensitivity Analysis and 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.

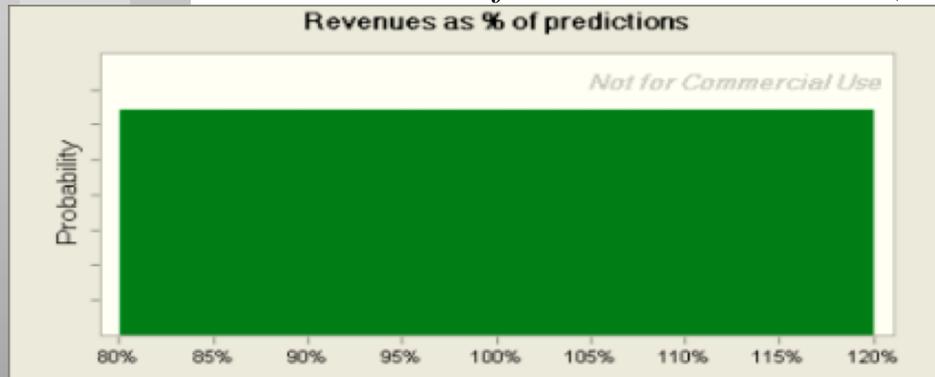
Corollary 1: Less is more. Not everything is worth varying...

Corollary 2: A picture is worth a thousand numbers (and tables).

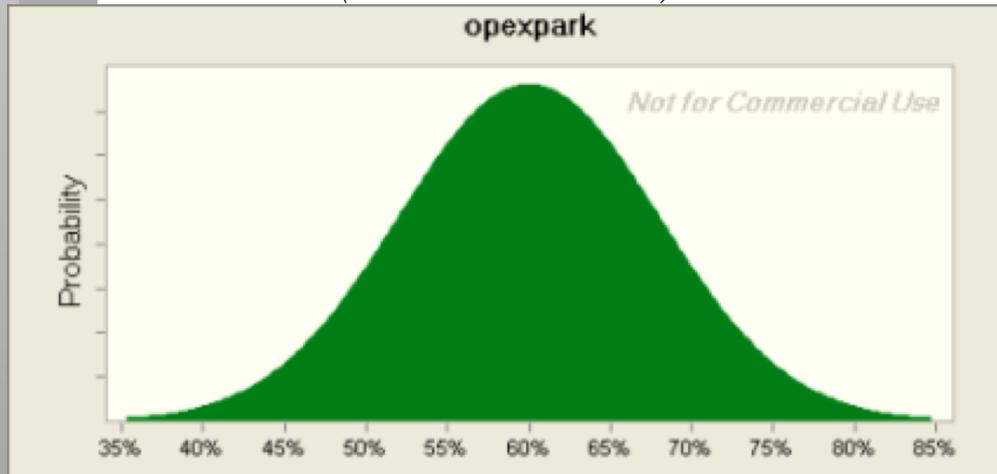


The final step up: Incorporate probabilistic estimates.. Rather than expected values..

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



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



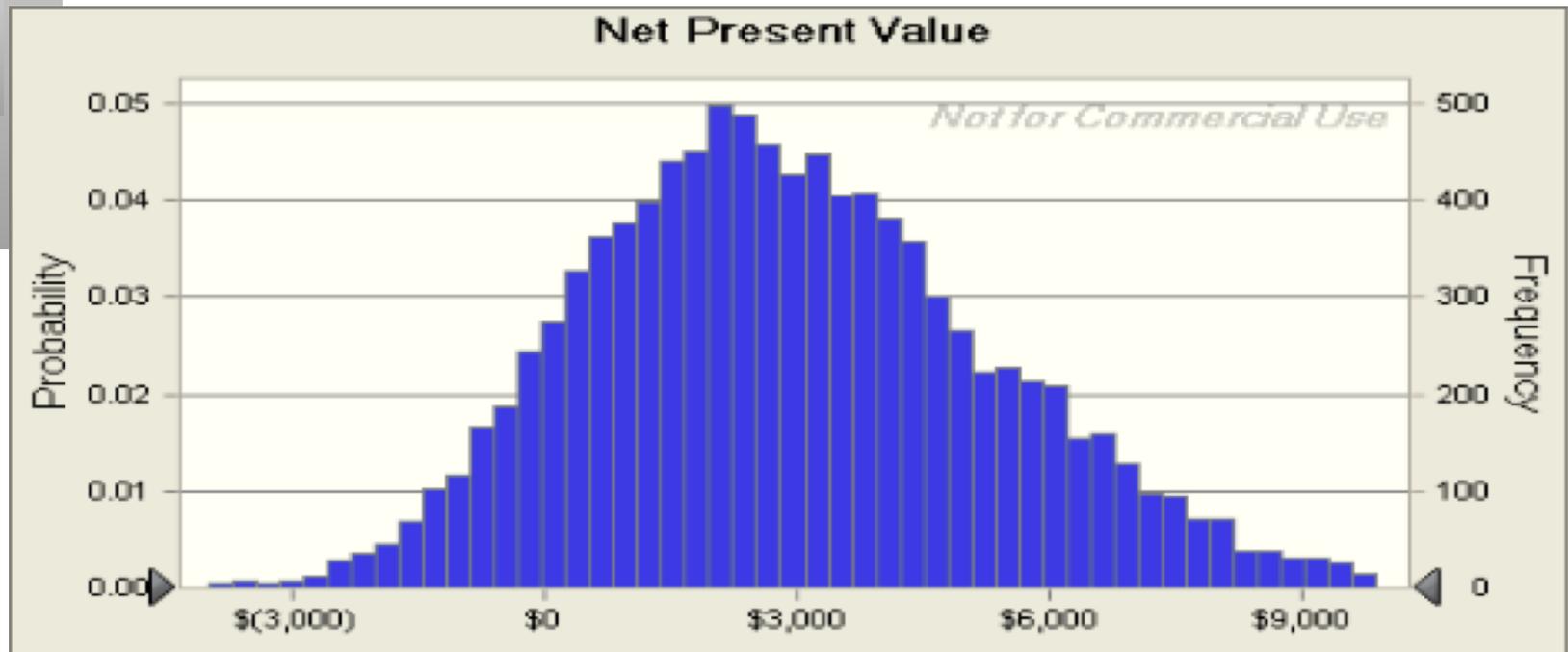
*Equity Risk Premium (Base Case = 6% (US) + 3.95% (Brazil) = 9.95%*



## The resulting simulation...

Average = \$2.95 billion

Median = \$2.73 billion



NPV ranges from -\$4 billion to +\$14 billion. NPV is negative 12% of the time.

## You are the decision maker...

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- 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 \$2.877 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 12% is higher than my threshold value for losing on a project.
  - c) Other

## Equity Analysis: The Parallels

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- 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) =  $\text{Net Income} / \text{BV of Equity}$
  - 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 Brief Example: A Paper Plant for Aracruz - Investment Assumptions

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- The plant is expected to have a capacity of 750,000 tons and will have the following characteristics:
- It will require an initial investment of 250 Million BR. At the end of the fifth year, an additional investment of 50 Million BR will be needed to update the plant.
- Aracruz plans to borrow 100 Million BR, at a real interest rate of 5.25%, using a 10-year term loan (where the loan will be paid off in equal annual increments).
- The plant will have a life of 10 years. During that period, the plant (and the additional investment in year 5) will be depreciated using double declining balance depreciation, with a life of 10 years. At the end of the tenth year, the plant is expected to be sold for its remaining book value.

## Operating Assumptions

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- The plant will be partly in commission in a couple of months, but will have a capacity of only 650,000 tons in the first year, 700,000 tons in the second year before getting to its full capacity of 750,000 tons in the third year.
- The capacity utilization rate will be 90% for the first 3 years, and rise to 95% after that.
- The price per ton of linerboard is currently \$400, and is expected to keep pace with inflation for the life of the plant.
- The variable cost of production, primarily labor and material, is expected to be 55% of total revenues; there is a fixed cost of 50 Million BR, which will grow at the inflation rate.
- The working capital requirements are estimated to be 15% 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.

## The Hurdle Rate

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

	Cost of equity	Pre-tax Cost of debt	After-tax cost of debt	D/(D+E)	Cost of capital
US dollars	20.82%	8.50%	5.61%	52.47%	12.84%
\$R	26.75%	13.82%	10.79%	52.47%	18.37%
Real	18.45%	6.3725%	3.54%	52.47%	10.63%

## Breaking down debt payments by year

Year	Beginning Debt	Interest expense	Principal Repaid	Total Payment	Ending Debt
1	R\$ 100,000	R\$ 6,373	R\$ 7,455	R\$ 13,828	R\$ 92,545
2	R\$ 92,545	R\$ 5,897	R\$ 7,930	R\$ 13,828	R\$ 84,615
3	R\$ 84,615	R\$ 5,392	R\$ 8,436	R\$ 13,828	R\$ 76,179
4	R\$ 76,179	R\$ 4,855	R\$ 8,973	R\$ 13,828	R\$ 67,206
5	R\$ 67,206	R\$ 4,283	R\$ 9,545	R\$ 13,828	R\$ 57,661
6	R\$ 57,661	R\$ 3,674	R\$ 10,153	R\$ 13,828	R\$ 47,508
7	R\$ 47,508	R\$ 3,027	R\$ 10,800	R\$ 13,828	R\$ 36,708
8	R\$ 36,708	R\$ 2,339	R\$ 11,488	R\$ 13,828	R\$ 25,220
9	R\$ 25,220	R\$ 1,607	R\$ 12,220	R\$ 13,828	R\$ 12,999
10	R\$ 12,999	R\$ 828	R\$ 12,999	R\$ 13,828	R\$ 0

## Net Income: Paper Plant

	1	2	3	4	5	6	7	8	9	10
<i>Capacity (in '000s)</i>	650	700	750	750	750	750	750	750	750	750
<i>Utilization Rate</i>	90%	90%	90%	95%	95%	95%	95%	95%	95%	95%
<i>Production Rate (in '000)</i>	585	630	675	713	713	713	713	713	713	713
<i>Price per ton</i>	400	400	400	400	400	400	400	400	400	400
Revenues (in Real BR 00	R\$ 234,000	R\$ 252,000	R\$ 270,000	R\$ 285,000						
- Direct Expenses	R\$ 155,300	R\$ 163,400	R\$ 171,500	R\$ 178,250						
- Depreciation	R\$ 35,000	R\$ 28,000	R\$ 22,400	R\$ 17,920	R\$ 14,336	R\$ 21,469				
<b>Operating Income</b>	<b>R\$ 43,700</b>	<b>R\$ 60,600</b>	<b>R\$ 76,100</b>	<b>R\$ 88,830</b>	<b>R\$ 92,414</b>	<b>R\$ 85,281</b>				
- Interest Expenses	R\$ 6,373	R\$ 5,897	R\$ 5,392	R\$ 4,855	R\$ 4,283	R\$ 3,674	R\$ 3,027	R\$ 2,339	R\$ 1,607	R\$ 828
Taxable Income	R\$ 37,327	R\$ 54,703	R\$ 70,708	R\$ 83,975	R\$ 88,131	R\$ 81,607	R\$ 82,254	R\$ 82,942	R\$ 83,674	R\$ 84,453
- Taxes	R\$ 12,691	R\$ 18,599	R\$ 24,041	R\$ 28,552	R\$ 29,965	R\$ 27,746	R\$ 27,966	R\$ 28,200	R\$ 28,449	R\$ 28,714
<b>Net Income</b>	<b>R\$ 24,636</b>	<b>R\$ 36,104</b>	<b>R\$ 46,667</b>	<b>R\$ 55,424</b>	<b>R\$ 58,167</b>	<b>R\$ 53,860</b>	<b>R\$ 54,287</b>	<b>R\$ 54,742</b>	<b>R\$ 55,225</b>	<b>R\$ 55,739</b>

# A ROE Analysis

Year	Net Income	Beg. BV: Assets	Depreciation	Capital Exp.	Ending BV: Assets	BV of Working Capital	Debt	BV: Equity	Average BV: Equity	ROE
0		R\$ 0	R\$ 0	R\$ 250,000	R\$ 250,000	R\$ 35,100	R\$ 100,000	R\$ 185,100		
1	R\$ 24,636	R\$ 250,000	R\$ 35,000	R\$ 0	R\$ 215,000	R\$ 37,800	R\$ 92,545	R\$ 160,255	R\$ 172,678	14.27%
2	R\$ 36,104	R\$ 215,000	R\$ 28,000	R\$ 0	R\$ 187,000	R\$ 40,500	R\$ 84,615	R\$ 142,885	R\$ 151,570	23.82%
3	R\$ 46,667	R\$ 187,000	R\$ 22,400	R\$ 0	R\$ 164,600	R\$ 42,750	R\$ 76,179	R\$ 131,171	R\$ 137,028	34.06%
4	R\$ 55,424	R\$ 164,600	R\$ 17,920	R\$ 0	R\$ 146,680	R\$ 42,750	R\$ 67,206	R\$ 122,224	R\$ 126,697	43.75%
5	R\$ 58,167	R\$ 146,680	R\$ 14,336	R\$ 50,000	R\$ 182,344	R\$ 42,750	R\$ 57,661	R\$ 167,433	R\$ 144,828	40.16%
6	R\$ 53,860	R\$ 182,344	R\$ 21,469	R\$ 0	R\$ 160,875	R\$ 42,750	R\$ 47,508	R\$ 156,117	R\$ 161,775	33.29%
7	R\$ 54,287	R\$ 160,875	R\$ 21,469	R\$ 0	R\$ 139,406	R\$ 42,750	R\$ 36,708	R\$ 145,448	R\$ 150,783	36.00%
8	R\$ 54,742	R\$ 139,406	R\$ 21,469	R\$ 0	R\$ 117,938	R\$ 42,750	R\$ 25,220	R\$ 135,468	R\$ 140,458	38.97%
9	R\$ 55,225	R\$ 117,938	R\$ 21,469	R\$ 0	R\$ 96,469	R\$ 42,750	R\$ 12,999	R\$ 126,220	R\$ 130,844	42.21%
10	R\$ 55,739	R\$ 96,469	R\$ 21,469	R\$ 0	R\$ 75,000	R\$ 0	R\$ 0	R\$ 75,000	R\$ 100,610	55.40%
										36.19%

Real ROE of 36.19% is greater than  
Real Cost of Equity of 18.45%

## 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.

### *Equity Excess Returns and EVA: 2008*

Company	Net Income	BV of Equity	ROE	Cost of Equity	ROE - Cost of Equity	Equity EVA
Disney	\$4,427	\$30,753	14.40%	8.91%	5.49%	\$1,688.34
Aracruz	-R\$ 4,213	5361	-78.59%	18.45%	-97.05%	(\$5,202.85)
Bookscape	\$1.50	\$6.00	25.00%	20.94%	4.06%	\$0.24
Deutsche Bank	-€ 3,835.00	€ 38,466.00	-9.97%	10.72%	-20.69%	(\$7,958.62)
Tata Chemicals	INR 9,644	23,928	40.30%	13.93%	26.37%	\$6,309.81
Tata Chemicals(w/o extraordinary loss)	INR 3,700	23928	15.46%	13.93%	1.53%	\$366.10

# An Incremental CF Analysis

	0	1	2	3	4	5	6	7	8	9	10
Net Income		R\$ 24,636	R\$ 36,104	R\$ 46,667	R\$ 55,424	R\$ 58,167	R\$ 53,860	R\$ 54,287	R\$ 54,742	R\$ 55,225	R\$ 55,739
+ Depreciation & Amortization		R\$ 35,000	R\$ 28,000	R\$ 22,400	R\$ 17,920	R\$ 14,336	R\$ 21,469				
- Capital Expenditures	R\$ 150,000	R\$ 0	R\$ 0	R\$ 0	R\$ 0	R\$ 50,000	R\$ 0				
- Change in Working Capital	R\$ 35,100	R\$ 2,700	R\$ 2,700	R\$ 2,250	R\$ 0	-R\$ 42,750					
- Principal Repayments		R\$ 7,455	R\$ 7,930	R\$ 8,436	R\$ 8,973	R\$ 9,545	R\$ 10,153	R\$ 10,800	R\$ 11,488	R\$ 12,220	R\$ 12,999
Cashflow to Equity	-R\$ 185,100	R\$ 49,481	R\$ 53,474	R\$ 58,382	R\$ 64,371	R\$ 12,958	R\$ 65,176	R\$ 64,956	R\$ 64,722	R\$ 64,473	R\$ 106,958

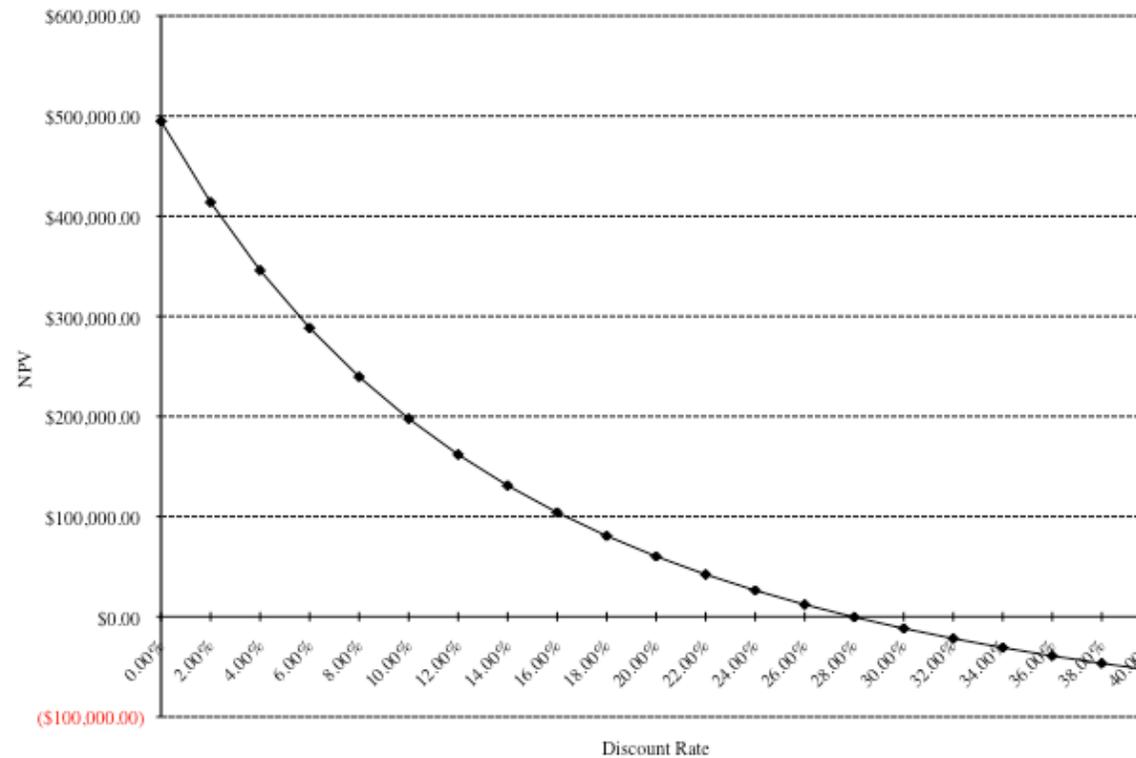
## An Equity NPV

Discounted at real  
cost of equity of  
18.45%

Year	FCFE	PV of FCFE
0	(185,100 BR)	(185,100 BR)
1	49,481 BR	41,773 BR
2	53,474 BR	38,110 BR
3	58,382 BR	35,126 BR
4	64,371 BR	32,696 BR
5	12,958 BR	5,556 BR
6	65,176 BR	23,594 BR
7	64,956 BR	19,851 BR
8	64,722 BR	16,698 BR
9	64,473 BR	14,043 BR
10	181,958 BR	33,458 BR
NPV		75,806 BR

# An Equity IRR

Figure 5.6: NPV Profile on Equity Investment in Paper Plant: Aracruz



## Real versus Nominal Analysis

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- In computing the NPV of the plant, we estimated real cash flows and discounted them at the real cost of equity. We could have estimated the cash flows in nominal terms (either US dollars or \$R) and discounted them at a nominal cost of equity (either US dollar or \$R). Would the answer be different?

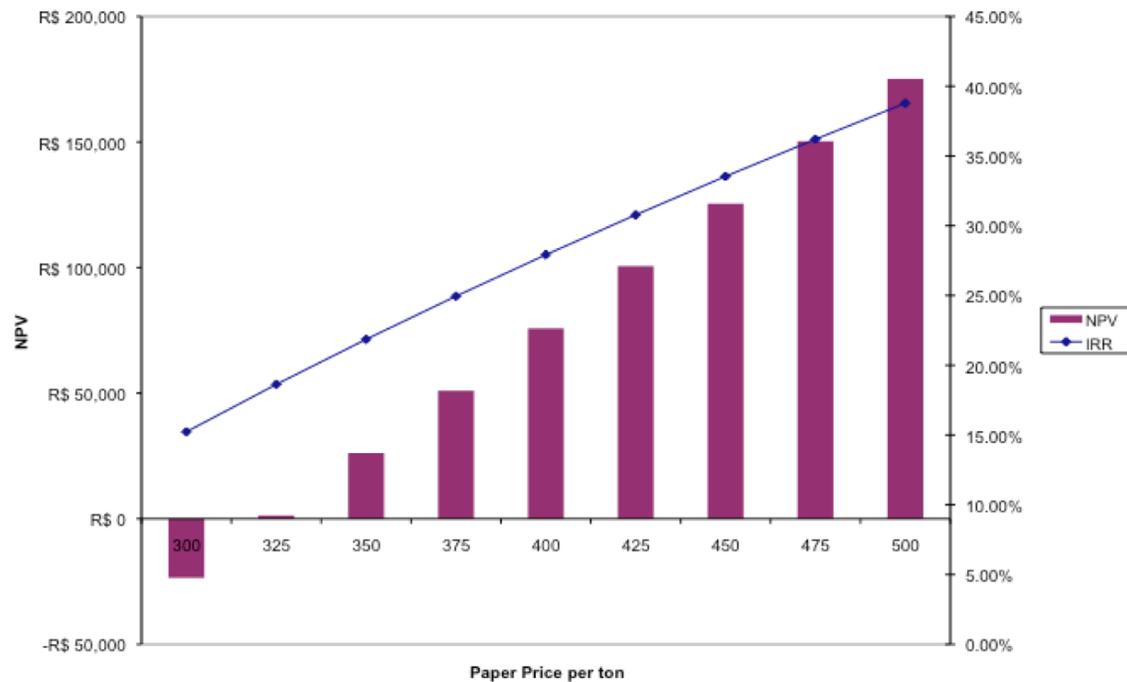
- a) Yes
- b) No

Explain

## Dealing with Macro Uncertainty: The Effect of Paper Prices..

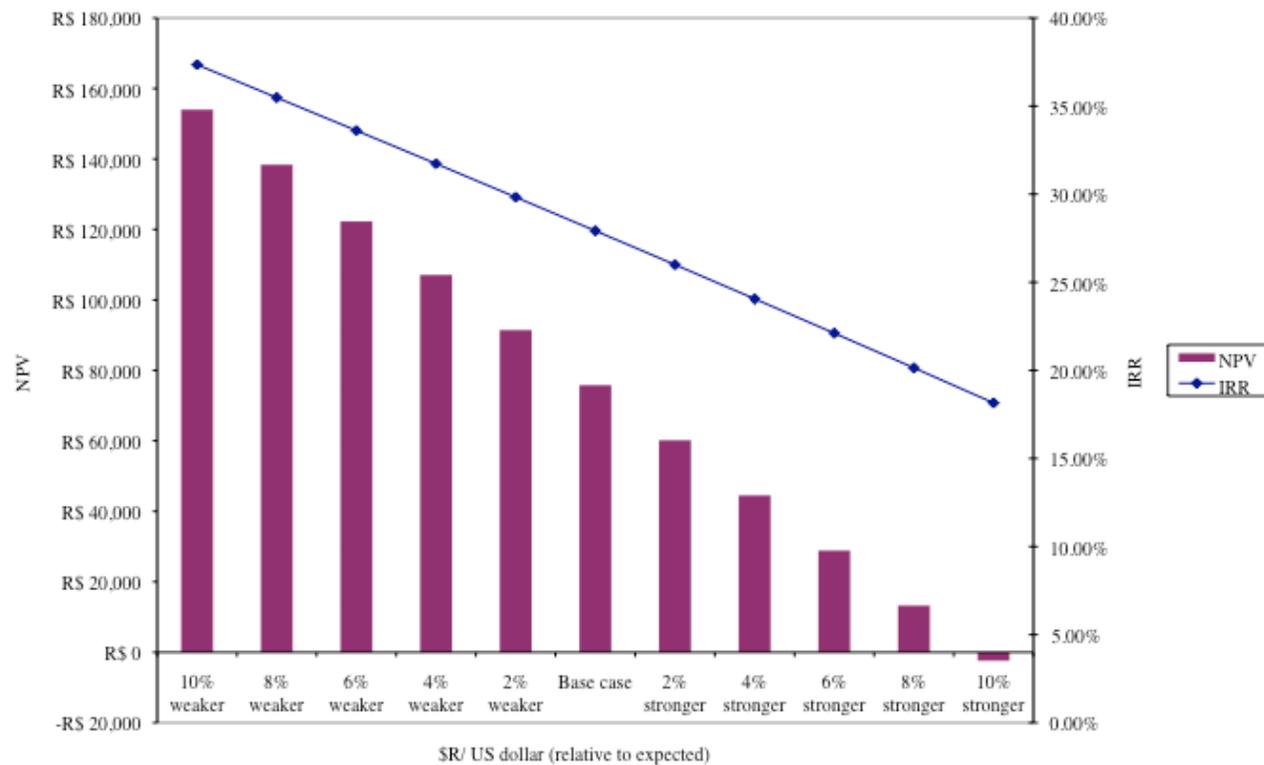
- Like the Disney Theme Park, the Aracruz paper plant's actual value will be buffeted as the variables change. The biggest source of variability is an external factor –the price of paper and pulp.

Figure 5.9: Aracruz Paper Plant: Effect of Changing pulp prices



## And Exchange Rates...

Figure 5.10: Aracruz Paper Plant: Effect of Changing Exchange Rates



## Should you hedge?

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- The value of this plant is very much a function of paper and pulp prices. There are futures, forward and option markets on paper and pulp that Aracruz can use to hedge against paper price movements. Should it?
  - a) Yes
  - b) NoExplain.
  
- The value of the plant is also a function of exchange rates. There are forward, futures and options markets on currency. Should Aracruz hedge against exchange rate risk?
  - a) Yes
  - b) NoExplain.

## Acquisitions and Projects

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- 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 Chemicals and Sensient Technologies

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- Sensient Technologies is a publicly traded US firm that manufactures color, flavor and fragrance additives for the food business. Tata Chemicals is an Indian company that manufactures fertilizers and chemicals.
- Based upon 2008 financial statements, the firm reported
  - Operating income of \$162 million on revenues of \$1.23 billion for the year
  - A tax rate of 37% of its income as taxes in 2008
  - Depreciation of \$44 million and capital expenditures of \$54 million.
  - An Increase in Non-cash working capital of \$16 million during the year.
- Sensient currently has a debt to capital ratio of 28.57% (translating into a debt to equity ratio of 40%) and faces a pre-tax cost of debt of 5.5%.

## Estimating the Cost of Capital for the Acquisition

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- In assessing the cost of capital for the acquisition, we will
  - Estimate all values in US dollar terms (rather than rupees)
  - Use Sensient's risk, debt and tax characteristics in making our assessments.
- While Sensient Technologies is classified as a specialty chemical company, its revenues are derived almost entirely from the food processing business. Consequently, we feel that the unlevered beta of food processing companies in the United States is a better measure of risk; in January 2009, we estimated an unlevered beta of 0.65 for this sector.
- Using the US corporate tax rate of 37% (to reflect the fact that Sensient's income will be taxed in the US), Sensient's current debt to capital ratio of 28.57% (D/E=40%) and its pre-tax cost of debt of 5.5%:
  - Levered Beta =  $0.65 (1 + (1 - .37) (.40)) = 0.8138$
  - Cost of Equity =  $3.5\% + 0.8138 (6\%) = 8.38\%$
  - Cost of capital =  $8.38\% (1 - .2857) + 5.5\% (1 - .37) (.2857) = 6.98\%$

## Estimating the Cash Flow to the Firm and Growth for Sensient

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- Using the operating income (\$162 million), capital expenditures (\$44 million), depreciation (\$54 million) and increase in non-cash working capital (\$16 million), we estimate the cash flow to the firm for Sensient Technologies in 2008 :  
$$\begin{aligned} \text{Cash Flow to the firm} &= \text{After-tax Operating Income} + \text{Depreciation} - \text{Capital} \\ &\quad \text{Expenditures} - \text{Change in Non-cash Working Capital} = 162(1-.37) + 44 - 54 - 16 \\ &= \$76.06 \text{ million} \end{aligned}$$
- We will assume that the firm is mature and that all of the inputs to this computation – earnings, capital expenditures, depreciation and working capital – will grow 2% a year in perpetuity.

## Value of Sensient Technologies: Before Synergy

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- We can estimate the value of the firm, based on these inputs:

$$\begin{aligned}\text{Value of Operating Assets} &= \frac{\text{Expected Cashflow to the firm next year}}{(\text{Cost of Capital} - \text{Stable growth rate})} \\ &= \frac{\$76.06 (1.02)}{(.0698 - .02)} = \$1,559 \text{ million}\end{aligned}$$

- Adding the cash balance of the firm (\$8 million) and subtracting out the existing debt (\$460 million) yields the value of equity in the firm:

$$\begin{aligned}\text{Value of Equity} &= \text{Value of Operating Assets} + \text{Cash} - \text{Debt} \\ &= \$1,559 + \$8 - \$460 \text{ million} = \$1,107 \text{ million}\end{aligned}$$

- The market value of equity in Sensient Technologies in May 2009 was \$1,150 million.
- To the extent that Tata Chemicals pays the market price, it will have to generate benefits from synergy that exceed \$43 million.