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

- <u>Accrual Accounting</u>: 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.
- <u>Operating versus Capital Expenditures</u>: 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

- 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 four examples...

- <u>Rio Disney</u>: 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

- 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

- 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 estimate	s 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
P	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.

- 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										
Depreciation: Pre-Project		\$50	\$50	\$50	\$50	\$50	\$50	\$50	\$50	\$50	\$50
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
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

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		(\$19)	(\$57)	(\$32)	\$40	\$120	\$148	\$178	\$209	\$244	\$250
Operating Income after Taxes		(\$31)	(\$93)	(\$52)	\$66	\$196	\$241	\$290	\$341	\$397	\$408

And the Accounting View of Return

a

			Book va	lue of		Average		
	After-tax					BV of	ROC	ROC
Year	Operating Income	Pre-project investment	Fixed assets	Working capital	Total Capital	Capital	(a)	(b)
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?

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?

 \Box The riskfree rate of 3.5% (T. Bond rate)

 \Box The cost of equity for Disney as a company (8.91%)

 \Box The cost of equity for Disney theme parks (8.20%)

 \Box The cost of capital for Disney as a company (7.51%)

 \Box The cost of capital for Disney theme parks (6.62%)

 $\Box \quad \text{None of the above}$

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 is 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).

Country risk premium for Brazil = 2.50% (34/21.5) = 3.95%

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:

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

Would lead us to conclude that...

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



Measuring ROC for existing investments..

								ROC -
	EBIT	BV of	BV of		BV of	Return on	Cost of	Cost of
Company	(1-t)	Debt	Equity	Cash	Capital	Capital	Capital	Capital
Disney	\$4,359	\$16,892	\$30,753	\$3,670	\$43,975	9.91%	7.51%	2.40%
		R\$						
Aracruz	R\$ 379	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	INR	INR	INR	INR	INR			
Chemicals	4,134	12,614	23,928	725	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:

EVA = (ROC – Cost of Capital) (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

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

For the most recent period, compute the EVA earned by your firm EVA = Return Spread * ((BV of debt + BV of Equity-Cash)_{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:

Tax Benefit = Depreciation * 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.

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

Aswath Damodaran

The Capital Expenditures Effect

- 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.

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

- 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

\$ 500 million hasalready been spent & \$50 million indepreciation will exist

anyway

		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
1	+ 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	2	4	5	6	7	0	0	10
	0	1	Z	3	4	3	0	/	0	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
- Incremntal 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

Any expenditure that has <u>already been incurred</u>, and <u>cannot be recovered (even</u> 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 <u>should not be considered</u> since they are not incremental.

<u>A Behavioral Aside</u>: 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?
 - **U** 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

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


Discounted cash flow measures of return

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

- In a project with a finite and short life, you would need to compute a **salvage value**, which is the expected proceeds from selling all of the investment in the project at the end of the project life. It is usually set equal to book value of fixed assets and working capital
- In a project with an infinite or very long life, we compute cash flows for a reasonable period, and then compute a **terminal value** for this project, which is the present value of all cash flows that occur after the estimation period ends..
- Assuming the project lasts forever, and that cash flows after year 10 grow 2% (the inflation rate) forever, the present value at the end of year 10 of cash flows after that can be written as:
 - Terminal Value in year 10= CF in year 11/(Cost of Capital Growth Rate)=692 (1.02) /(.0862-.02) = \$ 10,669 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 V	/alue =	\$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



Aswath Damodaran

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.



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.

- 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_t = Exchange Rate today * $(1.07/1.02)^{t}$
- 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:

\$R Cost of Capital =

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

= (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	

NPV = R\$ 5,870/2.04= \$ 2,877 Million NPV is equal to NPV in dollar terms

Aswath Damodaran

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
D 1 1 10 5	10	\$692	-\$357	\$303	-\$1,790
Payback = 10.5 years \rightarrow	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

Discounted Payback = 17.7 years

Aswath Damodaran

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).

And here is a really good picture...



Aswath Damodaran

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



Aswath Damodaran

The resulting simulation...



NPV ranges from -\$4 billion to +\$14 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 \$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

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 Brief Example: A Paper Plant for Aracruz - Investment Assumptions

- 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.

- 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
Capacity (in '000s)	650	700	750	750	750	750	750	750	750	750
Utilization Rate	90%	90%	90%	95%	95%	95%	95%	95%	95%	95%
Production Rate (in '000	585	630	675	713	713	713	713	713	713	713
Price per ton	400	400	400	400	400	400	400	400	400	400
Revenues (in Real BR 0	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				
Operating Income	R\$ 43,700	R\$ 60,600	R\$ 76,100	R\$ 88,830	R\$ 92,414	R\$ 85,281				
- 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
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

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 re							
		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



Aswath Damodaran

64

Real versus Nominal Analysis

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

Aswath Damodaran

And Exchange Rates...



Should you hedge?

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) No

Explain.

- 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) No

Explain.

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 Chemicals and Sensient Technologies

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

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

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 :

Cash Flow to the firm = After-tax Operating Income + Depreciation – Capital Expenditures – Change in Non-cash Working Capital = 162 (1-.37) + 44 – 54 – 16 = \$76.06 million

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

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

- Value of Operating Assets = $\frac{\text{Expected Cashflow to the firm next year}}{(\text{Cost of Capital} \text{Stable growth rate})}$ $= \frac{\$76.06 (1.02)}{(.0698 .02)} = \$1,559 \text{ million}$
- 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:
 Value of Equity = Value of Operating Assets + Cash Debt = \$1,559 + \$8 \$460 million = \$1,107 million
- 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.

Measuring Investment Returns II. Investment Interactions, Options and Remorse...

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.

Back to the big picture...



I. Mutually Exclusive Investments

Wehave 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

- <u>They are mutually exclusive</u>: Taking one investment makes the other one redundant because they both serve the same purpose
- <u>The firm has limited capital and cannot take every good investment (i.e., investments with positive NPV or high IRR).</u>
- 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



Aswath Damodaran

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



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.

The sources of capital rationing...

Cause	Number of firms	Percent of total
Debt limit imposed by outside agreement	10	10.7
Debt limit placed by management external	3	3.2
to firm		
Limit placed on borrowing by internal	65	69.1
management		
Restrictive policy imposed on retained	2	2.1
earnings		
Maintenance of target EPS or PE ratio	14	14.9

An Alternative to IRR with Capital Rationing

- The problem with the NPV rule, when there is capital rationing, is that it is a dollar value. It measures success in absolute terms.
- The NPV can be converted into a relative measure by dividing by the initial investment. This is called the profitability index.
 - Profitability Index (PI) = NPV/Initial Investment
- In the example described, the PI of the two projects would have been:
 - PI of Project A = 467,937/1,000,000 = 46.79%
 - PI of Project B = 1,358,664/10,000,000 = 13.59%

Project A would have scored higher.

Case 3: NPV versus IRR



Why the difference?

These projects are of the same scale. Both the NPV and IRR use time-weighted cash flows. Yet, the rankings are different. Why?

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.

NPV, IRR and the Reinvestment Rate Assumption

- The NPV rule assumes that intermediate cash flows on the project get reinvested at the hurdle rate (which is based upon what projects of comparable risk should earn).
- The IRR rule assumes that intermediate cash flows on the project get reinvested at the IRR. Implicit is the assumption that the firm has an infinite stream of projects yielding similar IRRs.
- Conclusion: When the IRR is high (the project is creating significant surplus value) and the project life is long, the IRR will overstate the true return on the project.

Solution to Reinvestment Rate Problem





Why NPV and IRR may differ.. Even if projects have the same lives

- 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".

Comparing projects with different lives..



Why NPVs cannot be compared.. When projects have different lives.

The net present values of mutually exclusive projects with different lives cannot be compared, since there is a bias towards longer-life projects. To compare the NPV, we have to

- replicate the projects till they have the same life (or)
- convert the net present values into annuities
- The IRR is unaffected by project life. We can choose the project with the higher IRR.

Solution 1: Project Replication



Solution 2: Equivalent Annuities



What would you choose as your investment tool?

Given the advantages/disadvantages outlined for each of the different decision rules, which one would you choose to adopt?

- a) Return on Investment (ROE, ROC)
- b) Payback or Discounted Payback
- c) Net Present Value
- d) Internal Rate of Return
- e) Profitability Index
- Do you think your choice has been affected by the events of the last quarter of 2008? If so, why? If not, why not?

What firms actually use ..

Decision Rule	% of Firms using as primary decision rule in			
	1976	1986	1998	
IRR	53.6%	49.0%	42.0%	
Accounting Return	25.0%	8.0%	7.0%	
NPV	9.8%	21.0%	34.0%	
Payback Period	8.9%	19.0%	14.0%	
Profitability Index	2.7%	3.0%	3.0%	

II. Side Costs and Benefits

- Most projects considered by any business create side costs and benefits for that business.
 - The side costs include the costs created by the use of resources that the business already owns (opportunity costs) and lost revenues for other projects that the firm may have.
 - The benefits that may not be captured in the traditional capital budgeting analysis include project synergies (where cash flow benefits may accrue to other projects) and options embedded in projects (including the options to delay, expand or abandon a project).
- The returns on a project should incorporate these costs and benefits.

A. Opportunity Cost

An opportunity cost arises when a project uses a resource that may already have been paid for by the firm.

When a resource that is already owned by a firm is being considered for use in a project, this resource has to be priced on its next best alternative use, which may be

- a sale of the asset, in which case the opportunity cost is the expected proceeds from the sale, net of any capital gains taxes
- renting or leasing the asset out, in which case the opportunity cost is the expected present value of the after-tax rental or lease revenues.
- use elsewhere in the business, in which case the opportunity cost is the cost of replacing it.

Assume that Disney owns land in Bangkok already. This land is undeveloped and was acquired several years ago for \$ 5 million for a hotel that was never built. It is anticipated, if this theme park is built, that this land will be used to build the offices for Disney Bangkok. The land currently can be sold for \$ 40 million, though that would create a capital gain (which will be taxed at 20%). In assessing the theme park, which of the following would you do:

- a) Ignore the cost of the land, since Disney owns its already
- b) Use the book value of the land, which is \$5 million
- c) Use the market value of the land, which is \$ 40 million
- d) Other:

Case 2: Incremental Cost? An Online Retailing Venture for Bookscape

- The initial investment needed to start the service, including the installation of additional phone lines and computer equipment, will be \$1 million. These investments are expected to have a life of four years, at which point they will have no salvage value. The investments will be depreciated straight line over the four-year life.
- The revenues in the first year are expected to be \$1.5 million, growing 20% in year two, and 10% in the two years following.
- The salaries and other benefits for the employees are estimated to be \$150,000 in year one, and grow 10% a year for the following three years.
- The cost of the books will be 60% of the revenues in each of the four years.
- The working capital, which includes the inventory of books needed for the service and the accounts receivable will be10% of the revenues; the investments in working capital have to be made at the beginning of each year. At the end of year 4, the entire working capital is assumed to be salvaged.
- The tax rate on income is expected to be 40%.

Cost of capital for investment

Wee will re-estimate the beta for this online project by looking at publicly traded Internet retailers. The unlevered total beta of internet retailers is 4.25, and we assume that this project will be funded with the same mix of debt and equity (D/E = 53.47%, Debt/Capital = 34.84%) that Bookscape uses in the rest of the business. We will assume that Bookscape's tax rate (40%) and pretax cost of debt (6%) apply to this project.

Levered Beta _{Online Service} = 4.25 [1 + (1 - 0.4) (0.5357)] = 5.61Cost of Equity _{Online Service} = 3.5% + 5.61 (6%) = 37.18%Cost of Capital_{Online Service} = 37.18% (0.6516) + 6% (1 - 0.4) (0.3484) = 25.48%

Incremental Cash flows on Investment

	0	1	2	3	4
Revenues		\$1,500,000	\$1,800,000	\$1,980,000	\$2,178,000
Operating Expenses					
Labor		\$150,000	\$165,000	\$181,500	\$199,650
Materials		\$900,000	\$1,080,000	\$1,188,000	\$1,306,800
Depreciation		\$250,000	\$250,000	\$250,000	\$250,000
Operating Income		\$200,000	\$305,000	\$360,500	\$421,550
Taxes		\$80,000	\$122,000	\$144,200	\$168,620
After-tax Operating Income		\$120,000	\$183,000	\$216,300	\$252,930
+ Depreciation		\$250,000	\$250,000	\$250,000	\$250,000
- Change in Working Capital	\$150,000	\$30,000	\$18,000	\$19,800	-\$217,800
+ Salvage Value of Investment					\$0
ATCF	-\$1,150,000	\$340,000	\$415,000	\$446,500	\$720,730
Present Value	-\$1,150,000	\$270,957	\$263,568	\$225,989	\$290,710

NPV of investment = -\$98,775

The side costs...

It is estimated that the additional business associated with online ordering and the administration of the service itself will add to the workload for the current general manager of the bookstore. As a consequence, the salary of the general manager will be increased from \$100,000 to \$120,000 next year; it is expected to grow 5 percent a year after that for the remaining three years of the online venture. After the online venture is ended in the fourth year, the manager's salary will revert back to its old levels.

■ It is also estimated that Bookscape Online will utilize an office that is currently used to store financial records. The records will be moved to a bank vault, which will cost \$1000 a year to rent.

NPV with side costs...

Additional salary costs

	1	2	3	4	Total
Increase in Salary	\$20,000	\$21,000	\$22,050	\$23,153	
After-tax expense	\$12,000	\$12,600	\$13,230	\$13,892	
Present Value	\$9,563	\$8,002	\$6,696	\$5,603	\$29,865

Office Costs

Additional Storage Costs =	\$1,000.00
After-tax expense =	\$600.00
Present value of costs=	\$1,404.92

NPV adjusted for side costs= -98,775- \$29,865 - \$1405 = \$130,045

Opportunity costs aggregated into cash flows

Year	Cashflows	Opportunity costs	w with opportunit	Present Value
0	-\$1,150,000		-\$1,150,000	-\$1,150,000
1	\$340,000	\$12,600	\$327,400	\$260,916
2	\$415,000	\$13,200	\$401,800	\$255,184
3	\$446,500	\$13,830	\$432,670	\$218,989
4	\$720,730	\$14,492	\$706,238	\$284,865
Adjusted NPV				-\$130,045

In the Aracruz example, assume that the firm will use its existing distribution system to service the production out of the new paper plant. The new plant manager argues that there is no cost associated with using this system, since it has been paid for already and cannot be sold or leased to a competitor (and thus has no competing current use). Do you agree?

a) Yes

b) No

Case 4: Excess Capacity: A More Complicated Example

- Assume that a cereal company has a factory with a capacity to produce 100,000 boxes of cereal and that it expects to uses only 50% of capacity to produce its existing product (Bran Banana) next year. This product's sales are expected to grow 10% a year in the long term and the company has an after-tax contribution margin (Sales price Variable cost) of \$4 a unit.
- It is considering introducing a new cereal (Bran Raisin) and plans to use the excess capacity to produce the product. The sales in year 1 are expected to be 30,000 units and grow 5% a year in the long term; the after-tax contribution margin on this product is \$5 a unit.
- The book value of the factory is \$ 1 million. The cost of building a new factory with the same capacity is \$1.5 million. The company's cost of capital is 12%.

A Framework for Assessing The Cost of Using Excess Capacity

- I If I do not add the new product, when will I run out of capacity?
- If I add the new product, when will I run out of capacity?
 - When I run out of capacity, what will I do?
 - 1. Cut back on production: cost is PV of after-tax cash flows from lost sales
 - 2. Buy new capacity: cost is difference in PV between earlier & later investment
Opportunity Cost of Excess Capacity

Year	Old N		w Old + New		Lost ATCF		PV(AT
1	50.00%	30.00%	80.00%	\$0			
2	55.00%	31.50%	86.50%	\$0			
3	60.50%	33.08%	93.58%	\$0			
4	66.55%	34.73%	101.28%	\$5,115	\$	3,251	
5	73.21%	36.47%	109.67%	\$38,681	\$	21,949	
6	80.53%	38.29%	118.81%	\$75,256	\$	38,127	
7	88.58%	40.20%	128.78%	\$115,124	\$	52,076	
8	97.44%	42.21%	139.65%	\$158,595	\$	64,054	
9	100%	44.32%	144.32%	\$177,280	\$	63,929	
10	100%	46.54%	146.54%	\$186,160	\$	59,939	
		PV	PV(Lost Sales)=		30	3.324	

 $-1,500,000/1.12^8 = $461,846$

■ Opportunity Cost of Excess Capacity = \$ 303,324

Assume that in the Disney theme park example, 20% of the revenues at the Bangkok Disney park are expected to come from people who would have gone to Disneyland in Anaheim, California. In doing the analysis of the park, you would

- a) Look at only incremental revenues (i.e. 80% of the total revenue)
- b) Look at total revenues at the park
- c) Choose an intermediate number

Would your answer be different if you were analyzing whether to introduce a new show on the Disney cable channel on Saturday mornings that is expected to attract 20% of its viewers from ABC (which is also owned by Disney)?

- a) Yes
- b) No

Aswath Damodaran

B. Project Synergies

A project may provide benefits for other projects within the firm. If this is the case, these benefits have to be valued and shown in the initial project analysis.

Consider, for instance, a typical Disney animated movie. Assume that it costs \$ 50 million to produce and promote. This movie, in addition to theatrical revenues, also produces revenues from

- the sale of merchandise (stuffed toys, plastic figures, clothes ..)
- increased attendance at the theme parks
- stage shows (see "Beauty and the Beast" and the "Lion King")
- television series based upon the movie

Example 1: Adding a Café to a bookstore: Bookscape

- The initial cost of remodeling a portion of the store to make it a cafe, and of buying equipment is expected to be \$150,000. This investment is expected to have a life of 5 years, during which period it will be depreciated using straight line depreciation. None of the cost is expected to be recoverable at the end of the five years.
- The revenues in the first year are expected to be \$60,000, growing at 10% a year for the next four years.
- There will be one employee, and the total cost for this employee in year 1 is expected to be \$30,000 growing at 5% a year for the next 4 years.
- The cost of the material (food, drinks ..) needed to run the cafe is expected to be 40% of revenues in each of the 5 years.
- An inventory amounting to 5% of the revenues has to be maintained; investments in the inventory are made at the beginning of each year.
- The tax rate for Bookscape as a business is 40% and the cost of capital for Bookscape is 14.9%.

NPV of Café: Stand alone analysis

	0	1	2	3	4	5
Investment	\$150,000					
Revenues		\$60,000	\$66,000	\$72,600	\$79,860	\$87,846
Labor		\$30,000	\$31,500	\$33,075	\$34,729	\$36,465
Materials		\$24,000	\$26,400	\$29,040	\$31,944	\$35,138
Depreciation		\$30,000	\$30,000	\$30,000	\$30,000	\$30,000
Operating Income		-\$24,000	-\$21,900	-\$19,515	-\$16,813	-\$13,758
Taxes		-\$9,600	-\$8,760	-\$7,806	-\$6,725	-\$5,503
Operating Income after Taxes		-\$14,400	-\$13,140	-\$11,709	-\$10,088	-\$8,255
+ Depreciation		\$30,000	\$30,000	\$30,000	\$30,000	\$30,000
- Capital Expenditures						
- Changes in Working Capital	\$3,000	\$300	\$330	\$363	\$399	-\$4,392
Cash Flow to Firm	-\$153,000	\$15,300	\$16,530	\$17,928	\$19,513	\$26,138
PV of Cash flow to Firm	-\$153,000	\$13,316	\$12,521	\$11,819	\$11,195	\$13,052
Net Present Value (without synergies) =		-\$91,097				

The side benefits

Assume that the cafe will increase revenues at the book store by \$500,000 in year 1, growing at 10% a year for the following 4 years. In addition, assume that the pre-tax operating margin on these sales is 10%.

	1	2	3	4	5
Increased Revenues	\$500,000	\$550,000	\$605,000	\$665,500	\$732,050
Operating Margin	\$0	\$0	\$0	\$0	\$0
Operating Income	\$50,000	\$55,000	\$60,500	\$66,550	\$73,205
Operating Income after Taxes	\$29,000	\$31,900	\$35,090	\$38,599	\$42,459
PV of Additional Cash Flows	\$25,239	\$24,163	\$23,132	\$22,146	\$21,201
PV of Synergy Benefits	\$115,882				
Net Present Value (without synergies) =	-\$91,097				
Net Present Value (with synergies) =	\$24,785				

■ The net present value of the added benefits is \$115,882. Added to the NPV of the standalone Café of -\$91,097 yields a net present value of \$24,785.

Case 2: Synergy in a merger..

Earlier, we valued Sensient Technologies for an acquisition by Tata Chemicals and estimated a value of \$1,559 million for the operating assets and \$1,107 million for the equity in the firm. In estimating this value, though, we treated Sensient Technologies as a stand-alone firm.

Assume that Tata Chemicals foresees potential synergies in the combination of the two firms, primarily from using its distribution and marketing facilities in India to market Sensient's food additive products to India's rapidly growing processed food industry.

- It will take Tata Chemicals approximately 3 years to adapt Sensient's products to match the needs of the Indian processed food sector more spice, less color.
- Tata Chemicals will be able to generate Rs 1,500 million in after-tax operating income in year 4 from Sensient's Indian sales, growing at a rate of 4% a year after that in perpetuity from Sensient's products in India.

Estimating the cost of capital to use in valuing synergy..

To estimate the cost of equity:

- All of the perceived synergies flow from Sensient's products. We will use the levered beta of 0.8138 of Sensient in estimating cost of equity.
- The synergies are expected to come from India; consequently, we will add the country risk premium of 4.51% for India.
- We will assume that Sensient will maintain its existing debt to capital ratio of 28.57%, its current dollar cost of debt of 5.5% and its marginal tax rate of 37%.
 - Cost of debt in US \$ = 5.5% (1-.37) = 3.47%
 - Cost of capital in US = 12.05% (1-.2857) + 5.5% (1-.37) = 9.60%
- Cost of capital in Rs = $(1 + \text{Cost of Capital}_{\text{US}\,\$}) \frac{(1 + \text{Inflation Rate}_{\text{Rs}})}{(1 + \text{Inflation Rate}_{\text{US}\,\$})} 1$

$$= (1.096)\frac{(1.03)}{(1.02)} - 1 = 10.67\%$$

Aswath Damodaran

Estimating the value of synergy... and what Tata can pay for Sensient...

We can now discount the expected cash flows back at the cost of capital to derive the value of synergy:

• Value of synergy_{Year 3} = $\frac{\text{Expected Cash Flow}_{\text{Year 4}}}{(\text{Cost of Capital - g})} = \frac{1500}{(.1067 - .04)} = \text{Rs 22,476 million}$

• Value of synergy today =
$$\frac{\text{Value of Synergy}_{\text{year 3}}}{(1 + \text{Cost of Capital})^3} = \frac{22,476}{(1.1067)^3} = \text{Rs 16,580 million}$$

- Earlier, we estimated the value of equity in Sensient Technologies, with no synergy, to be \$1,107 million. Converting the synergy value into dollar terms at the current exchange rate of Rs 47.50/\$, the total value that Tata Chemicals can pay for Sensient's equity:
 - Value of synergy in US = Rs 16,580/47.50 = 349 million
 - Value of Sensient Technologies = \$1,107 million + \$349 million = \$1,456 million

III. Project Options

One of the limitations of traditional investment analysis is that it is static and does not do a good job of capturing the options embedded in investment.

- The first of these options is the <u>option to delay</u> taking a project, when a firm has exclusive rights to it, until a later date.
- The second of these options is taking one project may allow us to <u>take advantage of</u> <u>other opportunities (projects)</u> in the future
- The last option that is embedded in projects is the <u>option to abandon a project</u>, if the cash flows do not measure up.
- These options all add value to projects and may make a "bad" project (from traditional analysis) into a good one.

The Option to Delay

- When a firm has exclusive rights to a project or product for a specific period, it can delay taking this project or product until a later date.
- A traditional investment analysis just answers the question of whether the project is a "good" one if taken today.
- Thus, the fact that a project does not pass muster today (because its NPV is negative, or its IRR is less than its hurdle rate) does not mean that the rights to this project are not valuable.





An example: A Pharmaceutical patent

- Assume that a pharmaceutical company has been approached by an entrepreneur who has patented a new drug to treat ulcers. The entrepreneur has obtained FDA approval and has the patent rights for the next 17 years.
- While the drug shows promise, it is still very expensive to manufacture and has a relatively small market. Assume that the initial investment to produce the drug is \$ 500 million and the present value of the cash flows from introducing the drug now is only \$ 350 million.
- The technology and the market is volatile, and the annualized standard deviation in the present value, estimated from a simulation is 25%.

Valuing the Patent

Inputs to the option pricing model

- Value of the Underlying Asset (S) = PV of Cash Flows from Project if introduced now = \$350 million
- Strike Price (K) = Initial Investment needed to introduce the product = \$ 500 million
- Variance in Underlying Asset's Value = $(0.25)^2 = 0.0625$
- Time to expiration = Life of the patent = 17 years
- Dividend Yield = 1/Life of the patent = 1/17 = 5.88% (Every year you delay, you lose 1 year of protection)
- Assume that the 17-year riskless rate is 4%. The value of the option can be estimated as follows:
- Call Value= 350 $\exp^{(-0.0588)(17)}$ (0.5285) -500 $(\exp^{(-0.04)(17)} (0.1219) =$ \$ 37.12 million

Insights for Investment Analyses

- Having the exclusive rights to a product or project is valuable, even if the product or project is not viable today.
- The value of these rights increases with the volatility of the underlying business.
- The cost of acquiring these rights (by buying them or spending money on development R&D, for instance) has to be weighed off against these benefits.

The Option to Expand/Take Other Projects

- Taking a project today may allow a firm to consider and take other valuable projects in the future.
- Thus, even though a project may have a negative NPV, it may be a project worth taking if the option it provides the firm (to take other projects in the future) has a more-than-compensating value.
- These are the options that firms often call "strategic options" and use as a rationale for taking on "negative NPV" or even "negative return" projects.



An Example of an Expansion Option

- Disney is considering investing \$ 100 million to create a Spanish version of the Disney channel to serve the growing Mexican market.
- A financial analysis of the cash flows from this investment suggests that the present value of the cash flows from this investment to Disney will be only \$ 80 million. Thus, by itself, the new channel has a **negative NPV of \$ 20 million**.
- If the market in Mexico turns out to be more lucrative than currently anticipated, Disney could expand its reach to all of Latin America with an additional investment of \$ 150 million any time over the next 10 years. While the current expectation is that the cash flows from having a Disney channel in Latin America is only \$ 100 million, there is considerable uncertainty about both the potential for such an channel and the shape of the market itself, leading to significant variance in this estimate.

Valuing the Expansion Option

- Value of the Underlying Asset (S) = PV of Cash Flows from Expansion to Latin America, if done now =\$ 100 Million
- Strike Price (K) = Cost of Expansion into Latin American = \$150 Million
- We estimate the variance in the estimate of the project value by using the annualized standard deviation in firm value of publicly traded entertainment firms in the Latin American markets, which is approximately 30%.
 - Variance in Underlying Asset's Value = $0.30^2 = 0.09$
- Time to expiration = Period of expansion option = 10 years
- Riskless Rate = 4%

Call Value= \$ 36.3 Million

Considering the Project with Expansion Option

- NPV of Disney Channel in Mexico = \$80 Million \$100 Million = \$20 Million
 - Value of Option to Expand = \$ 36.3 Million
- NPV of Project with option to expand
 - = \$ 20 million + \$ 36.3 million
 - = \$ 16.3 million
- Take the first investment, with the option to expand.

The Option to Abandon

A firm may sometimes have the option to abandon a project, if the cash flows do not measure up to expectations.

If abandoning the project allows the firm to save itself from further losses, this option can make a project more valuable.



Aswath Damodaran

Valuing the Option to Abandon

Disney is considering taking a 25-year project which

- requires an initial investment of \$ 255 million in an real estate partnership to develop time share properties with a South Florida real estate developer,
- has a present value of expected cash flows is \$ 254 million.
- While the net present value is negative, assume that Disney has the option to abandon this project anytime by selling its share back to the developer in the next 5 years for \$ 150 million.
- A simulation of the cash flows on this time share investment yields a variance in the present value of the cash flows from being in the partnership is 0.04.

Project with Option to Abandon

- Value of the Underlying Asset (S) = PV of Cash Flows from Project = \$ 254 million
- Strike Price (K) = Salvage Value from Abandonment = \$ 150 million
- Variance in Underlying Asset's Value = 0.04
- Time to expiration = Abandonment period =5 years
- Dividend Yield = 1/Life of the Project = 1/25 = 0.04 (We are assuming that the project's present value will drop by roughly 1/n each year into the project)
- Assume that the five-year riskless rate is 4%.

Should Disney take this project?

- Call Value = $254 \exp^{(0.04)(5)} (0.9194) 150 (\exp^{(-0.04)(5)} (0.8300))$ = \$ 89.27 million
- Put Value= $\$ 89.27 254 \exp^{(0.04)(5)} + 150 (\exp^{(-0.04)(5)} = \$ 4.13 \text{ million}$
- The value of this abandonment option has to be added on to the net present value of the project of -\$ 1 million, yielding a total net present value with the abandonment option of \$ 3.13 million.

IV. Assessing Existing or Past investments...

- While much of our discussion has been focused on analyzing new investments, the techniques and principles enunciated apply just as strongly to existing investments.
- With existing investments, we can try to address one of two questions:
 - <u>Post –mortem</u>: We can look back at existing investments and see if they have created value for the firm.
 - <u>What next?</u> We can also use the tools of investment analysis to see whether we should keep, expand or abandon existing investments.

Analyzing an Existing Investment



In a post-mortem, you look at the actual cash flows, relative to forecasts.

You can also reassess your expected cash flows, based upon what you have learned, and decide whether you should expand, continue or divest (abandon) an investment

Aswath Damodaran

a. Post Mortem Analysis

The actual cash flows from an investment can be greater than or less than originally forecast for a number of reasons but all these reasons can be categorized into two groups:

- <u>Chance</u>: The nature of risk is that actual outcomes can be different from expectations. Even when forecasts are based upon the best of information, they will invariably be wrong in hindsight because of unexpected shifts in both macro (inflation, interest rates, economic growth) and micro (competitors, company) variables.
- <u>Bias</u>: If the original forecasts were biased, the actual numbers will be different from expectations. The evidence on capital budgeting is that managers tend to be over-optimistic about cash flows and the bias is worse with over-confident managers.
- While it is impossible to tell on an individual project whether chance or bias is to blame, there is a way to tell across projects and across time. If chance is the culprit, there should be symmetry in the errors actuals should be about as likely to beat forecasts as they are to come under forecasts. If bias is the reason, the errors will tend to be in one direction.

b. What should we do next?



Aswath Damodaran

Example: Disney California Adventure

Disney opened the Disney California Adventure (DCA) Park in 2001, at a cost of \$1.5 billion, with a mix of roller coaster ridesand movie nostalgia. Disney expected about 60% of its visitors to Disneyland to come across to DCA and generate about \$100 million in annual after-cash flows for the firm.

By 2008, DCA had not performed up to expectations. Of the 15 million people who came to Disneyland in 2007, only 6 million visited California Adventure, and the cash flow averaged out to only \$ 50 million between 2001 and 2007.

In early 2008, Disney faced three choices:

Shut down California Adventure and try to recover whatever it can of its initial investment. It is estimated that the firm recover about \$ 500 million of its investment.

- Continue with the status quo, recognizing that future cash flows will be closer to the actual values (\$ 50 million) than the original projections.
- Invest about \$ 600 million to expand and modify the par, with the intent of increasing the number of attractions for families with children, is expected to increase the percentage of Disneyland visitors who come to DCA from 40% to 60% and increase the annual after tax cash flow by 60% (from \$ 50 million to \$ 80 million) at the park.

Aswath Damodaran

DCA: Evaluating the alternatives...

- <u>Continuing Operation</u>: Assuming the current after-tax cash flow of \$ 50 million will continue in perpetuity, growing at the inflation rate of 2% and discounting back at the theme park cost of capital of 6.62% yields a value for continuing with the status quo Value of DCA = $\frac{\text{Expected Cash Flow next year}}{(\text{Cost of capital - g})} = \frac{50(1.02)}{(.0662 - .02)} = 1.103 billion
- <u>Abandonment</u>: Abandoning this investment currently would allow Disney to recover only \$ 500 million of its original investment.
 Abandonment value of DCA = \$ 500 million
- Expansion: The up-front cost of \$ 600 million will lead to more visitors in the park and an increase in the existing cash flows from \$ 50 to \$ 80 million.

Value of CF from expansion = $\frac{\text{Increase in CF next year}}{(\text{Cost of capital - g})} = \frac{30(1.02)}{(.0662 - .02)} = \662 million

First Principles

