



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

Life is too short for regrets, right?

## Independent investments are the exception...

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

# I. Mutually Exclusive Investments

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

# Comparing Projects with the same (or similar) lives..

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- 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

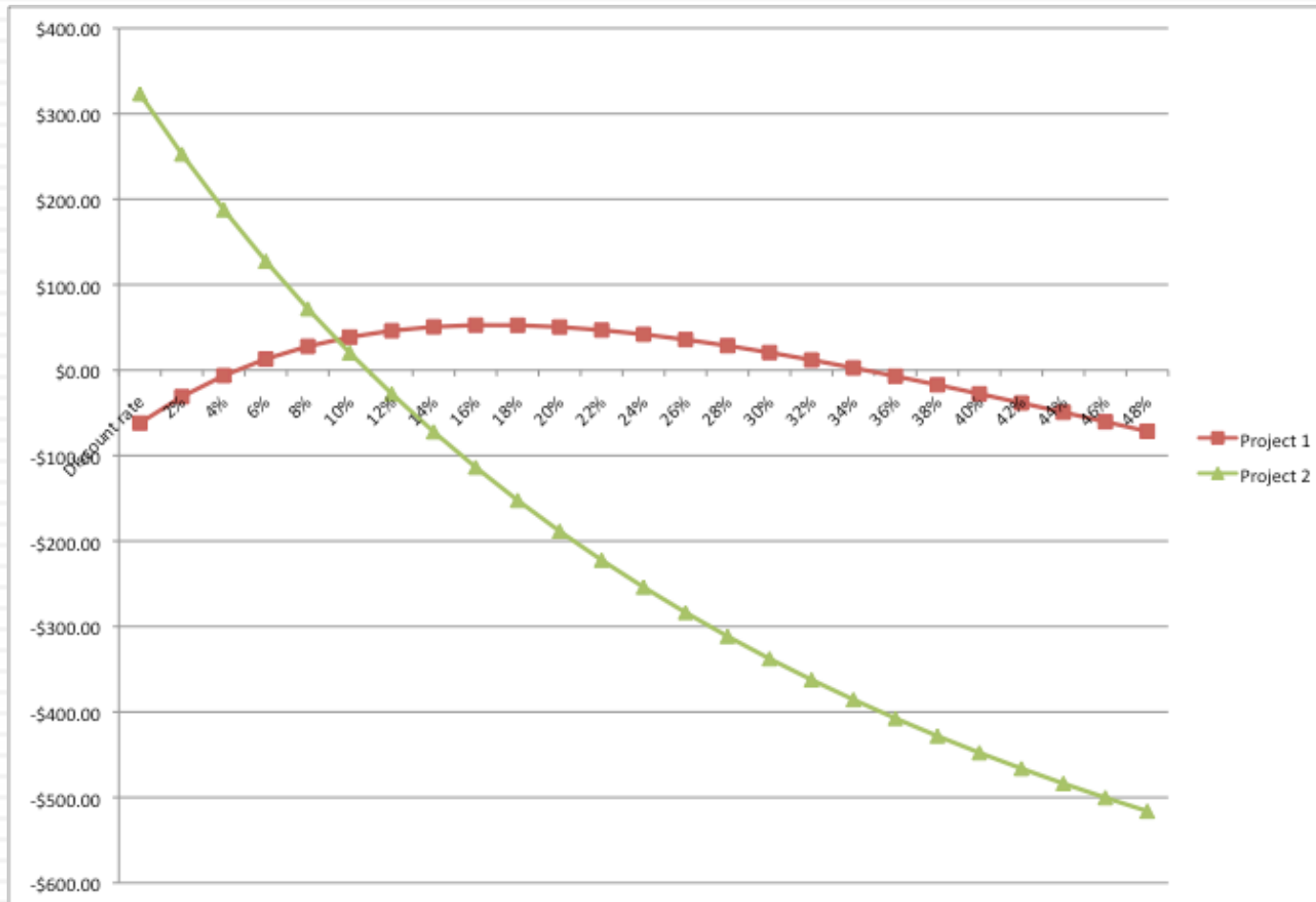
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- Consider two projects with the following cash flows:

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

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# What do we do now?

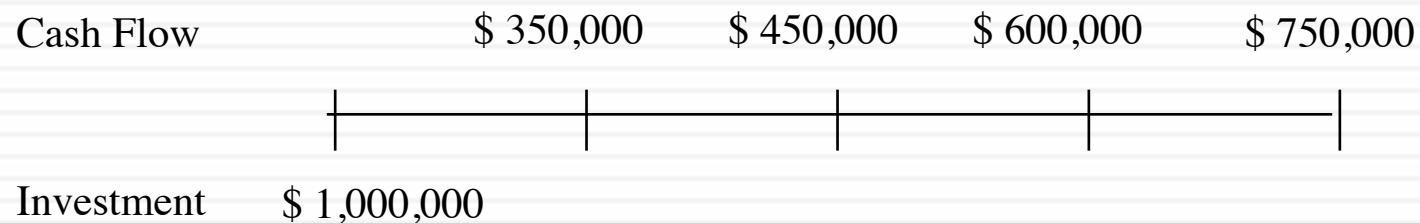
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- Project 1 has two internal rates of return. The first is 6.60%, whereas the second is 36.55%. Project 2 has one internal rate of return, about 12.8%.
- Why are there two internal rates of return on project 1?
- If your cost of capital is 12%, which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

## Case 2: NPV versus IRR

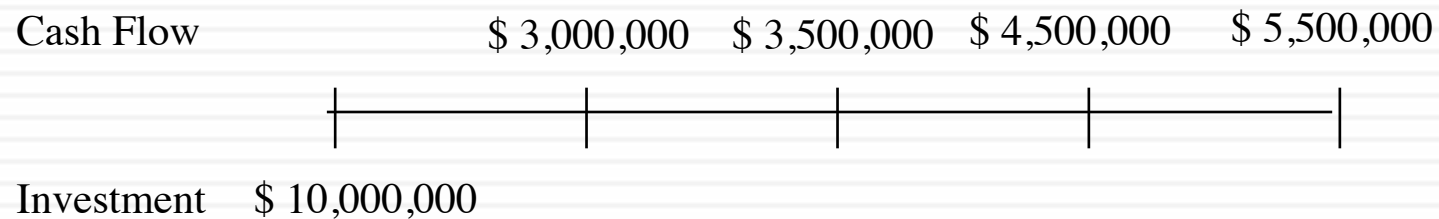
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### *Project A*



NPV = \$467,937  
IRR = 33.66%

### *Project B*



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



# Which one would you pick?

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- 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

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- 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...

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

# An Alternative to IRR with Capital Rationing

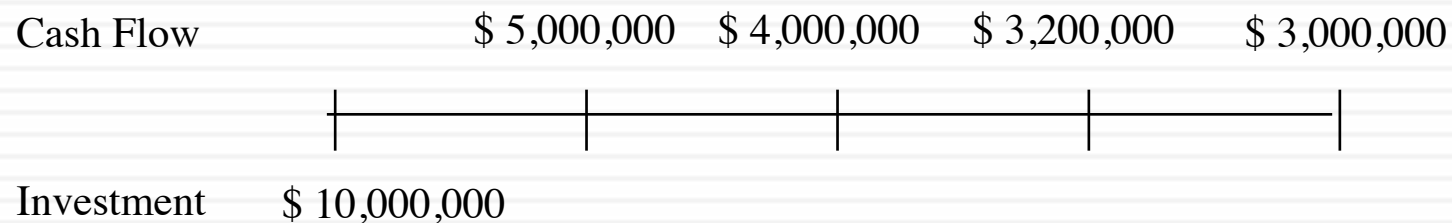
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- The problem with the NPV rule, when there is capital rationing, is that it is a dollar value. It measures success in absolute terms.
- The NPV can be converted into a relative measure by dividing by the initial investment. This is called the profitability index.
  - Profitability Index (PI) =  $\text{NPV} / \text{Initial Investment}$
- 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

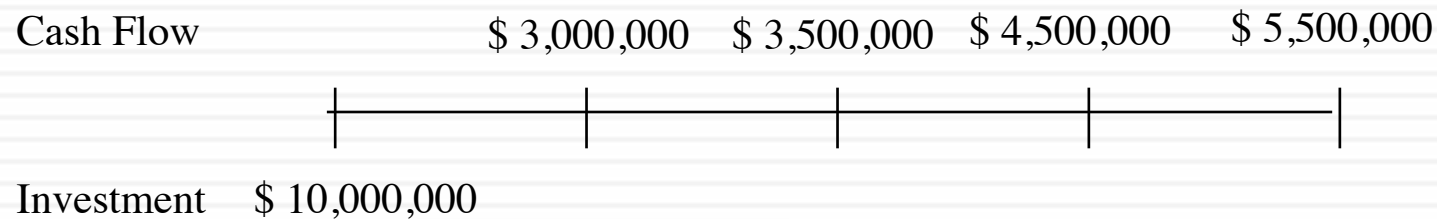
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### *Project A*



NPV = \$1,191,712  
IRR=21.41%

### *Project B*



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

# Why the difference?

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- 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

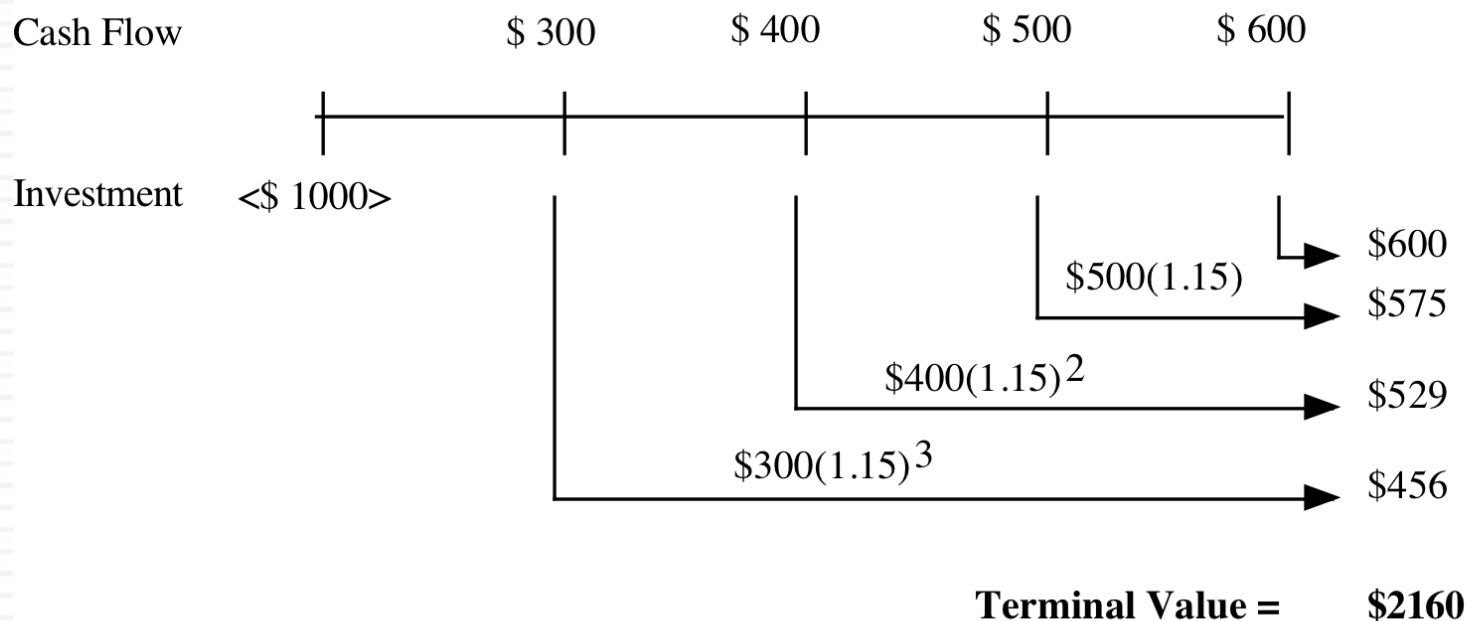
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- The NPV rule assumes that intermediate cash flows on the project get reinvested at the hurdle rate (which is based upon what projects of comparable risk should earn).
- The IRR rule assumes that intermediate cash flows on the project get reinvested 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

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*Figure 6.3: IRR versus Modified Internal Rate of Return*



Internal Rate of Return = 24.89%  
Modified Internal Rate of Return = 21.23%



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

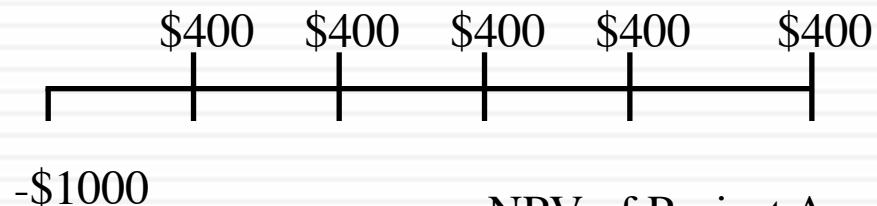
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- A project can have only one NPV, whereas it can have more than one IRR.
- The NPV is a dollar surplus value, whereas the IRR is a percentage measure of return. The NPV is therefore likely to be larger for “large scale” projects, while the IRR is 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..

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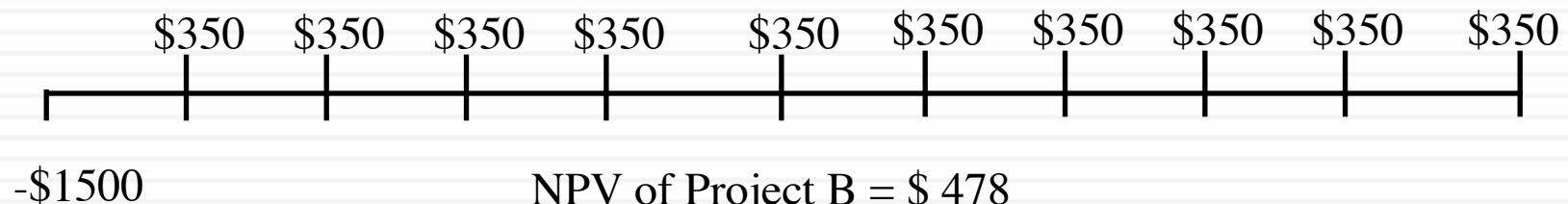
## Project A



NPV of Project A = \$ 442

IRR of Project A = 28.7%

## Project B



NPV of Project B = \$ 478

IRR for Project B = 19.4%

Hurdle Rate for Both Projects = 12%

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

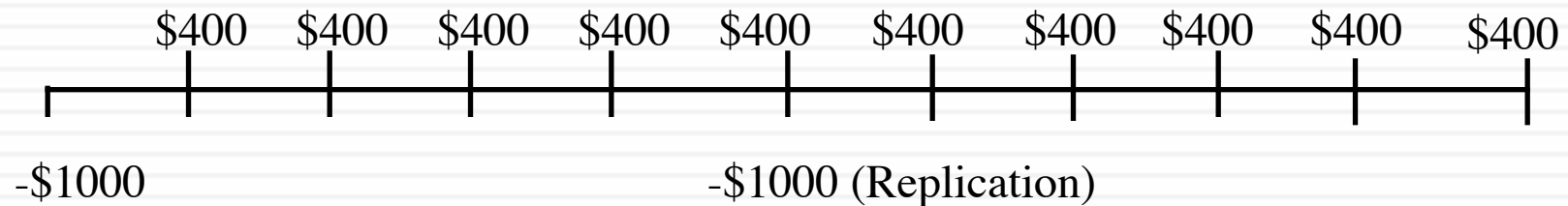
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- The net present values of mutually exclusive projects with different lives cannot be compared, since there is a bias towards longer-life projects. To compare the NPV, we have to
  - ▣ replicate the projects till they have the same life (or)
  - ▣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

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## Project A: Replicated



NPV of Project A replicated = \$ 693

## Project B



NPV of Project B = \$ 478

## Solution 2: Equivalent Annuities

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- Equivalent Annuity for 5-year project

- ▣ =  $\$442 * PV(A, 12\%, 5 \text{ years})$

- ▣ = \$ 122.62

- Equivalent Annuity for 10-year project

- ▣ =  $\$478 * PV(A, 12\%, 10 \text{ years})$

- ▣ = \$ 84.60

# What would you choose as your investment tool?

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- 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 ..

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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

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- 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

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- 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.

# Case 1: Foregone Sale?

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- Assume that Disney owns land in Rio 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 Rio. 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:
  - ▣ Ignore the cost of the land, since Disney owns its already
  - ▣ Use the book value of the land, which is \$ 5 million
  - ▣ Use the market value of the land, which is \$ 40 million
  - ▣ Other:

## Case 2: Incremental Cost?

### An Online Retailing Venture for Bookscape

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- ❑ 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 be 10% 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

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- We 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.
- Cost of capital computation
  - Levered Beta<sub>Online Service</sub> =  $4.25 [1 + (1 - 0.4) (0.5357)] = 5.61$
  - Cost of Equity<sub>Online Service</sub> =  $3.5\% + 5.61 (6\%) = 37.18\%$
  - Cost of Capital<sub>Online Service</sub> =  $37.18\% (0.6516) + 6\% (1 - 0.4) (0.3484) = 25.48\%$

# Incremental Cash flows on Investment

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	0	1	2	3	4
<i>Revenues</i>		\$1,500,000	\$1,800,000	\$1,980,000	\$2,178,000
<i>Operating Expenses</i>					
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...

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- 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...

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## □ 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=  $-98,775 - \$29,865 - \$1,405 = \$130,045$

## □ 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

## Case 3: Excess Capacity

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- 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

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- Assume that a cereal company has a factory with a capacity to produce 100,000 boxes of cereal and that it expects to use 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

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- 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?
  - Cut back on production: cost is PV of after-tax cash flows from lost sales
  - Buy new capacity: cost is difference in PV between earlier & later investment

# Opportunity Cost of Excess Capacity

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Year	Old	New	Old + New	Lost ATCF	PV(ATCF)
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(Lost Sales)=					\$ 303,324

- PV (Building Capacity In Year 3 Instead Of Year 8) =  $1,500,000/1.123 - 1,500,000/1.128 = \$ 461,846$
- Opportunity Cost of Excess Capacity = \$ 303,324

# Product and Project Cannibalization: A Real Cost?

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- Assume that in the Disney theme park example, 20% of the revenues at the Rio Disney park are expected to come from people who would have gone to Disney theme parks in the US. 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

## B. Project Synergies

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- A project may provide benefits for other projects within the firm. 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
- In investment analysis, however, these synergies are either left unquantified and used to justify overriding the results of investment analysis, i.e., used as justification for investing in negative NPV projects.
- If synergies exist and they often do, these benefits have to be valued and shown in the initial project analysis.

# Example 1: Adding a Café to a bookstore: Bookscape

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- Assume that you are considering adding a café to the bookstore. Assume also that based upon the expected revenues and expenses, the café standing alone is expected to have a net present value of -\$91,097.
- 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%.

Side Benefits	1	2	3	4	5
Increased Revenues	\$500,000	\$550,000	\$605,000	\$665,500	\$732,050
Operating Margin	10.00%	10.00%	10.00%	10.00%	10.00%
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..

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- 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..

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- 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) + 3.47% (.2857) = 9.60%

$$\text{Cost of capital in Rs} = (1 + \text{Cost of Capital}_{\text{US \$}}) \frac{(1 + \text{Inflation Rate}_{\text{Rs}})}{(1 + \text{Inflation Rate}_{\text{US \$}})} - 1$$

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



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

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- We can now discount the expected cash flows back at the cost of capital to derive the value of synergy:
  - Value of synergy<sub>Year 3</sub> = 
$$\frac{\text{Expected Cash Flow}_{\text{Year 4}}}{(\text{Cost of Capital} - g)} = \frac{1500}{(.1067 - .04)} = \text{Rs } 22,476 \text{ million}$$
  - Value of synergy today = 
$$\frac{\text{Value of Synergy}_{\text{year 3}}}{(1 + \text{Cost of Capital})^3} = \frac{22,476}{(1.1067)^3} = \text{Rs } 16,580 \text{ million}$$
- 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

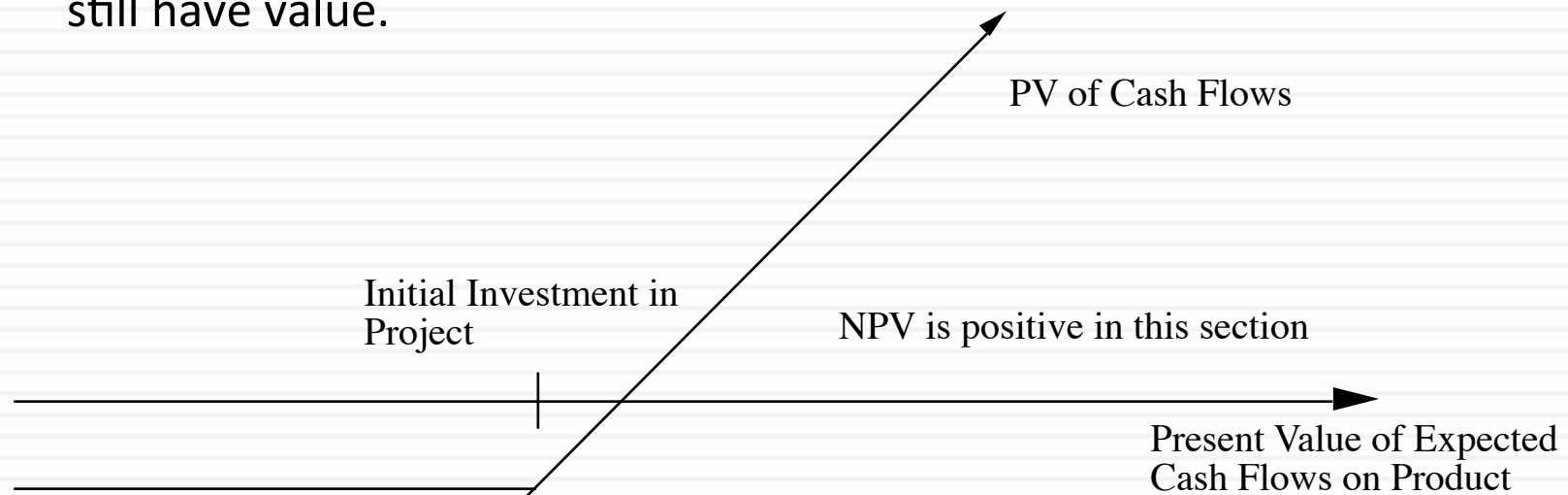
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- One of the limitations of traditional investment analysis is that it is static and does not do a good job of capturing the options embedded in investment.
  - ▣ The first of these options is the option to delay taking a project, when a firm has exclusive rights to it, until a later date.
  - ▣ The second of these options is taking one project may allow us to take advantage of other opportunities (projects) in the future
  - ▣ The last option that is embedded in projects is the option to abandon a project, 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

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- 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. The rights to a “bad” project can still have value.



# Insights for Investment Analyses

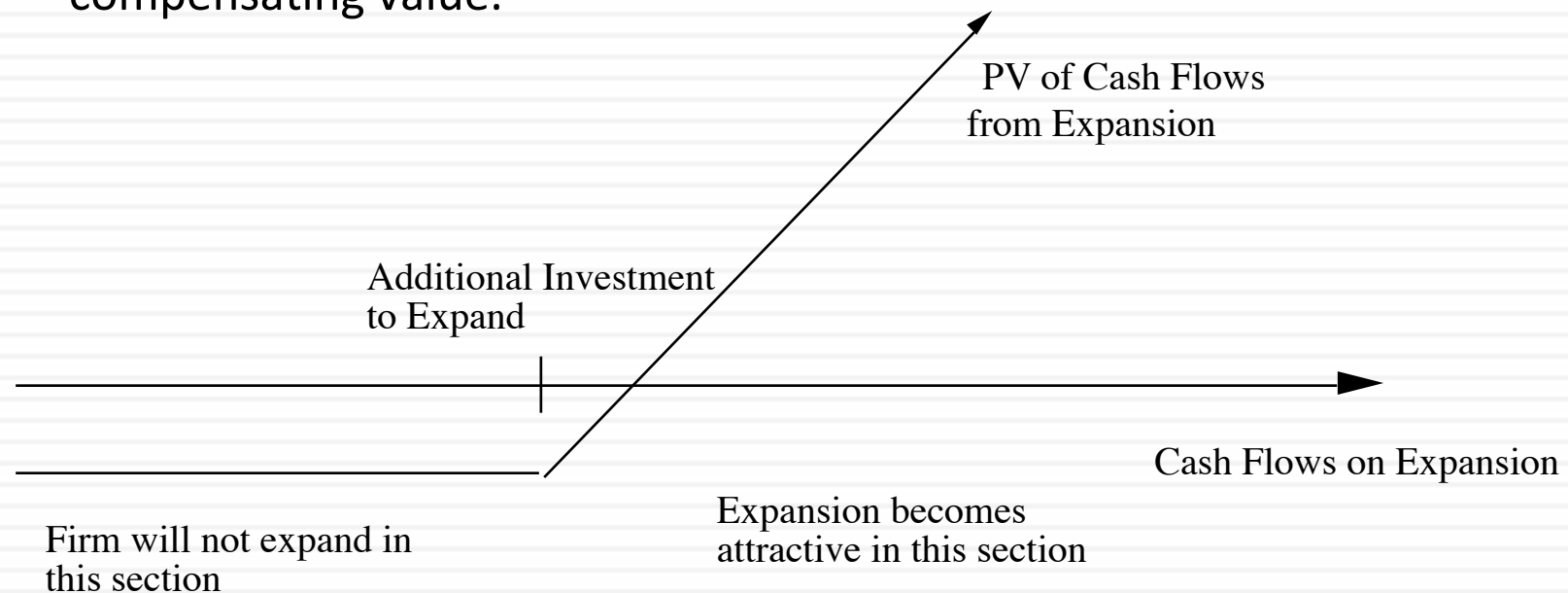
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- Having the exclusive rights to a product or project is valuable, even if the product or project is not viable today.
- The value of these rights increases with the volatility of the underlying business.
- The cost of acquiring these rights (by buying 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

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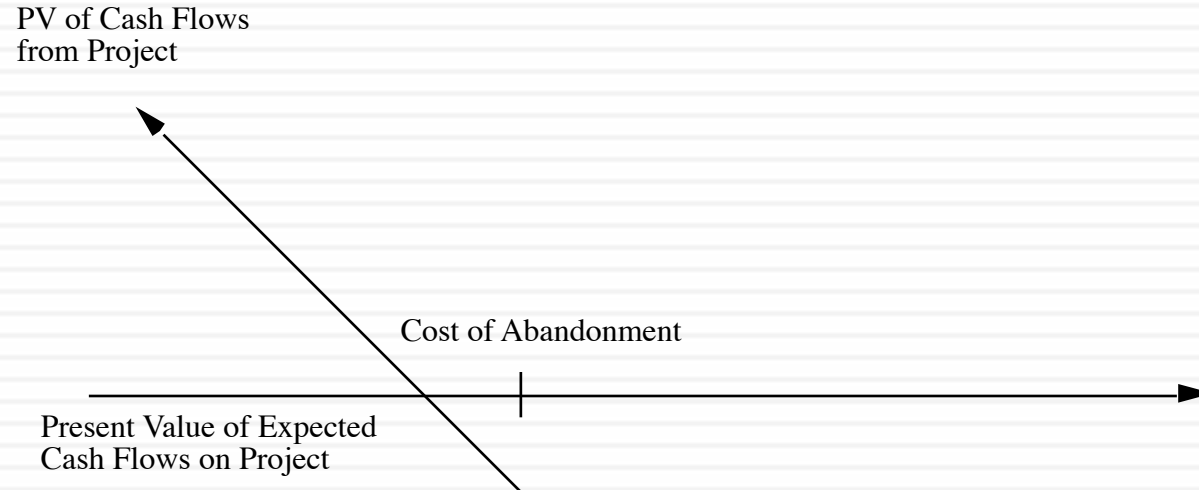
- Taking a project today may allow a firm to consider and take other valuable projects in the future. Thus, even though a project may have a negative NPV, it may be a project worth taking if the option it provides the firm (to take other projects in the future) has a more-than-compensating value.



# The Option to Abandon

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- 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.



## IV. Assessing Existing or Past investments...

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- 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:
  - Post –mortem: We can look back at existing investments and see if they have created value for the firm.
  - What next? We can also use the tools of investment analysis to see whether we should keep, expand or abandon existing investments.

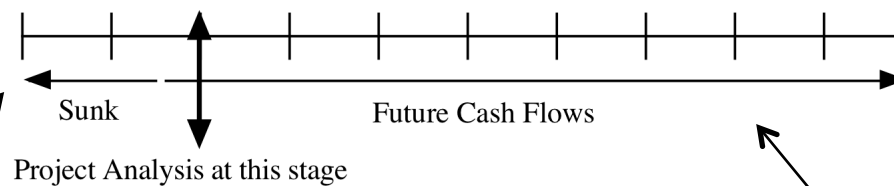
# Analyzing an Existing Investment

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Figure 6.13: Analysis of Existing Project

Cashflow estimates from

New analysis:  $A_0$   $A_1$   $NF_0$   $NF_1$   $NF_2$   $NF_3$   $NF_4$   $NF_5$   $NF_6$   $NF_7$   $NF_8$   
 Initial Analysis :  $F_0$   $F_1$   $F_2$   $F_3$   $F_4$   $F_5$   $F_6$   $F_7$   $F_8$   $F_9$   $F_{10}$



$F_n$  = Forecast of cash flows in period  $n$  in initial analysis  
 $A_n$  = Actual Cash Flow in period  $n$   
 $NF_n$  = New forecast of cash flows in period  $n$  at end of period 2

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



## a. Post Mortem Analysis

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- 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:
  - ▣ Chance: 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.
  - ▣ Bias: 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?

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$$\sum_{t=0}^{t=n} \frac{NF_n}{(1+r)^n} < 0 \quad \text{.....} \quad \text{Liquidate the project}$$

$$\sum_{t=0}^{t=n} \frac{NF_n}{(1+r)^n} < \text{Salvage Value} \quad \text{.....} \quad \text{Terminate the project}$$

$$\sum_{t=0}^{t=n} \frac{NF_n}{(1+r)^n} < \text{Divestiture Value} \quad \text{.....} \quad \text{Divest the project}$$

$$\sum_{t=0}^{t=n} \frac{NF_n}{(1+r)^n} > 0 > \text{Divestiture Value} \quad \text{.....} \quad \text{Continue the project}$$

# Example: Disney California Adventure

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- Disney opened the Disney California Adventure (DCA) Park in 2001, at a cost of \$1.5 billion, with a mix of roller coaster rides and 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 park, 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.

# DCA: Evaluating the alternatives...

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- Continuing Operation: 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

$$\text{Value of DCA} = \frac{\text{Expected Cash Flow next year}}{(\text{Cost of capital} - g)} = \frac{50(1.02)}{(.0662 - .02)} = \$1.103 \text{ billion}$$

- Abandonment: Abandoning this investment currently would allow Disney to recover only \$ 500 million of its original investment.

$$\text{Abandonment value of DCA} = \$ 500 \text{ million}$$

- 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.

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

# First Principles

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## Chapters 5 & 6: Measuring Returns on Investments

