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

Life is too short for regrets, right?

Independent investments are the exception…

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

I. Mutually Exclusive Investments

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

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

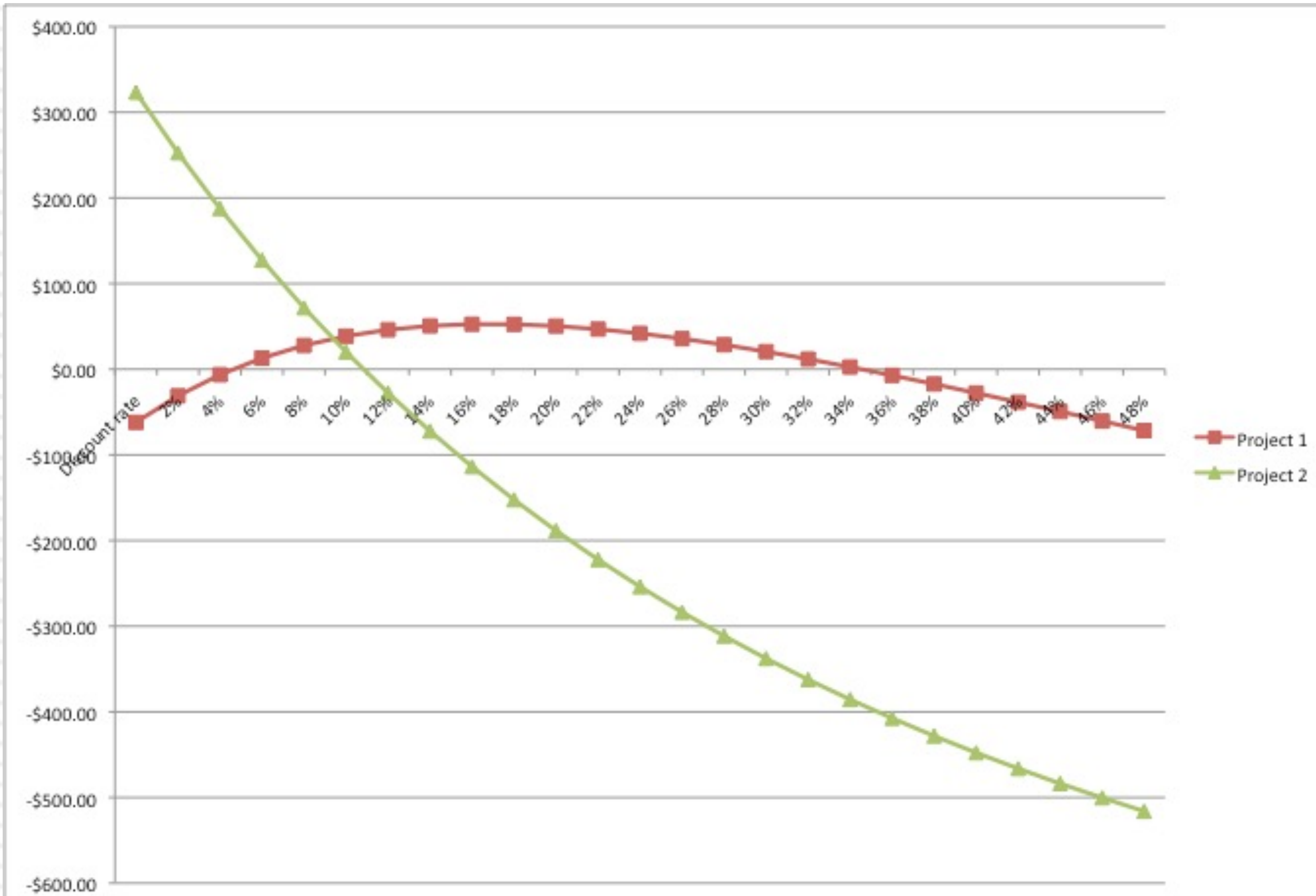
- When comparing and choosing between investments with the same lives, we can
  - Compute the accounting returns (ROC, ROE) of the investments and pick the one with the higher returns
  - Compute the NPV of the investments and pick the one with the higher NPV
  - Compute the IRR of the investments and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

Case 1: IRR versus NPV

- Consider two projects with the following cash flows:

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

Project's NPV Profile



What do we do now?

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

Case 2: NPV versus IRR

Project A

Cash Flow		\$ 350,000	\$ 450,000	\$ 600,000	\$ 750,000
Investment	\$ 1,000,000				

NPV = \$467,937
IRR= 33.66%

Project B

Cash Flow		\$ 3,000,000	\$ 3,500,000	\$ 4,500,000	\$ 5,500,000
Investment	\$ 10,000,000				

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

Which one would you pick?

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

Capital Rationing, Uncertainty and Choosing a Rule

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

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 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

- 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

Project A

Cash Flow $ 5,000,000 $ 4,000,000 $ 3,200,000 $ 3,000,000

Investment $ 10,000,000

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

Project B

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

Investment $ 10,000,000

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

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?

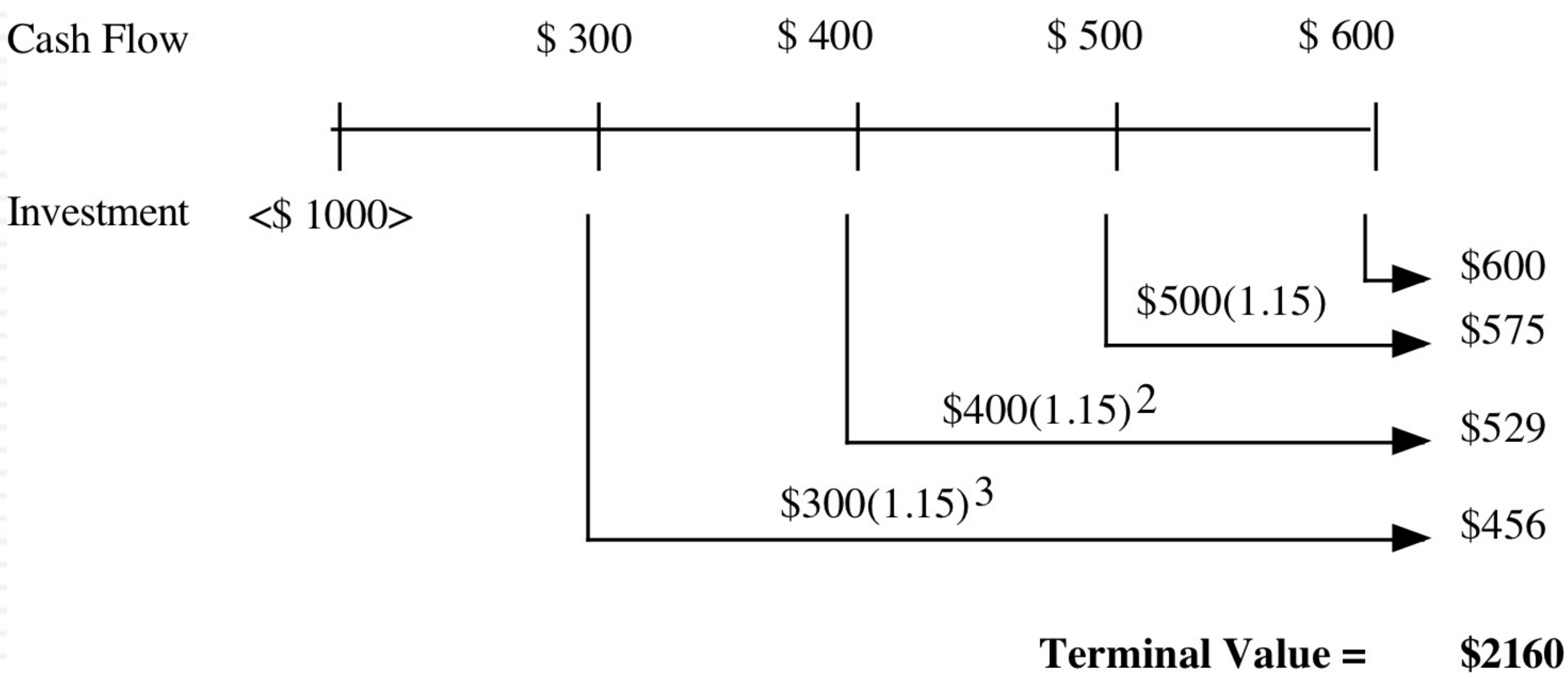
- Which one would you pick?
  a. Project A. It gives me the bigger bang for the buck and more margin for error.
  b. Project B. It creates more dollar value in my business.

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

Figure 6.3: IRR versus Modified Internal Rate of Return



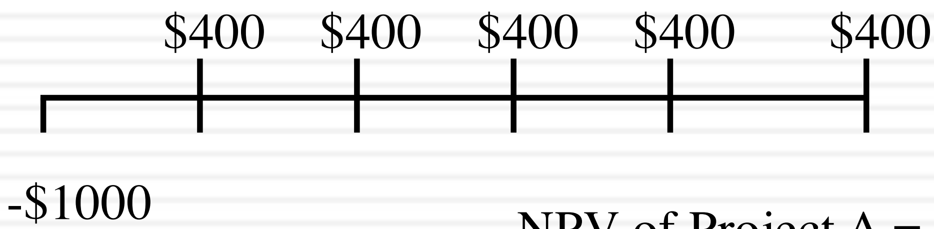
Internal Rate of Return = 24.89%
Modified Internal Rate of Return = 21.23%

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

- 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".

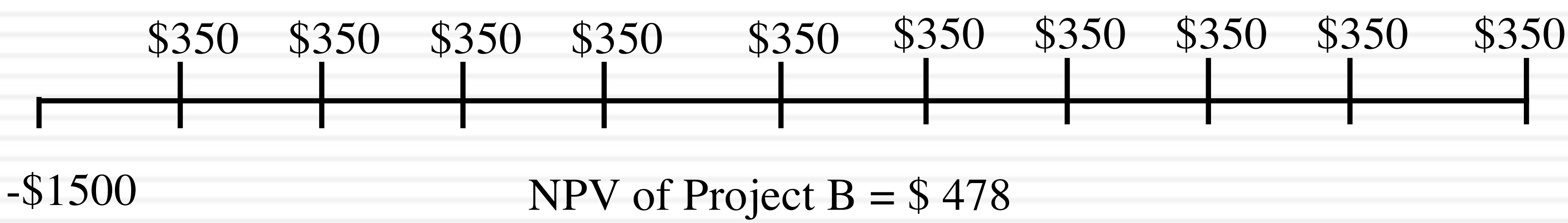
Comparing projects with different lives..

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%

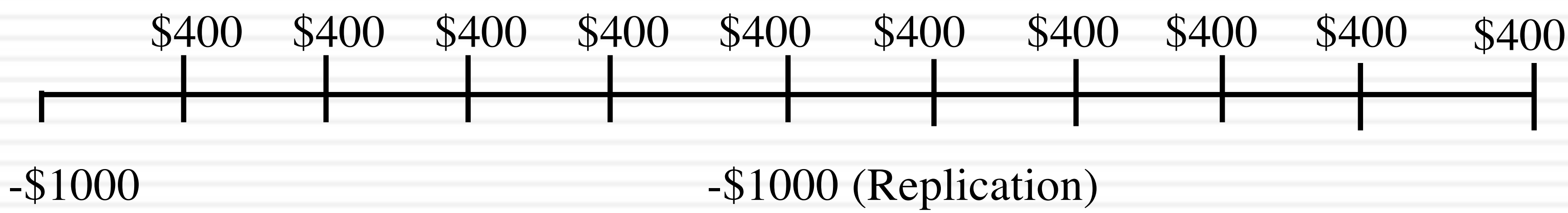
Hurdle Rate for Both Projects = 12%

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

- 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.

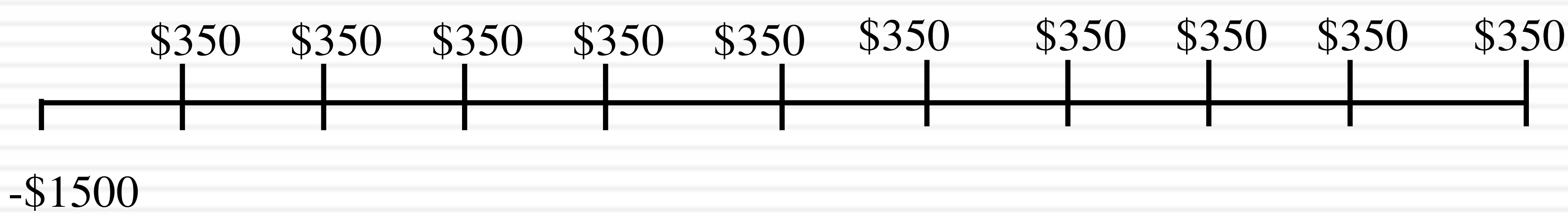
Solution 1: Project Replication

Project A: Replicated



NPV of Project A replicated = $ 693

Project B



NPV of Project B= $ 478

Solution 2: Equivalent Annuities

- Equivalent Annuity for 5-year project
  - = $442 * PV(A,12%,5 years)
  - = $ 122.62
- Equivalent Annuity for 10-year project
  - = $478 * PV(A,12%,10 years)
  - = $ 84.60

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.

Case 1: Foregone Sale?

- 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

- 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 cost of the books will be 60% of the revenues in each of the four years.
  - 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 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 Bookscape investment

- We will re-estimate the beta for this online project by looking at publicly traded online retailers. The unlevered total beta of online retailers is 3.02, and we assume that this project will be funded with the same mix of debt and equity (D/E = 21.41%, Debt/Capital = 17.63%) that Bookscape uses in the rest of the business. We will assume that Bookscape's tax rate (40%) and pretax cost of debt (4.05%) apply to this project.

  Levered Beta $_{\text{Online Service}}$ = 3.02 [1 + (1 – 0.4) (0.2141)] = 3.41

  Cost of Equity $_{\text{Online Service}}$ = 2.75% + 3.41 (5.5%) = 21.48%

  Cost of Capital$_{\text{Online Service}}$= 21.48% (0.8237) + 4.05% (1 – 0.4) (0.1763) = 18.12%

- This is much higher than the cost of capital (10.30%) we computed for Bookscape earlier, but it reflects the higher risk of the online retail venture.

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
Cash flow after taxes	-$1,150,000	$340,000	$415,000	$446,500	$720,730
Present Value	-$1,150,000	$287,836	$297,428	$270,908	$370,203

NPV of investment = $76,375

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 = PV of $34,352

	1	2	3	4
Increase in Salary	$20,000	$21,000	$22,050	$23,153
After-tax expense	$12,000	$12,600	$13,230	$13,892
Present Value @18.12%	$10,159	$9,030	$8,027	$7,136

- Office Costs
  - After-Tax Additional Storage Expenditure per Year = $1,000 (1 – 0.40) = $600
  - PV of expenditures = $600 (PV of annuity, 18.12%,4 yrs) = $1,610
- NPV with Opportunity Costs = $76,375 – $34,352 – $1,610= $ 40,413
- Opportunity costs aggregated into cash flows

Year	Cashflows	Opportunity costs	Cashflow with opportunity costs	Present Value
0	($1,150,000)		($1,150,000)	($1,150,000)
1	$340,000	$12,600	$327,400	$277,170
2	$415,000	$13,200	$401,800	$287,968
3	$446,500	$13,830	$432,670	$262,517
4	$720,730	$14,492	$706,238	$362,759
Adjusted NPV				$40,413

Case 3: Excess Capacity

- In the Vale example, assume that the firm will use its existing distribution system to service the production out of the new iron ore mine. The mine 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

A Framework for Assessing The Cost of Using Excess Capacity

- 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

Product and Project Cannibalization: A Real Cost?

- 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

- 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.

Case 1: Adding a Café to a bookstore: Bookscape

- 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 -$87,571.
- 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		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		$30,000	$33,000	$36,300	$39,930	$43,923
PV of Additional Cash Flows		$27,199	$27,126	$27,053	$26,981	$26,908
PV of Synergy Benefits		$135,268				

- The net present value of the added benefits is $135,268. Added to the NPV of the standalone Café of -$87,571 yields a net present value of $47,697.

Case 2: Synergy in a merger..

- We valued Harman International for an acquisition by Tata Motors and estimated a value of $ 2,476 million for the operating assets and $ 2,678 million for the equity in the firm, concluding that it would not be a value-creating acquisition at its current market capitalization of $5,248 million. In estimating this value, though, we treated Harman International as a stand-alone firm.
- Assume that Tata Motors foresees potential synergies in the combination of the two firms, primarily from using its using Harman's high-end audio technology (speakers, tuners) as optional upgrades for customers buying new Tata Motors cars in India. To value this synergy, let us assume the following:
  - It will take Tata Motors approximately 3 years to adapt Harman's products to Tata Motors cars.
  - Tata Motors will be able to generate Rs 10 billion in after-tax operating income in year 4 from selling Harman audio upgrades to its Indian customers, growing at a rate of 4% a year after that in perpetuity (but only in India).

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

- Business risk: The perceived synergies flow from optional add-ons in auto sales. We will begin with the levered beta of 1.10, that we estimated for Tata Motors in chapter 4, in estimating the cost of equity.
- Geographic risk: The second is that the synergies are expected to come from India; consequently, we will add the country risk premium of 3.60% for India, estimated in chapter 4 (for Tata Motors) to the mature market premium of 5.5%.
- Debt ratio: Finally, we will assume that the expansion will be entirely in India, with Tata Motors maintain its existing debt to capital ratio of 29.28% and its current rupee cost of debt of 9.6% and its marginal tax rate of 32.45%.
  - Cost of equity in Rupees = 6.57% + 1.10 (5.5%+3.60%) = 16.59%
  - Cost of debt in Rupees = 9.6% (1-.3245) = 6.50%
  - Cost of capital in Rupees = 16.59% (1-.2928) + 6.50% (.2928) = 13.63%

Estimating the value of synergy… and what Tata can pay for Harman

- Value of synergy$_{\text{Year 3}}$ = $\frac{\text{Expected Cash Flow}_{\text{Year 4}}}{(\text{Cost of Capital - g})} = \frac{10{,}000}{(.1363-.04)} = \text{Rs } 103{,}814 \text{ million}$
- Value of synergy today = $\frac{\text{Value of Synergy}_{\text{year 3}}}{(1+\text{Cost of Capital})^3} = \frac{103{,}814}{(1.1363)^3} = \text{Rs } 70{,}753 \text{ million}$
- Converting the synergy value into dollar terms at the prevailing exchange rate of Rs 60/$, we can estimate a dollar value for the synergy from the potential acquisition:
  - Value of synergy in US $ = Rs 70,753/60 = $ 1,179 million
- Adding this value to the intrinsic value of $2,678 million that we estimated for Harman's equity in chapter 5, we get a total value for the equity of $3,857 million.
  - Value of Harman = $2,678 million + $1,179 million = $3,857 million
- Since Harman's equity trades at $5,248 million, the acquisition still does not make sense, even with the synergy incorporated into value.

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 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.