CHAPTER 8 LECTURE - NET PRESENT VALUE AND OTHER INVESTMENT CRITERIA

8-1

1

Learning Objectives

After studying this chapter, you should be able to:

LO1 Summarize the payback rule and some of its shortcomings.

LO2 Discuss accounting rates of return and some of the problems with them.

LO3 Explain the internal rate of return criterion and its associated strengths and weaknesses.

LO4 Evaluate proposed investments by using the net present value criterion.

LO5 Apply the modified internal rate of return.

LO6 Calculate the profitability index and understand its relation to net present value.

8-2

2

Capital Budgeting

- Analysis of potential projects
- Long-term decisions
- Large expenditures
- Difficult/impossible to reverse
- Determines firm's strategic direction

Good Decision Criteria

- All cash flows considered?
- TVM considered?
- Risk-adjusted?
- Ability to rank projects?
- Indicates added value to the firm?

8-3

3

Net Present Value

How much value is created from undertaking an investment?

Step 1: Estimate the expected future cash flows.

Step 2: Estimate the required return for projects of this risk level.

Step 3: Find the present value of the cash flows and subtract the initial investment to arrive at the Net Present Value.

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Net Present Value
Sum of the PVs of all cash flows

$$NPV = \sum_{t=0}^{n} \frac{CF_t}{(1+R)^t}$$

NOTE: t=0

Initial cost often is CF_0 and is an outflow.

$$NPV = \sum_{t=1}^{n} \frac{CF_t}{(1+R)^t} - CF_0$$

8-5

5

NPV – Decision Rule

- ***If NPV is positive, accept the project***
- **NPV > 0 means:**
  - **Project is expected to add value to the firm**
  - **Will increase the wealth of the owners**
- **NPV is a direct measure of how well this project will meet the goal of increasing shareholder wealth.**

8-6

6

Sample Project Data

- **You are looking at a new project and have estimated the following cash flows, net income and book value data:**
  - **Year 0: CF = -165,000**
  - **Year 1: CF = 63,120 NI = 13,620**
  - **Year 2: CF = 70,800 NI = 3,300**
  - **Year 3: CF = 91,080 NI = 29,100**
  - **Average book value = $72,000**
- **Your required return for assets of this risk is 12%.**
- **This project will be the example for all problem exhibits in this chapter.**

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Computing NPV for the Project

- **Using the formula:** $NPV = \sum_{t=0}^{n} \frac{CF_t}{(1+R)^t}$

$NPV = -165{,}000/(1.12)^0 + 63{,}120/(1.12)^1 + 70{,}800/(1.12)^2 + 91{,}080/(1.12)^3 = 12{,}627.41$

Capital Budgeting Project			NPV
		Required Return =	12%
Year	CF	Formula	Disc CFs
0	(165,000.00)	=(-165000)/(1.12)^0 =	(165,000.00)
1	63,120.00	=(63120)/(1.12)^1 =	56,357.14
2	70,800.00	=(70800)/(1.12)^2 =	56,441.33
3	91,080.00	=(91080)/(1.12)^3 =	64,828.94
			12,627.41

8-8

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Computing NPV for the Project
Using the TI BAII+ CF Worksheet

Cash Flows:

CF0	=	-165000
CF1	=	63120
CF2	=	70800
CF3	=	91080

Display	*You Enter*
	CF, 2nd,CLR WORK
C00	-165000 *Enter, Down*
C01	63120 *Enter, Down*
F01	*1* *Enter, Down*
C02	70800 *Enter, Down*
F02	*1* *Enter, Down*
C03	91080 *Enter, Down*
F03	*1* *Enter, NPV*
I	*12* *Enter, Down*
NPV	*CPT*
12,627.41	

8-9

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Calculating NPVs with Excel

- NPV function: =NPV(rate,CF01:CFnn)
  - First parameter = required return entered as a decimal (5% = .05)
  - Second parameter = range of cash flows *beginning with year 1*
- After computing NPV, subtract the initial investment (CF0)

	A	B	C	D
2			Required Return =	12%
3	Year	CF	Formula	Disc CFs
4	0	(165,000.00)	=(-165000)/(1.12)^0 =	(165,000.00)
5	1	63,120.00	=(63120)/(1.12)^1 =	56,357.14
6	2	70,800.00	=(70800)/(1.12)^2 =	56,441.33
7	3	91,080.00	=(91080)/(1.12)^3 =	64,828.94
8				12,627.41
9				
10		EXCEL	=NPV(D2,B5:B7)	177,627.41
11			NPV + CF0	12,627.41

8-10

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Net Present Value (in Excel)
Sum of the PVs of all cash flows.

$$NPV = \sum_{t=1}^{n} \frac{CF_t}{(1+R)^t} - CF_0$$

- NPV = PV inflows – Cost
  NPV=0 → Project's inflows are "exactly sufficient to repay the invested capital and provide the required rate of return"
- NPV = net gain in shareholder wealth
- Rule: Accept project if NPV > 0

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NPV

To see how we might go about estimating NPV, suppose we believe the cash revenues from our fertilizer business will be $20,000 per year, assuming everything goes as expected.

Cash costs (including taxes) will be $14,000 per year. We will wind down the business in eight years. The plant, property, and equipment will be worth $2,000 as salvage at that time.

The project costs $30,000 to launch. We use a 15 percent discount rate on new projects such as this one. Is this a good investment? If there are 1,000 shares of stock outstanding, what will be the effect on the price per share from taking the investment?

Time (years)	0	1	2	3	4	5	6	7	8
Initial cost	–$30								
Inflows		$20	$20	$20	$20	$20	$20	$20	$20
Outflows		– 14	– 14	– 14	– 14	– 14	– 14	– 14	– 14
Net inflow		$ 6	$ 6	$ 6	$ 6	$ 6	$ 6	$ 6	$ 6
Salvage									2
Net cash flow	–$30	$ 6	$ 6	$ 6	$ 6	$ 6	$ 6	$ 6	$ 8

8-12

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Present value = $6,000 × (1 − 1/1.15^8)/.15 + 2,000/1.15^8
= $6,000 × 4.4873 + 2,000/3.0590
= $26,924 + 654
= $27,578

NPV = −$30,000 + 27,578 = −$2,422

Excel Solution

Rate	0.15		
Nper	8		
Pmt	6000		
Fv	2000	PV =	($26,923.93)
		PV =	($653.80)
		Total =	($27,577.73)

When we compare this to the $30,000 estimated cost, the NPV is: -$2,422

Therefore, this is *not* a good investment. Based on our estimates, taking it would *decrease* the total value of the stock by $2,422. With 1,000 shares outstanding, our best estimate of the impact of taking this project is a loss of value of $2,422. If 1000 shares, this is $2.422 per share.

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	A	B	C	D	E	F	G	H
1								
2	Using a spreadsheet to calculate net present values							
3								
4	From Example 8.1, the project's cost is $10,000. The cash flows are $2,000 per year for the first two							
5	years, $4,000 per year for the next two, and $5,000 in the last year. The discount rate is							
6	10 percent; what's the NPV?							
7								
8		Year	Cash flow					
9		0	−$10,000	Discount rate =		10%		
10		1	2,000					
11		2	2,000		NPV =	$2,102.72	(*wrong* answer)	
12		3	4,000		NPV =	$2,312.99	(*right* answer)	
13		4	4,000					
14		5	5,000					
15								
16	The formula entered in cell F11 is = NPV(F9,C9:C14). This gives the wrong answer because the							
17	NPV function actually calculates present values, not net present values.							
18								
19	The formula entered in cell F12 is = NPV(F9,C10:C14) + C9. This gives the right answer because the							
20	NPV function is used to calculate the present value of the cash flows and then the initial cost is							
21	subtracted to calculate the answer. Notice that we added cell C9 because it is already negative.							

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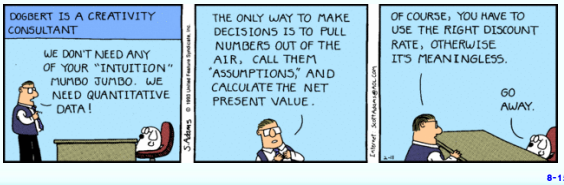
NPV Method

- Meets all desirable criteria
  - Considers all CFs
  - Considers TVM
  - Adjusts for risk
  - Can rank mutually exclusive projects
- Directly related to increase in V_F (value of the firm)
- Dominant method; always prevails



8-15

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Payback Period

- **Definition:** How long does it take to get the initial cost back in a nominal sense?
- **Computation:**
  1. Estimate the cash flows
  2. Subtract the future cash flows from the initial cost until the initial investment has been recovered
- A "break-even" type measure
- Decision Rule – *Accept if the payback period is less than some preset limit*

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Project Example Information

- You are reviewing a new project and have estimated the following cash flows:
  - Year 0: CF = -165,000
  - Year 1: CF = 63,120; NI = 13,620
  - Year 2: CF = 70,800; NI = 3,300
  - Year 3: CF = 91,080; NI = 29,100
  - Average Book Value = 72,000
- Your required return for assets of this risk level is 12%.

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Computing Payback for the Project

Capital Budgeting Project

Year	CF	Cum. CFs
0	$ (165,000)	$ (165,000)
1	$ 63,120	$ (101,880)
2	$ 70,800	$ (31,080)
3	$ 91,080	$ 60,000

Payback = year 2 +
+ (31080/91080)

Payback = 2.34 years

- *Do we accept or reject the project?*

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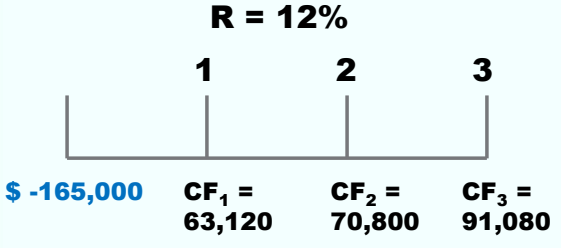
Project Example - Visual



The required return for assets of this risk level is 12% (as determined by the firm).

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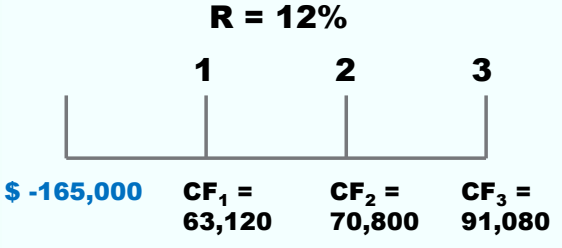
Payback Computation



Year 1: $165,000 – 63,120 = 101,880

We need to get to zero so keep going…

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Payback Computation

R = 12%

1	2	3
$ -165,000	CF_1 = 63,120	CF_2 = 70,800	CF_3 = 91,080

Year 2: $101,880 – 70,800 = 31,080

We need to get to zero so keep going…

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Payback Computation

R = 12%

1	2	3
$ -165,000	CF_1 = 63,120	CF_2 = 70,800	CF_3 = 91,080

Year 3: $31,080 – 91,080 = -60,000

We "passed" zero so payback is achieved

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Analyzing the Rule

- When compared to the NPV rule, the payback period rule has some rather severe shortcomings.
  - First, the payback period is calculated by simply adding up the future cash flows.
  - There is no discounting involved, so the time value of money is completely ignored.
  - The payback rule also fails to consider risk differences.
  - The payback would be calculated the same way for both very risky and very safe projects.
- Perhaps the biggest problem with the payback period rule is coming up with the right cutoff period, because we don't really have an objective basis for choosing a particular number.
- Put another way, there is no economic rationale for looking at payback in the first place, so we have no guide as to how to pick the cutoff. As a result, we end up using a number that is arbitrarily chosen.

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Payback Decision

- We need to know a "management's number. What does the firm use for the evaluation of its projects when they use payback?
- Most companies use either 3 or 4 years.
- Let's use 4 in our numerical example
  - Our computed payback was 3 years
  - The firm's uses 4 years as it's criteria, so…
  - YES, we Accept this project as we recover our cost of the project early.

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Calculating Payback One More Time

The projected cash flows from a proposed investment are:

Year	Cash Flow
1	$100
2	200
3	500

- This project costs $500. What is the payback period for this investment?

- The initial cost is $500. After the first two years, the cash flows total $300.
- After the third year, the total cash flow is $800, so the project pays back sometime between the end of year 2 and the end of year 3.
- Since the accumulated cash flows for the first two years are $300, we need to recover $200 in the third year.
- The third-year cash flow is $500, so we will have to wait $200/500 = .40 years to do this.
- The payback period is thus 2.4 years, or about two years and five months.

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Long and Short

Suppose again that we require a 15 percent return on this type of investment. We can calculate the NPV for these two investments as:

Year	Long	Short
0	-$250	-$250
1	100	100
2	100	200
3	100	0
4	100	0

Now we have a problem. The NPV of the shorter-term investment is actually negative, meaning that taking it diminishes the value of the shareholders' equity. The opposite is true for the longer-term investment—it increases share value.

$$NPV(Short) = -\$250 + 100/1.15 + 200/1.15^2 = -\$11.81$$

$$NPV(Long) = -\$250 + 100 \times (1 - 1/1.15^4)/.15 = \$35.50$$

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Decision Criteria Test - Payback

1. Does the payback rule account for the time value of money?
2. Does the payback rule account for the risk of the cash flows?
3. Does the payback rule provide an indication about the increase in value?
4. Should we consider the payback rule for our primary decision rule?

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Decision Criteria Test - Payback

Q: So if Payback is not that great as a capital budgeting technique, why use it?

A: Because it is so easy to compute!

Advantages and Disadvantages of the Payback Period Rule

Advantages	Disadvantages
1. Easy to understand.	1. Ignores the time value of money.
2. Adjusts for uncertainty of later cash flows.	2. Requires an arbitrary cutoff point.
3. Biased toward liquidity.	3. Ignores cash flows beyond the cutoff date.
	4. Biased against long-term projects, such as research and development, and new projects.

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Internal Rate of Return

- Most important alternative to NPV
- Widely used in practice
- Intuitively appealing
- Based entirely on the estimated cash flows
- Independent of interest rates

- **Definition:**
  - IRR = discount rate that makes the NPV = 0
- **Decision Rule:**
  - *Accept the project if the IRR is greater than the required return*

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NPV vs. IRR

NPV: Enter r, solve for NPV

$$\sum_{t=0}^{n} \frac{CF_t}{(1+R)^t} = NPV$$

IRR: Enter NPV = 0, solve for IRR.

$$\sum_{t=0}^{n} \frac{CF_t}{(1+IRR)^t} = 0$$

Without a financial calculator or Excel, this becomes a trial-and-error process

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Calculating IRR with Excel

- Start with the cash flows as you did to solve for NPV
- Use the IRR function
  - Enter the range of cash flows, beginning with the initial cash flow (Cash flow 0)
  - You can enter a guess, but it is not necessary
  - The default format is a whole percent

	A	B	C
1	IRR		
2	Year	CF	
3	0	(165,000.00)	
4	1	63,120.00	
5	2	70,800.00	
6	3	91,080.00	
7			
8	EXCEL	=IRR(B3:B6)	16.13%

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Computing IRR for the Project
Using the TI BAII+ CF Worksheet

Cash Flows:		
CF0	=	-165000
CF1	=	63120
CF2	=	70800
CF3	=	91080

Display	*You Enter*
	CF, 2nd, CLR WORK
C00	165000 *Enter, Down*
C01	63120 *Enter, Down*
F01	*1* *Enter, Down*
C02	70800 *Enter, Down*
F02	*1* *Enter, Down*
C03	91080 *Enter, Down*
F03	*1* *Enter, IRR*
IRR	*CPT*
16.1322	

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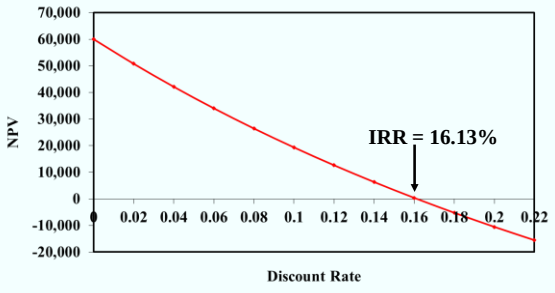
NPV Profile For The Project



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Decision Criteria Test - IRR

- Does the IRR rule:
  - Account for the time value of money?
  - Account for the risk of the cash flows?
  - Provide an indication about the increase in value?
  - Permit project ranking?
- Should we consider the IRR rule for our primary decision criteria?

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IRR - Advantages

- Preferred by executives
  - Intuitively appealing
  - Easy to communicate the value of a project
- If the IRR is high enough, may not need to estimate a required return
- Considers all cash flows
- Considers time value of money
- Provides indication of risk

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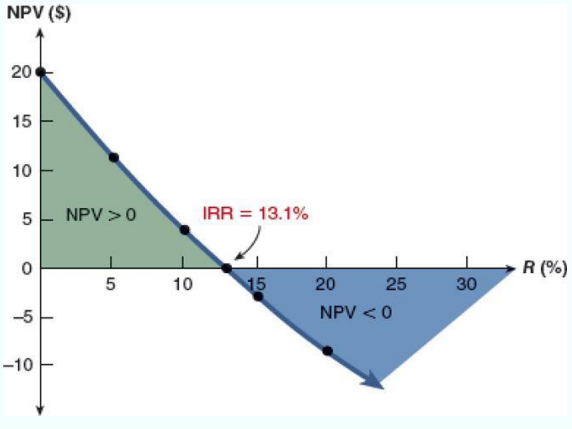

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	A	B	C	D	E	F	G	H
1								
2	Using a spreadsheet to calculate internal rates of return							
3								
4	Suppose we have a four-year project that costs $500. The cash flows over the four-year life will be							
5	$100, $200, $300, and $400. What is the IRR?							
6								
7		Year	Cash flow					
8		0	-$500					
9		1	100		IRR =	27.3%		
10		2	200					
11		3	300					
12		4	400					
13								
14								
15	The formula entered in cell F9 is = IRR(C8:C12). Notice that the Year 0 cash flow has a negative sign,							
16	representing the initial cost of the project.							
17								

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Advantages and Disadvantages of the Internal Rate of Return

Advantages	Disadvantages
1. Closely related to NPV, often leading to identical decisions.	1. May result in multiple answers with nonconventional cash flows.
2. Easy to understand and communicate.	2. May lead to incorrect decisions in comparisons of mutually exclusive investments.

Summary of Decisions for the Project

Summary	
Net Present Value	***Accept***
Payback Period	***???***
Average Accounting Return	***???***
Internal Rate of Return	***Accept***

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NPV vs. IRR

- **NPV and IRR will generally give the same decision**
- **Exceptions**
  - **Non-conventional cash flows**
    - **Cash flow sign changes more than once**
  - **Mutually exclusive projects**
    - **Initial investments are substantially different**
    - **Timing of cash flows is substantially different**
    - **Will not reliably rank projects**

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IRR & Non-Conventional Cash Flows

- **"Non-conventional"**
  - **Cash flows change sign more than once**
  - **Most common:**
    - **Initial cost (negative CF)**
    - **A stream of positive CFs**
    - **Negative cash flow to close project.**
    - **For example, nuclear power plant or strip mine.**
  - **More than one IRR ….**
  - **Which one do you use to make your decision?**

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Non-Conventional Cash Flows

- Suppose an investment will cost $90,000 initially and will generate the following cash flows:
  - Year 1: 132,000
  - Year 2: 100,000
  - Year 3: -150,000
- The required return is 15%.
- Should we accept or reject the project?

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Non-Conventional Cash Flows
Summary of Decision Rules

- NPV > 0 at 15% required return, so you should *Accept*
- IRR =10.11%, which would tell you to *Reject*
- However, the IRR value of 42.66% also yields NPV = 0
- You find this by specifying different values for guess
- Recognize the non-conventional cash flows and look at the NPV profile

I =	15%	
YR	CF	
0	-$90,000	
1	$132,000	
2	$100,000	
3	-$150,000	
NPV	$1,769.54	> 0
IRR-1	10.11%	< 15%
IRR-2	42.66%	> 15%

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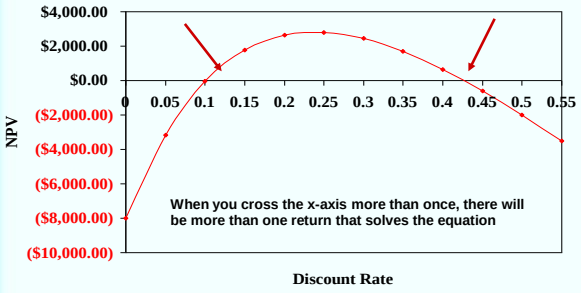
NPV Profile

IRR = 10.11% and 42.66%



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Independent versus Mutually Exclusive Projects

- Independent
  - The cash flows of one project are unaffected by the acceptance of the other.
- Mutually Exclusive
  - The acceptance of one project precludes accepting the other.

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Reinvestment Rate Assumption

- IRR assumes reinvestment at IRR
- NPV assumes reinvestment at the firm's weighted average cost of capital(opportunity cost of capital)
  - More realistic
  - NPV method is best
- NPV should be used to choose between mutually exclusive projects

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Example of Mutually Exclusive Projects

Period	Project A	Project B
0	-500	-400
1	325	325
2	325	200
IRR	19.43%	22.17%
NPV	64.05	60.74

The required return for both projects is 10%.

Which project should you accept and why?

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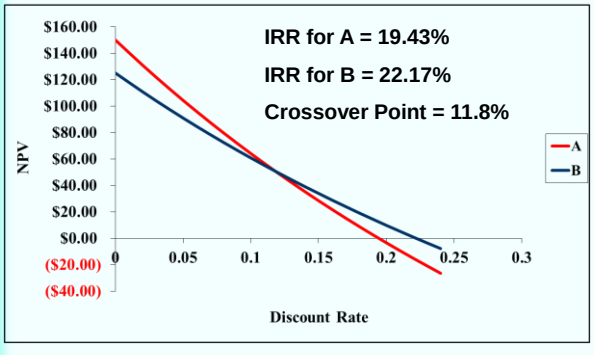
NPV Profiles



IRR for A = 19.43%

IRR for B = 22.17%

Crossover Point = 11.8%

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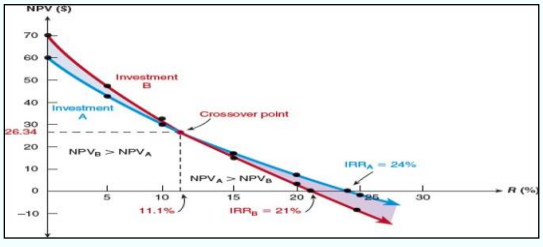
Another Example of Mutually Exclusive Projects

Year	Investment A	Investment B
0	–$100	–$100
1	50	20
2	40	40
3	40	50
4	30	60

Discount Rate	NPV (A)	NPV (B)
0%	$60.00	$70.00
5	43.13	47.88
10	29.06	29.79
15	17.18	14.82
20	7.06	2.31
25	–1.63	–8.22



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Two Reasons NPV Profiles Cross

- Size (scale) differences.
  - Smaller project frees up funds sooner for investment.
  - The higher the opportunity cost, the more valuable these funds, so high discount rate favors small projects.
- Timing differences.
  - Project with faster payback provides more CF in early years for reinvestment.
  - If discount rate is high, early CF especially good

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Conflicts Between NPV and IRR

- NPV directly measures the increase in value to the firm
- Whenever there is a conflict between NPV and another decision rule, *always* use NPV
- IRR is unreliable in the following situations:
  - Non-conventional cash flows
  - Mutually exclusive projects

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Profitability Index

- Measures the benefit per unit cost, based on the time value of money
  - A profitability index of 1.1 implies that for every $1 of investment, we create an additional $0.10 in value
- Can be very useful in situations of capital rationing
- *Decision Rule: If PI > 1.0 → Accept*

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Profitability Index

- For conventional CF Projects:

$$PI = \frac{\sum_{t=1}^{n} \frac{CF_t}{(1+r)^t}}{|CF_0|}$$

PV(Cash Inflows)

Absolute Value of Initial Investment

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Profitability Index

Profitability Index	
Year	CF
0	(165,000.00)
1	63,120.00
2	70,800.00
3	91,080.00

NPV	177,627.41	12.00%

$$PI = \frac{\sum_{t=1}^{n} \frac{CF_t}{(1+r)^t}}{|CF_0|} = \frac{177,627.41}{165,000} = 1.08$$

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Advantages and Disadvantages of the Profitability Index

Advantages	Disadvantages
1. Closely related to NPV, generally leading to identical decisions.	1. May lead to incorrect decisions in comparisons of mutually exclusive investments.
2. Easy to understand and communicate.	
3. May be useful when available investment funds are limited.	

	A	B
CF(0)	(10,000.00)	(100,000.00)
PV(CIF)	15,000.00	125,000.00
PI	1.50	1.25
NPV	5,000.00	25,000.00

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Capital Budgeting In Practice

- Consider all investment criteria when making decisions
- NPV and IRR are the most commonly used primary investment criteria
- Payback is a commonly used secondary investment criteria
- All provide valuable information

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Summary

Calculate ALL -- each has value

Method	What it measures	Metric
NPV	→ $ increase in VF	$$
Payback	→ Liquidity	Years
IRR	→ E(R), risk	%
PI	→ If rationed	Ratio

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NPV Summary

Net present value =

- Difference between market value (PV of inflows) and cost
- Accept if NPV > 0
- No serious flaws
- Preferred decision criterion

IRR Summary

Internal rate of return =

- Discount rate that makes NPV = 0
- Accept if IRR > required return
- Same decision as NPV with conventional cash flows
- Unreliable with:
  - Non-conventional cash flows
  - Mutually exclusive projects
- We have MIRR = better alternative

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Payback Summary

Payback period =

- Length of time until initial investment is recovered
- Accept if payback < some specified target
- Doesn't account for time value of money
- Ignores cash flows after payback
- Arbitrary cutoff period
- Asks the wrong question

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Profitability Index Summary

Profitability Index =

- Benefit-cost ratio
- Accept investment if PI > 1
- Cannot be used to rank mutually exclusive projects
- May be used to rank projects in the presence of capital rationing

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Choosing the Optimal Capital Budget

- Finance theory says to accept all positive NPV projects.
- Two problems can occur when there is not enough internally generated cash to fund all positive NPV projects:
  - An increasing marginal cost of capital.
  - Capital rationing

Increasing Marginal Cost of Capital

- Externally raised capital can have large flotation costs, which increase the cost of capital.
- Investors often perceive large capital budgets as being risky, which drives up the cost of capital.
- If external funds will be raised, then the NPV of all projects should be estimated using this higher marginal cost of capital.

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International Capital Budgeting

- Find the PV of the foreign CF's denominated in the foreign currency and discounted by the foreign country's cost of capital
- Convert the PV of the CF's to the home country's currency
  multiplying by the spot exchange rate
- Subtract the parent company's initial cost from the Present values of net cash flows to get the NPV

Amount and Timing of Foreign CF's will depend on

- Differential tax rates
- Legal and political constraints on CF
- Government subsidized loans

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Summary of Investment Criteria

I. Discounted cash flow criteria

A. *Net present value (NPV).* The NPV of an investment is the difference between its market value and its cost. The NPV rule is to take a project if its NPV is positive. NPV is frequently estimated by calculating the present value of the future cash flows (to estimate market value) and then subtracting the cost. NPV has no serious flaws; it is the preferred decision criterion.

B. *Internal rate of return (IRR).* The IRR is the discount rate that makes the estimated NPV of an investment equal to zero; it is sometimes called the *discounted cash flow (DCF) return.* The IRR rule is to take a project when its IRR exceeds the required return. IRR is closely related to NPV, and it leads to exactly the same decisions as NPV for conventional, independent projects. When project cash flows are not conventional, there may be no IRR or there may be more than one. More seriously, the IRR cannot be used to rank mutually exclusive projects; the project with the highest IRR is not necessarily the preferred investment.

C. *Modified internal rate of return (MIRR).* The MIRR is a modification to the IRR. A project's cash flows are modified by (1) discounting the negative cash flows back to the present; (2) compounding all cash flows to the end of the project's life; or (3) combining (1) and (2). An IRR is then computed on the modified cash flows. MIRRs are guaranteed to avoid the multiple rate of return problem. But, it is unclear how to interpret them, and they are not truly "internal" because they depend on externally supplied discounting or compounding rates.

D. *Profitability index (PI).* The PI, also called the *benefit-cost ratio,* is the ratio of present value to cost. The PI rule is to take an investment if the index exceeds 1. The PI measures the present value of an investment per dollar invested. It is quite similar to NPV, but, like IRR, it cannot be used to rank mutually exclusive projects. However, it is sometimes used to rank projects when a firm has more positive NPV investments than it can currently finance.

II. Payback criteria

A. *Payback period.* The payback period is the length of time until the sum of an investment's cash flows equals its cost. The payback period rule is to take a project if its payback is *less* than some cutoff. The payback period is a flawed criterion primarily because it ignores risk, the time value of money, and cash flows beyond the cutoff point.

III. Accounting criteria

A. *Average accounting return (AAR).* The AAR is a measure of accounting profit relative to book value. It is *not* related to the IRR, but it is similar to the accounting return on assets (ROA) measure in Chapter 3. The AAR rule is to take an investment if its AAR exceeds a benchmark AAR. The AAR is seriously flawed for a variety of reasons, and it has little to recommend it.

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Quick Quiz

- Consider an investment that costs $100,000 and has a cash inflow of $25,000 every year for 5 years. The required return is 9% and required payback is 4 years.
  - What is the payback period?
  - What is the NPV?
  - What is the IRR?
  - Should we accept the project?
- What decision rule should be the primary decision method?
- When is the IRR rule unreliable?

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Quick Quiz Solution

	r =		9%	
	Req. PB =		4 yrs	
		Cumulatve		Cumulative
t	CF	CFs	DCF	DCFs
0	(100,000.00)	(100,000.00)	(100,000.00)	(100,000.00)
1	25,000.00	(75,000.00)	22,935.78	(77,064.22)
2	25,000.00	(50,000.00)	21,042.00	(56,022.22)
3	25,000.00	(25,000.00)	19,304.59	(36,717.63)
4	25,000.00	0.00	17,710.63	(19,007.00)
5	25,000.00	25,000.00	16,248.28	(2,758.72)
			(2,758.72)	
	Payback =	4 years		
	NPV =	($2,758.72)	=NPV(E3,C9:C13)+C8	
	IRR =	7.93%	=IRR(C8:C13)	

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