

## *Chapter 7 – Net Present Value and Other Investment Rules*

### Payback Period

How soon is the initial investment recovered?

t	A	B
0	-\$10,000	-\$10,000
1	3,000	1,000
2	4,000	2,000
3	5,000	3,000
4	6,000	5,000
5		

A: Payback period =

B: Payback period =

If the required payback is 3 years, accept Project A and reject Project B.

Advantages:

1. Easy to understand.
2. Adjusts for uncertainty of later cash flows
3. Biased toward liquidity

Disadvantages

1. Ignores time value of money
2. Cutoff is arbitrary.
3. Ignores cash flows beyond cutoff date.
4. Biased against long-term projects such as R&D.

### Discounted Payback

Adjust payback period for time value of money problems.

### Average Accounting Return

Dumb.

Net Present Value

NPV = PV of outflows + PV of inflows

If the required return 10 percent, should you accept either project?

t	X	Y
0	-\$175,000	-\$280,000
1	65,000	100,000
2	85,000	140,000
3	75,000	120,000
4	65,000	80,000

## Disadvantages

1. Required return?

## Advantages

1. Accounts for time value of money.
2. Adjusts for risk.
3. Uses all cash flows.
4. Can be used to rank projects.

Profitability Index

$$PI = PV \text{ of inflows} / PV \text{ of outflows}$$

If the required return is 10 percent, what is the PI of each project?

t	X	Y
0	-\$175,000	-\$280,000
1	65,000	100,000
2	85,000	140,000
3	75,000	120,000
4	65,000	80,000

## Advantages:

1. Closely related to NPV, and will give identical decision with conventional cash flows. Assuming conventional cash flows, if the NPV is positive, what is the profitability index?
2. Easy to understand and communicate.

## Disadvantages

1. Not appropriate with non-conventional cash flows.
2. Cannot be used to rank mutually exclusive investments.

Internal Rate of Return

IRR is the interest rate that makes the NPV of the project equal to zero.

If the required return is 10 percent, what is the IRR of each project?

t	X	Y
0	-\$175,000	-\$280,000
1	65,000	100,000
2	85,000	140,000
3	75,000	120,000
4	65,000	80,000

## Advantages:

1. Same decision as NPV for conventional cash flows.
2. Easy to understand and communicate.
3. Don't need return?

## Disadvantages

1. May result in multiple answers with unconventional cash flows.
2. May lead to incorrect decision with unconventional cash flows.
3. Cannot be used to rank projects.
4. Others to come.

NPV Profile

Graph of NPV for different interest rates.

t	X	Y
0	-\$175,000	-\$280,000
1	65,000	100,000
2	85,000	140,000
3	75,000	120,000
4	65,000	80,000

0%	\$115,000.00	\$160,000.00
5%	\$82,265.75	\$111,698.93
10%	\$55,083.33	\$71,410.42
15%	\$32,271.63	\$37,458.84
20%	\$12,943.67	\$8,580.25
25%	-\$3,576.00	-\$16,192.00
IRR	23.85%	21.65%

**Problems with IRR**1. Investing or Financing?

t	R	S
0	-\$100	\$100
1	130	-130

2. \_\_\_\_\_.

<u>t</u>	<u>Cash flows</u>
0	-\$100
1	230
2	-132

3. Scale

t	M	N
0	-\$1	-\$10
1	1.50	11

4. Timing

t	F	G
0	-\$10,000	-\$10,000
1	10,000	1,000
2	1,000	1,000
3	1,000	12,000
0%	\$2,000.00	\$4,000.00
10%	\$669	\$751
15%	\$109	-\$484
IRR	16.04%	12.94%

5.

t	Cash flows
0	\$10
1	-30
2	35

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

6. Reinvestment Assumption and MIRR

t	Cash flows
0	-\$60
1	155
2	-100

The interest rate is 20%.

Method #1: The Discounting Approach

t	Cash flows
0	$-\$60 + (-100/1.20^2) = -\$129.44$
1	155
2	0

MIRR = 19.71%

Method #2: The Reinvestment Approach

t	Cash flows
0	-\$60
1	0
2	$-100 + (\$155 \times 1.20) = \$86$

MIRR = 19.72%

Method #3: The Combination Approach

t	Cash flows
0	$-\$60 + (-\$100/1.20^2) = -\$129.44$
1	0
2	$\$155 \times 1.20 = \$186$

MIRR = 19.87%

*Chapter 8 – Making Capital Investment Decisions*

Stand-alone principle

Sunk costs

Opportunity costs

Side effects

– Erosion

– Synergy

Net working capital

Exclude financing costs

A company is considering a new project that will last for five years. The equipment necessary for production will cost \$400,000 and will be depreciated on a straight-line basis to a zero salvage value. The project will generate sales of \$300,000 per year. Variable costs are 40 percent of sales and fixed costs are \$30,000. The project will require an initial investment of \$50,000 in net working capital. The tax rate is 30 percent and the required return is 12 percent. What is the payback period, NPV, and IRR?

Aunt Sally's Sauces is considering expansion into a new line of all natural tomato sauces. Sally paid \$50,000 for a marketing study that determined sales for the product will be \$650,000 per year for five years. Equipment will cost \$500,000 and will be depreciated on a straight-line manner to zero over the five-year life of the project. The equipment will have a salvage value of \$50,000 in five years. Annual fixed costs are projected at \$80,000 per year and variable costs are 60 percent of sales. Net working capital in the amount of \$75,000 is needed at the beginning of the project. The tax rate is 40 percent and the required return is 15 percent. What is the payback period, NPV, and IRR?

A company is considering a new project that will generate sales of \$1.6 million, \$2 million, \$1.9 million, and \$1.4 million over the next four years. The variable costs are 30 percent of sales and fixed costs are \$400,000. The equipment necessary for the project costs \$1.5 million and will be depreciated on a 3-year MACRS schedule. The equipment will be worth \$100,000 in four years. Net working capital will be 20 percent of next year’s sales. The tax rate is 40 percent and the required return is 11 percent. What is the payback period, NPV, and IRR?

ICO	
Equipment	\$(1,500,000)
NWC	<u>(320,000)</u>
	\$(1,820,000)

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>
Sales	\$1,600,000	\$2,000,000	\$1,900,000	\$1,400,000
VC	480,000	600,000	570,000	420,000
FC	400,000	400,000	400,000	400,000
Dep	<u>499,950</u>	<u>666,600</u>	<u>222,300</u>	<u>111,150</u>
EBT	\$220,050	\$333,400	\$707,700	\$468,850
Tax	<u>88,020</u>	<u>133,360</u>	<u>283,080</u>	<u>187,540</u>
NI	\$132,030	\$200,040	\$424,620	\$281,310
+ Dep	<u>499,950</u>	<u>666,600</u>	<u>222,300</u>	<u>111,150</u>
OCF	\$631,980	\$866,640	\$646,920	\$392,460
Δ NWC	(80,000)	20,000	100,000	280,000
Capital sp				<u>60,000</u>
Net CF	\$551,980	\$886,640	\$746,920	\$732,460
Beg NWC	\$320,000	\$400,000	\$380,000	\$280,000
End NWC	<u>400,000</u>	<u>380,000</u>	<u>280,000</u>	<u>0</u>
NWC CF	\$(80,000)	\$20,000	\$100,000	\$280,000

Salvage value	
Sales price	\$100,000
Taxes	<u>(40,000)</u> $(BV - MV)T_c = (\$0 - 100,000)(.40)$
Aftertax salvage value	\$60,000

Payback period	2.51 years	$2 + 381,380 / 746,920$
NPV	\$425,531.75	
IRR	21.14%	