

CHAPTER 9:

ISSUES IN CAPITAL BUDGETING

9-1

Project	Investment	NPV	PI	
A	\$25	\$10	0.40	
B	\$30	\$25	0.83	Accept
C	\$40	\$20	0.50	Accept
D	\$10	\$10	1.00	Accept
E	\$15	\$10	0.67	Accept
F	\$60	\$20	0.33	
G	\$20	\$10	0.50	Accept
H	\$25	\$20	0.80	Accept
I	\$35	\$10	0.29	
J	\$15	\$5	0.33	

b. Cost of Capital Rationing Constrain = NPV of rejected projects = \$45 million

9-2: Linear Programming Problem

Maximize

$$20X_1 + 20X_2 + 15X_3 + 20X_4 + 30X_5 + 10X_6 + 20X_7 + 35X_8 + 25X_9 + 10X_{10}$$

subject to

$$20X_1 + 25X_2 + 30X_3 + 15X_4 + 40X_5 + 10X_6 + 20X_7 + 30X_8 + 35X_9 + 25X_{10} \leq 100$$

$$10X_1 + 15X_2 + 30X_3 + 15X_4 + 25X_5 + 10X_6 + 15X_7 + 25X_8 + 25X_9 + 15X_{10} \leq 75$$

9-3

$$\text{NPV(I)} = -12,000 - 500/0.1 = -17,000$$

$$\text{EAC(I)} = -17,000 * 0.1 = -1,700$$

Remember that this is a perpetuity: $PV = A/i$; $A = PV * i$;

$$\text{NPV(II)} = -5,000 - 1,000(1 - (1.1)^{-20})/0.1 = -1,351.4 \quad \text{EAC(II)} = -15,87$$

$$\text{NPV(III)} = -3,500 - 1,200(1 - (1.1)^{-15})/0.1 = -12,627 \quad \text{EAC(III)} = -1,660$$

CHOOSE OPTION II (GAS HEATING SYSTEM)

9-4

$$\text{NPV of Wood Siding} = -5,000 - 1,000(PVA, 10, 10\%) = \$(11,145)$$

$$\text{EAC of Wood Siding} = -11,144 * (APV, 10, 10\%) = \$(1,814)$$

$$\text{EAC of Aluminum Siding investment} = -15,000 * 0.1 = -1,500$$

$$\text{Maintenance Cost for Aluminum Siding} = 1,813.63 - 1,500 = 313.63$$

9-5

EAC for 1-year subscription = \$20.00

EAC for 2-year subscription = \$ 36 (APV,20%,2) = \$23.56

EAC for 3-year subscription = \$ 45 (APV,20%,3) = \$21.36

9-6

a. Initial investment = 10 million (Distribution system) + 1 million (WC) = 11 million

b.

Incremental Revenues	10,000,000	
Variable Costs (40%)	40,00,000	
Advertising Costs	1,000,000	
BTCF	5,000,000	
Taxes	1,600,000	= (5,000,000-1,000,000)*0.4
ATCF	\$3,400,000	

c. NPV = -11,000,000 + 3,400,000 (PVA,10 years,8%) + 1,000,000 (PF, 10 years, 8%)
= \$12,277,470

d. Precise Breakeven :

$(-10,000,000 - .1x) + (.6x - 1,000,000 - (.6x - 1,000,000 - 1,000,000) * .4) (PVA, 10yrs, 8\%)$

$+ .1x / 1.08^{10} = 0$

$(-10,000,000 - .1x) + (.6x - 1,000,000 - (.6x - 1,000,000 - 1,000,000) * .4) (6.71) + .1x * 0.4632 = 0$

$-.1x + 2.4156x + .04632x = 10,000,000 + 200,000 * 6.71$

$2.36192x = 11,342,000$

$x = 4,802,025.47$ or Increase 4.80% from initial level of 10%

9-7

The existing machine has an annual depreciation tax advantage = $500000(0.40)/5 =$

40,000. The present value of this annuity equals $\frac{40000}{.1} \left(1 - \frac{1}{1.1^5}\right) = 151631.47$

The new machine has an annual depreciation tax advantage = $2000000(0.40)/10 =$

80,000. The present value of this annuity equals $\frac{80000}{.1} \left(1 - \frac{1}{1.1^{10}}\right) = 491565.37$.

However, it will be necessary to spend an additional 1.7m. to acquire the new machine.

Net Cost of the New Machine = $-1,700,000 + 491,565 - 151,531 = \$1,360,066$

. Solving, for the annual savings that we would need each year for the next 10 years,

Annual Savings = $\$1,360,066$ (Annuity given PV, 10 years, 10%) = $\$221,344$

(I am assuming no capital gains taxes. If there are capital gains taxes, the initial investment will be net reduction because of capital losses from the sale of the old machine).

9-8

	1	2	3	4	5	
Revenues	\$15,000	\$15,750	\$16,538	\$17,364	\$18,233	
- Op. Exp.	\$7,500	\$7,875	\$8,269	\$8,682	\$9,116	
- Depreciation	\$8,000	\$8,000	\$8,000	\$8,000	\$8,000	
EBIT	\$(500)	\$(125)	\$269	\$682	\$1,116	
- Taxes	\$(200)	\$(50)	\$108	\$273	\$447	
EBIT (1-t)	\$(300)	\$(75)	\$161	\$409	\$670	
+ Depreciation	\$8,000	\$8,000	\$8,000	\$8,000	\$8,000	
ATCF	\$7,700	\$7,925	\$8,161	\$8,409	\$8,670	
PV at 12%	\$6,875	\$6,318	\$5,809	\$5,344	\$4,919	\$29,266

$$NPV = -50,000 + \$29,266 + \$10,000/1.12^5 = \$(15,060)$$

b. Present Value from Additional Book Sales

Year	Sales	Pre-tax Operating margin	After-tax operating margin
0			
1	20000	8000	4800
2	22000	8800	5280
3	24200	9680	5808
4	26620	10648	6388.8
5	29282	11712.8	7027.68
		NPV (@ 12%)	\$20,677

The present value of the cashflows accruing from the additional book sales equals \$20,677

c. The net effect is equal to \$20,677 - \$15,060 = \$ 5,617. Hence, the coffee shop should be opened.

9-9

$$NPV \text{ of less expensive lining} = -2000 - 80 (AF, 20\%, 3 \text{ YEARS}) = \$(2,169)$$

$$EAC \text{ of less expensive lining} = -2168.52 / (AF, 20\%, 3 \text{ YRS}) = \$(1,029)$$

Key question: how long does the more exp. lining have to last to have an EAC < - 1029.45?

$$NPV \text{ of more expensive lining} = -4000 - 160 (AF, 20\%, n \text{ years})$$

$$EAC \text{ of more expensive lining} = NPV / (AF, 20\%, n \text{ years})$$

Try different lifetimes. You will find that the EAC declines as you increase the lifetime and that it becomes lower than 1,029.45 at 14 years.

9-10

$$NPV(A) = -50,000 - 9,000 (AF, 8\%, 20 \text{ years}) + 10,000/1.08^{20} = \$(136,218)$$

$$EAC(A) = NPV / (AF, 8\%, 20 \text{ years}) = \$13,874$$

$$NPV(B) = -120,000 - 6,000 (AF, 8\%, 40 \text{ years}) + 20,000/1.08^{40} = \$(190,627)$$

$$EAC(B) = NPV / (AF, 8\%, 40 \text{ years}) = \$15,986$$

9-11

NPV of Project A = $-5,000,000 + 2,500,000 (PVA, 10\%, 5) = \$4,476,967$

Equivalent Annuity for Project A = $4,476,967 (APV, 10\%, 5) = \$1,181,013$

NPV of Project B = $1,000,000 (PVA, 10\%, 10) + 2,000,000/1.1^{10} = \$6,915,654$

Equivalent Annuity for Project B = $6,915,654 (APV, 10\%, 10) = \$1,125,491$

NPV of Project C = $2,500,000/.1 - 10,000,000 - 5,000,000/1.1^{10} = \$13,072,284$

Equivalent Annuity for Project C = $13,072,284 * 0.1 = \$1,307,228$

9-12

Equivalent Annual Cost of inexpensive machines = $-2,000 (APV, 12\%, 3) - 150 = \(983)

Equivalent Annual Cost of expensive machines = $-4,000 (APV, 12\%, 5) - 50 = \$(1,160)$

I would pick the more expensive machines. They are cheaper on an annual basis.

9-13

Annualized Cost of spending \$400,000 right now = $\$400,000 (.10) = \$40,000$

Maximum Additional Cost that the Town can bear = $\$100,000 - \$40,000 = \$60,000$

Annual expenditures will have to drop more than \$40,000 for the second option to be cheaper.

9-14

Initial Cost of First Strategy = \$10 million

Initial Cost of Second Strategy = \$40 million

Additional Initial Cost associated with Second Strategy = \$30 million

Additional Annual Cash Flow needed for Second Strategy to be viable:

= $\$30 \text{ million } (APV, 12\%, 15 \text{ years}) = \4.40

Size of Market under First Strategy = $0.05 * \$200 \text{ million} = \10 million

Size of Market under Second Strategy = $0.10 * \$200 \text{ million} = \20 million

Additional Sales Associated with Second Strategy = \$10 million

After-tax Operating Margin needed to break even with second strategy = 44%

9-15

Project	Initial Investment	NPV	PI	IRR
I	5	3	0.60	21%
II	5	2.5	0.50	28%
III	15	4	0.27	19%
IV	10	4	0.40	24%
V	5	2	0.40	20%

a. The PI would suggest that the firm invest in projects II, IV and V.

b. The IRR of project I is higher than the IRR of project V.

c. The differences arise because of the reinvestment rate assumptions ; with the IRR, intermediate cash flows are reinvested at the IRR; with the PI, cash flows are reinvested at the cost of capital.

9-16

	Years 1- 10
ATCF : Store	10,000
- CF from Lost Sales	-1,200
Net ATCF	8,800

$$NPV = -50,000 + 8,800 (PVA, 14\%, 10 \text{ years}) = \$(4,098)$$

I would not open the store.

9-17

$$\text{Initial Investment} = - \$150,000 = - \$210,000$$

Annual Cash Flows from Baby-sitting Service

Additional Revenues \$1,000,000

$$ATCF = \$1,000,000 (.10) - \$ 60,000 (1-.4) = \$64,000$$

(I used a tax rate of 40%)

$$NPV = -150,000 + \$64,000 (PVA, 12\%, 10\text{years}) = \$211,614$$

Yes. I would open the service.

9-18

$$\text{Total Cost of Buying Computers} = \$2,500 * 5,000 = \$12,500,000$$

$$\text{- PV of Salvage} = \$2,500,000/1.1^3 = \$1,878,287$$

$$\text{- PV of Depreciation} = \$3,333,333*.4*(PVA, 10\%, 3) = \$3,315,802$$

$$\text{Net Cost of Buying Computers} = \$7,305,911$$

$$\text{Annualized Cost of Buying Computers} = \$7,305,911 (APV, 10\%, 3) = \$2,937,815$$

$$\text{Annualized Cost of Leasing} = \$5,000,000 (1-.4) = \$3,000,000$$

It is slightly cheaper to buy the computers rather than lease them.

