

Chapter 12

12.1 Personal Discount Rate

- a) Capital costs = $C_k = \$300$;
Recurring costs = $C_r = (3¢)(1600) + 10 = \$58/\text{yr.}$
 $F = (1.1)^{10} = 2.594$; $1/\text{CRF} = (F-1)/rF = 6.14$
NPV "Life Cycle Cost" = $\$300 + 58[6.14] = \656.40
Equivalent Annual Cost = $300/6.14 + 58 = \$107$

Here the net present value gives more immediate meaning than equivalent annual cost since it represents the total cost to the buyer over the lifetime of the item in terms of present dollars.

- b) The cash flow diagram should show $-\$400$ in extra costs immediately, and then annual benefits of 1000 (savings in cents/kwh).

- i) Plainsville: $-\$400 + 30(6.14) < 0$
Costs more than savings: Choose old model
- ii) New York: $-\$400 + 76(6.14) > 0$
Savings more than costs: Choose new model

Note: service charge is unchanged between alternatives, and is not a factor.

- c) i) Connie's discount rate is $r = 10\%$
Her savings of new model over the old are: $-\$400 + 76(6.14) = 66.64$
Connie should buy the new model

- ii) Ralph's discount rate is $r = 20\%$; $1/\text{CRF} = (F-1)/rF = 4.18$
 $-\$400 + 76(4.18) < 0$, so he should buy the old model!

This illustrates several points:

- technical improvement does not necessarily mean economic improvement;
- economic rationality depends upon economic circumstance;
- introduction of new technology may diffuse slowly because, while economically desirable for some, it may be uneconomic for others.

12.2 Student Finances

- a) The student's money is currently invested as follows:
\$200 at 9% (saving a \$1.50 monthly service charge at the bank)
\$200 at 6% (the savings bank)
\$100 at 5% (the bond)
\$100 at 0% (the cash above 200 in the bank account)

The student's opportunities are
\$200 for a month to save \$20 thus 10% a month
\$200 at 18% (the store bill)

The student should consequently redeploy his assets, disposing of the low return placements and putting the money in the high returns. That is, he spends \$400 on paying for the bicycle and the store bill.

- b) If he had an extra \$100 he could keep it in the savings bank at 6%.
- c) Buying the bicycle now means that he loses interest on the savings account that is 6%/year or 1/2%/month or \$1. The true cost is thus \$201.
- d) 6% for additional money; at least 9% if he were to have less money and thus incur service charges at the bank.

12.4 Inheritance

- a) 19.3% for the whole \$5000, 12% at margin.
- b) 19.3%; $(12 + r)/2 = 19.3 \Rightarrow r = 26.6\%$.

12.4 Money Store

Discount rate = Opportunity cost - Inflation rate
= $(10/0.6) - 5 = 11.6\%$

The key factor is that the company's opportunity cost at the margin is 16.67% which, after taxes at 40%, leaves a return of $0.6(16.67) = 10\%$

12.5 DR Review

- a) The opportunity cost of money to taxpayers.
b) In evaluating public projects.
c) As a weighted average of consumer and private industry investment.
d) 8% - 12%.

12.6 Port Authority

They could use the money to retire bonds ahead of schedule. 8% or 8-1/2%.

12.7 Park Hue

a) The benefits are \$6 and 10 min per workday. The costs are either the lump sum of cost of the car, or the initial cost plus monthly payments and expenses. The opportunity cost depends on what gains the person could make with the additional time.

b) Can be determined considering how much the person could make (in %) investing the money, or how much he would have to pay in order to borrow the money.

c) This adds an extra dimension of benefit, normally, the value of having the car around for weekends, etc.

12.8 Snowbird High Again

a) The superintendent should ignore the initial costs of the heating system because they will be paid from the contingency fund. If the money is not spent, the school will lose it; the "opportunity cost" is zero. Therefore, the analysis should include only the future costs of the systems over the 20 year lifetime of the school.

Without any calculations, the residual oil heater is better because it has the lowest annual costs. When doing the calculations, remember that a second gas fired boiler must be purchased in ten years if the superintendent chooses that option.

NPC (coal) = \$62,310 NPC (gas) = \$87,050 NPC (oil) = \$43,617

b) From the school's point of view, the discount rate should be 7% (its opportunity cost for capital).

c) From the perspective of the city council and the ordinary citizen who may get a tax rebate, the discount rate should be at least 8% -- what they can obtain otherwise at the bank.

12.9 Hi-Tacky Corporation

(12/.5) - 8 = 16

12.10 Start-up

The opportunity costs for the projects are:

- i) for insulation: perpetual savings of \$5600/yr. on \$40,000 mean a return of 14%, net of inflation, or 18% including inflation. This is because the price of fuel presumably increases with inflation.
- ii) for mortgage: 12%, but with inflation.
- iii) for annuity: The rate is approximately $3200/20,000 = 16\%$, with inflation. At that rate, lack of earnings beyond 30 years have no significant effect on present value.
- iv) An investment that doubles in 5 years returns 14% (close enough), including inflation.

The priority for current investments is thus:

<u>Project</u>	<u>Size, \$</u>	<u>Return, %</u>
Insulation	40,000	18
Annuity	20,000	16
Investment	30,000	14
Mortgage	80,000	12

For a \$20,000 investment the minimum discount rate, including inflation, is 16%; for \$60,000 it is $[40(18) + 20(16)]/60 = 17.33\%$.

12.11 Government Procurement

- i) The annual return is 14%, net of inflation, since the costs avoided would normally rise with other prices.
- ii) The annual return is 17.5%, but this includes inflation since the lease is set. The return net of inflation is: $17.5 - 6 = 11.5\%$
- iii) Here the return again includes inflation. For this project to be better than (i), it must return at least: $14 + 6 = 20\%$. Evaluating it at this discount rate, we see it has a positive present value: $211 - 200 = 11$. Therefore it returns somewhat more than 20%.

The economic ranking is: (iii) best; (i) ; (ii).