Lesson 8-1: Present Worth Analysis

Present Worth Analysis

Learning Objectives

- Present worth criteria
- Comparing two choices using present worth
- Equal, unequal, and infinite project lives
- Multiple alternatives using present worth

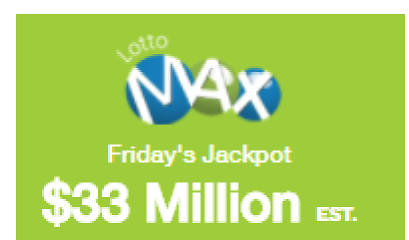
Assumptions in Solving Present Worth Problems

- End-of-Period Convention
  - All cash flow amounts are calculated as amounts at the end of each period:
    - Now = Period 0 (beginning of period 1)
    - Future amounts happen at the end of the period specified
- No Sunk Costs
  - Only the current situation and the potential future is considered
- Two viewpoints
  - Investor and Borrower (at some interest rate)
  - Conventional assumption—required money is obtained at interest rate *i*

Present Worth Analysis

- Comparing the present value of two potential alternatives
- Relies on the principle of equivalence we developed before

- Consider a simple annuity – The Daily Grand (always game responsibly)
  - $1000 per day = $365,000 per year
  - Assume 7% interest (balanced investments)
  - Assume you'll live for 60 years
- PV = $365000(P/A, 7%, 60) = $5,124,301
- VERSUS
- LottoMax:
- PV = $33,000,000 (est)
  - A = $33M(A/P, 7%, 60)
  - A = $2,350,564 (also est)



Economic Criteria

- Investment projects are judged against an appropriate economic criterion, depending on the situation:

Situation	Rule
Neither input nor output fixed	Maximize (output-input)
Fixed input	Maximize output
Fixed output	Minimize input

Economic Criteria Example: Electric Power Generation

Situation	***Example***	***Criterion***
Fixed input	$10 million capital available	Maximize output and/or revenue
Fixed output	700 megawatts output required	Minimize the total cost of generation
Neither fixed	No limit on capital & at least 500 megawatts output required	Maximize output per invested $ or (revenue – costs)

Applying Present Worth Techniques

- Three potential ‘analysis periods’ (or ‘planning horizon’ or ‘project life’) are possible when comparing alternatives:
    1. Equal lives; the useful lifetimes of the alternatives are equal to the analysis period
    2. Not equal lives; the alternatives have useful lifetimes that are different from the analysis period;
    3. Infinite analysis period, $n = \infty$

1. Single Project

- Net Present Value (Net Present Worth)

$$NPV = PW_B - PW_C$$

- E.g. you're evaluating a new process improvement. The new process is more expensive, but will improve yields. Is it worth doing?

1. Single Project (con't)

- Expected Development costs: \$10,000
- Expected annual operating costs: \$2,000
- Expected annual savings: \$5,500, increasing \$500 per year.
    - Assume over 10 years and 12% interest
- PV of Development costs: $P = F(P/F, 12\%, 0)$
- PV of Operating Costs: $P = A(P/A, 12\%, 10)$
- PV of Annual Savings: $P = A(P/A, 12\%, 10) + G(P/G, 12\%, 10)$

1. Single Project (con't)

- PV of Development costs: $P = F(P/F, 12\%, 0)$
  - $P = \$10{,}000*1 = \$10{,}000$
- PV of Operating Costs: $P = A(P/A, 12\%, 10)$
  - $P = \$2000*5.65 = \$11{,}300$
- PV of Annual Savings: $P = A(P/A, 12\%, 10) + G(P/G, 12\%, 10)$
  - $P = \$5500*5.65 + \$500*20.25 = \$41{,}200$
- $NPV = P(s)-P(d)-P(o\&m) = \$41{,}200-\$11{,}300-\$10{,}000$
- $NPV = \$19{,}900$

1.1. Useful Lifetime = Analysis Period

- When selecting between two alternatives using Present Worth Analysis:
  - Maximize:
    - Net Present Worth = Present worth benefits – Present worth of costs
    - Consider end of life costs (salvage, reclamation)
  - The alternative with the higher Net Present Worth (NPW) is selected

$$NPW = PW_B - PW_C$$

Interest rate:	10%	
Year	***Device A***	***Device B***
0	-$1,000	-$1,000
1	$310	$400
2	$310	$350
3	$310	$300
4	$310	$250
5	$310	$200
PV of costs=	-$1,000	-$1,000
PV of benefits=	$1,175.14	$1,173.22
NPV=	$175.14	$173.22
Recommend Device A.		
Interest rate:	10%	
Lifetime:	25	years
Year	***Plan A***	***Plan B***
0	-$400	-$360
25	$0	-$360
PV of costs=	-$400.00	-$393.23
PV of benefits=	$0.00	$0.00
NPV=	-$400.00	-$393.23
Recommend Plan B.		

Present Worth Analysis: Problem 1

Two outdoor facilities are being considered for an upcoming Olympic baseball event in three years. The ticket price is fixed for the event at \$150/person payable in the event year.

Facility A requires a non-refundable deposit of \$250,000 and will hold 15,000 people for the event.

Facility B does not require a deposit but holds only 13,000 people. If the event sells out in either facility, which facility should be chosen based on a present worth analysis, if the interest rate is 10%?

Present Worth Analysis: Solution 1

n = 3 year   i = 0.10

Present worth of Facility A

$NPV = -P_c + P_b = -P_c + F(1+i)^{-n}$

$NPV = -250{,}000 + 15{,}000(150)(0.7513)$

$NPV = \$1{,}440{,}458.30$

Present worth of Facility B

$P = -P_c + P_b = -P_c + F(1+i)^{-n}$

$P = 0 + 13{,}000(150)(0.7513)$

$P = \$1{,}465{,}063.86$

Choose Facility B because the NPW of B is more profitable based on a present worth analysis.

Present Worth Analysis:

The provincial government is considering building a new hospital in the Fraser Valley. Their two options are to build a full sized facility now for \$800 million, or build a smaller facility now for \$600 million and expand the facility in 40 years for another \$700 million. Regardless of

the option chosen, the

facility will be used for 80 years.

Assume 7% nominal interest.

Present Worth Analysis:

Fixed output, so criteria is to minimize costs.

Full Facility: PW = Pc = \$800 million

Two stage construction: PW = \$600m + 700m (P/F, 7%, 40)

$= \$600m + \$700m(1+0.07)^{-40} = \$600m + \$46.75m = \$646.75m$

Province should take option 2, phased construction.