

Appendix A

Advanced Evaluation Techniques

Description and Demonstration Advanced Evaluation Techniques

There are four key measures that should be considered when undertaking the performance of a potential investment, each of which is specifically aligned to negate the inaccuracies resulting from differing cost and life combinations. These measures are summarized in the following table:

Measure Selection Table

Investment Costs (Size)	Investment Lives (Time)	Appropriate Measure to Use
Same	Same	Net Present Value (NPV)
Different	Same	Present Value Index (PVI)
Same	Different	Annuity of NPV
Different	Different	Annuity of PVI

It is important that the correct measure is used to suit the appropriate circumstances, as a misleading result can be obtained. Each of these measures are reviewed in the following sections.

In general, these measures have the following advantages and disadvantages:

Advantages

- They consider the time value of money
- Measures use standard accounting and economic techniques
- No ambiguities/anomalies in options comparison (as long as correct measure is used)

Disadvantages

- Tedious calculation unless computer modeled
- Need to know organization's opportunity cost of capital
- There is subjectivity in determining expected annual cash inflows and expected period of benefit

Net Present Value (NPV)

NPV evaluations should not be used for a comparison when options with different investment sizes are being compared. The present value method compares the present value of future cash flows expected from an investment project to the initial cash outlay for that investment. Net cash flows are the difference between forecasted cash inflow received because of the investment with the expected cash outflow of the investment. *If the NPV is negative, then the project is rejected.*

Advantages and Disadvantages

- Measures actual worth using standard of profitability
- Is only appropriate when the projects evaluated have a similar expected life and costs

Present Value Index (PVI)

The Present Value Index is essentially a ratio of the present value of net inflows to the present value of the original investment. *If this ratio is less than one, then that option should be rejected.*

Advantages and Disadvantages

- Negates the impact of different capital investments in options being compared
- Only a suitable comparator when the same investment life exists for both investments

Annuity of NPV (Net Present Value)

This method is suitable for use when investment sizes are the same, but the lives are unequal. It is found by dividing the NPV by the PV of annuity. The output of this evaluation method displays an annual benefit (or loss) expected from the investment. *The option with a higher annuity of NPV is preferred. An option with a negative annuity of NPV should be rejected.*

Advantages and Disadvantages

- Negates the impact of differing investment lives
- Options being compared must have the same investment costs to deliver reasonable results

Annuity of PVI (Present Value Index)

The Annuity of PVI should be utilized when the investment sizes are different, and unequal investment lives are present. The annuity of PVI is calculated through two calculations, the output of which is a rate of return. This rate of return should exceed the organization's internal hurdle rate with the option having the highest rate of return being preferable.

Advantages and Disadvantages

- Allows for both different investment costs and sizes
- Is more complex to evaluate

Calculation Example

Take the case of a potential investment. There are two identified options – Machine C or Machine D. Both of these machines can do the task required of them, but they have different investment costs and lives. The minimum required rate of return is 12%.

Example option details table

	Machine C	Machine D
Cost (assumed as today's value, thus not discounted)	\$20,000	\$65,000
Salvage value	\$0	\$5,000
Estimated life	5 years	12 years
Added revenue per year	\$16,000	\$22,000
Added out of pocket costs per year	(\$10,200)	(\$10,000)
Net cash inflows	\$5,800	\$12,000

For this particular example, both the costs and the lives are different, as such an Annuity of PVI would ideally be utilized as per the PVI Calculation Table. However, to show how the different calculations are undertaken, and the different answers that can be obtained if the incorrect method is used, each method of evaluation will be undertaken.

NPV Calculation Table

	Machine C	Machine D
PV of inflows (= Revenue x PV of an annuity of \$1)	$5,800 \times 3.6048 =$ 20,909	$12,000 \times 6.1944 =$ 74,328
Plus PV of salvage (= Salvage value x PV of \$1 at time of salvage)	$0 \times 0.5674 = 0$	$5,000 \times 0.2567 = 1,284$
Equals PV Total of inflows	20,909	75,612
Less PV of original investment	(20,000)	(65,000)
Equals Net Present Value	\$909	\$10,612

Evaluation Rules:

1. If NPV is negative, then reject
2. The option with the higher NPV is preferred

Based on these rules, Machine D would be the preferred option under NPV analysis.

PVI Calculation Table

	Machine C	Machine D
PV of total inflows	20,909	75,612
PV of original investment	20,000	65,000
PVI = PV of total inflows/PV of original investment	20,909/20,000 = 1.045	75,612/65,000 = 1.163

Evaluation Rules:

3. If PVI is less than 1, then reject
4. The option with the greater PVI is preferred

Based on these rules, Machine D would be the preferred option under PVI analysis.

Annuity of NPV Calculation Table

	Machine C	Machine D
NPV	909	10,612
PV of Annuity	3.6048	6.1944
Annuity of NPV (= NPV/PV of Annuity)	909/3.6048 = \$252	10,612/6.1944 = \$1,713

Evaluation Rules:

5. If Annuity of NPV is negative, then reject
6. The option with the greater Annuity of NPV is preferred

Based on these rules, Machine D would be the preferred option under Annuity of NPV analysis.

Annuity of PVI Calculation Table

	Machine C	Machine D
PV Annuity (= PV of total inflows/PV of annuity of \$1 at end of life)	20,909/3.6048 = 5,800	75,612/6.1944 = 12,207
PV of original investment	20,000	65,000
Annuity of PVI (= PV Annuity/PV of original investment)	5,800/20,000 = 0.29	12,207/65,000 = 0.19

Evaluation Rules:

7. The rate of return found should equal or exceed the internal hurdle rate for the organization, otherwise reject the option.
8. The option with the higher rate of return is preferred

Based on these rules, Machine C with an annual 29% return would be the preferred option under Annuity of PVI analysis.