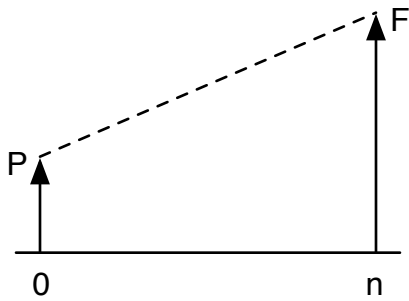


Time Value of Money

Principal	Amount borrowed or owed to a lender
Invested Capital	Amount of money invested in a project or asset or company, etc. Typically an initial outlay
Interest Rate	Cost of money expressed as a percentage per period of time
Interest Period	A period of time that determines how frequently interest is calculated – e.g. annually, semi-annually, monthly.
Duration/Life	The time horizon of the transaction that determines the number of interest periods
Receipts	Cash inflows
Disbursements	Cash outflows
Future Sum	The amount of money in the future that results from the cumulative effects of earning interest over time

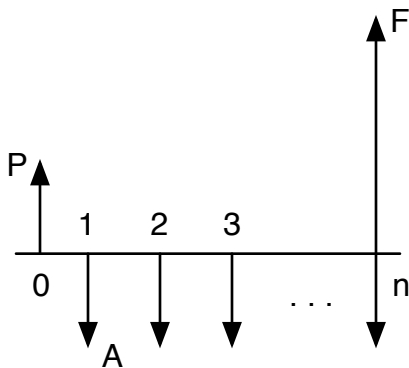
Single Payment Cash Flows



Simple Interest
 $I = \text{Interest Earned}$
 $I = (i \cdot P) \cdot N$

Compound Interest
 $F = P(1+i)^N$
 $P = \frac{F}{(1+i)^N}$

Uniform Series



$$F = A \cdot \left[\frac{(1+i)^N - 1}{i} \right]$$

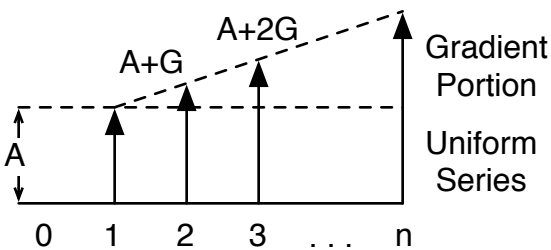
$$A = F \cdot \left[\frac{i}{(1+i)^N - 1} \right]$$

$$P = A \cdot \left[\frac{(1+i)^N - 1}{i \cdot (1+i)^N} \right]$$

$$A = P \cdot \left[\frac{i \cdot (1+i)^N}{(1+i)^N - 1} \right]$$

Gradient Series

Linear Gradient Series:



Note: The given formulas are for the gradient portion of the series only. The resultant values must be added to the underlying uniform series.

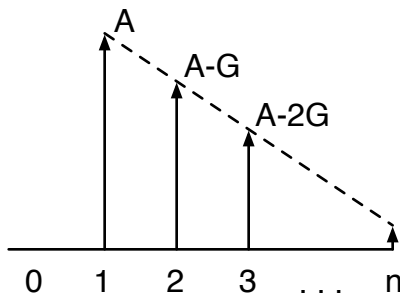
$$F = \frac{G}{i} \cdot \left[\frac{(1+i)^N - 1}{i} - N \right]$$

$$P = G \cdot \left[\frac{(1+i)^N - iN - 1}{i^2 \cdot (1+i)^N} \right]$$

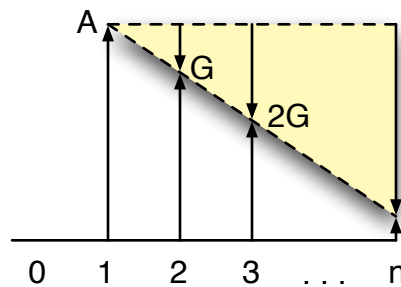
$$A' = G \cdot \left[\frac{(1+i)^N - iN - 1}{i \cdot ((1+i)^N - 1)} \right]$$

A' is the value of the gradient portion of the series if it were a uniform series. A' plus A is the overall "A" of the entire series.

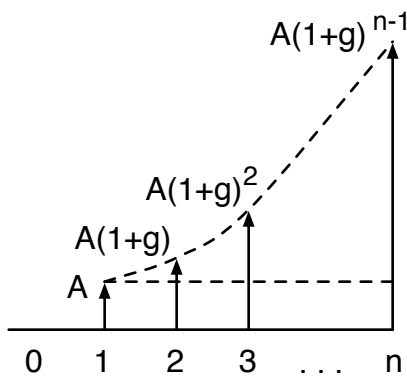
Decreasing Linear Gradient:



The gradient section is identical to a uniform series of height A minus the decreasing gradient portion.



Geometric Gradient:



Note: The given formulas are for both the underlying uniform series and the gradient portion of the series together.

If $i \neq g$,

$$F = A \cdot \left[\frac{(1+i)^N - (1+g)^N}{i-g} \right]$$

$$P = A \cdot \left[\frac{1 - (1+i)^{-N} (1+g)^N}{i-g} \right]$$

If $i = g$,

$$F = N \cdot A \cdot (1+i)^{N-1}$$

$$P = \frac{N \cdot A}{1+i}$$

Note: If the series is decreasing, g is negative.

Deferred Annuity

A uniform series of annual cash flows that start at some point in the future beyond the end of year one.

Rule of 72

You can approximate how long it will take for a present sum to double, given a certain compound interest rate by dividing 72 by the interest rate.

$$\frac{72}{i} = N \text{ to double a present sum}$$

Compounding Frequency

Nominal or Annual percentage rate is the percentage rate that is compounded with non-annual frequency.

Effective Interest Rate is the percentage rate of the nominal rate if it had an annual frequency.

Compounding and Payment Freq.

On the left hand side of the chart you will find the formulas to calculate the effective interest per period or per year when there is only one payment or withdrawal involved in the transaction. On the right hand side of the chart, you will find the formulas to calculate the effective interest per payment period.

- ▶ Compounding and payment frequency are both annual ==> $i=r$
- ▶ Compounding is more Frequent than Annual and:
 - Payment and Compounding Frequency are the Same ==> $i=r/M$
 - Compounding Frequency Greater than Payment Frequency ==> $i= (1+r/M)^C-1$
 - Compounding Frequency less than Payment Frequency and Payments start to earn interest right away ==> Case A
 - Compounding Frequency less than Payment Frequency and Payments earn interest at the end of compounding period ==> Case B

Where,

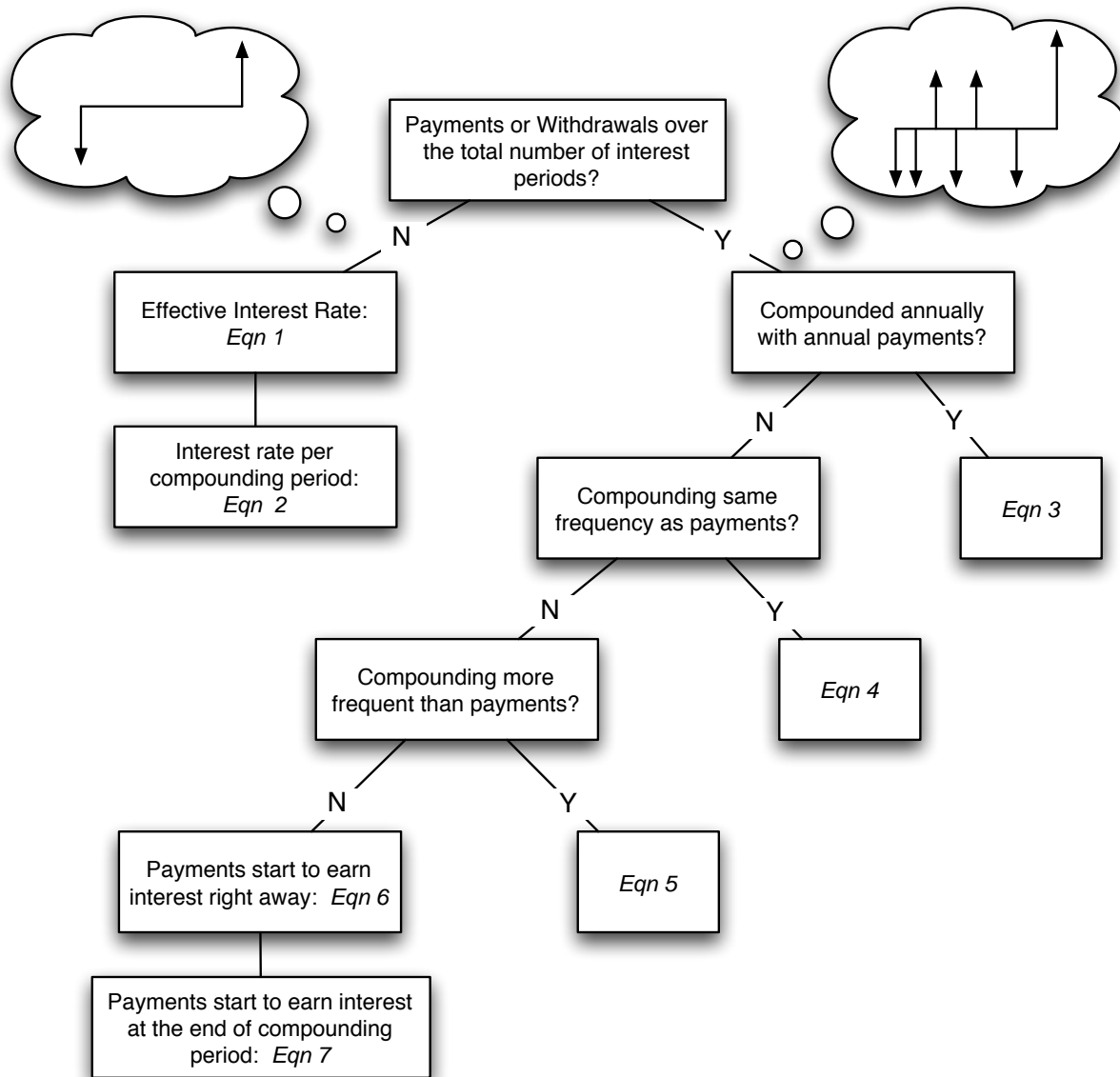
i = per period rate

r = nominal annual interest rate

M = number of compounding periods per year (ex: $M=12$ if compounded monthly)

K = number of payment periods per year

C = number of compounding periods per payment period.



Eqn 1: $i_{effective} = (1 + r/M)^M - 1$

Eqn 2: $i = r/M, N = M \cdot (\text{number of years})$

Eqn 3: $i = r$

Eqn 4: $i = r/M$

Eqn 5: $i = (1 + r/M)^C - 1$

Eqn 6: $i = (1 + r/M)^C - 1$

Eqn 7: $i = r/K$

Effective Interest Rate

Effective Interest Rate per Payment Period

$$i_k = \left(1 + \frac{r}{M}\right)^c - 1$$

or

$$i_k = \left(1 + \frac{r}{ck}\right)^c - 1$$

r = the nominal annual interest rate

k = the number of payment periods per year

M = the number of compounding periods per year

c = the number of compounding periods per payment period

$M = ck$

Commercial Loans

Types:

1. Pay back principal and interest in equal payments (amortized loan)
2. The amount of principal paid back in each payment is constant;
3. The amount of interest paid back in each payment is constant until the last payment, with the principal being paid back at the end of the term.

Amortized Loans

In an amortized loan each payment consists of an interest portion and a principal portion, but the magnitude of each varies with each payment. The interest portion is highest in the first payment and declines with each subsequent payment as the principal is paid down.

B_0 = original loan principal

B_n = principal balance outstanding on an amortized loan after n payments

I_n = interest portion of the payment in period n

$$= B_{n-1} \cdot (i)$$

P_n = principal portion of payment in period n

$$= A - I_n$$

A = loan payment

$$= P_n + I_n$$

N = total number of loan payments during term of loan

n = number of loan payments that have already been made

$$B_n = A(P/A, i, N - n)$$

$$= B_0(F/P, i, N - n) - A(F/A, i, n)$$

i = loan interest rate

A = loan payment

n = the number of loan payments that have been made

Mortgages

Most conventional mortgages limit the amount that can be borrowed against an asset to a maximum of 75% of the purchase price or appraised value, whichever is lower. The mortgagor must provide the remainder, or the equity portion.

A **high-ratio mortgage** is a type of mortgage which permits the mortgagor to borrow in excess of 75% of the purchase price or appraised value of the asset (whichever is lower).

A **collateral mortgage** is a mortgage that provides backup security on a loan that is already secured. If the primary security does not cover the loan in the event of default, the asset providing the security in the collateral mortgage might be used to repay the loan.

The **amortization period** of a mortgage is the number of years it will take to repay it in full.

The **term** of the mortgage is the number of the years the mortgage covers. the term might be a few months to a few years. When the term is up the unpaid principal can typically be re-financed with the same mortgage or another.

The **interest rate** specified in a mortgage is typically expressed as a nominal annual rate, compounded semi-annually. In a **fixed rate mortgage**, the interest is fixed for the term of the mortgage. In a **variable-rate mortgage** the interest rate fluctuates during the term.

An **open mortgage** is one in which the principal can be paid at any time without penalty.

In a **closed mortgage**, if the principal is paid back before the end of the term of the mortgage, the mortgagor must pay a penalty. The penalty is typically the greater of three month's interest, or, if mortgage rates have dropped, the so-called interest rate differential. The differential is the extra interest the mortgagor would have paid for the remainder of the term of the mortgage (relative to current rates) if the mortgage was not pre-paid.

Some closed mortgages have **pre-payment privileges** allowing the mortgagor to pre-pay up to 10% of the principal on the anniversary date of the mortgages. Some closed mortgages also allow the borrower to increase the regular payment by up to 100% once per year.

Bonds

Par Value or Face Value (V), The principal amount of the bond or the amount borrowed. Bond par values are typically even denominations (e.g. \$1,000, \$2,000, \$5,000).

Maturity Date, Bonds typically have a specified date at which the principal must be paid back. This is known as the maturity date.

Coupon Rate (r), the nominal annual interest rate paid by the borrower on the bond. Sometimes the annual interest owed is paid monthly, quarterly, annually. For example, a 10% coupon rate on a \$1,000 bond might involve semi-annual interest payments of \$50.

Debenture, an unsecured bond. There is no pledge of assets to secure the bond in the event of default of the borrower.

Mortgage Bond, a bond that is secured by a pledge of assets such as property or buildings.

Bond Value, the present value of the bond face value to be paid back at the bond maturity date plus the present value of the interest payments to be received over the term of the bond, as determined by the coupon rate.

Bond Yield to Maturity, the actual rate of interest earned on a bond taking into account the price paid for the bond, the coupon rate, the face value and the term to maturity. The yield to maturity is the interest rate that establishes equivalence between the price paid for the bond and the interest payments and principal repayment.

Current Yield, the interest rate on the bond divided by the current market price.

Example:

A 5 year \$1,000 bond with a coupon rate of 8% and quarterly interest payments is currently selling for \$1,150. What is the current nominal and effective yield?

$$V = \$1,000$$

$$r = 8\% = 2\% \text{ per quarter or } \$20 \text{ per quarter}$$

$$\begin{aligned} \text{Current Nominal Yield} &= \frac{\$20}{\$1,150} \\ &= 1.74\%/\text{quarter} \\ &= 6.96\%/\text{year compounded quarterly} \end{aligned}$$

Current Effective Yield

$$\begin{aligned}i &= \left(1 + \frac{r}{M}\right)^M - 1 \\ &= \left(1 + \frac{0.0696}{4}\right)^4 - 1 \\ &= 7.14\%\end{aligned}$$

Payback Method

- ▶ Determine how long it will take to pay back the loan
- ▶ Does not take time value of money into account

$$\text{Payback Period} = \frac{\text{Investment}}{\text{Net Receipts}}$$

Or, for non-equal receipts:

n	Net Cash Flows	Cumulative Cash Flows
0	-1,000	-1,000
1	-600	-1,600
2	400	-1,200
3	500	-700
4	750	50
5	1,000	1,050

Discounted Payback Period Method

The payback period is determined by calculating the number of periods it will take to recover the investment, taking into account the interest cost of unrecovered funds.

Example:

n	Net Cash Flows (\$)	Cost of Unrecovered Funds @ i = 10%	Cumulative Cash Flows (\$)
0	-1000.00		-1000.00
1	-600.00	$-\$1,000(0.1) = -\100	-1700.00
2	400.00	$-\$1,700(0.1) = -\170	-1470.00
3	500.00	$-\$1,470(0.1) = -\147	-1117.00
4	750.00	$-\$1,117(0.1) = -\111.70	-478.70
5	1000.00	$-\$478(0.1) = -\47.87	473.43

Net Present Worth Method

- ▶ The summation of the present worth of the positive cash flows and the present worth of the negative cash flows
- ▶ Uses the “Minimum Attractive Rate of Return” (**MARR**) as the interest rate
- ▶ The NPW will vary with the MARR!

Example

Year	0	1	2	3
Machine	-9000	4500	4500	4500

MARR = 8%

$$\begin{aligned} \text{Net Present Worth} &= -9,000 + 4,500(P/A, i = 8\%, n = 3) \\ &= 2,596.95 \end{aligned}$$

Net Future Worth Method

The summation of the future worth of the positive cash flows and the future worth of the negative cash flows at the specified future point in time.

Unrecovered Balance of Investment

Example:

What is the unrecovered balance at t=3 of a \$100,000 investment that produces a positive net cash flow of \$30,000 per year for 10 years? The MARR is 10%.

Period	0	1	2	3
Beginning Balance	0	-100000	-80000	-58000
Interest Cost	0	-10000	-8000	-5800
Cash Flow	-100000	30000	30000	30000
Unrecovered Balance	-100000	-80000	-58000	-33800

The unrecovered balance at t=3 is \$33,800.

Capitalized Cost

- ▶ The Net Present Worth of Long Term Investments
- ▶ The calculation of the net present worth of an infinite or near infinite series of cash flows is referred to as the **capitalization** of the project cost
- ▶ The net present worth of a perpetual series of cash flows is known as the **capitalized cost**

$$\text{Capitalized Cost} = I_0 + \frac{A}{i}$$

I_0 = initial investment

A = periodic upgrade cost or perpetual series

Economic Evaluation of Alternatives

Economic Life is Greater than Study Period

- ▶ Do a standard NPW for each alternative
- ▶ Compare NPWs

Economic Life is Greater than Study Period

Options:

1. The original alternative is replaced with an identical alternative.
2. The original alternative is replaced with a superior alternative that will be available at that time (i.e. the end of the life of the alternative)
3. The remainder of the study period requirements are met by leasing for the remaining duration of the study period

For options 1 and 2 it may be necessary to truncate the cash flows and assume a salvage value at the end of the study period. For option 3 there is no salvage value at the end of the study period because the company does not own the asset.

Unequal Economic Lives

Valid to compare unequal economic lives in the case where, while one alternative may be more expensive, it will complete the task faster. For example two different mining techniques.

If study period is not specified, for example if the need being addressed is indefinite. If the lives of the alternatives being compared are equal, the study period chosen would be equal to the lives of the alternatives. If the lives are unequal the most common choices for a study period are:

1. the least common multiple of the lives of the alternatives
2. the shortest life of the alternatives
3. the longest life of the alternatives.

Equivalent Annual Worth Method

Converts the cash flows associated with each alternative to an equivalent series of annual cash flows. Again, the conversion is done using the MARR as the interest rate.

$$EAW = NPW \cdot (\text{capital recovery factor})$$

$$EAW = NPW(A/P, i = MARR, n)$$

When calculating the EAW of an alternative that has a repeating series of cash flow cycles, calculation of the EAW of any one of the repeating cycles will give the EAW of the entire series.

Equivalent Annual Cost Method – only costs are being analyzed for a particular alternative. Capital costs are often translated into equivalent annual costs so that they can be added to annual operating costs to provide an overall picture of annual costs.

Capital Recovery Cost

Equivalent Annual Cost (EAC) is the same as the **Capital Recovery Cost (CRC)** and is the capital cost spread out over the life minus the salvage cost spread out over the life.

$$CRC = P(A/P, i, N) - S(A/F, i, N)$$

$$CRC = (P - S)(A/P, i, N) + S \cdot (i)$$

P = Acquisition Cost

S = Salvage Value

Unit Profit/Cost

Helpful for comparing. Ex: Truck drives 300,000km/year at a cost of \$37,800 would have a unit cost of \$0.126/km. This number can be compared with other shipping methods.

Also helpful for "Make or Buy" decisions. Cost per unit is helpful here.

EAW With Unequal Lives

Same methods as NPW

Rate of Return

Internal Rate of Return: the interest rate that causes the PW Cash Inflows = PW Cash Outflows. That is, NPW = 0.

Example 1:

An investment of \$50,000 generates positive end of year cash flows of \$20,106 for 3 years. What interest rate will cause the unrecovered balance of the investment to be zero at t=3?

Try $i=10\%$

N	Beginning Investment Balance	Return on Unrecovered Balance 10%	Cash Flow	Ending Balance
0	0	0	-50000	-50000
1	-50000	-5000	20106	-34894
2	-34894	-3489	20106	-18277
3	-18277	-1828	20106	~\$0

If this does not work, try another value. IRR can be found through linear interpolation of two incorrect guesses.

Example 2:

Suppose you invest \$15,000 today and receive payments of \$5,000 at the end of each year for the next 5 years. What is the IRR on this investment?

$$NPW = 0 = -15,000 + 5,000(P/A, i = ?, N = 5)$$

$$5,000(P/A, i = ?, N = 5) = 15,000$$

$$(P/A, i = ?, N = 5) = \frac{15,000}{5,000} = 3.0$$

Therefore, the P/A part must give 3.0 for some value, i.

Try $i = 18\%$, PAIN gives 3.1272

Try $i = 20\%$, PAIN gives 2.9906

$$IRR = 18\% + \frac{3.1272 - 3.0}{3.1272 - 2.9906} \cdot (20 - 18) = 18\% + 1.8624\% = 19.8624\%$$

IRR and MARR

The MARR is the target minimum acceptable rate of return on an investment. The IRR is the actual rate of return on the investment.

If $IRR > MARR$, accept the investment.

If $IRR < MARR$, reject the investment.

If $IRR = MARR$, the investment will earn the target minimum rate of return.

IRR Cautions

1. A cash flow can have more than one IRR
2. The highest IRR does not guarantee the best NPW or EAW

Multiple IRRs possible if the signs of the cash flow switch more than once. Linear interpolation can not be used on these IRRs.

Incremental Analysis

To avoid errors in choosing a mutually exclusive alternative, use incremental analysis.

In incremental analysis, the difference in cash flows between two mutually exclusive alternatives is computed, and then the IRR is computed on the resulting cash flow series.

If $IRR_{Y-X} > MARR$, select Y;

If $IRR_{Y-X} = MARR$, select either one;

If $IRR_{Y-X} < MARR$, select X;

Note: that these rules apply in the case where Y-X is an incremental investment, i.e., negative initial cash flow.

Example:

	0	1	2	3	4
Project X	-\$1,000	\$100	\$350	\$600	\$850
Project Y	-\$1,000	\$1,000	\$200	\$200	\$200
X - Y	\$0	-\$900	\$150	\$400	\$650

IRR (X-Y)

Since $X - Y = 0$ at $t = 0$ we can find the IRR by setting $NPW = 0$ at $t = 1$

Try $i = 13\%$

$$\begin{aligned} \text{NPW (X-Y)} &= -\$900 \\ &+ \$150 \text{ (P/F, } i = 13, N = 2) \\ &+ \$400 \text{ (P/F, } i = 13, N = 2) \\ &+ \$650 \text{ (P/F, } i = 13, N = 3) \\ &= -\$3.11 \text{ (close enough to zero!)} \end{aligned}$$

If MARR is $< 13\%$ X is preferred.
If MARR is $> 13\%$ Y is preferred.

In comparison to Y, X required an incremental investment of \$900 at $t = 1$, yielding higher positive cash flows from $t = 2$ to $t = 4$. The incremental investment is justified (i.e., X is preferred) if MARR is $< 13\%$. It is not justified if MARR is $> 13\%$, i.e. Y is the preferred alternative.

Incremental Analysis of Multiple

Step 1:

Put alternatives in order of increasing initial investment. Only deal with alternatives with IRRs greater than the MARR.

Step 2:

Check the IRR of the first alternative. If it is greater than the MARR, use this alternative as the base case.

Step 3:

Do incremental analysis of the base case with alternative with the next highest initial investment. If the Next-Base IRR gives an IRR greater than MARR, use the Next as the new base case. Repeat step 3 for until best alternative is found.

IRR Analysis – Unequal Lives

Alternatives must be compared on equal lives. Use lowest common multiple to equalize lifespan.

Depreciation

Fixed assets: assets that are used by the business for more than one year, and typically several years. Examples are vehicles, property, and equipment. They depreciate over time.

Depreciation accounting: accountants spread the cost of a fixed asset over time in a manner that matches as best as possible the decline in value over time.

Consider:

1. The cost of the asset
2. The value of the asset at the end of its economic life or salvage value
3. The economic or depreciable life of the asset
4. The depreciation method that will be used for depreciation accounting purposes.

Methods:

1. **Straight-line method**
2. **Declining balance method**
3. Double declining balance method
4. Declining balance converting to straight line method
5. Sum-of-years'-digits (SOYD) method
6. Units of production method

Net Book Value (NBV): initial cost of an asset less accumulated depreciation up to the specified point in time that the net book value is being recorded.

Straight-Line Method

Depreciation Charge:

$$DC = \frac{P - S}{N}$$

DC = depreciation charge in each accounting period

P = the cost of the asset

S = the estimated salvage value at the end of its depreciable life

N = its depreciable life

Net Book Value:

$$Bv_n = P - (n/N(P - s))$$

n = the number of accounting periods into the future where the net book value is being calculated

N = the depreciable life of the asset

Example:

The net book value of our \$100,000 machine after 5 years of its 10 year depreciable life.

$$Bv_n = P - \left(\frac{n}{N} \cdot (P - s) \right)$$

$$Bv_5 = 100,000 - \frac{5}{10}(100,000 - 10,000)$$

$$Bv_5 = 55,000$$

Declining Balance Method

The asset value is depreciated at a constant rate over its depreciable life, giving depreciation charges that decline each subsequent accounting period.

$$DC_n = Bv_{n-1}(\text{depreciation rate})$$

where

DC_n = the depreciation charge for period n

Bv_{n-1} = the net book value at the beginning of period n

Bv_n = the net book value at a specified point in time (n)

$$Bv_n = P(1 - \text{depreciation rate})^n$$

Under Canadian tax laws, the declining balance method is used to depreciate fixed assets.

Fixed assets are classified into certain categories. The allowable depreciation rate for each category is known as the capital cost allowance or CCA. For example brick buildings are Class 3 assets with an allowable CCA of 5%. Vehicles are Class 8 assets with an allowable CCA of 20%. The shorter the life of the asset, the higher the CCA.

Another important factor of Canadian tax law as it relates to depreciation is the so-called "half in the first year rule". According to this rule, in the first year of the ownership of an asset, the cost base used to determine the first year's depreciation charge is half of the acquisition cost.

Example:

Depreciation rate = 30%

n	Depreciation Charge	Net Book Value
0		\$100,000 / 2
1	\$15,000	\$85,000
2	\$25,500	\$59,500
3	\$17,850	\$41,650

The cost base in the first year for the purposes of calculating depreciation is one half of the acquisition cost. At $t = 1$ the cost base reverts back to the full un-depreciated cost base (ie. $\$100,000 - \$15,000 = \$85,000$).

Income Statement

The riskier the business, the higher the required minimum rate of return on investment capital.

Revenues
<u>-Expenses</u>
Taxable Income
<u>-Income Tax</u>
Net Income

Note that income tax payable is determined by multiplying taxable income by the relevant corporate tax rate. Any special tax shelters the company is eligible for reduce the taxes payable.

Revenue = (selling price)(units sold)

Expenses

- ▶ cost of goods sold
- ▶ operating expenses
- ▶ non-operating expenses

Cost of Goods Sold are the direct costs of production. This includes such expenses as raw materials and labor employed in the production of finished goods.

Gross Margin = revenues – costs of goods sold

Operating Expenses are other expenses associated with the business in addition to cost of goods sold expenses.

These are expenses not directly associated with the production of finished goods/services. Typical operating expenses are:

- ▶ Salaries & wages
- ▶ Administration
- ▶ Heat, lights, power
- ▶ Rentals
- ▶ Maintenance
- ▶ Vehicle expense
- ▶ Marketing and promotion
- ▶ Depreciation (depreciation expense associated with production machinery might be included in cost of goods sold)

Non-Operating Expenses are expenses such as interest paid on borrowed money. While some accountants will categorize interest as operating expense, many do not because interest expense is a function of how the business is financed, not how it is operated.

Operating Profit = Gross Margin – Operating Expenses

Profit Before Tax/Taxable Income = Operating Profit – Non-Operating Expenses – Extraordinary Income/Expenses

Extraordinary income or expenses arise from events/activities that do not relate to the normal operation of a business. For example, if a fixed asset is sold at a fair market value that exceeds its net book value, the excess value is recorded as extraordinary income.

Income taxes payable are calculated by multiplying the appropriate income tax rate (according to tax loss) by taxable income.

Net Income/Profit After Tax/Bottom Line = Profit before tax – income taxes

After Tax Cash Flow

After tax cash flow from operating activities = ATCF = Net Income + Depreciation

In calculating taxable income on the income statement, depreciation is one of the allowable expense deductions that reduces taxable income and therefore income taxes.

However, depreciation is not a cash payment like for example, a wage expense. Depreciation is an arbitrary mathematical calculation that is intended to represent the reduction in value of a fixed asset during a given time period. The cash outflow on the acquisition of a fixed asset occurs when the asset is acquired.

Net project cash flow = cash inflow – cash outflow

Elements of an After Tax Cash Flow Analysis:

- ▶ Initial Investment
- ▶ Salvage Value
- ▶ Revenues/Savings
- ▶ Operating and Maintenance Costs
- ▶ Leasing Expenses
- ▶ Investments in Working Capital
- ▶ Liquidation of Working Capital
- ▶ Interest Expense and Repayment of Debt
- ▶ Tax Shelters
- ▶ Income Taxes

Initial Investment A typical project involves an investment in assets. The cash outflow normally consists of the acquisition cost of the asset plus other costs such as shipping, installation and training if they are not included in the acquisition cost.

Salvage Value The salvage value of an asset may or may not be significant in an after tax cash flow analysis depending upon its magnitude and how far out into the future it occurs.

Net salvage value is the fair market value of the asset less any disposal costs and tax effects due to capital gains and losses.

Revenues/Savings Most projects generate a future revenue stream or cost saving both of which represent cash inflows or returns on the initial investment.

Operating and Maintenance Costs Investments on fixed assets typically result in operating costs as well as periodic costs for repairs and maintenance.

Leasing Expenses When assets are leased instead of purchased, the lease payments are cash outflows that must be considered in the analysis.

Investments in Working Capital

Working capital consists of assets such as cash, accounts receivable (amounts owed by customers for goods sold on credit) and inventory (raw material, semi-processed goods and finished goods).

Many investments result in expansion of a business, and therefore a need for more working capital. This can be offset to a degree by buying inventory from suppliers on credit (known as accounts payable) and short term loans, but an incremental investment in working capital often accompanies an investment in fixed assets.

Liquidation of Working Capital

As a project nears the end of its life, inventories are often sold and accounts receivable are collected resulting in a recovery of incremental investment in working capital necessitated by the expansion of the business.

Interest Expense and Repayment of Debt

When projects are financed by borrowing money, the principal borrowed is a cash inflow, whereas interest paid and principal paid back are cash outflows.

Tax Credits

Investments in fixed assets trigger depreciation expenses that are not cash outflows, but they do reduce taxable income, which reduces taxes payable.

Other special tax credits that may apply for certain types of investments will also reduce taxes payable.

Income Tax

To the extent that investments generate incremental profit or income, the profit will be taxable resulting in tax payments.

Summary

Cash Flow = Cash Inflow – Cash Outflow

Cash Inflows:

- ▶ Revenues/cost savings
- ▶ Salvage value
- ▶ Tax saving on capital loss on disposal of an asset
- ▶ Liquidation of working capital
- ▶ Borrowed funds

Cash Outflows:

- ▶ Initial investments
- ▶ Operating costs
- ▶ Repairs and maintenance costs
- ▶ Incremental investment in working capital
- ▶ Interest and principal loan repayments
- ▶ Income taxes

