

Cost Benefit Analysis

These notes are intended to serve as a general guideline for the preparation of cost benefit analysis of capital expenditure projects.

Method

The cost benefit analysis is based on the comparison of a base case and one or more alternatives. For each case all the cash flows over a period of time are identified and organised into a spreadsheet. The bottom line is the net cash flow after tax. This series of cash flows can be converted to a present value (NPV) by using an appropriate discount rate.

The two cash flows from the base case and the alternative are compared. If the NPV of the alternative is greater than the NPV of the base case, then the alternative is economically advantageous. If the two NPVs are the same, then the alternative is economically indifferent to the base case. If the NPV of the alternative is lower than the cash flow of the base case, then the proposal is economically disadvantageous. In the case of a series of alternatives, the same procedure can be applied to find the highest NPV.

Time basis

Cash flows should be analysed for the entire life cycle of the project. In the case of projects involving technology, the life cycle can be quite short. In this situation a minimum of five years is recommended to ensure that there is a suitable upgrade path for the proposed technology.

The forecast of future cash flows usually becomes unreliable after 10 years. A good analysis will typically be from 3 to 10 years.

If the first cash flow occurs at present, it is commonly referred to as Day 1 of Year 0. This amount is not subject to discounting. For the rest of the periods the assumption is that all cash flows accrue to the end of the period and is discounted using the full rate for that period. In some cases it may be appropriate to have different length intervals, such as half year or quarters.

Assumptions

MODEL PARAMETERS								
Parameters		<i>Risk and Country dependent</i>			<i>ProjectWare</i>			
A	Discount Rate	10%						
B	Depreciation Rate for Computer equipment	40%			<i>Dim Balance method</i>			
C	Depreciation rate for other assets	20%						
D	Corporate Tax	30%						
Escalation Basis		<i>Country dependent parameters</i>						
	Wages Inflation	3%	3%	4%	4%	5%	<i>0% for real analysis</i>	
	Prices Inflation	5%	5%	6%	6%	6%		
	Computer Costs fluctuation	2%	2%	2%	2%	2%		
Escalation Indexes			1	2	3	4	5	
E	Wages Inflation	1	1.030	1.061	1.103	1.147	1.205	
F	Prices Inflation	1	1.050	1.103	1.169	1.239	1.313	
G	Computer Costs fluctuation	1	1.020	1.040	1.061	1.082	1.104	
Exchange Rates Fluctuation								
H	AUD/Currency forecast	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Fig 1

The discount rate depends on the cost of equity and funding costs. The analysis should be performed in nominal terms, i.e. allowing for inflation. The discount rate used should reflect this fact. If the analysis is performed in real terms, then a different discount rate must be used.

If the project has overseas components, then a suitable exchange rate should be used.

Inflows

Typical inflows will be related to business activities. Also note that benefits can be generated from incremental savings when the alternative is compared to the base case.

		PROJECT COST AND BENEFITS						
		AUDK	End of...					
INFLOWS		Day 1	Year 1	Year 2	Year 3	Year 4	Year 5	Residue
1	Revenue		200	220	242	266	293	
2	Fees & Commission		20	22	24	27	29	
3	Sale of assets/disposal							
4	Escalated Inflows	0	231	267	311	363	423	0 (1+2+3)*F

Fig 2

Capital Outlays

Capital outlays are subject to a different tax treatment than the general outlays. This is the only reason why they are shown separately. In some cases technology is subject to a deflation in price through time.

		Capital OUTLAYS						
5	Premises, fixtures, fittings		10					
6	Escalated Costs	0	11	0	0	0	0	5*F
7	Computers & Comms.	50	50	50				
8	Escalated Costs	50	51	52	0	0	0	7*G
9	Other Capital			1	1	1	1	
10	Escalated Costs	0	0	1	1	1	1	9*F
11	Total	50	62	53	1	1	1	6+8+10

Fig 3

Other Outlays

They are shown separately to reflect the different escalation rates used.

		IT Operating OUTLAYS						
12	Development costs		200					
13	Operation costs		30	30	30	30	30	
14	Communications		20	20	20	20	20	
15	Software purchase/licence		5					
16	Software maintenance			15	15	15	15	
17	Hardware lease/rental							
18	Hardware maintenance			20	20	20	20	
19	Total Escalated Costs	0	268	94	99	105	112	(12+..+18)*F

Fig 4

Business Operating OUTLAYS									
20	Personnel		50	55	61	67	73		
21	Escalated Costs		0	52	58	67	77	88	20*E
22	Premises								
23	Consumables			2	2	2	2	2	
24	Other								
25	Escalated Costs		0	2	2	2	2	3	(22+23+24)*F
26	Total		0	54	61	70	79	91	21+25

Fig 5

Risk loading of cash flows

Additional cash flows may be included to factor for risk. A probabilistic approach is recommended, i.e. the expected cash flow is the total cash flow associated with the event multiplied by the probability of occurrence (Expected value).

Net Cash flow before tax

Net Cash flow pre Tax									
27		-50	-152	59	141	177	219	0	4-11-19-26

Fig 6

This is the sum of all inflows and outflows.

Tax effects

There are three major tax effects: tax on income, depreciation shield and credit on expenses.

For the depreciation shield, a separate depreciation schedule is needed for each asset category with a different depreciation factor. For the purposes of the analysis, each asset should be “liquidated” at the end of the period and tax on capital gains/losses calculated.

Since tax is payable at the end of the period, cash flows can be lagged by one year. The effective tax paid will depend on the organisation's tax situation.

TAX IMPACT

Depreciation Schedule									
	Day 1	Year 1	Year 2	Year 3	Year 4	Year 5	Residue		
28	Computer residual value	50	101	113	68	41	24	15	
29	Depreciation cost		40	45	27	16	10		28*B
30	Other Assets residual value	0	0	1	2	3	4	3	
31	Depreciation cost		0	0	0	1	1		30*C
32	Total Depreciation		40	45	27	17	10		29+31
Tax Impact									
33	Depreciation Tax shield		12	14	8	5	3		32*D
34	Tax Credit on Expenses		96	46	51	55	61		(19+26)*D
35	Income Tax		69	80	93	109	0		4*D
	Gain/Loss on asset disposal							5	Res(3-28-30)*D
36	Total Tax (lagged)			39	-20	-34	-48	59	33+34-35

Fig 7

Net Cash Flow after Tax

This is the bottom line of the alternative. This is the series of cash flows whose present value is calculated for the economic comparative analysis.

Net Cash Flow after Tax									
37	Converted to AUD\$	-50	-152	99	121	143	171	59	(27+36)*H
	Cumulative Cash Flow	-50	-202	-103	17	160	331	389	+37

Fig 8

Financial Indicators

There are 3 main indicators that can be used for comparative purposes. The net present value (NPV) is the sum of the discounted cash flows. If there is a cash flow at the beginning of the project, it is usually not discounted. Unless using a discount rate that reflects the actual cost of equity and funding, the NPV should not be used as an absolute figure, but for comparison purposes only.

FINANCIAL INDICATORS			
Net Present Value	AUDK	221	NPV(A,37)
Internal Rate of Return	44%	Only if NPV > 0 etc	IRR(37,A)
Payback Period		2.9 Years	

Fig 9

The internal rate of return is an estimate of the return being earned on the initial outlay. It is also the discount rate that produces a zero NPV.

The IRR can be compared to the discount rate as a hurdle rate. Care should be taken as there are multiple mathematical solutions that may not be adequate for the particular set of cash flows.

The Payback period is defined as the time taken to recover the initial outlay. It is calculated as follows:

1. Identify the period in which the cumulative cash flow becomes positive. This is the Payback year
2. Divide the cumulative cash flow at the end of the previous year by the total cash flow for the Payback year, ignoring the negative sign.
3. The Payback period will be the Payback year plus the fraction calculated in the previous point.

Impact to Profit and Loss account

The data used in the previous analysis can be used to calculate the impact of the project in the Profit and Loss account. The major difference between cash flow analysis and P&L is in the treatment of capital expenditure., The cost of book depreciation is used to amortise the expense over the life of the assets. The main correction to the cash flows is to add back the capital outlays and replace with the book depreciation cost. Note that the book depreciation cost is different from tax depreciation. It is usually 20% straight-line method.

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