IIT ROORKEE

NPTEL ONLINE CERTIFICATION COURSE

Project Management for Managers

Lec – 16

Capital Budgeting techniques- I

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D : $\frac{\text{Average income after tax but before interest}}{\text{Average investment}}$

E : $\frac{\text{Average income before interest and taxes}}{\text{Initial investment}}$

F : $\frac{\text{Average income before interest and taxes}}{\text{Average investment}}$

G : $\frac{\text{Total income after tax but before depreciation} - \text{Initial investment}}{(\text{Initial investment} / 2) \times \text{years}}$

Year	Investment (Book value)	Depreciation	Income before Interest and Taxes	Interest	Income before Tax	Tax	Income after Tax
1	1.00	0.20	0.30	0.10	0.20	0.100	0.100
2	0.80	0.20	0.35	0.10	0.25	0.125	0.125
3	0.60	0.20	0.40	0.10	0.30	0.150	0.150
4	0.40	0.20	0.40	0.10	0.30	0.150	0.150
5	0.20	0.20	0.35	0.10	0.25	0.125	0.125
Sum	3.00	1.00	1.80	0.50	1.30	0.650	0.650
Average	**0.60**	**0.20**	**0.36**	**0.10**	**0.26**	**0.130**	**0.130**

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Average	0.60	0.20	0.36	0.10	0.26	0.130	0.130

Measures

A: $$\frac{\text{Average income after tax}}{\text{Initial investment}} = \frac{0.13}{1.00} = 13.0\%$$

B: $$\frac{\text{Average income after tax}}{\text{Average investment}} = \frac{0.13}{0.60} = 21.7\%$$

C: $$\frac{\text{Average income after tax but before interest}}{\text{Initial investment}} = \frac{0.13 + 0.10}{1.0} = 23.0\%$$

D: $$\frac{\text{Average income after tax but before interest}}{\text{Average investment}} = \frac{0.13 + 0.10}{0.60} = 38.3\%$$

E: $$\frac{\text{Average income before interest and tax}}{\text{Initial investment}} = \frac{0.36}{1.0} = 36\%$$

F: $$\frac{\text{Average income before interest and tax}}{\text{Average investment}} = \frac{0.36}{0.60} = 60\%$$

G: $$\frac{\text{Total income after tax but before depreciation} - \text{Initial investment}}{(\text{Initial investment} / 2) \times \text{years}} = \frac{0.65 + 1.00 - 1.00}{1/2 \times 5} = 26.0\%$$

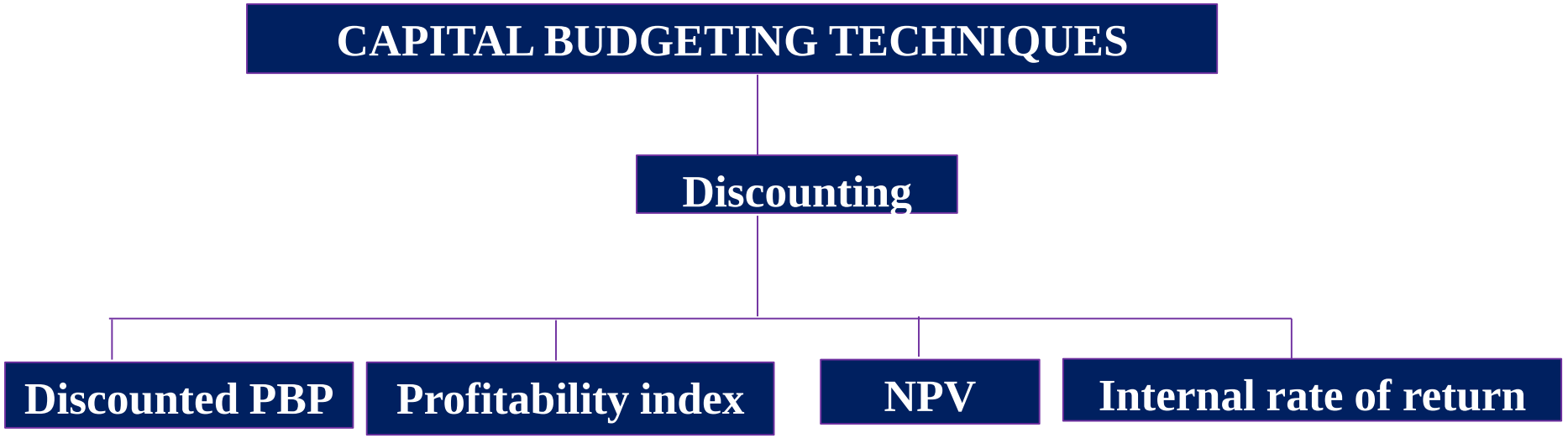
De-merits of ARR method:

Like the pay-back period method, this method **ignores** the **time value of money.**

This method takes into account the accounting **profits** rather than the cash inflows and hence **ignores the fact that the actual cash flows can be re-invested.**

It is the discretion of the management to choose the **arbitrary cut-off rate of return** in choosing the projects. This may not always ensure the right selection.

The concept of average investment and average earnings **differ widely** and hence may produce different results.


CAPITAL BUDGETING TECHNIQUES
Discounting
Discounted PBP
Profitability index
NPV
Internal rate of return

Time value of money: Money available today is more than tomorrow.

Compound amount = Principal $(1+ r)^n$

or , Principal = Compound amount / $(1+ r)^n$

or , present value of money = future value * present value factor

where PVF = $1/(1+ r)^n$

r = Discount factor,

n = No of periods

Present value: Any **value that occurs at the beginning of the problem** is a present value. As zero is good baseline, **all cash flows are converted into their present value for analysis**.

PVF is the ratio of PV and future value and is available in the form of table.

Future value: ????????????

Future value: The **last cash flow** is generally called future value, it can be understood as the **cash transaction taking place after certain duration of time**. If the **same amount is transacted after a regular interval,** it is termed annuity.

Annuity payment: ??????????????????

Annuity payment: As per literary meaning, an annuity payment means the **yearly payment that occurs every year for more than one year.**

But in financial terms, the duration may not be yearly, it may be less as well, say quarterly, monthly, weekly etc., but the **duration b/w two successive payments remains constant**.

Each **payment, if taken alone, is a future value**, but together they make an annuity.

Discount factor: DF is the **expected returns per unit of period over the life of the project or investment.**

It is necessary to understand that **if annuity is for quarterly payment or transactions**, the **annual expected return should be reduced to one quarter** for computational purpose, similarly 1/12, if it is monthly.

Number of periods: The total no. of periods in any annuity is very important as they **define the value of annuity**.

It should again be noted that **if transactions are done yearly**, it is the no. of years, but in the situation of **quarterly payments, the no. of periods should be quadrupled the no. of years.**

Ex: Mr Sharma wishes to invest some money for future need of 5 lac after 5 yrs. @ 9 %, how much money should he deposit in Bank.
If interest is paid semi annually, then how much money should he deposit in Bank.

Ex: Mr Sharma wishes to invest some money for future need of 5 lac after 5 yrs, @ 9 %, how much money should he deposit in Bank

Present value = $500000/(1+0.09)^5$

= 325000

What if interest is paid semi annually?

Present value = $500000/(1+0.045)^{10}$ = 318712

Ex: Mr X wants to receive 120,000 every year for next 10 years (starting from next year from now).How much should he deposit now ? If interest rate is 10%.????

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Present value of an annuity of ₹ 1 paid for period t at a rate $k = [1 - 1/(1 + k)^t]/k$

	Rate																			
Period	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%
1	0.990	0.980	0.971	0.962	0.952	0.943	0.935	0.926	0.917	0.909	0.901	0.893	0.885	0.877	0.870	0.862	0.855	0.847	0.840	0.833
2	1.970	1.942	1.913	1.886	1.859	1.833	1.808	1.783	1.759	1.736	1.713	1.690	1.668	1.647	1.626	1.605	1.585	1.566	1.547	1.528
3	2.941	2.884	2.829	2.775	2.723	2.673	2.624	2.577	2.531	2.487	2.444	2.402	2.361	2.322	2.283	2.246	2.210	2.174	2.140	2.106
4	3.902	3.808	3.717	3.630	3.546	3.465	3.387	3.312	3.240	3.170	3.102	3.037	2.974	2.914	2.855	2.798	2.743	2.690	2.639	2.589
5	4.853	4.713	4.580	4.452	4.329	4.212	4.100	3.993	3.890	3.791	3.696	3.605	3.517	3.433	3.352	3.274	3.199	3.127	3.058	2.991
6	5.795	5.601	5.417	5.242	5.076	4.917	4.767	4.623	4.486	4.355	4.231	4.111	3.998	3.889	3.784	3.685	3.589	3.498	3.410	3.326
7	6.728	6.472	6.230	6.002	5.786	5.582	5.389	5.206	5.033	4.868	4.712	4.564	4.423	4.288	4.160	4.039	3.922	3.812	3.706	3.605
8	7.652	7.325	7.020	6.733	6.463	6.210	5.971	5.747	5.535	5.335	5.146	4.968	4.799	4.639	4.487	4.344	4.207	4.078	3.954	3.837
9	8.566	8.162	7.786	7.435	7.108	6.802	6.515	6.247	5.995	5.759	5.537	5.328	5.132	4.946	4.772	4.607	4.451	4.303	4.163	4.031
10	9.471	8.983	8.530	8.111	7.722	7.360	7.024	6.710	6.418	6.145	5.889	5.650	5.426	5.216	5.019	4.833	4.659	4.494	4.339	4.192
11	10.368	9.787	9.253	8.760	8.306	7.887	7.499	7.139	6.805	6.495	6.207	5.938	5.687	5.453	5.234	5.029	4.836	4.656	4.486	4.327
12	11.255	10.575	9.954	9.385	8.863	8.384	7.943	7.536	7.161	6.814	6.492	6.194	5.918	5.660	5.421	5.197	4.988	4.793	4.611	4.439
13	12.134	11.348	10.635	9.986	9.394	8.853	8.358	7.904	7.487	7.103	6.750	6.424	6.122	5.842	5.583	5.342	5.118	4.910	4.715	4.533
14	13.004	12.106	11.296	10.563	9.899	9.295	8.745	8.244	7.786	7.367	6.982	6.628	6.302	6.002	5.724	5.468	5.229	5.008	4.802	4.611
15	13.865	12.849	11.938	11.118	10.380	9.712	9.108	8.559	8.061	7.606	7.191	6.811	6.462	6.142	5.847	5.575	5.324	5.092	4.876	4.675
16	14.718	13.578	12.561	11.652	10.838	10.106	9.447	8.851	8.313	7.824	7.379	6.974	6.604	6.265	5.954	5.668	5.405	5.162	4.938	4.730
17	15.562	14.292	13.166	12.166	11.274	10.477	9.763	9.122	8.544	8.022	7.549	7.120	6.729	6.373	6.047	5.749	5.475	5.222	4.990	4.775
18	16.398	14.992	13.754	12.659	11.690	10.828	10.059	9.372	8.756	8.201	7.702	7.250	6.840	6.467	6.128	5.818	5.534	5.273	5.033	4.812
19	17.226	15.678	14.324	13.134	12.085	11.158	10.336	9.604	8.950	8.365	7.839	7.366	6.938	6.550	6.198	5.877	5.584	5.316	5.070	4.843
20	18.046	16.351	14.877	13.590	12.462	11.470	10.594	9.818	9.129	8.514	7.963	7.469	7.025	6.623	6.259	5.929	5.628	5.353	5.101	4.870

Solution:120000*6.145 (from table) = 737400.

Discounted PBP: while evaluating projects with DPBP method, **present values of cash flow are considered instead of cash flow itself** as in the case of PBP method.

DPBP is **length of time required to recover the initial cash outflow** from the discounted future cash flow.

DPBP = Y0- (Cu.PV0)/(CF1)

Y0 = is the year just before the pay back period is attained

CuPV0 = cumulative present value of Y0

CF1 = cash flow of pay back year

Ex: Find DPBP ????, if discount factor is 10%

Year	Cash flow
0	-140
1	30
2	40
3	50
4	60
5	45

DPBP= Y0- (Cu.PV0)/(CF1),

Y0 = is the year just before the pay back period is attained

CuPV0 = cumulative present value of Y0

CF1= cash flow of pay back year

Ex: FIND DPBP, if discount factor is 10%

Year	Cash flow	PVF	PV	CuPV
0	-140	1	-140	-140
1	30	$1/(1+0.10) = 0.90$	27	-113
2	40	$1/(1+0.10)^2 = 0.82$	33.04	-79.96
3	50	$1/(1+0.10)^3 = 0.75$	37.55	-42.41
4	60	$1/(1+0.10)^4 = 0.68$	40.98	-1.43
5	45	$1/(1+0.10)^5 = 0.62$	27.94	26.51

DPBP = 4 - (-1.43/27.94) = 4.05 yrs

Ex: Find DPBP ????, if DF=10%

Year	Cash flow
0	-300
1	80
2	80
3	180
4	180
5	180

Net Present Value

NPV: NPV is the most common approach used in the filed of financial investment analysis.

It is very **simple** to use and evaluate on the basis of **wealth maximization objective**.

It is defined as the **difference b/w the present value of cash inflows and present value of cash outflows .**

Advantages of NPV

1. Considers all cash flows.
2. Considers time value of money.
3. Computes contribution towards wealth creation.
4. Allows expected changes in cost of capital.

The limitation of NPV

1. Requires pre-determination of DF.
2. Does not consider risk factors.

Determine PI and NPV, assuming DF as 10%, should we accept this project??

Year	Cash flow
0	-160
1	30
2	40
3	50
4	60
5	100

Determine PI and NPV, assuming DF as 10%

Year	Cash flow	PVF (10%)	PV	
	-160	1	-160	
1	30	$1/(1+0.10) = 0.9091$	27.27	
2	40	$1/(1+0.10)^2 = 0.826$	33.06	
3	0	$1/(1+0.10)^3 = 0.751$	37.57	200.56
4	60	$1/(1+0.10)^4 = 0.683$	40.57	
5	100	$1/(1+0.10)^5 = 0.621$	62.09	
		Total	**40.56**	

PI = 200.56/160 = 1.25

NPV = 200.56-160 = 40.56,

We should accept project.

Ex: **Determine PI and NPV, assuming DF as 10%**

Year	Cash flow
0	-140
1	30
2	40
3	50
4	60
5	45

Should we accept this project????