Capital Budgeting/Investment Appraisal: Tools & Techniques

PGC - AFM

MODULE – 2: CORPORATE FINANCE FUNDAMENTALS

PROF. M SHAMEEM JAWED, IIM VISAKHAPATNAM

For Firm's growth and survival in the competitive market space, it needs…

Constant Flow of Ideas, for:

- Developing **New Product/Services**
- Improving the **quality of existing** Product/Service
- **Reducing the cost** of production/operations
- Reach to **new markets/geographies**, etc.

Thus, good companies should always be looking new project proposals, screen them and choose the ones which are value maximizing!

Capital Budgeting?

Process of identifying projects that add value to the firm (shareholders).

At mid/senior management levels, Capital Budgeting is perhaps one of the most important and crucial decisions which managers make. **Why**?

Ans (Why?)

Cap. Budgeting:

- Defines the **strategic direction** of the firm(Product/Geographical diversification)
- **Long term implications** (reducing financial flexibility)
- Poor decisions can have serious value eroding consequences in future
  - (**Overinvestment/ underinvestment**) leading to excess capacity or inferior quality w.r.t. competition resulting in reduced profitability or shrinking market share.

Six most used Capital Budgeting Methods…

Net Present Value (NPV)

Internal Rate of Return (IRR)

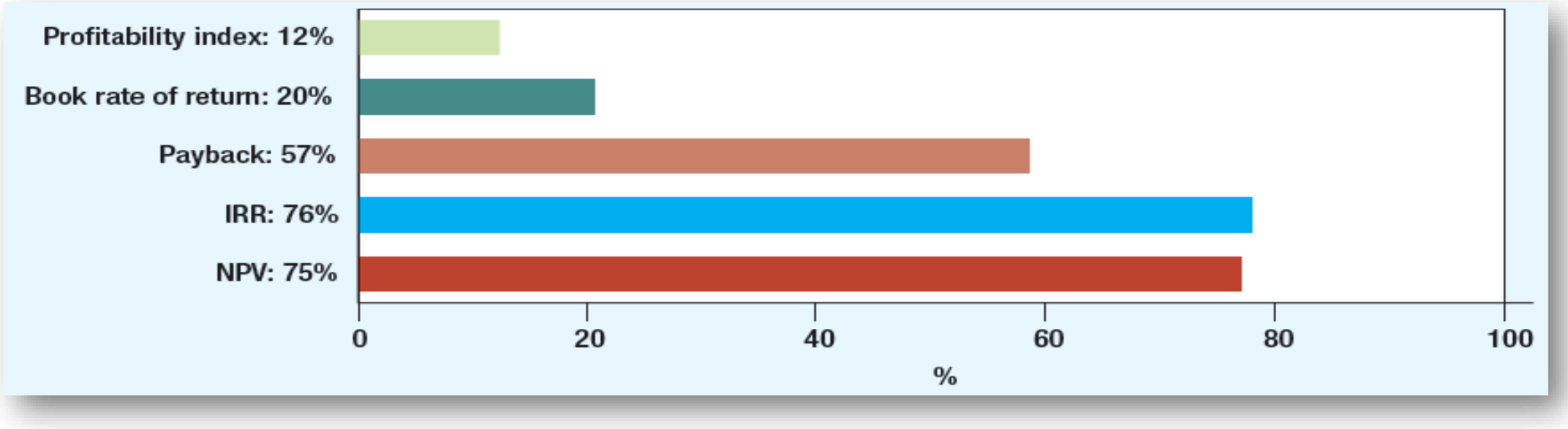
Modified Internal Rate of Return (MIRR)

Payback Method

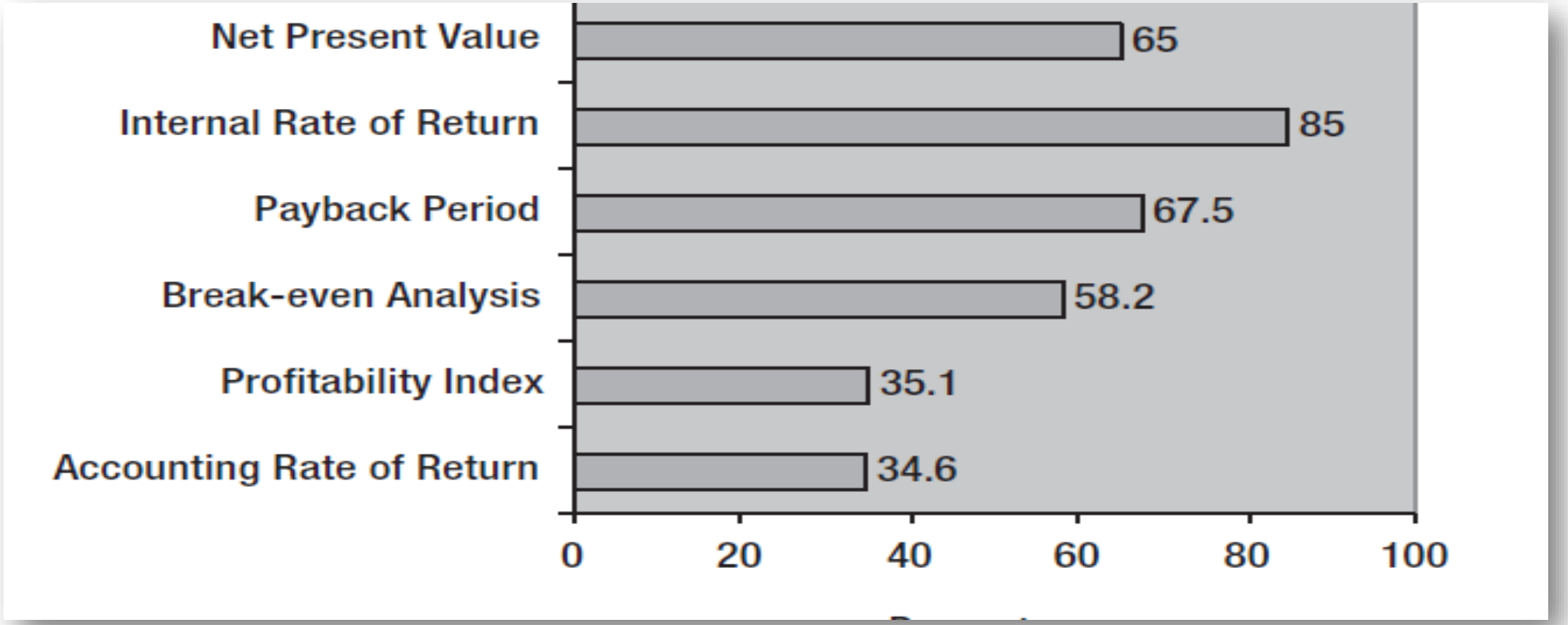
Discounted Payback Method

Profitability Index (PI)

CFO Decision Tools (Globally)



CFO Decision Tools (India)



Capital Budgeting Methods Used in Practice: A Temporal View

	Primary Criterion			Calculate and Use
	1960	1970	1980	1999
NPV	0%	0%	15%	75%
IRR	20	60	65	76
Payback	35	15	5	57
Discounted Payback	NA	NA	NA	29
Other	45	25	15	NA
Totals	100%	100%	100%	

Sources: The 1999 data are from John R. Graham and Campbell R. Harvey, "The Theory and Practice of Corporate Finance: Evidence from the Field," *Journal of Financial Economics,* 2001, pp. 187–244. Data from prior years are our estimates based on averaging data from these studies: J. S. Moore and A. K. Reichert, "An Analysis of the Financial Management Techniques Currently Employed by Large U.S. Corporations," *Journal of Business Finance and Accounting,* Winter 1983, pp. 623–645; and M. T. Stanley and S. B. Block, "A Survey of Multinational Capital Budgeting," *The Financial Review,* March 1984, pp. 36–51.

Project S & L

Project/Year	t=0	t=1	t=2	t=3	t=4
Project-S	-1,000	500	400	300	100
Project-L	-1,000	100	300	400	600
Cost of Capital = (Project)		10%			

Net Present Value (NPV) Method

$$NPV = CF_0 + \frac{CF_1}{(1+r)^1} + \frac{CF_2}{(1+r)^2} + \cdots + \frac{CF_N}{(1+r)^N}$$

- Let's calculate the NPV of Project S & L…

NPV In MS-Excel

= NPV(rate, value1, value2, …., value(n)) – value0

E.g.,

= NPV (0.1, B2 : B12) – B1

= NPV (10%, B2 : B12) – B1

Internal Rate of Return

Example

- Tool A costs 4,000. Investment will generate Rs. 2,000 and Rs. 4,000 in cash flows for two years. What is IRR?

$$NPV = \sum_{t=0}^{n} \frac{CF_t}{(1 + IRR)^t} = 0.$$

$$NPV = -4{,}000 + \frac{2{,}000}{(1+IRR)^1} + \frac{4{,}000}{(1+IRR)^2} = 0$$

$$IRR = 28.08\%$$

IRR In MS-Excel

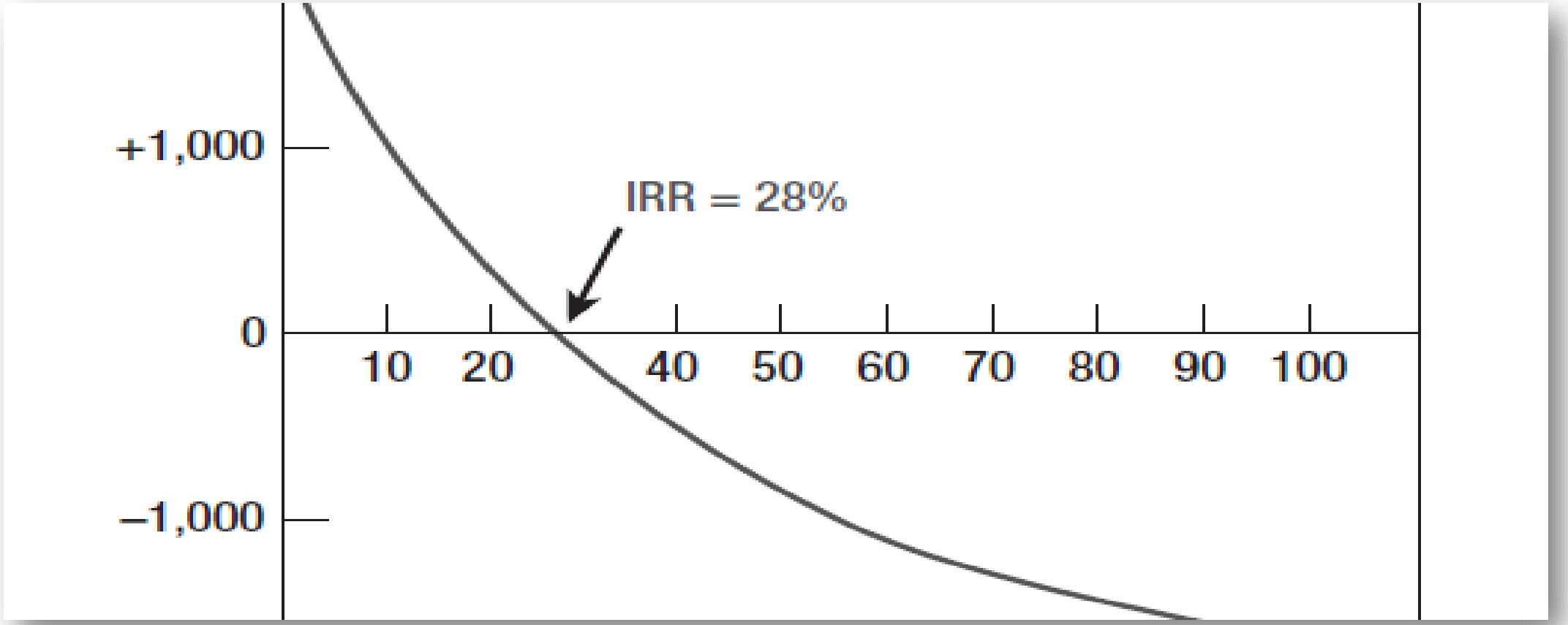
= IRR(value0, value2, ……, value(n), Guess)

E.g.,

= IRR (B1 : B12, 0.1)

= IRR (B1 : B12, 10%)

Internal Rate of Return



Internal Rate of Return

Pitfall 1: Lending or Borrowing?

- IRR?
- NPV ?

Project/Year	t=0	t=1
A	-1,000	1500
B	+1,000	-1500
Cost of Capital of the (Projects) = 10%		

Internal Rate of Return

Pitfall 1: Lending or Borrowing?

- NPV of project increases as discount rate increases for some cash flows

	Cash Flows, ₹			
Project	C_0	C_1	IRR	NPV at 10%
A	−1,000	+1,500	+50%	+364
B	+1,000	−1,500	+50%	−364

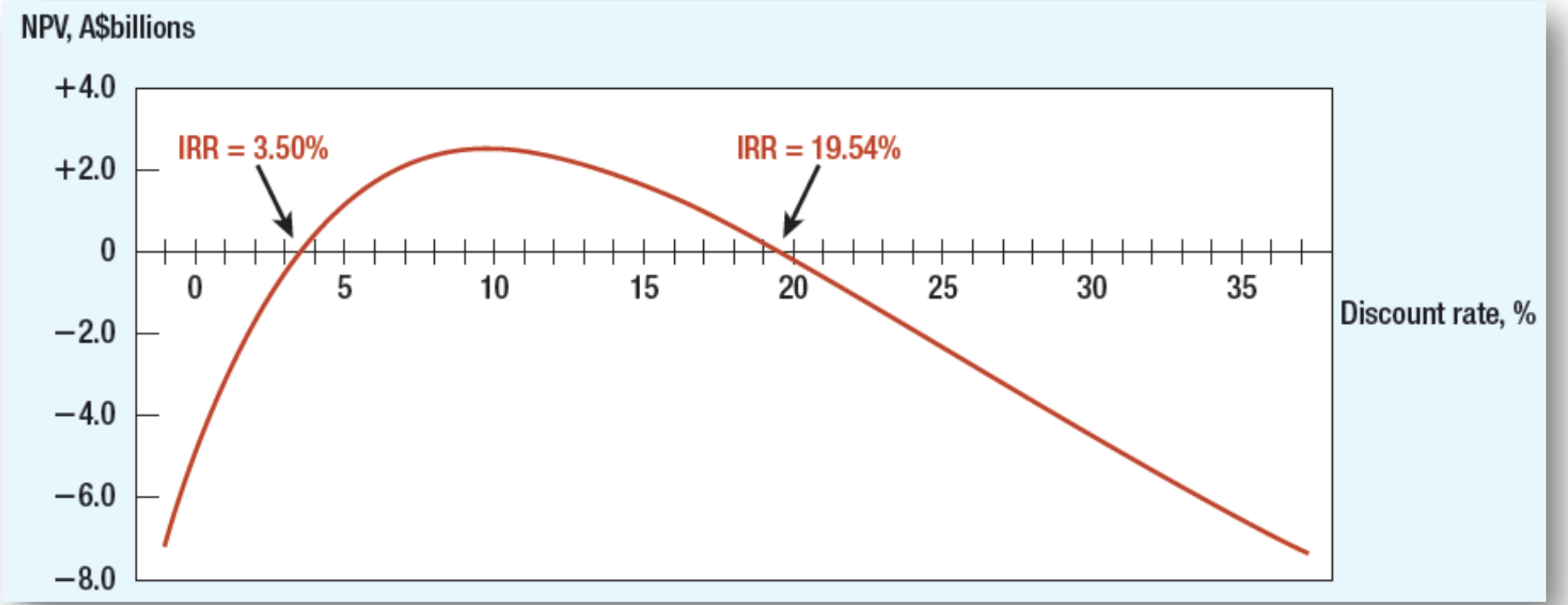
Internal Rate of Return

Pitfall 2: Multiple Rates of Return

- Certain cash flows generate NPV = 0 at two different discount rates
  - Following cash flow generates NPV = $A253 million at IRR% of 3.5% and 19.54%

Cash Flows (billions of Australian dollars)				
C_0	C_1	. . .	C_9	C_{10}
−30	10		10	−65

Multiple Rates of Return



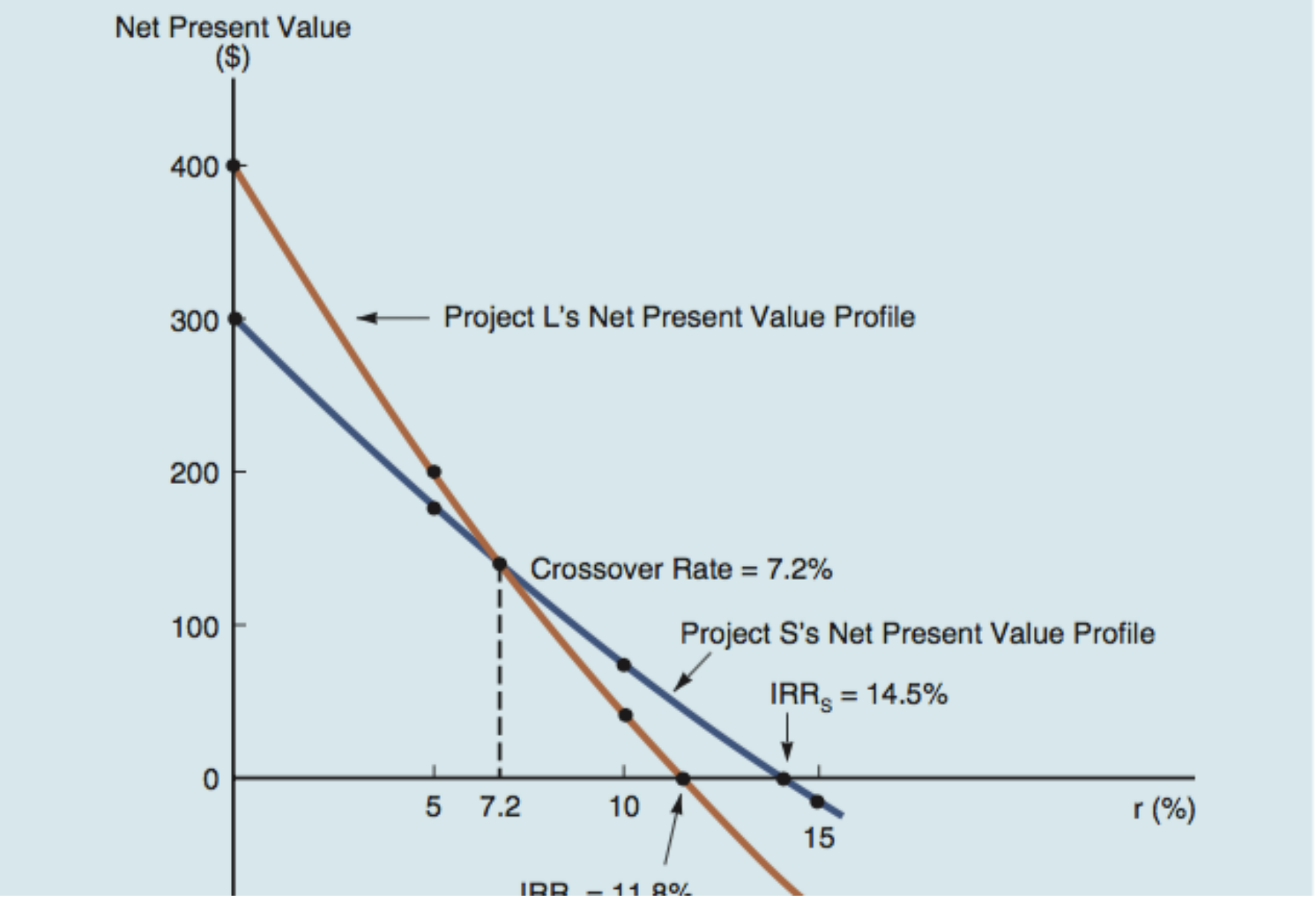
Internal Rate of Return

Pitfall 3: Mutually Exclusive Projects

- IRR sometimes ignores magnitude of project

	Cash Flows, ₹			
Project	C_0	C_1	IRR (%)	NPV at 10%
D	−10,000	+20,000	100	+ 8,182
E	−20,000	+35,000	75	+11,818

Project/Year	t=0	t=1	t=2	t=3	t=4
Project-S	-1,000	500	400	300	100
Project-L	-1,000	100	300	400	600
Cost of Capital = (Project)		7.0%			


Net Present Value
($)
400
300
200
100
0
Project L's Net Present Value Profile
Crossover Rate = 7.2%
Project S's Net Present Value Profile
IRR$_S$ = 14.5%
5
7.2
10
15
r (%)

Internal Rate of Return

Pitfall 4: More than One Opportunity Cost of Capital

- Term Structure Assumption
  - Assume discount rates stable during term of project

- Implies all funds reinvested at IRR
  - False assumption

MIRR

$$\sum_{t=0}^{N} \frac{COF_t}{(1+r)^t} = \frac{\sum_{t=0}^{N} CIF_t (1+r)^{N-1}}{(1+MIRR)^N}$$

$$\text{PV of costs} = \frac{\text{Terminal value}}{(1+MIRR)^N}$$

$$= \text{PV of terminal value.}$$

MIRR in MS-Excel

=MIRR(cash flows, financing rate, reinvestment rate)

- Where:
  - *Cash Flows* – Individual cash flows from each period in the series
  - *Financing Rate* – Cost of borrowing or interest expense in the event of negative cash flows
  - *Reinvestment Rate* – Compounding rate of return at which positive cash flow is reinvested

Payback

Payback Period

- Number of years before cumulative cash flow equals initial outlay

Payback Rule

- Only accept projects that pay back within desired time frame
- Ignores later year cash flows and present value of future cash flows

Payback

Example

- Find disadvantage of only taking projects with payback period of two years or less

	Cash Flows, ₹					
Project	C_0	C_1	C_2	C_3	Payback Period (years)	NPV at 10%
A	−2,000	500	500	5,000	3	+2,624
B	−2,000	500	1,800	0	2	−58
C	−2,000	1,800	500	0	2	+50

Discounted Payback

Number of years required to recover the investment from *discounted* net cash flows.

Project S	Year:	0	1	2	3	4
	Cash flow:	(1,000)	500	400	300	100
	Discounted cash flow:	(1,000)	455	331	225	68
	Cumulative discounted CF:	(1,000)	(545)	(215)	11	79
	Percent of year required for payback:		1.00	1.00	0.95	0.00
	Discounted Payback:	2.95				

Let’s now talk a little about the X-factor!

Can you point out one basic underlying assumption in all the methods discussed so far which may not be true in real life?

- Timing of cash flows – both in and out!
- Cash don’t wait till the end of the year to come and go!

=XNPV(rate, values, dates) ,

=XIRR (values, date, guess[rate])

Choosing Capital Investments When Resources are Limited

Capital Rationing

- Limit set on amount of funds available for investment
  - **Soft Rationing**
    - Imposed by management
  - **Hard Rationing**
    - Imposed by unavailability of funds in capital market

Choosing Capital Investments When Resources are Limited

Profitability Index (PI)

- Tool for selecting between project combinations and alternatives
- Set of limited resources and projects can yield various combinations
- Highest weighted average PI indicates optimal project

Choosing Capital Investments When Resources are Limited

Cash Flows (₹ millions)					
Project	C_0	C_1	C_2	NPV at 10%	Profitability Index
A	−10	+30	+5	21	2.1
B	−5	+5	+20	16	3.2
C	−5	+5	+15	12	2.4
D	0	−40	+60	13	0.4

$$\text{Profitability index} = \frac{\text{Net PV of Furture Cash inflows}}{\text{Investments (Net PV of cash outflows)}}$$

Choosing Capital Investments When Resources are Limited

Example

- Select best projects for Rs. 300,000

Project	NPV	Investment	PI
A	230,000	200,000	1.15
B	141,250	125,000	1.13
C	194,250	175,000	1.11
D	162,000	150,000	1.08

Choosing Capital Investments When Resources are Limited

Example

Project	NPV	Investment	PI
A	230,000	200,000	1.15
B	141,250	125,000	1.13
C	194,250	175,000	1.11
D	162,000	150,000	1.08

Select Projects with highest Weighted average PI.

$$\text{WAPI(B,D)} = \frac{1.13*(125)}{300} + \frac{1.08*(150)}{300} + \frac{0.00*(25)}{300} = 1.01$$

Choosing Capital Investments When Resources are Limited

Example (Continued)

Project	NPV	Investment	PI
A	230,000	200,000	1.15
B	141,250	125,000	1.13
C	194,250	175,000	1.11
D	162,000	150,000	1.08

Select projects with highest weighted average PI

- WAPI (BD) = 1.01
- WAPI (A) = 0.77
- WAPI (BC) = 1.12

Let’s turn to the case:

Let’s turn to the case – 1

Take 5 minutes and
read the Case…

Which are the top four projects to be recommended?

Project	#1	#2	#3	#4	#5	#6	#7	#8
Initial Investment	-10,000	-10,000	-10,000	-10,000	-10,000	-10,000	-10,000	-10,000
Year								
1	1,500	7,000	0	800	1,400	11,000	6,000	-1,750
2	1,500	5,000	0	1,000	1,400		4,500	-300
3	1,500	100	0	1,000	1,400		1,500	300
4	1,500		0	1,000	1,400		450	1,750
5	1,500		0	2,000	1,400		350	3,500
6	1,500		0	2,000	1,400			6,000
7	1,500		0	2,000	1,400			11,250
8	8,000		0	3,000	1,400			
9			0	3,000	1,400			
10			29000	3,000	1,400			
11				2,000	1,400			
12				2,000	1,400			
13				-1,000	1,400			
14					1,400			
15					1,400			
Sum of Cash Flows	18,500	12,100	29,000	21,800	21,000	11,000	12,800	20,750
Excess Cash Flow	8,500	2,100	19,000	11,800	11,000	1,000	2,800	10,750

For projects with unequal life…

- Repeated Chain Method
- Equivalent Annuity Method

Do we get the cash flows (on a platter) for real life projects?

- No, someone needs to estimate them…
- Can we do it ourselves?

New Project – Cash flow analysis for CB Analysis

- Take a look at the Regency Integrated Chips (RIC)
- What is it all about – what's the managerial dilemma?
- If you are that manger – what will you do. What will be basis of your decision?

Thank you