SESSION 2.4

ESTIMATION OF ECONOMIC INTERNAL RATE OF RETURN

Introductory Course on Economic Analysis of Investment Projects

Economics and Research Department (ERD)

Project Economic Assessment

- Comparison of economic costs and benefits over certain period.
- Three types of project decisions:
  - Choose the least-cost option for the same benefits,
  - Choose the best among project alternatives,
  - Determine economic viability of the single alternative.
- Factors considered in the assessment:
  - Economic costs and benefits
  - Timing of costs and benefits
  - Discount rate
  - Residue value

Economic Viability depends on the following:

1. NPV
   - Do not accept projects with negative NPV.
   - For mutually exclusive projects in the same time frame without cost constraints, the project with largest NPV is favored
   - NPV is sensitive to discount rate.

2. IRR
   - When only one project alternative is considered, the *IRR* can be used for project decision, i.e. only proceed with the project if the *IRR is greater* than the default discount rate.
   - IRR is ratio instead of value. It should not be used to select one project from a group of candidate projects because size of the project matters.

Sample EIRR Calculation 1

Year	GROSS BENEFITS Non-Increm	Increm	Total Benefits	ECONOMIC COSTS Capital Investmnt	O&M	Total Cost	Net Economic Benefit
2004	0	0	0	73.2	0	73.2	-73.2
2005	0	0	0	156.6	0	156.6	-156.6
2006	0	0	0	201.7	0	201.7	-201.7
2007	0	0	0	226.3	0	226.3	-226.3
2008	0	0	0	188.0	0	188.0	-188.0
2009	1.5	36.2	37.7	106.6	2.1	108.7	-71.0
2010	10.2	243.3	253.5	7.2	14.5	21.8	231.7
2011	11.0	239.6	250.5	0	14.5	14.5	236.0
2012	11.9	239.6	251.4	0	14.5	14.5	236.9
2013	12.4	239.6	251.9	0	14.5	14.5	237.4
2014	12.4	239.6	251.9	0	13.9	13.9	238.1
2015	12.4	239.6	251.9	0	13.3	13.3	238.6
2016	12.4	239.6	251.9	0	13.3	13.3	238.6
2017	12.4	239.6	251.9	0	13.3	13.3	238.6
2018	12.4	239.6	251.9	0	18.9	18.9	233.0
2019	12.4	239.6	251.9	0	18.9	18.9	233.0
2020	12.4	239.6	251.9	0	18.9	18.9	233.0
2021	12.4	239.6	251.9	0	18.9	18.9	233.0
2022	12.4	239.6	251.9	0	13.3	13.3	238.6
2023	12.4	239.6	251.9	0	13.3	13.3	238.6
2024	12.4	239.6	251.9	0	13.3	13.3	238.6
2025	12.4	239.6	251.9	0	13.3	13.3	238.6
2026	12.4	239.6	251.9	0	13.3	13.3	238.6
2027	12.4	239.6	251.9	0	13.3	13.3	238.6
2028	12.4	239.6	251.9	0	13.3	13.3	238.6
2029	12.4	239.6	251.9	0	13.3	13.3	238.6
2030	12.4	239.6	251.9	0	13.3	13.3	238.6
2031	12.4	239.6	251.9	0	18.9	18.9	233.0
2032	12.4	239.6	251.9	0	18.9	18.9	233.0
2033	12.4	239.6	251.9	0	18.9	18.9	233.0
2034	10.3	247.6	257.9	0	18.9	18.9	239.0
NPV @	48.1	972.2	1020.3	641.6	60.3	701.9	318.4
Unit: USD million						EIRR =	16.8%

Project Decisions (I)

- Choosing between alternatives when the same benefits are to be achieved
  - Select the one with the lowest present value of economic costs at a chosen discount rate.
  - Including cases where benefits are hard to quantify; However, the alternatives may not provide exactly the same level of output, or different alternatives have multiple and differing outcomes.

Project Decisions (II)

- Choosing between alternatives when benefits are not the same and can be valued
  - Select the one with the highest, positive NPV at the chosen discount rate.
  - IRR is not the right indicator because it does not reflect project size.
  - Pay attention to the underlying assumptions: a) alternatives are within budget; b) alternatives have the same time frames.
- Determining economic viability of the single alternative
  - IRR> default discount rate or NPV>0

Time Frames of Projects

- Projects with different time frames are not directly comparable.
- An example
  - A major hydroelectric dam (HED), which would last 60 years, versus a cogeneration plant (CGP), which would last 20 years.
  - NPV of HED is $32 million and NPV of CGP is $30 million.
  - Assume discount rate of 12%

$$NPV(CGP*3) = 30 + \frac{30}{(1+0.12)^{20}} + \frac{30}{(1+0.12)^{40}} = 33.4$$

Discount Rate

- Also referred to as social discount rate
  - Reflect the social marginal rate of time preference;
  - Exceed in theory the marginal rate of return on private investment;
- ADB uses 12 percent
  - Reject (sub)projects with an IRR < 12% unless there are substantial unquantifiable benefits
  - Relatively conservative if benefits occur in the future.

Residual Value

- The project is usually assessed over a limited time period. The benefits and costs, however, may extend far after the assessment horizon.
  - In practice, the assessment of the assessment period is determined by the nature of each project.

- Methods to estimate residual values
  - Simple projection
  - Liquidation value
  - Depreciated value
  - Equal to zero

EIRR Calculation (2)

	BENEFITS						COSTS			
	VOC Savings		Passenger	Savings in	Terminal	Total		Road	Total	Net
	Normal	Generated	Time Savings	Maintenance	Value	Benefits	Capital	Maintenance	Cost	Benefits
2009	0	0	0	0	0	0	60.80	0.00	60.80	-60.80
2010	0	0	0	0	0	0	44.68	0.00	44.68	-44.68
2011	12.31	3.026	2.145	0	0	17.48	47.63	0.00	47.63	-30.15
2012	13.25	3.404	2.367	0.084	0	19.11		0.06	0.06	19.05
2013	14.28	3.678	2.604	0.042	0	20.60		0.03	0.03	20.58
2014	15.39	3.971	2.865	0	0	22.22		0.11	0.11	22.11
2015	16.59	4.285	3.153	0	0	24.02		0.16	0.16	23.87
2016	17.89	4.622	3.469	0	0	25.98		2.10	2.10	23.87
2017	19.29	4.984	3.817	0	0	28.09		0.15	0.15	27.94
2018	20.82	5.338	4.199	0	0	30.35		2.29	2.29	28.07
2019	21.29	6.364	4.518	0	0	32.17		0.18	0.18	31.99
2020	21.78	7.466	4.864	2.563	0	36.67		0.71	0.71	35.96
2021	22.28	8.651	5.238	0	0	36.17		0.12	0.12	36.05
2022	22.80	9.946	5.645	0	0	38.39		2.17	2.17	36.22
2023	23.33	11.359	6.088	0	0	40.78		0.13	0.13	40.65
2024	23.88	12.901	6.570	0.419	0	43.77		0.21	0.21	43.56
2025	24.45	14.582	7.094	0	0	46.13		0.23	0.23	45.89
2026	25.04	16.417	7.664	0	0	49.12		2.60	2.60	46.52
2027	25.65	18.416	8.286	0	0	52.35		0.24	0.24	52.11
2028	26.27	20.597	8.964	0	0	55.83		1.52	1.52	54.31
2029	26.92	22.973	9.702	0	0	59.60		0.25	0.25	59.35
2030	27.59	25.563	10.508	0	242.74	306.40		0.84	0.84	305.57
PV	108.39	40.45	24.29	0.80	20.06	194.00	123.81	3.23	127.04	**66.96**
IRR										**17.3%**

Thank you.