Environmental Economics

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EPFL ENAC LEUrE

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Master semester 2 or 4

Exercises

PROJECT CHOICE

What discount rate to consider?

An investment of 780 generates constant incomes of 220 for four years. There is no scrap value. The table below shows the present value of these four payments of 220 for different discount rates:

Discount rate	3.0%	3.5%	4.0%	4.5%	5.0%	5.5%	6.0%	6.5%	7.0%
Total PV	817.8	808.1	798.6	789.3	780.1	771.1	762.3	753.7	745.2

Which is the value of the discount rate that an investor should focus on for assessing this investment? How is it called and what does it tell him about this investment?

What scrap value?

A machine costing 2000 generates annual net incomes of 200

The investor plans to use it for 10 years

What must be the scrap value of this machine at the end of this period to make the investment profitable for him, assuming that he requires a rate of return of 5%

Information: the present value of 10 annuities of 200 discounted at 5% is equal to 1544

A firm invests 3000 in its own wastewater treatment plant

This allows it to save 600 in wastewater fee every year

We know that this investment is entirely paid back after 6 years

Write the equation to be solved for the IRR, using the formula for annuities (capital recovery factor)

Minimum lifetime

A machine costing 2000 generates constant annual net incomes of 200

What must be the minimum lifetime of this machine to be profitable for an investor whose cost of capital = 5%?

This exercise is an opportunity to discuss

- – sunk costs
- – stranded assets

	Discount rate	5.00%	
End of year	**Payment received**	**Present value**	**Cumulated present value**
1	200	190	190
2	200	181	372
3	200	173	545
4	200	165	709
5	200	157	866
6	200	149	1015
7	200	142	1157
8	200	135	1293
9	200	129	1422
10	200	123	1544
11	200	117	1661
12	200	111	1773
13	200	106	1879
14	200	101	1980
15	200	96	2076
16	200	92	2168
17	200	87	2255
18	200	83	2338
19	200	79	2417
20	200	75	2492

Payback period

- A State plans a river transportation system to connect a town to a waste treatment plant

- The loading and unloading quays cost $ 3 million each

- The machinery and barges cost $ 2 million

- Fixed operating costs: $ 100 thousand per year

- Variable operating costs: $ 3 per ton of waste

- Expected waste tonnage: 40,000 tons in year 1, growing by 5,000 tons every year up to maximum capacity of 100,000 tons

- The State will charge $ 12 per ton of waste to the town

- The entire investment is paid for by a loan at 4%

- The excess of revenues over operating and interest costs is used for amortization

- After how many years will the loan be entirely paid back?

- **Write out the payments and balance of the loan for the first three years**

Payback period - answered

Year	Volume of waste (ktons)	Income (k$)	Variable operating costs (k$)	Fixed operating costs (k$)	Interest on loan (k$)	Net income (k$)	Balance of loan (k$)
0							8 000
1	40	480	120	100	320	- 60	8 060
2	45	540	135	100	322	- 17	8 077
3	50	600	150	100	323	27	8 050
4	55	660	165	100	322	73	7 978
5	60	720	180	100	319	121	7 857
6	65	780	195	100	314	171	7 686
7	70	840	210	100	307	223	7 463
8	75	900	225	100	299	276	7 187
9	80	960	240	100	287	333	6 854
10	85	1020	255	100	274	391	6 463
11	90	1080	270	100	259	451	6 012
12	95	1140	285	100	240	515	5 498
13	100	1200	300	100	220	580	4 917
14	100	1200	300	100	197	603	4 314
15	100	1200	300	100	173	627	3 687
16	100	1200	300	100	147	653	3 034
17	100	1200	300	100	121	679	2 356
18	100	1200	300	100	94	706	1 650
19	100	1200	300	100	66	734	916
20	100	1200	300	100	37	763	152
21	100	1200	300	100	6	794	**- 642**
22	100	1200	300	100	- 26	826	-1 467
23	100	1200	300	100	- 59	859	-2 326
24	100	1200	300	100	- 93	893	-3 219
25	100	1200	300	100	- 129	929	-4 148