

ECONOMICS OF EDUCATION

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Course Material Developed by Department of Economics,
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Week 4

Cost- Benefit Analysis in Education 1

Direct returns to education (at least partly)

education results in direct, measurable returns to the individual and society

Benefit – cost analysis methods

1. Internal rate of return analysis
2. Net present value analysis

1. Internal rate of return to education - r

$$\sum_{t=1}^n \frac{(W_S - W_{S-1})_t}{(1+r)^t} = \sum_{t=1}^n \frac{(W_{S-1} + C_S)_t}{(1+r)^t}$$

Private rate of return → measure of private profitability of investment in education

Social rate of return → measure of the profitability of alternative investments from the society's perspective (society ≠ government)

Fiscal rate of return ® mesure of the profitability of investment in education to government

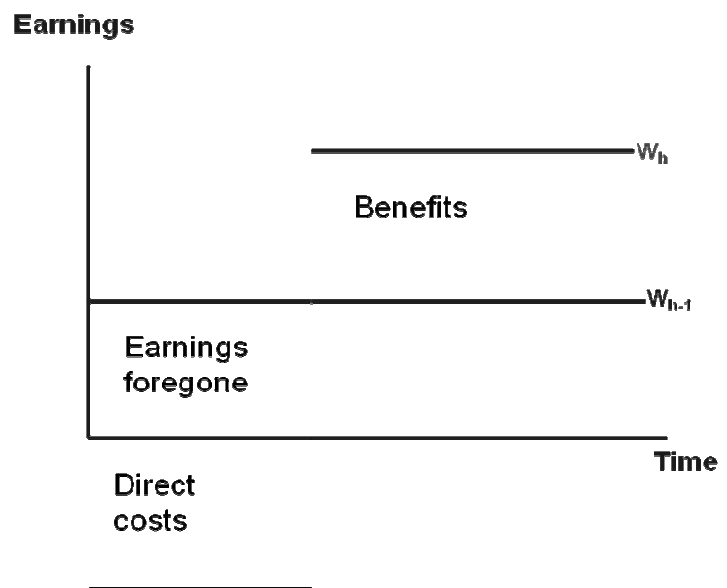
Internal rate of return to education – the short-cut method

$$r_h = \frac{\bar{W}_h - \bar{W}_{h-1}}{S(\bar{W}_{h-1} + C)}$$

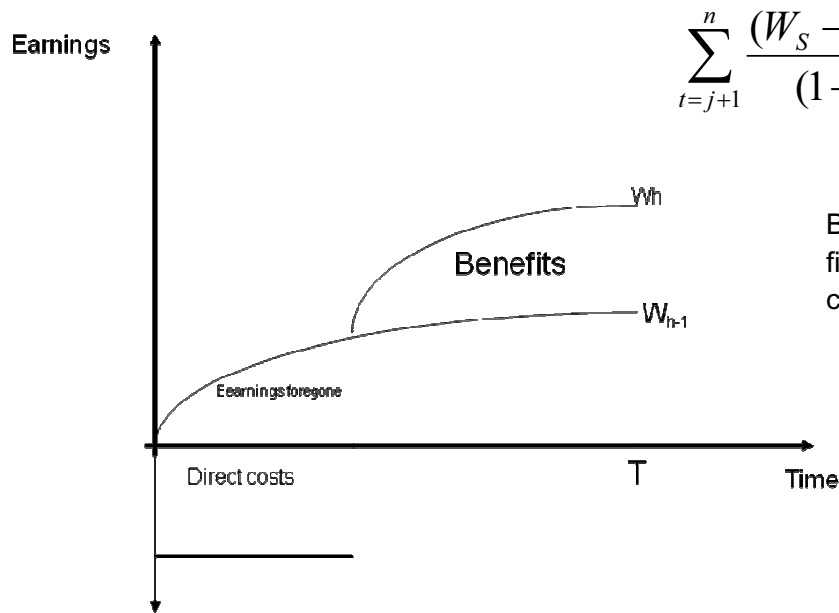
S → length of studies at h level of education

C → annual direct costs of education

Only rough preliminary calculations



Internal rate of return to education – the full or elaborate method



$$\sum_{t=j+1}^n \frac{(W_S - W_{S-1})_t}{(1+r)^t} = \sum_{t=1}^j \frac{(W_{S-1} + C_S)_t}{(1+r)^t}$$

Both private, social and fiscal rate of return can be calculated with full method

Private and social costs

DIRECT COSTS	Social	Private
1) Direct public spending on education per student	+	-
2) Amortized capital costs on education per student	+	-
3) School fees, all kinds	- transfer, not counted	+
4) Other private school related expenditure (books, supplies, transportation etc.)	+	+
5) Student support (scholarship, stipends, bursaries, allowances, etc.)	- transfer, not counted	deduct from foregone earnings

INDIRECT COSTS	Social	Private
6) Foregone earnings W_{S-1}	Before tax	After tax
7) Part time earnings of students	Before tax Deduct from earnings	After tax Deduct from earnings
8) Costs of tax exemption	+	-
9) Implicit rent and depreciation	+	-

	Social	Private
Incremental income attributable to education ($W_S - W_{S-1}$)	Before tax	After tax

Benefits and costs for fiscal rate of return calculations

Benefits

additional income tax and social contribution revenues from higher wages

Costs: 1) Direct costs

direct public spending per student from public sources

2) Indirect costs

lost income tax revenue and social contribution on students' foregone earnings

Measurement problems 1

1. Cross-section versus life cycle (cohort) data
2. Annual earnings versus hourly wages
3. Adjustments
 - probability of unemployment/inactivity
 - mortality
 - impact of repetition

Cross-section data

Net monthly earnings by age
and educational attainment,
Hungary, 2009. HUF.

	kor	altiskola	szakiskola	erettsegi	diploma
1.	18	97019.83333	112488	99453.33333	.
2.	19	102401.537	107216.4615	111440.881	.
3.	20	103585.6015	102602.2051	110489.1444	.
4.	21	100033.5282	108534.3041	120202.1193	145462.2308
5.	22	104786.9755	109396.4086	126181.4308	168991.9231
6.	23	105741.2761	113990.448	136229.8785	175065.8561
7.	24	106112.1973	114872.8965	149235.8921	203153.9172
8.	25	113465.1451	116706.6135	157417.0366	213685.3595
9.	26	108810.0836	121817.939	159384.9903	228280.8261
10.	27	109577.9585	122462.3492	170176.8509	245729.841
11.	28	109366.5826	124910.9861	174841.0225	268552.8844
12.	29	109775.3601	125136.6193	179280.069	291743.5914
13.	30	112082.7143	127415.3223	182775.9048	299825.8924
14.	31	107372.2387	130600.3331	184707.0294	323337.8069
15.	32	112190.4857	130597.3481	182639.6524	336374.0259
16.	33	112196.5028	134106.2838	188966.2367	355277.1282
17.	34	113782.75	136208.193	186589.3375	367392.7992
18.	35	114497.1471	133492.8085	190003.8171	379471.0847
19.	36	110507.1032	132669.6758	192315.7861	384967.7968
20.	37	116011.5981	133143.3041	185653.0718	387186.426
21.	38	111908.694	134187.4598	190913.9488	403453.4573
22.	39	115229.7627	134880.7753	191276.7858	392785.3821
23.	40	113711.2676	133122.9128	192509.1155	397107.6035
24.	41	110697.1505	132683.051	192211.5625	369099.5377
25.	42	111504.3606	138784.9502	192319.8084	363570.2473
26.	43	118063.4897	132183.9952	178940.6149	357303.1562
27.	44	111220.0719	134683.0415	187305.4429	355660.5394
28.	45	111779.6953	135866.4611	180366.423	361861.347
29.	46	114425.459	134208.1223	184791.2145	371156.2756
30.	47	107852.2032	135889.9729	183436.5299	343201.4223
31.	48	108378.137	137355.3244	186857.7097	369723.5364
32.	49	110597.2278	132937.4619	191791.0536	358808.1683
33.	50	106770.0159	132223.9086	187262.1692	361069.4182
34.	51	106393.121	131733.0646	190565.9776	366572.8352
35.	52	111163.1288	133268.3559	191751.4298	366657.8758
36.	53	110571.119	133015.7239	190573.5956	367619.4685
37.	54	112812.6314	138531.9725	196186.131	369838.6035
38.	55	110384.8169	138217.3162	195198.0415	368859.94
39.	56	109641.0404	136171.5799	202287.9752	387618.5638
40.	57	110296.7901	135947.1338	203677.4861	393330.6432
41.	58	104907.6461	140357.694	202081.6709	415456.1114
42.	59	107752.3867	135639.8141	204266.4886	419193.9605
43.	60	102033.3252	129726.6783	197963.1263	448458.2895
44.	61	99049.97647	120326.4313	199251.5755	451522.1529
45.	62	101865.7857	123158.095	183198.3447	442406.1812

Source: Based on data of
Hungarian Wage-Tariff
Survey, 2009.
N=192 764

ex ante

Assumption: constant age-
education- relationship over
time

	kor	altiskola	szakiskola	erettsegi	diploma
.	18	97019.83333	112488	99453.33333	.
.	19	102401.537	107216.4615	111440.881	.
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45.					

Life-cycle (cohort) data

ex post

- lack of data
- necessary to adjust data for changes in price level (the longer the period, the less reliable is the adjustment)
- highly affected by fluctuations in the business cycle, by crises – significant potential error

Year	W_{h-1}	W_h
1967	1500	0
1968	1520	0
1969	1540	0
1970	1700	0
1971	1720	2200
...
2011	183200	442406

Annual versus hourly earnings

- education affects both productivity (hourly wage) and increase in employability (number of working hours)
- number of hours worked is individual's choice between leisure and income
- education affects individuals' choice in favor of work

Adjustments

Adjustment of age earnings profiles with:

- anticipated real growth in earnings (g)
- unemployment (u)
- mortality (m)

$$\hat{W}_{ht} = W_{ht} (1+g)(1- m_{ht}) (1-u_{ht})$$

Measurement problems 2

- Social benefits assumption: observed wages are a good proxy for the marginal product of labor, the difference in average wage between two education levels measures the difference in marginal productivity, i.e. the marginal product of the additional education

MP = W? (public sector wages?)

- External benefits are ignored

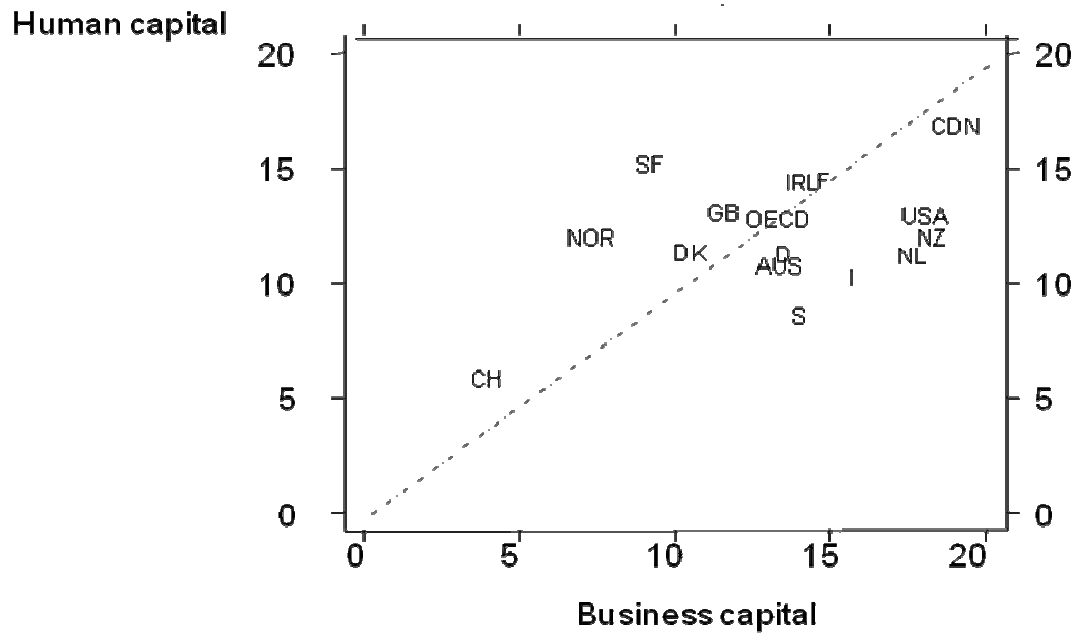
Lifetime income differentials are attributed to education

Is a portion (or all) of the differentials are due to differences in ability, motivation, socioeconomic and other factors which correlate with years of schooling completed?

- ability bias

(to be discussed next week)

Rates of return to human capital and business capital in 16 countries 1995

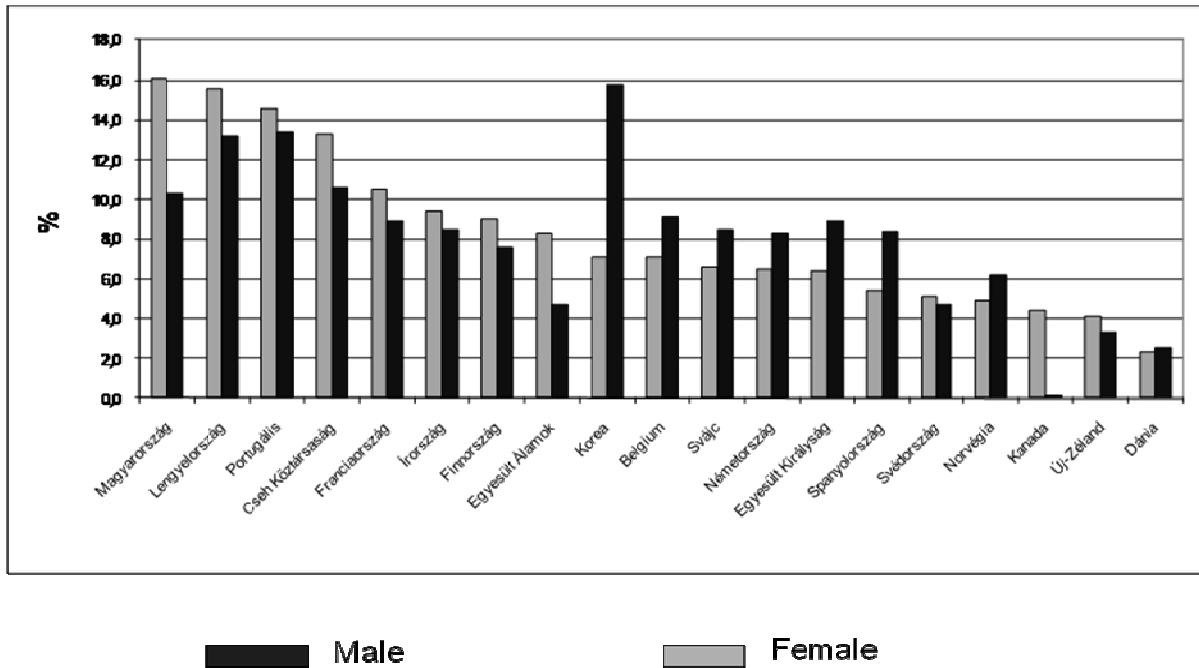


Returns to investment in education by level of education, by regions 2002 Full method

Region	Social %			Private %		
	Primary	Secondary	Higher	Alsó fok	Középfok	Felsőfok
Asia	16.2	11.1	11.0	20.0	15.8	18.2
Europe/middle East/North Africa	15.6	9.7	9.9	13.8	13.6	18.8
Latin America/Caribbean	17.4	12.9	12.3	26.6	17.0	19.5
OECD	8.5	9.4	8.5	13.4	11.3	11.6
Sub-Saharan Africa	25.4	18.4	11.3	37.6	24.6	27.8

Source: G. Psacharopoulos -H.A. Patrinos: Returns to Investment in Education. A Further update. World Bank Policy Research Working Papers 2002.

Private internal rates of return - university level degree 2004



Source: Education at a Glance 2008: OECD Indicators

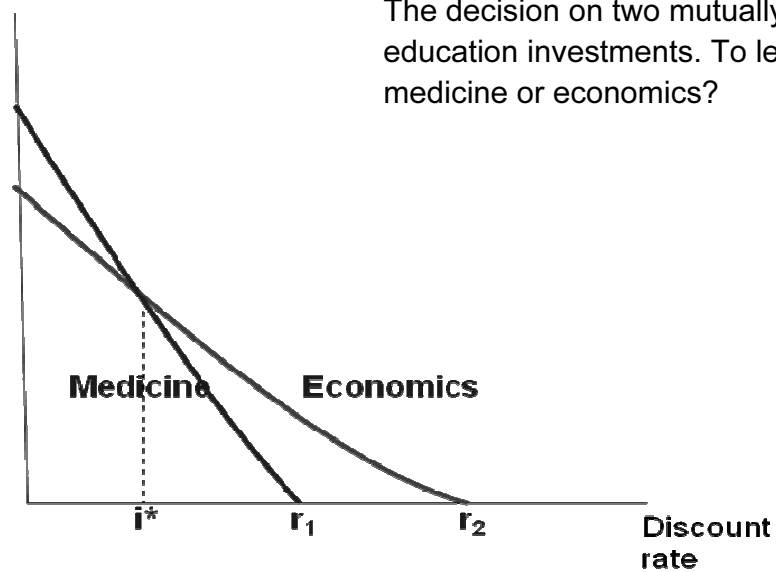
2. Net present value analysis

$$NCV = \sum_{t=1}^n \frac{(W_S - W_{S-1})_t}{(1+i)^t} - \sum_{t=1}^n \frac{(W_{S-1} + C_S)_t}{(1+i)^t}$$

Decision criteria: select all projects where the present value of benefits exceeds the present value of costs $NCV > 0$

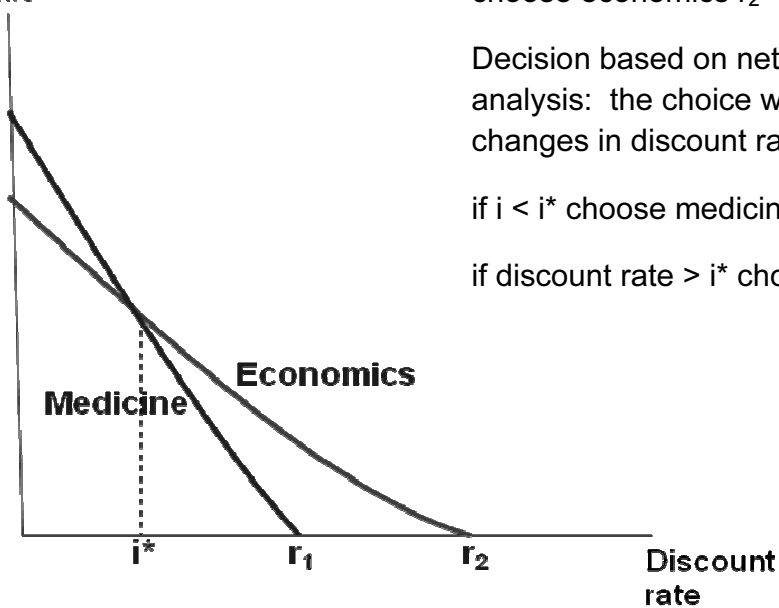
2. Net present value analysis –the choice of discount rate

Net present value



The decision on two mutually exclusive education investments. To learn medicine or economics?

Net present value



Decision based on rate of return analysis:
choose economics $r_2 > r_1$

Decision based on net present value analysis: the choice would vary with changes in discount rate

if $i < i^*$ choose medicine,

if discount rate $> i^*$ choose economics