Master in Economics

Labour economics – Lecture 6

March 2025

Lecture 6

Topics

- **Human Capital and Inequality**
  - Investments in Human Capital: Education and Training
  - Human Capital Investments: The Basic Model
  - Human Capital Investments: The Demand for a College Education
  - Human Capital Investments: Education, Earnings, and Post-Schooling Investments in Human Capital
  - Human Capital Investments: Is Education a Good Investment?

Bibliography:

- **Ehrenberg, Ronald & Robert Smith, *Modern Labor Economics: Theory and Public Policy* – Chapter 9**
- **Novo, Alvaro, *Ability and Selection; Human Capital; Returns to Schooling*, Mimeo**
- **Novo, Alvaro & Centeno, Mário *When supply meets demand: Wage inequality in Portugal*, Mimeo**

Investments in human capital: Education and Training

- **many labour supply choices require substantial initial investment on the part of the worker**

  - **an initial cost; expected to be recovered over time**

- *Labor supply:*

  - *current* **wages and working conditions are not the only deciding factors**

- **A framework that incorporates investment behaviour and a lifetime perspective**

Investments in human capital: Education and Training

- **3 kinds of labour market investments by workers:**
  - education and training
  - migration
  - search for new jobs

- **involve:**
  - an initial cost
  - expectation that it will pay off well into the future

Investments in human capital: Education and Training

- **human capital - worker skills that it can "rent out"**
- **investments in human capital:**
  - Stock of productive capital: knowledge and skills of the worker
    - from education, training or learning by doing (experience) productive capital
  - Value of the productive capital: how much skills can earn in the LM
  - Job search and Migration: increase its value by increasing the price (wage) received for given stock of skills

Investments in human capital: Education and Training

- **investment in knowledge and skills - three stages:**
    - **early childhood** - parental resources and guidance, cultural environment and early schooling experiences influence basic language and mathematical skills, attitudes toward learning, and general health and life expectancy (these themselves affect the ability to work)
    - **teenagers or young adults** – knowledge and skills as full-time students in a high school, college, or vocational training programs
    - **after entering the labour market** - generally on a part-time basis, through on-the-job training, night school, or participation in relatively short, formal training programs

Investments in human capital: Education and Training

- **focus on the latter two stages**
  - explain why people faced with what appears to be the same environment make different choices
- **individuals' investing in human capital affected by:**
  - the ease and speed with which they learn
  - aspirations and expectations about the future
  - access to financial resources

Human Capital Investments: The Basic Model

- **investment in human capital: short-term costs with the expectation about future benefits**

- **costs of human capital divided into three categories:**
  - out-of-pocket expenses: tuition costs and expenditures on supplies
  - forgone earnings (salaries/income): impossible to work full-time
  - psychic losses: occur because learning is often difficult and tedious

Human Capital Investments: The Basic Model

- **the expected returns of educational and training investments by workers may be:**
    - higher future earnings
    - increased job satisfaction over lifetime
    - a greater appreciation of nonmarket activities and interests

- **problem - quantify all the future benefits and sum them over the relevant years**
    - not straightforward: delay involved in receiving those returns
    - risk

Human Capital Investments: The Basic Model

- **the concept of present value**
    - when an investment decision is made, the investor commits to a current outlay of expenses in return for a stream of expected future benefits
    - investment returns subject to an element of risk - no one can predict the future with certainty
    - there is a delay – benefits typically flow in over may be a long period
    - investors need to compare the value of the current investment outlays with the current value of expected returns - must take into account effects of the delay in returns

Human Capital Investments: The Basic Model

- ## the concept of present value
  - someone is offered $100 now or $100 in a year
  - question: would that person be equally attracted to these two alternatives?
  - the answer: no, because if she received the money now, she could either spend (and enjoy) it now or she could invest the $100 and earn interest over the next year
    - if the interest rate were 5 percent $100 now could grow into $105 in a year's time - $100 received now is worth more than $100 to be received in a year
    - with an interest rate of 5 percent, it would take an offer of $105 to be received in a year to match the value of getting $100 now
    - at a 5% interest rate $100 now and $105 in the next year have equivalent value - with a 5 percent interest rate, the future value in a year of $100 now is $105

    $$B_1 = B_0 + B_0(r) = B_0(1 + r) = 100(1.05) = 105$$

    - the present value of $105 to be received in a year is (at a 5 percent interest rate) $100

    $$B_0 = B_1 /(1+r) = 105/1.05 = 100$$

  discounting: the procedure for taking a future value and transforming it into its present-value equivalent

Human Capital Investments: The Basic Model

- **the present value of human capital investments**
  - if a human capital investment yields returns for *T* years, the sum of these benefits has a present value that is calculated as follows:

  $$Present\ value = B_1/(1+r) + B_2/(1+r)^2 + ... + B_T/(1+r)^T$$

  - as long as *r* is positive, benefits in the future will be progressively discounted at higher rates
  - the smaller *r* is the greater the weight placed on future benefits

Human Capital Investments: The Basic Model

- **modeling the human capital investment decision**

  - people are utility maximizers and take a lifetime perspective when making choices about education and training
  - they compare the near-term investment costs (C) with the present value of expected future benefits when making a decision
  - Schooling investment: attractive if the PV of future benefits exceeds costs:

  $$B_1 /(1+r) + B_2 /(1+r)^2 + ... + B_T /(1+r)^T > C$$

  - Stop invest: only when the benefits equal or less than the additional costs

Human Capital Investments: The Basic Model

- **modeling the human capital investment decision**
    - two ways to look at whether the criterion is met
        - present-value method:
            - specify a value for the discount rate r and then determine how the present value of benefits compares to costs

        - internal rate of return method:
            - how large could the discount rate be and still render the investment profitable?

                – if the benefits are so large that even a very high discount rate would render investment profitable, then the project is worthwhile

                – compute the internal rate of return by setting the present value of benefits equal to costs, solving for r, and then comparing r to the rate of return on other investments
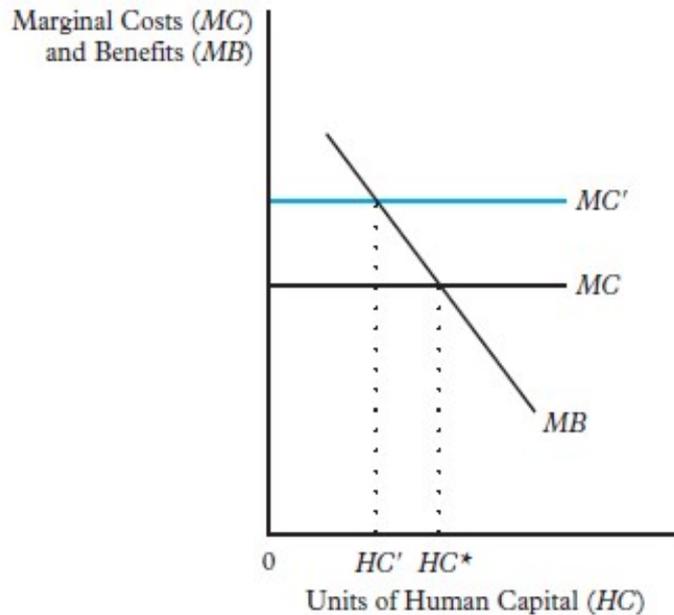
Human Capital Investments: The Basic Model

- **modeling the human capital investment decision**
  - human capital decisions in terms of marginal costs and marginal benefits
    - the marginal costs (*MC*) of each additional unit of human capital (e.g. the tuition, supplies, forgone earnings, and psychic costs of an additional year of schooling) assumed to be constant
    - the present value of the marginal benefits (*MB*) decline with the years of schooling - each added year of schooling means fewer years over which benefits can be collected
    - (optimal) utility-maximizing amount of human capital:
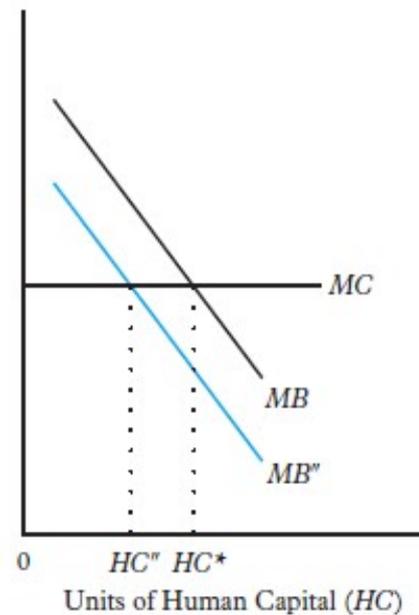   - the amount for which *MC = MB*

Human Capital Investments: The Basic Model

- **modeling the human capital investment decision**

Panel (a):

MC′ **arduous psychic cost** – lower levels of human capital, hence *HC′ < HC**.

Panel (b):

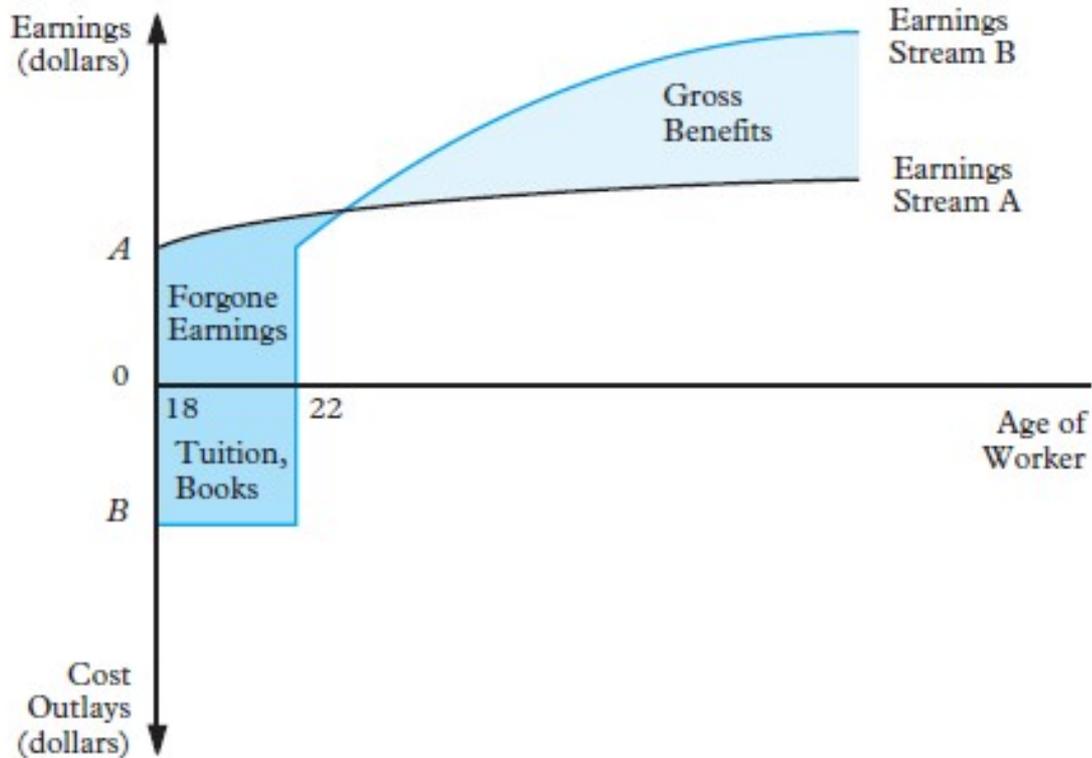*MB″* **expect smaller future benefits** - acquire less human capital, thus *HC″ < HC**.

The Demand for a College Education

Human Capital Investments: The Demand for a College Education

- **weighing the costs and benefits of college**
  - people attend college when they <u>believe</u> they will be <u>better off</u>
    - for some, at least part of the benefits may be short term—they like the courses or the lifestyle of a student— college is partially a <u>consumption good</u>
    - for others college attendance has just the <u>nature of an investment</u>

  - person considering college has a choice between two streams of earnings:
    - A: Earnings stream of <u>high school graduate</u>:
      - immediate, but don't rise very high
    - B: <u>College graduate</u> :
      - negative income for the first years (attendance costs),
      - followed by a period when the salary may be less than that of the high school graduate, but then it takes off and rises above

Human Capital Investments: The Demand for a College Education

- **weighing the costs and benefits of college**

Human Capital Investments: The Demand for a College Education

- **weighing the costs and benefits of college**
  - college graduate earnings must rise above those HS graduate to induce investment in a college education (unless the consumption-related returns were large)
  - the gross benefits (difference in earnings between the two streams) must total much more than the costs because they will be discounted

    - suppose it costs $25,000 per year to obtain a four-year college education and the real interest rate (the nominal rate less the rate of inflation) is 2 percent
    - the after-tax returns—if they were the same each year—must be $3,652 in constant -dollar terms (after effects of inflation) each year for 40 years in order to justify the investment
      ($3,652 because $100,000 invested at a 2% provide a payment (of interest and principal) totalling $3,652/year for 40 years; $Y = X (1-1/(1+r)^n)/r$

Human Capital Investments: The Demand for a College Education

- **predictions of the theory (*ceteris paribus)*
  - Present-orientedness:
    - present-oriented people are less likely to go to college than forward looking people
  - Age:
    - most college students will be young
  - Costs:
    - college attendance will decrease if the costs of college rise
  - Earnings differentials:
    - college attendance will increase if the gap between the earnings of college graduates and high school graduates widens

Human Capital Investments: The Demand for a College Education

- **predictions of the theory**
    - present-oriented people are less likely to go to college than forward looking people (other things equal)
        - those who do not weigh future events or outcomes very heavily - use a <u>very high discount rate r</u>
            - if r is large, the present value of benefits associated with college will be lower than if r is smaller;
            - implies that those who are present-oriented are less likely to attend college

Human Capital Investments: The Demand for a College Education

- **predictions of the theory**
  - most college students will be young
    - with similar yearly benefits of going to college, young people have a <u>larger present value of total benefits</u> than older workers simply because they have a longer remaining work life ahead of them
    - younger people will have a greater propensity than older people to obtain college education or engage in other forms of training activity

Human Capital Investments: The Demand for a College Education

- **predictions of the theory**
  - college attendance will decrease if the costs of college rise
    - if forgone earnings or tuition costs fall, expect more college enrollments *(food and lodging are not always opportunity costs of going to college because some of these costs would have to be incurred in any event)*

    - access to the funds required to pay for tuition, books, and fees: there are wide differences in how costly it is to obtain the funds needed for college, and those who find it very costly or impossible to obtain such funds are said to be "credit-constrained"
      - Some: all or part of these funds from their families or college scholarships
      - Others: costs of loans or generating their own funds through working

Human Capital Investments: The Demand for a College Education

- **predictions of the theory**
  - college attendance will decrease if the costs of college rise
    - subsidized, low interest government loans to college students and publicly funded universities are two major ways in which society has tried to deal with credit constraints facing potential college students

Most studies find that relaxing these constraints (making borrowing easier or cheaper) increases college attendance and that the <u>public policies to relax the constraints have been largely successful</u>

Human Capital Investments: The Demand for a College Education

- **predictions of the theory**
  - college attendance will decrease if the costs of college rise
    - psychic costs of a college investment
      - students who have greater <u>aptitudes</u> for the kind of learning college demands are more likely to attend
      - mounting evidence that the acquisition of human capital is powerfully affected by <u>family background</u> - the parental investments and family environments that affect the ability to learn

Family background is other form of constraint that can affect the cost of acquiring human capital: need to pay more attention to <u>publicly funded investments in early childhood</u> education and environments necessary to relax this constraint

Human Capital Investments: The Demand for a College Education

- **predictions of the theory**
    - college attendance will decrease if the costs of college rise
        - psychic costs of a college investment - "peer effects":
            - if status with one's peers is enhanced by studying hard and getting good grades the costs of studying are reduced—while the opposite occurs if status is reduced by academic achievement

Human Capital Investments: The Demand for a College Education

- **predictions of the theory**
  - college attendance will increase if the gap between the earnings of college graduates and high school graduates widens
    - demand for education is positively related to the increases in <u>expected lifetime earnings</u> that a college education allows
    - the average <u>returns received by recent college graduates</u> have an important influence on students' decision

Human Capital Investments: The Demand for a College Education

- **predictions of the theory**

Table 9.1 Changes in College Enrollments and the College/High School Earnings Differential, by Gender, 1970–2018

Year	College enrollment rates of new high school graduates		Ratios of mean earnings of college to high school graduates, ages 25–34, previous year[a]	
	Male (%)	Female (%)	Male	Female
1970	55.2	48.5	1.38	1.42
1980	46.7	51.8	1.19	1.29
1990	58.0	62.2	1.48	1.59
2000	59.9	66.2	1.60	1.74
2010	62.8	74.0	1.59	1.66
2018	66.9	71.4	1.72	1.66

[a] This covers year-round, full-time workers. Data for the first two years are for personal income, not earnings; however, in the years for which both income and earnings are available, the ratios are essentially equal.

Sources: U.S. Department of Education, *Digest of Education Statistics 2018* (December 2019), Table 302.10, at https://nces.ed.gov/programs/digest/d19/tables/dt19_302.10.asp?current=yes; U.S. Bureau of the Census, *Money Income of Families and Persons in the United States*, Current Population Reports P-60, no. 66 (Table 41), no. 129 (Table 53); U.S. Bureau of the Census, Current Population Survey Tables for Personal Income, PINC-04, at

Human Capital Investments: The Demand for a College Education

- **predictions of the theory**

Ratio of mean base wage of college to high school graduates, age 25-34 - Portugal

	male	female
1985	1.59	1.49
2018	1.54	1.56

Source: Quadros de Pessoal

Human Capital Investments: The Demand for a College Education

Relative Compensation of new entrants in the labour market by level of schooling and year

(total new entrants =1)

Year	New entrants to the labour market		
	College graduates	Non college graduates/ Ignored	Total
	average	average	average
1992	2,74	,96	1,00
1993	2,62	,96	1,00
1994	2,47	,95	1,00
1995	2,28	,94	1,00
1996	2,15	,94	1,00
1997	2,04	,93	1,00
1998	1,93	,86	,94
1999	1,93	,91	1,00
2000	1,89	,90	1,00
2002	1,77	,89	1,00
Total	2,03	,93	1,00

Human Capital Investments: The Demand for a College Education

Relative Compensation of new entrants in the labour market by field of study

(total new entrants =1)

Area of education	1994	1995	1996	1997	1998	1999	2000	2002	Total
Economics/Management	2,56	2,31	2,20	2,05	1,92	2,00	1,83	1,75	1,99
Engineering	2,71	2,44	2,31	2,30	2,20	2,34	2,27	2,07	2,27
Arts	1,83	1,77	1,81	1,87	1,57	1,72	1,85	1,78	1,78
Natural Sciences	2,13	1,93	1,81	1,75	1,81	1,78	1,96	1,96	1,90
Education Sciences/ teaching	2,23	2,09	1,94	1,90	1,87	1,85	1,66	1,57	1,84
Health sciences	2,28	2,35	2,40	2,32	2,17	2,17	2,10	1,93	2,13
Socail sciences	2,13	2,04	1,89	1,88	1,85	1,74	1,83	1,72	1,81
Internations Relations/ communication sciences	2,07	1,98	1,77	1,78	2,04	1,68	1,85	1,51	1,80
Agriculture, forestry, Agroindustries	1,97	1,91	1,80	1,81	1,77	1,76	1,65	1,61	1,78
Other	2,37	2,25	2,07	1,92	1,69	1,81	1,73	1,64	1,83
Total	2,40	2,23	2,10	2,01	1,90	1,92	1,90	1,78	1,95

Human Capital Investments: The Demand for a College Education

- **other factors that affect college education demand**
  - **Uncertainty**
    - even if individuals know the average earnings differentials between college and high school graduates, they must also <u>assess their own probabilities of success</u> in specific fields requiring a college education/degree;
    - presence of role models can help reduce the uncertainty that surrounds the estimates of future success in specific areas
    - current returns may be an unreliable estimate of future returns
  - **Friends:** could be important in human-capital decisions (fit with the crowd)
  - **Ethnic affiliation/origin** - the importance attached to human-capital investments varies across ethnic groups
  - **Neighbourhoods** - human-capital investment decisions in affluent neighbourhoods will not be the same as those in poor inner-city neighbourhoods

Human Capital Investments: The Demand for a College Education

- **market responses to changes in college attendance**
  - returns to college attendance determined by the forces of <u>both employer demand and employee supply</u>:
    - if more high school students decide to attend college (when presented with higher returns to such an investment) market forces will tend to lower these returns in the future
    - increased numbers of college graduates put downward pressure on the wages observed in labour markets for these graduates (other things equal)
    - a fall in the number of high school graduates will tend to raise wages in markets for less-educated workers

Education, Earnings, and Post-Schooling Investments in Human Capital

Human Capital Investments: Education, Earnings, and Post-Schooling Investments in Human Capital

- **four notable characteristics of earnings of men and women of various ages with different levels of education**
  - average earnings of full-time workers rise with the level of education
  - the most rapid increase in earnings occurs early, giving a concave shape to the age/earnings profiles of both men and women
  - age/earnings profiles tend to fan out, so that education-related earnings differences later in workers' lives are greater than those early on
  - the age/earnings profiles of men tend to be more concave and to fan out more than those for women

Human capital theory can be used to explain the above empirical regularities
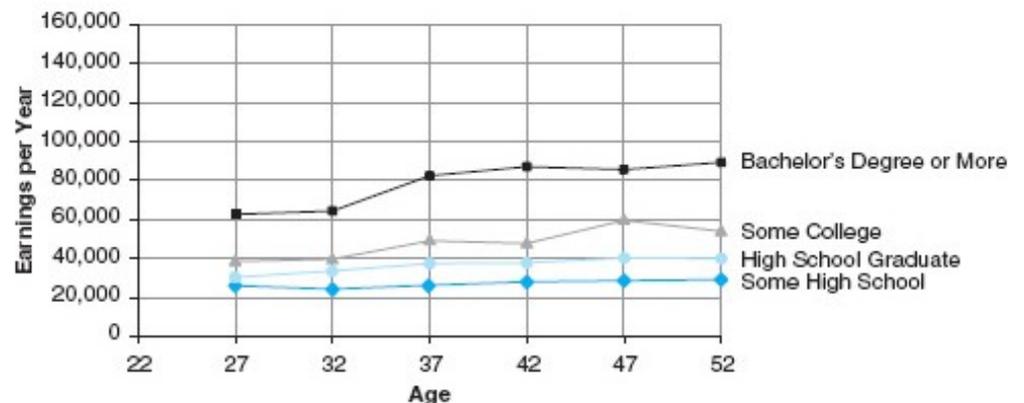
Human Capital Investments: Education, Earnings, and Post-Schooling Investments in Human Capital

- **average earnings and educational level**

  - investment model of educational choice implies: earnings rise with the level of education;

  - if they did not, incentives for students to invest in more education would disappear

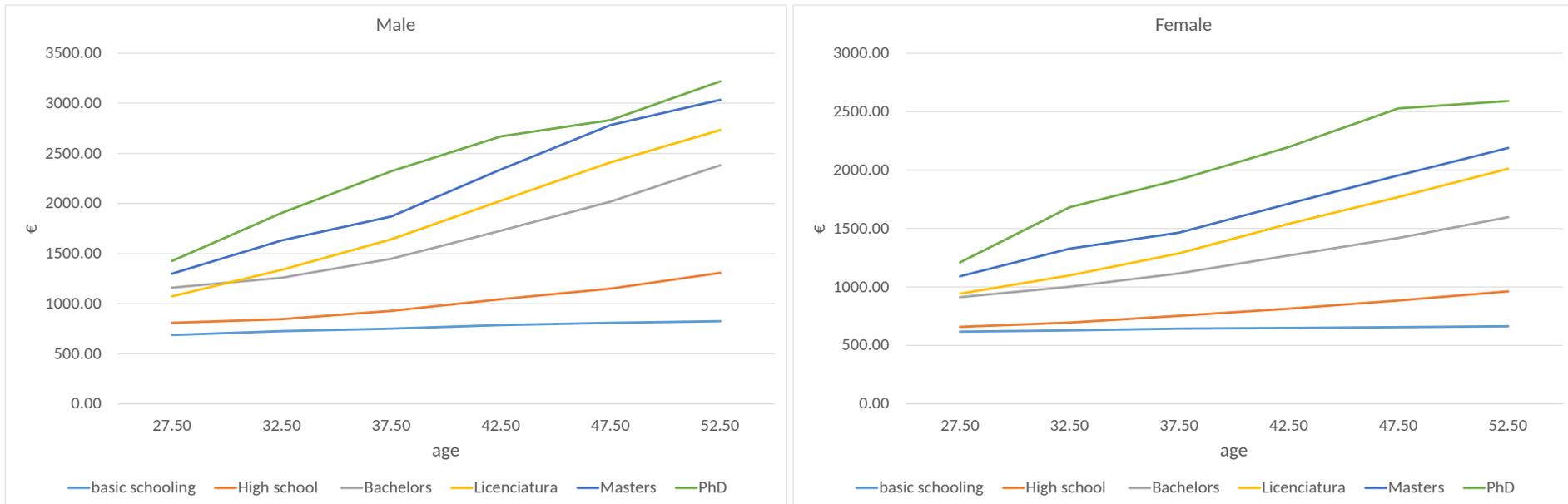Money Earnings (Mean) for Full-Time, Year-Round Male Workers, 2018
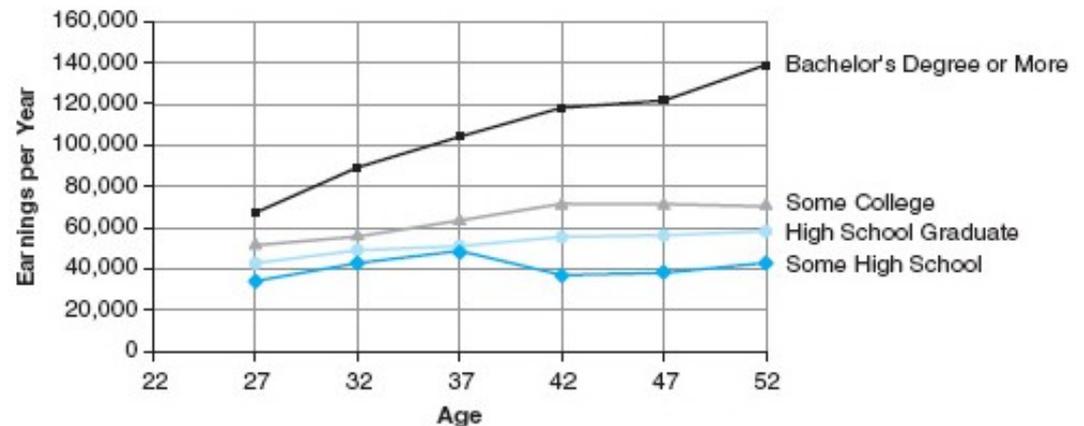
Female Workers, 2018

Human Capital Investments: Education, Earnings, and Post-Schooling Investments in Human Capital

- **average earnings and educational level in Portugal**

Money monthly base wage for Full-Time Workers, 2018
(Portugal)

Human Capital Investments: Education, Earnings, and Post-Schooling Investments in Human Capital

- **on-the-job training and the concavity of age/earnings profiles**
  - the age/earnings profiles typically rise steeply early on, then tend to flatten:
    - human capital theory explains the concavity of these profiles in terms of on-the-job training (there are other explanations)
    - explanation: training declines with age
    - training on the job
      - learning by doing (skills improving with practice)
      - formal training programs at or away from the workplace
      - informally working under the tutelage of a more experienced worker
  - all forms entail reduced productivity among trainees during the learning
  - both formal and informal training also involve a commitment of time by those who serve as trainers or mentors

Human Capital Investments: Education, Earnings, and Post-Schooling Investments in Human Capital

- **on-the-job training and the concavity of age/earnings profiles**
    - training costs are either shared by workers and the employer (specific training) or are borne mostly by the employee (general training)
    - from the perspective of workers:
        - training depresses wages during the learning period, but allows them to rise with enhanced productivity afterwards
        - jobs that require a training investment: workers are willing to accept lower wages in the short run to get higher pay later on
    - returns are generally larger when the post-investment period is longer: expect workers' investments in on-the-job training to be greatest at younger ages and to fall gradually as they grow older

Human Capital Investments: Education, Earnings, and Post-Schooling Investments in Human Capital

- **on-the-job training and the concavity of**
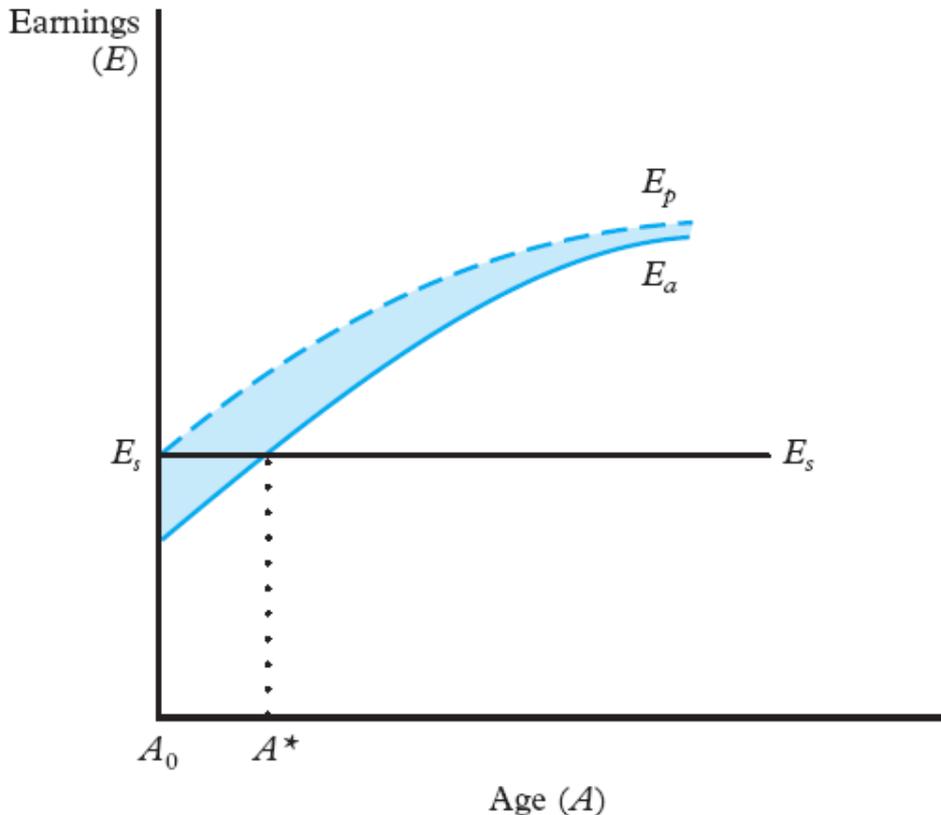
- the individual has <u>completed full-time schooling</u> and is able to earn E_s at age A_0
- without further training and if the knowledge and skills <u>do not depreciate over time</u> earnings would remain at E_s over the life cycle
- invest in <u>on-the-job training</u>: future earnings potential can be enhanced - the (dashed) curve E_p
- investment in on-the-job training has the consequence that actual earnings E_a are below potential E_p: actual earnings lie below as long as the worker is investing
- the gap between E_p and E_a equals the worker's <u>investment costs</u>

Human Capital Investments: Education, Earnings, and Post-Schooling Investments in Human Capital

- **on-the-job training and the concavity of age/earnings profiles**
  - the figure reflects the theoretical implication that <u>human capital investments decline with age</u>
    - with each succeeding year
      - actual earnings become closer to potential earnings
      - the yearly increases in potential earnings become smaller and smaller because workers become less willing to invest in human capital as they age
    - then:
      - the curve E_p takes on a concave shape, quickly rising above but flattening later in the life cycle
      - curve E_a takes on its concave shape for the same reasons

Human Capital Investments: Education, Earnings, and Post-Schooling Investments in Human Capital

- **on-the-job training and the concavity of age/earnings profiles**
  - for those who invest in on-the-job training, <u>actual earnings start below E_s</u>, approach it near age A^* and continue to rise above it afterward
  - <u>age A^*</u> - <u>overtaking age</u> - the age at which workers with the same level of schooling have equivalent earnings regardless of whether they have invested in on-the-job training

Human Capital Investments: Education, Earnings, and Post-Schooling Investments in Human Capital

- **on-the-job training and the concavity of age/earnings profiles**
  - empirical implication:
    - we can observe educational levels workers possess, but we cannot observe workers' E_p or the time they have spent in on-the-job training
    - statistical methods: analyse earnings differences across individuals, the correlation between earnings and education will be strongest at $A*$ where $E_a = E_s$
    - the correlation between schooling and earnings is weakened both before and after by the presence of on-the-job training, which we cannot measure and for which we cannot therefore statistically control
    - empirical studies: educational and earnings levels correlate most strongly at about 10 years after labour market entry

Human Capital Investments: Education, Earnings, and Post-Schooling Investments in Human Capital

- **the fanning out of age/earnings profiles**
  - earnings differences across workers with different educational backgrounds tend to become <u>more pronounced as they age</u>
  - Why: more job training for those with higher educational attainment
  - investments in human capital tend to be more likely when:
    - expected earnings differentials are greater
    - initial investment costs are lower
    - investor has either a longer time to recoup the returns or a lower discount rate
  - investments in human capital tend to be more likely for those who have the ability to learn more quickly:
    - shortens the training period
    - fast learners probably also experience lower psychic costs (lower frustration)

Human Capital Investments: Education, Earnings, and Post-Schooling Investments in Human Capital

- **the fanning out of age/earnings profiles**
  - people who have the <u>ability to learn quickly</u> are those most likely to seek out—and be presented by employers with—training opportunities
    - who are the fast learners? most likely the people who, because of their abilities, were best able to reap benefits from formal schooling
  - human capital theory leads us to expect that <u>workers who invested more in schooling will also invest more in post-schooling job training</u>
  - the tendency of the better-educated workers to invest more in job training explains why their age/earnings profiles start low, rise quickly, and keep rising while less-educated counterparts profiles have levelled off
    - earnings rise more quickly because they are investing more heavily in job training, and they rise for a longer time for the same reason

Human Capital Investments: Education, Earnings, and Post-Schooling Investments in Human Capital

- **women and the acquisition of human capital**
  - earnings of women who work full-time year-round are <u>lower</u> than those of men of equivalent age and education;
  - within each educational group earnings rise less steeply with age
  - explanations:
    - a major difference in the incentives of men and women to make human capital investments has historically been in the <u>length of work life over which the costs of a human capital investment can be recouped</u>
      - if the historical experience causes younger women who are making important human capital decisions to expect a discontinuity in their own labour force participation, they might understandably <u>avoid occupations or fields of study in which their skills depreciate during the period out of the labour market</u>
      - historical experience can also cause <u>employers to avoid hiring women for jobs requiring much on-the-job training</u>

Human Capital Investments: Education, Earnings, and Post-Schooling Investments in Human Capital

- **women and the acquisition of human capital**

Table 9.2   Labor Force Participation Rates, Part-Time Employment Status, and Hours of Work in the United States, by Gender (2019)
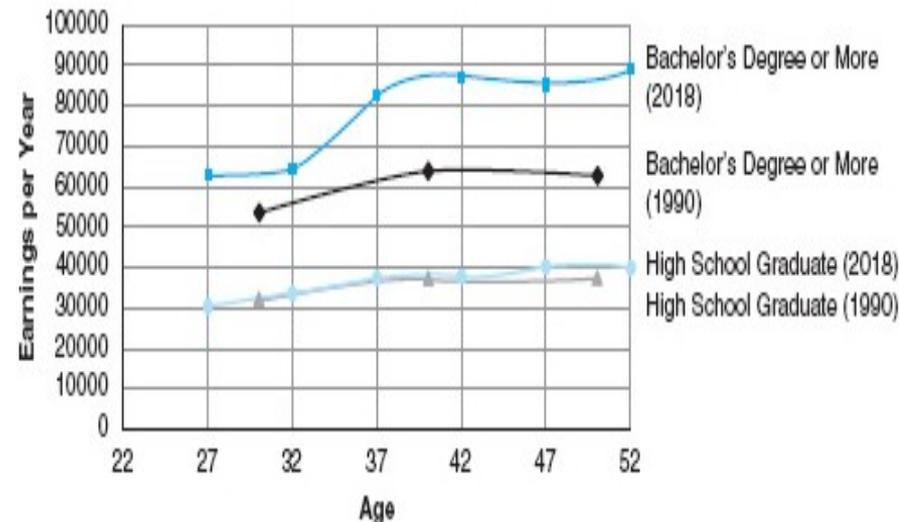
	Women	Men
Labor force participation rate, age 16 and over	57.4%	69.2%
Percent of employed who worked full time	71.6%	83.5%
Average weekly hours of full-time workers, by occupation:		
Management, business, and financial	42.6	45.7
Professional specialty	41.1	43.3
Office/administrative support	40.2	41.8
Sales	41.1	44.2
Installation and repair	42.3	43.0

Sources: U.S. Bureau of Labor Statistics website—Labor Force Statistics from the Current Population Survey, available at www.bls.gov/cps/tables.htm, Tables 2, 22, 23

Human Capital Investments: Education, Earnings, and Post-Schooling Investments in Human Capital

- **women and the acquisition of human capital**

  - recent changes in the labour force participation of women, especially married women of childbearing age, are causing <u>dramatic changes in the acquisition of schooling and training by women</u>

  - women received less on-the job training than men traditionally, but the gap is narrowing – this generated the flatter age/earnings profiles, but incentives are changing that concavity

The Increased Concavity of Women's Age/Earnings Profiles

Bachelor's Degree or More (2018)

Bachelor's Degree or More (1990)

High School Graduate (2018)

High School Graduate (1990)

Human Capital Investments: Education, Earnings, and Post-Schooling Investments in Human Capital

- **women and the acquisition of human capital**
  - dramatic changes in the level of formal education received by women in recent years and their fields of study have also changed markedly
  - changes reflect the increased returns to human capital investments arising from women's <u>increased attachment to the labour force</u> and <u>longer expected work lives</u>
    - Women: well over half of both bachelor's and master's graduates
    - there have also been dramatic shifts in the fields in which women major, most notably in the areas of <u>business</u> (graduate and undergraduate), <u>law</u>, and <u>medicine</u>: where women have gone from <u>under 10%</u> of all majors to 45% more

Human Capital Investments: Education, Earnings, and Post-Schooling Investments in Human Capital

- **women and the acquisition of human capital**

Table 9.3 Percentages of Women among College and University Graduates, by Degree and Field of Study, 1971 and 2017

Percentage of Women among:	Bachelor's Degree		Master's Degree	
	1971	2017	1971	2017
Total	43.4%	57.3%	40.1%	59.4%
Business majors	9.1	47.0	3.9	47.3
Computer science majors	13.6	19.1	10.3	30.9
Education majors	74.5	81.1	56.2	77.2
Engineering majors	0.8	20.4	1.1	24.9
English majors	66.7	70.4	61.0	66.8
Health majors	77.1	84.1	55.9	81.6

Sources: U.S. National Center for Education Statistics, *Digest of Education Statistics 1993* (1993), Tables 235, 269, 271–273, 275, 278; *Digest of Education Statistics 2018* at nces.ed.gov/programs/digest/d18/, Table 318.30

Human Capital Investments: Is Education a Good Investment?

- **the question of whether more education would be a good investment**
  - individuals - "will I increase my monetary and psychological income enough to justify the costs of additional education?"
  - government policymakers - "do the expected social benefits of enhanced productivity outweigh the opportunity costs of investing more social resources in the educational sector?"

Human Capital Investments: Is Education a Good Investment?

- **is education a good investment for individuals?**
  - answer this question by calculating the <u>internal rates of return</u> to educational investments: estimate benefits by <u>calculating earnings differentials</u>
    - comparing the earnings of <u>similar people who have different levels of education</u>: earnings increases associated with increases in schooling, after controlling for age, race, gender, health status, union status, and residential location

  Typically estimate rates of return: 5–12 percent

Human Capital Investments: Is Education a Good Investment?

- **is education a good investment for individuals?**
  - **ability bias:** conventional estimates <u>may overstate</u> the gain an individual could obtain by investing in education, because they <u>do not distinguish</u> between the contribution of <u>ability</u> and <u>schooling</u>
    - people who are smarter, harder working, and more dynamic are likely to obtain more schooling
    - such people might be more productive (earn higher than-average wages) even if they did not complete more years of schooling than others
    - when measures of true ability are not observed or accounted for all the earnings differentials associated with college to college itself and none to ability, even though some of the added earnings college graduates typically receive may have been received by an equally able high school graduate who did not attend college

    Attempts to include ability – IQ, twins, unobserved heterogeneity - results of studies of identical twins with the same genes suggest that ability bias in the conventional estimates may not be very large

Human Capital Investments: Is Education a Good Investment?

- **is education a good investment for individuals?**
  - selection bias: psychic costs of schooling and individual discount rates also affect decisions about educational investments, yet they cannot be measured
    - studies have tried to find contexts in which people who are alike have different levels of education because of factors beyond their control – e.g. the implementation of compulsory schooling laws (laws that require children to remain in school until they reach a certain age)

  Studies of high school dropouts—some of whom, by the accident of their birthday, will have been forced into more schooling than others—have yielded estimated rates of return that lie slightly above the range of conventional estimates

Human Capital Investments: Is Education a Good Investment?

- **is education a good social investment?**
  - the issue of education as a social investment has been of heightened interest due to:
    - product markets have become more global, increasing the elasticity of both product and labour demand
    - growing availability of high-technology capital has created new products and production systems that may require workers to have greater cognitive skills and to be more adaptable, efficient learners
    - some students in elementary and secondary school students have scored relatively poorly on achievement tests in mathematics and science

Human Capital Investments: Is Education a Good Investment?

- **is education a good social investment?**

Table 9.4 International Comparisons of Schooling, 2015

Country	2015 expenditures per pupil, elementary and secondary level (USD)	2015 math test scores, 15-year-olds	2015 science test scores, 15-year-olds
France	9,897	493	495
Germany	10,863	506	509
Japan	10,167	532	538
United Kingdom	11,078	492	509
United States	12,424	470	496

Source: U.S. National Center for Education Statistics, *Digest of Education Statistics, 2018,* Tables 605.10, 602.40 at the National Center for Education Statistics website—http://nces.ed.gov/programs/digest/d18/tables/dt18_605.10 and http://nces.ed.gov/programs/digest/d18/tables/dt18_602.40

Human Capital Investments: Is Education a Good Investment?

- **is education a good social investment?**
    - the social cost: the resources devoted to schooling
    - the social benefit: increased educational investments increase worker productivity then society's stock of human capital increases as a result
        - bigger (if there are externalities) or smaller (if the educational system works as a mean of finding out who is productive) than the increase for the individual

education has positive externalities and so the social benefits are larger than the private benefits

others argue that returns to society are smaller than the returns to individuals – the educational system is used by the society as a screening device that sorts people by their (predetermined) ability

Human Capital Investments: Is Education a Good Investment?

- **is education a good social investment?**
  - education can be a signalling device – in this case social investment is justified?
  - the signalling model
    - an employer seeking to hire workers is never completely sure of the actual productivity of any applicant, and in many cases, the employer may remain unsure long after an employee is hired
    - an employer can observe certain indicators that firms believe to be correlated with productivity: age, experience, education, and other personal characteristics
      - some indicators – e.g. age - are immutable, others – e.g. formal education - can be acquired by workers
      - indicators that can be acquired by individuals can be called signals – there are signalling aspects of formal education

Human Capital Investments: Is Education a Good Investment?

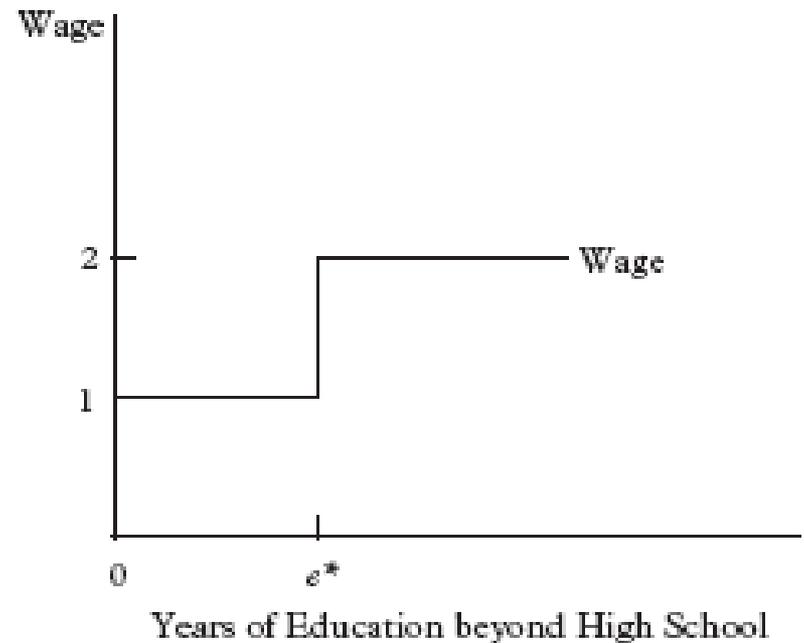- **is education a good social investment?**
  - **the signalling model**
    - **example: suppose that firms wanting to hire new employees for particular jobs know that there are two groups of applicants that exist in roughly equal proportions - group 1 has a productivity of 2 and the other has a productivity of 1**
      - **assume the productivity levels cannot be changed by education**
      - **employers cannot readily distinguish which applicants are from which group: firms would be forced to assume that all applicants are "average" - they would have to assume that each had a productivity of 1.5 (and would offer them wages of up to 1.5)**
      - **workers would be receiving what they were worth on average but any firm that could devise a way to distinguish between the two groups (at little or no cost) could enhance its profits**

    using educational attainment as a hiring standard can increase profits even if education does not enhance productivity

Human Capital Investments: Is Education a Good Investment?

- **is education a good social investment?**

    - suppose that employers come to believe that applicants with at least e^* years of education beyond high school are the ones with productivity 2 and that those with less than are in the lower-productivity group

    - with this belief, workers with less than e^* years would be rejected for any job paying a wage above 1, while those with at least e* would find that competition among employers drives their wages up to 2
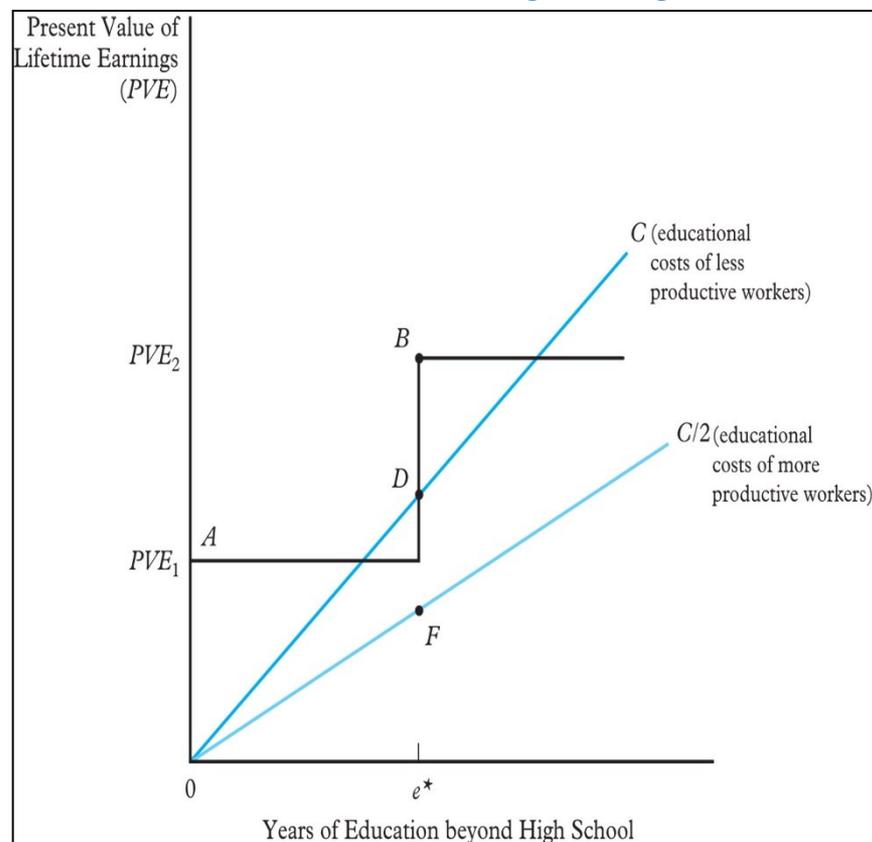
Human Capital Investments: Is Education a Good Investment?

- ## is education a good social investment?

  - *PVE$_1$* and *PVE$_2$* are the sums of the discounted lifetime earnings of workers who earn wage of 1 and wage of 2, respectively

  - each year of education costs *C* for those with lower productivity (lower cognitive ability or distaste for learning) and *C/2* for those with greater productivity

  - workers choose the level of schooling at which *PVE$_1$* – C and *PVE$_2$* – *C/2* will be maximized. For lower productivity workers, the choice would be *A0* with zero years of schooling beyond high school because acquiring *e** yields *BD* (< *A0*)

  - higher productivity workers with cost of *C/2* would find it profitable to acquire *e** years beyond high school because *BF* (>*A0*) exceeds other schooling choices

The Lifetime Benefits and Costs of Educational Signaling

Human Capital Investments: Is Education a Good Investment?

- **is education a good social investment?**
  - signalling or human capital?
    - direct evidence of the role schooling plays in society - <u>signalling or human capital</u> - is difficult to obtain because of the different views:
      - advocates of the signalling hypothesis argue that what is learned in school is proportional to the time spent there and that an added bonus, which is the rate of return, just for a diploma is proof of the signalling hypothesis
      - advocates who are of the view that schooling enhances human capital argue that those who graduate after four years of college have more than four times what the freshman dropout learned

Human Capital Investments: Is Education a Good Investment?

- **is education a good social investment?**
    - is public sector training a good social investment?
        - many studies have analysed the benefits of public sector training programs by comparing what would be earned in the absence of the training programs
        - studies found that per-student, the direct costs of these training programs have been in the range of $4,900 to $10,000, but they also had opportunity costs in the form of forgone output

    studies found that adult women are the only group among the disadvantaged that clearly benefit from these training programs