Chapter Nine
Human Capital Theory: Applications to Education and Training

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Learning Objectives

- Factors that determine the market rate of return to education
- Is education economically worthwhile?
- Is education a predictor of greater productivity?
- Market signalling and screening
- On-the-job training
- Government-funded training programs

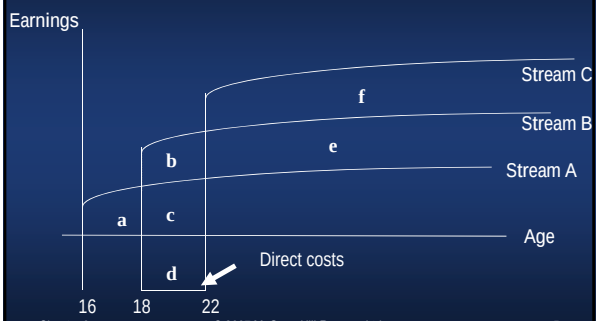
Human Capital Theory

- Investments are made to improve productivity and earnings
- Costs incurred with the expectation of future benefits
- Benefits must exceed costs

Human Capital Theory

- **Costs:**
  - **Direct costs**
    - **books, tuition**
  - **Opportunity cost**
    - **income forgone**
  - **Private costs vs. social costs**
- **Benefits**
  - **Consumption vs. Investment Benefits**
  - **Private benefits vs. social benefits**

Alternative Income Streams
(Age-Earnings Profiles)



Age-Earnings Profiles

Common attributes:

- Increase with age but at a decreasing rate
- Higher for those with more education

Optimal Human Capital Investment

The optimal investment in human capital is determined by comparing the costs and the benefits of having and additional year of education, using the following concepts:

- **Marginal costs and benefits of education**
- **Rate of return on investment in education**

Optimal Human Capital Investment

- **To maximize the net present value of lifetime earnings:**
  - Increase education until…
  - Present value of benefits of additional year (MB) equals present value of additional costs (MC), **or**
  - **i = r**

  where: i = internal rate of return
  r = market interest rate

Optimal Human Capital Investment

- **Simplifying assumptions:**
  1. No direct (consumption) utility or disutility from education
  2. Hours of work are fixed
  3. Income streams associated with education amounts are known
  4. Individuals can borrow and lend at the real interest rate (perfect capital markets)

Optimal Human Capital Investment

Formal analysis of benefits:

- Consider an 18-year-old high school graduate faced with a decision to work or go to college:
  The net present value of benefits at age 18 over T – 18 remaining years of work would be:
- $PV = Y/(1+r)^0 + Y/(1+r)^1 + \ldots + Y/(1+r)^{T-18}$
- $PV = Y + \sum_{t=1}^{T-18} Y/(1+r)^t$ or, $PV \approx Y + Y/r$

Where, Y = income (constant over working years, T – 18)
r = market interest rate (discount rate)
T = age

Optimal Human Capital Investment

- Cost of Investing one more year in (post secondary) education (MC):
- MC = Y + D
- Where,
- Y = forgone income while attending one more year of school
- D = direct cost of one more year of school

Optimal Human Capital Investment

Total benefit of one more year of school:

- $PV^* = (Y + \Delta Y)/r - D$
- Where, ΔY = increase in income due to extra year of schooling (MB)
- Optimum quantity (# of years) of education will be achieved when:

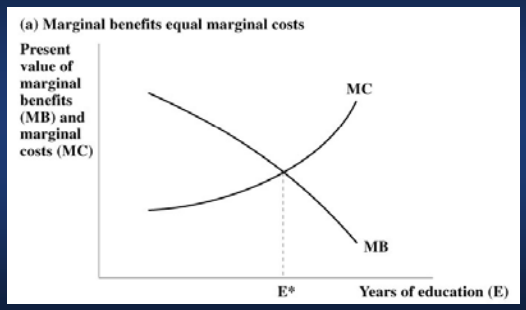
MC = MB, or PV = PV*

PV (Y + D) = PV* (ΔY), that is:

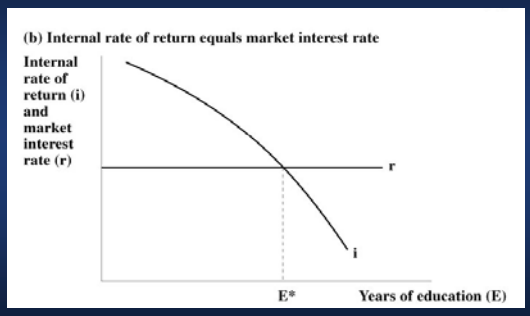
$Y + D = \Delta Y/r$, or $r = \Delta Y/(Y + D) = i$

Where i = the internal rate of return

Optimal Human Capital Investment



Optimal Human Capital Investment



Implications of Theory

1. Investment should be made early in one's life
2. Little incentive for individuals experiencing discontinuity in the workforce
3. Investment in education and progressive tax system

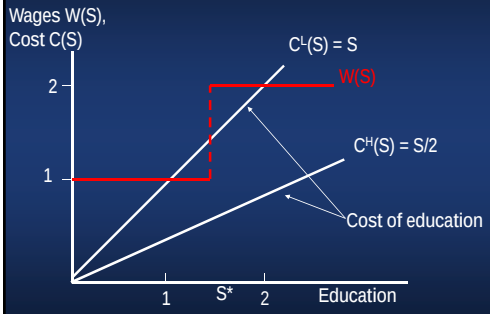
Factors Influencing Education

- Income tax
  - Increase in progressivity of taxes reduces demand for education
- Student loans
  - Alter marginal cost of education and levels of educational attainment (increase in productivity will benefit both the society and the individual)

Education as a Filter

- Education acts as a signal of the productivity of employees
- Higher wages are offered if employers believe that education increases productivity – even if education does not increase productivity

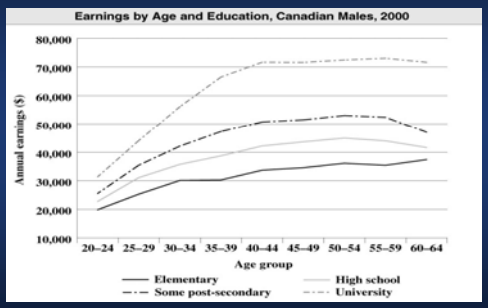
Offered Wage and Signalling Cost Schedules



Empirical Evidence: Education and Earnings

- Earnings increase with age experience
- Increase is most rapid to age 40 or 44 for individuals with the most education
- Differential is wider between groups at age 50 than 20–30

Empirical Evidence: Education and Earnings



Estimates of Private Returns to Schooling in Canada, 1995

Level of Schooling	Males	Females
Bachelor's degree[2]	17	20
Master's degree	nc[3]	5
Ph.D.	2	10
Bachelor's Degree by Field of Study	**Males**	**Females**
Education	12	19
Humanities and fine arts	nc	13
Social sciences[4]	13	18
Commerce	18	25
Natural sciences	17	22
Engineering and applied science	22	24
Health sciences	29	30

Human Capital Earnings Function

- Estimates the rate of return to education
- Controls for other factors that may affect earnings such as ability and experience

$$\ln Y = \alpha + rS + \beta_1 EXP + \beta_2 EXP^2 + \varepsilon$$

Where:

Y = Earning; α = Fixed component of wage with no schooling; r = i = internal rate of return; S = Years of schooling; EXP = Experience (= age – S – 5); ε = Random variable (motivation, luck, etc.)

Signalling, Screening, and Ability

- Determinants difficult to control
  - innate ability, motivation, perseverance, tolerance, etc.
- Education as Signalling/Screening
- Private returns on education
- Social returns on education

Addressing Ability Bias

- Natural experiments are ways to separate control and experimental (or treatment) groups
  - Isolate the influence of education from unobserved ability factors
    - Research on twins
    - Compulsory school attendance laws
    - Proximity to college findings

Increased Returns to Education and Inequality

- Variation of returns to schooling over time
- Increased returns have coincided with increases in income inequality

Training

General Training

- **Skills used in various firms**
- **Firms will offer higher wages for this training**
- **Trainee is willing to bear the cost since higher wages are offered for these skills**

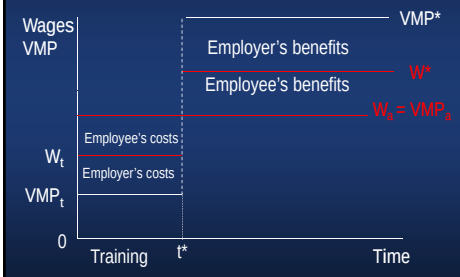
Specific Training

- **Training useful to the firm that provides the training**
- **Trainee is unwilling to bear the cost because there are no higher earnings**
- **Firm does not have to pay higher wages because other firms are not competing for such trainees**

Costs, Benefits, and Financing of Training

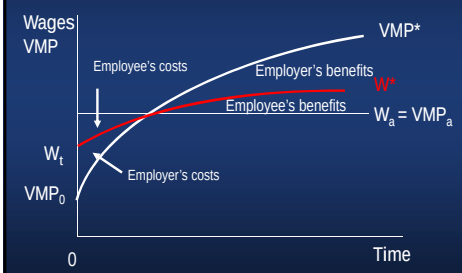
Costs, Benefits, and Financing of Training

Specific training as a shared investment



Costs, Benefits, and Financing of Training

Earnings growth with gradual training



Appropriate Role of Government

- Private markets may not provide socially optimal amounts of training:
  - Imperfect information
  - Social benefits not included
- Training subsidies to disadvantaged could:
  - Increase working hours
  - Raise wages above the poverty line

Summary

- Investment in human capital
  - Benefits and costs and return to schooling
- Education and alternative age earnings profiles
- Education and labour productivity
- The human capital earnings function
- Education as a signalling factor
- Empirical results and the ability bias
- On-the-job training
  - General training vs. specific training
- Government training programs

End of Chapter Nine