Lecture 4. Schooling & Rates of Return to Schooling

1. Schooling: full-time investment in human capital

(1) Years of schooling

The schooling model:

Schooling is an intra-marginal decision. It comes about when individuals are unable to equate marginal costs and benefits of investment. The optimal years of schooling is reached for an individual when his/her marginal rate of return to schooling equals the rate of discount.

(1). Rates of Return to Schooling

a. The present value formula and the rate of return to education

Suppose a person is at age t and the retirement age is T. The person faces a decision whether or not to study a programme. The annual benefits of studying this programme are: B_j (j=t+1, ..., T), and the current cost is: C. The discount rate is i. Then the present value of this investment is:

$$PV = B_{t+1}/(1+i) + B_{t+2}/(1+i)^2 + ... + B_T/(1+i)^{T-t}$$

The internal rate of return, r, is defined as the discount rate that makes PV=C. For education investment, r is the so-called rate of return to education.

A simple numerical example:

Suppose a person only lives for two periods. In period 1, she/he has to decide whether or not to attend school. If she/he attends

school she/he would earn 10,000 dollars more a month or 120,000 more a year. The cost of schooling is 100,000 a year (both direct and indirect costs). What is the rate of return to schooling for her/him?

PV=120,000/(1+r)= C = 100,000, and r=0.2 or r is 20%.

b. The Simplified Annuity Formula

Assume that both the annual benefits are constant over time: B_j = B (j=t+1, .. ,T), then

$PV = B/(1+i) + B/(1+i)^2 + ... + B/(1+i)^{T-t} = (B/i)(1-1/(1+i)^{T-t})$

When T-t is very large, $1/(1+i)^{T-t}$ is approximately zero. So PV=B/i.

The rate of return, r, is therefore approximately B/C when a person is very young.

So to extend above example to a case of studying for a university degree in Hong Kong, we can assume a university graduate can earn on average HK$120,000 extra a year than a high school graduate. The cost for study (including the opportunity cost) is also 120,000 a year or 360,000 for three years. Then, the internal rate of return for investment in university degree is:

r = B/C = 120,000/360,000 = 0.33 or 33%.

c. Mincerian Earnings equation and rate of return to human capital investment

<u>Basic</u>:

$\log(wage) = c + rS + gT + hT^2$,

where S is years of schooling, and T is years of experiences. c is a constant, and r is rate of return to an extra year of education.

Extended:

$\ln(\text{wage}) = c + r_i(\text{Dummies of Education levels}) + gT + hT^2$,

So a university graduate's earning is: $\ln(\text{wage}_u) = c + r_u + gT + hT^2$

and a high school graduate's earning is: $\ln(\text{wage}_h) = c + r_h + gT + hT^2$

The internal rate of return for university education is therefore:

$r = (\text{wage}_u - \text{wage}_h)/[(\text{extra years of study for university degree}) \times \text{wage}_h]$

$\approx [\ln(\text{wage}_u) - \ln(\text{wage}_h)] /(\text{extra years of study for university degree})$

$= (r_u - r_h)/ (\text{extra years of study for university degree})$

In general rate of return for a higher level of education: $r = (r_j - r_i)/(\text{extra schooling years})$

2. Estimates of the rate of return to education

Hong Kong: an example with 1991 Census (1% sample) and using SPSS http://www.ln.edu.hk/econ/staff/staffmain.htm

Worldwide comparison: Psacharopoulos & Patrinos (2002) http://econ.worldbank.org/files/18081_wps2881.pdf

3. Main problems associated with estimating rate of return to education

(1). Unobserved ability bias

Individual abilities are often difficult to observe and measure. However, abilities are positively related to both education and earnings. Therefore, without properly controlling for abilities the return to education can be easily over-estimated.

(2). Measurement errors

Measurement errors may arise in both educational attainment (people tend to over-exaggerate their qualifications) and earnings (people tend to under-report their earnings, fringe benefits are often not counted). These measurement errors tend to bias the return to education downwards.

(3) Selectivity bias

People make optimal decisions on how much education they should receive. Such optimal decisions often result that the opportunity costs for receiving or not receiving certain education are hard to calculate. The use of average earnings of other people to estimate one's opportunity cost can be misleading and hence biases the estimated return to education.

A somewhat more demanding extra reading:

http://www.nber.org/papers/w11544