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EDUCATION AS INVESTMENT TO HUMAN CAPITAL. COMPUTATION OF RATES OF PRIVATE AND SOCIAL RETURNS TO EDUCATION. /A METHODOLOGICAL SURVEY/

1. INTRODUCTION

On the basis of the Human Capital Theory the education can be seen as investment to the individual human capital, so we can compute the rate of returns of these investments in the same way as of investments in the physical capital (Schultz [1983], Becker [1993]). The returns to education can be examined from private and social point of view, however different costs and benefits have to be taken into account depending on whether private or social rates of returns is computed. In this paper the author surveys the methods of the computation of rates of private and social returns to education and make a short comparison.

2. THE COMPLETE METHOD

Costs and benefits of education can appear in different points of time and measure. The basis of the complete method is computing the internal rate of returns to education, so we look for the rate that equalizes discounted benefits to the discounted costs at the present or at a given point of time, where the net present value is zero.

The net present value equals (Psacharopoulos [1995]):

$$NPV = \sum_{i=t+1}^n \frac{(W_j - W_{j-1})_i}{(1+r)^i} - \sum_{i=1}^t \frac{(W_{j-1} + C_j)_i}{(1+r)^i}. \quad (1)$$

Considering that net present value is zero, discounted costs and benefits equal:

$$NPV = 0, \text{ that is}$$

$$\sum_{i=1}^t \frac{(W_{j-1} + C_j)_i}{(1+r)^i} = \sum_{i=t+1}^n \frac{(W_j - W_{j-1})_i}{(1+r)^i} \quad (2)$$

where,

i: is number of years,
j: is the given schooling qualification (can be university, college, grammar school, vocational secondary school, vocational school, technical school),
n: is the number of years of work (experience), (generally to the retirement age),
t: is the number of years of schooling,

W_{j-1} : is earnings at $j-1$ -th schooling level,

C_j : direct costs of schooling at given j -th schooling level,

$(W_{j-1} + C_j)$: complete (direct and indirect) costs of schooling at given j -th schooling level,

$W_j - W_{j-1}$: difference of earnings between the j -th and the previous schooling qualification, so the benefits from earnings,

$\sum_{i=1}^t \frac{(W_{j-1} + C_j)_i}{(1+r)^i}$: is the present value of direct and indirect costs,

$\sum_{i=t+1}^n \frac{(W_j - W_{j-1})_i}{(1+r)^i}$: the present value of benefit of education/schooling.

The discounted streams of costs and benefits refer to the first (schooling) year of obtained schooling qualification. Of course computing of present value can carry out for any optional year, either the last year of schooling or the first year of work. The internal rate of return for the first year of work is the following.

$$\sum_{i=t}^1 (W_{j-1} + C_j)_i \cdot (1+r)^i = \sum_{i=1}^n \frac{(W_j - W_{j-1})_i}{(1+r)^i} \quad (3)$$

We suppose at application of the model that both costs and benefits appear at the end of years.

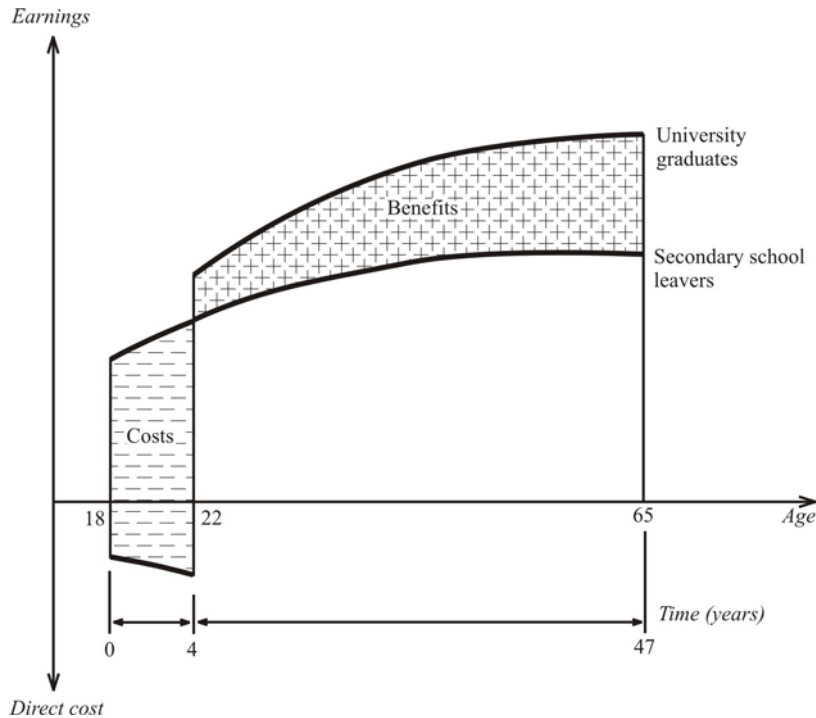


Figure 1. Age-earnings profile for computing of rates of returns using complete method. Source: Mingat and Tan [1988]

2.1 Costs

2.1.1 Indirect costs

The costs can be divided into two parts: direct and indirect costs. The failed earnings belong to the indirect costs since the individual learns at school and stays away from labour market i.e. he or she does not realize any benefits from working. Of course these items are not considered before minimum age of legal employment, for example for primary school pupils under fourteen years. The extent of the minimum age of employment is fixed by law so can be different between countries. Net earnings as actually realised value by the individual are taken into account for profit and indirect costs when calculating the private rates of returns to education and are corrected with probability of unemployment.

However gross earnings are taken into account for calculating the social rates of returns to education. A correction is necessary with the probability of becoming unemployed because if the individual wants to work and tries to get a job, it is possible that can not find any, moreover the probability of becoming unemployed can be different for individuals with different qualifications. Considering the probability of unemployment (q) the equation (1) is the following:

$$NPV = \sum_{i=1}^t \frac{(q_{j-1} \cdot W_{j-1} + C_j)_i}{(1+r)^i} - \sum_{i=t+1}^n \frac{(q_j \cdot W_j - q_{j-1} \cdot W_{j-1})_i}{(1+r)^i} \quad (4)$$

where

r : is the rates of returns to education,

$q_j \cdot W_j - q_{j-1} \cdot W_{j-1}$: difference of earnings between the j -th and the previous

schooling qualification, so the benefits from earnings with correcting of probability of unemployment,

$(q_{j-1} \cdot W_{j-1} + C_j)$: complete (direct and indirect) costs of schooling at given schooling level.

2.1.2 Direct costs

The actual expenditures belong to the direct costs, however specification of real expenditures is not unequivocal since if we suppose free education, then the question can be raised: what kind of costs should be listed. Direct costs which must be paid by the individual or his provider can appear at any level of education. Among others we can rank the following to the direct costs (Cohn-Geske [1990], Varga [1998]):

- expenditures of text books, dictionaries,
- costs of equipments for schoolings (stationeries, exercise-books, gymnastic equipments, etc.)
- the additional costs incurred by accomodation, meals, travel and public transport,
- tuition fees, registration fee and other charges,
- expenses of private lessons, costs of preparatory courses for entrance examination, expenses of language courses.

3. THE SHORT METHOD

The Short method is a simpler estimate of the rates of returns to education that does not take into account different earnings from time to time and permanence of difference between earnings of miscellaneous qualified persons and costs of education is supposed (Fig. 2). Expenses and incomes arisen in different time, are not discounted for the same time so we do not take into account time value of the money. The short method is mostly applied if we have no accessible details data broken down by educational level and age, in this case we can calculate on average earnings by educational level. This estimation procedure is suited to approach private and social rates of returns to education (Psacharopoulos [1995]).

$$r = \frac{\overline{W}_j - \overline{W}_{j-1}}{t \cdot (\overline{W}_{j-1} + C_j)} \quad (5)$$

where

\overline{W}_j : is average earnings at j -th schooling level,

\overline{W}_{j-1} : is average earnings at $j-1$ -th schooling level,

t : is the number of years of schooling,

C_j : direct costs of schooling at given schooling level.

Failed earnings as indirect costs and direct costs of education are taken into account for the same amount of time, for example for five years in case of estimate of rates of returns to university qualification. However failed earnings shall not be taken into account for the whole period of the education in case of computing the rates of returns to primary education, where the highest completed level of education is primary school in comparison with persons without primary school qualification, because these persons can not reach the minimum age of employment for example for the first six years of education, so the specified form of the (5) equation is the following:

$$r = \frac{\overline{W}_j - \overline{W}_{j-1}}{k \cdot \overline{W}_{j-1} + t \cdot C_j} \quad (6)$$

where

k : number of years in which earnings can be realized with $j-1$ -th educational level on the labor market in the (schooling) years of the given (j -th) educational level.

The educational qualification at j and $j-1$ -th levels do not mean cardinal number or serial number but they mean the given educational levels (j) (university, college, secondary technical school, grammar school, vocational secondary school, industrial/trade school, professional school, primary school), and the next lower educational levels ($j-1$).

The following equation is given from (5), assuming $C_j = 0$ in the calculation of the private rates of returns to education:

$$r = \frac{\overline{W}_j - \overline{W}_{j-1}}{t \cdot \overline{W}_{j-1}} \quad (7)$$

Deficiency of this method is that the difference of earnings with given educational qualification by ages is not taken into account. However we have to mention that the statement is not completely true since all age groups play a role in the calculation of the average earnings with a unit for each, but more precise estimates of full method is not controversial. In the comparative and analytical studies of the complete and short method (Mingat and Tan [1988]) was deduced that the order of magnitude of these two estimates and the structure of returns to education do not differ significantly from each other. Furthermore, estimates of these two methods are not absolutely precise but these two procedures are suitable for analysis of the education investment priority because for those the exact figures are not indispensable.

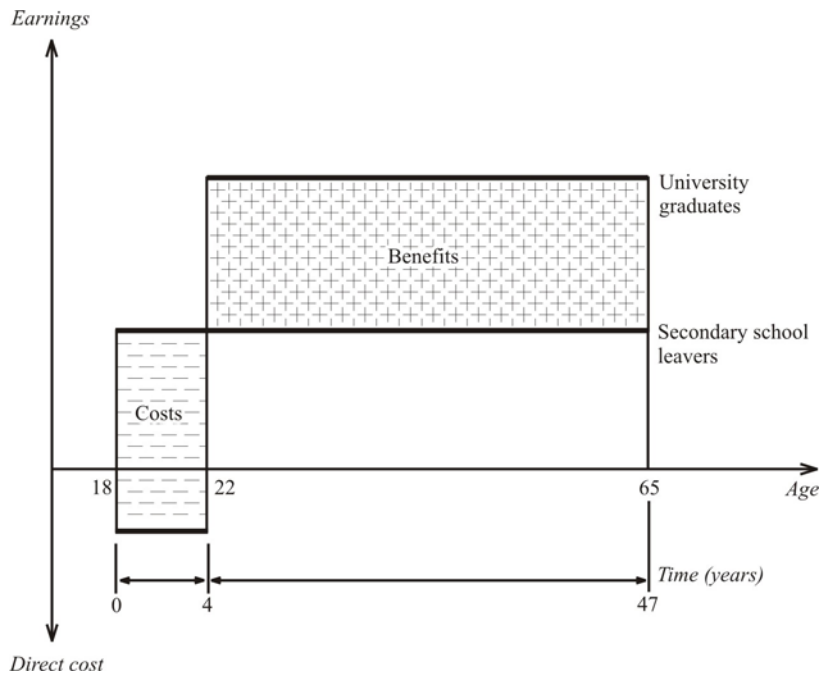


Figure 2. Age-earnings profile for computing of rates of returns using short method. Source: Mingat and Tan [1988].

4. THE REVERSE COST-BENEFIT METHOD

Throughout application of this procedure we try to answer: given the cost of investment, what level of annual benefits would produce a given rate of return on the investment? (Psacharopoulos [1995]). The equation is the following:

$$\overline{W}_j - \overline{W}_{j-1} = r \cdot \left[t \cdot (\overline{W}_{j-1} + C_j) \right] \quad (8)$$

The procedure is based on the short-cut method since it takes into account the earnings of the given educational levels (j) and the next lower educational levels ($j-1$).

Furthermore permanence of the costs is supposed at given education level.

5. THE EARNINGS FUNCTION METHOD

On the basis of the well-known method as Mincerian equation dependent variable is the logarithm of income, independent variables are years of schooling, years of labor market experience and its square of the earnings (Mincer [1974]). The function can be specified in the following form:

$$Y = f(S, EX) \quad (9)$$

Its logarithm form:

$$\ln Y_i = a + b \cdot S_i + c \cdot EX_i + d \cdot EX_i^2 \quad (10)$$

where

$\ln Y$: is the natural logarithm of income,

S_i : is the number of years of schooling,

EX_i : is the number of years of work experience,

EX_i^2 : is the square of the number of years of working experience,

a : is a constant,

b, c és d : are regression coefficients.

Conditions of the application of this method that data of individual earnings, qualification (number of years of schooling), years of work experience namely the number of years of working shall be available. The b coefficient in the model is average private rate of return of one additional schooling year, which correspond to the estimated rate of return by short method:

$$b = \frac{\partial \ln W}{\partial S} = \frac{W_s - W_o}{W_o} \cdot \frac{1}{\Delta S} = \frac{W_s - W_o}{\Delta S \cdot W_o} = r \quad (11)$$

where

W_s : is the earnings of the individual who has completed S years of schooling,

W_o : is the earnings of the individual who has completed o years of schooling,

ΔS : is the difference of the education years between two groups.

The rate of returns to education can be estimated for different levels of education by earning functions method with the introduction dummy variables instead of the continuous years of schooling variable. The completed schooling levels by the individual are indicated D_u , D_s , D_p separately, in the appropriate place

university, secondary and primary school level. The extended earnings function can be written in the following form:

$$\ln Y_i = a + b_p \cdot D_p + b_s \cdot D_s + b_u \cdot D_u + c \cdot EX_i + d \cdot EX_i^2 \quad (12)$$

In due course the rates of returns to different schooling levels (primary school, secondary and tertiary education) are the following¹:

$$\begin{aligned} r_p &= \frac{b_p}{D_p} \\ r_s &= \frac{b_s - b_p}{D_s - D_p} \\ r_u &= \frac{b_u - b_s}{D_u - D_s} \end{aligned} \quad (13)$$

The direct costs of education (for example tuition fees, the additional costs incurred by accomodation, meals, travel and public transport etc.) are not taken into account for application of the earnings function method, only the indirect costs as failed earnings are considered. It can be mentioned as the deficiency of the method that assumes constant age-earnings profiles (Psacharopoulos [1995]).

CONCLUSIONS

The short method is a quicker and simpler way to estimate the rate of return to investment in education than the complete method, assuming flat age-earning

¹On the basis of Psacharopoulos [1995].

profiles (illustrated in figure 2). The advantage of the short method is that it requires fewer data and yields estimates comparable to those from the complete method. The results may be a better reflection of recent patterns in the profitability of investing in education, because they do not incorporate information from older workers whose labor market experiences may be less relevant (Mingat-Tan [1988], pp 114.).

The complete method can be mentioned as more precise estimate among described calculation procedures since both private and social rate of return to education can be calculated, the procedure shall take into account age variation of the earnings, furthermore there is opportunity for correcting probability of mortality and becoming unemployment, and for taking into account some extents of the external benefits².

The basic Mincerian earnings function does not distinguish between different levels of schooling, but it initiates dummy variables in the extended earnings function in order to solve this problem.

The advantage of the earnings function is that it can be used to estimate the influence of different factors on earnings including ability, social class background and other factors. The disadvantage of the Mincerian way of estimating the returns to education is that it requires a large sample of individual observations. This method resembles the short method in the way that the rate of return to education is estimated as a ratio of a constant annual benefits flow to the education (direct and indirect) costs for attaining the next level of education (Psacharopoulos [1999]). Moreover an obvious disadvantage of the Mincerian earnings function approach is that it can be used only to estimate the private rate of return. The social rate of return differs from the private returns in that it takes account of private and social costs. The social costs include the private costs and the value of teachers' time, materials, the value of the use of buildings and capital equipment etc. In the private rate of return estimation earnings should be after tax (after deduction of income taxes and employee social-security contributions), whereas earnings in the social rate of return calculation should be before tax. The private rate of return to education is used to explain the demand for education, how taxes on earnings affect private benefits. The social rates of returns can point to problems of resource allocation in the education sector (between the different educational levels and types of schools).

Private returns to education are always greater than the social returns to education, since the government subsidizes education. According to Mingat-Tan

² Taking into account of the probability of mortality and becoming unemployment, and the extern benefits into calculations is solvable with thorough caution in the other methods.

[1988] the greater the subsidies, the greater the divergence between the private and social returns, and the greater the incentives for individuals to invest in a particular type or level of education.

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AZ OKTATÁS, MINT AZ EMBERI TŐKÉBE TÖRTÉNŐ BERUHÁZÁS. AZ OKTATÁS EGYÉNI ÉS TÁRSADALMI MEGTÉRÜLÉSÉNEK SZÁMÍTÁSI ELJÁRÁSAI. /MÓDSZERTANI ÁTTEKINTÉS/

Az emberi tőke elmélete alapján, az oktatás az egyén emberi tőkéjébe történő beruházásaként értelmezhető, és így a megtérülése ugyanúgy, mint a fizikai tőkék tekintetében vizsgálható és mérhető. Az oktatás egyéni és társadalmi megtérülése egyaránt becsülhető, míg az egyéni megtérülési ráta számításakor

arra keressük a választ, hogy mennyire jövedelmező az egyén számára az oktatásban való részvétel, addig a társadalmi megtérülési számítások során azt vizsgáljuk, hogy az állam számára mennyire kifizetődő a különböző oktatás programokra költeni. A tanulmányban az oktatás megtérülési rátáinak lehetséges számítási eljárásait (teljes, rövidített, fordított módszereket és a Mincer-féle kereseti függvény módszerét) tekintjük át, az összehasonlítás igényével.