

我國受僱者教育投資的社會報酬率之分析

The Social Rate of Return to Investment in Education of the Employee in Taiwan

張昌吉

Chun-Chig Chang

摘 要

本文分析我國受僱者在接受不同層級的教育之後所產生的社會投資報酬率。

依據教育經濟學家 George Psacharopoulos 的理論，以及行政院主計處、教育部的數據資料，估算出教育的社會投資報酬率，從 1976 年計算至 1987 年，其平均的社會投資報酬率如下：小學的社會投資報酬率為 38.08 %；國民中學為 18.96 %；高中為 12.65 %；專科學校為 16.78 %；大學為 13.28 %；研究所為 9.39 %。此項估算若分為初等教育、中等教育、高等教育，其社會投資報酬率分為 38.08 %；18.96 %及 13.03 %，比起一般開發中國家的初級教育為 27 %；中等教育為 16 %；高等教育為 13 %均來得高，可見我國教育的成效卓著，對社會極具貢獻。

因此，受僱者除應接受短期職訓教育外，多接受正規教育亦對社會產生極高的投資報酬率，故鼓勵受僱者再職進修正規教育亦為應當推動之勞動政策。

I、Introduction

This paper will estimate the social rate of return to education of the employee in Taiwan. The impact of education includes the social rate of return to education and the private rate of return to education. For the reason that the

* 作者為美國馬里蘭大學政策科學哲學博士，國立政治大學勞工研究所副教授。

personal income data are very difficult to collect, so this paper basically focusing on the social rate of return to education. From this research we can know that if the employee gained more education in different education level then how much the society will benefit.

II、*Social Rates of Return to Education: Research Question*

As we already know, the Nine Year Compulsory Education Policy (NYCEP) can be seen as an investment. It is an investment by the government to increase the wealth of the collective body. Just like a commercial organization deciding whether or not to continue its investment on certain items so that the organization's resources can be most efficiently used, the government should calculate the social rate of return of its policy investment so that the government's budget can be used best. If the social rate of return to the policy is high enough, then it is reasonable for the government to continue the investment. If the social rate of return is low, then the government should either try to improve the implementation of the policy, or consider investing the resources in other, higher return policies.

III、*Social Rate of Return: Methodology and Data*

1. Conceptual framework

According to investment theory, the rate of return on a project is a summary statistic describing the relationship between the costs and benefits associated with the project. It is defined as the rate of interest which causes the sum of the discounted net benefits to equal zero. Thus, if the project's expected net benefits are B_t per year, extending over a period of n years, the internal rate of return (r) of this project is defined by solving equation (i) for r .

$$\text{Equ.(i)} \quad \sum_{t=1}^n \frac{B_t}{(1+r)^t} = 0$$

By analogy, the rate of return to a given educational level can be defined by comparing the level of education to the next lower one. For example, an investment project called "higher education (h)" can be evaluated relative to the alterna-

tive project "senior high school education (s)." The costs during, say, four years' study consist of direct outlays (C_h) and foregone earnings (W_s) while the benefits reflect the differential between wages earned by a higher education graduate (W_h) and those earned by a secondary school graduate (W_s) in the years following completion of higher education. On the assumption that the length of study will be four years and that the higher education graduate will have a working life of 43 years, the rate of return to investment in higher education can be found by solving equation (ii) for r .

$$\text{Equ. (ii)} \quad \sum_{t=-3}^0 (C_h + W_s)_t (1+r)^{-t} = \sum_{t=1}^{43} (W_h - W_s)_t (1+r)^{-t}$$

Equation (ii) is merely the application of the most general statement of rate of return calculations (equation (i)) to more specific assumptions.

Rates of return may be either "private" or "social." Private rates of return include only the benefits received directly by the worker and only the direct and opportunity costs borne personally by him/her. The social rate of return includes not only private costs and benefits, but also all income earned but not received by the worker, as well as all costs of education that are subsidized. If wages equal the marginal product of each type of labor and if the benefits and costs streams in equations (i) and (ii) are thought of as private ones, we can calculate the social rate of return to higher education by adding taxes to the net earnings stream and subsidies to the cost stream (Psacharopoulos, 1980). Thus, we now define

$$\text{Equ. (iii)} \quad W'_s = W_s + T_s \quad \text{and} \quad W'_h = W_h + T_h$$

where T_s and T_h are the income tax paid by the two kinds of graduates, and $C'_h = C_h + S_h$, where S_h is the subsidy society provides to higher education per student, over and above the part borne by the student himself. Substituting the values of W'_h , W'_s and C'_h in equation (ii), we have

$$\text{Equ. (iv)} \quad \sum_{t=-3}^0 (C'_h + W'_s)_t (1+r')^{-t} = \sum_{t=1}^{43} (W'_h - W'_s)_t (1+r')^{-t}$$

r' is the social rate of return to higher education.¹

2. Social costs of different educational levels

Social costs measure the total resources of education which include (1) direct costs - the rental value of building and equipment, salaries for teachers and staff, etc., and (2) indirect costs, such as earnings foregone by students. The direct costs can be computed simply by dividing the total expenditures of the different educational levels by their respective total number of students. For indirect costs, we will take the foregone earnings of students from junior high schools and above into account; students below this level have not reached the legal working age of 15.

We will use the same method to calculate social rates of return to different educational levels, specifically, elementary school, junior high school, senior high school, junior college, university and senior colleges, and graduate school. That is, the rate of return to elementary school relative to no education, junior high school relative to elementary school, senior high school relative to junior high school, etc., will be calculated. Since there are no data on actual expenditures borne out of pocket by students and their parents, the private rate of return cannot be computed.²

Data. The data to perform the rate of return calculations come from several sources. The data on earnings by level of education come from DGBAS reports for 1989. This data source, which also uses labor force survey data,³ provides average earnings by level of education for each year between 1976 and 1988. Cost data by level of education come from The Educational Statistics of the Republic of China, published by the Ministry of Education 1989.

Direct cost data is provided in Appendix Table A. The Ministry of Education provides summaries of total public expenditures per year for each level of education for public and private education together in Taiwan. The educational system of Taiwan is predominantly public in the lower levels, but substantially private at higher levels. For example, in 1988-89, one percent of elementary education, 4.6% of junior high school, 25% of senior high school, 81.7% of junior college, 60.4% of university students, and 23.1% of graduate students attended private institutions. These percentages are somewhat higher than for earlier years. On the other hand, private schools and universities in Taiwan receive very large subsidies from the central government. The subsidized portions of private educa-

tion are included in the cost estimates, but no data exists from which it would be possible to estimate the unsubsidized portion of educational costs of running private schools. The result is that the cost estimates that are available (and are summarized in Appendix Table A) may underestimate the true costs of providing junior college and university education in Taiwan.

Data on average earnings by year for persons of different educational attainments is provided in Appendix Table B. These data are used both to estimate the opportunity cost of attending a level of education, as well as to approximate the net benefit from attending that level of education. Appendix Table C summarizes the total measurable social costs of education, which are equal to the direct cost plus the opportunity cost of schooling. For example, the total cost of attending one year of senior high school in 1976 is the direct cost to Taiwan of providing a year of schooling (NT\$ 7535, Table A) plus the foregone earnings of a junior high school graduate in 1976 (NT\$ 60109, Table B), for a total social cost of NT\$ 67644. The net benefit to a high school graduate of 1976 is estimated in this dissertation as the difference in incomes over his work life of high school graduation compared with junior high school graduation. In this dissertation this difference is computed as the year of graduation income of senior high school graduates less the income of junior high school graduates. For 1976 graduates of senior high school, this is NT\$ 77318 - NT\$ 60109, or NT\$ 17209. This net income is presumed to not change through retirement at age 65. In other words, the rate of return to, for example, senior high school education involves three years of net costs while the student is in high school, followed by n years of net benefits, where the benefits period extends from the customary age of graduation from this level until 65.⁴ The calculations compare junior high school graduation with respect to elementary education, senior high school education with respect to junior high school, junior college education with respect to senior high school, senior college and university education with respect to senior high school, and graduate school with respect to university and senior college education.

This method for estimating the net benefit to education suffers from several weaknesses. Since salaries rise with experience, real economic growth, and inflation, the differentials computed in our cross-sectional methodology are likely to understate the actual change in net earnings over time, and therefore understate

the true rate of return to education. Whether the estimates of the true rate of return are underestimated or overestimated depends in part on the age distribution of the workers in the samples used to calculate average wages. For example, if young workers are overrepresented in the sample, then the actual average earnings for a given education level will be underestimated. On the other hand, if older workers are overrepresented, the average earnings may be overestimated. We expect that the impact of NYCEP would be to increase the number of young workers with higher levels of education, and decrease the number of younger workers with less education. This would cause our estimates of the rate of return to education to be biased downward.

This measurement problem of potentially underestimated rates of return clouds the comparison of rates of return to education with interest rates in the rest of the economy, which also include a premium for anticipated inflation. Also, part of the return to education may be a return to ability differences, so that the rate of returns we can estimate consist partly of a return to being more able, and therefore able to get higher education, particularly in the pre-NYCEP years, and partly to a pure return to education.

Another difficulty is that the results are more reliable for men than for women, since women may spend many years outside the labor force, therefore not receiving net benefits in those years.

To summarize, the rate of returns that can be calculated are subject to various biases. The lack of private spending on private education in Taiwan tends to underestimate costs, therefore overestimate the rate of return to education. The lack of data on ability of workers and on number of years out of the labor force for women also overestimates the rate of return to education. The use of cross sectional earnings data by educational level tends to underestimate the rate of return to education. It is not possible to gauge which set of biases predominate. However, while the procedures employed here may be flawed, they are exactly the same flawed procedures that other economists have used to analyze rates of return in other developing countries.⁵

IV、*Social Rate of Return to Education: Results*

The results of the rate of return calculations are summarized in Table 1.⁶

Table 1: Estimates of the Social Rate of Return to Different Educational Levels in Taiwan for Graduates of Different Years(%)

	PRMRY	JR-HGH	SR-HGH	JR-CLG	SR-CLG UNV	GRAD
1976	36.50	19.15	13.84	17.27	11.87	8.74
1977	38.74	20.76	13.58	17.40	15.11	9.68
1978	40.63	20.44	13.57	17.35	13.85	9.36
1979	39.31	19.91	13.14	17.22	13.99	10.48
1980	39.41	19.10	13.09	17.27	15.14	11.31
1981	37.94	18.43	12.65	17.39	13.90	11.08
1982	34.93	17.92	11.86	16.49	12.34	8.73
1983	34.43	17.79	12.06	16.49	12.22	8.72
1984	45.03	18.14	12.45	16.51	12.47	8.66
1985	36.15	17.91	11.90	16.30	12.85	8.16
1986	39.22	19.47	11.88	15.97	13.02	9.37
1987	34.72	18.45	11.81	15.70	12.63	8.61
AVRG	38.08	18.96	12.65	16.78	13.28	9.39

Another classification reviewed by Todaro, that of the Organization for European Cooperation and Development (OECD), classifies Taiwan as an upper-income, Newly Industrializing Country (NIC). Other NICs include the Republic of Korea, Mexico, Brazil, Portugal, Argentina, and Greece.

The social rate of return estimated for 1987 graduates of primary school is 34.72 percent; 18.45 percent for junior high school; 11.81 percent for senior high school; 15.70 percent for junior college; 12.63 percent for university and senior college; and 8.61 percent for graduate school.

Averaging the results over the 12 year period 1976-1987, the results are slightly higher than for 1987. Taiwan's social rate of return to differences in edu-

cational levels averages 38.08 percent for primary school; 18.96 percent for junior high school; 12.65 percent for senior high school; 16.78 percent for junior college; 13.28 percent for university and senior college; and 9.39 percent for graduate school. This very slight downward trend in the calculated rates of return suggests the possibility that the marginal rate of return to education may be falling in Taiwan.

Psacharopoulos' summaries of rates of return to levels of education in developing countries (see table 2). Table 2 summarizes and compares the results for Taiwan with the results for the average of developing, intermediate, and advanced countries. Taiwan's social rate of return to primary education is 38.08 percent, which is 11.08% higher than Psacharopoulos' average for developing countries and more than double the rate of return in intermediate countries. For secondary education the Taiwan average is 18.96 percent, which is nearly three percentage points higher than the developing economies' average, five percentage points higher than the intermediate countries' average, and nearly double the advanced countries' average. In higher education the Taiwan average is 13.03 percent, which is identical to the developing economy average, but is three percentage points higher than the intermediate average and four points higher than the advanced countries average.

From Tables 1 and 2, we can find some rate of return patterns. (1) The returns to primary education are the highest among all educational levels; this is consistent with worldwide patterns. (2) All the rate of return to investment in education estimates are well above the ten percent common yardstick of the opportunity cost of capital, except for graduate school. Since the methodology did not permit the earnings differences to rise with inflation or experience, while inflation premiums are normally included in the opportunity cost of capital, this strengthens the argument that education is indeed a valuable investment for Taiwanese society. (3) There are diminishing marginal returns to investment in education. With the slight exception of junior college, the estimated social rates of return decline rapidly after primary school.

There are several policy implication in the data: (1) Since primary education is already compulsory, the high measured rate of return raises the question of

Table 2: Social Rate of Return to Investment in Education (percent)

Country	Primary Education	Secondary Education	Higher Education
Taiwan R.O.C.	38.08	18.96	13.03
Other Developing Countries	27	16	13
Intermediate Countries	16	14	10
Advanced Countries	not applicable	10	9

whether the return to improving the quality of primary education would also be high. Perhaps a priority of the ROC government should be to evaluate the costs and benefits of improvements. (2) Secondary and higher education are socially profitable and should be pursued and expanded. (3) Even though the social rate of return declines with higher levels of education, the returns stay sufficiently high that there is no obvious argument for cutting the extent of investment in education. (4) The social rates of return to education in Taiwan are at least as high as the average for other developing countries, and are also higher than for the intermediate and advanced countries. (5) The labor policy should encourage the employee to gain more education in different education level during their career development process. On the job training can be implemented not only on the short term or technical classes but also the long term and formal education in different education level.

Appendix Table A: Direct Public Expenditures on Education Per Student

Year	< PRMRY	PRMRY	JR - HGH	SR - HGH	JR - CLG	SR - CLG UNV	GRAD
1976	3056.86	4707.68	12987.89	7535.513	17585.36	17584.36	17584.36
1977	3695.15	5432.32	14324.22	8149.941	11110.76	30359.54	30359.54
1978	4428.18	5808.69	17041.01	9683.67	16139.14	30812.18	30812.18
1979	5652.90	7713.46	21191.95	12169.85	18507.42	32838.15	32838.15
1980	7236.87	9463.08	27192.62	14694.12	19584.50	47371.48	47371.48
1981	8584.56	12417.15	33320.55	17509.35	31870.33	58918.60	58918.60
1982	10014.20	14828.40	40578.23	21921.90	38838.40	76949.51	76949.51
1983	12125.85	16724.89	39764.02	22605.85	43351.09	94427.74	94427.74
1984	11881.30	17901.61	39400.08	23976.70	42529.99	80598.46	80598.46
1985	12197.76	19379.23	44231.14	25733.47	43992.88	97990.80	97990.80
1986	13112.96	20603.67	47202.28	27569.53	44715.77	92208.57	92208.57
1987	13557.89	21341.32	49931.88	31422.47	50342.69	113615.40	113615.40

Appendix Table B: Average Earnings by Educational Level and Year

Year	< PRMRY	PRMRY	JR - HGH	SR - HGH	JR - CLG	SR - CLG UNV	GRAD
1976	44059	60776	60109	77318	89816	111785	112905
1977	44718	67374	75538	87079	101920	127940	159340
1978	50405	80223	85099	101179	119544	148388	156611
1979	60735	96398	101664	117960	144613	175839	206763
1980	70862	116747	116644	144256	176284	225098	336415
1981	81970	132523	132155	163103	209638	259870	397521
1982	85745	136183	137676	171121	225249	271830	330642
1983	85758	145180	148451	177401	232397	293326	397004
1984	70538	155759	163463	191411	248337	303847	414579
1985	94798	160303	168510	194844	256338	332324	375667
1986	98788	164734	172616	204392	262709	346620	449804
1987	113687	181170	196565	220017	285413	366313	470726

Appendix Table C: Direct Costs Plus Foregone Earnings

Year	PRMRY	JR - HGH	SR - HGH	JR - CLG	SR - CLG UNV	GRAD
1976	4707.68	73763.89	67644.513	94902.36	107400.36	129369.36
1977	5432.32	81698.22	83687.941	98189.76	132279.54	158299.54
1978	5808.69	97264.01	94782.67	117318.14	150356.18	179200.18
1979	7713.46	117589.95	113833.85	136467.42	177451.15	208677.15
1980	9463.08	143939.62	131338.12	163840.50	223555.48	272469.48
1981	12417.15	165843.55	149664.35	194973.33	268556.48	318788.60
1982	14828.4	176761.23	159597.90	209959.40	302198.51	348779.51
1983	16724.89	184944.02	171056.85	220752.09	326824.74	387753.74
1984	17901.61	195159.08	187439.70	233940.99	328935.46	384445.46
1985	19379.23	204534.14	194243.47	238836.88	354328.80	430314.80
1986	20603.67	211936.28	200185.53	249107.77	354917.57	438828.57
1987	21341.32	231101.88	227987.47	270359.69	399028.40	479928.40

Foot Note

註一：Psacharopoulos, George. Returns to Education: An International Comparison (New York: Elsevier Scientific Publishing Company 1973).

註二：In principle, one might survey a sample of Taiwan schools and colleges, particularly in the private sector, to find out what tuition costs would have been in various years. But estimating the total out-of-pocket costs to parents, particularly for private education, is complicated by the fact that private schools add many additional fees onto the basic tuition fee, these fees vary greatly from school to school, and it would be difficult if not impossible to get time series data on all out-of-pocket costs incurred by the parents.

註三：The micro-data used for the earnings functions is a subset of the labor force survey data collected by DGBAS.

註四：The period of net costs is six years for primary school, three years each for junior high school, senior high school, and junior college, and four years for senior college and university. Since most graduate education is at the masters' level, I assumed that the period of net costs for graduate school was two years. Students are predicted to graduate at 12 years of age for elementary school, 15 for junior high school, 18 for senior high school, 21 for junior college, 22 for senior college and university, and 24 for graduate school. While a small percentage of males volunteer for the military, and are paid competitive market salaries, most males have to undergo two years of compulsory military service at low wages. However, these two years out of the labor market for males was ignored in the computations.

註五：According to a standard textbook in development economics, Taiwan was classified in the 1985 World Bank categorization as an upper-middle income country. GNP per capita in upper-middle income countries falls in the range of U.S. \$ 1,190 to U.S.\$ 4,129 (in 1985 U.S. dollars). Taiwan's per capita income in 1985 was U.S.\$ 3,250, which is similar to that of Iran (\$3,690), Macao (\$3,450), Venezuela (\$3,080), Greece (\$3,550), and Malta (\$3,310). Taiwan's per capita income is far below that of Hong Kong (\$6,230), Japan (\$11,300), Singapore (\$7,420), and virtually every country in Europe, including the East Bloc countries. Todaro considers upper-middle

income countries to be "developing countries" (Todaro, 1989, p16-17).

註六：I am grateful to my friend Don-sing Hwong of the Academia Sinica for help in programming the solutions to the discounting equations for each of the schooling levels for each year.

Reference

- Blaug, Mark. 1972. "The Correlation Between Education and Earning: What does it signify ? " Higher Education. 1(1):53-76.
- Blaug, Mark. 1970. An Introduction to the Economics of Education. London: Allen Lane. The Penguin Press.
- Mincer, Jacob. 1974. Schooling Experience and Earnings, New York: Columbia University Press for National Bureau of Economic Research. p88.
- Psacharopoulos, George. 1970. "Estimating Shadow Rates of Return to Investment in Education," Journal of Human Resources. Volume 5 No. 1 pp. 34-50.
- Psacharopoulos, George. 1980. "Returns to Education: An Updated International Comparison" in Timothy King ed. Education and Income: A Background Study for the World Development Report 1980. World Bank Staff Working Paper No. 402 July pp.95-96.
- Psacharopoulos, George. 1981. "Returns to Education: An Updated International Comparison," Comparative Education, Volume 17 No. 3 pp. 321-41.
- Psacharopoulos, George & Maureen Woodhall. 1985. Education for Development: An Analysis of Investment Choices. New York: Oxford University Press for the World Bank.
- Psacharopoulos, George. 1988a. Economics of Education: Research and Studies. Elmsford, New York: Pergamon Press.
- Psacharopoulos, George. 1988c. "Shadow Wages and Rates of Return," in George Psacharopoulos ed. Economics of Education: Research and Studies, pp. 347-48. Elmsford, New York: Pergamon Press.