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Estimating the return to education in Hong Kong: An econometric approach

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Abstract

The return to education is one of the most frequently-studied topics in labour economics. This paper attempts to estimate the private return to education in Hong Kong using the Mincerian equation and data from the 2016 By-census. The result suggests that, holding other factors constant, an additional year of schooling would increase the monthly income of a man by 11.6% and that of a woman by 12.6% respectively. Alternatively, a model in categorical form suggests that the returns to education at bachelor's degree and master's degree levels are much higher than those of upper secondary education and matriculation. The results were generally in line with those from previous studies.

以計量經濟方法估算香港的教育回報

摘要

教育回報率是勞動經濟學中其中一個最常被研究的課題。本文嘗試利用 Mincer 方程式以及 2016 年中期人口普查的數據估算香港的教育私人回報。結果顯示在其他條件都不變的情況下，接受一年額外的教育會令男性和女性的每月收入分別增加 11.6%和 12.6%。另一方面，使用類別變數的模型顯示學士課程和碩士課程的教育回報遠較高中和預科的教育回報為高。這些結果與先前的研究大致相同。

I. INTRODUCTION

1. The return to education (defined here as the increase in a person's income after receiving more education) is one of the most frequently-studied topics in labour economics. The rate of return to education is important as it provides a reference for individuals to decide whether to continue to receive additional education or to enter the job market. It may also help policy makers to decide how much resources should be allocated to the education sector. This study uses the Mincerian equation and data from the 2016 By-census to estimate the private return to education in Hong Kong.

II. LITERATURE REVIEW

2. The Mincerian wage equation (Mincer 1974[1]) is one of the most popular specifications used to estimate the return to education. In its basic form, it relates the income of a person, in logs, to years of schooling and potential work experience, with the latter defined as the age of the person minus the number of years of schooling received minus 6 (i.e. the age one starts going to school)[2]. Though many variations are possible, a starting point is to write:

$$\ln income_i = \alpha + \beta_1 s_i + \beta_2 exp_i + \beta_3 exp_i^2$$

where

$income_i$ is the person's labour income;
s_i is the number of years of schooling; and
exp_i is the number of years of potential work experience.

3. The magnitude of β_1 is the percentage change in a person's labour income when he or she receives an additional year of schooling, holding work experience constant. For example, Mincer's (1974) original estimate using 1960 US Census data showed that an additional year of schooling would lead to an 11.5% increase in a person's labour income. As will be discussed later, the estimated coefficient β_1 is equivalent to an internal rate of return (IRR) under certain conditions, which is one reason for the relative popularity of Mincer's approach. The coefficients β_2 and β_3 allow labour income to rise quadratically with work experience, which is expected to yield diminishing returns (i.e., β_2 should be positive and β_3 should be negative).

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1 Mincer, J. (1974). *Schooling, Experience, and Earnings*. New York: Columbia University Press.

2 As people do not necessarily enter the job market immediately after graduation, and could temporarily leave the job market after working for a few years, potential work experience calculated using this approach may be higher than actual work experience.

4. More recently, Montenegro and Patrinos (2014)[3] used Mincer's equation on a large scale to estimate the return to education in 139 economies with harmonised household survey data. Based on the latest available survey for each economy, the average rate of return was 9.7% (9.1% for men and 11.4% for women). The estimated overall return to education varied significantly across economies, ranging from 1.6% to 22.4%. There was also some variation by region and income, as the average return was 9.4% in 13 East Asia and Pacific economies and 10.0% in 33 high income economies. By type of schooling, across all surveys in the sample, the average return to tertiary education was the highest, at 15.2%, followed by 10.6% for primary education and 7.2% for secondary education.

5. Some previous studies also used Mincer's equation and census data from Hong Kong to estimate the return to education. For instance, based on data from the 2001 Census, and using a specification that focused on categories rather than years of education, Lui (2007)[4] found that those with matriculation would earn around 20% more than those with only upper secondary education, while those with a college degree could earn around 29% more than those with matriculation.

6. An alternative to Mincer's equation is to estimate the return to education using a full IRR approach (including two previous studies from this office conducted in 2006[5] and 2017[6] respectively). Under this approach, the return to education is the interest rate under which the future stream of benefits from education (i.e. the income differential between a person with a higher education level as compared to a person with a lower education level) is equal to the costs of education after discounting for time. It can be thought of as the rate of return a hypothetical investment that costs the same as further schooling would have to generate in order to be equal in value. The latest update to OECD's *Education at a Glance* publication[7] (which adopts the IRR approach) suggested that the private returns to education to upper secondary education in OECD economies were around 25% for men and 32% for women and those for tertiary education were 16% for men and 19% for women.

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3 Montenegro, C. E., and H. A. Patrinos. (2014). "Comparable estimates of returns to schooling around the world." World Bank Policy Research Working Paper 7020. https://openknowledge.worldbank.org/handle/10986/20340

4 Lui, H.K. (2007). The return to language ability in Hong Kong: before and after the handover. *Applied Economics Letters* 14(2), pp. 121-125.

5 Economic Analysis and Business Facilitation Unit. (2006) Estimating the social rate of return of university education in Hong Kong. https://www.hkeconomy.gov.hk/en/pdf/wp/Rate_ReturnU(2006).pdf

6 Office of the Government Economist (2017). Returns on attaining university education. https://www.hkeconomy.gov.hk/en/pdf/box-17q2-5-1.pdf

7 OECD. (2020). *Education at a Glance 2020: OECD Indicators*. OECD Publishing, Paris. https://doi.org/10.1787/69096873-en

7. A difficulty with the IRR approach is that it requires an estimate of the direct costs of education, which could be difficult to obtain. Thus, the Mincerian equation remains a popular option for researchers around the world due to its simplicity with respect to the model setup and hence the data required for the analysis, even though it does not consider the direct costs of education. Nonetheless, under certain assumptions, the return to education estimated from the Mincerian equation is the same as that estimated using the IRR approach. These include: (i) the only cost of schooling is the opportunity cost, i.e. the income forgone while attending school, and no other direct costs of schooling are involved; (ii) no income taxes; (iii) additional years of schooling do not reduce the number of years eventually worked; and (iv) the return to education is linear in years of schooling (Heckman, Lochner, and Todd, 2008)[8]. In Hong Kong's case, since direct costs of public schooling and income taxes are both quite low, the assumptions are conceivably close enough to reality that the Mincerian estimate could reasonably approximate a full IRR estimate.

III. DATA AND METHODOLOGY

8. In this study, the Mincerian equation is estimated by OLS regression with the 5% sample dataset of the 2016 By-census from the Census and Statistics Department. The focus of the research is to study the effect of educational attainment on the earnings of local employees in Hong Kong's labour market. As such, non-employees (e.g. employer, self-employed etc.), mobile residents[9], foreign domestic helpers (FDHs)[10], and expatriates[11] were dropped from the analysis.

9. Following the basic framework in para. 2, the model in this study is as follows:

$$income_i = \alpha + \beta_1 s_i + \beta_2 s_i * gender_i + \beta_3 exp_i + \beta_4 exp^2{}_i + \beta_5 gender_i + \beta_6 marital_i + \beta_7 gender_i * marital_i$$

where

$income_i$ is the log of monthly income from main employment;

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8 Heckman, J. J., Lochner, L. J., & Todd, P. E. (2008). "Earnings functions and rates of return." *Journal of Human Capital* 2(1), pp. 1-31.

9 Mobile residents are Hong Kong permanent residents who had stayed in Hong Kong for at least 1 month but less than 3 months during the 6 months before or for at least 1 month but less than 3 months during the 6 months after the reference time point.

10 A person is considered to be a FDH if (i) the person is not born in Hong Kong, the Mainland, Macau, or Taiwan; (ii) the person's relationship to the household is "live-in domestic helper/ live-in chauffeur/ live-in gardener"; and (iii) the person's nationality is either (1) Bangladeshi, (2) Filipino, (3) Indonesian, (4) Sri Lankan, or (5) Thai.

11 A person is considered to be an expatriate if (i) the person is not born in Hong Kong; (ii) the person's duration of residence in Hong Kong is less than 7 years; and (iii) the person's ethnicity is not Chinese.

s_i is the number of years of schooling;
exp_i is the number of years of potential working experience (the age of the person minus s_i minus 6);
$gender_i$ is a binary variable for gender (1 = male, 0 = female); and
$marital_i$ is a binary variable for marital status (1 = married, 0 = otherwise).

Interaction terms allow the return to education to vary by gender, with different baseline earnings levels according to gender and marital status.

10. Since the dataset only contains the highest education level completed, it was necessary to attempt to convert the education levels to the number of years of schooling. In the conversion process, it was implicitly assumed that the person did not repeat any study year. There were also some assumptions on the durations of the study programmes. For example, it is assumed that taught master's programmes last for 1 year, while research master's programmes last for 2 years. Doctoral programmes are assumed to last 5 years. For higher diplomas and associate degrees, the duration of study is assumed to be 2 years. However, as the durations of some diploma/certificate courses could be quite different even if they are classified under the same category (e.g. the craft level courses, and courses provided by Vocational Training Council/ Construction Industry Council), the observations involving these courses were removed from the dataset (a total of 12 357 observations were removed for this reason, out of 366 619 in the full 5% sample dataset). Similarly, as the dataset did not contain information on work experience, a potential work experience variable was constructed according to the common practice in the literature.

11. The above specification implicitly assumes that the return to education is constant across different levels of education, i.e. an additional year in primary school would lead to the same increase in income as an additional year in secondary school. Taking into consideration the possible differences in the returns to education brought by different levels of education in reality, an alternative model is also used for the estimation. The extended model is as follows:

$$income_i = \alpha + \beta_1 upper\_secondary_i + \beta_2 matriculation_i + \beta_3 subdegree_i + \beta_4 bachelor_i + \beta_5 master_i + \beta_6 doctoral_i + \beta_7 exp_i + \beta_8 exp^2{}_i + \beta_9 gender_i + \beta_{10} marital_i + \beta_{11} gender_i * marital_i$$

where

$upper\_secondary_i$, $marticulation_i$, $subdegree_i$, $bachelor_i$, $master_i$, and $doctoral_i$ are binary variables for having completed secondary 5, secondary 7, sub-degree, bachelor's degree, master's degree, and doctoral degree programmes respectively, and the other variables are the same as before.

12. Under this alternative model, the education levels are in category form and individuals with secondary 3 education are the base case. The returns to different levels of education (i.e. upper secondary, undergraduate degree, etc.) as compared to the base case are measured by the coefficient of the respective binary variable.

IV. RESULTS

13. The results from estimating the two regression models are summarised in **Table 1** below:

Table 1: Summary of regression results

	Base model	**Alternative model (Schooling in categorical form)**
Variable	**Coefficient**	**Coefficient**
s_i	0.1263***	-
$s_i * gender_i$	-0.0098***	-
$upper\_secondary_i$	-	0.2523***
$matriculation_i$		0.4913***
$subdegree_i$	-	0.6641***
$bachelor_i$	-	1.0323***
$master_i$	-	1.3647***
$doctoral_i$	-	1.5614***
exp_i	0.0312***	0.0540***
$exp^2{}_i$	-0.0004***	-0.0009***
$gender_i$	0.1752***	0.0587***
$marital_i$	0.0868***	0.0659***
$gender_i * marital_i$	0.1337***	0.1202***
Adjusted R^2	0.406	0.446
Number of observations	118 173	92 283

Note: ***, **, * indicate statistical significance at the 1%, 5% and 10% levels.

14. The regression results of the two models are in line with economic intuition and the findings of other previous studies. In particular, the base model suggests that an additional year of schooling would increase the monthly income of a man by 11.6% and that of a woman 12.6% respectively, holding other factors constant. These figures are somewhat higher than the findings of some previous studies (e.g. the global averages of 9.1% for men and 11.4% for women in Montenegro and Patrinos (2014)).

15. Meanwhile, the alternative model which uses a categorical measurement of education suggests that the earnings of individuals who have completed at least some upper secondary education are 28.7% higher than that of individuals with a highest education level at secondary 3 or below. As for other levels of education, their marginal effects on earnings on top of the preceding level of education are summarised in **Table 2** below:

Table 2: Effects on earnings for different levels of education

Level of education	Increase in earnings (compared to the preceding level)
Upper secondary	**28.7%**
Matriculation	27.0%
Sub-degree	18.9%
Bachelor's degree	44.5%
Master's degree	39.4%
Doctoral degree	21.7%

Note: percentages are exact and derived from the relevant coefficients in **Table 1**.

16. The results suggest that the returns on education at bachelor's degree, master's degree levels are much higher than that of upper secondary education and matriculation. This is conceivably because jobs in higher-paying sectors would require a certain level of education. However, the return to a doctoral degree is lower than that of a master's degree, possibly due to diminishing returns. The result shows similar patterns as Lui (2007)[12], in which the return to education for college is higher than that for matriculation.

17. By way of further comparison, referring to the coefficients in Table 1, a bachelor's graduate could expect to earn 0.541 log points higher income than a matriculation graduate, which corresponds to a private return to education of about 19.8% per year of undergraduate-level education[13]. A full IRR calculation by this office, published at about the same time as the 2016 By-census, yielded a private rate of return of 17.7% (Office of the Government Economist 2017). This is generally as expected because the full IRR calculation takes into account the direct costs of education, which are low in Hong Kong but not zero (thus, the full IRR is smaller). Nevertheless, the simple Mincerian estimate is surprisingly close and has the advantage that it can be calculated quickly and easily for other levels of education as well.

[12] Lui, H.K. (2007). The return to language ability in Hong Kong: before and after the handover. *Applied Economics Letters*, 14(2): 121-125.

[13] At the time, the overwhelming majority of local bachelor's degree graduates had attended three year programmes. In exact terms, $exp(0.541/3) - 1 = 19.8\%$.

V. LIMITATIONS

18. Nevertheless, the Mincerian equation has some inherent limitations. First of all, as mentioned earlier, it can produce quick and simple results for reference, but it cannot substitute for a full IRR calculation. Further, in the basic equation, it was implicitly assumed that the return for an additional year of education is the same regardless of the level of education, e.g. the increase in income would be the same for an additional year of primary education and an additional year of tertiary education. It is unlikely to be true in reality. While no commonly agreed solution to this heterogeneous return across different education levels has appeared so far (Patrinos, 2016)[14], a categorical approach (as shown in the alternative model) may to some extent address this problem. Moreover, the Mincerian equation does not take into account some other endogenous factors that would affect the choice of education itself, e.g. ability (i.e. people that are more capable or with a higher marginal returns to education would choose higher levels of schooling).

VI. CONCLUSION

19. Using the Mincerian equation, data from the 2016 By-census data suggested that a year of additional education would increase the individual's monthly income by around 12.6%. This result, and others, are broadly comparable to previous findings for Hong Kong and other advanced economies. Further, compared to the previous studies using Hong Kong's Census dataset in earlier years, the return to post-secondary education is higher than before, while that for secondary education has decreased. This conceivably reflects Hong Kong's transformation into a more knowledge-based economy over time.

[14] Patrinos, H. A. (2016). Estimating the return to schooling using the Mincer equation. *IZA World of Labor* 2016: 278. https://doi.org/10.15185/izawol.278