Expansion of Schooling in Hong Kong : Economic Activity, Cohort Effects, and Earnings

Richard Yue-Chim Wong
Chinese University of Hong Kong

Ka-Fu Wong
Hong Kong Polytechnic

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Introduction

It is often alleged that rapid expansion of formal education in developing economies benefits younger cohorts more than older cohorts because it is often too late for the older cohorts to benefit from the new schooling opportunities. This effect is often exacerbated by the greater relevance, if not higher quality, of schooling of a more recent vintage. As a consequence earnings growth will differ by cohorts.

The cohort effect alone lowers the observed inequality of personal earnings because the between-group variation due to age differences is reduced. There is, however, a potential offsetting effect. If rapid expansion of schooling increases the variance of schooling distribution within the population then observed earnings inequality may be increased. This will be more likely if schooling expansion took place more at the tertiary level than at the primary level. Since this is not the case in Hong Kong and in the other new industrialized economies, like South Korea, Taiwan and Singapore, therefore, the primary effect of rapid

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expansion of schooling has an equalizing effect on earnings. The effect is likely to be stronger the more rapidly the schooling system is expanded.

In developing economies, many individuals do not work as employees, but are employers working in a small family business or self-employed individuals. Formal schooling is often more valuable to workers than to employers or self-employed individuals because of screening effects. But human capital also raises allocative ability in the sense of Welch (1970) or the ability to deal with disequilibria in the sense of Schultz (1975), an essential input into entrepreneurial capacity. If this is the case, then schooling can be more valuable to employers and self-employed individuals than to workers. Consequently, the rapid expansion of schooling will generate stronger cohort effects among employees if screening effect dominate, and the opposite result if human capital effects dominate. The importance of cohort effects therefore varies with the type of economic activity -- employee or employer/self-employed -- an individual is engaged in.

In this paper we report some empirical results obtained from a study of personal earnings growth during the periods 1976-1981 and 1981-1986 for different cohorts of men and women in Hong Kong. The aim is to examine the cohort effect on earnings and rates of return to education under a regime of rapid expansion of schooling opportunities. If cohort effects are important, then it must be removed before the true effects of the consequences of schooling and experience on earnings can be revealed.

Data Description

The three datasets used in the analysis are the 1976 By-Census, 1981 Census, and 1986

By-Census of population. As a result of the open door policy in China after 1978, there was a major influx of immigrants from China towards the end of the 1970's. As a consequence, the population composition altered radically. By 1981, tough and effective measures were adopted to control the immigration flow. To remove the effect of immigrants on our analysis only those who were not recent immigrants from China are included in the study. This is defined as those who had arrived in Hong Kong before the previous census year, i.e., more than five years. Only employees, employers and self-employed individuals are used. This yielded samples sizes of 103,043 men and 48,700 women in 1976, 245,598 men and 128,677 women in 1981, and 418,918 men and 225,646 women in 1986.

From these data samples, we obtained the logarithmic value of monthly earnings (MLEARN) for each individual. The earnings were deflated by a cost of living index so that all figures are expressed in 1976 dollars. The figures indicate that the mean earnings of men rose by 21.3 per cent during 1976-1981 and by 25.4 percent during 1981-1986. For women the corresponding figures were 25.1 per cent and 20.6 per cent. The mean years of schooling (EDUC) were 8.4, 9.8 and 10.4 years respectively for men in 1976, 1981 and 1986. For women the corresponding figures were respectively 7.2, 9.1 and 10.2 years. Clearly women were making greater progress than men were in terms of education.

The mean years of potential work experience (EXP) is defined as age minus years of schooling minus four. The figures for men were 21.5, 19.3 and 19.5 years in 1976, 1981 and 1986, respectively. For women the corresponding figures were respectively 18.2, 16.6 and 16.3 years. Adjusting for years of schooling, the implied corresponding figures for mean age for men were 33.9, 33.1 and 33.9, and those for women were 29.4, 29.7 and 30.5.

The aging process was briefly arrested for men as a result of the massive influx of young immigrant men from China during the 1979-1980 period. The proportion of recent immigrants from China, i.e., those that arrived within the last five years, constituted 8.7 per cent of the population of men in 1981, but only 2.1 per cent in 1986. The corresponding figures for women were 7.9 per cent and 3.9 per cent.

The pattern of economic activity among men and women have not changed substantially over the period 1976-1986. Among men, employers and self-employed individuals were 15.7, 12.5 and 13.5 per cent of the working population in 1976, 1981 and 1986, respectively. For women the corresponding figures were respectively 6.6, 4.9 and 6.1 per cent.

Methodology

Since one of our major interest is to estimate cohort effects, one has to follow individuals over time. This is of course not possible with independent cross-sectional census data in which individuals cannot be identified and followed over time. The alternative is to pool individuals from different census years together and estimate synthetic cohort effects. Individuals with identically observed characteristics in each census, but differing in age by an amount that is exactly equal to the number of years that has elapsed between the census years are considered to be identical for observational purposes. One can then make the assumption that the earnings growth between the census years approximates the average earnings growth of a representative individual with the indicated set of characteristics. In this study, four sets of characteristics are considered. They are sex, years of education, marital status, and economic activity type (employees and employers/self-employed).

One can estimate earnings functions using pooled data from different census data sets. Regression equations can be estimated separately by sex and for employees and employers/self-employed individuals. The following estimation equation is employed in the empirical work:

(1) $$\begin{aligned} Learn = {} & a_1 + a_2 Educ + a_3 Educ^2 + a_4 Exp + a_5 Exp^2 + \\ & a_6 Cohort + a_7 Cohort^2 + a_8 Married + a_9 Widowed + \\ & a_{10} Divorced + a_{11} Educ*Exp + a_{12} Educ*Cohort + \\ & a_{13} Exp*Cohort, \end{aligned}$$

where, Educ = years of schooling; Exp = years of potential experience; Cohort = years of potential experience viewed from the vantage point of the 1976 By-Census; Married, Widowed and Divorced = marital status dummy variables; and Learn = logarithmic value of earnings. The equation allows for quadratic terms in schooling, experience, and cohort, and for first-order interaction terms among them.

Unlike sex, the choice of economic activity is endogenously determined. Consequently, the estimated coefficients using equation (1) will be subject to sample selection bias. The method proposed by Lee (1983) is used to correct for such bias. This requires us first to predict the probability that an individual will select a particular choice of economic activity. The selection rule is based on logistic discrimination as follows:

(2) $$\log[p_i/(1-p_i)] = X_i b + e_i$$

where p_i is the probability of choosing to be an employer/self-employed individual, X_i is a vector of explanatory variables that include those in equation (1), and e_i is an error term. In the actual estimation of equation (2), a modification is adopted which replaces the maximum

likelihood method used by Lee (1983) on individual data by ordinary least squares estimation based on cell proportions, where each cell is defined by the values of the vector X_i. The predicted value of p_i, to be called P_i, can be used to construct a new variable, Lamda =/ $0(P_i)/P_i$, which we shall use as an additional regressor in equation (1)./ $0(P_i)$ is the normal density function associated with the cumulative distribution function P_i. This procedure allows us to obtain consistent estimates of the coefficients in equation (1).

Analysis of Earnings Functions

Table 1 presents summary statistics of the variables used in the analysis of earnings functions. Table 2 presents ordinary least squares estimates of the coefficients of the employer/self-employed log odds ratio. The figures imply that more educated individuals, more recent cohorts, those with more potential experience, and those who have ever been married are more likely to be employers/self-employed individuals. These findings suggest that education are more useful to employers/self-employed individuals and provides indirect evidence for the importance of human capital investments in providing allocative ability. Potential experience is also relevant for determining the decision to become an employer/self-employed individual since knowledge of markets and credit worthiness take time to accumulate. One of the interest findings is that more recent cohorts have a higher propensity to become employers/self-employed individuals. This is consistent with the observation that average firm size have actually been declining over time in Hong Kong. The reasons have not been well investigated.

Since establishing a business usually requires some overhead costs, the availability of capital would matter. This is partially proxied by ability to own a home in Hong Kong, which

is a major form of saving. Public renters are those who have to rent subsidized government housing and are usually those with the least ability to accumulate capital, they are followed by those who own subsidized government provided homes. The wealthiest group in society would be those who live in private housing, and those who own such housing are usually more well off than those who rent them. This is borne out by the estimated coefficients in Table 2.

Tables 3 and 4 present ordinary least squares estimates of individual earnings functions respectively for men and women. The dependent variable is log monthly earnings. The interpretation of the coefficients of these earnings functions will be based on human capital theory as explicated in Becker (1964) and Mincer (1973).

For both sexes there is strong evidence that the rates of return to schooling rise with years of schooling (EDUC, $EDUC^2$). The education-experience interaction term (EDUC*EXP) is significantly negative implying that more educated individuals tend to make fewer post-schooling investments in human capital measured in time-equivalent units. The significant negative signs on the education-cohort interaction term (EDUC*COHORT) among employees imply that the rates of return to schooling have been rising over time, but this is not the case for employers. To obtain a more clear picture of the rates of return to education by cohort and level of schooling we computed these rate for a representative individual with 20 years of experience in each census year and for two levels of schooling (primary level implies 8 years of schooling and university graduate implies 18 years of schooling). These figures are given in Table 5. One finds that the rates of return to education are rising over time among employed men, but are flat among employer/self-employed men. For women, rising rate of return to education are found among employees, but there is some evidence that falling rates of

return are present among employer/self-employed women. These results are true regardless of the level of schooling that is used to make the computations.

Both the experience (EXP, EXP^2) and the cohort (COHORT, $COHORT^2$) terms indicate a quadratic relationship with earnings. The cohort effects imply that more recent cohorts have higher earnings than older ones, but that the effect is smaller the more recent the cohort. The experience-cohort interaction term (EXP*COHORT) is significantly positive suggesting that post-schooling investments in human capital are larger among older cohorts. This suggests that to the extent individuals with the similar years of experience have similar earnings then older cohorts should be making more post-schooling investments in order to compensate for vintage effects.

In Table 6 we calculate the cohort effect on earnings growth between the 5-year census period for an individual with 20 years of experience at years of schooling 8 and 18. The results are given for the estimates when interaction terms are allowed and when they are omitted. In the latter case the effects would not vary by years of schooling. In general, the difference in cohort effects between the two census periods are quite small. There is evidence that cohort effects are smaller in magnitude among employees than employers/self-employed individuals, and the effects are more pronounced at lower levels of education.

Among employees, the cohort effects are slightly stronger for men than for women. This is to be expected because schooling primarily enhances market productivity. Since men specialize in market pursuits more than women, therefore cohorts effects on earnings will have a larger negative effect on men. This happens despite the fact that working women are probably a more selected group than working men.

Married men who work as employees have earnings that are 13.2 to 15.2 per cent higher than single men; the corresponding figures for widowed and divorced men are respectively 4.6 to 5.6 and -1.9 to 0.1 per cent. For employers/self-employed individuals the respective figures for married, widowed, and divorced men are 12.4 to 14.3, -4.3 to -2.7, and -15.6 to -14.3 per cent. These figures suggest that there is strong complementarity between being married and earnings, and that such complementarity is magnified when the men work as employers/self-employed individuals.

Married women who work as employees have earnings that are -20.7 to -18.9 per cent higher than single women; the corresponding figures for widowed and divorced women are respectively -15.0 to -13.6 and -28.0 to -25.7 per cent. For employers/self-employed individuals the respective figures for married, widowed, and divorced women are -24.2 to -19.0, -8.7 to -3.8, and -22.3 to -14.8 per cent. These figures suggest that unlike men, women's earnings are not complementary with being married, and that such lack of complementarity is reduced when the women work as employers/self-employed individuals.

The interaction between earnings, economic activity and marital status is considered in greater detail in Wong (1986). The findings here are consistent with those documented in Wong's earlier study. The estimated coefficients for the correction for selectivity bias variables (LAMDA) are all significantly negative implying that the choice of economic activity is indeed a cause of bias in the estimates. The coefficients of determination (R^2) are in the range of 0.39 to 0.43 for employees and 0.22 to 0.26 for employers/self-employed among both men and women.

Conclusion

In this study we estimated the magnitude of the cohort effect on earnings. Since this is best attributed to the productivity effects of the expansion of schooling opportunities, we now have an indirect measure of the benefits of investment in education due to a more recent vintage of education. The measured benefits are larger for both men and women. The calculated point estimates of these vintage effects vary from 13.7 to 31.7 per cent over a five-year period in 1976-81 and 1981-86.

The differential cohort effects by sex and economic activity on earnings and rates of return to education are interesting. When combined with the results on predicting the log-odds ratio for being an employer/self-employed individual, they suggest a rich interaction process at play. There are obviously vintage and obsolescence effects in schooling investments: rates of return to education rise with more recent cohorts among employees, but not among employers/self-employed individuals. This suggests that investment in schooling is less subject to vintage and obsolescence effects among employers/self-employed individuals. Since more educated individuals prefer to work as employers/self-employed individuals and recent cohorts are more likely to work as employers/self-employed individuals, therefore the rapid expansion of schooling achieves a higher social return when more individuals choose to become entrepreneurs rather than workers. This implies that the social gains to public investment in schooling is being partially preserved in a form that is less subject to obsolescence and vintage effects.

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Table 1
Means and Standard Deviations

	Men		Women	
	Employee	Employer	Employee	Employer
Log Earn	7.3263	7.5402	6.9971	6.94
	(0.5727)	(0.8316)	(0.6038)	(0.8720)
Educ	9.995	9.0896	9.5019	5.9071
	(3.9412)	(4.4176)	(4.7477)	(5.3967)
Exp	18.6817	28.3892	15.807	31.7156
	(14.3440)	(13.5241)	(15.7535)	(15.4043)
Cohort	12.7201	22.6424	9.7251	25.6095
	(14.8490)	(14.3239)	(16.2314)	(16.3856)
Married	0.5607	0.8382	0.4473	0.7853
	(0.4963)	(0.3683)	(0.4972)	(0.4106)
Widowed	0.0089	0.0141	0.0385	0.1039
	(0.0941)	(0.1180)	(0.1925)	(0.3052)
Divorced	0.0074	0.0099	0.0094	0.0169
	(0.0855)	(0.0992)	(0.0963)	(0.1288)
N	469478	75755	268289	16711

Notes: Absolute t-values in parentheses

Table 2
OLS Estimates of Employer/Self-Employed Log Odds Ratio

	Men	Women
Constant	-3.58677 (-140.17)	-5.04916 (-117.25)
Educ	0.01939 (11.88)	0.02665 (9.75)
Cohort	-0.00341 (-2.32)	-0.04856 (-19.76)
Exp	0.04752 (30.50)	0.10128 (39.47)
Married	0.86688 (62.63)	1.17805 (54.09)
Widowed	0.70599 (12.55)	0.98539 (19.83)
Divorced	1.23277 (20.35)	1.94475 (22.44)
Public Renter	-0.75865 (-51.14)	-0.78346 (-30.26)
Public Homeowner	-0.42751 (-21.14)	-0.20566 (-6.06)
Private Homeowner	0.35223 (23.02)	-0.01559 (-0.60)
R2	0.7623	0.6901
N	13822	11709

Note: Absolute t-values in parentheses

Table 3
OLS Estimates of Men's Earnings Function

	Employee	Employee	Employer	Employer
Constant	7.0029	6.56832	7.91278	7.54911
	(720.01)	(525.82)	(199.30)	(135.14)
Educ	-0.04936	0.00843	-0.02582	0.00913
	(-83.23)	(7.37)	(-13.31)	(1.99)
Educ2	0.00557	0.00377	0.00427	0.00347
	(195.75)	(95.76)	(44.33)	(25.84)
Exp	0.06962	0.09489	0.05117	0.09463
	(196.65)	(92.51)	(26.58)	(21.25)
Exp2	-0.00077	-0.00256	-0.00049	-0.00338
	(-108.44)	(-45.90)	(-16.38)	(-14.95)
Cohort	-0.03486	-0.03959	-0.03382	-0.06344
	(-140.54)	(-42.55)	(-24.31)	(-16.34)
Cohort2	0.000013	-0.00176	-0.00009	-0.00279
	(2.18)	(-32.44)	(-3.78)	(-12.91)
Married	0.15197	0.13175	0.14258	0.12404
	(66.61)	(57.54)	(13.73)	(11.80)
Widowed	0.05629	0.04568	-0.02784	-0.04336
	(7.70)	(6.28)	(-1.15)	(-1.79)
Divorced	0.00111	-0.01928	-0.14305	-0.15557
	(0.14)	(-2.41)	(-5.01)	(-5.45)
Educ*Exp	-0.00026	-0.00062		
	(-4.70)	(-3.02)		
Educ*Cohort	-0.00101	-0.00006		

Notes: Absolute t-values in parentheses