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Abstract

The paper estimates rates of return to schooling in Rawalpindi, Pakistan in the Becker-Mincer framework. The estimates show that the rates of return are significantly different across work-status categories with the self-employed obtaining a lower return than the employed. Consequently, pooling of the two subsamples from LDCs--as is often done in similar exercises --is incorrect. Nevertheless, the estimates, especially those for the employed, compare favorably with those from other countries.

Introduction

The purpose of this paper is to obtain estimates of the rates of return to schooling for Pakistan using the standard Becker-Mincer methodology. Though widely used in both industrial and developing countries, this approach has not been used in Pakistan yet. The only estimates for returns to schooling that have been made so far are by Hamdani (1977). Limited to discrete data on educational attainments, i.e., level of education attained and not years of actual schooling completed, Hamdani's study used project appraisal techniques to calculate the internal rate of return. As a consequence, he was unable to treat in a satisfactory manner those who had completed one level of education and part of another level. For example, if a person had finished part of his secondary schooling but not completed secondary school, he was classified as having completed primary schooling only. It would be expected, therefore, that the rates of return so calculated were biased upwards.

The use of the standard approach using continuous data enables unbiased estimates to be made. In addition it allows the applicability of the human capital model to Pakistan to be tested. Finally, the use of a standard approach enables the rate of return to be compared with those of other countries.

The paper is divided into three sections and a conclusion. The section that follows summarises briefly the Becker-Mincer methodology, while section 2 sets out the estimates. Section 3 compares the estimates derived with those from other countries. The conclusion discusses the main results of the paper, the issue of generalisability of the estimates from the urban sample to the country and the rate limitation of the analysis.

The Human Capital Model

In the Becker-Mincer model of human capital, a man with no schooling or training is assumed to earn E_0 in each year of his life. Each year's education raises earnings by a constant percentage amount α, which is the rate of return to schooling. Denoting by E_S the level of earnings of a man with s years of schooling but no training, we have

$$E_s = E_0 e^{\alpha s} \quad (1)$$

Such E_s-constant earnings profiles would be observed if jobs did not add to individuals' market skills. Training on the job and learning by doing do contribute to such development.Individuals are therefore willing to pay for the acquisition of such skills by forgoing part of their potential earnings. If E_t is the potential earnings of the individual in each period and $k_t E_t$ his investment in post-school training (k_t being the net investment ratio), we have[1]

$$\ln E_t = \ln E_0 + \alpha S + \int_0^t \alpha k_z dz \quad (2)$$

Observed earnings Y_t are therefore the difference between potential earnings and the value of the post-school investment:

$$\ln Y_t = \ln E_t + \ln(1 - k_t) \quad (3)$$

Given a functional form for the time path of k_t, we can obtain an estimable form for our earnings function. The most commonly used form, following Mincer (1974), is linear.

$$k_t = k_0 - b_t \quad (4)$$

The net investment ratio and therefore the value of the post-school investment decline over time. Substituting (2) and (4) into (3), we are able to obtain the Becker-Mincer human capital earnings function.[2]

$$\ln Y_t = \ln E_0 + k_0 (1-k_0/2) + \alpha S + [\alpha k_0 - b(1+k_0)] X - (\gamma b/2 + b^2/2) X^2 + \mu_t \quad (5)$$

The returns to schooling estimated in the earnings function over the whole sample are averages of the effects of schooling per se and the effects of training during working life. Investment in post-school training typically takes place early in the life cycle in the form of forgone earnings from potential earnings, while benefits accrue later in life. To obtain the true rate of return to schooling, the method used by Mincer isolates the effect of experience, relying on the point of "overtaking," defined to be the point where potential earnings, free of training costs and returns, are equal to observed earnings. If the overtaking year is denoted by l, we have

$$\ln Y_l = \ln E_0 + \alpha S + U_l \quad (6)$$

By assuming a common overtaking year for all individuals, the overtaking point can be identified as one where the explanatory power of the regression of log of earnings on schooling is at its maximum. We would now be able to identify l by estimating (6) for the overtaking set alone.

1 It has been assumed here that both schooling and post-schooling investment bear the same rate of return, a. This assumption is necessary for the indemnification of k0 and b.

2 After integration and the addition of an error term, we get to equation (5).

Estimation of the Model

The data upon which the analysis is based is derived from a survey of households in Rawalpindi, the fifth largest city in Pakistan, with a population of 716,761 in 1977 at the time of the survey[3] and historically an important regional metropolis and administrative centre. It was the nation's capital during the 1960s and today is only ten miles from the current capital, Islamabad. Though there is manufacturing activity in the city, the development of Islamabad on the outskirts of Rawalpindi has allowed an expansion of wholesale trade and construction.

The overtaking set was determined for our sample to consist of individuals with 3-5 years of work experience. The regression results for this set are presented in Table 1. Because a large proportion of the sample reported a self-employed work status (37 percent), separate estimates were made for the group as well. For the full sample, returns to schooling are estimated at 8.9 percent. For employees the estimate is higher still at 11.2 percent, but much lower for the self-employed, standing at only 2.5 percent.

Table 1: Overtaking Year Regressions for Males
(t-Ratios in Parentheses)

Variables	Employees		Self-Employed		Full Sample	
Constant	4.84 (63.23)	4.93 (57.10)	5.83 (38.47)	5.85 (34.38)	5.12 (70.15)	5.20 (62.94)
GRAD	.122 (13.67)	.058 (2.22)	.025 (1.21)	.012 (.20)	.089 (10.99)	.042 (1.64)
$(GRAD)^2$		.004 (2.14)		.001 (.21)		.003 (1.95)
R^2	.461	.47	.260	.022	.294	.303
σ^2 (e)[a]	.362	.356	.409	.523	.454	.450
mean (GRAD)	7.53		3.84		5.86	
σ^2 (GRAD)	23.10		17.63		23.03	
mean (ln y)	5.92		6.20		6.02	
σ^2 (ln y)	.569		.416		.532	
mean (ln y*)	5.73		5.98		5.79	
σ^2 (ln y*)	.667		.420		.641	
R^2	.364		.017		.149	
mean (exp)	15.09		23.17		17.97	
σ^2(exp)	149.28		203.802		183.61	
Number of Observations	221		71		292	

* **GRAD** is the number of years of schooling of the individual, **ln y*** denotes log earnings of men in the overtaking experience years, **ln y** denotes log of monthly income of the individual and **exp** denotes the actual years of experience.

* σ^2 denotes standard deviation of the relevant variable, while **e** denotes the residual of the regression.

The extremely small estimate for the return on schooling for the self-employed is striking. For Hong Kong (see Wong 1981) α was estimated to be similar for both the self-employed and the employed.

3 The population figure is a projection of the 1972 census estimate at a 3.2 percent annual growth rate.

The functional form that we derived earlier and the estimates which we have just discussed assume a constant return to each additional year of schooling. In order to go beyond constraining returns-to-schooling to such a linear pattern, equations with a quadratic functional form for returns-to-schooling were also estimated and are also presented in Table 1. The results of these estimations indicate increasing returns to additional years of schooling. Estimates for completed levels of education are 7.2 percent for completed primary schooling, i.e., 5 years of schooling; 10.2 percent for a high school diploma, i.e., 10 years of schooling; and 13.8 percent for a university graduate, i.e., 16 years of schooling. For the employees at the same levels of schooling the estimates are 9.8 percent, 13.8 percent and 18.6 percent, respectively. It follows, therefore, and it is further substantiated by the insignificant schooling coefficients in the estimations for the self-employed, that higher levels of schooling yield a significantly larger return in employment than in self-employment.

The estimates derived for the three levels of schooling range from 7 percent for the self-employed individual with completed primary schooling to about 18.6 percent for the employed individual with university education. The estimates for an earlier sample ranged from 7 percent to 27 percent (Hamdani 1977). However, as mentioned above, there is reason to expect that those results were biased upwards. Our estimates do appear to bear this hypothesis out.

Earnings function estimates for both the statuses and for all individuals are presented in Table 2. As expected, estimates of α, the returns to schooling, are lower than those for the overtaking sets. Non-linear returns to schooling are once again indicated. The introduction of the quadratic schooling term raises the R^2 but leaves the experience coefficients unaffected. Experience variables are significant with the expected signs indicative of the usual concave age-earnings profile. It is worth noting that the experience variable here is an observed variable and not one derived from the difference between age and schooling.

As in the overtaking set, the full sample regressions indicate a small estimate for the returns to schooling among the self-employed. In the sample they are all owner-operators and expected to hold small amounts of capital. The low estimate of returns to schooling is most likely a consequence of our lack of information on capital holdings. In the earnings function estimates for the employed, earnings are the dependent variable, whereas for the self-employed the dependent variable is earnings plus capital income. The direction of the bias as a result of the omission of the capital variable is not immediately clear. To the extent that capital endowments can be substituted for human capital acquisitions (by means of bequests, for example--see Becker 1981), our estimates of α for the self-employed will be downward biased. On the other hand, a positive correlation between capital holding and the amount of human capital acquisition would result in an upward bias for the rate of return estimate derived here. Such an upward bias could well emerge if educated people tended to inherit both more physical and more human capital. Moreover, since higher earnings induce higher savings, an increase of level of education could also produce this result.

Table 2: Log Earnings of all Men*
(t-Ratios in Parentheses)

Variables	Employees		Self-Employed		Full Sample	
Constant	5.08 (148.86)	5.15 (150.37)	4.80 (125.15)	4.89 (125.44)	5.67 (87.54)	5.69 (87.93)
GRAD	.055 (20.07)	-.019 (-2.32)	.077 (24.64)	.002 (.212)	.024 (4.69)	-.023 (-1.48)
$(GRAD)^2$		.006 (9.60) [.051][a]		.006 (8.43) [.085]		.005 (3.23) [.017]
Exp	.063 (20.77)	.064 (21.73)	.069 (17.89)	.070 (18.56)	.043 (8.38)	.044 (8.69)
(exp)2	-.001 (-15.32) [.475] [19.00]	-.001 (-16.19) [.495][b] [19.01]	-.001 (-12.52) [.497] [24.24]	-.001 (-13.00) [.488] [25.40]	-.0008 (-7.79) [.246] [8.27]	-.0008 (-8.10) [.235] [7.25]
R^2	.260	.287	.392	.418	.088	.099
Observations	2484	2484	1599	1599	885	885

* For explanations of variable names see footnote to the previous table.

a. Values in square brackets under S^2 are estimates of r at the mean value of S.

b. Values in square brackets under EXP^2 are estimates of K_0 and T, respectively.

Table 2 presents estimates of k_0, the initial net investment ratio, and of T (= k_0/b), the terminal period of on-the-job investments. Lower k_0 and T are indicated for the self-employed. These individuals invest less of their potential earnings in learning on the job, and they finish this learning much earlier than their counterparts in employment. Because the self-employed are an older group of people, our results may merely be capturing vintage and cohort effects. Overall the human capital model fits the employee category well but not that of the self-employed[4]. The observed difference between the self-employed and the employed is somewhat surprising and different from results from Hong Kong. Wong (1981) found little to distinguish between the self-employed and the employed with similar estimates for the returns to schooling, a, initial investment in on-the-job training, k_0, and the time of termination of on-the-job training, T.

Comparison of the Results

The Rawalpindi results are compared with those of some other countries in Table 3. Both the employee subsample and the full sample results are presented. The results, especially for the employee subsample, compare well with other countries. Estimates of α, the return to schooling, are generally lower than in other countries. The R^2 for the employee sample is roughly comparable to that of other countries while the R^2 for the full sample is quite low, indicating once again the lack of adequate explanatory variables for the self-employed. The $R^{\wedge 2}$ presented in Tables 1 and 3 is the Mincer measure of estimating the explanatory powers of schooling in the human capital model. It is defined as

$$R^{\wedge 2} = 1 - \frac{\text{Var u in overtaking set}}{\text{Var y in full sample}}$$

4 A comparison of the full sample regression coefficients with those of the two work status choices shows that the employee and the full sample results agree. This group therefore dominates in the full sample results.

Table 3: Decomposition of Variance for LoG Earnings in Six Countries[a]

	U.S.	U.K.	France	Morocco	Singapore	Hong Kong	Pakistan	
							Employed	Full Sample
I. Schooling - Experience Model Estimated in Total Sample: [b]								
$\ln Y = \text{constant} + r\,GRAD + a_1 exp - a_2(exp)^2$								
R	.107	.097	.108	.158	.113	.071	.077	.055
R^2	.285	.316	.350	.443	.449	.249	.392	.260
σ^2 (ln Y	.680	.436	.546	.650	.373	.349	.569	.532
$R^2\sigma^2(\ln Y)$	.194	.138	.191	.288	.167	.087	.223	.138
$(1-R^2)\sigma^2(\ln Y)$	.486	.298	.355	.362	.206	.262	.346	.394
R^2	.485	.528	.445	.678	.684	.395	.364	.149
$R^{\wedge 2}\sigma^2(\ln Y)$	.330	.230	.243	.441	.255	.138	.207	.079
$(1-R^{\wedge 2})\sigma^2(\ln Y)$	.350	.206	.303	.209	.194	.211	.362	.453
II. Schooling Model Estimated in Overtaking Sample: [c]								
$\ln Y^* = \text{constant} + rS$								
R	.165	.068	.110	.175	.134	.140	.112	.089
R^2	.328	.105	.340	.696	.596	.444	.461	.294
$\sigma^2(\ln Y^*)$	.520	.230	.459	.687	.400	.379	.667	.641

Sources:
1. U.S. from Mincer (1974).
2. U.K. from Psacharopoulos and Layard (1979).
3. France from Riboud (1977).
4. Morocco from Psacharopoulos (1977).
5. Singapore from Liu and Wong (1980).
6. Hong Kong from Wong (1981).

a. Hong Kong and Pakistan estimates use monthly earnings, Singapore estimates use hourly wages, and the rest use annual earnings.
b. ln Y denotes log monthly earnings of men in the total sample.
c. ln Y* denotes log monthly earnings of men in the overtaking experience years.

For our sample, 15 percent of the variation in earnings is explained by schooling alone, whereas for employees the measure is 26.4 percent. $R^{\wedge 2}$ was observed to be different for the two categories, employment and self-employment, even in Hong Kong, although the difference was not as large as in Rawalpindi. The $R^{\wedge 2}$ is lower than the regression R^2, a consequence of the variance of Morocco being larger in the overtaking years than in the whole sample. For Britain, France, and the United States, the $R^{\wedge 2}$ is larger than the R^2 in the overtaking years' regressions; the opposite results hold for Hong Kong, Morocco, and now Pakistan. Except for Singapore, the less developed countries differ in this respect from the developed countries. An explanation for such a result probably lies in the dynamic effects embodied in cross-section data. Higher income growth rates in the poorer countries, coupled with rapid industrialization and technology transfers, have in all probability been shifting the demand for skilled or educated manpower outward. Consequently both the demand for schooling and school enrolments would have tended to rise over time to the benefit of younger cohorts. The resulting observed variation in earnings would therefore be reduced, even though lifetime variation, which by construction is what the overtaking set seeks to approximate, is increased.

Conclusion

Estimates of the rate of return for schooling for the employee subsample compare favorably with those of other countries, and the full sample estimates seem to be reflecting the poor fit of the human capital model to the self-employed subsample[5] As the results of the two subsamples--the employed and the self-employed differ so much--perhaps pooling is not advisable. The human capital model, which by now has been verified in a number of countries, appeared to explain better earnings behavior for the employed than for the self-employed. While significant and increasing returns to schooling were obtained for the employed, returns to schooling for the self-employed were weak and significantly lower than for the employed. Nevertheless, estimates of the human capital model for Pakistan, especially those for the employed, compared favourably to similar estimates from other countries.

On the issue of generalizability of results to the whole country, it should be noted that we have an urban sample from a relatively large country where sizeable regional and city differentials may be expected. In general it may be reasonable to expect that greater income differentials exist in rural areas than in urban areas, leading to a smaller level of observed income inequality for cities than for the country as a whole. In this case, it is possible that estimates of rates of return for the country are larger than ones obtained here. However, to the extent that urban areas and especially Rawalpindi, which is in close proximity to the capital and therefore holds prospects of government employment to its residents, are able to provide the necessary infrastructure, institutional and otherwise, that complements formal education, the productivity of education will be increased. In such an event, the estimated rates of return from our sample may overestimate the national rates of return.

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5 This raises the question of the treatment of the occupational choice variable. A model and estimation of endogenous occupational choice is presented in Haque (1986a, 1986b).

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