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I. Introduction

Empirical tests of the human capital hypothesis--that education increases an individual's income--have been applied to several countries with favourable results [13]. These results show that : (1) income differentials between individuals of different educational levels are wide; (2) the differentials establish shortly after the initial years of work and maintain through the duration of the life cycle; (3) the differentials are greater in developing countries than in developed countries; (4) after allowing for educational costs the returns to education exceed the returns to physical capital investment in developing countries; (5) the highest returns are to primary education; and (6) private returns exceed social returns. Which, if not all, of these results are true for Pakistan is not known. This paper yields such comparative results through an application of the human capital hypothesis to Rawalpindi City. The data for Rawalpindi is for males and derives from a socio-economic survey conducted by the Pakistan Institute of Development Economics in 1975.

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For the impatient reader, the unqualified results of the paper are as follows. The application of the human capital hypothesis to Rawalpindi City is favourable. For all surveyed males at all completed educational levels, income differentials emerge with the initial year of work and maintain over the life cycle. The differentials increase slightly by educational level: at the peak of the life cycle, the primary educated earn only 1.1 times the earnings of the uneducated; while the secondary educated earn 1.5 times the earnings of the primary educated, and the college educated earn 1.8 times the earnings of the secondary educated. These ratios are low, though, in very rough comparison with those in other countries.

The social returns to completed education vary between 8 and 10 percent. Although low, if allowance is made for productivity growth, then the latter returns are compatible with the returns to physical capital investment. The private returns to completed education vary between 11 and 27 percent, and, generally, rise by educational level. For the lower educational levels, both social and private returns are low in comparison with those in other countries. Finally, the excess of private returns over social returns is attributable to government educational expenditure, and the rise in the excess by educational level indicates that higher education is more heavily subsidized than lower education.

For the patient reader who desires the qualifications to these results, the organization of the paper is as follows. The next section broadly identifies the theoretical framework of the study. The subsequent section describes the various data utilized in the analysis, and specifically identifies the theoretical framework with a selection of variables and forms appropriate for the data. The fourth section estimates the earnings functions; derives the gross income differentials by age categories, or age-income profiles; and calculates the marginal rates of return. The paper concludes with a summary of the results and a discussion of the policy implications.

II. Theoretical Framework

The human capital conceptualization of education is as an investment activity which yields a return over the lifetime of the educated individual /1/. There are several project analysis techniques to calculate this return and one of these is the internal rate of return: it is the discount rate which reduces to zero the present value of the lifetime income differentials attributable to education net of educational costs.[1] As education is attained in stages, a separate rate, defined at the margin, is calculable for each educational level.

[1] Note that there exists a debate on the correct choice of technique and that while the selection of the internal rate of return is most popular it is nonetheless arbitrary. See: /13, p. 19/.

The marginal rate, r, is calculable by determining the following algebraic expression:

$$\sum_{t} (Y_e - Y_{e-1})_t \quad (1 + r)^{-t} = 0$$

where Y is net income and $(Y_e - Y_{e-1})_t$ is the net income differential attributable to the marginal educational level, e, for each year, t, of the individual's lifetime. Clearly, the magnitude of the rate varies directly with the magnitude and timing of the net income differentials: the greater the differentials and the earlier these are realized, the higher is the rate of return.

The calculation of the net income differentials involves two major steps and numerous minor ones [15, chap. 2]. The first major step is the estimation of the gross income differentials over the lifetime of the educated individual. The second major step is the derivation of the net income differentials through the deduction of educational costs. The numerous minor steps consist of corrections to either income or costs for such factors as: differences in private and social perspective; noneducational determinants of income; and the probabilities of employment and life expectancy. The two major steps are now outlined in turn, while the numerous minor steps are noted wherever appropriate.

The estimation by educational level of the lifetime gross income differentials requires a separate estimation of an earnings function--a regression of income on age--for each

educational level.[2] The lifetime gross incomes to each educational level is then simply the difference in the estimated lifetime incomes for that level and its preceding one. The lifetime gross incomes to each educational level are the social gains in increased productivity due to education (provided wages reflect the marginal product of labour), while the lifetime gross incomes calculated exclusive of income tax--by a regression of disposable income on age--are the private gains realized by the individual.[3] As individual lifetime longitudinal data is unavailable, the earnings function is fitted on cross-section data for employed individuals of varying ages at a given educational level. The presumption is that a cross-sectional age-income profile of an individual's prospective educational peers determines the individual's ex ante expectations of the returns to different educational levels.[4]

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[2]Alternatively, an earnings function can be estimated for the pooled data of all educational levels. In this form, the earnings function is a regression of income on schooling and work experience; see: [5]. This form is not considered necessary in the paper except for the post-graduate educational level for which very few observations necessitate a pooling with the college educational level.

[3]If wages do not reflect the marginal product of labour, then corrections to gross incomes are necessary; see: [13, p. 26]. Although there is a need for such corrections--the shadow wage of unskilled labour is estimated at one-half of the market wage [8]--no corrections are made in view of the absence of a similar estimate for skilled labour, and of the lack of accurate information on the association of skill with educational level.

[4]However, possible future shifts in the labour market are not considered, so that the calculated rates of return are not ideally ex ante; see: [13, pp. 23-4]. It is possible to allow for simple productivity growth by the addition of the expected annual growth rate to the calculated rates of return; see: [13, pp. 31]. Although there is reason to believe that expected productivity growth is positive [4], [7], the addition is not made in view of the present absence of an accurate estimate.

For each educational level, a concave earnings function is estimated by a least squares regression of income on age, and on selected standardization variables. Notationally, the form of the regression is:

$$\ln(Y) = a + bA - cA^2 + \sum_i d_i Z_i + u$$

where $\ln(Y)$ is the natural logrithm of income, A is age, and Z_i are standardization variables; of course, u is the well-behaved regression error, and the regression coefficients are a, b, c, and d_i. The inclusion of the standardization variables is to correct for income differences between educational levels due to noneducational factors [13, pp. 28-9]. For instance, if the proportion of self-employed individuals declines by educational level, and if a part of self-employment income is likely to be a return to physical capital investment and not education, then nonstandardization overestimates the age regression coefficients of the lower educational levels to a greater extent than those of the higher educational levels and, therefore, underestimates the income differentials attributable to education. The standardization is attained by first allowing for such noneducational factors, Z_i, in each educational level regression, and second by holding the Z_i constant in deriving each educational level's age-income profile.

The derivation of the age-income profiles from the estimated earnings functions is straightforward. The profiles are simply

plots of the standardized regressions in an age-income Cartesian plane; as such, each depicts the lifetime expected incomes for a particular educational level. Theory suggests that each profile follows the life cycle: it rises initially with age through the accumulation of job experience, peaks at middle age, and then gradually declines with increased age.[5] Theory also suggests that the profiles for higher educational levels rise above those for lower educational levels--once the inexperience handicap resulting from a delayed entry into the job market is overcome--so that income differentials emerge and maintain over the life cycle. Clearly, whether these differentials yield high rates of return depends on educational costs.

Educational costs are of two types: monetary and opportunity. Monetary costs comprise all direct and indirect expenditures on education. The former include he cost of tuition, books, supplies, and teacher salaries (not paid through tuition revenue); the latter include the capital cost of classroom buildings and other school property (also not paid through tuition revenue). Opportunity costs comprise all earnings forgone during school attendance. Although nonmonetary, forgone earnings for the relevant time period derive readily from the age-income profile of the Y_{e-1} educational level, which represents the highest income alternative to school attendance.

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[5]The decline is more rapid for profiles derived from cross-section data due to the 'vintage effect': individuals are not homogeneous in the quality of their education as new technology is embodied in younger individuals [1, p.143].

The distinction between private and social cost is simple. Private cost is that incurred by the individual. This consists of the individual's monetary expenditures on tuition (less any financial assistance provided to the individual), books, supplies, and the opportunity cost of forgone earnings, all expressed annually for each year of school attendance. Social cost is that incurred by society. This consists of the private cost, and all remaining expenditures not incurred by the individual such as the cost of teacher salaries and school property (not paid through tuition revenue), also expressed annually per pupil.

The deduction of annual private (social) costs from the estimated annual private (social) gross income differentials yields, for each educational level, the lifetime private (social) net income differentials. As the net incomes derive from earnings functions estimated for employed individuals (who by definition are alive), corrections for the probabilities of employment, w, and life expectancy, s, are necessary as these effects are not reflected in the estimations.[6]

[6] A correction is sometimes made for the probability of labour force participation on the assumption that the labour force entry decision is, like the employment and life expectancy decisions, also determined exogenously and not by the individual. This assumption is not made in the paper and no labour force participation correction is considered.

The corrections imply a downward adjustment to the lifetime net income differentials. Notationally, the adjusted differentials for each educational level, e, are:

$$\sum_t w_t s_t (Y_e - Y_{e-1})_t$$

where both w and s are positive but less than unity, and are indexed by t as these very over the life cycle. The discount rate which reduces to zero the present value of these adjusted differentials is the rate of return to the marginal educational level, e.

Finally, the probability rates w_t and s_t are defined as follows. The employment rate, w_t, is the proportion of employed individuals in the labour force of age t. And the life expectancy rate, s_t, is the proportion of individual alive at the initial school-going age (of the particular educational level) who survive to the year t. Ideally, these rates should be calculated separately for each educational level. This disaggregation is specially appropriate for w_t as the probability of employment is likely to vary (and not necessarily positively) with educational attainment.

III. Data

Two principal types of data are used in the paper. The socio-economic data is from a 1,000 household survey of Rawalpindi City. The educational cost data is from national estimates by the government of Pakistan. Both data are for 1975. The survey data is discussed first.

A. Socio-Economic Data

To begin with, some brief characteristics of Rawalpindi City are useful. The most important of these is that Rawalpindi is the fifth largest Pakistani city with an estimated population of 673,000 individuals in 1975.[7] The city is an important regional metropolis, with primarily administrative functions. In the early sixties, it was the Nation's interim capital. Even today, several of the earlier capital functions remain. With the development of Islamabad, the new capital.. on its outskirts, Rawalpindi's wholesale trade and construction activities expanded, and have emerged as important. However, manufacturing activity is largely nonexistant in the city.

In August and September of 1975, the Pakistan Institute of Development Economics undertook a socio-economic survey of 1,000 Rawalpindi households.[8] A tight budget necessitated the small sample size and a simple sampling design. The latter involved, first, a random selection without replacement of 16 clusters--a cluster consists of approximately 225 households--

[7]The estimation is a projection of the 1972 census estimate at a 3.2 percent annual growth rate.

[8]The unidentified Institute members involved in the undertaking were : Iqbal Alam, Stephen E. Guisinger, Sarfraz K. Qureshi, and Abdul Wasay.

from a 400-cluster sampling frame developed for Rawalpindi City by the Central Statistical Division. And second, a selection of a fixed proportion of households per cluster, x (= 1,000 / 16), from the Division's cluster-wise address listing of all structured and semi-structured dwellings. The household selection criterion was to sample every i^{th} (= the total number of dwellings / x) address, given a randomly chosen initial address.[9]

Basic socio-economic information was collected for each of the 1,000 selected households. For this purpose, a 57-item questionnaire was developed, twice pre-tested, and revised. The revised questionnaire was completed for each household by one of six direct-hire professional enumerators through an interview with the head of household or, if unavailable, the senior-most household member. Interviews were conducted on Sundays and weekday evenings to minimize the probability of unattended dwellings. All completed questionnaires were field checked by a supervisor at the close of each enumeration day for omissions and ambiguous answers; if necessary, the enumerators were instructed to re-conduct unsatisfactory interviews.

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[9] The i^{th}+1 dwelling address was sampled whenever the i^{th} dwelling was: (1) unattended during two re-visits, (2) vacant, (3) an establishment, (4) an institution, or (5) government-owned.

Two types of sampling error can arise for the above sample size and design. First, small samples generally yield few observations for minority groups, so generalizations derived from the data for these groups could be erroneous. As expected, the sample yielded 1,541 males and only 123 females in the labour force. Even the male subsample, when disaggregated by educational level, yields few observations for the higher educational levels: only 10 males have university education. To avoid possible errors associated with inadequate sample size, the paper analyses only the male subsample and, moreover, focusses attention on only the lower educational levels.

Second, small, simply selected samples are generally unrepresentative of the larger population, so any generalization derived from the data could be erroneous. One technique which reduces the possibility of this type of sampling error is stratification. Although the sampling design does not allow for stratification, a post-selection examination indicates that the selected clusters are geographically well-stratified. Within clusters, however, the sampling of only structured and semi-structured dwellings introduces the possibility of skewed income, educational, and migrant status distributions; a reasonable presumption is that this design excludes a greater proportion of the poor, the illiterate, and the recent migrant, so that the effect--if any--of the sampling error is to underestimate the return to primary education. With respect to

other variables (such as age, sex, and occupation), a post-selection examination of the distributions of the sampled labour force members with the corresponding distributions identified by the earlier and larger--311,749 persons--1960 socio-economic survey of Rawalpindi [10], indicates that the two samples are similarly distributed and, to the extent that the earlier survey is representative, the present survey is representative.

Several checks were undertaken to gauge the extent of nonsampling error in the survey; there are two types: response and nonresponse. With regard to response errors, the likelihood of unintentional recall errors is relatively low as all questions pertain to basic, easily recallable information: age, sex, employment status, and the like; however, the self-employed appear to have greater difficulty in interpreting their hours worked than do employees: the former typically work from sunrise to sunset even though they always manage to have meals and an afternoon rest in between! A more serious type of response error is the likelihood of the intentional underreporting of income. To control for this problem, expenditure and type-of-housing questions were asked to determine a lower bound to household income; in addition, the enumerators were asked to note their opinion in each completed questionnaire on the probability of underreporting. A careful analysis of these controls suggests some potential

instances of income underreporting; but none of these were particularly unbelieveable to justify elimination.

Finally, there is the possibility of nonresponse errors. These errors are usually traceable to improperly completed questionnaires and careless data transcription. The twin procedures adopted to check for these errors are field checks by Institute staff and data editing. Aside from the already noted field checks, approximately 20 percent of the sample households were visited by Institute staff and no instances of enumerator-counterfeited questionnaires for nonexistant households were noted. The data was manually edited ~~xkxhe~~ at the coding and card punching stages, and computer-edited through multiple consistency checks at the print-out stage: minor errors were spotted and corrected.

The summary statistics for the data of interest are as follows. There are 1,664 individuals in the labour force, of whom 1,541 are males. Half the males in the labour force, 50.4 percent, are employees, while 33.7 percent are self-employed; almost all of the former 97.7 percent, are salaried, and almost all of the latter, 88.5 percent, are individual operators. Surprisingly, only 5.3 percent of the males in the labour force are unemployed; underemployment, though, is substantial: 23.8 percent of the males would like to work more hours. The minority members of the male labour force are apprentices, 3.2 percent, and unpaid family helpers, 7.5 percent.

The subsample of all employed and self-employed males is chosen for analysis. Apprentices are excluded for a theoretical reason: although in the labour force, they are also investing in human capital through on-the-job training so their earnings are lower (by the amount of the trainee cost) than the earnings of nonapprentices, and the two earnings are not comparable, therefore [1, p.157]. It is possible to include the unemployed and so directly correct the income differentials for the probability of employment [13, p.29], this is not done, however, as the unemployment rate yielded by the sample, 5.3 percent, appears to be low; instead, the indirect employment correction indicated in the previous section is used. Ideally, unpaid family helpers should be included; they are excluded, though, because their income is not easily determinable. Still, it is possible to allow for their presence indirectly: a standardization variable indicating the number of unpaid family helpers associated with each self-employed individual--the variable is necessarily zero for employees--is defined for the earnings functions.

Analysis of the self-employed is troublesome because a portion of self-employment income tends to be a return to physical capital investment. A reasonable assumption is that the return is low for individual operators (who presumably own little capital stock) and high for those self-employed with employees. If correct, then the problem is serious for

only a fraction, 4.6 percent, of the selected subsample. Again, an appropriate allowance for the problem is possible. A standardization variable, this thime a dummy (= 1 if an individual is self-employed with employees, and 0 otherwise), is defined for the earnings functions.

The distribution of the selected subsample of 1,295 individuals by educational level is as follows.[10] 439 are unschooled of whom 50 are functional literates; 119 have less than primary schooling. 285 have completed primary school and possibly some secondary schooling; 375 have completed secondary school through matriculation and possibly some college schooling. 67 have completed college and received a B.A. degree; and 10 have attended university and received a post-graduate diploma. This arbitrary, discontinuous grouping is unfortunate; yet, it is the response grouping of the educational question used in the survey.

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[10] Education in Pakistan consists of : 5 years of primary school; 3 years of middle school and 2 years of high school, both of which together comprise secondary school and completion of which is termed matriculation; 2 years of intermediate college and 2 years of degree college, both of which together comprise college and the completion of which is marked with the award of a B.A. degree; and 2 years of university, the completion of which is marked with the award of a post-graduate diploma. As a simplification, medicine, engineering, and similar specialized education is not considered.

With one exception, the above distribution yields sufficient observations per educational level group to allow the estimation of a separate earnings function for each. The exception is the university educational level which, for the estimation purpose, is combined with the college educational level to form a post-secondary group of 77 observations. For the latter group, a dummy variable (= 1 for university graduates and 0 otherwise) is defined to distinguish between the age-income profiles of the college and university educational levels. This technique assumes that the two profiles are similarly shaped and differ only in the intercept. Although perhaps an acceptable assumption, any interpretation of the dummy variable coefficient must be cautious as its estimation depends on only 10 observations.

Income, the dependent variable in the earnings functions, is defined as hourly earnings. Specifically, it is the ratio of monthly income to monthly hours worked, where monthly income is wage income (including bonus payments) and income in kind for both primary and secondary occupations, and monthly hours worked are the hours worked in the survey reference week multiplied by 4. The choice of hourly earnings is based on observed variations in the sample in the average hours worked per week between individuals of different educational levels: the educated tend to work fewer hours than the uneducated. As already noted, these variations in part may be due to nonsampling

error (since the uneducated are proportionately more self-employed); however, in part these also reflect an individual's time allocation decision between work and leisure. In the latter and potentially more important case, hourly earnings standardize for this substitution effect and are, therefore, a more appropriate measure of income.[11]

It is desirable to conclude this discussion of the survey data with a review of the calculations to be performed in the next section. For each of five educational level groups (unschooled, incomplete primary, primary(-plus), secondary(-plus) and post-secondary), consisting of employed and self-employed individuals, an earnings function is estimated by a regression of the natural logarithm of hourly earnings on age and two standardization variables. Also, the earnihgs function estimation for the post-secondary educational level group includes a dummy variable identifying university graduates in order to derive an age-income profile for these individuals, and the estimation for the unschooled group includes a dummy variable for functional literates.[12] The two standardization variables attempt to control for the effects of unpaid family helpers and nonearnings income. The standardization is attained in two ways: first, within each educational level's

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[11] Even in the former case, standardization may be appropriate as nonwork time incurred in underemployment is not strictly leisure.

[12] No age-income profile is derived for functional literates, though.

earnings function, by an evaluation of the function with these variables set to zero (since all calculations are for individuals with no unpaid family helpers and no nonearnings income); and second, between educational levels, by maintaining these variables constant at zero in the derivation of each educational level's age-income profile.

B. Cost Data

The initial step in the specification of costs is to determine the number of years of schooling associated with each educational level. The determination is simple for the unschooled, college, and university levels: at 0, 4, and 2 years of marginal schooling, respectively; however, the determination is approximate for the three open-ended educational level groups: incomplete primary, primary(-plus), and secondary(-plus). The years of schooling for the incomplete primary group is determined at 2 (which is the average number of years of incomplete primary schooling = (5-1) / 2). The average years of schooling of the primary(-plus) group and the marginal years of schooling of the secondary(-plus) group are determined at 5 each. On the simple assumption that the proportion who complete further years is small so that the distribution of individuals is skewed towards 5 years of (average or marginal) schooling; if the latter assumption is incorrect, then its effect--if any--is to over-estimate the return to primary and secondary education.[13]

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[13]Given the assumption, the (-plus) qualification is deleted from the primary and secondary educational level groups.

Note that the above determination does not consider--due to lack of data--the likelihood of individuals repeating one or more years of schooling.

The next step is to determine the annual cost of schooling. As already noted, the cost consists of all monetary expenditures on schooling and all earnings foregone during school attendance. The latter derive readily rom the age-income profile of the Y_{e-1} educational level. The former ordinarily derive from expenditure data, but unfortunately none exists; instead, these derive from national estimates by the Planning Commission [12], and the Bureau of Educational Planning [11]. The expenditure estimates are detailed in Appendix Table 1; although perhaps slightly low, no attempt to second-guess is made.

The average annual cost of schooling by educational level is summarized in Table 1. Two rough comparisons of these figures with those for other countries is possible. First, as in most countries, opportunity cost (= private cost - direct cost) is the principal component of social cost for primary and secondary education; however, the proportion, 70 percent, is high relative to that observed in developing countries, 53 percent, or even that observed in developed countries, 67 percent, [13, pp. 126-7]. Second, ignoring opportunity cost and all indirect costs, the direct cost of a year of secondary (college) education is twice (nine times) the cost of a year of primary education; these

Table 1

Average Annual Rupee Educational Cost Per Student By Level

Educational Level	Years of Schooling	Social Cost	Government Cost		Private Cost	
			Total	Direct (%)	Total	Direct (%)
School						
Primary	5	885	246	59	639	5
Middle	3	2,123	507	59	1,616	2
High	2	2,524	710	56	1,814	3
College						
Intermediate	2	4,742	1,931	52	2,811	16
Degree	2	5,574	2,441	49	3,133	15
University	2	21,985	17,414	29	4,571	17

Source: Appendix Table 1 and age-income profiles (for opportunity cost).

Note : annual opportunity cost is calculated for a ten-month schooling cycle.

cost rations are identical to those observed in developed countries but much less than those in developing countries, 7: 1 (and 77: 1). In view of these disparities it is important to emphasize that the expenditure cost data for Pakistan derives from estimates.

IV. Analysis

A. Earnings Functions

For each educational level, an earnings function is estimated as specified in the previous section; the estimations are summarized in Table 2. By standard criteria, the estimations are good. All equations are significant at the 1 percent level, by the F-test. The human capital variables in all quations possess expected signs and are also significant at the 1 percent level, by the t-test. And, the goodness-of-fit of all regressions--the $\bar{R}^2$ varies between 20 percent and 43 percent--is respectable for household data if it is recalled that the samples are stratified by education (itself a principal determinant of income) and the dependent variable is hourly earnings instead of monthly earnings.

Table 2

Male Earnings Function by Educational Level

Educational Level	Sample Size	Regression Coefficients (t-statistic value)								ln(Y)	
		Constant	Age	Age^2	Helpers	Employer	University	Literate	R^2(F)	Mean	Variance
Unschooled	439	-1.1410	0.0684 (9.20)	-0.0007 (8.14)	0.3108 (5.92)	0.5534 (4.78)		0.0220 (0.27)	.32 (40.12)	.423	.422
Incomplete Primary	119	-1.3744	0.0800 (5.83)	-0.0008 (4.52)	0.2391 (2.31)	0.6662 (3.33)			.43 (21.88)	.435	.376
Primary	285	-0.7955	0.0615 (5.49)	-0.0006 (4.65)	0.3113 (3.32)	0.2825 (1.93)			.20 (16.94)	.504	.302
Secondary	375	-1.0190	0.0962 (7.97)	-0.0011 (7.30)	0.0807 (0.71)	0.6085 (3.88)			.20 (25.58)	.866	.320
Post-Secondary	77	-1.1389	0.1166 (2.89)	-0.0012 (2.47)	0.0208 (0.05)	0.0012 (0.00)	0.3781 (1.95)		.23 (4.18)	1.387	.375

Note: The dependent variable, ln(Y), is the logarithm of before-tax hourly Rupee earnings.

The importance of the standardization and dummy variables varies. The helpers variable, a standardization for unpaid family helpers, and the employer variable, a standardization for nonearnings income, are important only for the lower educational levels. This is traceable to occupational differences between educational levels: the more educated tend to enter employee occupations rather than self-employment occupations. The literate variable, a dummy identifying the literate among the unschooled group, is insignificant suggesting no wage premium for functional literacy. However, the university variable, a dummy identifying university graduates among the post-secondary group is positive and significant at the 5 percent level, by the t-test.

A cursory look at the variance of the dependent variable provides a rough indication of the differences in income inequality between educational levels. The variance of ln(Y) is a popular measure of income inequality /2,p.7/. By this measure, income inequality is greatest among the unschooled. It is least among the primary schooled. Generally, the degree of income inequality declines by educational level, if allowance is made for the heterogeneous nature of the post-secondary educational level.

A similar look at the mean of the dependent variable provides an indication of the differences in income between educational levels. The mean of ln(Y) is the logarithm of

the geometric mean of Y, and is therefore a popular central tendency measure of income [2, p.7]. By this measure, hourly earnings rise by educational level. The marginal rises for the secondary and post-secondary educational levels are significant at the 1 percent level, by t-tests of the difference between means modified for unequal variances. However, the rises for the lower educational levels are insignificant.

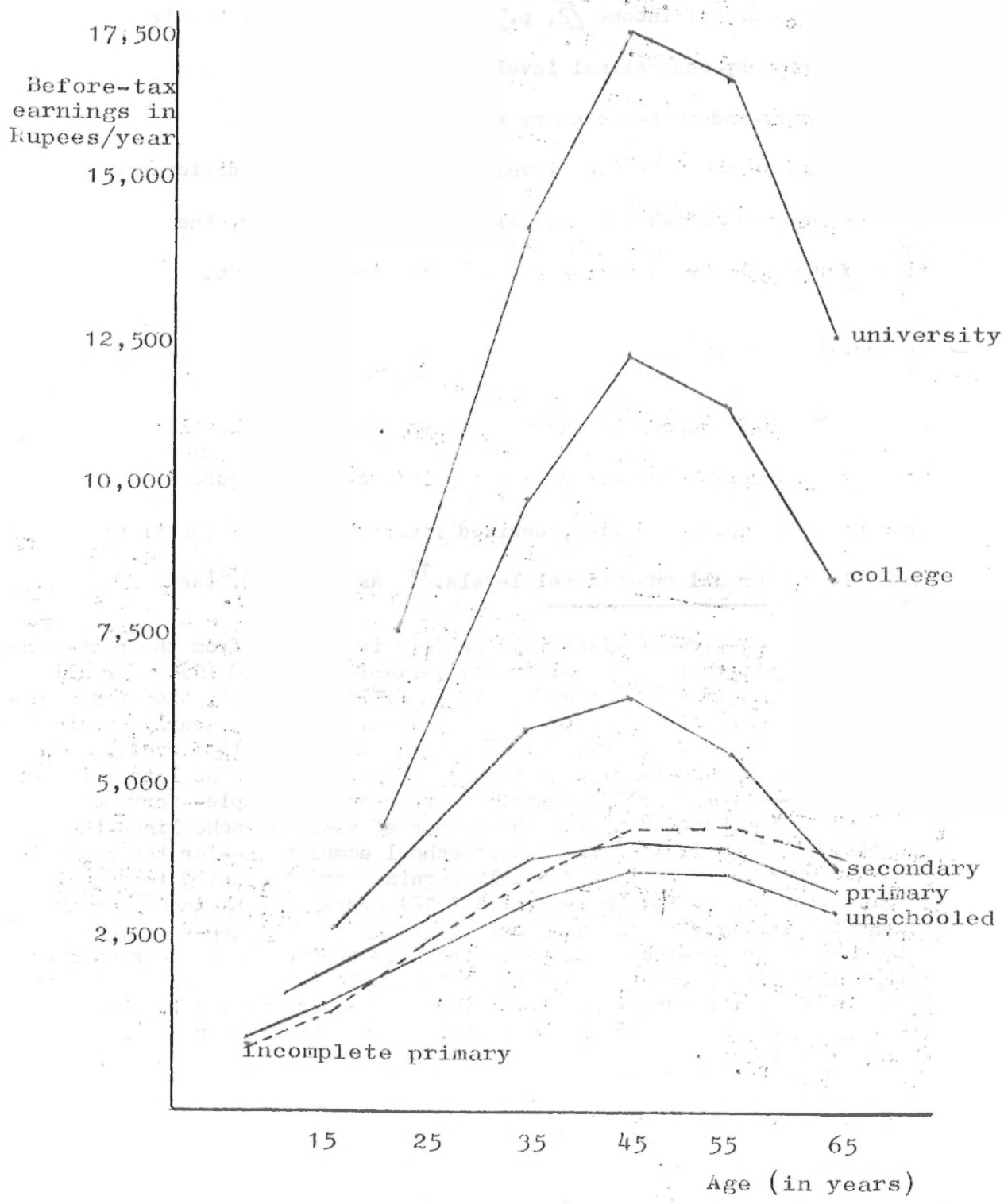
B. Age-Income Profiles

The differences in income between educational levels are more appropriately viewed over the life cycle. Figure 1 presents age-income profiles, derived from the earnings functions in Table 2, for all educational levels.[14] As expected, the

[14] The college (university) profile is derived from the post-secondary earnings function with the university variable set at 0 (1). For all profiles, the derivation procedure is as follows. First, the standardization and literacy variables are set at 0. Second, estimated hourly earnings are calculated for all regressions for an assumed 65-year life cycle. The initial years vary depending on the age of job entry. The latter is set at 7 years --the age of the youngest worker in the sample--for the unschooled group and at 5 plus the number of years of schooling--the age immediately following the age of school completion--for the remaining groups. Third, the estimated hourly earnings are converted to annual earnings; to do so, 2,304 (= 48 * 4 * 12) hours of work in a year are assumed. Finally, the annual earnings are plotted in ten-year age intervals in an age-income Cartesian plane, and the plots are connected with linear line segments. Note that the profiles appear to peak at the same age since the actual peaks lie in the same age interval. In fact, the average peak age is 49 years, and the peak age range is 45 to 53 years.

Figure 1

Male Age-Earnings Profiles by Educational Level



profiles are concave and follow the life cycle: these rise initially with age through the accumulation of job experience, peak on the average at age 49, and then decline with increased age. With one exception, the concavity of the profiles increases by educational level. Also with one exception, the profiles for higher educational levels are above those for lower educatinal levels so that income differentials emerge with the initial year of work and maintain over the life cycle.

The latter exception is the profile of the incomplete primary educational level. Although below the unschooled profile initially, it rises above the unschooled profile (at about age 20), the primary profile (at about age 40) , and the secondary profile (at about age 60) . The initial negative income differential is intuitively a puzzle: presumably, individuals do not compl te school due to high opportunity costs, yet, the earnings of those who do leave school are lower than the earnings of those who do not attend school. One explanation is on-the-job training [1, p. 15]: the initial negative differential could represent an implicit training investment cost, and the subsequent, increasingly positive income differential would then represent a joint return to the training and the partial schooling. An alternate explanation is the 'screening hypothesis' [9, p. 986]: in the absence of a certification of incomplete schooling, school leavers are initially underpaid their marginal product.

Returning to the differences in income between educational levels, these increase by educational level, but slightly. The ratios of gross annual income differentials at age 49 for primary/unschooled, secondary/primary, and college/secondary are 1.12, 1.47, and 1.84, respectively. The college educated earn three times the earnings of the uneducated. These ratios are low in very rough comparison to those for other developing countries (where the average secondary/primary ratio is 2.39), and are in line with those in developed countries (where the average secondary/primary ratio is 1.43),[15] The low magnitude of the ratios is partly explained by the urban setting of the earners sample, though.

C. Rates of Return

The analysis now turns to the net differences in income between ducational levels. As indicated in the second section, the project analysis technique selected to relate income benefits with costs is the internal rate of return. Table 3 presents the private and social internal rates of return to all (marginal) educational levels. The calculation of the social rates is based on the before-tax, age-income profiles in Figure 1 and

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[15] The comparison is very rough as the ratios and educational levels for other countries are computed differently; see [13, p.132].

Table 3

Marginal Rates of Return to Education by Level

Educational level	Years of Schooling	Returns (in percentage) Private	Social
Incomplete Primary	2	7	5
Primary	5	14	10
Secondary	5	11	9
College	4	14	10
University	2	27	8

Note: The returns to the primary level are marginal with respect to the unschooled level and not the uncomplete primary level, and are therefore average returns.

All rates are corrected for the probability of life expectancy.

on the social cost estimations in Table 1; while the calculation of the private rates is based on after-tax, age-income profiles (not presented) and on the private cost estimations in Table 1. All rates are corrected for the probability of life expectancy.[16]

For all educational levels, private returns exceed social returns. Ignoring the extreme levels, the excess is 2-4 percentage points. Between educational levels, the variation in private returns exceeds the variation in social returns. Private returns vary between 7 and 27 percent, and, generally, rise by educational level. Social returns vary between 5 and 10 percent, only.

In comparison with other countries, the returns to primary and secondary education are low.[17] For primary education, private and social returns are about 10 percentage points below the averages of comparable returns in other countries, and are outside the standard deviations of the averages. For secondary education, private and social returns are about 5 percentage points below the averages of comparable returns in other countries, but are inside the standard deviations of the averages. Between all educational levels, the rates do not exhibit the pattern observed in other countries of declining returns by educational level.

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[16] The probability of life expectancy, s_t, for each year t of the life cycle is calculated as the multiplicative product of the survival rates for all years between the initial school-going age (of a particular educational level) and the age t. The survival rates are from: / 3, Appendix Table IB/.

[17] All comparisons with other countries are based on figures in: / 13, chap. 4/.

However, the 2-4 percentage point excess of private returns over social returns is comparable with a 3-6 percentage point excess observed in other countries.

The absence of reliable employment rate estimates prevent the calculation of returns corrected for the probability of employment. However, a common presumption is that unemployment is serious primarily for individuals with secondary and post-secondary education and, also primarily for their initial years in the job market due to the inexperience handicap resulting from their delayed entry.[18] If true, then a check on the sensitivity of returns to the probability of employment is possible with the use of arbitrary but reasonable correction rates. If it is assumed that the probabilities of employment in the first five years of entry in the job market for individuals with secondary and post-secondary education are, respectively: .50, .75, .85, .90, and .95, then the corrected social returns to secondary, college, and university education are 9 percent, 9 percent, and 7 percent, respectively. And, the corrected private returns are 11 percent, 13 percent, and 26 percent, respectively.

[18] By this presumption, the age-income profiles for higher educational levels in Figure 1 might initially lie below those for lower educational levels if the profiles were corrected for the probability of employment.

Evidently, returns are relatively insensitive. The employment correction lowers the returns by not more than a percentage point. This result is similar to that observed in other countries [6, p.23]. On the matter of sensitivity, rates of return were also calculated without the life expectancy correction, and for nonstandardized earnings functions. These rates do not differ from those presented in Table 3, except for the incomplete primary level and, then too, the differential is only 2 percentage points.

V. Conclusion

The results of the paper are summarized as follows. For all completed educational levels, income differentials emerge with the initial year of work and maintain over the life cycle. The differentials increase slightly by educational level: at the peak of the life cycle, the primary educated earn only 1.1 times the earnings of the uneducated; while the secondary educated earn 1.5 times the earnings of the primary educated, and the college educated earn 1.8 times the earnings of the secondary educated. These ratios are low, though, in very rough comparison with those in other countries. Differentials are not observable for functional literates, and the differentials observable for the incomplete primary educated are apparently influenced over the life cycle by either on-the-job training or the so-called 'certificate effect'.

The social returns to education vary between 5 and 10 percent; however, the returns to completed education vary only slightly, between 8 and 10 percent. The private returns to education vary between 7 and 27 percent, and, generally, rise by educational level. The private return to primary education is 14 percent, while the private return to university education is 27 percent. For the lower educational levels, both social and private returns are low in comparison with those in other countries. Finally, there is incidental indication that the degree of income inequality declines by educational level.

The above results are subject to five specific and four broad qualifications. The specifics: first, the rates reflect returns to male education in an urban enviornment--Rawalpindi City; at best, therefore, the returns are representative for males in other urban areas, in no case are these representative for females or rural afeas. Second, even for Rawalpindi the sample is small, so all inferences from the results--especially those for the sparsely represented higher educational levels--should be guarded. Third, the cost data is derived from estimates. Fourth, the returns are uncorrected for unemployment, but these appear to be insensitive to such a correction; and fifth, the returns do not allow for productivity growth over time--if the annual rate of growth is known, though, it should be added to the returns.

Now the broader qualifications: first, the returns assume that market wages reflect the marginal product of labour; if incorrect, then the sensitivity of the returns to different reflection patterns should be explored. Second, while the earnings functions standardize for nonearnings income, unpaid family helpers, and weekly hours worked, the functions do not standardize--due to lack of data--for family background and ability. For the latter, a popular alternative to standardization is an arbitrary downward correction to age-income profiles [13, p. 28]; no such correction is attempted. Third, also due to lack of data, no allowance for the wastage cost of school repeaters or dropouts is possible. Finally, the net consumption benefits of education are ignored in the calculations, so such benefits should be regarded as additional to the calculated returns.

Given these qualifications, the policy implications of the results can be assessed. The first concerns the investment choice between human capital and physical capital. Generally, the social returns to education are low. However, for the investment allocation decision it is specially important to allow for labour productivity growth: if allowance is made, for instance, for a 2 percent annual growth in productivity, then the social returns to completed education rise to 10-12 percent, and these are comparable with a 12 percent return to physical capital investment. With an allowance for productivity growth, therefore, investment in education is as profitable as investment in physical capital.[19]

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[19]The reader can modify this statement to suit different figures if the above are unreasonable.

The second policy implication concerns the investment choice between educational levels. Contrary to expectations, the social return to primary education is not higher than the social returns to other educational levels. It is neither lower, however. In fact, the differential in social returns is too narrow to recommend resource allocation towards any particular educational level. Rather--unless the consumption benefits of education are strongly skewed--the recommendation is for investment at all levels of education.

The third policy implication concerns the difference between social and private returns to education. Private returns exceed social returns, and the excess rises by educational level from 2 percentage points to 19 percentage points. As the excess is attributable to government educational expenditure (and only negligibly to the income tax adjustment), the rise in the excess by educational level indicates that higher education is more heavily subsidized than lower education. Evidently, this distribution reflects government policy.[20] In any case, the present policy of free primary and secondary education provides only a small subsidy--a 2-4 percentage point excess differential in returns--relative to the existing college

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[20] Such a policy is stated by the Federal Minister for Education, Abdul Hafeez Pirzada, in a speech delivered at the Installation and Oath Taking Ceremony of the Students Union of the Quaid-i-Azam University, Islamabad, on October 26, 1976.

and university education subsidy--a 4-19 percentage point excess differential in returns.

The fourth policy implication concerns the wide variation--of 20 percentage points--in the private returns to education. The variation is largely at the extreme educational levels: the return to incomplete primary education is one-half of the returns to primary, secondary, and college education; while the return to university education is almost double the returns to primary, secondary, and college education. Such wide variations indicate a highly imperfect market: the low return to incomplete primary education suggests an excess supply of individuals at that level and, or, the operation of a 'certificate effect'; while the high return to university education suggests a shortage of individuals at that level. Although such a market situation ranks private incentives in favour of further education, only individuals from relatively high income families with access to low-cost educational financing can realize the high returns on further education.[21] Even then, the demand for higher education could exert excessive market pressure on existing higher educational

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[21] The argument assumes imperfect access to educational financing. If this argument is too intuitive, the reader is referred to formal models of the private demand for education from which the argument derives; see [13, pp. 77-79] for a discussion and references.

facilities--pressure which does not reflect social resource allocation considerations.[22]

A narrowing of the private returns is recommended, therefore. This is possible with a shift in the finance of university direct costs from the government to the private sector. A 1,000 rupee increase in the annual university student tuition lowers the private return to university education from 27 percent to 23 percent or by only 4 percentage points; a further 1,000 rupee increase lowers the return by only an additional 3 points; and an even further 1,000 rupee increase lowers the return by only an additional 2 points. In fact, a complete shift in the finance of university direct costs to the private sector is possible without altering the ranking of private incentives in favour of university education: a 5,000 rupee increase in the annual university student tuition lowers the private return to university education to 15 percent--which is still the highest return to any educational level.[23] To ensure that a tuition

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[22] Although unsubstantiated in the paper, the assessment that the private demand for higher education presently exceeds the capacity of existing facilities is reasonable.

[23] The cautions reader may prefer a lower tuition increase than 5,000 rupees, however; not only because a large increase is impractical, but also because a safe margin of error should be attached to the university income differentials as these are based on few data observations. In defense of the estimations, though, a careful scrutiny of the university age-income profile in Figure 1 shows it to be very realistic, if not low, in comparison to the National Pay Scale for government employees with a M.A. degree who typically commence work at the Grade 16 level.

increase does not deprive individuals from low income families of a university education, appropriate low-cost educational finance schemes can be established through existing credit institutions.

The fifth policy implication concerns the government policy to universalize primary education. The results of the paper are too limited in scope to substantiate the desirability of this policy. Perhaps no analysis which ignores the consumption benefits of literacy should even attempt to do so. However, if the policy is accepted as given, then it is useful to note that any shift in the finance of university direct costs from the government to the private sector releases funds which can be allocated towards primary education. A quick calculation shows that a 1,000 rupee increase in the annual university student tuition allows an approximate 1 percent increase in national primary school enrollment.[24]

The sixth policy implication concerns the opportunity cost of primary education. The survey data indicates a relatively high opportunity cost to the final three years of primary education: for these years, opportunity cost comprises 97 (78) percent of total private (social) cost. Since the years cover ages 7-9, the cost is frequently de-emphasized: the

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[24] The calculation: (1,000) (13,000) / (246) (5,093,430) = .01 where 13,000 (5,093,430) is national university (Primary) enrollment for 1975 / 12, chap. 22/, and 246 is the annual per student rupee cost of primary education incurred by the government.

labour force entry age is typically assumed at 10, for instance; however, such de-emphasis is misleading. Opportunity cost is both apparent and real, and needs to be recognized if the private incentives in favour of primary education are to be improved. A corollary to this implication is that a further reduction in direct cost will yield a negligible improvement in the private incentives in favour of primary education.

The final policy implication is speculative and concerns the potential benefit of primary curricular reform. A proposal presently debated is the institution of an intensive learning program designed to shorten the primary years of schooling to 4 years or, more ambitiously, to 3 years.[25] If it is assumed that such a program alters the duration of education with no sacrifice in quality, then the effect of a four- (three-) year schooling program is to raise the private return to primary education by 6 (27) percentage points to 20 (41) percent, and to raise the social return by 4 (13) percentage points to 14 (23) percent.[26] It is important to emphasize that these rises are speculative as a static labour market is assumed. Still, these are sufficiently encouraging to recommend a careful analysis of the proposal.

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[25]Such a program has been established in Nepal and is under consideration in other countries. In Pakistan, a principal proponent is Khalid H. Bokhari of the Ministry of Education's Bureau of Educational Planning.

[26]Note that the rises are attributable largely to a reduction in opportunity cost so if direct cost is to increase, which is likely, the rises would still be about the same magnitude.

Appendix Table 1

Educational Expenditure Estimates Per Student By Level

Educational level	Years of Schooling	Expenditure (in Rupees)							
		Total	Private	Government					
				Total	Direct	Annual Amortization	Total	Building	Equipment
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
School:									
Primary	5	276	30	246	145	101	810	660	150
Middle	3	547	40	507	300	207	1,666	250	1,416
High	2	758	48	710	400	310	2,500	500	2,000
College:									
Intermediate	2	2,376	445	1,931	1,000	931	7,500	1,000	6,500
Degree	2	2,910	469	2,441	1,200	1,241	10,000	1,500	8,500
University	2	18,183	769	17,414	5,000	12,414	100,000	15,000	85,000

Source: [1], chap. 4 for column 2, [12], chap. 22 for columns 4, 7, and 8.

Note : Student residence fees are included in column 2 for the college and University levels. Column 5 is column 6 weighted by an amortization factor, $Kr / (K-1)$, where $K = (1+r)^t$, r = a rate of discount, and t = the expected life of building and equipment in years; r is set at 12 percent and t is set at 30.

References

1. Becker, Gary S. Human Capital. New York : Columbia University Press. 1974.

2. Chiswick, Barry R. Income Inequality. New York: Columbia University Press. 1974.

3. Farooqui, Naseem Iqbal and Iqbal Alam. "Provisional Abridged Life Tables for Urban and Rural Areas in Pakistan, Based on PGS 1968 and 1971." Pakistan Development Review. Autumn 1974.

4. Guisinger, Stephen E. and Mohammad Irfan. "Real Wages of Industrial Workers in Pakistan: 1954 to 1970." Pakistan Development Review. Winter 1974.

5. Hanoch, Giora. "An Economic Analysis of Earnings and Schooling." The Journal of Human Resources. Summer 1967.

6. Hoerr, O.D. "Educational Returns and Educational Reform in Ethiopia." Eastern Africa Economic Review. December 1974.

7. Kemal, A.R. "Sectoral Growth Rates and Efficiency of Factor Use: 1959/60 to 1969/70." Pakistan Development Review. (Forthcoming.)

8. Khan, Shahrukh Rafi. "An Estimate of the Shadow Wage Rate in Pakistan." Pakistan Development Review. Winter 1974.

9. Layard, Richard and George Psacharopoulos. "The Screening Hypothesis and the Returns to Education." Journal of Political Economy. September/October 1974.

10. Pakistan. Central Statistical Office. Socio-Economic Survey Rawalpindi 1960. Karachi. 1960.

11. _____. Ministry of Education. Bureau of Educational Planning. Pakistan Education 1974: A Sector Assessment. Islamabad. October 1974.

12. _____. Planning Commission. Draft Fifth Five Year Plan 1976-81. Islamabad. January 1976.

13. Psacharopoulos, George. Returns to Education. San Francisco: Jossey-Bass Inc., Publishers. 1973.