PUBLIC SECTOR EARNINGS FUNCTION AND IMPLICATIONS FOR INVESTMENT IN HUMAN CAPITAL: THE NIGERIAN CASE

JOE U. UMO

I. INTRODUCTION

DESPITE the proliferation of econometric studies of the earnings function as an aspect of human capital research in industrialized countries (ICs),[1] only scant, if any, attention has been paid to it in some less developed countries (LDCs). This is particularly unfortunate because of the heavy investment in human capital currently taking place in these countries. In Nigeria, for instance, educational expenditure between 1974 and 1977 has risen to ten times its post civil war level [26, p. 18]. This, of course, means that some vital sets of information on investment assumption, payoff, and structure are sadly lacking—to the detriment of rational investment and planning decisions in education.

Even in ICs where earnings function studies abound, the focus has been almost exclusively on the private sector while the public sector is ignored despite its growing importance. As Psacharopoulos and Williams have correctly observed, this amounts to "a neglect of a wealth of information...which might be of value for educational and manpower policy" [22, p. 45]. Such a neglect is likely to be particularly harmful to an LDC like Nigeria where the public sector is the most important investor and consumer in the human capital market (as we shall elaborate later). This means that its investment behavior in this market is decisive and hence worthy of formal investigation.

This study therefore is an attempt to use a recent cross sectional data from the Nigerian public sector to test the basic propositions of human capital theory via estimating earnings function and deriving policy implications for investment in higher education. Although the Nigerian public sector is our "test laboratory" we hope that the results would be of interest to human capital theory in general and investment in human capital in the LDCs in particular.

The study is divided into three broad sections. Section II specifies the model, discusses the variables and some specification problems. In Section III the data, estimation methodology, and the results are discussed. The paper concludes in Section IV with a summary of findings and the analysis of policy implications.

This paper is based on Chapter 4 of the author's doctoral dissertation [26]. I have benefited from the initial comments of Professors N. Spulber, Herbert J. Kiesling, Richard Pfister, and William P. Travis all of the Department of Economics, Indiana University, Bloomington, and of Mr. F. A. Olaloku of the University of Lagos, Nigeria. All remaining errors belong to me.

[1] See, for instance, citations in a recent survey of the literature by Blaug [6, pp. 827–55].

II. THE MODEL

A generalized earnings model (GEM) based on the classical least squares assumptions and containing both continuous and dummy regressors will be specified.[2] Let the basic variables be defined as follows:

Y^i = annual untaxed salary of the i th worker.
$SCHD_t{}^i$ = dummies for t levels of schooling of i th worker; $t=1, 2, \ldots, 5$.
$AG_j{}^i$ = age dummies defined for j th age categories; 22–66 years where $j=1, 2, \ldots, 9$.
$FLD_n{}^i$ = field of education defined for categories; $n=1, 2, \ldots, 7$.
$OCC_k{}^i$ = occupational dummies for categories; $k=1, 2, \ldots, 7$.
$JSTAT^i$ = dummy for job status (tenure) with 1 if tenured, 0 if not.
SEX^i = sex dummy; 1 if female and 0 if male.
$QUAL^i$ = quality of education dummy; $QUAL=1$ if with honors degree and 0 otherwise.

We now specify two variants of GEM as:

$$\ln Y^i = a_0 + \sum_{t=1}^{T} a_t SCHD_t{}^i + \sum_{j=1}^{J} b_j AG_j{}^i + \sum_{n=1}^{N} c_n FLD_n{}^i + \sum_{k=1}^{K} d_k OCC_k{}^i + eJSTAT + U_1 . \qquad \text{(GEM 1)}$$

$$t=1, \ldots, T(=5), \quad j=1, \ldots, J(=9), \quad n=1, \ldots, N(=7), \quad k=1, \ldots, K(=7).$$

$$\ln Y^i = \beta_0 + \sum_{j=1}^{J} \beta_j AG_j{}^i + \sum_{k=1}^{K} \sigma_k OCC_k + \delta JSTAT + \chi SEX + \alpha QUAL + U_2 , \qquad \text{(GEM 2)}$$

where the variables under summation signs are vectors as defined previously, and U_1 and U_2 are stochastic error terms of GEM 1 and GEM 2 respectively. The models are assumed to fulfil all the classical ordinary least squares assumptions including zero mean and constant unknown variance.

GEM 1 states that relative earning of the individual is a function of years of schooling, age, field of study, occupation, and job status. GEM 2 on the other hand, makes relative earning a function of age, occupation, job status, sex, and quality of education. The difference between the two specifications is basically

[2] The standard model is expressed as:
GEM; $Y=\beta_0+\sum \beta_1 X_{ij}+U_j$,
where Y is the dependent variable, X independent variable and U_j are error terms. See [23] and [5] for similar specifications.

that schooling variables are dropped from GEM 2 and retained in GEM 1 whereas sex and educational quality variables are added to GEM 2 and dropped from GEM 1. The main reason for this is to create an experimental situation in which all non-human capital variables are estimated (GEM 2) as a basis for drawing comparison between a model with a mixture of human and non-human capital variables (GEM 1). It should however be noted that the above two models are typical of the several variants of GEM which will be implemented. (See Appendix for detailed definition of all the variables.)

A brief description of each variable in theoretical terms is in order.

A. *Description of Variables*

1. *Education*

Education is measured by years of schooling. It is hypothesized that earnings will vary positively with education because of the expected productivity that cognitive learning imparts in school—a fundamental assumption of human capital theory.

An alternative view of the economic role of education is given by the so-called "screening" hypothesis or theory of "credentialism" [21] [1] [25]. According to this view, education (schooling) is a filtering mechanism for selecting job applicants whose academic credentials indicate they have the personality traits that would make them trainable on the job. The conceptual and empirical problems concerning this hypothesis have been noted by many economists.[3] If the credentialist view of education is a plausible one, it is difficult to explain why self-employed people seek education.

In Nigeria, however, the screening phenomenon seems plausible because of the observed emphasis on certificates on the part of both employers and students.[4] Be that as it may, it seems reasonable to view credentialism as complementary to rather than competitive with the human capital theoretic explanation since the ability to be selected will still have a positive effect on earnings.[5]

2. *Age*

In the human capital literature, age is regarded as a depreciation phenomenon. Thus in most empirical work, age is found to be negatively related not only to education but also to earnings. It would appear that the fundamental reason for this association is traceable to the negative impact of biological obsolescence on human productivity.[6] The impact of age on individual learning and earning

[3] See Blaug [6, pp. 845–48] who has given an informative state of the arts survey of this subject.

[4] Apart from the widespread certificate racket from time to time in the country, it is rather rare for high school or university failures or dropouts to get jobs whose remuneration reflects their exact educational attainment (or productivity) at the point they dropped out.

[5] We shall, however, not try to discriminate between human capital and screeming hypothesis in this study.

[6] Developmental psychologists have however shown that such impact is minimal and comes much later in one's life. See the survey of psychological literature by Biren [4, pp.180–81].

is differentially offset by experience, quantum, and vintage of acquired human capital stock.

Human capitalists in general predict a concave age-earnings profile for individuals because of experience and post-school investment considerations [11, pp. 28–29]. We therefore hypothesize that this pattern will hold for Nigeria.

3. *Field of study*

Inter-occupational mobility is a widely observed phenomenon in Nigeria, as indeed in other countries. The introduction of field variables (along with occupational variables to be elaborated later) will not only enable us observe the prospects for such mobility in Nigeria but will make it possible to assess the relative attractiveness of each field of study in economic terms. No a priori prediction can be made at this point in respect of any of the fields which included the humanities, law, the social sciences, science and mathematics, engineering, the health sciences, and accounting.

4. *Occupation*

Human capital theory takes the view that education influences earnings via occupation. Becker draws attention to this by noting that "education has little direct effect on earnings; it operates primarily through the effect on knowledge and skills" [2, p. 162]. Methodologically, he also notes that the use of measures of knowledge like occupation would eliminate the entire effects of education on earnings. Although this would mean over-adjusting for the influence of education on earnings, the contention by Hanoch [9, pp. 31–32] that occupation has elements of non-pecuniary returns and motivations seems equally persuasive. Besides, its inclusion in our context will enable us track the phenomenon of inter-occupational mobility (discussed above) in Nigeria.

5. *Job status*

Presumptive intuition has it that what attracts people into the civil service is the prospect of job security obtained there vis-à-vis the private sector. Although this notion is widely held, no formal empirical confirmation has been sought. In the absence of private sector data which would enable a direct test of this hypothesis, we can do so indirectly by seeking the impact that tenureship has no earnings. We therefore prefer the hypothesis that tenureship has a productivity enhancing effect. This will be upheld in our analysis if the coefficient of *JSTAT* is positively significant.

6. *Sex*

It is here hypothesized that sex-specific earnings differentials do not exist in Nigeria. This is so for several reasons. First, educational qualification is the major requirement for entry into the public service career. Second, the problem of child rearing is mostly taken care of, by extended family arrangements and hence constitutes no impediments for women's participation in the labor force. Thus overt discrimination against women based on educational qualification and

labor market participation common in most Western countries is assumed to be absent in Nigeria.[7]

7. *Quality of education*

Our theoretical expectation is that earnings will vary positively with the quality of education. This arises because of the expected productivity enhancing effect of education.

Unfortunately, it is often not easy to isolate whether this quality is imparted by students' ability or by the teaching effectiveness of institutions. On the rather stringent assumption that the genetic and acquired abilities of all entrants into institutions of higher learning in Nigeria are approximately equal, we attribute quality differences to instructional effectiveness. In the absence of a more suitable measure, this assumption allows us to use the dichotomous degree classification (honors-pass) as a proxy for quality. We therefore expect possession of honors degree to be productivity enhancing.

B. *Some Specification Problems*

Although a generalized earnings function can conceivably include as many variables as possible, it has been common for most specifications to include ability, socioeconomic status (SES), and employment. Since these variables are missing from our specification, it becomes necessary to examine to what extent our estimates may be biased.

The effect of omitted variables on coefficients of any model has been elaborated at length by Theil [24] and his principle will briefly be applied to the case on hand.

Consider two sets of variables in an earnings generating function. Let Z represent a vector of included educational variables and Ω a vector of excluded variables which are positively correlated with educational variables. Now, let the earnings function be specified as:

$$Y=\beta_0+\beta Z+\delta\Omega+U_1, \tag{1}$$

where U_1 is a stochastic error term. If OLS is applied to (1) above when Ω is omitted, we can obtain estimate of β as $\hat{\beta}$ and this satisfies

$$E(\hat{\beta})=\beta+\lambda d, \tag{2}$$

where E is expectation operator and d is the OLS estimate of α in the regression equation:

$$\Omega=\alpha_0+\alpha Z+U_2. \tag{3}$$

Thus if Ω is omitted, our coefficient of Z would be biased estimate of β unless either λ or d is zero. If λ is zero, then the excluded variables do not influence Y and if d is zero, then the excluded variables are not linearly related to Z.

[7] It should be noted that this does not imply that women are not discriminated against in educational market. Some tentative evidence of this is shown by Umo [26, p. 209]. Our generalization should be extended only with some caution to the private sector until this area is studied.

There are reasons for suspecting that either λ or d is zero or very close to being zero by our omission of Ω whose elements are ability, SES, and employment. Each will be briefly discussed in turn.

(1) Ability is purported to be measured by the intelligence quotient (IQ) although it is possible that acquired ability, experiential and other environmental factors can bias this measurement. In spite of these shortcomings, studies that have incorporated ability variable show that it intercorrelates positively with education and earnings, but that the magnitude of such intercorrelation is so small that in general its effects on the estimates are minimal.[8] In this study, one expects that ability would have an insignificant effect partly because our focus is on higher education[9] and partly because of the relative homogeneity in the students' acquired ability caused by a highly selective system of university admissions in Nigeria.[10]

(2) SES has been proxied by variables like parental education, income, occupation, and wealth.[11] Based on some socioeconomic evidences it can safely be assumed that Nigerian students have a homogeneous SES. O'Connell and Beckett [19], for instance, have shown that a substantial proportion of Nigerian students have rural background; and Yesufu [27] has also shown that majority of these students come from families with no formal education and whose incomes per annum are below N1,000.00 (=U.S.$1,500.00).

(3) Employment is often assumed to be the channel through which education affects earnings. This is because highly educated people tend to be more employable and to participate longer in the labor market. Fortunately for our data set, all the subjects had a stable job at the time it was collected (1975). And such stability was virtually guaranteed by shortage of labor both at the intermediate and higher level categories.[12]

From the above considerations it seems fairly reasonable to assume that our omission of Ω from the specification is not likely to bias in any significant sense our estimate of GEM.

III. THE DATA, ESTIMATION, AND RESULTS

A. *The Data*

The basic data used in testing GEM were obtained from a sample of 2,446 civil servants in the Bendel State of Nigeria in 1975.[13] Although the list was compiled

[8] See studies of Becker [2, p. 159], Morgan and David [12], Grilliches and Mason [8].

[9] Becker [2, p. 55] has noted that the influence of ability on higher education is insignificant.

[10] Competition for university admission is very stiff. In 1978/79 session, for instance, only 13,000 out of a total of 131,000 qualified applicants were given admission.

[11] It is not clear which of these variables is an adequate proxy.

[12] In Bendel State of Nigeria where the data were collected, manpower shortage at intermediate and senior levels has been estimated at 2,659, and 8,265 respectively, see [13, p. 27].

[13] See [14]. This list covers people with high school education or equivalent up to the university degree holders or equivalent. The data have been taped and can be obtained from the author on request.

mainly for government record purposes, the set contained all the basic information needed to carry out this type of study. In particular, the following pieces of information were extracted from each observation: annual earnings, educational qualification, age, experience, career status (i.e., whether tenured, or on probation), sex, occupation, field of education, and quality of the degree obtained. Pieces of information on fringe benefits and taxes were collected from government published sources [14, pp. 183–88] [16, p. 27].

Some few comments on the use of civil service data for this study are in order, since some economists seem to be cautious about inferences drawn from public sector activities.[14] First, the public sector is the largest employer of high level manpower in Nigeria [17, p. 29].

Second, for most fields of higher education—law, agriculture, and veterinary medicine, for instance, the government is the sole employer of labor [17, p. 29]. In view of the above considerations, it seems reasonable to expect that the behavior of the public sector in the educational market would be interesting from the point of view of investment and consumption. And lastly, the present compensation structure reflects the recent comprehensive reform of the Nigerian public service and would broadly mirror the structure obtainable in the private sector.[15] This makes it possible to make some generalizations across the public sector as well as provide some tentative insights into the earnings behavior within the private sector.[16]

B. *Estimation and Results*

Twelve variants of GEM were estimated in order to gain deeper insights into the process and structure of earnings generation in the Nigerian public sector. The stepwise regression technique was used with the intention of entering variables in their order of importance as well as excluding those whose F-level of tolerance were insufficient for inclusion in the computation. The dependent variables were also varied as a means of discovering the degree of sensitivity of the parameters to changes in dependent variables which are of interest to this study. More specifically pre-tax annual earnings Y and post-tax net earnings Y^T (including all fringe benefits), were entered in both arithmetic and natural log forms as dependent variables.

For expositional convenience the results of the estimates which are shown in Table I will be interpreted in terms of four sets of experiments. Discussion of each set will touch on relevant methodological issues associated with the estimates.

14 This is so because of the "market failure" inherent in the production and consumption of public goods, as marginal conditions for market equilibrium often tend to break down.

15 It should be noted that the Udoji Public Service Commission whose report was published in 1974 and implemented in 1975 created a productivity-oriented civil service. This is shown not only by the rational principles that guided the determination of wages (see [14, Vol. 4, Chap. 14]) but also by a mass retrenchment (purging) of about 10,000 low productivity workers (deadwoods) from the public sector. See Ola and Olowu [20, pp.299–307] for a short essay on this exercise.

16 Generalizations to the private sector should of course be made with caution, until this sector is studied.

TABLE

OLS ESTIMATES OF THE GENERALIZED

Independent Variables	(*E*1) *Y*	(*E*2) Y^T	(*E*3) ln *Y*	(*E*4) ln Y^T	(*E*5) ln *Y*
YRSCH	2943.97	2121.98	0.2729	0.1817	
	(371.21)	(300.138)	(0.0671)	(0.0337)	
			(1.277)	(1.747)	
$YRSCH^2$	17776.33	−1228.9	−1.0922	−0.909	
	(2869.88)	(2321.42)	(0.5193)	(0.2610)	
			(−0.67)	(−1.14)	
YRSAGE	423.46	313.86	0.04304	0.02832	
	(59.067)	(47.65)	(0.0107)	(0.00537)	
			(0.76)	(1.02)	
AGE^2	−4076.665	−2938.31	−0.2996	−0.2383	
	(722.72)	(583.685)	(0.1305)	(0.0657)	
			(−0.43)	(−0.71)	
QUAL					
*FIELD*1 (Humanities/ law)	17.972†	−15.575†	−0.01286†	−0.00406†	−0.014†
	(132.46)	(106.59)	(0.02384)	(0.01204)	(0.0253)
*FIELD*2 (Social science)	232.1657†	153.74†	0.02596†	0.0146*	0.0629
	(133.43)	(107.368)	(0.02405)	(0.0121)	(0.0249)
					(0.04)
*FIELD*3 (Science & math.)	69.927†	116.2999*	0.0204†	0.01628*	0.02075†
	(119.558)	(96.204)	(0.0215)	(0.01087)	(0.0228)
*FIELD*4 (Engineering, technology & agriculture)	359.0503	332.64	0.0952	0.0456	0.19669
	(144.417)	(116.205)	(0.0259)	(0.0131)	(0.0259)
			(0.05)	(0.05)	(0.112)
*FIELD*5 (Medical, e.g., nursing, doctors)	−671.418	−673.473	−0.1336	−0.0798	0.00653†
	(127.002)	(157.308)	(0.03519)	(0.0115)	(0.03736)
			(−0.08)	(−0.103)	
*FIELD*6 (Accounting)	−553.128	−485.158	−0.1384	−0.0641	−0.07020
	(186.629)	(146.96)	(0.0328)	(0.01661)	(0.0338)
			(−0.06)	(−0.05)	(−0.03)
*OCC*1 (Administration)	619.166	484.74	0.1709	0.06775	0.1760
	(102.179)	(82.74)	(0.0185)	(0.00929)	(0.0192)
			(0.157)	(0.12)	(0.16)
*OCC*2 (Teaching)	−606.527	−468.87	−0.0579	−0.0427	0.01536†
	(146.0409)	(117.82)	(0.0263)	(0.01328)	(0.0268)
			(−0.03)	(−0.05)	
*OCC*3 (Accounting/ statistician)	682.529	607.08	0.22498	0.091105	0.2093
	(145.092)	(117.24)	(0.0262)	(0.01319)	(0.0271)
			(0.11)	(0.098)	(0.11)
*OCC*4 (Law)	1935.166	9610.95	0.3054	0.1652	0.3144
	(196.375)	(158.1010)	(0.0353)	(0.01786)	(0.0364)
			(0.14)		(0.14)
*OCC*5 (Health professions, e.g., nursing)	0.00101†	76.2855†	−0.0433*	0.00103†	−0.07039
	(0.27902)	(133.67)	(0.0299)	(0.27902)	(0.03156)
			(−0.03)		(−0.05)

I

EARNINGS MODEL FOR NIGERIA

(E6) $\ln Y^T$	(E7) Y	(E8) $\ln Y$	(E9) $\ln Y$	(E10) $\ln Y$	(E11) $\ln Y$	(E12) $\ln Y$
	795.82	0.1886	0.1885			0.3225
	(107.50)	(0.0199)	(0.02014)			(0.0187)
	(0.13)	(0.16)	(0.16)			(0.276)
−0.00495†	784.62	0.1648	0.1621			
(0.0127)	(155.17)	(0.0289)	(0.02883)			
	(0.12)	(0.13)	(0.128)			
0.03036	1102.12	0.2301	0.2262			
(0.01254)	(153.93)	(0.0286)	(0.0284)			
(0.03)	(0.13)	(0.14)	(0.138)			
0.01556*	898.58	0.2126	0.2428			
(0.01147)	(113.25)	(0.0257)	(0.02087)			
	(0.14)	(0.17)	(0.195)			
0.0927	1724.02	0.4037	0.4339			
(0.01302)	(152.66)	(0.03008)	(0.02829)			
	(0.19)	(0.23)	(0.247)			
−0.01635*	1211.68	0.2886	0.0774			
(0.0187)	(225.706)	(0.04187)	(0.026)			
	(0.15)	(0.18)	(0.048)			
−0.0342	599.376	0.1406				
(0.017)	(215.59)	(0.04)				
	(0.05)					
0.06993	1622.82	0.3753	0.3937		0.50303	0.3769
(0.00966)	(115.601)	(0.2312)	(0.0213)		(0.02022)	(0.02029)
(0.29)	(0.29)	(0.34)	(0.36)		(0.46)	(0.347)
0.00888†	61.005†	0.099	0.11007		0.2047	0.1244
(0.0135)	(173.86)	(0.0336)	(0.03227)		(0.0322)	(0.03078)
		(0.05)	(0.05)		(0.106)	(0.064)
0.0839	1074.45	0.2989	0.36901		0.2844	0.25024
(0.0136)	(181.63)	(0.0341)	(0.03001)		(0.03163)	(0.03001)
(0.09)	(0.112)	(0.15)	(0.194)		(0.1502)	(0.132)
0.1691	4117.74	0.7478	0.7633		0.7935	0.7018
(0.01828)	(231.959)	(0.0439)	(0.04335)		(0.0374)	(0.0355)
(0.155)	(0.36)	(0.33)	(0.34)		(0.354)	(0.313)
0.01229†	−817.94	−0.236†			0.01594	−0.0253†
(0.0158)	(202.29)	(0.0379)			(0.0244)	(0.02511)
	(−0.117)				(0.011)	(−0.018)

TABLE

Independent Variables	(*E*1) *Y*	(*E*2) Y^T	(*E*3) ln *Y*	(*E*4) ln Y^T	(*E*5) ln *Y*
*OCC*6 (Engineering & technology)	−122.237*	−157.504†	−0.00322†	−0.01629	−0.002821†
	(102.768)	(83.404)	(0.0186)	(0.00934)	(0.0192)
JSTAT (Job tenureship)	899.95	768.677	0.1899	0.09515	0.1837
	(89.687)	(72.31)	(0.0162)	(0.00815)	(0.01666)
			(0.15)	(0.153)	(0.14)
*SCHD*2 (13–15 yrs.)					0.12802
					(0.01739)
					(0.14)
*SCHD*3 (16 yrs.)					0.5108
					(0.0246)
					(0.47)
*SCHD*4 (17–18 yrs.)					0.6733
					(0.0268)
					(0.448)
SCHD5 (19–20+yrs.)					0.9133
					(0.04003)
					(0.31)
*AG*1 (22–26 yrs.)					−0.4629
					(0.1019)
					(−0.2725)
*AG*2 (27–31 yrs.)					−0.4181
					(0.1009)
					(−0.34)
*AG*3 (32–36 yrs.)					−0.3766
					(0.10079)
					(−0.36)
*AG*4 (37–41 yrs.)					−0.2275
					(0.10087)
					(−0.20)
*AG*5 (42–46 yrs.)					−0.1139†
					(0.10124)
					(−0.09)
*AG*6 (47–51 yrs.)					−0.0194†
					(0.1016)
					(−0.0129)
*AG*7 (52–56 yrs.)					−0.0429†
					(0.1036)
					(−0.019)
*AG*8 (57–61 yrs.)					−0.04987†
					(0.1298)
					(0.007)
*EX*1 (0–5 yrs.)					
*EX*2 (6–10 yrs.)					
*EX*3 (11–15 yrs.)					

I (Continued)

(E6) ln Y^T	(E7) Y	(E8) ln Y	(E9) ln Y	(E10) ln Y	(E11) ln Y	(E12) ln Y
−0.01649	0.0042†	0.0264			0.18677	0.1449
(0.0096)	(0.4531)	(0.0243)			(0.020191)	(0.0193)
					(0.1705)	(0.1323)
0.09129	1025.94	0.2273	0.22105			0.1137
(0.00837)	(105.35)	(0.0195)	(0.01971)			(0.02035)
(0.15)	(0.15)	(0.17)	(0.173)			(0.0897)
0.0594						
(0.0087)						
(0.13)						
0.2406						
(0.0123)						
(0.46)						
0.327						
(0.0135)						
(0.447)						
0.4615						
(0.0211)						
(0.32)						
−0.223				−0.7781	−0.545	−0.5325
(−0.0511)				(0.1578)	(0.1343)	(0.1264)
(−0.26)				(−0.458)	(−0.321)	(−0.313)
−0.2149				−0.5711	−0.3915	−0.4456
(0.0507)				(0.1561)	(0.1328)	(0.1253)
(−0.36)				(−0.478)	(−0.327)	(−0.372)
−0.1972				−0.4866	−0.3511	−0.4063
(0.05065)				(0.1557)	(0.1325)	(0.1253)
(−0.38)				(−0.466)	(−0.33)	(−0.389)
−0.1254				−0.3101	−0.2194	−0.2491
(0.05067)				(0.1559)	(0.1325)	(0.1255)
(−0.23)				(−0.2767)	(−0.195)	(−0.222)
−0.06702*				−0.1978*	−0.1459†	−0.1707*
(0.0508)				(0.1563)	(0.1328)	(0.1261)
(−0.10)				(−0.157)	(−0.115)	(−0.135)
−0.02092†				−0.1183†	−0.0789†	−0.086†
(0.0510)				(0.1571)	(0.1334)	(0.1266)
(−0.02)				(−0.078)	(0.047)	(−0.057)
−0.0312†				−0.191†	−0.1143†	−0.1319†
(0.0520)				(0.1601)	(0.1361)	(0.12906)
(−0.023)				(−0.084)	(−0.05)	(−0.0584)
−0.0458†				−0.06351†	−0.09459†	−0.1484†
(0.0652)				(0.2019)	(0.1713)	(0.1614)
(−0.013)				(−0.008)	(−0.013)	(−0.021)
	602.180†	0.168†				
	(737.3)	(0.136)				
	−621.57	−0.1032				
	(1805.4)	(0.3349)				
	993.37†	0.2681†				
	(1041.53)	(0.1933)				

TABLE

Independent Variables	(*E*1) *Y*	(*E*2) Y^T	(*E*3) ln *Y*	(*E*4) ln Y^T	(*E*5) ln *Y*
*EX*4 (16–20 yrs.)					
*EX*5 (21–25 yrs.)					
*EX*6 (26–30 yrs.)					
*EX*7 (31–35 yrs.)					
SEX					
Constant	37057.39	28728.15	8.4214	10.0044	7.9745
	(5930.103)	(4816.609)	(1.077)	(0.5393)	(0.1006)
$\bar{R}^2$	0.613	0.623	0.678	0.653	0.661
SEE	1421.647	1143.919	0.2559	0.1293	0.2623
F	243.44	239.098	304.37	288.94	192.54

Notes: 1. N=2,446.
2. Standard errors in first parentheses, β coefficients in second parentheses.
3. All unmarked coefficients are significant at 1 per cent or less.

Experiment 1: Regressions with Continuous School and Age Variables

The results of the first four equations (*E*1 to *E*4) in Table I make up our first set of experiment. The independent variables which are continuous are schooling and age, the dummy or dichotomous variables entered are fields of studies, occupation, and job status.

We shall focus attention on *E*3 since this was the best equation of the set. That all variables were entered in this equation implies that no variable had an *F* value too low to be left out of computation. The basic findings of this experiment can be summarized as follows:

(1) Education-earnings profile is concave since years of schooling (*YRSCH*) is positively significant and its quadratic term is negatively significant. This confirms the basic human capital theoretical prediction discussed earlier (see Section II).

(2) Similarly, the age-earnings profile is concave for the age coefficient and its quadratic terms are significantly well behaved.

(3) Three of the field-of-education variables, namely, the humanities, social science, and physical science were insignificant, while the other three fields (nursing, engineering, and accounting) were significant with unstable signs. One suspects a possible collinearity of these variables with occupational categories and we reserve any definitive statement on their behavior until further experiments con-

I (Continued)

(*E*6) ln Y^T	(*E*7) Y	(*E*8) ln Y	(*E*9) ln Y	(*E*10) ln Y	(*E*11) ln Y	(*E*12) ln Y
	−1053.12†	−0.386†				
	(1798.11)	(0.3336)				
	755.63†	0.2246†				
	(1039.21)	(0.1928)				
	1102.003†	−0.3074†				
	(1272.07)	(0.2362)				
	−538.13†	−0.2213†				
	(1804.9)	(0.3349)				
						0.02348†
						(0.02114)
						(0.02004)
8.79	1935.17	7.712	7.704	8.5868	8.2534	8.165
(0.0505)	(110.69)	(0.02116)	(0.2026)	(0.1549)	(0.1323)	(0.125)
0.639	0.382	0.45	0.442	0.175	0.408	0.476
0.131	1796.83	0.33337	0.33707	0.4098	0.34717	0.3264
174.65	74	97.9	177.13	65.92	121.43	131.95

* Significant at 5 per cent.
† Insignificant.

trolling for collinearity problems are undertaken.

(4) With the exception of medical and technological categories, all other occupational variables, viz., administration, teaching, research, law, and accounting were statistically significant. The signs of the statistically significant variables were positive except teaching which turned out to be negative—implying that teaching as an occupation tends to depress one's earnings.

(5) Job security or tenure is significantly positive thereby confirming the hypothesis that career tenure tends to be productivity enhancing. The path by which this enhancement takes place has not been investigated in the model but it would appear that tenure does impart a sense of belonging and identification with organizational goals—an area of investigation calling for a multi-disciplinary approach.

(6) It should be noted that the above results were consistent with all variants of the dependent variable. ln Y^T had lower values apparently because of taxation. The $\bar{R}^2$ of the untaxed and taxed dependent variables were about 0.68 and 0.65 respectively.

Experiment 2: Regressions with Dichotomous Variables Only

The results of this experiment are shown in *E*5 and *E*6. Age and schooling were entered as dummy variables in order to allow for possible nonlinearities

in the functions. Such nonlinearity is expected because of the hypothesized concavity in their earnings profile. It is probable for instance that the impact on earnings of t years of schooling, would be different from the impact of t-1 years of schooling at higher educational level. Estimation with dummies would reveal these weights. Age was divided into nine categories (see definition of variables in Appendix) and the nineth category was used as a dummy reference variable.[17] Education on the other hand, was categorized into the following five groups: high school certificate (11–12 years), post-high school professional training like the Nigerian Certificate of Education (NCE) (13–15 years), first degree (16 years), master's degree or equivalent (17–18 years), and the doctorate degree (19–20 years). The 11–12 years category was used as a reference dummy variable.

Again using the stepwise regression procedure, all the variables entered the equations with schooling variables in the lead. Since field and occupational variables continue to exhibit erratic behavior, definitive inferences about them will be postponed for subsequent experiments. The highlights of the remaining variables were then as follows:

(1) Earnings are an increasing function of education as seen by the tendency of the coefficients of schooling (all positively significant) to rise rapidly from lower to higher levels of education. In $E5$, for instance, the increase is from 12.8 per cent for post-high school certificate holders to 91.3 per cent for Ph.D. holders. The same but lower rates hold for $E6$. This result, of course, is what human capital theory predicts and is consistent with the findings of others, e.g., Blaug's [5, pp. 1–31], and Psacharopoulos and Williams' [22, pp. 43–59].

(2) It is well known that an insight into the importance of each independent variable cannot be validly inferred from the size of the regression coefficient since the size is sensitive to measurement units chosen. The traditional approach for evaluating the significance of the regression coefficients is the use of the so-called β coefficient.[18] Using this criterion we can rank the importance of qualifications as follows (coefficient in parenthesis): bachelor's degree (0.47), master's degree (0.45), the Ph.D. (0.31), and post-high school diploma (0.14). This ranking is important not only in terms of expected returns from investing in these categories of degrees but also in terms of income distribution.[19]

(3) All the age variables are negative, the first four being significant and the last four being insignificant. The negative sign is not surprising in view of the

[17] The inclusion of all dummy variables created from any given set of variables, as is well known, would render the normal equation insoluble because of the problem of singularity of the moment matrix. This is so, since the kth dummy variable is completely determined by the first k-1 dummies entered in the regression equation. See elaboration in [10, pp. 72–189]. Thus we had to subtract one variable from each of the summation limits in GEM 1 and GEM 2.

[18] Beta coefficient (β) is a product of the regression coefficient of the jth variable and the ratio of standard deviation of the jth independent variable to the standard deviation of the dependent variable. For elaboration of alternative measures of β coefficients, see [7, pp. 197–99].

[19] See elaboration of rates of return analysis and income distributional implications in [26, pp. 137–66].

theoretical conclusion reached earlier that age is a depreciation phenomenon in human capital. Despite this, a closer examination of the age variables using standardized β coefficients, reveals a saw tooth concave profile that flattens out from ages 47–51. This is basically consistent with the finding in Experiment 1 especially if the trend is smoothed.

Experiment 3: Regressions Excluding Schooling Variables

This set of experiment was an attempt to improve on the degree of othogonality of the variables entered so as to achieve a more consistent pattern of ranking for both fields of study and occupations. This was done by (i) withdrawing the schooling variables in all the relevant equations ($E7$–$E9$) and (ii) removing some occupational variables that were linearly dependent on field variables, viz., nursing and medical variables, occupations, engineering/technology, and accounting.

(1) As was expected some stability in terms of signs and significance of the coefficients emerged (see $E9$ in particular). The field variables then rank as engineering/technology (0.25), mathematics and science (0.19), social sciences (0.14), law and humanities (0.13), health science (0.05). Occupations on the other hand rank as administration (0.36), law (0.34), accounting/statistics (0.19), and teaching (0.05). An examination of equations 7 and 8 exhibits broadly the same trend in ranking although some of the coefficients are not statistically significant to qualify for ranking.

(2) It is clear from the above that one's field of study does not necessarily rank as one's occupation. Thus from the point of view of investment payoff, occupational choice is probably more important than the choice of educational field of specialization. For instance, although humanities and law rank low as fields, the professions like administration and law (respectively) using these skills rank quite high. This observed inconsistency between field of study and the profession has also been confirmed by Blaug's [5], study of Thailand in which he reached the conclusion that "the occupation actually followed has a larger effect on earnings than does the formal preparation for the occupation" [5, p. 21]. We can therefore hypothesize that schooling pays via entry into lucrative occupations in Nigeria.

(3) The quality of education variable was significantly positive, as was expected, the implication being that possession of an honors degree enhances one's earnings. It is possible that part of the reason for this is that the honors degree does not so much reflect productivity as that it enhances one's chance of being "screened" for a higher paying job. This, as was suggested earlier, is one of the problems facing any empirical test of "screening" thesis.

(4) Experience dummies (see $E7$ and $E8$) were consistently insignificant with unstable signs. The coefficients however exhibited a concave saw-tooth profile similar to what was observed for its proxy-age.

(5) With the omission of the schooling variable, there has been a marked drop in the explanatory power of the models (see $\bar{R}^2$ in $E7$ to $E9$). This again indirectly stresses the importance of schooling variables in human capital theory.

Experiment 4: Regressions with Non-schooling Variables in Hierarchical Progression

This experiment was an attempt to test GEM 2 as well as further control for possible multi-collinearity problems. Groups of variables were entered in hierarchical steps starting from the age variables ($E10$), followed by age and occupational variables ($E11$) and ending with all the variables in GEM 2. The results are shown in $E10$ to $E12$.

Apart from shedding some considerable light on the behavior of certain parameters, this set of experiment serves to confirm what had already been found in the previous ones—which is reassuring. More specifically, it has been shown that:

(1) Age variables have exhibited the earlier pattern of rising saw-tooth profile (see $E10$).

(2) Occupational variables in $E11$ rank as administration (0.46), law (0.35), engineering and technology (0.17), accounting and statistics (0.15), teaching/research (0.10), and medical field (0.011). It is disturbing, though not surprising, that the investment payoff to teaching and health occupations fared very poorly as these professions are critical to the developmental welfare of people in the country. While one may explain the poor performance of the health professions in terms of the preponderance of nurses in the sample (whose mean earning was N1,222). It is difficult to infer any bias in the case of teachers' coefficients since most teachers in the sample were either graduates with first degrees or the NCE. This finding is of course consistent with the perenial complaints by these two groups of workers about the inadequacy of their compensation.[20]

(3) Equation $E12$ shows the estimates of GEM 2. All the coefficients have the expected signs and most are statistically significant thereby confirming our theoretical expectations on them (see Section II). Sex was entered for the first time in the model. Although it is correctly signed it is statistically insignificant. The correct sign would suggest that women are not discriminated against in the labor market although its non-significance would caution against a definitive statement about it. More research is obviously needed in this area.

IV. SUMMARY OF FINDINGS AND POLICY IMPLICATIONS

An attempt has been made to specify and test a generalized earnings function for the Nigerian public sector taking into account both human and non-human capital variables available to us. All our experiments have yielded some encouraging results that have implications for manpower policy and higher educational investment planning. These results and some of the associated policy implications are summarized below:

(1) The basic earnings profile with respect to age and education are concave

[20] After the publication of the *Udoji Public Service Commission Report* in January 1975, the groups most aggrieved by their salary awards were teachers, nurses, and doctors. It would appear that efforts to improve their service conditions have not been successful since these complaints are still being heard from time to time.

as predicted by human capital theory. This confirms the robustness of this theory even in an LDC like Nigeria.

(2) Although earnings are increasing monotonic functions of educational levels, the importance of each level of higher education in terms of explaining the variance, decreases in the following order: bachelor's degree, master's degree, the Ph.D., and post-high school professional course. This implies that the payoff to investment in higher education would roughly rank in that pattern. In particular, investment in first degrees is most profitable vis-à-vis higher degrees while investment in non-degree courses are the least profitable.[21]

Although the above would suggest to an individual to invest only in first degrees, this would not follow for society since the non-monetary benefits or positive externalities of investments in all sectors of higher education are quite substantial [26, pp. 130–57].

(3) Age is a depreciating phenomenon in human capital. The reasons for this had already been given (see Section II). The finding however does suggest that efforts be made in the Nigerian higher educational system to minimize the (time) age spent in the process. At present, the average beginning age of the Nigerian university students is twenty-four while that of their counterparts in the United States and Japan are eighteen and seventeen respectively.[22] The reasons for this can be traced to unnecessary duplication of courses in the system, e.g., two years of higher school or general certificate of education (GCE) advanced level, or three years of NCE as direct entry requirements into some degree programs. Not only are the individual and public resources wasted in these duplications and lack of rationalizations, but it does imply a shortened yield period for investments in education. This problem looks even greater when one takes into account the relatively short life expectancy in most LDCs.

(4) Occupational categories in terms of their importance as investment propositions ranked in descending order as administration, law, engineering and technology, accounting and statistics, medical fields, and teaching. The implication is that teaching and health occupations are grossly under-remunerated in Nigeria. There seems to be no economic rationale for instance while the highest grade which a productive graduate teacher can reach is salary level 14 which is worth about N10,000.00 per annum[23] as is now the current practice. There is a clear need for meaningful career incentives to be given to health workers and teachers in the country.

(5) Occupational choices are more important to peoples' lifetime earnings than are fields of studies, especially where mobility between field and occupation is not hampared by stringent trade or professional requirements. There is a clear need to investigate in detail the impact of such mobility on allocative efficiency and utilization of labor both in the public and private sectors. But meanwhile,

[21] This was in fact confirmed by the direct computation of rates of return to these degrees. See [26, pp. 220–24]. It must be emphasized that this inference abstracts from non-pecuniary payoffs to higher education.

[22] See [3].

[23] See salary gradings in "Nigeria Federal Budget 1976/77" [15].

this finding leads us to hypothesize that schooling pays via entry into lucrative occupations. If this interpretation is correct, there is need for career counselling in our higher educational system. However, the matter deserves further research attention.

(6) While casual observation shows that discrimination against women may have been important in higher educational markets via investment choices favoring men, empirical test reveals no systematic discrimination against women in the Nigerian labor market. In view of the possible wastes and underutilization of human resources that such discrimination (if it exists) would imply, there is need to focus research attention on this issue.

(7) Job tenureship is productivity-enhancing and hence should be encouraged. However, its problems in generating static inefficiency should be watched; although evidence from Japanese industries does suggest that the dynamic efficiency benefits of tenureship tends to outweigh its negative impacts on static efficiency.[24]

(8) Quality of education as proxied by the possession of an honors degree enhances ones earnings. It is, however, not clear whether this enhancement is caused by greater productivity (education effects) or caused by the greater chance of being preferred by an employer (certificate effects). If our earlier assumption that instructional effectiveness is what imparts "quality" education on students, then a reasonably strong case can be made for emphasizing teaching effectiveness in Nigerian institutions of higher learning than is presently the case.

(9) The generalized earnings model specified has explained a substantial variance in earnings with the available data—68 per cent. This compares favorably with numerous studies of earnings which have been shown by Blaug [5, p. 18, fn. 12] to vary from 15 per cent to 89 per cent.

Obviously, our findings must be regarded as tentative in what is essentially a pioneer research effort in Nigeria, as in most other LDCs. Other possible shortcomings inherent in the data and methodology discussed earlier also caution against any claim to definitive conclusions from the results. Be this as it may, the results and policy implications of the study should, hopefully, generate further hard thinking and analysis in this direction.

[24] See [26, p. 180] for detailed discussions of this.

REFERENCES

1. ARROW, K. J. "Higher Education as a Filter," *Journal of Public Economy*, Vol. 2, No. 3 (July 1973).
2. BECKER, G. S. *Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education* (New York: National Bureau of Economic Research, 1975).
3. BEREDAY, G. Z. F. "Social Stratification and Education in Industrial Countries," *Comparative Education Review*, Vol. 21, Nos. 2–3 (June–October 1977).
4. BIREN, J. E. "Psychological Aspects of Aging," in *International Encyclopedia of the Social Sciences* (New York: MacMillian, 1968).
5. BLAUG, M. "An Economic Analysis of Personal Earnings in Thailand," *Economic Development and Cultural Change*, Vol. 23, No. 1 (October 1974).

6. ————. "The Empirical Status of Human Capital Theory: A Slightly Jaundiced Survey," *Journal of Economic Literature,* Vol. 14, No. 3 (September 1976).
7. GOLDBERGER, A. S. *Econometric Theory* (New York: John Wiley, 1964).
8. GRILICHES, Z., and MASON, W. M. "Education, Income, and Ability," *Journal of Political Economy,* Vol. 80, No. 3 (May–June 1972).
9. HANOCH, G. "An Economic Analysis of Earnings and Schooling," *Journal of Human Resources,* Vol. 2, No. 3 (Summer 1967).
10. JOHNSTON, J. *Econometric Methods,* 2nd ed. (New York: McGraw-Hill, 1972).
11. MINCER, J. *Schooling, Experience and Earnings* (New York: National Bureau of Economic Research, distributed by Columbia University Press, 1974).
12. MORGAN, J., and DAVID, M. H. "Education and Income," *Quarterly Journal of Economics,* Vol. 77, No. 3 (August 1963).
13. *New Nigerian,* November 14, 1977.
14. Nigeria, Federal Ministry of Information. *Public Service Review Commission* (1972–1974) (Lagos, September 1974).
15. ————. *Recurrent and Capital Estimates of the Government of the Federal Republic of Nigeria 1976/77* (Lagos, 1977).
16. Nigeria. *Income Tax Management, Uniform Taxation Provision Decree, 1975* (Enugu: Government Printer, 1975).
17. Nigeria, Ministry of Economic Development and Reconstruction, National Manpower Board. *University Graduate Employment: A Sample Survey of Employment Experience of Men and Women Graduating in 1972,* Vol. 1 (Lagos, 1973).
18. Nigeria, Ministry of Establishment. *Bendel State Staff List* (Benin City, 1975).
19. O'CONNEL, J., and BECKETT, P. A. "Social Characteristics of an Elite-in-Formation: The Case of the Nigerian University Students," *British Journal of Sociology,* Vo.l 26, No. 3 (September 1975).
20. OLA, R. O.F., and OLOWU, C. A. "Recent Administrative Developments in Nigeria, January 1975–April 1977," *Quarterly Journal of Administration,* Vol. 11, No. 4 (July 1977).
21. PHELPS, E. S. "The Statistical Theory of Racism and Sexism," *American Economic Review,* Vol. 62, No. 4 (September 1972).
22. PSACHAROPOULOS, G., and WILLIAMS, G. "Public Sector Earnings and Educational Planning," *International Labour Review,* Vol. 108, No. 1 (July 1973).
23. ROGERS, A. J. "Professional Incomes and Rates of Returns to Higher Education in Brazil" (Ph.D. diss., Michigan State University, 1969).
24. THEIL, H. *Economic Forecasts and Policy* (Amsterdam: North Holland Publishing Co., 1961).
25. THUROW, L. C. "Measuring the Economic Benefits of Education," in *Higher Education and the Labour Market,* ed. M. S. Gordon (New York: McGraw-Hill, 1974).
26. UMO, J. U. "Economics of Human Capital Production and Investment: The Case of Nigerian Higher Education" (Ph.D. diss., Indiana University, 1978).
27. YESUFU, T. M. "Employment Aspirations and Prospects of Nigerian University Undergraduates and Graduates," *Research Bulletin,* 1/1001 (Lagos: University of Lagos Human Resources Research Unit, 1974).

APPENDIX

DEFINITION OF VARIABLES

(1) Y^i : Annual untaxed salary of the i th worker;
(2) Y^{Ti} : Annual taxed (net earnings) of i th worker; this includes fringe benefits.
(3) $YRSCH^i$: Number of years of schooling of i th worker.
(4) $YRSAGE^i$: Years of age of i th worker.

(5) $QUAL^i$: Quality of education dummy. $QUAL=1$ if honors or higher degree and 0 otherwise.

AG_j^i : Age dummies defined for age categories 22–66 where $j=1, 2, \ldots, 9$; (6)–(14) below.

(6) $AG1$: 22–26 years.
(7) $AG2$: 27–31 years.
(8) $AG3$: 32–36 years.
(9) $AG4$: 37–41 years.
(10) $AG5$: 42–46 years.
(11) $AG6$: 47–51 years.
(12) $AG7$: 52–56 years.
(13) $AG8$: 57–61 years.
(14) $AG9$: 62–66 years.

FLD_n^i : Field of education defined for categories $n=1, 2, \ldots, 7$; (15)–(21) below.

(15) $FIELD1$: Humanities/law.
(16) $FIELD2$: Social sciences.
(17) $FIELD3$: Science and mathematics.
(18) $FIELD4$: Engineering, technology, and agriculture.
(19) $FIELD5$: Medical fields such as the practice of medicine (physicians), nursing, radiography, and so on.
(20) $FIELD6$: Accounting.
(21) $FIELD7$: Others.

OCC_k^i : Occupational dummies defined for categories $k=1, 2, \ldots, 7$; (22)–(28) below.

(22) $OCC1$: Administration.
(23) $OCC2$: Teaching.
(24) $OCC3$: Accounts and statistics.
(25) $OCC4$: Law.
(26) $OCC5$: Health professions like medicine and nursing.
(27) $OCC6$: Engineering and technology.
(28) $OCC7$: Others.

(29) $JSTAT^i$: Dummy for job status (tenure) with 1 if tenured and 0 if not.

$SCHD_t^i$: Dummies for levels of schooling $t=1, 2, \ldots, 5$; (30)–(34) below.

(30) $SCHD1$: 11–12 years of schooling (high school diploma).
(31) $SCHD2$: 13–15 years of schooling (post-secondary professional training lasting 2 to 3 years such as Advanced Teachers Courses, Intermediate Accounting/Secretarial Certificates, and so on).
(32) $SCHD3$: 16 years of schooling (bachelor's degree or equivalent).
(33) $SCHD4$: 17–18 years of education (master's degree or equivalent including one-year post-graduate diploma).
(34) $SCHD5$: 19–20+ years of schooling (Ph.D. or equivalent).

EXP_s^i : Experience on the job dummies where $s=1, \ldots, 8$; (35)–(42) below.

(35) $EX1$: 0–5 years of experience.
(36) $EX2$: 6–10 years of experience.
(37) $EX3$: 11–15 years of experience.
(38) $EX4$: 16–20 years of experience.
(39) $EX5$: 21–25 years of experience.
(40) $EX6$: 26–30 years of experience.
(41) $EX7$: 31–35 years of experience.
(42) $EX8$: 36+ years of experience.
(43) SEX : Sex dummy: 1 if female and 0 if male.