April, 1974

The Labor Market for Agricultural Graduates in India
A Benefit-Cost Case Study of G. B. Pant University of Agriculture and Technology

By

Richard L. Shortlidge, Jr.

Occasional Paper No. 69
Employment & Income Distribution Project
Department of Agricultural Economics
Cornell University
Ithaca, New York

A Joint Research Project With:

G. B. Pant University of Agriculture
and Technology
Pantnagar, Uttar Pradesh, India

Research supported by Contract No. AID/csd-2805
"The Impact of New Technology on Rural Employment and Income Distribution"
Cornell University and the United States Agency for International Development

ACKNOWLEDGMENTS

The author wishes to acknowledge the assistance and advice of professors and friends at Cornell University. To Professor John W. Mellor the author is grateful for the years of intellectual criticism and constant encouragement; to Professor Vladimir L. Stoikov the author wishes to express his gratitude for his insights into the theory of human resource economics and the functioning of the labor market; to Professor Leighton W. Hazlehurst go special thanks for his insistence that economics must consider social and cultural aspects of human behavior in any study of society.

A special acknowledgment to the many people at the G. B. Pant College of Agriculture and Technology who made this study possible. To the Vice Chancellor, D. P. Singh and his staff I wish to express my thanks for their close cooperation in making university records and information available. To Dean N. K. Anant Rao I wish to express gratitude for sharing his insights with me into the employment of graduates from the university. To the Professors in Agricultural Economics at Pantnagar and particularly S. L. Shah, R. D. Singh, and R. C. Agrawal many thanks for your guidance and help in conducting the field research in India. To the graduates at Pantnagar, A. Bhatnagar, T. N. Mishra, K. M. B. Rahim, D. V. Sharma, P. M. Sharma, Pratap Singh, and Sushil Srivastava *bahut dhanyawad*! It was your untiring and patient work that made this research possible.

The financial support under contract No. AID/csd 2805 entitled, "The Impact of New Technology on Rural Employment and Income," of the United States Agency for International Development which made this study possible is gratefully acknowledged, and also the support and help of the Department of Agricultural Economics at Cornell University, who sponsored the study.

This paper is a condensed version of the author's Ph.D. dissertation, "The Employment and Earnings of Agricultural Graduates in India: A Benefit-Cost Case Study of G.B. Pant College of Agriculture and Technology," Cornell University, May 1973. For errors remaining in the paper, the author is singularly responsible.

PREFACE

One of the key problems in rural development is provision of the trained manpower to create and staff the institutions necessary to servicing the farmer's efforts to increase production. The major effort by the Government of India as well as the assistance of various foreign aid donors to develop and expand agricultural universities reflects the importance of this need. As educational institutions expand questions continue to arise as the efficacy of the training which they provide, the nature and productivity of the activities undertaken by their graduates, and hence, as to the level of returns to educational investment. There is also concern as to the extent to which rural people themselves may have access to the higher education necessary to participation in the institutions of rural development.

Richard Shortlidge, very much in the tradition of other elements of our research program, provides a detailed, quantitative analysis, not only of costs and returns to education in an agricultural university in India, but also of the components of the costs and returns and from that, the bases for improved educational policy. His analysis of the employment market for graduates of an agricultural university is particularly important and relevant. In subsequent analyses Shortlidge will deal with other aspects of education in rural development and various aspects of rural education at the pre-university level.

This work is part of a larger effort supported by USAID at Cornell University, dealing with the relation between technological change in agriculture and employment and income distribution. The basic thrust of the research undertaken in this program is positive – based on the assumption that technological change which increases the supply of food grains, the basic wages goods and item of expenditure of the poor, is basically desirable for the poor; and the recognition that many economic and institutional aspects of poverty may reduce the extent to which the poor obtain the innate benefits of increased food production through technological change in agriculture. In diagnosing the policy needs for broadening participation in the increased income from new agricultural technologies it is necessary to consider the direct and indirect effects of increased income – a consideration which has carried our analysis over a broad range of studies of expenditure patterns, labor supply relations, problems of small farmers and, as in this study, various aspects of education – particularly as they relate to the creation of the institutions of rural development and the relationship among participation in education, access to various types of jobs and income distribution.

Access to education becomes, with economic development, one of the most important levers of economic and political power. The series of analyses by Shortlidge, of which this is a part, contribute substantially to our knowledge in these areas, particularly with respect to the rural sector.

This study is another effort in a continuing intellectual interchange and cooperative research effort between researchers at G. B. Pant University of Agriculture and Technology, Pantnagar, Uttar Pradesh and Cornell University. We continue to be grateful for the opportunity for research cooperation which has been provided and particularly for the continuing advice of various members of its faculty. This, as previous studies, reflects their generous contributions.

JOHN W. MELLOR

February 27, 1974
Ithaca, New York

TABLE OF CONTENTS

THE LABOR MARKET FOR AGRICULTURAL GRADUATES IN INDIA: A BENEFIT-COST CASE STUDY OF G. B. PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY

by

Richard L. Shortlidge, Jr.

Introduction

Rapid growth and development occurred during the 1960's in India's system of modern agricultural universities. This study is an evaluation of one of these universities, G. B. Pant University of Agriculture and Technology, from the standpoint of economic efficiency and equity. At the outset, it should be emphasized that economic criteria are only one of several vantage points from which to assess investments of society's resources. Political and social criteria are also valid. The selection of economic criteria in no sense attempts to impart an implicit value judgment with regard to the hierarchical ordering of criteria. The weighting of criteria is a legitimate and correct function of the political process. This study's principle value is an input into this process by providing knowledge of the economic effectiveness of the investment of society's scarce resources which have alternative uses.

The primary orientation of this study is an evaluation of the university's teaching function. Ignored is the university as a research and extension institution. These other two functions are discussed only to the extent they bear directly on the teaching activities of the university. The output from the teaching activities is the individual graduates. Their performance in the labor market sheds light on the effectiveness of the university as a teaching institution. A measure of performance is the net gain in earnings resulting from having obtained an education at the university. Measured against the cost of obtaining that education, it is possible to estimate the rate of return on the investment.

Of interest to public policy is the return on the investment of society's resources. Therefore, the social rate of return is estimated. However, it is useful to understand factors affecting the demand for education. For this reason, the private rate of return is estimated.

Since cost-benefit analysis ignores distributional aspects of an investment, the equity dimension is handled through a descriptive analysis of the socio-economic characteristics of graduates compared to the average college graduate in India. This section of the study discusses briefly various schemes of the university to attract students with both limited financial resources and disadvantaged backgrounds.

The analysis centers on the following five degrees awarded by the university:

1. Bachelor of Science Agriculture
   a. The regular three year program, and
   b. The special two year program for Gramsevaks, Village Level Workers;
2. Bachelor of Veterinary Science (four year degree program);
3. Bachelor of Science Agricultural Engineering and Technology (four year degree program);
4. Master of Science Agriculture (two year degree program); and
5. Master of Veterinary Science (two year degree program).

The Theoretical Model

Given two activities, X and Y, an optimal allocation of resource "i" between X and Y obtains when the marginal social product of "i" in X equals the marginal social product of "i" in Y. In the absence of equilibrium, an optimal allocation of resources can be achieved by the shifting of resource "i" between the two activities until equilibrium is achieved. It is this theorem of economics upon which cost-benefit analysis rests.

There are essentially four ways of viewing the investment of resources in an educational institution. First, rates of return can be compared among the various degrees awarded by the university. Equilibrium obtains if their marginal rates of return are equal. Second, rates of return estimated for one educational institution can be compared with similar degrees awarded by another institution. Third, rates of return for educational investments can be compared across different levels of education, i.e., secondary versus primary education. Fourth, educational investments may be compared with the returns of investments in other areas, i.e., a university versus a steel mill.

This analysis primarily addresses the first two types of questions. First a comparison of the rates of return among the various degrees awarded by the university is made and second the rates of return for the university are compared with various other estimates for college graduates in India.

The Data

Information on the labor market experience of graduates was collected from a mailed questionnaire. As of March 16, 1971, the university had awarded 1,872 degrees (see Table 1). The number of awarded degrees is greater than

Table 1. Degrees Awarded by the University as of March 16, 1971 and Their Representation in the Sample of Respondents to the Employment Questionnaire

Degree Category	Number of Awarded Degrees as of March 16, 1971	Number of Awarded Degrees in the Sample of Respondents	Proportion of Awarded Degrees Represented in the Sample
B. Sc. Ag. a. Village Level Workers	116	64	55.17%
b. Regular Three Year Degree Ag.	686	215	31.34%
B. Vet. Sc.	500	184	36.80%
B. Sc. Ag. Eng. and Tech.	266	93	34.96%
M. Sc. Ag.	208	77	37.02%
M. Vet. Sc.	84	28	33.33%
M. Tech.	5	2	40.00%
Ph.D.	7	3	42.86%
TOTAL	1,872	666	35.58%

the number of individuals receiving degrees, since some individuals have received more than one degree from the university. Taking this into account, the number of individuals receiving degrees from the university was 1,580. Among this group it was necessary to exclude 44 individuals for whom insufficient mailing addresses existed or known to reside outside the area served by India's domestic postal system, reducing the universe of graduates to 1,536.

On April 1, 1971, a questionnaire was sent to these 1,536 individuals eliciting information on employment, gross monthly earnings, dates of employment, and periods of unemployment. As of June 14, 1971, 605 questionnaires had been returned, an overall response rate of 39 percent (see Table 1). These 605 individuals accounted for 666 awarded degrees.[1]

With only two graduates with a Master of Technology and three with Ph.D.'s, these categories were dropped. This resulted in a sample of 661 degrees.

For each of these individuals, information on tuition and fees, financial assistance, hostel payments, and food payments was collected from the official university student accounts. The actual expenditures by the university

[1]The validity of the analysis depends on the representativeness of the sample. In mailed questionnaires, the act of responding lies beyond the control of the investigator. Therefore, it is essential to estimate sample bias. Non-respondents and respondents were compared across a set of six characteristics: (1) having responded to any previous mailed questionnaire from the university, (2) participation in the two year degree for Village Level Workers, (3) having obtained more than one degree from the university, (4) having received financial assistance while a student, (5) being a resident of Uttar Pradesh state, and (6) overall grade point average. Respondents differed significantly from non-respondents for only two of these variables: first, a significantly higher proportion of Village Level Workers responded; and second, a significantly larger proportion of graduates who had received more than one degree responded. Since the final degree is the one of primary interest, these two sources of bias were not judged important. Furthermore, the sample was not unduly weighted with either graduates from the initial or later years. Without reason to assume otherwise, the sample was taken as representative.

for staff salaries and contingencies were judged the major items in the university's annual recurring instructional budget. This information was compiled by year and by college. Data on construction and maintenance cost for each college complex and the administrative wing including library were gathered from the comptroller's records.

The equity analysis is based on a 10 percent sample of students expecting to complete their degree requirements in July 1971. This resulted in a sample of 40 students. This sample also provided the information on book and stationery expenditures.

Estimation of Earnings

A simple regression model is used to explain the observed variation in monthly earnings in rupees, Y_m, by a set of independent variables, X_j:

$$Y_m = f(X_j) \qquad m = 1, 2, \ldots n \quad j = 1, 2, \ldots p \qquad (1)$$

Y_m is the earnings of a graduate in the m-th month since graduation. The set of independent variables comprising X_j are divided into two subsets. The first, X_L, consists of variables whose major impact is assumed to be on the initial earnings of graduates, i.e., earnings in the first job. The second subset, X_R, is composed of variables which affect earnings over time, primarily at junctures such as promotions and job changes. The model postulates a multiplicative rather than additive function.

The first subset, X_L, includes the following variables:

X_1 = Year of graduation;

X_2 = Age at graduation;

X_3 = Overall grade point average; and

X_4 = Initial period of unemployment in months.[2]

The second subset, X_R, includes the following:

X_5 = Number of jobs previously held;

X_6 = Employment in the state of Uttar Pradesh;[3] and

X_7 = Number of months since graduation.

The functional form selected was:

$$Y_m = aX_1^{b_1} X_2^{b_2} \ldots\ldots X_6^{b_6} X_7^{b_7} (\exp(c_1 X_7^{-1})). \qquad (2)$$

This function was selected for the following reasons. First, the function is linear in logs. Therefore, the estimated parameters are unbiased maximum-likelihood estimators. Second, the shape of the function is consistent with empirical evidence on age-earnings profiles. Third, the function's projected life time earnings are consistent and reasonable estimates with what might be expected under Indian conditions. Other functional forms were tested including the omission of the exponential expression ($\exp(c_1 X_7^{-1})$) and the removal of the constraint that X_7 be raised to the power minus one. Both of these were likewise consistent with the assumptions of least-square estimators and gave adjusted R^2's not dissimilar to the model actually used. However, it was felt that their projected earnings were too high and in conflict with empirical evidence regarding the generally observed shape of earnings profiles.

To measure the impact on earnings of the type of firm employing graduates, five dummy variables were introduced into equation 2. Employment category is assumed to influence the slope of the function X_7, months since graduation, rather than the intercept. The five employment categories were:

D_1 = University research, extension, and/or teaching;

D_2 = Government of India corporations, or research institutions;

D_3 = Military service;

D_4 = State government; and

D_5 = Farming and private business (see Table 2)

Incorporating these dummy variables into the model:

$$Y_m = aX_1^{b_1} X_2^{b_2} \ldots\ldots X_7^{(b_8 D_1 + b_9 D_2 + b_{10} D_3 + b_{11} D_4 + b_{12} D_5)} (\exp(c_1 X_7^{-1})). \qquad (3)$$

With only a few graduates in military service, this dummy variable was dropped in the equation's estimation. In addition with an overwhelming majority, 97 percent of the Gramsevaks working in state government, the dummy employment category variables are not relevant.

The regression results are presented in Table 3.

Year of Graduation, Ln X_1, is significant in all but two equations. The two in which it is not significant are (1) the Bachelor of Science Agricultural Engineering and Technology and (2) the Master of Science Agriculture. In both these cases graduates had fewer years in the labor force. The first graduating class from the engineering college was in 1966 and the first M.Sc.Ag.'s in 1965. Being relatively recent entrants into the labor force may explain the lack

[2]The only significant period of unemployment among graduates from Pantnagar occurred during the immediate post-graduation period before the initial job. This is consistent with Blaug's conclusion regarding graduates in India. Mark Blaug, *et al.*, *The Causes of Graduate Unemployment in India*, London: Allan Lane the Penguin Press, 1969, p. 75.

[3]In 1960-1961 among the fourteen states in India, Uttar Pradesh ranked tenth in per capita income. Little change has occurred during the decade in the relative ranking of Uttar Pradesh. Therefore, it is hypothesized that due to a lower standard of living in the state, graduates employed in Uttar Pradesh could anticipate earning less than those employed outside the state. National Council of Applied Economic Research, *Estimates of State Income*, New Delhi: N.C.A.E.R., 1967, Table 5, p. 57.

Table 2. Firms Employing and Positions Held by Graduates from G. B. Pant University of Agriculture and Technology (1963-1971)*

Employment Category	Firms Employing Graduates	Representative Positions Held by Graduates
Non-University Teaching	Intermediate Colleges, Middle Schools, High Schools	Instructor, Teacher, Demonstrator
University Research and Extension	G.B. Pant University of Agriculture and Technology, A.P. Agricultural University, Punjab Agricultural University	Supervisor, Officer, Additional District Agricultural Officer of Extension, Agricultural Officer (Extension), Farm Manager, Agricultural Inspector, Field Supervisor, Research Associate, Assistant Agricultural Engineer, Technical Associate, Block Officer (Pantnagar Farm), Senior Research Associate, Chemist
University Teaching	G.B. Pant University of Agriculture and Technology, other agricultural universities in India	Instructor, Demonstrator, Assistant Professor, Associate Professor, Professor
G.O.I. Corporations	National Seed Corporation of India, Food Corporation of India, Punjab National Bank, Bank of Baroda, Syndicated Bank, United Commerical Bank	Assistant Officer, Inspector, Assistant Superintendent, Manager, Technical Associate, Agricultural Officer, Officer
G.O.I. Research Institution	Indian Veterinary Research Institute, Indian Council of Agricultural Research, Council of Scientific Industrial Research, National Sample Survey, National Council of Applied Economic Research, National Council of Educational Research and Training	Assistant Professor, Research Assistant, Field Investigator, Junior Research Fellow, Junior Technical Associate, Trainee

*This table does not exhaust the names of the firms hiring graduates from the university nor does it give all the different occupations or positions being filled by graduates. The table's purpose is to indicate the types of firms in which graduates work and the type of jobs they perform.

of significance of this variable. For the most part the positive relationship between year of graduation and monthly earnings is a function of increases in Dearness Allowance and Bonuses to counteract inflationary trends in India.

Age at graduation, Ln X_2, is significant only for the Master of Science Agriculture, the older the graduate the higher the starting salary. Therefore, it appears that older post-graduate students in agriculture have an advantage in the labor market.

Overall grade point average, Ln X_3, is significant for graduate Village Level Workers, for Bachelors of Science Agriculture, for Bachelors of Science Agricultural Engineering and Technology, and for Masters of Science Agriculture. These degree categories, with the exception of Village Level Workers, have a large proportion of graduates employed in private business. From an historic examination of their job records, grade point average appears positively and significantly related to employment in private business. Grades are also important for employment in university research, extension, and/or teaching. Since the majority of graduates in research and extension are employed in Pantnagar, grades appear important in the selection and hiring process. For graduates employed in state government, grades are not reflected in significantly higher earnings. The single exception of this generalization is the Village Level Worker. Graduate Village Level Workers with higher grades are more likely to receive rapid

Table 2 – Continued

Employment Category	Firms Employing Graduates	Representative Positions Held by Graduates
Military Service	Indian Army	Officer-in-Charge/Military Farm, Commissioned Officer
State Government	One of the state governments in India, primarily Uttar Pradesh	Inspector, Officer, Research Assistant, Agricultural Extension Officer, Veterinary Assistant Surgeon, Assistant Engineer, Soil Conservation Officer, Mechanical Engineer, Additional District Agricultural Officer (Extension)
Farming	Own farm and non-owned farm	Farm Manager
Private Business	Escorts, Ltd., Indian Potash Ltd., Indian Explosives, Hindustan Lever, Union Carbide (India) Ltd., Warner Hindustan, Tractors and Farm Equipment Ltd., Massey-Ferguson, Duncan Tea Estates, own business	Veterinary Surgeon, Manager, Subject Manner Specialist/Extension, Supervisor, Officer, Inspector, Foreman, Owner, Farm Manager, Farm Representative, Technical Officer, Trainee, Sales Representative, Technical Advisor, Chemist Service Engineer, Apprentice Engineer, Assistant Agricultural Engineer, Junior Engineer, Section Engineer
	Ford Foundation, Rockefeller Foundation	

promotion than those with lower grades, and hence the positive association between earnings and grade point average.

The initial period of unemployment in months, Ln X4, is significant in only two equations. For Village Level Workers, longer periods of unemployment are associated with higher earnings. A few Village Level Workers did not return to their posts in state government service. For them, the severance of ties meant unemployment. In the long run these individuals were able to secure employment at initial salaries higher than those received by their comrades returning to state government service. For the regular three year graduate, the longer the period of initial unemployment the lower initial earnings are. This conforms to expected labor market behavior. The longer an individual remains unemployed, the more likely he is to revise downward his earnings expectations.

Only Bachelors of Veterinary Science have had an unemployment problem which approximated the all-India average of 5.7 months.[4] For veterinary undergraduates the average unemployment period after graduation was 4.6 months in the 1960's. Although experiencing the longest period of unemployment, unemployment has not been associated with a decline in their earnings. Thus, the period of unemployment is essentially one of waiting for ultimate absorption into state government service as jobs become available.

For the other graduates, the average periods of unemployment have been 2.6 months for Bachelors of Science Agriculture, 1.9 months for Bachelors of Science Agricultural Engineering and Technology, 1.6 months for Masters of Science Agriculture, and .6 months for Masters of Veterinary Science. For Village Level Workers the period averaged .2 months. For most graduating classes, the period of initial unemployment has undergone little systematic year to year variation. Only veterinary undergraduates have experienced an increase in this period. With no relationship between unemployment and earnings, this increase has not manifested itself in a significant reduction in starting salaries. Veterinary graduates are simply required to wait longer for their initial job without the need to revise their reservation wage. The problem is potentially more troublesome for agricultural undergraduates given the significant negative association between earnings and unemployment.

[4]Mark Blaug, *et al., op. cit.*, p. 81.

Table 3. Estimation of the Monthly Earnings for Graduates Using the Functional Form of Log-Log-Inverse

Variable Identification	Estimated Regression Coefficients and Standard Errors in Brackets							
	Village Level Workers							
	All Cases	Remains V.L.W.	Immediately Appointed Dist. Ag. Officer	B. Sc. Ag.	B. Vet. Sc.	B. Tech.[1]	M. Sc. Ag.	M. Vet. Sc.
1. Mean of Dependent Variable Ln Monthly Pay in Rupees	5.738083	5.509501	5.990725	5.935632	5.968597	6.057913	6.209065	6.224754
2. Intercept Term	2.823090*** (1.110569)	1.182194 (1.850008)	.727477 (1.479930)	1.625444 (1.757616)	4.109915** (.878972)	4.285915** (1.392188)	1.677253 (1.030667)	6.579068** (2.991524)
3. Ln X_1 = Year of Graduation	.342906*** (.067308)	.393999** (.098621)	.372340** (.086809)	.135862**** (.049684)	.140989** (.070033)	.122928 (.106688)	.058107 (.076502)	.688593**** (.244639)
4. Ln X_2 = Age at Graduation	.249266 (.315492)	.752874 (.520824)	.243416 (.304856)	.402445 (.451215)	.285965 (.222467)	.013814 (.423326)	.801398**** (.304290)	-1.079727 (.830484)
5. Ln X_3 = Overall Grade Point Average	.410892* (.224763)	.463215 (.359048)	.353784* (.213655)	1.141369** (.273157)	.138127 (.177955)	.406403* (.214498)	.683352** (.306595)	.516801 (.701350)
6. Ln X_4 = Initial Period of Unemployment in Months	.035722**** (.013309)	.055664**** (.019679)	-.005599 (.013639)	-.012139** (.005965)	-.002656 (.005493)	-.007631 (.006456)	-.004440 (.005473)	.004669 (.011699)
7. Ln X_5 = Number of Jobs Previously Held	.171321*** (.073189)		-.128060 (.106276)	.027583 (.058851)	.137218** (.058517)	.120196** (.056472)	.063607 (.061075)	-.304277*** (.121969)
8. Ln X_6 = Job Located in U.P. State	-.149331*** (.060661)	-.049531 (.090732)	-.386992** (.069099)	-.179891**** (.060125)	.320475** (.051343)	-.182252** (.052665)	.071323 (.048966)	-.278488**** (.091349)
9. Ln X_7 = Months Since Graduation	.352620** (.047159)	.298556** (.064374)	.829636** (.178032)	.343456** (.051817)	.232484**** (.071572)	.341354** (.071872)	.246401** (.049469)	.473405** (.102037)
10. b_8 Ln X_7 = Employment in University Research, Extension, and Teaching (Shifter for No. 9)				0[2]	-.026424	0[2]	0[2]	0[2]
11. b_9 Ln X_7 = Employment in G.O.I. Corp. or Research Institution (Shifter for No. 9)				-.001292 (.022160)	-.007881 (.024737)	-.016381 (.024185)	.094141** (.020753)	-.053599 (.034327)
12. b_{10} Ln X_7 = Employment in State Gov't (Shifter for No. 9)				.019054 (.024955)	0[2]	-.051241**** (.017745)	-.037303 (.023137)	0[2]
13. b_{11} Ln X_7 = Employment in Farming or Private Business (Shifter for No. 9)				.095416** (.019976)	.012162 (.028605)	-.011793 (.022240)	.204744** (.019303)	0[2]
14. $1/X_7$ = Inverse of Months Since Graduation	1.329502** (.306967)	1.168442**** (.383869)	13.505190** (3.983551)	.981086** (.435547)	.850076 (.940615)	1.270767** (.644145)	.737664*** (.292350)	1.050775*** (.437222)
15. R^2	.661	.516	.585	.541	.414	.446	.754	.547

[1] Graduates with a Bachelor of Science Agricultural Engineering and Technology.

[2] The effect of employment is measured in the regression coefficient for variable Ln X_7, or variable number 9.

Level of Significance: *significant at .100, **significant at .050, ***significant at .020, ****significant at .010, *****significant at .001.

The number of jobs previously held, Ln X_5, is significant in the equation for the Bachelor of Science Agriculture (Village Level Worker), the Bachelor of Veterinary Science, the Bachelor of Science Agricultural Engineering and Technology, and the Master of Veterinary Science. Except for the Master of Veterinary Science, the relationship is positive. This variable measures the impact of both intrafirm and interfirm changes. No distinction between the two is made. The Master of Veterinary Science is somewhat of an anomaly in that the relationship is significant and negative. The precise reason for this is unclear. The answer lies in the shifts in employment occurring over time and particularly the movement of graduates into university teaching, research, and extension. These shifts when they occur often involved a cut in pay. It is conjectured that veterinary graduate students are attempting to maximize long run expected earnings and willing to sacrifice current earnings. The evidence for this comes from the negative coefficient on the dummy variable for employment in Government of India corporations or research institutions.

Location of employment in Uttar Pradesh, Ln X_6, is significant in all cases except the Master of Science Agriculture. As expected the relationship is negative. The results support the hypothesis that graduates earned less in Uttar Pradesh than in other parts of India. For the Master of Science Agriculture, the relationship though insignificant is positive. An agriculture undergraduate, aware of the premium attached to the Master of Science Agriculture and wishing to remain in his home state of Uttar Pradesh, is able to obtain the best of both worlds by seeking an advanced degree in agriculture.

In all equations, the coefficient for "months since graduation," Ln X_7, is significant. On the other hand, the other time variable, the inverse of X_7, is insignificant in the equation for the Bachelor of Veterinary Science. The precise reason for this is not absolutely clear. It may be related to dominance of state government employment. The effect of the inverse term is to decrease the rate at which earnings increase over time. Therefore, the greatest payoff in earnings occurs during the immediate post graduation period. This phenomenon is more likely to be true in areas not dominated by a rigid pay scale in which advancement is more akin to tenure than expertise. This situation is less true of state government employment where promotion is oriented basically to length of service. This may account for the lack of significance for the coefficient to $1/X_7$ in the case of veterinary graduates.

Employment in Government of India corporations or research institutions is significant only for the Master of Science Agriculture. For these graduates, its effect is to increase the slope of the function. Employment in state government is negative and significant for graduates with a Bachelor of Science Agricultural Engineering and Technology. Employment in private business is significant and positive for both Bachelors of Science Agriculture and Masters of Science Agriculture.

Earnings Projections

Based on the equations estimated by OLS the age-earnings profiles for each degree are constructed. These functions are only averages. They indicate what an average graduate can anticipate earning not what he may actually earn. The earnings profiles for the various degrees are given in Tables 4A and 4B.

The following summarizes the major results of the regression projections.

Average Monthly Earnings by Degree Category

	Monthly Earnings in Rupees			
Degree Category	Starting	At the 7th Year	Peak	Lifetime Average
Master of Veterinary Science	335	882	1,888	1,313
Master of Science Agriculture	390	715	1,172	916
Bachelor of Science Agricultural Engineering and Technology	360	612	1,041	800
Bachelor of Science Agriculture	251	529	1,004	743
Bachelor of Veterinary Science	320	483	716	588
Bachelor of Science Agriculture (VLW)	226	419	687	518

The highest average lifetime earnings are for graduates with a Master of Veterinary Science, followed by the Master of Science Agriculture, the Bachelor of Science Agricultural Engineering and Technology, and the Bachelor of Science Agriculture. The lowest are for the Bachelor of Science Agriculture (Village Level Worker) and the Bachelor of Veterinary Science.

For the Bachelor of Science Agriculture, the highest paying positions are in private business or farming. In this category, a graduate can expect to earn over his lifetime Rs. 1,097 per month or 1.7 times the earnings of graduates employed in Government of India Corporations, 1.7 times those employed in university research and extension, and 1.5 times those in state government.

For the Bachelor of Veterinary Science the highest paying positions appear to be in private business or farming, but this conclusion must be tempered since the coefficient was not significant. On the average jobs in private business paid over the lifetime of the graduates 1.2 times the earnings of graduates in university research, extension, and teaching; and 1.1 times the average earnings of graduates engaged in Government of India corporations. The earnings in state government service are only slightly lower. There is a little variation in average lifetime earnings

Table 4A. Annual Earnings (Rupees) of Graduates Computed on the Basis of the Functions Estimated Using Log-Log-Inverse

	Earnings are by Average and by Employment Category for Each Degree Program													
	Village Level Workers			Average Earnings					Employed in University Research, Extension and Teaching					
Year After Grad.	All Cases V.L.W. Rs.	Remarks V.L.W. Rs.	Promoted Dist. Ag. Off. Rs.	B. Sc. Ag. Rs.	B. Vet. Sc. Rs.	B. Tech.* Rs.	M. Sc. Ag. Rs.	M. Vet. Sc. Rs.	B. Sc. Ag. Rs.	B. Vet. Sc. Rs.	B. Tech.* Rs.	M. Sc. Ag. Rs.	M. Vet. Sc. Rs.
1.	2721	2704	797	3016	3843	4231	4682	4024	2899	3691	4386	4331	4151
2.	3186	2949	1634	3879	4289	4808	5775	5702	3622	3391	5131	5046	6007
3.	3699	3331	2407	4571	4732	5495	6589	7019	4218	4348	5931	5624	7460
4.	4109	3634	3133	5119	5071	6040	7215	8091	4687	4620	6568	6064	8652
5.	4455	3888	3825	5582	5348	6497	7731	9016	5080	4843	7104	6423	9684
6.	4759	4109	4492	5986	5584	6894	8176	9839	5423	5032	7573	6729	10605
7.	5031	4304	5139	6348	5791	7348	8568	10588	5728	5197	7991	6998	11446
8.	5278	4481	5770	6677	5976	7569	8921	11277	6005	5344	8371	7239	12223
9.	5505	4643	6387	6981	6144	7863	9243	11920	6260	5477	8720	7457	12948
10.	5717	4793	6992	7263	6298	8135	9541	12524	6496	5598	9045	7657	13631
11.	5915	4932	7587	7528	6440	8389	9817	13094	6717	5711	9348	7843	14277
12.	6102	5063	8172	7777	6572	8628	10075	13637	6925	5815	9633	8015	14893
13.	6278	5186	8749	8014	6696	8853	10319	14155	7122	5913	9903	8176	15481
14.	6446	5303	9317	8239	6813	9067	10549	14651	7308	6004	10160	8330	16046
15.	6606	5414	9879	8453	6924	9270	10768	15128	7486	6091	10405	8475	16589
16.	6760	5520	10435	8659	7029	9465	10977	15587	7656	6173	10638	8613	17113
17.	6907	5621	10984	8857	7128	9651	11176	16031	7820	6251	10863	8744	17620
18.	7049	5718	11528	9047	7224	9830	11367	16461	7977	6326	11079	8869	18111
19.	7186	5812	12066	9231	7315	10001	11551	16877	8128	6397	11287	8989	18588
20.	7318	5902	12600	9408	7403	10168	11727	17282	8274	6465	11488	9105	19052
21.	7446	5989	13129	9580	7488	10328	11898	17676	8416	6531	11682	9216	19503
22.	7570	6073	13654	9747	7569	10484	12063	18059	8552	6594	11870	9323	19943
23.	7690	6154	14174	9909	7648	10634	12222	18433	8685	6655	12053	9426	20373
24.	7807	6233	14691	10067	7724	10780	12377	18798	8814	6714	12230	9526	20792
25.	7921	6310	15204	10220	7797	10922	12527	19155	8940	6771	12403	9623	21202
26.	8032	6385	15713	10370	7869	11060	12673	19504	9062	6826	12571	9717	21605
27.	8140	6457	16219	10516	7938	11195	12815	19846	9182	6880	12735	9809	21998
28.	8246	6528	16722	10658	8005	11326	12953	20181	9298	6932	12895	9898	22384
29.				10798	8071	11454	13088	20509	9412	6982	13051	9984	22763
30.				10934	8135	11579	13220	20831	9523	7031	13204	10068	23135
31.				11067	8197	11702	13348	21147	9631	7079	13355	10150	23500
32.				11198	8257	11821	13474	21458	9738	7126	13500	10230	23859
33.				11326	8316	11938	13596	21764	9842	7172	13643	10309	24212
34.				11452	8374	12055	13716	22064	9944	7216	13785	10385	24560
35.				11575	8431	12165	13834	22360	10044	7259	13921	10460	24902
36.				11696	8486	12276	13949	22651	10142	7302	14056	10533	25239
37.				11815	8540	12384	14062		10239	7343	14188	10605	
38.				11932	8592	12490			10333	7384	14319		
39.				12047					10427				
Avg. Life-Time Earnings	6210	5123	9335	8911	7054	9597	10988	15759	7847	6186	10818	8594	17348
Age at Grad.	32	32	32	21	22	22	23	24	21	22	22	23	24

* Bachelor of Science Agricultural Engineering and Technology.

Table 4B. Annual Earnings (Rupees) of Graduates Computed on the Basis of the Functions Estimated Using Log-Log-Inverse

Earnings are by Averages and by Employment Category for Each Degree Program

Year After Grad.	Graduates Employed in G.O.I. Corporation and Research Institution					Graduates Employed in State Government				Graduates Employed in Farming and Private Business			
	B. Sc. Ag. Rs.	B. Vet. Sc. Rs.	B. Tech.* Rs.	M. Sc. Ag. Rs.	M. Vet. Sc. Rs.	B. Sc. Ag. Rs.	B. Vet. Sc. Rs.	B. Tech.* Rs.	M. Sc. Ag. Rs.	B. Sc. Ag. Rs.	B. Vet. Sc. Rs.	B. Tech.* Rs.	M. Sc. Ag. Rs.
1.	2892	3803	4272	5082	3784	2993	3853	4041	4074	3410	3931	4304	6165
2.	3608	4212	4895	6643	5138	3829	4309	4421	4533	4782	4464	4958	9168
3.	4200	4632	5608	7767	6212	4502	4758	4979	4958	5844	4960	5697	11333
4.	4664	4958	6177	8642	7077	5034	5101	5420	5280	6703	5339	6284	13082
5.	5054	5215	6654	9372	7816	5482	5382	5788	5542	7440	5650	6777	14584
6.	5393	5439	7069	10006	8469	5874	5621	6107	5764	8094	5916	7207	15917
7.	5696	5635	7440	10571	9059	6226	5832	6390	5957	8686	6150	7590	17126
8.	5971	5809	7775	11082	9600	6544	6019	6645	6130	9231	6358	7938	18240
9.	6223	5968	8083	11551	10102	6837	6189	6879	6286	9737	6548	8257	19276
10.	6457	6113	8369	11987	10572	7110	6346	7094	6428	10212	6722	8553	20249
11.	6675	6247	8635	12393	11015	7366	6490	7294	6560	10660	6883	8829	21167
12.	6881	6372	8886	12775	11434	7607	6624	7483	6682	11085	7033	9089	22040
13.	7076	6489	9123	13135	11833	7835	6750	7660	6796	11491	7175	9335	22873
14.	7260	6598	9347	13473	12214	8053	6869	7827	6903	11878	7307	9568	23669
15.	7436	6703	9561	13805	12580	8263	6981	7986	7005	12251	7433	9790	24435
16.	7605	6802	9765	14119	12951	8458	7088	8138	7101	12609	7553	10002	25173
17.	7766	6896	9961	14418	13270	8649	7189	8283	7193	12955	7667	10206	25886
18.	7922	6985	10149	14706	13597	8833	7286	8422	7280	13289	7776	10401	26574
19.	8072	7077	10330	14984	13913	9010	7379	8556	7363	13613	7880	10590	27243
20.	8216	7154	10505	15252	14220	9181	7468	8685	7444	13927	7981	10772	27891
21.	8356	7233	10674	15511	14518	9347	7554	8810	7520	14232	8077	10947	28521
22.	8491	7310	10838	15762	14808	9507	7637	8930	7595	14529	8171	11118	29136
23.	8623	7384	10996	16005	15090	9663	7717	9046	7666	14820	8261	11283	29735
24.	8750	7455	11150	16242	15365	9815	7794	9159	7735	15103	8348	11443	30319
25.	8875	7524	11300	16472	15633	9963	7869	9269	7802	15379	8432	11599	30890
26.	8996	7591	11446	16696	15896	10107	7941	9375	7866	15649	8514	11751	31449
27.	9114	7656	11588	16914	16152	10247	8012	9479	7929	15913	8593	11898	31996
28.	9229	7719	11726	17127	16403	10385	8080	9579	7990	16172	8671	12043	32531
29.	9341	7780	11861	17335	16648	10519	8147	9678	8049	16425	8746	12183	33056
30.	9451	7840	11992	17538	16889	10650	8211	9774	8107	16674	8819	12321	33571
31.	9558	7898	12122	17737	17125	10778	8275	9867	8163	16918	8891	12455	34077
32.	9663	7955	12249	17931	17357	10904	8336	9959	8217	17157	8960	12587	34574
33.	9766	8011	12372	18122	17584	11027	8396	10049	8271	17392	9028	12716	35062
34.	9867	8064	12493	18308	17808	11148	8455	10136	8323	17624	9095	12842	35542
35.	9966	8118	12612	18492	18027	11266	8513	10222	8374	17851	9160	12966	36015
36.	10063	8169	12728	18671	18243	11383	8569	10306	8423	18075	9224	13087	36479
37.	10159	8220	12843	18848		11497	8624	10389	8472	18295	9286	13206	36939
38.	10252	8270	12955			11609	8678	10469		18512	9347	13323	
39.	10343					11720				18726			
Ave. Life-Time Earnings	7793	6623	9909	14202	13010	8698	7114	8226	7975	13162	7288	10155	25729
Age at Grad.	21	22	22	23	24	21	22	22	23	21	22	22	23

*Bachelor of Science Agricultural Engineering and Technology.

among the various employment categories for veterinary undergraduates. The lack of significant variation may be a function of the limited number of observations on jobs other than state government service.

For graduates with a Bachelor of Science Agricultural Engineering and Technology, the highest paying positions are in university research, extension, and/or teaching, where the average lifetime earnings are Rs. 902 per month. This is 1.3 times the earnings of graduates employed in state government, 1.1 times those employed in Government of India corporations or research institutions, and 1.1 times those employed in private business or farming. Only graduates employed in state government service have earnings which are significantly lower than those employed in university research, extension, and/or teaching.

The highest average lifetime monthly earnings for graduates with a Master of Science Agriculture are in private business and/or farming with an average of Rs. 2,144. The lowest earnings are received in state government employment with an average of Rs. 590 per month. Therefore, graduates in private business or farming can expect to earn about 3.6 times the earnings of those in state government. In addition, the earnings of graduates in private business are 3.0 times the average of graduates in university research extension or teaching; 1.8 times the earnings of graduates in Government of India corporations or research institutions.

For the Master of Veterinary Science, the highest monthly average earnings are for graduates employed in university research, extension, and teaching. The average lifetime earnings are Rs. 1,446 per month. Next are graduates employed in Government of India research institutions with an average of Rs. 1,084 per month.

An examination of the earnings of graduate Village Level Workers indicates that failure to achieve promotion in a short period of time results in a substantial reduction in earnings. For example, on the basis of the regression, the Village Level Worker who is not promoted but remains in his original appointment has an average lifetime earnings of Rs. 427 per month. With immediate promotion, the expected lifetime earnings are Rs. 778 per month. This is 1.8 times the average of those without promotion.

Movement of Graduates in the Labor Market (1963-1971)

The majority of jobs held by graduate Village Level Workers (Gramsevaks) have been in state government service. These jobs account for 96.7 percent of the total. The average V.L.W. held 1.9 jobs during 1963 and 1971. Village Level Workers upon graduation generally return to their pre-university positions. There they remain until promoted to posts as district extension administrators, often as District Agricultural Extension Officers (59.3 percent of the jobs after promotion). The V.L.W. waits on the average 19.4 months before being promoted.

The largest proportion of jobs occupied by graduates in the regular three year agricultural undergraduate program has been in university research and extension. This area comprises 37.6 percent of all jobs held. Private business and farming accounted for 18.1 percent, Government of India corporations 13.7 percent, and state government 11.9 percent. During the period 1963 to 1971 the 138 graduates with a Bachelor of Science Agriculture who entered the labor force held 226 jobs, or an average of 1.64 jobs per graduate. Approximately 36 percent of the graduates in agriculture, however, continued their education – the majority at Pantnagar. Positions in university research and extension are most likely to be taken immediately upon graduation. Of the jobs in university research and extension, 62.4 percent have been first jobs. For positions in Government of India corporations and private business, the proportions are 12.9 percent and 41.5 percent, respectively. Of he positions in state government, 70.4 percent have been first jobs. Graduates who secured state government jobs were less likely to shift out of this employment category. For those in university extension and research the average length of employment has been less than two years with graduates shifting to Government of India corporations, private business, or returning for an advanced degree at the university.[5]

Between 1964 and 1971, the sample of 162 graduates in veterinary science who entered the labor force upon graduation held 173 jobs for an average of 1.1 jobs per graduate. The overwhelming majority, 79.8 percent, have been in state government, primarily as veterinary assistant surgeons. Of the veterinary undergraduates only 14.3 percent have elected to continue their education immediately after graduation. Of the jobs held by graduates only 5.2 percent have been in university research and extension, 3.5 percent in private business, and 2.9 percent each in military service and Government of India research institutions. The labor market for veterinary undergraduates has been dominated by jobs in state government and primarily in Uttar Pradesh.

From 1966 to 1971, the sample of 80 graduates with a Bachelor of Science Agricultural Engineering and Technology who entered the labor force immediately after graduation held 169 jobs for an average of 2.1 jobs per graduate. The average engineering graduate has been in the labor force for 28 months. The large number of jobs held makes the technology graduate the most mobile among Pantnagar graduates. Of the jobs held, 35.5 percent have been in state government, 20.1 percent in university research and extension, 18.3 percent in private business,

[5]Graduates seeking an advanced degree are most likely to do so immediately after completion of the bachelor's. Only a small proportion return to the university after entering the labor force. For example, 36.1 percent of the Bachelors of Science continued their education after graduation and only 5.6 percent returned after entering the labor force. For Bachelors of Veterinary Science, the comparable proportions are 14.3 percent and 1.6 percent, respectively; and for Bachelors of Science Agricultural Engineering and Technology 16.7 percent and 6.2 percent, respectively.

and 13.0 percent in university teaching. Short run initial employment has been in university research and extension and private business. Long run employment has been in G.O.I. corporations, state government, and university teaching. For technology graduates, the frequency of job change indicates a fluidity and uncertainty, not true of other graduates, in the labor market.

Of the 89 graduates in the sample of Masters of Science Agriculture, 10 percent continued for their Ph.D. immediately after graduation. An additional five percent returned for the Ph.D. degree after some labor market experience. The 80 graduates entering the labor force, during the period 1965 to 1971, held 119 jobs for 1.5 jobs per graduate. Of these jobs, 45.4 percent have been in university research and extension, 13.5 percent in Government of India corporations, 14.3 percent in private business, 12.6 percent in university teaching, and 9.2 percent in state government. The remainder is scattered between farming and Government of India research institutions. Of the positions in university research and extension, 74.1 percent were first jobs. Likewise, 80 percent of the positions in university teaching were first jobs, and 63.6 percent of the positions in state government. Graduates are more apt to shift into Government of India corporations or private business from university research and extension.

Less than 10 percent of the graduates with a Master of Veterinary Science continued their education. The 31 graduates between 1966 and 1971 entering the labor force held 48 jobs for an average of 1.5 jobs per graduate. Of the 48 jobs held, 33.3 percent have been in Government of India research institutions, 27.1 percent in university teaching, 10.4 percent in state government, 11.5 percent in university research, 8.3 percent in military service, and 4.2 percent in private business and farming. The demand for Masters of Veterinary Science was dominated mainly by positions in university teaching, research, and governmental research institutions.

In a survey of 10 percent of the students expecting to complete their degree requirements by July 1971, respondents were asked to list both their preference for employment and the actual employment of their fathers. In the original research design, student employment preference for first jobs were to be matched. However, only four of the forty students interviewed had accepted or received a job offer by June 1971 the month of the survey, eliminating the possibility of testing the linkage between preference and actual employment.

Do students prefer employment in areas similar to those of their fathers or guardians? To test this relationship, it is hypothesized that there is no difference between the observed pattern of father's employment and the student's preference for employment. The hypothesis is rejected at the .005 level of significance. The source of the largest variation between the observed and expected values occurs in agriculture. Whereas 40 percent of the fathers are engaged in farming, only five percent of the students listed farming as a first preference. This is in contrast to other employment areas such as government service and private business where students are more apt to prefer employment in proportion to that of their fathers.

The decision not to return to the family farm may in fact be rational when the following is taken into account. First, students come from large families with extensive landholdings. The median farm size of families is 30 acres. The average household size is 7.1 persons. In most of these families, there is likely to be a family member who can resume operation of the farm in the event of the father's death. Second, these large farming operations have already probably acquired expertise in the use of new agricultural technologies. A son with a Bachelor of Science Agriculture, etc., adds little to the improved efficiency of the farm. The marginal benefit from having him solely on the family farm is less than if he is employed elsewhere. Therefore, the student and his family maximize their joint welfare through non-farm employment. Third, the student's employment in one of the Government of India corporations or with one of the large private businesses such as Escorts, Indian Explosives, etc., is a source of family prestige and influence. Fourth, although not employed full-time on the farm, the student can still act as a valuable consultant and information source for the family's farm.[6]

Costs

In a cost-benefit-analysis of an educational investment, a distinction is made between private and social costs. Private costs are those incurred on behalf of or by an individual personally. Their incidence may fall on the individual, the family, or some combination. Furthermore, private costs are divided into *direct* and *indirect* costs. Direct costs include tuition, fees, books, transportation, and clothing. Also there may be net increases in the monetary outlay for lodging and food associated with going to school. These are net of those incurred in the next best alternative, for example remaining at home. The principle indirect cost is earnings foregone while in school. Particularly for higher education, the indirect costs are generally the largest component of private costs. Private costs are net of scholarships or other forms of financial assistance.

[6]It should be noted that although the student doesn't return to the farm, he is often employed in a sector of the economy which serves agriculture. The graduates, therefore, man the infrastructure of agriculture in the private and public sectors. Out of a required number of 305,000 agricultural graduates by 1986, it has been estimated that only 50,000 or 16.49 percent will be directly engaged in farming. The remainder will be in supportive roles in extension, research, sales and administration both in the private and public sector. Tyrell Burgess, Richard Layard, and Pitambar Pant, *Manpower and Educational Development in India 1961-1986*, Edinburgh: Oliver and Boyd, 1968, p. 25.

Social costs consist of the total value of resources allocated to the investment priced at their true social valuation. In a perfectly competitive system with an equitable distribution of resources, market prices would measure the real resource costs to society in deploying resources to different activities. Externalities and non-market forces distort factor price relationships. Thus, market prices are as a rule a poor index of the social opportunity cost. Economists, in theory, utilize the concept of "shadow prices" to handle the problem of market imperfections and externalities.[7] Given the practical problems of developing a set of shadow prices, the convention is often to rely on market prices.[8]

A. Private Costs

In 1960-1961 when the university admitted its first students in the Colleges of Agriculture and Veterinary Science, the average annual tuition and fees charged were Rs. 252 and Rs. 264, respectively. For the College of Agricultural Engineering, later the Pant College of Technology, the average student admitted in 1962-1963 was charged Rs. 282 in tuition and fees. For the post graduate degrees of Master of Science Agriculture and Master of Veterinary Science, initiated in 1963-1964 and 1964-1965, the amounts were Rs. 470 and Rs. 576, respectively. By 1969-1970 average annual charged tuition had increased to Rs. 348 for the Bachelor of Science Agriculture, Rs. 266 for Bachelor of Veterinary Science, Rs. 358 for a Bachelor of Science Agricultural Engineering and Technology, Rs. 656 for a Master of Science Agriculture, and Rs. 677 for a Master of Veterinary Science.

Using the "Consumer Price Index for Urban Non-Manual Employees" published monthly by the Reserve Bank of India, real tuition and fee charges declined over the first decade of the university's operation. The increases in tuition and fees which occurred during the 1960's, particularly the substantial increase in 1968-1969, represented an effort to reestablish parity with the fee structure of 1960-1961.

The average tuition and fees charged by degree program and year of enrollment at the university are given in Table 5. These are averages for the 1960's. For example, the average first year tuition and fees charged were Rs. 256 for the Bachelor of Science Agriculture (V.L.W. program), Rs. 279 for the Bachelor of Science Agriculture (Non-V.L.W. program), Rs. 284 for the Bachelor of Veterinary Science, Rs. 273 for the Bachelor of Science Agricultural Engineering and Technology, Rs. 555 for the Master of Science Agriculture, and Rs. 532 for the Master of Veterinary Science.

There are essentially four means to minimize the incidence of tuition and fee charges to students. First, tuition and fee charges in an inflationary situation will tend to decrease in real terms if no upward revision is made. Second, the university may increase the number of individuals receiving financial assistance while holding the amount per recipient constant. Third, the university may increase the amount per recipient while holding the number of students receiving aid constant. Fourth, the above means may be used in combination. The effect of either the second or the third approach would be an increase in the financial assistance per student enrolled. The first means has already been discussed. The second and third are discussed below.

For the post-graduate degrees of Master of Science Agriculture and Master of Veterinary Science, 100 percent of the students received some form of financial assistance. This was also the case for Village Level Workers enrolled in the Bachelor of Science Agriculture program. In 1960-1961, 28.6 percent of the three year Bachelor of Science Agriculture students received some form of financial assistance by the time they graduated. Of the 1960-1961 students in the Bachelor of Veterinary Science program, 25.8 percent received some form of financial assistance during their four years at the university. By the end of the decade financial assistance for these two degree categories increased to 45.5 percent and 53.5, respectively. Similar increases occurred in the Bachelor of Science Agricultural Engineering program. Of the class of engineering students admitted in 1962-1963, 33.9 percent received some form of aid during their four years. For the class admitted in 1966, 47.5 percent secured financial assistance while at the university.

Concurrently with an increase in the proportion of students receiving financial assistance, there was an increase in aid per recipient with the most rapid growth occurring for Bachelors of Science Agriculture. An average student in 1960-1961 received Rs. 30 per year in scholastic assistance. This rose to Rs. 270 in 1969-1970. The average per student financial assistance for the Bachelor of Veterinary Science in 1960-1961 was Rs. 79 per year. This grew to Rs. 249 by 1969-1970. Furthermore, the average amount of financial assistance more than doubled for both the Master of Science Agriculture and the Master of Veterinary Science during the 1960's.

The average amounts of financial assistance per student for the 1960's by year of enrollment and degree are given in Table 5. The average first year Bachelor of Science Agriculture student (non-V.L.W.) received Rs. 126, the Bachelor of Science Agriculture (V.L.W.) Rs. 1223, the

---

[7] Amartya K. Sen, *Choice of Techniques: An Aspect of Theory of Planned Economic Development*, 3rd Edition, New York: Augustus M. Kelly, 1968, pp. XVIII and XIX.

[8] Linear programming provides a procedure for overcoming these practical problems through utilization of the dual. For examples of linear programming methods in educational planning refer to: Samuel Bowles, *Planning Educational Systems for Economic Growth*, Cambridge, Mass.: Harvard University Press, 1969, pp. 82-130 and pp. 156-173; Russell C. Davis, *Planning Human Resource Development: Educational Models and Schemata*, Chicago, Illinois: Rand McNally, 1960, pp. 150-159.

Table 5. Average Annual Private Direct Costs by Degree Program and Year of Enrollment for the 1960's (Amounts in Rupees)[1]

Year Enrolled	Item of cost	Degree Program Enrolled in: B. Sc. Ag. (V.L.W.) Rs.	B. Sc. Ag. (Non-V.L.W.) Rs.	B. Vet. Sc. Rs.	B. Sc. Ag. Eng. & Tech. Rs.	M. Sc. Ag. Rs.	M. Vet. Sc. Rs.
First	Tuition	256	279	284	273	555	532
	Hostel & food	467	481	428	457	914	860
	Books	59	59	63	110	78	131
	Sub-total	782	819	775	840	1547	1523
	Scholarship	-1223	-126	-161	-335	-1253	-1444
	Cost of living at home	- 446	-446	-446	-446	- 446	- 446
	TOTAL Direct cost	- 887	+247	+168	+ 59	- 152	- 367
Second	Tuition	236	238	223	212	578	592
	Hostel & food	601	563	498	485	1376	1098
	Books	51	51	58	113	67	205
	Sub-total	888	852	779	810	2021	1895
	Scholarship	-1223	-155	-174	-341	-1519	-1573
	Cost of living at home	- 457	-457	-457	-457	- 457	- 457
	TOTAL Direct cost	- 792	+240	+148	+ 12	+ 45	- 135

[1]A positive total represents a net outflow of expenditure by the student. A negative total implies the student received in subsidy an amount greater than his expenditure.

Bachelor of Veterinary Science Rs. 161, the Bachelor of Science Agricultural Engineering and Technology Rs. 335, the Master of Science Agriculture Rs. 1253, and the Master of Veterinary Science Rs. 1444.

Average per student expenditures on books and stationery were estimated from the 10 percent random sample of students expecting to finish their degree requirements in July 1971. It was assumed that their expenditures were representative of the decade. The average student in the Bachelor of Science Agriculture program spent Rs. 59 the first year for books. For the other degree programs the averages were Rs. 63 for the Bachelor of Veterinary Science, Rs. 110 for the Bachelor of Science Agricultural Engineering and Technology, Rs. 78 for the Master of Science Agriculture, and Rs. 131 for the Master of Veterinary Science. Furthermore, it was assumed Village Level Workers spent an amount comparable to a regular agricultural undergraduate.

There is little empirical data on average book expenditures at the college level in India. Blaug has estimated that on an average an undergraduate in arts and science spends Rs. 150, an engineering student Rs. 200, and a post-graduate student Rs. 250.[9] If these represent reasonable approximations, it appears that a student at Pantnagar spends less on books than the average college student in India. There are three reasons for believing this may indeed be correct. First, the university has an excellent campus library facility. In 1969-1970, the total book collection was 85,425 volumes.[10] Of the 1,621 students enrolled in

[9]Blaug, *op. cit.*, pp. 197-198.

[10]U.P. Agricultural University, *Academic Plan*, p. 57.

Table 5. Continued

Year Enrolled	Item of cost	Degree Program Enrolled in: B. Sc. Ag. (V.L.W.) Rs.	B. Sc. Ag. (Non-V.L.W.) Rs.	B. Vet. Sc. Rs.	B. Sc. Ag. Eng. & Tech. Rs.	M. Sc. Ag. Rs.	M. Vet. Sc. Rs.
Third	Tuition		254	233	219		
	Hostel & food		645	666	594		
	Books		50	58	110		
	Sub-total		949	957	923		
	Scholar-ship		-154	-180	-351		
	Cost of living at home		-469	-469	-469		
	TOTAL Direct cost		+326	+308	+103		
Fourth	Tuition			246	250		
	Hostel & food			792	797		
	Books			111	89		
	Sub-total			1149	1136		
	Scholarship			-166	-324		
	Cost of living at home			-482	-482		
	TOTAL Direct cost			+501	+330		

the university, 1,305 were members of the library. The average circulation per member during this same year was 20.4 books, indicating an active use of library facilities. Second, the library maintains a stock of prescribed textbooks available to students on a rental basis. An average of 2.6 textbooks per enrolled student was rented during 1969-1970.[11] Third, under a subsidized textbook scheme students have the option of purchasing textbooks from the library at fifty percent of cost.

The average payment for food and hostel in 1960-1961 for both the Bachelor of Science Agriculture and the Bachelor of Veterinary Science was Rs. 389 per year. By 1966-1967, these payments had increased to Rs. 494 and Rs. 417, respectively. Similar increases during this period were noted for other degree programs.

During the period 1960-1961 to 1966-1967 hostel rates remained unchanged. In 1967-1968 and 1968-1969 hostel charges were increased, the largest increases occurring for single room occupancy. However, the largest component of the food and hostel payments was food. A dramatic increase in food and hostel expenditures occurred during 1967-1968 with the adoption of the three-meal cafeteria system. Prior to this change, the majority of the hostels were on a two-meal system in which students dined in a common mess arrangement. Food was cooked and consumed in bulk, thus affording some economies of scale. With the introduction of the three-meal cafeteria system, students were given a greater choice in menu. Greater selection and variety of food available meant a reduction in the economies of scale associated with the old system. For example, the average expenditure on food and hostel for the Bachelor of Science Agriculture was Rs. 494 in 1966-1967, for the Bachelor of Veterinary Science Rs. 417, for the Bachelor of Science Agricultural Engineering and Technology Rs. 509, for the Master of Science Agriculture Rs. 702, and for the Master of Veterinary

[11] *Ibid.*, p. 58.

Science Rs. 751. In 1967-1968 the respective amounts were Rs. 798, Rs. 868, Rs. 810, Rs. 1055, and Rs. 870. Even allowing for price changes, the rise in food and hostel charges represented a substantial increase in cost.[12]

The average expenditures on food and hostel for the 1960's by year enrolled and degree are given in Table 5. The first year average for the Bachelor of Science (Non-V.L.W.) was Rs. 481, for the Bachelor of Science Agriculture (V.L.W.) Rs. 467, for the Bachelor of Veterinary Science Rs. 428, for the Bachelor of Science Agricultural Engineering and Technology Rs. 457, for the Master of Science Agriculture Rs. 914, and for the Master of Veterinary Science Rs. 860.

The only payment for food and hostel which is a relevant educational cost is that over and above the one incurred in the next best alternative, either remaining at home or working. To estimate the *net* expenditure for food and hostel, it was necessary to compute an expenditure which would have been incurred had the student not enrolled at the university. Using *National Sample Survey* data from the 13th, 16th, and 18th Rounds, it was possible to approximate the at home expenditure.[13] The N.S.S. presents information on the per capita monthly expenditure on food by consumer expenditure class for the state of Uttar Pradesh. Based on the family earnings derived from the 10 percent random sample of graduating seniors, it was possible to assign students to an N.S.S. expenditure class. Students fell in the highest expenditure class used by the N.S.S. For each year between those reported in the *National Sample Survey* and the period after 1964, per capita monthly food expenditures were calculated through interpolation and extrapolation of trends in average per capita expenditure and the proportion spent on food. Assuming an average student remained at the university for ten months during the year, the average annual at home food costs were estimated to be Rs. 446 the first year, Rs. 457 the second, Rs. 469 the third, and Rs. 482 the fourth.

Until 1966-1967 there was little discrepancy between the actual student expenditures on food and hostel and the at home approximations. With the introduction of a cafeteria system a marked increase in the cost of living at the university occurred.

[12]The full increase in cost is not due solely to the change from common mess to cafeteria arrangements. The official university accounts record three meals in 1967-1968 whereas previously only two were recorded.

[13]Cabinet Secretariat, Government of India, "Tables with Notes on Consumer Expenditures," *National Sample Survey*, 13th Round Sept. 1957-1958, Delhi: Manager of Publications, 1962; Cabinet Secretariat, Government of India, *National Sample Survey*, 16th Round, July 1960-1962, Delhi: Manager of Publications, 1965; Cabinet Secretariat, Government of India, *National Sample Survey*, 18th Round, February 1963-January 1964, Delhi: Manager of Publications, 1968.

B. Social Costs

The university performs functions in the areas of research, extension and teaching. Although complementarities no doubt exist among these functional areas, it is assumed for simplicity and convenience that they do not. To partition these joint costs to teaching, it was decided to rely on the proportion of the staff's time in teaching and related activities such as paper grading, class preparation, and student counselling as a proxy. Using the *Programme Directory for the Third Trimester 1970-1971*, the proportion of the staff's time in teaching was 29.0 percent for the College of Agriculture, 36.7 percent for the College of Veterinary Science, and 43.3 percent for the College of Technology. With the expansion of both research and extension during the decade, it was assumed (1) in 1960 approximately 80 percent of the staff's time was devoted to teaching and (2) this proportion declined to the levels observed in 1970-1971.[14] These amounts are utilized as weights to allocate the university's recurring and non-recurring expenditure to teaching.

The annual recurring expenditure per student and the annual rent per student for the university's fixed capital investment were computed from official university records made available by the Comptroller. First, the annual expenditures for staff and contingencies were assumed the major items of recurring expenditure. Second, the per student rent on the fixed capital investment was calculated by summing the university's investment in its physical plant for the 1960's, depreciating these using a straightline method over sixty years, and dividing by the number of students enrolled in each period. The average per student capital cost for the 1960's was Rs. 124 in the College of Agriculture, Rs. 112 in the College of Veterinary Science, and Rs. 139 in the Pant College of Technology (see Table 6).

For the recurring budget an annual per student expenditure was calculated for each year in the 1960's. In the university's draft budget for 1970-1971, expenditures and revenue sources were given for the period 1966-1967 to 1970-1971 (estimated). Expenditures were divided among the various colleges and the administration complex. Three main categories of expenditures are employed in determining the annual recurring expenditures: (1) expenditures on officers, (2) expenditures on establishment, and (3) expenditures on contingencies. These categories cover the cost of staff and non-durable materials, the main components of the recurring budget.

[14]A sensitivity test was employed using two additional assumptions regarding the allocation of the budget according to the time devoted to teaching. The additional assumptions were (1) the proportion of the staff's time in teaching remained constant at the 1970-1971 level over the decade and (2) the allocating of the full cost to teaching. The former assumption and those actually used, result in similar estimates of the internal rate of return. Only the use of the latter results in a substantial decrease in the return.

Table 6. Average Annual Depreciation and Recurring Cost Per Student Enrolled from 1960 to 1970 if Only a Portion of the Full Cost of the University's Operation is Awarded to Teaching (Assumption 2)*

Expenditure Item	Per Student Cost in the College of		
	Agriculture	Veterinary Medicine	Technology
Depreciation plus maintenance			
a. College complex	124	112	139
b. Administration complex including library	43	43	43
c. Hostel facilities	220	220	220
Sub-total	387	375	402
Annual recurring expenditures			
a. College expenditures	483	538	1,058
b. Administration expenditures including library	445	445	445
Sub-total	928	983	1,503
Total Cost	Rs. 1,315	Rs. 1,358	Rs. 1,905

*The costs were allocated to teaching by assuming that in 1960–1961 eighty percent of the staff time was devoted to teaching and this proportion declined uniformly to the following levels:

a. College of Agriculture	29.00%
b. College of Veterinary Science	36.70%
c. Pant College of Technology	43.27%
d. Administration, library, and hostel facilities	100.00%

Based on *Programme Directory for the Third Trimester 1970–1971.*

For the costs of the administrative complex including library and hostels, it was decided to allocate them completely as instructional costs. This is justified if one accepts the following reasons as valid. First, in the absence of a proxy such as the proportion of time devoted to teaching, there was no satisfactory means to segregate costs. Second, the administrative and hostel complexes are by in large adjuncts to the university's teaching activities. The estimated fixed capital cost per student for the administrative complex was Rs. 43 and for hostels Rs. 220 over the 1960's.[15]

The annual average recurring expenditure per student for the College of Agriculture was Rs. 483, for the College of Veterinary Science Rs. 538, and for the Pant College of Technology Rs. 1058. For all colleges, the annual average recurring expenditure for the administrative complex was Rs. 445.

The total recurring cost per student for the College of Agriculture was Rs. 928, for the College of Veterinary Science Rs. 983, and for the Pant College of Technology Rs. 1503. The total nonrecurring per student cost for the College of Agriculture was Rs. 387, for the College of Veterinary Science Rs. 375, and for the Pant College of Technology Rs. 402. For all colleges the largest cost component is the recurring expenditure. In addition the most expensive program at the university is the engineering college.

[15]Student hostel charges covered less than half the actual imputed annual rent.

The Education Commission 1964-1966 estimated the per student expenditure in agricultural colleges for 1961-1962 at Rs. 1,136 and for engineering and technology colleges Rs. 1,164.[16] Since the commission's estimates fail to proportion costs, the relevant comparative figures would be the per student costs at Pantnagar without attempting to differentiate among teaching, research, and extension. Therefore, if the full costs of the university's operation are assigned as instructional expenditures, it costs Rs. 1,631 to educate a student in the College of Agriculture, Rs. 1,538 in the College of Veterinary Science, and Rs. 2,582 in the College of Technology. Thus, compared to an all India average the costs at Pantnagar vary from approximately 1.5 to 2.0 times as much.

In a study of Sardar Patel University in 1964-1965, Amin and Pathak calculated per student institutional costs for the faculties of agriculture and engineering. Their estimates include expenditures for educational purposes and a value of current fixed assets. Their computed per student institutional costs are Rs. 824 for agriculture and Rs. 1,334 for engineering.[17]

Based on these two estimates, Pantnagar spends a greater amount per student than an average agricultural or technical college in India. In addition, the comparison with Sardar Patel suggests that the programs in the agricultural university cost considerably more than those in traditional universities.

Between 1967-1968 and 1970-1971 the proportion of the university's revenue obtained from student fees ranged from 5.9 percent in 1967-1968 to a low of 3.8 percent in 1968-1969. The proportion of university revenue coming from student payments is insignificant compared to other sources and has remained fairly constant. On the other hand, growth has occurred in the proportion covered by the university's farming operation which coincides with a decrease in the share derived from both central and the state governments. Approximately 80 percent of the university's income is generated from farm profits with 12 percent coming from governmental sources. By comparison, the average agricultural college in 1961-1962 received 82 percent of its revenue from governmental sources and 11.6 percent from student fees.[18]

C. Foregone Earnings

Ideally, foregone earnings should be obtained from a cohort similar to the one studied controlling for socio-economic and ability characteristics. Normally, such data is absent leaving the researcher with a rough approximation. In this case, it was impossible given the constraints of time and resources to estimate the actual foregone earnings for most of the undergraduates from G.B. Pant University of Agriculture and Technology. The exceptions were the foregone earnings of graduates in the special two year agricultural degree for Village Level Workers, the Master of Science Agriculture, and the Master of Veterinary Science. Fortunately, a sufficient number of V.L.W.'s listed their earnings prior to coming to the University making it possible to compare pre- and post-university earnings. Based on this comparison, it was ascertained that V.L.W.'s after leaving the university and prior to promotions earned salaries at their pre-university grade and scale. Increases in earnings resulted from the promotional opportunities which university training opened to V.L.W.'s. This allowed the estimation of an alternative stream of earnings for the cohort of V.L.W.'s and hence controls for socio-economic and ability characteristics.

For the post-graduate degrees in agriculture and veterinary science, the earnings at the bachelor's level served as a measure of foregone earnings. Since in both the V.L.W.'s and post-graduates' cases, the same or similar cohorts are employed in the computation of foregone earnings, the full differential in earnings may be attributed to their additional investments in education rather than assigning a portion of the increase to differences in socio-economic ability characteristics.

For undergraduates in agriculture, veterinary science, and agricultural engineering, it was necessary to seek a measure of foregone earnings from a secondary source. Since undergraduates at the university are generally admitted at completion of their Intermediate Science program (12 years of schooling in Uttar Pradesh), the appropriate opportunity cost would be the average earnings of intermediates. The only recent source of earnings for intermediates which could be located was for those employed in various factories studied by David Oven in 1966.[19] Since these are firm specific, they are not suitable for a generalized estimation of foregone earnings. For this reason, it was decided to rely on the earnings of matriculates in the *Urban Income Survey 1960* adjusting for the full change in the price level between 1960 and 1970.[20] The Reserve Bank of India's Consumer Price Index for Urban Non-Manual Workers was utilized. This assumes that no real growth or decline has occurred in the earnings of matriculates.

Internal Rate of Return

The efficiency criterion in this analysis is the internal

[16] Ministry of Education and Youth Services, Government of India, *Report of the Education Commission 1964-1966, Supplementary Volume II*, Delhi: Ministry of Publications, 1970, pp. 56-67.

[17] R. K. Amin and Mahesh Pathak, "Costs of Education in Certain Faculties of Sardar Patel University," *Artha-Vikas*, vol. 3, no. 2, July 1967, pp. 23-41.

[18] *Report of the Education Commission 1964-1966*, p. 56.

[19] Blaug, *op. cit.*, pp. 267-269.

[20] *Ibid.*, Table 7.1, p. 171.

rate of return.[21] The internal rate of return is a discount rate equating the present value of an income stream, PV_B, to the present value of a cost stream, PV_C.

$$PV_B = PV_C \qquad (4)$$

Two categories of internal rates of return are calculated – social and private. The primary distinction between the two is that the total resource cost and gross earnings are employed in the social return; whereas for the private, only those costs born by and benefits accuring to the individual are relevant. The social and private internal rates of return must be narrowly interrupted as a monetary return to an investment in education since neither accounts for psychic benefits and costs.

The equation for estimation of the social internal rate of return may be expressed as:

$$O = \sum_{i=1}^{n} \frac{((B_i')(1-A_O) - SC_i) L_O^i}{(1+SR)^i} \qquad i = 1, \ldots n \qquad (5)$$

O = base year

in which:

B_i' = Net differential in gross earnings in the i-th year resulting from additional schooling,

A_O = Effect of nonschool factors such as ability and socio-economic background expressed as a proportion,

SC_i = Total resource cost incurred in the i-th year,

L_O^i = The probability of living from the base year of the investment, O, to the i-th year and,

SR = The social internal rate of return.

The private internal rate of return is expressed as:

$$O = \sum_{i=1}^{n} \frac{((1-\Delta T_i)(B_i')(1-A_O) - PC_i) L_O^i}{(1+PR)^i} \qquad i = 1, \ldots n \qquad (6)$$

O = base year

in which:

ΔT_i = Marginal tax rate applicable to the net earnings differential, B_i',

PC_i = Total cost incurred by the individual in making the educational investment, and

PR = The private internal rate of return.

The source of the mortality adjustment, L_O^i, was the life survivorship table for India in the UNO's *Demographic Yearbook 1966*. This table resembled the model life table of the UNO's *Age and Sex Patterns of Mortality: Model Life Tables for Underdeveloped Countries*, for a population with a life expectancy of 40 years. This over-estimates the incidence of age specific mortality for Pantnagar graduates for two reasons. First, if mortality is inversely related to income and given that college students in India come from higher income classes, lower class specific mortality than the all-India average would be expected. Second, the UNO's estimated life expectancy in South Asia (including Nepal, India, Pakistan, and Bangladesh) for the period 1965-1970 was 48 years. Therefore, the *Demographic Yearbook's* 1966 estimate based on 1961 and 1951 census data fails to account for more recent changes in life expectancy.[22]

The ability factor, A_O, was assumed to be .40. Forty percent of the observed differential in earnings was related to non-school characteristics and 60 percent to schooling characteristics. The use of this adjustment factor, although arbitrary, conforms to Blaug's use of .35 and .50 as well as Gounden's .50.[23]

No adjustment for non-school factors was made for (1) Village Level Workers and (2) the post-graduate degrees of Master of Science Agriculture and Master of Veterinary Science over their respective bachelor's degrees.

The convention is to treat net earnings as a measure of the private benefit and gross earnings as the social benefit. Since investment in additional schooling involves a marginal gain in earnings, the increment in earnings should be taxed at the appropriate marginal tax rate to determine the private benefit. However, lack of marginal tax tables for India necessitated the use of average tax rates.[24]

---

[21] "Internal rates of return are widely used in human capital calculations, but net present values are generally preferable to internal rates of return for making investment decisions. Assets cannot be compared using internal rates of return unless they happen to have exactly the same length of life. What is better – an asset which has an internal rate of return of 10 percent for 10 years or an asset which has an internal rate of return of five percent for 30 years? The rate of return is higher for the first project, but the total return is higher for the second project. The answer to the question obviously depends on what alternative uses could be found for the funds in the last 20 years of the 30 year period." Lester Thurow, *Investment in Human Capital*, Belmont, California: Wadsworth Publishing Co., 1970, p. 26. The investments studied in this paper, by in large, cover the same time period. The exception is the V.L.W. program. Since the majority of studies use the internal rate of return, it is employed here for purposes of comparison.

[22] Increasing the life expectancy from 40 to 48 years has little effect on the computed rates of return. The effect of an increase in life expectancy alters the probability of living an additional 20 or more years more significantly than 20 years or less. The most relevant period for the computation of the internal rate of return is the first ten to fifteen years of the investment period.

[23] Mark Blaug, *et al.*, *op. cit.*; and A. M. Nalla Gounden, "Investment in Education in India," *Journal of Human Resources*, vol. II, no. 3, Summer 1967, pp. 347-358.

[24] "Classification of the Tax Payable by Assessee's for the Year Ended the 31st March 1967, According to Ranges of Total Income Assessed and Class of Assessees, All India (New Series)," Central Statistical Organization, Department of Statistics, Cabinet Secretariat, Government of India, *Statistical Abstract of India 1969*, New Delhi, 1970, Table 182, pp. 541-542.

A. Social Rates of Return

The estimated social internal rates of return are presented in Table 7.

For the graduate Village Level Worker, two relevant pairs of social rates of return are computed. The first one assumes no delay in promotion.[25] This rate of return is compared with the return of the regular Bachelor of Science Agriculture employed in state government. The second one assumes that the real measure of the social benefit from investments in Village Level Workers is the earnings of regular three year agriculture graduates. The support for the latter assumption is threefold: first, the similarity in university training programs; second, the significantly higher grade point average for Village Level Workers while at the university,[26] and; third, the experience of three percent of the Village Level Workers who elected not to return to their posts in state government.

In the first case, the average social internal rate of return for the Village Level Worker is 8.3 percent compared to 9.9 percent for the regular agricultural undergraduate employed in state government service. In the second case, the social rate of return to the Village Level Worker is 13.5

[25]Village Level Workers realized the benefits of university training through promotion. Therefore, a long delay between graduation and promotion results in a net loss in social benefit measured by earned income. The average promotional delay during the 1960's was 19.4 months. During this period the benefit to society from university trained Village Level Workers is not reflected in the earnings profile. For this reason, the earnings profile is computed assuming no promotional delay.

[26]The V.L.W.'s average overall grade point average was 3.7525 out of a possible 5.000 compared with an average of 3.4826 for the regular agricultural undergraduate. Their difference was significant at a level of .001.

Table 7. Social Rates of Return for Graduates from G. B. Pant University of Agriculture and Technology by Degree Category and Area of Employment

Degree Category	Average Earnings	Earnings Profile of Graduates Employed in: University Research, Extension, and/or Teaching	G.O.I. Corporation or Research Institution	State Government	Farming and Private Business
1. Graduate Village Level Workers					
a. With Average Delay in Promotion	2.7%				
b. No Delay in Promotion	8.3%				
c. Using Profile of B. Sc. Ag.	13.5%				
2. Over Matriculation*					
a. B. Sc. Ag.	10.3%	8.0%	7.9%	9.9%	16.8%
b. B. Vet. Sc.	4.5%	1.8%	3.9%	4.7%	5.8%
c. B. Sc. Ag. Eng. & Tech.	8.2%	10.2%	8.9%	6.1%	9.3%
d. M. Sc. Ag.	7.5%	4.1%	11.1%	0.9%	17.7%
e. M. Vet. Sc.	8.9%	9.1%	7.0%	0.0[3]	0.0[3]
3. Over Average Earnings Respective Bachelor's Degree					
a. M. Sc. Ag.	6.2%	0.0[1]	16.6%	0.0[1]	34.3%
b. M. Vet. Sc.	17.8%	20.1%	13.3%	0.0[3]	0.0[3]
4. Over Earnings of Bachelor Degree Holders Employed in Same Category					
a. M. Sc. Ag.		0.0[2]	20.0%	0.0[1]	25.3%
b. M. Vet. Sc.		22.4%	13.9%	0.0[3]	0.0[3]

[1]Earnings profile was lower than respective profile at the Bachelor's level.

[2]Estimated return was less than minus 10 percent.

[3]Too few observations to calculate the earnings profile.

**Urban Income Survey 1960*

percent compared to an average of 10.3 percent for regular agriculture undergraduates.

Given the similarity in training experiences, the higher academic performance of V.L.W.'s, and the ability of a few V.L.W.'s to compete effectively in the same employment market, it is possible to claim that the program is more efficient than the regular three year degree. If correct, this is attributable to the reduction in the training program of one year. The conclusion of this analysis is that the program is at least as efficient as the regular undergraduate program. The performance of V.L.W.'s suggests, furthermore, the presence of complementarities between work experience and learning. In addition, academic performance does not appear impaired by the admission of individuals who on the average are ten years older than the average undergraduate.

A comparison of social rates of return contained in Table 7 reveals that the Bachelor of Science Agriculture is the most profitable degree with a return of 10.3 percent. The least is the Bachelor of Veterinary Science with a return of 4.5 percent.

The high social rates of return to both the Bachelor of Science Agriculture and the Master of Science Agriculture are a function of the proportion of graduates employed in private business. The return to the Bachelor of Science Agriculture graduate in private business is 16.8 percent. For the Master of Science Agriculture, the comparable return is 17.7 percent.

Low social rates of return are associated with employment in state government. State government employment dominated in the case of the Bachelor of Veterinary Science.

Compared to the undergraduate degree in veterinary science, the Master of Veterinary Science is a more efficient investment. The high social return is a function of the employment of Masters of Veterinary Science in university research, extension, and/or teaching. However, the expansion of employment in these areas is limited and inelastic. The potential for improvement in the employment market for veterinary graduates rests in the growth and expansion in private sector demand.

B. Private Rates of Return

Private rates of return are presented in Table 8. The pattern observed for the social rates of return is repeated here. The degrees with the highest private rates of return are those with a large proportion of graduates employed in the private sector or in Government of India corporations.

The private rate of return is 12.1 percent for graduate Village Level Workers and compares favorably with the 14.0 percent for Bachelor of Science Agricultural Engineering and Technology and the 8.8 percent for Bachelor of Veterinary Science.

For the Bachelor of Science Agriculture, the return is 16.2 percent and is related to the proportion of graduates finding employment in private business. The return for agricultural graduates in private business is 24.8 percent. On the other hand, the return is 15.7 percent in state government (note similarity with V.L.W.'s), 13.2 percent in university research, extension, and/or teaching, and 13.1 percent in Government of India corporations or research institutions.

There is an interesting and marked contrast between the experience of the Bachelor of Science Agriculture and the Master of Science Agriculture *vis-a-vis* employment in G.O.I. corporations or research institutions and state government. Whereas the return to undergraduates in agriculture is only 13.1 percent in Government of India corporations or research institutions the return to post-graduates is 16.4 percent over matriculation; and 23.4 percent over the average earnings of agricultural undergraduates. On the other hand, the private returns to undergraduates in state government is 15.7 percent whereas it is only 4.5 percent for Masters of Science Agriculture. In fact the earnings profiles are for all practical purposes identical (see Table 4A and 4B). No gain in earnings over undergraduates can be anticipated by post-graduates finding employment in state government.

Comparison With Other Studies

Using the average earnings for Bachelors of Arts, Bachelors of Science, and Bachelors of Commerce derived from the *Urban Income Survey 1960*, Blaug and his colleagues at the London School of Economics estimated the average private rate of return over matriculation to be 8.7 percent.[27] The returns to Pantnagar graduates are significantly greater than this. The average private rates of return are 13.3 percent for Village Level Workers, 16.2 percent for Bachelors of Science Agriculture, and 14.0 percent for Bachelors of Science Agricultural Engineering and Technology. Only in the case of Bachelors of Veterinary Science is the Blaug estimate approximated.

Comparing the private rates of return for graduates employed in different industry groups, Blaug obtained a return of 7.5 percent in the fertilizer industry for Bachelor of Arts, Bachelor of Science, and Bachelor of Commerce over matriculates. The private return was 5.9 percent in the electrical factory, 7.5 percent in the machine tool factory, and 8.9 percent in the consumer goods factory.

On the other hand, there is an increase in the returns to Pantnagar graduates employed in private business. This indicates that employers differentiate among graduates. It may be hypothesized that to attract ordinary arts and science graduates, employers need not pay a premium in the form of higher wages. However, private industry is willing to pay Pantnagar graduates substantially higher earnings. It is concluded that private industry in India differentiates among the type and quality of degrees.

Using *Urban Income Survey* data, Blaug computed a

[27] Blaug, *et al.*, *op. cit.*, pp. 218-219 and 223-224.

Table 8. Private Rates of Return for Graduates from G. B. Pant University of Agriculture and Technology by Degree Category and Area of Employment

Degree Category	Average Earnings	Earnings Profile of Graduates Employed in: University Research, Extension, and/or Teaching	G.O.I. Corporation or Research Institution	State Government	Farming and Private Business
1. Graduate Village Level Workers					
a. With Average Delay in Promotion	12.1%				
b. No Delay in Promotion	13.3%				
2. Over Matriculation*					
a. B. Sc. Ag.	16.2%	13.2%	13.1%	15.7%	24.8%
b. B. Vet. Sc.	8.8%	5.4%	8.0%	9.0%	10.5%
c. B. Sc. Ag. Eng. & Tech.	14.0%	16.2%	14.7%	11.1%	15.1%
d. M. Sc. Ag.	12.5%	8.4%	16.4%	4.5%	24.6%
e. M. Vet. Sc.	13.1%	14.2%	10.7%	0.0[3]	0.0[3]
3. Over Average Earnings Respective Bachelor's Degree					
a. M. Sc. Ag.	11.3%	0.0[1]	23.4%	0.0[1]	46.0%
b. M. Vet. Sc.	22.5%	25.4%	16.9%	0.0[3]	0.0[3]
4. Over Earnings of Bachelor Degree Holders Employed in Same Category					
a. M. Sc. Ag.		0.0[2]	28.7%	0.0[1]	31.6%
b. M. Vet. Sc.		29.1%	17.8%	0.0[3]	0.0[3]

[1]Earnings profile was lower than respective profile at the Bachelor's level.

[2]Estimated return was less than minus 10 percent.

[3]Too few observations to calculate the earnings profile.

**Urban Income Survey 1960*

private rate of return of 13.5 percent for an average engineering graduate over matriculation. In the fertilizer industry the return was 11.4 percent, in the electrical factory 12.9 percent, and in the machine tools factory 11.2 percent. The average engineering graduate from Pantnagar has a private rate of return of 14.0 percent with the highest return of 16.2 percent in university research, extension, and/or teaching. The Blaug estimates excluded graduates from the Indian Institutes of Technology. This suggests that, by and large, Pantnagar engineering graduates earned a return on their investment comparable to the all-India average, but probably lower than the one for graduates from the Indian Institutes of Technology.

Blaug estimated the social rate of return for the three classes of undergraduate degrees (B.A., B.Sc., and B. Com.) as 7.4 percent using the *Urban Income Survey*, 6.8 percent in the fertilizer factory, 5.2 percent in the heavy electrical goods factory, 7.0 percent in the machine tools factory, and 8.7 percent in the consumer products factory. Among Pantnagar undergraduates, higher social rates of return are obtained for the Bachelor of Science Agriculture, the Village Level Worker graduate, and the Bachelor of Science Agricultural Engineering and Technology.

Using the earnings of engineers from the *Urban Income Survey 1960*, Blaug estimated an average social rate of return of 10.8 percent. This contrasts with the Pantnagar average of 8.2 percent. The lower social return at Pantnagar for engineering undergraduates is a function of higher costs.

Blaug computed a social rate of return of 15.1 percent for the Master of Science over the Bachelor of Science in the fertilizer industry and 7.1 percent for the Master of Arts and Master of Science over the Bachelor of Arts employed in the heavy electrical goods industry. The Pantnagar social rates of return are 6.2 percent for Master of Science Agriculture over Bachelor of Science Agricul-

ture and 17.8 percent for Master of Veterinary Science over Bachelor of Veterinary Science.

Samuel Paul in a study of graduates from the two year diploma course offered by the Indian Institute of Management at Ahmedabad estimated a social rate of return of 27.5 percent assuming the effective period for benefits is thirty years and 26.0 percent if fourteen years.[28] The Ahmedabad diploma in management education is post-bachelor training and comparable to a masters. The social returns for Pantnagar graduates are 6.2 percent for Master of Science Agriculture and 17.8 percent for the Master of Veterinary Science. This indicates a lower return on post-graduate education at Pantnagar than at the Indian Institute of Management at Ahmedabad. However, Ahmedabad graduates are employed primarily in large corporations both in the private and public sectors. If the comparison is restricted to the Master of Science Agriculture graduates employed in private business and Government of India corporations, the social rates of return are 34.3 percent and 16.6 percent, respectively. Therefore, the lower average return to the Master of Science Agriculture is related to the proportion of graduates who are employed in state government and university research, extension, and/or teaching.

Equity

From the 10 percent random sample of Pantnagar seniors expected to complete their degree requirements in July 1971, parental average monthly earnings were estimated at Rs. 823. Only four percent of the urban households and 0.9 percent of the rural households in India earned more than Rs. 500. The vast majority, 80.3 percent of the urban and 90.6 percent of the rural, earned less than Rs. 200 per month.[29] Among students interviewed at Pantnagar in June 1971, 40 percent came from farming families with a median farm size of 30 acres. This compares with an all-Indian average of roughly 5 acres.[30] Therefore, it is concluded that the average student at Pantnagar comes from the upper one percent of rural households and the upper five percent of urban households.

Radhudkar's study of Village Level Workers estimates that the majority come from families owning between 10 and 15 acres of land.[31] Approximately 10 percent of the landholders in India own more than 10 acres.[32]

The Village Level Worker program draws individuals to the university from a lower socio-economic stratum than the one from which regular students come. Although Village Level Workers by no means represent the lowest rural income class, their inclusion in the university's agricultural program is an important step in expanding the base of participation in quality higher education in India.

The Education Commission 1964-1966 presented information on the family backgrounds of students in medical, technical, and agricultural colleges.[33] The commission found that 58 percent of the students at agricultural colleges come from agricultural families, 27 percent from central and state government families, and 12 percent from professional and private business families. For Pantnagar students, the comparable proportions are 40 percent from agricultural families, 37 percent from central and state government families, and 23 percent from professional and private business families. In contrast to the average agricultural college, Pantnagar has a higher representation of students from families of central and state government employees, the private business, and professionals with a lower proportion coming from agricultural families.

The most significant divergence arises when the monthly earnings of families are compared. For students enrolled in agricultural colleges, 52 percent of their families earned less than Rs. 150 per month. Only 4 percent of the families have earnings of Rs. 500 per month or above. Among Pantnagar students, 65 percent come from families earning Rs. 500 or more. Less than one percent earned Rs. 150 per month or less.

In terms of socio-economic background, students at Pantnagar are similar to those enrolled in the Indian Institutes of Technology. The Education Commission Report indicated that 59 percent of the students at the I.I.T.'s came from families earning more than Rs. 500 per month and only seven percent from those earning less than Rs. 150 per month. In terms of occupational background of parents, the I.I.T.'s drew the majority of their students from government service families: 61 percent from government service, 27 percent from private business or professionals, and four percent from agricultural families.[34]

Both Pantnagar and the Indian Institutes of Technology cater to students from India's upper income strata. The Indian Institutes of Technology have a higher proportion of students from the families of central and state government employees than Pantnagar. By contrast, Pantnagar attracts more students from the larger landholding families in rural India. Both institutes have similar proportions of students from professional and private business families.

From the standpoint of equity, Pantnagar caters to a higher social class than the average agricultural college in

[28] Samuel Paul, "An Application of Cost-Benefit Analysis to Management Education," *Journal of Political Economy*, vol. 80, no. 2. March/April 1972, pp. 328-346.

[29] Mark Blaug, *et al.*, *op. cit.*, p. 131.

[30] B. S. Minhas, "Rural Poverty, Land Redistribution and Development Strategy," *Indian Economic Review*, April 1970, pp. 97-128.

[31] Wasudeo B. Radhudkar, "The Relationship of Certain Factors to the Success of Village Level Workers," *Rural Sociology*, vol. 27, no. 4, December 1972, pp. 418-427.

[32] Minhas, *op. cit.*

[33] Blaug, *et al.*, *op. cit.*, pp. 132-133.

[34] *Ibid.*, p. 132.

India and is similar to the Indian Institutes of Technology. This raises a fundamental dilemma. Can an educational institution perform its task of supplying qualified and trained manpower for economic and social development while providing a means to improve the participation of the economically disadvantaged?[35]

Given unequal socio-economic characteristics and mental capabilities, "equality of educational opportunity" implies unequal measures to redress existing inequalities. Barriers to "equal educational opportunity" are both physical and psychological. Physical barriers arise from the limited economic resources and corresponding deficiencies in educational opportunities. Psychological barriers stem from the educational, aspirational, and motivational characteristics of the home and the school.[36]

G. B. Pant University of Agriculture and Technology has attempted to eliminate physical barriers restricting the access of the socially disadvantaged. First, the university reserves 18 percent of its undergraduates seats for members of scheduled castes or tribes with annual incomes of Rs. 5000 or less. Second, the university awards admission points to applicants from farming families with less than 12 acres of land and to students who pass high school from rural institutions. Third, liberal scholarships and textbook subsidies contribute to an overall reduction in private costs.

Despite its best efforts the university remains dominated by the economically and socially advantaged. The university may be able to offset some of the physical barriers to admission but it can do little to effect change in the psychological barriers. More fundamental is the effect of these barriers on participation and retention rates at lower educational levels. The vast majority of children from low income groups in rural India fail to acquire the prerequisites for admission to an institution such as Pantnagar. Thus, the pool from which the university draws is smaller than is the case for the economically and socially advantaged. The program of bringing Village Level Workers for the baccalaureate in agriculture is an example of how individuals from a lower socio-economic stratum can be given higher education without sacrificing the quality of the academic program. But even in this case, this results in the participation of a group not radically different from the average student. Such programs are not likely to attract the very poor. In addition, this program suggests that besides equity grounds for such a policy, there may be equally efficient grounds for undertaking these programs.

Policy Recommendations

First, the university on the basis of the performance of its Village Level Worker program should give serious consideration to expansion of this program.

Second, not only should the program for Village Level Workers be expanded, but the university should consider utilization of such schemes in other areas. For example, a program for women who work in rural areas might be developed in the College of Home Sciences. To coordinate the operations of these programs, the university might consider the establishment of an Institute for Rural Development Education.

Third, the dominance of state government employment for veterinary undergraduates should be the subject of a more intensive investigation. Such an investigation should address itself to the apparent inelastic demand for veterinary graduates in the private sector, the development of private practices in veterinary medicine, and how such practices might be incorporated into state government service without creating conflict of interests.

Fourth, the universities' employment of its graduates in research and extension serves as post-graduate training for both B.Sc. and M.Sc.'s in agriculture. This point of initial short run, practical employment is often a stepping stone to G.O.I. Corporations and private business. With an increase in the numbers of M.Sc.'s competing for these positions, the proportion of undergraduates hired may well decrease over time. Therefore, the University may well need to consider the provision of alternative forms of post-graduate practical training for its agricultural undergraduates to maintain their access to employment in G.O.I. Corporations and private business.

Fifth, the university through the association of agricultural universities and the Indian Council of Agricultural Research should encourage similar studies of other agricultural universities. This would assist in regional and national planning of agricultural manpower.

Sixth, the university should initiate similar studies at intervals of three to five years to account for changes in the labor market which may have occurred over time. This would enable the university to have an ongoing means of planning its own academic program.

---

[35]This dilemma is certainly far from unique to India. It is the underlying theme of the Coleman Report in the United States. James S. Coleman, *et al., Equality of Educational Opportunity*, Washington: U.S. Government Printing Office, 1966.

[36]Torsten Husen, *Social Background and Educational Career: Research Perspectives on Equality of Educational Opportunity*, Paris: O.E.C.D., pp. 14-16.

BIBLIOGRAPHY

Amin, R. K., and Mahesh Pathak, "Cost of Education in Certain Faculties of Sardar Patel University," *Artha-Vikas*, vol. 3, no. 2, July 1967, pp. 23-41.

Baur, E. Jackson, "Response Bias in a Mail Survey," *Public Opinion Quarterly*, vol. 11, no. 4, Winter 1947, pp. 594-600.

Ben-David, Shaul, and William G. Tomek, *Allowing for Slope and Intercept Changes in Regression Analysis.* Ithaca: Department of Agricultural Economics, Cornell University, A.E. Res. 179, November 1965.

Blaug, Mark, P.R.G. Layard, and Maureen Woodhall, *The Causes of Graduate Unemployment in India.* London: Allen Lane, The Penguin Press, 1969.

Bowles, Samuel, *Planning Educational Systems for Economic Growth.* Cambridge: Harvard University Press, 1969.

Burgess, Tyrell, Richard Layard, and Pitambar Pant, *Manpower and Educational Development in India, 1961-1986.* Edinburgh: Oliver and Boyd, 1968.

Coleman, James, *et al., Equality of Educational Opportunity.* Washington: U.S. Government Printing Office, 1966.

Davis, Russell C., *Planning Human Resource Development: Educational Models and Schemata.* Chicago: Rand McNally, 1960.

Denison, E. F., *The Sources of Economic Growth in the United States and the Alternatives Before Us.* New York: Committee for Economic Development, 1962.

Donald, Majorie N., "Implications of Non-Response for the Interpretation of Mail Questionnaire Data," *Public Opinion Quarterly*, vol. 24, no.1, Spring 1960, pp. 99-114.

Friedman, Milton, "The Use of Ranks to Avoid the Assumption of Normality Implicit in the Analysis of Variance," *American Statistical Association Journal*, vol. 32, 1937, pp. 675-701.

Ginzberg, Eli, Sol W. Ginsburg, Sidney Axelrod, and John L. Herma, *Occupational Choice: An Approach to General Theory.* New York: Columbia University Press, 1951.

Gounden, A. M. Nalla, "Investments in Education in India," *Journal of Human Resources*, vol. II, no. 3, Summer 1967, pp. 347-358.

Government of India, *Report of the University Education Commission, 1948-1950*, vol. I, New Delhi: Ministry of Education, 1963.

Halter, A. N., H. O. Carter, and J. G. Hooking, "A Note on the Transcendental Production Function," *Journal of Farm Economics*, vol. 39, no. 4, November 1957, pp. 966-974.

Harberger, Arnold C., "Investments in Men Versus Machines: The Case of India," in C. Arnold Anderson and May Jean Bowman (ed.), *Education and Economic Development*, Chicago: Aldine Publishing Company, 1965, pp. 11-50.

Haveman, Robert, *Water Resource Investment and the Public Interest.* Nashville: Vanderbilt University Press, 1965.

Husen, Torsten, *Social Background and Educational Career: Research Perspectives in Equality of Educational Opportunity*, Paris: O.E.C.D., 1972.

Jencks, Christopher, *et al., Inequality: A Reassessment of the Effect of Family and Schooling in America.* New York: Basic Books, Inc., 1972.

Kivlin, Joseph E., "Contributions to the Study of Mail-Back Bias," *Rural Sociology*, vol. 30, no. 3, September 1965, pp. 322-326.

Kothari, V. N., "Return to Education in India," in Baljit Singh (ed.), *Education as Investment*, Meerut: Meenakshi Prakashan, 1967, pp. 127-140.

Lehman, Jr., Edward C., "Tests of Significance and Partial Returns to Mail Questionnaires," *Rural Sociology*, vol. 28, no. 3, September 1963, pp. 284-289.

Lewis, Oscar, *Village Life in Northern India.* New York: Random House, 1958.

Madalgi, S. S., "Estimates of Farm Income in India, 1951-1952 and 1967-1968," *Economic and Political Weekly*, 5.13, March 28, 1970, A-28 to A-32.

McKean, Roland N., *Efficiency in Government Through Systems Analysis.* New York: John Wiley and Sons, 1958.

Mellor, John W., and Uma Lele, "Jobs, Poverty, and the 'Green Revolution'," *International Affairs*, vol. 48, no. 1, January 1972, pp. 20-32.

Minhas, B. S., "Rural Poverty, Land Redistribution and Development Strategy," *Indian Economic Review*, April 1970, pp. 97-128.

Ministry of Education and Youth Services, Government of India, *Report of the Education Commission 1964-1966, Supplementary Volume II.* Delhi: Ministry of Publication, 1970.

Mishan, E. J., *Cost-Benefit Analysis: An Informal Introduction.* London: George Allen and Unwin, Ltd., 1971.

———, *Economics for Social Decisions: Elements of Cost-Benefit Analysis.* New York: Praeger Publishers, 1973.

Mujumdar, N. A., "Intrasectoral Dualism and Agricultural Growth," *Economic and Political Weekly*, 5.13,

March 28, 1970, A-4.

Narayan, R. K., *The Bachelor of Arts*, London: Eyre and Spottiswoode, 1937.

National Council of Applied Economic Research, *Estimates of State Income*, New Delhi: N.C.A.E.R., 1967.

Paul, Samuel, "An Application of Cost-Benefit Analysis to Management Education," *Journal of Political Economy*, vol. 80, no. 2, March/April 1972, pp. 328-346.

Radhukar, Wasudeo B., "The Relationship of Certain Factors to the Success of Village Level Workers," *Rural Sociology*, vol. 27, no. 4, December 1962, pp. 418-427.

Saigaonkar, P. B., and A. V. Patel, "Relationship of Certain Factors with the Success of Village Level Extension Workers in Kaira District of Gujarat State," *Behavioral Sciences and Community Development*, vol. 4, no. 1, March 1970, pp. 23-32.

Sawhney, Mohan M., "Farm Practice Adoption and the Use of Information Sources and Media in a Rural Community in India," *Rural Sociology*, vol. 32, no. 3, September 1967, pp. 310-325.

Schwartzbaum, Allan M., Robert A. Rothman, and John H. McGrath, III, "Voluntary Questionnaire Write-ins and Respondent Attitudes," *Rural Sociology*, vol. 37, no. 3, September 1972, pp. 445-453.

Sen, Amartya K., *Choice of Techniques: An Aspect of the Theory of Planned Economic Development*, 3rd Edition, New York: Augustus M. Kelly, 1968.

Shortlidge, Jr, Richard L., "The Profitability of Educational Investments in India," Unpublished M.S. Thesis, Cornell University, 1970.

Steel, Robert G. D., and James H. Torrie, *Principles and Procedures of Statistics: With Special Reference to the Biological Sciences*. New York: McGraw-Hill Book Company, 1960.

Uttar Pradesh Agricultural University, *Academic Plan 1970-1980*. Pantnagar: U.P.A.U., 1971.

_____, *Programme Directory for Third Trimester 1970-1971*, Pantnagar: U.P.A.U., 1971.

Wallace, David, "A Case for and Against Mail Questionnaires," *Public Opinion Quarterly*, vol. 18, no. 1, Spring 1954, pp. 40-52.

Weisbrod, Burton A., and Peter Karpoff, "Monetary Return to College Education, Student Ability, and College Quality," *Review of Economics and Statistics*, vol. 50, no. 4, November 1968, pp. 491-497.

Wolfle, D., and V. G. Smith, "The Occupational Value of Education for Superior High School Graduates," *Journal of Higher Education*, vol. 27, April 1956, pp. 201-214.