DOCUMENT RESUME

ED 117 482 CE 006 151

AUTHOR Boskin, Michael J.
TITLE Occupational Choice: A Conditional Logit Model with Special Reference to Wage Subsidies and Occupational Choice. Final Report.
INSTITUTION Stanford Univ., Calif. Dept. of Economics.
SPONS AGENCY Manpower Administration (DOL), Washington, D.C. Office of Research and Development.
REPORT NO DLMA-91-06-12-28
PUB DATE Nov 73
NOTE 46p.; Revised, November 1973

EDRS PRICE MF-$0.83 HC-$2.06 Plus Postage
DESCRIPTORS *Economic Research; Federal Aid; Females; *Human Capital; Labor Supply; Males; Mathematical Models; *Occupational Choice; Race; Statistical Analysis; Training; *Unemployment; *Wages

ABSTRACT

A model of occupational choice based on the theory of human capital is developed and estimated by conditional logit analysis. The empirical results estimated the probability of individuals with certain characteristics (such as race, sex, age, and education) entering each of 11 occupational groups. The results indicate that individuals tend to choose those occupations with the highest discounted percent value of potential future earnings, the lowest present value of expected earnings foregone due to unemployment, and the lowest raining cost relative to net worth. The relative weights given to these three variables in choosing occupations varied markedly by race and sex. White males tended to weight expected earnings much more heavily relative to earnings foregone due to unemployment than black males or females of either race. Results were then employed in an analysis of the effects of a national wage subsidy scheme on the selection probabilities for each occupation. The results suggested a higher probability of entering low wage occupations due to the greater relative importance of the subsidy in these occupations. (Author/EA)

STANDARD TITLE PAGE FOR TECHNICAL REPORTS	1. Report No. DLMA 91-06-72-28		3. Recipient's Catalog No.
4. Title and Subtitle			5. Report Date October 1973
Occupational Choice: a Conditional Logit Model with [illegible] to Wage [illegible]			6. Performing Organization Code
7. Author(s) Michael J. Boskin			8. Performing Organization Rept. No.
9. Performing Organization Name and Address Department of Economics Stanford University Stanford, CA 94305			10. Project/Task/Work Unit No.
			11. Contract/Grant No. DL 91-06-72-28
12. Sponsoring Agency Name and Address **U.S. Department of Labor** **Manpower Administration** **Office of Research and Development** **1111 20th St., N.W. Washington, D.C. 20210**			13. Type of Report & Period Covered Final
			14. Sponsoring Agency Code

15. Supplementary Notes

Findings to be published in Journal of Political Economy, March 1974, and elsewhere.

16. Abstracts

A model of occupational choice based on the theory of human capital is developed and estimated by conditional logit analysis. The empirical results estimate the probability of individuals with certain characteristics (e.g. race, sex, age, education, etc.) entering each of eleven occupational groups. The results suggest that individuals tend to choose those occupations with the highest percent value of future earnings and lowest training costs and expected earnings foregone due to unemployment. The effect of a wage subsidy program is simulated; the results suggest a higher probability of entering low wage occupations due to the greater relative importance of the subsidy in these occupations.

17. Key Words and Document Analysis. 17a. Descriptors

economic analysis
earnings
statistical analysis
supply
unemployment

17b. Identifiers/Open-Ended Terms

lifetime earnings
occupational choice

17c. COSATI Field/Group 5C

18. Distribution Statement	19. Security Class (This Report)	21. No. of Pages
Distribution is unlimited. Available from National Technical Information Service, Springfield Va., 22151.	UNCLASSIFIED	
	20. Security Class (This Page) UNCLASSIFIED	22. Price

FORM CFSTI-35 (4-70) USCOMM-DC 85002-P70

INSTRUCTIONS FOR COMPLETING FORM CFSTI-35(4-70) (Standard Title Page for Technical Reports based on COSATI Guidelines to Format Standards for Scientific and Technical Reports Prepared by or for the Federal Government, PB-180 600).

1. **Report Number.** Each report shall carry a unique alphanumeric designation consisting of the letters DLMA followed by the contract or grant number, e.g., DLMA-81-25-68-10. For each report produced under a contract or grant, add -1, -2, etc. after the contract or grant number, e.g., DLMA 81-25-68-10-1.
2. **Government Accession Number.** Leave blank.
3. **Recipient's Catalog Number.** Reserved for use by each report recipient.
4. **Title and Subtitle.** Title should indicate clearly and briefly the subject coverage of the report, and be displayed prominently. Set subtitle, if used, in smaller type or otherwise subordinate it to main title. When a report is prepared in more than one volume, repeat the primary title, add volume number and include subtitle for the specific volume.
5. **Report Date.** Please use the date of issue of final report, not the date of approval of the draft. Abbreviate month (limited to three letters) and year, e.g., Sep. 70.
6. **Performing Organization Code.** Leave blank.
7. **Author(s).** Give name(s) in conventional order (e.g., John R. Doe, or J.Robert Doe). List author's affiliation if it differs from the performing organization.
8. **Performing Organization Report Number.** Insert if performing organization wishes to assign this number.
9. **Performing Organization Name and Address.** Give name, street, city, state, and zip code. List no more than two levels of an organizational hierarchy. Display the name of the organization exactly as it should appear in Government indexes such as USGRDR-I.
10. **Project/Task/Work Unit Number.** Leave blank.
11. **Contract/Grant Number.** Insert Department of Labor contract or grant number, preceded by DL, e.g., DL 81-25-68-10.
12. **Sponsoring Agency Name and Address.** Already filled in.
13. **Type of Report and Period Covered.** Indicate interim, final, etc., and, if applicable, dates covered.
14. **Sponsoring Agency Code.** Leave blank.
15. **Supplementary Notes.** Enter information not included elsewhere but useful, such as: Prepared in cooperation with . . . Translation of . . . Presented at conference of . . . To be published in . . .
16. **Abstract.** Include a brief (200 words or less) factual summary of the most significant information contained in the report. If the report contains a significant bibliography or literature survey, mention it here.
17. **Key Words and Document Analysis.** (a). **Descriptors.** Select only from attached Key Words-Descriptors, proper authorized terms that identify the major concept of the research and are sufficiently specific and precise to be used as index entries for cataloging.
    (b). **Identifiers and Open-Ended Terms.** Use identifiers for project names, code names, etc. If no descriptor exists, select terms from 1970 Manpower Research Projects index.
    (c). **COSATI Field/Group** Select from attached COSATI Subject Categories. Use only the code numbers, e.g., 5J, to indicate the field of Behavioral and Social Sciences and the appropriate group.
18. **Distribution Statement.** Cite any availability to the public with address and price.

19 & 20. **Security Classification.** Do not submit classified reports to the Clearinghouse.

21. **Number of Pages.** Insert the total number of pages, including this one and unnumbered pages, but excluding distribution list, if any.
22. **Price.** Insert price set by the National Technical Information Service ($3 for reports with 300 or fewer pages; $6 for those with 301-600 pages; $9 for those with 601-900 pages. The microfiche price for all reports in $.95.)

OCCUPATIONAL CHOICE: ABSTRACT

By

Michael J. Boskin

The multinomial extention of the logit decision model is applied to the choice of occupation by individual workers to test some important implications of the theory of human capital. Our results for all population subgroups confirm our a priori expectations from human capital theory that workers will tend to choose those occupations with the highest discounted present value of potential future earnings, the lowest present value of expected earnings foregone due to unemployment and the lowest training cost relative to net worth. The relative weights given to these three variables in choosing occupations varies markedly by race and sex. White males tend to weight expected earnings much more heavily relative to earnings foregone due to unemployment than black males or females of either race. The price ratio suggests that for white males measured unemployment includes a not insignificant amount of voluntarily enjoyed productive active (leisure or job search). For the other population subgroups, the price ratio is reversed and hints of risk-aversion or nonpecuniary costs involved in unemployment.

These results are then employed in an analysis of the effects of a national wage subsidy scheme on the selection probabilities for each occupation. The change in selection probabilities depends upon both the change in expected earnings, earnings foregone due to unemployment and training costs and the relative weights used in making a choice of

occupation. Since the wage subsidy varies inversely in absolute and relative value with market wage rates below the target wage, the subsidy increases the expected future earnings in the low-wage occupations. It therefore also increases the opportunity cost of work foregone to train, or search, for another job. The net effect of the wage subsidy on selection probabilities is thus complex; roughly speaking, it raises the probability of selecting low-wage occupations, but this result varies across population subgroups.

WAGE SUBSIDIES AND OCCUPATIONAL CHOICE

By

Michael J. Boskin

Department of Economics

Stanford University

revised, November 1973

The material in this project was prepared under Grant No. 91-06-72-28 from the Manpower Administration, U.S. Department of Labor, under the authority of title I of the Manpower Development and Training Act of 1962, as amended. Researchers undertaking such projects are encouraged to express freely their professional judgment. Therefore, points of view or opinions stated in this document do not necessarily represent the official position or policy of the Department of Labor.

Table of Contents

List of Tables

A CONDITIONAL LOGIT MODEL OF OCCUPATIONAL CHOICE

By

Michael J. Boskin

Department of Economics

Stanford University

revised, October 1972

A CONDITIONAL LOGIT MODEL OF OCCUPATIONAL CHOICE

by

Michael J. Boskin

I. Introduction

The theory of human capital[1] provides a convenient framework for analyzing the choice of occupation by individual workers. The present paper is devoted to an investigation of the implications of this framework. Section II briefly discusses the human capital approach to occupational choice. Section III reviews the conditional logit statistical model elaborated in McFadden [1968]. Section IV discusses the generation of the data. Section V presents the empirical results of this study, i.e., tests of hypotheses about the variables influencing occupational choice and estimates of the relative weights given to variables in selecting an occupation. Section VI offers a brief conclusion.

II. The Human Capital Approach to Analyzing Occupational Choice

The application of the theory of human capital to occupational choice is simple and straighforward.[2] In choosing among occupations (defined broadly enough so workers in different occupations are not perfect substitutes) a potential worker will weigh the benefits -- potential earnings and nonpecuniary returns -- and costs -- of training, foregone earnings, etc. The worker will invest in changing occupations

[1] See Becker [1964] and Schultz [1962].

[2] See, for instance, Fleisher [1970].

only if the returns are sufficiently large to make the particular change of occupations the most profitable use of his limited resources.

In this simplest formulation, we would always expect to find workers in those occupations with the highest discounted present value of future potential earnings.[3,4] However, given imperfect capital markets, resources for investing in oneself will not be equally accessible to all workers. The wealth position of an individual will partially determine his capability of making any particular profitable investment in himself.

It is thus clear that decisions on occupation choice will be governed by the returns -- primarily expected potential (full-time) earnings -- and costs -- primarily training and foregone potential earnings -- relative to the wealth position of the individual worker in alternative occupations. That is, the probability that a worker i will enter a particular occupation j will be a function of the relative present values of potential post-investment lifetime earnings, E, training costs and foregone earnings relative to wealth, $\frac{T}{W_i}$, and the present value of

[3]Abstracting for the mement from any differential nonpecuniary costs and benefits among occupations.

[4]More rigorously, the worker must choose simultaneously: (1) the optimal number of occupations over his lifetime; (2) the optimal length of stay in each occupation; and (3) the optimal sequence of occupations. That is, we have an integer dynamic programming problem. Therefore, our worker will always be in an occupation which enables him to maximize present value considering all possible occupational shifts.

expected income foregone due to unemployment, U, in alternative occupations;[5] i.e.,

$$p_{ij} = f(E_{i1},\ldots,E_{ij},E_{ij+1},\ldots,E_{in};\ U_{i1},\ldots,U_{ij},\ldots,U_{in};\ \frac{T_{i1}}{W_i},\ldots,\frac{T_{ij}}{W_i},\ldots,\frac{T_{in}}{W_i}) \quad (1)$$

We turn now to a discussion of the estimation of such a relationship.

III. A Conditional Logit Model of Occupational Choice[6]

If we assume preferences are such that all occupations have a positive selection probability for each individual, that the odds that a particular occupation will be chosen over another is independent of the presence of other possible occupations, and that the determination of the odds of choosing alternative occupations is additively separable in its arguments representing the occupation effect and the individual worker effect, we may invoke certain theorems proved by McFadden [1968]. These theorems essentially allow us to write the selection probability in the form

[5] This formulation may be motivated by an appeal to stochastic choice theory. For example, following Block and Marshak [1960] we may adopt a model whereby the probability of each outcome is proportional to the utility derived from the choice.

[6] The discussion that follows is based on McFadden [1968]. This estimator has also been used to study choice of college by Radner and Miller [1970].

$$p_{ij} = \{ \sum_{k=1}^{n} \exp[b(k) - b(j)] \}^{-1} \quad . \tag{2}$$

The weight $b(k)$ assigned to an occupation is a function of the attributes of the occupation. The individual observes a vector of variables, X_k, such as wage rates, unemployment rates, training costs, etc., for each occupation. The $b(k)$ which determine the selection probabilities are given by

$$b(k) = B(X_k, \theta) \quad , \tag{3}$$

where θ is a vector of unknown parameters specifying the functional form of B. For each individual, define a variable $f_k = 1$ if occupation k is selected and $f_k = 0$ otherwise. Then $\sum_{k=1}^{n} f_k = 1$. To estimate θ, we observe that the likelihood of a given sample is then

$$L = \prod_{i=1}^{m} \prod_{k=1}^{n} p_{ik}^{f_k} \quad . \tag{4}$$

Then,

$$\log L = - \sum_{i=1}^{m} \sum_{k=1}^{n} f_k \log\{ \sum_{k=1}^{n} \exp[B(X_k, \theta) - B(X_j, \theta)] \} \tag{5}$$

The method of maximum likelihood can be applied to (5) to obtain an estimator for θ with optimal asymptotic properties. McFadden [1968] shows that the estimator for the case where X_ℓ and θ are

K×1 vectors and B is the linear function $B(X_\ell,\theta) = \theta'X$ is consistent and asymptotically normal. This result is used to construct approximate large sample confidence bounds for the estimates.

We thus have for our case of a linear function of occupation attributes that the ratio of the odds of choosing occupation j over occupation k is given by

$$\frac{P_{ij}}{P_{ik}} = \frac{e^{\theta'X_j}}{e^{\theta'X_k}} \quad . \tag{6}$$

Taking logarithms yields

$$\log \frac{P_{ij}}{P_{iK}} = \theta'(X_j - X_\ell) \quad , \tag{7}$$

the log of the odds occupation j will be chosen over occupation k is a linear function of the attributes of the occupation. Thus we have the multinomial extension of traditional logit analysis (see Theil [1969] for another discussion of this statistical problem).

IV. The Data

We begin our discussion of the empirical results with an explanation of the generation of the data. We estimate the present value of expected lifetime whole income (expected wages time hours available for work, assumed = 2000) for individuals in our sample for various occupations they might enter. Our observations are taken from the 1967

Survey of Economic Opportunity, a detailed set of 30,000 interviews of predominantly low-income households; for a discussion of this data, see Hall [1973] or Boskin [1973]. First, we estimate the expected real hourly wage rate facing <u>each individual</u> as a function of his personal characteristics. This formulation is suggested by recent advances in the hedonic method of price measurement.[7] We employ here an extended version of the particular type of wage equation proposed by Hall [1973], i.e., we adopt an analysis of variance regression model:

$$\log \left(\frac{W}{P}\right) = \gamma' Z \qquad (8)$$

where the Z's represent personal characteristics such as race, sex, age, location, education, health, union membership, occupation, etc. We run separate regressions for each race-sex occupation group, thereby allowing a complete set of interactions between these and all other effects. In addition, we allow interactions between union membership and location; otherwise, all effects are assumed independent.

These results are not without interest in themselves; the interested reader should consult Hall [1973] and Boskin [1972]. For our purposes, however, they are important because they give us, <u>for each individual</u>, a method of estimating the wage he/she faces in each of eleven broad occupational classes. In addition, we can estimate how that wage rate varies with age. We thus can predict the course of

[7] See Hall [1973].

potential lifetime earnings for each individual in each of several occupations he might choose to enter. Of course, several refinements have to be made. We must at least attempt to allow for productivity growth; current twenty-year-old workers will be working with an improved technology when they are forty, so we must estimate this productivity growth and adjust the wages of current forty-year-old workers accordingly to estimate wage rates facing twenty-year-old workers twenty years from now. We estimate a constant rate of productivity growth from the average annual rate for 1960-1970. We also assume future potential earnings are discounted at a five per cent rate of interest; modest variations in the discount rate do not affect the results.[8]

We thus estimate the present value of expected lifetime potential earnings as

$$P.V._t = \sum_{t=t_o}^{65} \frac{W_t \cdot H_t (1+\gamma)^{t - t_o + 1/2}}{(1+r)^{t - t_o + 1}}, \qquad (9)$$

where

$P.V._t$ = the present value of potential work time remaining between age at t_o and age 65.

W_t = expected wage rate in year t.

H_t = hours available for work in year t, (= 2,000),

γ = expected rate of productivity increase; assumed to be constant at the average annual rate from 1960-1970.

r = discount rate; assumed to be five per cent.

The second variable used in the study is the ratio of an index of training costs to current net worth.[9] We use the data derived by

---

[8]A sample calculation for a representative individual is presented in Table 3.

[9]Net worth is defined as cashable net worth, including the value of consumer durables and excluding the value of human capital.

Scoville [1966] on specific training requirements by occupation. Out-of-pocket expenses are assumed to be one-third of foregone earnings. Foregone earnings are computed by multiplying the present wage rate by necessary work time foregone in retraining. We then take the ratio of training cost to net worth, the assumption being that the worker finances his retooling out of his own resources.

The final variable we examine in this study is expected lifetime earnings lost due to unemployment. If time spent unemployed was completely unproductive, i.e., contained no element of leisure or investment in search activity, the worker would be indifferent, <u>cet. par.</u>, between two occupations, one offering $1 more in the present value of future full-time earnings, the other offering $1 less in expected earnings foregone due to unemployment. We could then subtract expected earnings foregone due to unemployment (net of unemployment insurance) from expected full time earnings and use expected wage income as the focus of study. If, however, the measured unemployment includes a component of leisure or search, the time spent unemployed is valuable and the worker will require less than a $1 decrease in relative expected earnings foregone due to unemployment to be indifferent to an occupation with a $1 larger lifetime full-time earnings potential. We have therefore separated these two components of expected income in order to attempt to test this hypothesis. We estimate the expected duration of unemployment in a manner analogous to our procedure to estimate wages.[10] We estimate analysis of variance hedonic unemployment equations

[10] 1966 was a year of relatively full employment. Projecting unemployment over the life cycle based on this data is the most reasonable procedure available to us, but could result in misestimation as relative unemployment by occupation varies over the business cycle.

of the Hall-type (see Hall [1970]) by regressing time unemployed on a set of personal characteristics. We thus get an estimate of the expected unemployment facing a potential worker in each occupation, and how this unemployment varies by age. Following the procedure described above for potential earnings, we estimate the present value of potential earnings lost due to unemployment by using a formula similar to (7) in all but two respects. We replace H_t, hours available for work in year t, with u_t, expected hours lost due to unemployment and we replace w_t, the wage, by $(w_t - I_t)$, the wage net of the hourly equivalent of unemployment insurance.[11]

V. Empirical Results

Tables 1 and 2 present our empirical results, disaggregated by race and sex. Table 1 presents occupation characteristics such as discounted present value of potential future earnings, discounted present value of expected lifetime earnings foregone due to unemployment, and our estimate of the ratio of training costs to net worth. Since real wage and unemployment rates, even within race-sex groups (holding other variables, such as education, constant) differ substantially from occupation to occupation,[12] the substantial variation in our variables is hardly surprising. These variables summarize the information (potentially) available to the worker in choosing an occupation.[13]

[11] Unemployment insurance is based on 1966 figures, and assumed to grow at the rate for the 1960-70 period.

[12] See Reder [1955] for a discussion of these differentials.

[13] We do not claim that they are the only ones which conceivably could affect occupational choice; rather, we assume that the influence of other variables, e.g., those measuring tastes for certain types of work, is small relative to the variables considered here.

Table 1

OCCUPATION CHARACTERISTICS FOR POPULATION SUBGROUPS

(thousands of dollars)

		Mean for Adopted Occupations	Standard Deviation for Adopted Occupations	Mean Deviation for Non-Adopted Occupations (non-adopted) (- adopted)
Present Value of Lifetime Whole Earnings:	Total	63	56	3.6
	White Males	97	63	0.7
	Black Males	42	64	1.4
	White Females	52	48	-5.1
	Black Females	16	26	-12.8
Ratio of Estimated Training Costs to Net Worth:	Total	0.20	1.8	0.25
	White Males	0.38	2.9	0.08
	Black Males	0.19	1.6	0.70
	White Females	0.19	1.6	0.28
	Black Females	0.13	1.5	1.02
Present Value of Lifetime Earnings Lost Due to Unemployment:	Total	1.2	3.6	0.16
	White Males	1.2	2.0	0.15
	Black Males	2.6	8.2	-1.60
	White Females	0.8	6.0	-1.93
	Black Females	0.3	8.6	-5.28

Source: Computed from 1967 Survey of Economic Opportunity

The data offer some interesting insights into the workings of labor markets. The most obvious is the fact that opportunities and outcomes vary markedly among individuals -- both within and across population subgroups -- as evidenced by the large standard deviation of all variables. It is also interesting to draw some inferences across population subgroups. Relative to other population subgroups, white males enter occupations with far higher training costs (the higher foregone earnings included in the numerator is mostly offset by larger net worth in the denominator). In addition, the mean deviation for the non-adopted occupations for all three occupation characteristics is much smaller for white males than the other groups. Given age, education and the like, occupation thus makes less relative importance to white males than the other groups. Finally, we note that blacks (male and female) have a much larger mean deviation of the ratio of training costs to net worth; this implies the non-adopted occupations are relatively more expensive for blacks than for whites.

Table 2 presents our evidence on the relative weights given to earnings, unemployment and training costs. The results for all population subgroups confirm our a priori expectations from human capital theory that: 1) workers will tend to choose those occupations with the highest discounted present value of potential future earnings; 2) workers will tend to choose those occupations where retraining costs, in relation to net worth, are lowest; and 3) workers will tend to choose those occupations where, cet. par., the discounted present value of expected earnings foregone due to unemployment is lowest.[14]

[14] The predicted probabilities for adopted occupations ranged up to three times the predicted probabilities if random behavior was observed (probabilities equal to the percentages of jobs in each occupation).

Table 2

Relative Weights of Potential Earnings, Training Costs and Foregone Earnings Due to Unemployment in the Conditional Logit Decision Model

Estimate No.	Population Group	Variables Included	Estimate of θ ($x10^{-2}$)	Standard Deviation* ($x10^{-2}$)	Likelihood L ($x10^{2}$)
1	White Males	Present Value of Potential Earnings	1.084	0.075	-54.15
		Training Cost/Net Worth	-0.001	0.001	
		Present Value Time Unemployed	-0.051	0.090	
2	Black Males	Present Value of Potential Earnings	0.072	0.013	-44.64
		Training Cost/Net Worth	-0.010	0.001	
		Present Value Time Unemployed	-4.35	0.567	
3	White Females	Present Value of Potential Earnings	0.875	0.076	-47.07
		Training Cost/Net Worth	-0.005	0.002	
		Present Value Time Unemployed	-18.74	1.609	
4	Black Females	Present Value of Potential Earnings	0.378	0.132	-33.40
		Training Cost/Net Worth	-0.012	0.002	
		Present Value Time Unemployed	-20.78	1.82	

Source: Based on twenty-five hundred randomly selected observations from each population group from the 1967 Survey of Economic Opportunity.

*Convergence was obtained after approximately twenty iterations; standard deviations reported are from the last iteration.

All effects have the expected sign and almost all are measured quite precisely.[15]

The most striking result is that white males tend to weight training costs and expected income foregone due to unemployment relative to expected full-time earnings much less heavily than the other groups. This is consistent with the hypotheses of differential access to financing of training and education costs and of differential risk aversion.

It is instructive to examine the ratio of the coefficients for expected full-time earnings and expected earnings foregone due to unemployment. This figure varies markedly by race and sex. The expected earnings foregone due to unemployment does not appear to exert much of an influence on white males. The price ratio of trading one dollar in full-time earnings for twenty dollars in decreased earnings foregone due to unemployment suggests (perhaps) that measured unemployment for white males includes a not insignificant amount of voluntarily enjoyed productive activity -- for example, leisure or job search. For the other population subgroups -- females, many of whom work part-time and/or on and off throughout their lifetime, and black males, the price ratio is reversed. For example, white females appear to be willing to trade a dollar less in foregone earnings due to unemployment for twenty dollars of full-time earnings. This strongly hints of risk-aversion or non-pecuniary costs involved in white female unemployment.

[15]The results are similar when the training cost variable is left out of the equation. These results are available upon request from the author. It also should be pointed out that the likelihood ratio method may be used to test hypotheses about the coefficients.

VI. Summary and Conclusion

We have applied the conditional logit decision model to the choice of occupation by individual workers to test some important implications of the theory of human capital. Our empirical results are quite consistent with the human capital hypothesis that workers choose occupations to maximize the discounted present value of potential lifetime work time. Allowing for imperfect capital markets by including training costs relative to wealth and for unemployment by including the discounted present value of expected earnings foregone due to unemployment also yielded results consistent with a priori expectations.

Our conclusions apply to all four major race-sex population subgroups. The apparent differences among subgroups are consistent with well known labor market phenomena.

Table 3

Sample Calculation of the Present Value of Full-time Earnings by Occupation for a Representative Individual[a]

Occupation	Present Value of Full-time Earnings (thousands of dollars)
Professional/Technical	134
Farmer	76
Manager	141
Clerical	99
Sales	97
Craftsman	109
Operative	95
Private Household	67
Service	86
Farm Laborer	59
Laborer	83

[a]White male, high school graduate, aged forty.

REFERENCES

[1] Becker, G., Human Capital, NBER, 1964.

[2] Block, H. and J. Marschak, "Random Orderings and Stochastic Theories of Responses," in I. Olkin, et. al., Contributions to Probability and Statistics: Essays in Honor of Harold Hotelling, Stanford, 1960.

[3] Boskin, M., "The Economics of the Labor Supply," in G. Cain and H. Watts, eds., Labor Supply and Income Maintenance, Markham, 1973.

[4] __________, "Unions and Relative Real Wages," American Economic Review, June 1972.

[5] Fleisher, B., Labor Economics: Theory and Evidence, Prentice-Hall, 1970.

[6] Hall, R., "Wages, Income and Hours of Work in the U.S. Labor Force," forthcoming in Cain and Watts, op. cit.

[7] __________, "Why Is the Unemployment Rate So High at Full Employment?," Brookings Papers on Economic Activity: 3, 1970.

[8] McFadden, D., "The Revealed Preferences of a Government Bureaucracy," Technical Report No. 17, Economic Growth Project, University of California, Berkeley, 1968.

[9] __________, and C. Liew, "Conditional Logit Analysis Statistical Estimation Package," unpublished mimeo, University of California, Berkeley, 1969.

[10] Miller, H. and R. Hornseth, "Present Value of Estimated Lifetime Earnings," Technical Paper No. 16, U.S. Department of Commerce, 1967.

[11] Radner, R. and L. Miller, "Demand and Supply In U.S. Higher Education: A Progress Report," American Economic Review, May 1970.

[12] Reder, M., "The Theory of Occupational Wage Differentials," American Economic Review, 1955.

[13] Schultz, T., ed., "Investment in Human Beings," Journal of Political Economy, Pt. 2, October 1962.

[14] Scoville, J., "Education and Training Requirements for Occupations," Review of Economics and Statistics, November 1966.

[15] Theil, H., "A Multinomial Extension of the Linear Logit Model," International Economic Review, October 1969.

1. Introduction

In a previous study (Boskin [1974]), I have developed a probabilistic model of occupational choice by individual workers. That study estimated the weights given to a vector of occupation attributes, such as expected future earnings and income foregone due to unemployment, training costs, etc., in choosing among occupations. Several proposed public policy programs directly (and indirectly) affect these (relative) occupation attributes and are thus likely to affect occupational choice. Among the most prominent of these proposed programs is a national wage bill subsidy. This program would supplement, as sort of a negative payroll tax, the market wage paid low wage workers. Since expected wages vary from occupation to occupation for a given individual, the wage subsidy tends to make low (market) wage occupations relatively more appealing than in the absence of the program. However, by raising the (total) wage in low wage occupations, it increases the opportunity cost of foregoing current work in order to train, or look for, a job in another occupation. The purpose of the present paper is to provide a rough estimate of the net direct effect of a wage subsidy on the choice of occupation of various groups of workers.[1]

Toward this end, section 2 briefly discusses the conditional logit model of occupational choice and my earlier results on estimates of the weights given to various occupation attributes by different population subgroups in choosing among occupations.

---

[1] Indirect effects, such as those working through expected unemployment and changes in the relative (market) wage structure due to long-run shifts in the supply of workers among occupations, are not dealt with here. Also ignored are the effects of the taxes necessary to finance the program.

Section 3 describes the wage subsidy plan and how it affects the relative magnitudes of the variables influencing occupational choice.

Section 4 presents some empirical examples of the effect on the probability workers of different races and sexes will select each of eleven occupational groups due to a particular wage subsidy plan. We shall demonstrate that, even with our relatively broad groupings of occupations, a wage subsidy plan is likely to alter selection probabilities substantially.

Finally, section 5 presents a brief summary and conclusion.

2. A Model of Occupational Choice

The application of the theory of human capital to occupational choice is simple and straighforward.[2] In choosing among occupations (defined broadly enough so workers in different occupations are not perfect substitutes) a potential worker will weigh the benefits -- potential earnings and nonpecuniary returns -- and costs -- of training, foregone earnings, etc. The worker will invest in changing occupations only if the returns are sufficiently large to make the particular change of occupations the most profitable use of his limited resources.

In this simplest formulation, we would always expect to find workers in those occupations with the highest discounted present value of future potential earnings.[3,4] However, given imperfect capital markets, resources for investing in oneself will not be equally accessible to all workers. The wealth position of an individual will partially determine his capability of making any particular profitable investment in himself.

It is thus clear that decisions on occupation choice will be governed by the returns -- primarily expected potential (full-time)

---

[2]See, for instance, Fleisher [1970].

[3]Abstracting for the moment from any differential nonpecuniary costs and benefits among occupations.

[4]More rigorously, the worker must choose simultaneously: (1) the optimal number of occupations over his lifetime; (2) the optimal length of stay in each occupation; and (3) the optimal sequence of occupations. That is, we have an integer dynamic programming problem. Therefore, our worker will always be in an occupation which enables him to maximize present value considering all possible occupational shifts.

earnings -- and costs -- primarily training and foregone potential earnings -- relative to the wealth position of the individual worker in alternative occupations. That is, the probability that a worker i will enter a particular occupation j will be a function of the relative present values of potential post-investment lifetime earnings, E, training costs and foregone earnings relative to wealth, $\frac{T}{W_i}$, and the present value of expected income foregone due to unemployment, U, in alternative occupations;[5] i.e.,

$$P_{ij} = f(E_{i1},\ldots,E_{ij},E_{ij+1},\ldots,E_{in};\ U_{i1},\ldots,U_{ij},\ldots,U_{in};\ \frac{T_{i1}}{W_i},\ldots,\frac{T_{ij}}{W_i},\ldots,\frac{T_{in}}{W_i}) \quad (1)$$

Assuming that the weighting of these variables in determining selection probabilities is linear and invoking the logistic functional form for the representation of the probabilities[6] yields

$$\frac{P_{ij}}{P_{ik}} = \frac{e^{\theta' X_j}}{e^{\theta' X_k}} \quad (2)$$

[5] This formulation may be motivated by an appeal to stochastic choice theory. For example, following Block and Marshak [1960] we may adopt a model whereby the probability of each outcome is proportional to the utility derived from the choice.

[6] A fuller discussion of this derivation is presented in Boskin [1974].

where X represents the vector of earnings, training costs, etc., and θ are the weights to be estimated.

Taking logarithms yields

$$\log \frac{P_{ij}}{P_{iK}} = \theta'(X_j - X_\ell) \quad , \qquad (3)$$

the log of the odds occupation j will be chosen over occupation k is a linear function of the attributes of the occupation. Thus we have the multinomial extension of traditional logit analysis (see Theil [1969] for another discussion of this statistical problem).

We estimate θ by the method of maximum likelihood; McFadden [1968] has derived this estimator and demonstrated that it is consistent; its asymptotic normality property is used to construct approximate large sample confidence bounds for the estimates.

We begin our discussion of the empirical results with an explanation of the generation of the data. We estimate the present value of expected lifetime whole income (expected wages time hours available for work, assumed = 2000) for individuals in our sample for various occupations they might enter. Our observations are taken from the 1967 Survey of Economic Opportunity; for a discussion of this data, see Boskin [1973]. First, we estimate the expected real hourly wage rate facing each individual by a regression of hourly wage rates on personal characteristics such as race, sex, age, location, education, health, union membership, occupation, etc. We run separate regressions for each race-sex occupation group, thereby allowing a complete set of interactions between these and all other effects. In addition, we allow interactions between union membership and location; otherwise, all effects are assumed independent.

These results give us, <u>for each individual</u>, a method of estimating the wage he/she faces in each of eleven broad occupational classes.[7] In addition, we can estimate how that wage rate varies with age. We thus can estimate the course of potential lifetime earnings for each individual in each of several occupations he might choose to enter. Of course, several refinements have to be made. We must at least attempt to allow for productivity growth; current twenty-year-old workers will be working with an improved technology when they are forty, so we must estimate this productivity growth and adjust the wages of current forty-year-old workers accordingly to estimate wage rates facing twenty-year-old workers twenty years from now. We estimate a constant rate of productivity growth from the average annual rate for 1960-1970. We also assume future potential earnings are discounted at a five per cent rate of interest; modest variations in the discount rate do not affect the results.[8]

We thus estimate the present value of expected lifetime potential earnings as

[7] Of course, we would also expect a substantial intragroup substitution to occur. Our results are therefore a lower bound.

[8] A sample calculation for a representative individual is presented in Table 3 of Boskin [1974].

$$P.V._t = \sum_{t=t_0}^{65} \frac{W_t \cdot H_t (1+\gamma)^{t - t_0}}{(1+r)^{t - t_0}}, \qquad (4)$$

where

$P.V._t$ = the present value of potential work time remaining between age at t_0 and age 65.

W_t = expected wage rate in year t.

H_t = hours available for work in year t, (= 2,000),

γ = expected rate of productivity increase; assumed to be constant at the average annual rate from 1960-1970.

r = discount rate; assumed to be five per cent.

The second variable used in the study is the ratio of an index of training costs to current net worth.[9] We use the data derived by Scoville [1966] on specific training requirements by occupation. Out-of-pocket expenses are assumed to be one-third of foregone earnings. Foregone earnings are computed by multiplying the present wage rate by necessary work time foregone in retraining. We then take the ratio of training cost to net worth, the assumption being that the worker finances his retooling out of his own resources.

The final variable we examine in this study is expected lifetime earnings lost due to unemployment. If time spent unemployed was completely unproductive, i.e., contained no element of leisure or investment in search activity, the worker would be indifferent, cet. par., between two occupations, one offering $1 more in the present value of

[9] Net worth is defined as cashable net worth, including the value of consumer durables and excluding the value of human capital.

future full-time earnings, the other offering \$1 less in expected earnings foregone due to unemployment. We could then subtract expected earnings foregone due to unemployment (net of unemployment insurance) from expected full time earnings and use expected wage income as the focus of study. If, however, the measured unemployment includes a component of leisure or search, the time spent unemployed is valuable and the worker will require less than a \$1 decrease in relative expected earnings foregone due to unemployment to be indifferent to an occupation with a \$1 larger lifetime full-time earnings potential. We have therefore separated these two components of expected income in order to attempt to test this hypothesis. We estimate the expected duration of unemployment in a manner analogous to our procedure to estimate wages.[10] We thus get an estimate of the expected unemployment facing a potential worker in each occupation, and how this unemployment varies by age. Following the procedure described above for potential earnings, we estimate the present value of potential earnings lost due to unemployment by using a formula similar to (3) in all but two respects. We replace H_t, hours available for work in year t, with u_t, expected hours lost due to unemployment and we replace w_t, the wage, by $(w_t - I_t)$, the wage net of the hourly equivalent of unemployment insurance.[11]

[10] 1966 was a year of relatively full employment. Projecting unemployment over the life cycle based on this data is the most reasonable procedure available to us, but could result in misestimation as relative unemployment by occupation varies over the business cycle.

[11] Unemployment insurance is based on 1966 figures, and assumed to grow at the rate for the 1960-70 period.

Table 1 presents our evidence on the relative weights given to earnings, unemployment and training costs. The results for all population subgroups confirm our a priori expectations from human capital theory that: 1) workers will tend to choose those occupations with the highest discounted present value of potential future earnings; 2) workers will tend to choose those occupations where retraining costs, in relation to net worth, are lowest; and 3) workers will tend to choose those occupations where, cet. par., the discounted present value of expected earnings foregone due to unemployment is lowest.[12]

All effects have the expected sign and almost all are measured quite precisely.[13]

The most striking result is that white males tend to weight training costs and expected income foregone due to unemployment relative to expected full-time earnings much less heavily than the other groups. This is consistent with the hypotheses of differential access to financing of training and education costs and of differential risk aversion.

It is instructive to examine the ratio of the coefficients for expected full-time earnings and expected earnings foregone due to unemployment. This figure varies markedly by race and sex. The expected earnings foregone due to unemployment does not appear to exert much of an influence on white males. The price ratio of trading one dollar in

[12] The predicted probabilities for adopted occupations ranged up to three times the predicted probabilities if random behavior was observed (probabilities equal to the percentages of jobs in each occupation).

[13] The results are similar when the training cost variable is left out of the equation. These results are available upon request from the author. It also should be pointed out that the likelihood ratio method may be used to test hypotheses about the coefficients.

Table 1

Relative Weights of Potential Earnings, Training Costs and Foregone Earnings Due to Unemployment in the Conditional Logit Decision Model

Estimate No.	Population Group	Variables Included	Estimate of θ ($x10^{-2}$)	Standard Deviation* ($x10^{-2}$)	Likelihood L ($x10^{2}$)
1	White Males	Present Value of Potential Earnings	1.084	0.075	-54.15
		Training Cost/Net Worth	-0.001	0.001	
		Present Value Time Unemployed	-0.051	0.090	
2	Black Males	Present Value of Potential Earnings	0.072	0.013	-44.64
		Training Cost/Net Worth	-0.010	0.001	
		Present Value Time Unemployed	-4.35	0.567	
3	White Females	Present Value of Potential Earnings	0.875	0.076	-47.07
		Training Cost/Net Worth	-0.005	0.002	
		Present Value Time Unemployed	-18.74	1.609	
4	Black Females	Present Value of Potential Earnings	0.378	0.132	-33.40
		Training Cost/Net Worth	-0.012	0.002	
		Present Value Time Unemployed	-20.78	1.82	

Source: Based on twenty-five hundred randomly selected observations from each population group from the 1967 Survey of Economic Opportunity.

*Convergence was obtained after approximately twenty iterations; standard deviations reported are from the last iteration.

full-time earnings for twenty dollars in decreased earnings foregone due to unemployment suggests (perhaps) that measured unemployment for white males includes a not insignificant amount of voluntarily enjoyed productive activity -- for example, leisure or job search. For the other population subgroups -- females, many of whom work part-time and/or on and off throughout their lifetime, and black males, the price ratio is reversed. For example, white females appear to be willing to trade a dollar less in foregone earnings due to unemployment for twenty dollars of full-time earnings. This strongly hints of risk-aversion or non-pecuniary costs involved in white female unemployment.

These estimates of the weights given to various occupation parameters may now be used to estimate the effects of changes in these parameters on occupational choice. To one example of such change, that occasioned by a wage subsidy, we now turn.

3. Wage Subsidies

The idea of a wage subsidy has been offered as an alternative income maintenance program to the negative income tax, especially by those concerned over the labor supply disincentives of a negative income tax. The idea is simple, but less familiar than the NIT. The wage subsidy program would supplement the wage rate employers are willing to pay low-wage workers by a government grant, e.g. in the form of a negative payroll tax. The government would define a target wage rate, W^* , and pay the employee a certain percentage, r , of the difference between W^* and the market wage, w . Analytically, the wage subsidy results in a[14]

$$\bar{w} = w + r (W^* - w) ,$$

where $\bar{w}$ is the wage inclusive of the subsidy component.

It is important to note that, with a fixed target wage and sharing rate, the subsidy not only raises those wage rates below the target, but it also results in a greater absolute and relative increase the lower the wage. Thus, the wage subsidy makes the low wage occupatons relatively more attractive. An example of this equalization effect is presented in Table 2, where we examine the effect of a wage subsidy with a target wage of $4 and a sharing rate of 1/2.[15]

---

[14] We assume that this "negative payroll tax" will be "borne" by the worker; the argument is analogous to the case of the payroll tax being borne by workers. See Brittain [1972].

[15] Of course, this effect is accentuated as r or W^* increases.

Table 2

Effect on Wages of a

Wage Subsidy With $W^* = \$4$ and $r = 1/2$

Wage Before Subsidy	Wage Inclusive of Subsidy
$1.00	$2.50
1.50	2.75
2.00	3.00
2.50	3.25
3.00	3.50
3.50	3.75
4.00	4.00

Thus, such a subsidy program substantially increases the expected lifetime earnings in low-wage occupations.[16]

The wage subsidy also affects our other two variables. By raising wage rates it increases the foregone income during a period of training to change occupations. Hence, training costs will increase for persons facing a wage below the target wage. The subsidy also raises the opportunity cost of time spent unemployed and expected income lost due to unemployment.

Table 3 presents an example of the present value of lifetime full-time earnings, training costs and value of income lost due to

[16] It can also have an important income effect on human capital investment and hence future wage rates. Recall we are conditioning on current education. To the extent the subsidy fosters an increase in general (as opposed to the type specific to an occupation) human capital investment, our results will understate its long-run effect.

unemployment for each of eleven broad occupational groups[17] before and after the imposition of a wage subsidy program with $W^* = \$4$ and $r = 1/2$. It is clear that the subsidy substantially alters each of these three variables influencing occupational choice. The greater relative change for blacks and females occurs due to their lower market wages. Obviously, these groups benefit most from the wage subsidy plan.

[17] The classic discussion on occupational wage differentials is, of course, Reder [1955].

Table 3

Effects of Wage Subsidy on Occupation Attributes

	PVLE	PVLEPS	TC/NW	TC/NW PS	YLU	YLUPS
White Males						
Professional/Technical	217.9	226.5	16.9	21.6	12.1	12.5
Farmer	142.4	188.8	7.9	10.1	7.9	10.5
Manager	226.1	232.2	16.4	21.0	12.5	12.9
Sales	183.6	209.4	3.0	3.9	10.2	11.6
Craftsman	201.9	218.5	10.3	13.2	11.2	12.1
Operative	171.7	203.4	3.8	4.9	9.5	11.3
Private Household	128.9	182.0	3.6	4.6	7.1	10.1
Service	156.2	195.6	3.5	4.5	8.7	10.8
Farm Labor	118.7	176.9	4.4	5.7	6.6	9.8
Laborer	158.8	197.0	1.7	2.2	8.8	10.9
Clerical	185.5	210.3	2.6	3.3	10.3	11.6
Black Males						
Professional/Technical	206.5	220.8	18.2	22.3	19.8	21.2
Farmer	142.7	188.9	8.5	10.4	13.7	18.1
Manager	191.6	213.3	17.7	21.7	18.4	20.5
Sales	146.7	190.9	3.3	4.1	14.1	18.3
Craftsman	185.3	210.2	11.1	13.6	17.8	20.2
Operative	161.6	198.4	4.1	5.1	15.5	19.0
Private Household	123.3	179.2	3.9	4.8	11.8	17.2
Service	141.5	188.3	3.8	4.6	13.6	18.1
Farm Labor	104.0	169.5	4.8	5.8	10.0	16.3
Laborer	153.6	194.3	1.8	2.2	14.7	18.7
Clerical	181.7	208.4	2.8	3.4	17.4	20.0

Table 3 (continued)

	PVLE	PVLEPS	$\frac{TC}{NW}$	$\frac{TC}{NW}$ PS	YLU	YLUPS
White Females						
Professional/Technical	158.1	196.6	14.2	20.3	3.0	3.8
Farmer	90.1	162.6	6.6	9.5	1.7	3.1
Manager	146.2	190.7	13.8	19.7	2.8	3.7
Sales	103.5	169.2	2.6	3.7	2.0	3.3
Craftswoman	124.4	179.7	8.6	12.4	2.4	3.5
Operative	120.2	177.7	3.2	4.6	2.3	3.4
Private Household	69.8	152.4	3.0	4.3	1.3	2.9
Service	99.7	167.4	2.9	4.2	1.9	3.2
Farm Labor	78.4	156.7	3.7	5.3	1.5	3.0
Laborer	106.8	171.0	1.4	2.0	2.1	3.3
Clerical	138.4	186.8	2.2	3.1	2.7	3.6
Black Females						
Professional/Technical	168.5	201.8	13.5	19.9	5.3	6.4
Farmer	130.0	182.6	6.3	9.3	4.1	5.8
Manager	143.7	189.4	13.1	19.4	4.5	6.0
Sales	100.6	167.8	2.5	3.6	3.2	5.3
Craftswoman	116.7	175.9	8.2	12.1	3.7	5.6
Operative	109.4	172.3	3.1	4.5	3.5	5.4
Private Household	73.9	154.5	2.9	4.3	2.3	4.9
Service	99.7	167.4	2.8	4.1	3.1	5.3
Farm Labor	76.9	156.0	3.5	5.2	2.4	4.9
Laborer	94.8	165.0	1.3	2.0	3.0	5.2
Clerical	130.0	182.6	2.0	3.0	4.1	5.8

Source: Calculated from data generated as described above.

N.B. All variables for persons 21 years of age, assumed to work until 65, non-unionized, high school graduates in the urban west.

PVLE: present value of lifetime, full-time, earnings.

$\frac{TC}{NW}$: ratio of training cost to net worth.

YLU: present value of expected income lost due to unemployment.

PS: post-subsidy estimate.

4. Empirical Estimates of the Effect of a Wage Subsidy On Occupational Choice

We may now apply the weights estimated in Table 1 to the changes reported in Table 3 in lifetime earnings, income lost due to unemployment and training cost induced by the wage subsidy scheme. Table 4 presents these estimates. As should be evident from the discussion above, the wage subsidy (with a $4 target wage and a 50% sharing rate) substantially alters the estimated occupation selection probabilities in favor of low-wage occupations. The change in selection probabilities, however, varies markedly by race and sex. The change in probability depends upon both the change in the variables such as lifetime earnings <u>and</u> the relative weights given these variables in the selection process. Referring back to Table 1, we recall that white men and women place relatively greater weight on expected lifetime earnings than blacks of the same race and that females place relatively greater weight on expected earnings foregone due to unemployment than do males of the same race. Hence, for examples, the greater relative change in lifetime earnings for black males than white males (due to a lower market wage) is offset by the greater weight attached to lifetime earnings by whites.

The selection probabilities change most markedly for white men. For example, the selection probabilities for operatives, service and farm laborer increase by fourteen, twenty-four and fifty-two percent of their pre-subsidy probabilities, respectively. For black females, on the other hand, these three occupations are less likely to be chosen, since the wage subsidy dramatically increases the (heavily, and negatively, weighted) value of expected earnings foregone due to unemployment.

Table 4

Estimates of the Effect of a Wage Subsidy On Selection Probabilities

Occupation	White Males No Subsidy	White Males With Subsidy	White Males % Change	Black Males No Subsidy	Black Males With Subsidy	Black Males % Change
Professional/Technical	14.0%	12.4%	-11%	7.6%	8.3%	9%
Farmer	6.2	8.3	34	9.5	9.3	-2
Manager	15.3	13.2	-14	8.0	8.6	8
Sales	9.7	10.3	6	9.4	9.3	-1
Craftsman	11.8	11.4	-3	8.2	8.7	6
Operative	8.5	9.7	14	8.9	9.0	1
Private Household	5.3	7.7	45	10.2	9.6	-6
Service	7.2	8.9	24	9.6	9.4	-2
Farm Labor	4.8	7.3	52	10.9	10.0	-8
Laborer	7.4	9.0	22	9.2	9.2	0
Clerical	9.9	10.4	5	8.3	8.7	5

Occupation	White Females No Subsidy	White Females With Subsidy	White Females % Change	Black Females No Subsidy	Black Females With Subsidy	Black Females % Change
Professional/Technical	11.4	10.2	-11	7.8	8.3	6
Farmer	8.0	8.6	8	8.7	8.9	2
Manager	10.7	9.9	-8	8.3	8.9	7
Sales	8.6	8.9	4	9.4	9.3	-1
Craftswoman	9.6	9.4	-2	9.0	9.0	0
Operative	9.4	9.3	-1	9.2	9.1	-1
Private Household	7.2	8.1	13	10.1	9.6	-5
Service	8.4	8.8	5	9.4	9.3	-1
Farm Labor	7.6	8.3	9	10.0	9.6	-4
Laborer	8.7	8.9	2	9.5	9.3	-2
Clerical	10.3	9.7	-6	8.7	8.9	2

Source: Calculated from data presented in Tables 1 and 3.

The results suggest a substantial shift in the supply of workers to different occupations in response to the wage subsidy program.[18] The response of selection probabilities to the wage subsidy program depends both upon its effect on the variables influencing occupational choice and on their relative weights; since both the occupation attributes and the weights vary among the four race-sex groups, the net effect of the wage subsidy on the probability of selecting various occupations varies markedly race and sex.

---

[18] This will in turn alter the occupational wage structure, which will have a second-round effect on selection probabilities. We do not estimate these effects here.

5. Conclusion

We have estimated the effect of a wage subsidy on the choice of occupation by various worker subgroups. Since the wage subsidy affects the present value of lifetime earnings, the present value of income foregone due to unemployment and training costs, it affects the probability of selection of each occupation. The net effect varies across occupation for each individual, since the subsidy induces a greater increase in wages the lower the prevailing wage. It also varies by race and sex, because both the variables influencing occupational choice and the relative weights given to each of them in choosing occupations vary among the four race and sex groups.

REFERENCES

Block, H. and J. Marschak, "Random Orderings and Stochastic Theories of Responses," in I. Olkin, et. al., Contributions to Probability and Statistics: Essays in Honor of Harold Hotelling, Stanford, 1960.

Boskin, M., "The Economics of the Labor Supply," in G. Cain and H. Watts, eds., Labor Supply and Income Maintenance, Markham, 1973.

_________, "Unions and Relative Real Wages," American Economic Review, June 1972.

_________, "A Conditional Logit Model of Occupational Choice," forthcoming in Journal of Political Economy, March 1974.

Brittain, J., The Payroll Tax For Social Security, Brookings Institution, 1972.

McFadden, D., "The Revealed Preferences of a Government Bureaucracy," Technical Report No. 17, Economic Growth Project, University of California, Berkeley, 1968.

Reder, M., "The Theory of Occupational Wage Differentials," American Economic Review, 1955.

Scoville, J., "Education and Training Requirements for Occupations," Review of Economics and Statistics, November 1966.

Theil, H., "A Multinomial Extension of the Linear Logit Model," International Economic Review, October 1969.