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MALE-FEMALE DIFFERENCES IN WAGES AND EMPLOYMENT: A SPECIFIC HUMAN CAPITAL MODEL

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CHAPTER 1

Introduction

The labor force activity of women has changed dramatically during the postwar period. Between 1940 and 1971 the labor force participation rates of women rose from 27.4 per cent to 42.5 per cent. Since 1960, over 60 per cent of the increase in the total labor force is accounted for by women, and 72.3 per cent of that proportion by married women. This rapid increase in labor force participation has brought into sharp relief the different patterns of employment and compensation existing between men and women in the American labor market. The greater part of the increase in women workers between 1960 and 1971 were absorbed into a single major occupation group: clerical workers. In 1971, more than one out of three female workers was in a clerical occupation; more than 50 per cent were either clerical or service workers. There is no comparable occupational concentration for male workers.

Hand-in-hand with the large disparity in occupational distribution between men and women is the existence of differential earnings. In 1971 median weekly earnings for full-time wage and salary workers were $162 for males, $100 for females. Much of this difference in earnings can be accounted for by the different occupational distributions of men and women; women tend to be concentrated in lower paying occupations. However, differential wages exist by detailed occupational classification as well.

The most commonly alleged forces behind sex differences in occupational distribution and compensation is discrimination, by employers, workers, and consumers. Legislation[1] has been passed and government agencies established to combat discrimination through the legal system.

Economists have also focused much of their efforts in the area of wage and employment differences by sex on identifying and measuring discrimination. Henry Sanborn[2] implicitly defined discrimination as unequal pay for equal work in his paper investigating earnings differentials. Standardizing male and female earnings by occupational distribution and hours worked, he still found approximately a 24 per cent differential between men and women, using 1950 Census data and Bureau of Labor Statistics occupational surveys. However, he was able to isolate employment within given plants for a subset of male and female operatives, and found that within plant standardized earnings differentials were less than 10 per cent on average. He concluded that his results were compatible with the existence of employee or consumer discrimination but not discrimination against women by employers.

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[1]For example:

a. The Equal Pay Act of 1963, which requires equal pay for equal work.

b. Title VII of the Civil Rights Act of 1964 which bars discrimination in employment on the basis of race, color, sex, or national origin.

c. Executive Order 11246 of 1965, as amended by Executive Order 11375 of October, 1967, which bars discrimination by federal contractors.

[2]Henry Sanborn, "Pay Differences between Men and Women," Industrial and Labor Relations Review, Volume 17, July 1964.

Victor Fuchs[3] came to a similar conclusion in his work on hourly wage differentials between males and females. He found that the relative hourly wage of females could be raised by only one percentage point, from 60 to 61 per cent of the male hourly wage, by adjusting for color, schooling, age, and city size, and by an additional five points to 66 per cent by adjusting further for marital status, class of worker, and length of trip to work. This finding suggests that differences in labor "quality" or ability play a very small role in determining differential compensation. However, his work presents evidence counter-indicative of employer discrimination. For example, he finds self-employment to have a significant negative partial effect on the relative hourly earnings of females, which is contrary to the implication of the employer discrimination hypothesis. Nevertheless, Fuchs concludes that his results are compatible with the existence of discrimination by coworkers or consumers.

Ronald Oaxaca[4] attempted to identify the effect of discrimination on hourly earnings of women analysing data from the 1967 Survey of Economic Opportunity. His assumption is that discrimination is manifested through employers paying men and women differently for their personal market characteristics. By estimating an hourly earnings function for individuals of four sex-race categories, he found that discrimination accounted for more than 75 per cent of the average wage differential

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[3] Victor Fuchs, "Differences in Hourly Earnings Between Men and Women," Monthly Labor Review, Volume 94, No. 5, May 1971.

[4] Ronald Oaxaca, "Sex Discrimination in Wages," (paper presented at the Conference on Discrimination in Labor Markets, October 1971.)

between white males and white females, and for at least 88 per cent of the differential between black males and black females.

The error in this effort is that at no time did Oaxaca attempt to determine the behavioral causes of different coefficients for males and females in the earnings function other than discrimination.

More recent work by economists has focused on the fact that significant differences in the labor market behavior of males and females exist which could give rise to differentials even in the absence of discrimination by employers, consumers, or coworkers. The unique roles of men and women within marriage and the family imply different patterns of participation in the market and different investment in market oriented skills. Despite the rapid increase in labor force participation of women, their participation rates remain much lower than those of men.[5]

Fuchs also considers the effects of these forces in his paper. The 1960 Census One-in-One-Thousand Sample does not include direct data on labor turnover of males and females. However, the sharp decrease in relative earnings with increasing age suggests to Fuchs that "much of the overall differential is related to the more casual attachment of wommen to the labor force and to sex differences in post-school investment."

Solomon Polachek[6] estimates the effect that anticipated intervals

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[5]Significant contributions to the understanding of female labor supply behavior were made by Jacob Mincer in "Labor Force Participation of Married Women," Aspects of Labor Economics, Universities-National Bureau of Economic Research Conference Series 15 (Princeton: Princeton University Press, 1962), by Glen Cain in Married Women in the Labor Force (Chicago: University of Chicago Press, 1965), and by William Bowen and T. Aldrich Finegan in The Economics of Labor Force Participation (Princeton: Princeton University Press, 1969).

[6]Solomon Polachek, "Work Experience and the Difference Between Male and Female Wages" (Unpublished Ph.D. dissertation, Columbia University, 1973).

out of the labor force have on optimal post-school human capital investments made by women, and therefore on their earnings. He employed education-, marital status-, age- and sex-specific labor force participation rates to estimate the optimal volume of human capital investment for married-once, spouse-present males and females, and single, never married males and females. Using these expected capital measures as independent variables in the earnings function in place of the usual exposure terms results in the reduction of the discrimination coefficient, here defined as the coefficient of a dummy regressor which takes the value one if the individual is a female and zero for a male, by about 80 per cent for married-once, spouse-present males and females, the group for which the earnings differential is the largest.

In an extension of Polachek's analysis, Mincer and Polachek[7] measure the depreciation effect that intermittent periods of labor force withdrawal have on the woman's human capital stock, which is an additional depressant to female earnings. They use data from the National Longitudinal Survey of Work Experience for Women, 30-44, which permits isolating periods of market activity and of market withdrawal for individual women. By estimating earnings functions for women, segmenting their work histories into periods of market work and home work, they find significant depreciation of earnings for married women caused by periods out of the labor force. Mincer and Polachek estimate that the segmented pattern of participation of women, through its implications for both human capital investment and depreciation, accounts for about

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[7]Jacob Mincer and Solomon Polachek, "Family Investments in Human Capital: Earnings of Women," forthcoming Journal of Political Economy.

50 per cent of the observed earnings differential between married men and married women, the group for whom the earnings differential is the largest.

Differential labor force turnover patterns between males and females affect not only self-financed human capital accumulation and depreciation, but also imply differential incentives to the firm to invest in firm-specific training of males and females. Clearly, if females are expected to have higher firm-leaving rates than males, they represent a less desirable investment. Table 1 presents data on median year on current job by sex and major occupation group, for the years 1951, 1963, 1966, and 1968. We can get some idea of the magnitude of these differences in terms of turnover rates by employing the assumption that the underlying turnover rates are constant each year. These statistics are presented in Table 2. Tables 1 and 2 show a pattern of increasing turnover rates for both men and women in the period 1963-68, during the upturn of the business cycle. Because of the expected pattern of quit and layoff rates[8] over the business cycle, this increase can be interpreted as being due solely to increasing quit rates. Table 2 reveals that with the increase in turnover of both males and females in this period, the difference in turnover rates has increased both absolutely and relatively. Part of this increase may be due to the differential incidence of layoff during this period. Men, as primary workers, are embodied with more specific investment than women, and so their layoff rate will decline relative to females over the business cycle. In the postwar period, a significant part of the increase in

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[8]Donald Parsons, "Specific Human Capital: Layoffs and Quits" (unpublished Ph.D. dissertation, University of Chicago, 1970).

Table 1

Median Years on Current Job by Sex and Major Occupational Group 1951, 1963, 1966, 1968

	Males				Females			
	1951[a]	1963[b]	1966[c]	1968[d]	1951[a]	1963[b]	1966[c]	1968[d]
All Occupations:	3.9	5.7	5.3	4.2	2.2	3.0	2.8	2.1
Professional, Technical and Kindred Workers:	4.3	5.4	5.3	4.6	2.5	3.7	3.5	2.8
Managers, Officials, and Proprietors:	5.3	8.4	8.2	7.5	4.2	5.8	6.5	5.8
Clerical and Kindred Workers:	3.9	5.3	5.0	4.4	2.5	3.0	2.7	2.2
Sales Workers:	2.6	3.5	3.3	3.2	1.6	2.9	2.2	1.8
Craftsmen and Kindred Workers:	4.3	6.9	7.0	5.8	4.2	4.8	6.4	5.4
Operatives:	3.1	5.1	4.3	3.8	2.3	4.1	3.4	2.8
Service Workers, N.i. Private Household.	2.9	3.6	3.3	2.9	1.2	1.9	1.8	1.7
Laborers, N.i. farm and Mine:	1.6	2.5	1.8	2.1	...	...	2.2	2.8

Source: a) U.S., Department of Commerce, Bureau of the Census, Current Population Report #36, Series P-50, "Experience of Workers at Their Current Job, January 1951."

b) U.S., Department of Labor, Bureau of Labor Statistics, Special Labor Force Report #36, "Job Tenure of American Workers, January 1963."

c) U.S., Department of Labor, Bureau of Labor Statistics, Special Labor Force Report, "Job Tenure of Workers, January 1966."

d) U.S., Department of Labor, Bureau of Labor Statistics, Special Labor Force Report #112, "Job Tenure of Workers, January 1968."

Table 2

Turnover Rates Estimated from Job Tenure Data by Sex and Major Occupational Group for 1951, 1963, 1966, 1968

	Males							
	1951	1963	1966	1968	1951	1963	1966	1968
All Occupations:	.394	.340	.350	.383	.484	.434	.445	.492
Professional, Technical and Kindred Workers:	.380	.348	.350	.370	.463	.407	.410	.441
Managers, Officials, and Proprietors:	.350	.291	.293	.305	.383	.338	.323	.338
Clerical and Kindred Workers:	.394	.350	.358	.376	.463	.434	.451	.484
Sales Workers:	.457	.410	.419	.424	.538	.440	.484	.518
Craftsmen and Kindred Workers:	.380	.315	.313	.338	.383	.364	.325	.348
Operatives:	.429	.355	.380	.398	.463	.387	.415	.445
Service Workers, n.i. Private Household:	.440	.406	.419	.440	.587	.509	.518	.527
Laborers, n.i. farm and Mine:	.538	.463	.518	.492	...	.516	.484	.445

These figures are constructed from the data in Table I in the following manner: Assume median years of workers on the job is equal to average job tenure and that the underlying turnover rates 1-p, where p is the proportion of the work force remaining on the job from one year to the next, are the same for each year. Then

$$d = \text{mean number of years on job} = 1p + 2p^2 + 3p^3 + 4p^4 + \dots$$
$$= p(1 + 2p + 3p^2 + 4p^3 + \dots)$$
$$= p\frac{\partial}{\partial p}(p + p^2 + p^3 + p^4 + \dots)$$
$$= p\frac{\partial}{\partial p}[p/(1 - p)]$$
$$= p/(1 - p)^2$$

and p can be derived from the expression: $(1 - p)^2 d + (1 - p) - 1 = 0$

the female labor force was due to the entrance of older married women, who may have found employment in occupations or industries which have lower skill requirements and therefore higher turnover rates.[9] Age-specific tenure data is also available for the years 1951, 1963, 1966, and 1968, and presented in Table 3. These data are then converted into the turnover data presented in Table 4. Table 5 shows the absolute and relative differences in turnover rates increasing during the period 1963 to 1968 within age-specific categories, for the prime labor force age categories. The relationship is reversed for new entrants, aged 20-24, where females have lowere job leaving rates than males, but increases for older cohorts.

This paper analyzes the effects of differential turnover patterns and the existence of firm specific training, jointly financed by employer and employee, on male-female wage and employment differentials. Chapter 2 presents a model of a firm that invests in the training of its workers, where employee turnover represents depreciation on human capital. Differences in the turnover rates of men and women is shown to be an important determinant of the incentive to the employer to hire and train women as well as men. The empirical implications of the model for the relative wage and occupational distribution of women are contrasted with those derived from a model of general human capital investment. Chapter 3 outlines the problems involved in empirical formulation of the model, the choice of the unit of observation for empirical testing, and data limitations, and presents the results of empirical testing

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[9] Parsons, *ibid*.

Table 3

Median Years on the Job by Age and by Sex
1951, 1963, 1966, 1968

	1951[a]		1963[b]		1966[c]		1968[d]	
AGE	M	F	M	F	M	F	M	F
14-17	0.8	0.5	0.7	0.6	0.6	0.6	0.5	0.5
18-19	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5
20-24	1.2	1.4	1.0	1.1	1.0	1.1	0.8	1.6
25-34	2.8	1.8	3.5	2.0	3.2	1.9	2.8	1.4
35-44	4.5	3.1	7.6	3.6	7.8	3.5	6.9	2.9
45-54	7.6	4.0	11.4	6.1	11.5	5.7	11.3	5.1
55-64	9.3	4.5	14.7	7.8	15.8	9.0	14.8	8.7
65+	10+	4.9	16.6	8.8	15.5	11.2	13.5	10.0

Source: a) U.S., Department of Commerce, Bureau of the Census, Current Population Report #36, Series P-50, "Experience of Workers at Their Current Job, January 1951."

b) U.S., Department of Labor, Bureau of Labor Statistics, Special Labor Force Report #36, "Job Tenure of American Workers, January 1963."

c) U.S., Department of Labor, Bureau of Labor Statistics, Special Labor Force Report, "Job Tenure of Workers, January 1966."

d) U.S., Department of Labor, Bureau of Labor Statistics, Special Labor Force Report #112, "Job Tenure of Workers, January 1968."

Table 4

Turnover Rates by Age and by Sex,
1951, 1963, 1966, 1968

AGE	1951		1963		1966		1968	
	M	F	M	F	M	F	M	F
14-17	.656	.732	.678	.703	.703	.703	.732	.732
18-19	.703	.703	.732	.732	.732	.732	.732	.732
20-24	.587	.560	.618	.602	.618	.602	.656	.538
25-34	.445	.518	.410	.500	.424	.509	.445	.560
35-44	.373	.429	.303	.406	.300	.410	.315	.440
45-54	.303	.390	.256	.331	255	.340	.257	.355
55-64	.279	.373	.229	.300	.222	.282	.228	.286
65+	.270	.361	.217	.285	.224	.257	.238	.270

The figures presented in this table are constructed from the data presented in Table 3 in the same manner as the figures presented in Table 2 constructed from the data in Table 1. This method is explained in the footnote to Table 2.

Table 5

Absolute and Per Cent Differences in Turnover Rates
Between Males and Females, By Age, 1951, 1963, 1966, 1968

	1951		1963		1966		1968	
AGE	abs. diff	% diff*	abs. diff	% diff*	abs. diff	% diff*	abs. diff	% diff*
14-17	0.076	11.6	0.025	3.7	0.000	0.0	0.000	0.0
18-19	0.000	0.0	0.029	4.1	0.000	0.0	0.000	0.0
20-24	-0.027	-.05	-0.016	-2.6	-0.016	-2.6	-0.118	-18.0
25-34	0.073	16.4	0.090	22.0	0.085	20.0	0.115	25.8
35-44	0.056	15.0	0.103	34.0	0.110	36.7	0.125	39.7
45-54	0.090	28.7	0.075	29.3	0.085	33.3	0.098	38.1
55-64	0.094	33.7	0.071	31.0	0.060	27.0	0.058	25.4
65*	0.091**	33.7**	0.068	31.3	0.033	14.7	0.032	13.4

* % differential = (abs. diff)/$(1-p_t)$

** These figures were estimated by assuming average job tenure of males 65 years and older in 1951 was 10 years.

of the model on aggregate occupational data for males and females from the 1967 Survey of Economic Opportunity. In Chapter 4, the model is applied to occupational data from the 1967 Survey of Economic Opportunity for black and white men as an additional test of its applicability and empirical power. Chapter 5 summarizes the empirical findings and conclusions of the paper.

CHAPTER 2

A Model of Specific Human Capital Investment in Workers: Implications for the Relative Wage and Occupational Distribution of Women

I. The Model

The framework of analysis is a model of the firm which produces two outputs: X, a final good to be marketed, and T*, skilled labor, an intermediate input into the production of X.

$$X = X(T^*) \tag{1}$$
$$T^* = q^{\alpha} T_t$$

The output of X is defined by a production function for each period using a single input, T^*_t, and subject to constant returns to scale. Skilled labor, T^*_t, is produced by a Cobb-Douglas production function involving two inputs: T, which is conventional labor, or bodies, and q, the number of units of human capital investment embodied in each of the T workers. α is a measure of the elasticity of the "effectiveness" of labor with respect to training. The only restriction on α is that it be non-negative; this goes one step beyond the convention of defining skilled labor as the quantity invested per conventional laborer multiplied by the number of laborers (i.e., $\alpha = 1$).

The firm is subject to labor turnover, so that

$$T_t = P_t T_{t-1} + I_t \ . \tag{2}$$

T_t, the stock of workers during a given period t in the firm's life, is equal to the proportion of workers who remained on the job from period t-1, T_{t-1}, plus I_t, workers hired and trained in period t.

The firm can affect p_t, the proportion of workers remaining on the job from one period to the next, by offering a wage rate somewhat higher than the alternative wage of the employees. To the extent that the employer has financed the human capital investment in his workers, he will seek to share the costs and returns of this investment in order to reduce labor turnover to the firm.[10] I.e.,

$$p_t = p(W_t; W_A); \frac{\partial p_t}{\partial W_t} > 0 \qquad (3)$$

where W_t is the per period compensation of the T_t workers, and W_A is their highest alternative wage.

Human capital investment per worker, q, is produced at a cost to the firm. We assume increasing marginal cost of investment per worker: marginal costs increase with the intensity of investment. In addition, hiring of new workers, I_t, involves search costs to the firm. If costs of search increase with the number of new workers to be hired, then the cost function per worker of hiring and training new workers can be expressed as

$$C_t = C(q_t, I_t) \qquad (4)$$

where $C_1 = \frac{\partial C}{\partial q} > 0$ and $C_2 = \frac{\partial C}{\partial I} > 0$. C, as defined in expression (4) is essentially a price to the firm for each worker it hires and trains, which increases with the number hired and the intensity of training. Total cost per period of hiring and training I_t workers is equal to $C(q_t, I_t)\ I_t$.

The present value of the firm's total return to investment and production over time can be written as

$$\pi = \Sigma(\frac{1}{1+r})^t\ [kX(q_t^{\alpha}\ T_t) - W_tT_t - C(q_t, I_t)\ I_t]\ . \qquad (5)$$

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[10] D. Parsons, Ibid.; M. Kuritani, "Specific Training, Employment Stability and Earnings Distribution in Japan" (unpublished Ph.D. dissertation, Columbia University, 1973).

K is the market price of the firm's output X, assumed to be constant over time, and r is the discount rate faced by the firm.[11] The employer seeks to maximize π subject to

$$T_t = p_t T_{t-1} + I_t \tag{6}$$

$$p_t = p(W_t; W_A)$$

with respect to the variables he controls: W_t, q_t, and I_t.

In order to simplify the optimization problem, let us assume that labor market conditions are not expected to change over firm life, so that optimal values of W_t, I_t, q_t, and therefore p_t are the same for all t. Then

$$T = \frac{1}{1-p} \cdot I \tag{7}$$

and output of X is constant for all t. Expression (5) can be rewritten as

$$\pi = \Sigma\left(\frac{1}{1+r}\right)^t \left[kX\left(q^\alpha \frac{1}{1-p} I\right) - W \frac{1}{1-p} I - C(q, I) I\right] . \tag{8}$$

The employer wishes to maximize π, as expressed in (8), subject to the new constraint

$$p = p(W; W_A) . \tag{9}$$

First order conditions for a maximum are:

C-1 $\quad \frac{1}{r(1-p)} (kMP_q^\alpha - W) - C_2(q, I) - C(q, I) \leq 0; = 0 \text{ or } I = 0$

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[11] Infinite firm life is assumed in order to avoid explicit consideration of the scrap value of the firm at the end of the firm's life. This assumption is not unreasonable in that at the end of the employer's life he is free to sell the firm. The sale price will depend on the path the firm is on: the way to assure maximum sale price in this model is to assume an infinite firm life.

C-2 $\frac{k}{r(1-p)} MP_q \alpha - 1 \; I - C_1(q, I) \leq 0; = 0 \text{ or } q = 0$

C-3 $\frac{1}{1-p} I + \lambda \frac{\partial p}{\partial w} \leq 0; = 0 \text{ or } W = 0$

C-4 $- p + p(W; W_A) \leq 0; = 0 \text{ or } \lambda = 0$

λ is the Lagrangian multiplier associated with a constrained maximum of this type, and is equal to the shadow price of p in this problem. $MP = \frac{\partial X}{\partial T^*}$, the marginal product of skilled labor in the production of x.

Condition C-1 simply states that in equilibrium, the increment in present value of revenue from an additional person hired and trained must equal the marginal cost of hiring and training him. C-2 states that the increment in present value of revenue from investing an additional unit of training in each worker must just equal the marginal cost of investment. C-3 states that at the margin, the value of a decrease in turnover rates induced by an increase in wage rate must just equal the additional wage cost required to induce it. These are the marginal revenue must equal marginal cost conditions of profit maximization. C-4 simply requires that turnover rates may not be lower than the firm "production function" of turnover rates permits.

Let us now introduce the difference between male and female workers into the model. Assuming men and women to be perfect substitutes in production, there may still be differential returns to the employer from training them because of differential turnover rates, i.e., it is expected that over some range of wages $p_f < p_m$. Assume a cost curve per worker of the form

$$C(q_f, I_f) = W_{of} + aq_f + b/2q_f2 + cI_f \qquad (10)$$

$$C(q_m, I_m) = W_{om} + aq_m + b/2q_m2 + cI_m \ .$$

Except for W_{of} and W_{om}, the training period wages for males and females, the functional form of the curve for males and females is identical, while the level attained depends on the number hired and the quantity invested per worker. W_{of} and W_{om} are assumed different, since it is often presumed that women may buy their way into training by taking a lower wage during the training period, thus compensating the firm for their higher turnover rates. We assume that in searching for labor, the employer is searching in two distinct pools, male and female, for workers of a certain quality. There is some distribution of quality among workers in each pool. If the cost of search per worker of given quality increases with the intensity of search within each pool, the employer's least cost policy would be to search in both pools, i.e., hire both males and females. We assume that these costs will rise at an equal rate in both pools. However, it would be possible to postulate them rising at different rates, $c_f \neq c_m$, and introduce an additional distinction between males and females into the model.

When we introduce the distinction between males and females into the model, the decision is to maximize

$$\pi = \Sigma(\frac{1}{1+r})^t \ [kX(q_f^\alpha \frac{1}{1-p_f} I_f + q_m^\alpha \frac{1}{1-p_m} I_m) - W_f \frac{I_f}{1-p_f} - W_m \frac{I_m}{1-p_m} - C(q_f, I_f)\ I_f - C(q_m, I_m)\ I_m] \qquad (11)$$

subject to

$$p_f = p_f(W_f;\ W_h,\ W_A) \qquad (12)$$
$$p_m = p_m(W_m\ ;\ W_A) \ .$$

The variables used in these expressions are listed and defined in Table 6. p_f and p_m are affected by two kinds of job mobility: inter- and intra-market. The compensated substitution elasticity of inter-market mobility of market wage rates has been established to be greater for females than males.[12] However, if the females themselves anticipate a higher probability of leaving the labor force in a given period of time, the wage elasticity of their intra-market mobility should be lower than that for males, since the same observed wage differential between firms or occupations represents a smaller net benefit from migration to them.

The relative responsiveness of p_f and p_m to changes in wages is not clear. However, the equilibrium conditions below reveal that even if $p_f < p_m$ for any wage, females could still be hired; they would simply receive less training than males, and fewer of them would be hired.

First order conditions for the maximum are:

$$\text{C-1a} = \frac{1}{r}\frac{1}{1-p_f}(kMPq_f^{\alpha} - W_f) - (W_{0f} + aq_f + b/2q_f^{2} + 2cI_f) \leq 0 \; ; \; = 0 \text{ or } I_f = 0$$

$$\text{C-1b} = \frac{1}{r}\frac{1}{1-p_m}(kMPq_m^{\alpha} - W_m) - (W_{0m} + aq_m + b/2q_m^{2} + 2cI_m) \leq 0 \; ; \; = 0 \text{ or } I_m = 0$$

$$\text{C-2a} \quad \frac{k}{r}\frac{1}{1-p_f}\alpha MPq_f^{\alpha-1} I_f - (a + bq_f) I_f \leq 0 \; ; \; = 0 \text{ or } q_f = 0$$

$$\text{C-2b} \quad \frac{k}{r}\frac{1}{1-p_m}\alpha MPq_m^{\alpha-1} I_m - (a + bq_m) I_m \leq 0 \; ; \; = 0 \text{ or } q_m = 0$$

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[12] Glen Cain, Married Women in the Labor Force, and Jacob Mincer, "Labor Force Participation of Married Women," Reuben Cronau, in "Wage Comparisons - A Selectivity Bias" (National Bureau of Economic Research Working Paper No. 13, October 1973), suggests that established estimates of the wage elasticity of female labor force participation rates may be too high, since the underlying unknown "mean offer wage," to which labor force participation is actually responding, varies more than the observed "average acceptance wage."

Table 6

Variables Appearing in Expressions 11 and 12

Variable Name	Variable Definition
I_f	The number of females newly hired and trained in period t.
I_m	The number of males newly hired and trained in period t.
P_f	The proportion of female workers who leave the firm each period.
P_m	The proportion of male workers who leave the firm each period.
W_f	The wage rate paid to female workers in each period, after the training period.
W_m	The wage rate paid to male workers in each period, after the training period.
W_{of}	The wage rate paid to newly hired female workers during the training period.
W_{om}	The wage rate paid to newly hired male workers during the training period.
W_h	The home opportunity wage for females.
W_A	The market opportunity wage for both males and females.
MP	The marginal product of skilled labor in production.
q_f	The quantity of human capital invested per female worker.
q_m	The quanity of human capital invested per male worker.

$$\text{C-3a} \quad -\frac{1}{r}\frac{I_f}{1-p_f} + \gamma_f \frac{\partial p_f}{\partial W_f} \leq 0 \; ; \quad = 0 \text{ or } W_f = 0$$

$$\text{C-3b} \quad -\frac{1}{r}\frac{I_m}{1-p} + \gamma_m \frac{\partial p_m}{\partial W_m} \leq 0 \; ; \quad = 0 \text{ or } W_m = 0$$

$$\text{C-4a} \quad - p_f + p_f(W_f;\, W_m,\, W_A) \leq 0 \; ; \quad = 0 \text{ or } \gamma_f = 0$$

$$\text{c-4b} \quad - p_m + p_m(W_m;\, W_A) \leq 0 \; ; \quad = 0 \text{ or } \gamma_m = 0 \, .$$

γ_f and γ_m are the multipliers arising from the constrained maximization. γ_f is the shadow price of p_f and γ_m the shadow price of p_m in this optimization problem.

Assume that the firm reaches an internal optimum; then all first order conditions for the maximum can be taken as equalities. Conditions C-1a and C-1b state that the marginal revenue, i.e., the discounted stream of additional profits, from hiring an additional worker, whether male or female, must equal the marginal cost of hiring and training him in equilibrium. C-2a and C-2b state that the marginal return from investing one more unit of training in each worker must equal the marginal cost of training. C-3a and C-3b state that at the margin, the increase in return from a fall in turnover rate must just equal the additional wage cost required to induce it. These are the familiar marginal revenue must equal marginal cost conditions of profit maximization, directly analogous to those presented for the simple model.

II. Implications of Specific Human Capital Investment for the Wages And Occupational Distribution of Women

Equilibrium conditions C-1a and C-1b can be combined to form an "optimal wage differential" equation. In equilibrium

$$W_m^* - W_f^* = kMP(q_m^\alpha - q_f^\alpha) + \left(\frac{1-p_f}{1-p_m} - 1\right)(MPq_m^\alpha - W_m*) \qquad (13)$$

$$+ r(1-p_f)[W_{of} - W_{om} + a(q_f - q_m) + b/2(q_f^2 - q_m^2)$$

$$+ 2c(I_f - I_m)] \; .$$

It is clear from the equation that the existence of employer-financed investment in human capital and differential turnover rates combine to be a sufficient condition for wage differentials to exist, even in the absence of any taste for discrimination by employers, co-workers, or consumers.

Differences in turnover imply different levels of investment in male and female workers, and lesser hiring of women than men. Combining equilibrium conditions C-1a and C-1b differently, we find that

$$I_f/I_m = \frac{\frac{1}{1-p_f}(kMPq_f^\alpha - W_f) - W_{of} - aq_f - b/2q_f^2}{\frac{1}{1-p_m}(kMPq_m^\alpha - W_m) - W_{om} - aq_m - b/2q_m2} \; . \qquad (14)$$

If $p_f < p_m$ in equilibrium, $I_f < I_m$.

Combining C-2a and C-2b

$$\frac{a + bq_f}{q_f^{\alpha-1}} \Bigg/ \frac{a + bq_m}{q_m^{\alpha-1}} = \frac{1 - p_m}{1 - p_f} \; . \qquad (15)$$

Clearly, $q_f = q_m$ if and only if $p_f = p_m$. For $p_f < p_m$, and for $0 < \alpha < 2$[13] optimal $q_f < q_m$.

The model formulated in Section I is in terms of a single firm demanding a single kind of skill, q. Expression (15) shows that within a given occupation women will undergo less firm specific training than men. An additional interpretation of this result exists. If levels of investment q, are positively correlated with occupational classification, smaller optimal investment in women may imply occupational segregation within the firm as well, i.e., it may be optimal for employers to hire and train females in the lower skill occupations, and to make more efficient use of males by training them in the high skill occupations within the firm.

The parameter α is the elasticity of the "effectiveness" of labor with respect to training. If α is equal to 1.0, the employer is indifferent between human capital and bodies: one person with two units of training is equally as productive as two persons with one unit of training each. As α increases, human capital becomes more heavily weighted in the production function. By differentiating the first order conditions at the maximum, we find that

$$\frac{\frac{dq_f}{d\alpha}}{q_f} - \frac{\frac{dq_m}{d\alpha}}{q_m} < 0 \qquad (16)$$[14]

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[13] $0 < \alpha < 2$ is required because of the assumption that the cost curve of investment per worker is quadratic in investment. With constant returns to scale, $\alpha \geq 2$ would imply marginal revenue from investment rising at least as fast as marginal cost. Quantity invested would be indefinite in the case of $\alpha = 2$, and infinite in the case of $\alpha > 2$. $\alpha = 0$ implies $q_f = q_m = 0$, since marginal revenue would be 0, and therefore everywhere below marginal cost.

[14] See Appendix A-I for demonstration of these results.

if $p_f < p_m$ in equilibrium. As human capital becomes more important in production, women will receive proportionately less human capital investment than men. Women in the higher skill occupations would have less training relative to their male counterparts than women in the low skill occupations. Similarly, we expect the relative number of women to men demanded will be lower in the higher skill occupations.[15]

$$\frac{dI_f}{I_f d_\alpha} - \frac{dI_m}{I_m d_\alpha} < 0 \ . \tag{17}$$

If we consider an increase in the importance of specific training for the economy over time, then expressions (16) and (17) can be interpreted to state that the relative skills of women in the economy as a whole would fall over time, and their occupational distribution would deteriorate, given no change in their labor force behavior.

A shift in demand for investment in human capital by firms away from women and toward men also implies shifts in the relative wages of women. For an increase in α, although each firm does not desire to increase wages for either males or females, as all firms attempt to increase the hiring and training of workers. Clearly, since the shift in demand is proportionately greater for men than women, the relative wage of women will fall (disregarding supply elasticities).

Similarly, the greater relative net profitability of men than women in high skill occupations at a moment in time implies the relative wage of women across occupations should be inversely related to the skill level. This model does not explicitly consider the possibility of female selection toward occupations on the basis of their own labor

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[15] See Appendix A-1. This implication can be proved only under certain assumptions.

force characteristics, i.e., lower labor force turnover of women in high investment occupations, because of the higher expected cost to them of depreciation on self-financed human capital from leaving the firm or labor force. To the extent that specific investment and general investment are correlated across occupations, we might expect such a pattern of occupational selection to exist. This phenomenon would offset somewhat the prediction of lower relative wages for women in occupations with higher specific training requirements.

The model as developed in Section I of this chapter is a partial equilibrium model. It is a model of how firms react to differences in turnover and different levels of specific human capital investment. One implication of this model is that wage differentials between firms and between occupations may exist within sex categories as well as across them. In order for the market to tolerate such differentials in equilibrium, an additional constraint must be imposed that within sex categories, training period wages are such that the rate of return to the worker from his share of investment is equalized across all firms and all occupations.

$$\frac{\Sigma \frac{1}{(1+d)^t} \cdot p_m (W_m - W_A)}{W_A - W_{om}} = R_m \qquad (18)$$

$$\frac{\Sigma \frac{1}{(1+d)^t} \cdot p_f (W_f - W_A)}{W_A - W_{of}} = R_f \ .$$

R_m and R_f are the rates of return to investment for men and women, respectively. It is not necessary that R_m equal R_f.

III. A Simulation of the Model

The magnitude of the effect of training and turnover on relative wages can be determined empirically. For purposes of illustration, it is interesting to simulate the model, making assumptions about the parameters and solving sequentially for q_f, q_m, W_f, W_m, I_f and I_m.

Economic theory tells us that γ_f and γ_m are the shadow prices of p_f and p_m, respectively, and that they can be explicitly determined:

$$\gamma_f = \left(\frac{1}{1-p_f}\right)^2 (kMPq_f^{\alpha} - W_f) I_f \tag{16}$$

$$\gamma_m = \left(\frac{1}{1-p_m}\right)^2 (kMPq_m^{\alpha} - W_m) I_m \ .$$

For simplicity, assume that $\frac{\partial(1-p)}{\partial W} \cdot \frac{W}{1-p} = \frac{-\partial p}{\partial W} \cdot \frac{W}{1-p} = -\eta$ for both males and females, and let $a = 0$. Solving the first order equilibrium conditions gives the following relationships.

$$q_f = \left[\frac{\alpha kMP}{br(1-p_f)}\right]^{\frac{1}{2-\alpha}} \tag{17}$$

$$q_m = \left[\frac{\alpha kMP}{br(1-p_m)}\right]^{\frac{1}{2-\alpha}}$$

$$W_f = \frac{\eta}{1+\eta} kMPq_f^{\alpha} = \frac{\eta}{1+\eta} (kMP)^{\frac{2}{2-\alpha}} \left[\frac{\alpha}{br(1-p_f)}\right]^{\frac{\alpha}{2-\alpha}}$$

$$W_m = \frac{\eta}{1+\eta} kMPq_m^{\alpha} = \frac{\eta}{1+\eta} (kMP)^{\frac{2}{2-\alpha}} \left[\frac{\alpha}{br(1-p_m)}\right]^{\frac{\alpha}{2-\alpha}}$$

$$I_f = \frac{2-\alpha(1+\eta)}{1+\eta} \cdot \frac{kMPq_f^{\alpha}}{4c.r(1-p_f)} - \frac{W_{of}}{2c} = \frac{2-\alpha(1+\eta)}{4c.r(1+\eta)} \cdot \left(\frac{kMP}{1-p_f}\right)^{\frac{2}{2-\alpha}} \left(\frac{\alpha}{br}\right)^{\frac{\alpha}{2-\alpha}} - \frac{W_{of}}{2c}$$

$$I_m = \frac{2-\alpha(1+\eta)}{1+\eta} \frac{kMPq_m}{4c.r(1-p_m)} - \frac{W_{om}}{2c} = \frac{2-\alpha(1+\eta)}{4c \cdot r(1+\eta)} \left(\frac{kMP}{1-p_m}\right)^{\frac{2}{2-\alpha}} \left(\frac{\alpha}{br}\right)^{\frac{\alpha}{2-\alpha}} - \frac{W_{om}}{2c} .$$

Ignoring training period wages,

$$\frac{q_f}{q_m} = \left(\frac{1-p_m}{1-p_f}\right)^{\frac{1}{2-\alpha}} \tag{18}$$

$$\frac{W_f}{W_m} = \left(\frac{1-p_m}{1-p_f}\right)^{\frac{\alpha}{2-\alpha}}$$

$$\frac{I_f}{I} = \left(\frac{1-p_m}{1-p_f}\right)^{\frac{2}{2-\alpha}} .$$

These relationships are plotted on log-log paper in Figures Ia, Ib, and Ic. A very strong positive association between α and p_f/p_m in the market place could lead to a positive association between q_f/q_m, W_f/W_m, and I_f/I_m and α, although the partial effect of α on all these variables is negative for a given p_f/p_m.

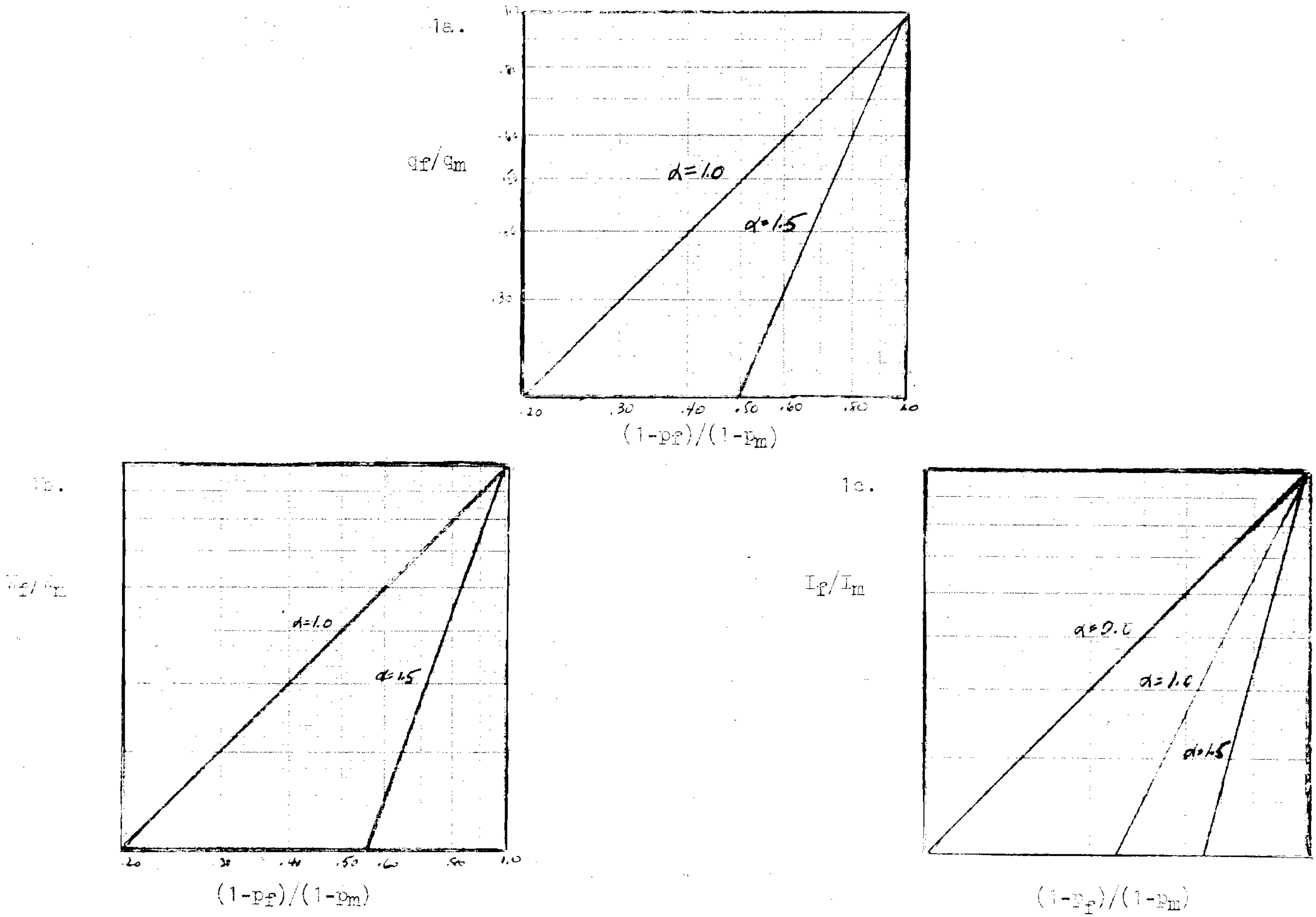
1a.
q_f/q_m
α=1.0
α=1.5
.20 .30 .40 .50 .60 .80 1.0
$(1-p_f)/(1-p_m)$
1b.
α=1.0
α=1.5
.20 .30 .40 .50 .60 .80 1.0
$(1-p_f)/(1-p_m)$
1c.
I_f/I_m
α=2.0
α=1.0
α=1.5
$(1-p_f)/(1-p_m)$

Figure 1

IV. Implications of General Human Capital Investment

It is interesting at this point to contrast the implications of general human capital investment for relative wage and quantity of training of females with those derived from the specific human capital model. Selection by low turnover females to occupations involving larger quantities of self-financed, or general, human capital implies a higher relative quantity of training in these occupations than in lower investment occupations. Let us employ the Ben-Porath[16] model in an extremely simplified form. Market wage is equal to a rental price, a, per unit of general human capital multiplied by the number of units of general human capital, H_g. If we assume that women are employed in the home as well as the market, the return to females from total employment is

$$J_f = \Sigma \frac{1}{(1+r)^t} \; pW + (1-p)W_h \quad = \Sigma(1/1+r)^t \; paH_{gf} + (1-p)W_h \;. \tag{19}$$

P is the proportion of time spent in the market in any given period, assumed for simplicity to be the same for all periods, W is the market wage, equal to aH_{gf}, and W_h is the home wage. No depreciation of market skills is associated with spending less than full time in the market.

If males are assumed to spend full time in the market, because of zero home productivity, then the return to investment for males can be expressed as

$$J_m = \Sigma(1/1+r)^t \; aH_{gm} \;. \tag{20}$$

The marginal revenue of investment in general human capital for males is

$$MR_m = a\Sigma(1/1+r)^t = a/r \;. \tag{21}$$

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16 Y. Ben-Porath, "The Production of Human Capital and the Life Cycle of Earnings," Journal of Political Economy, Vol. 75, August, 1967.

MR_m, marginal revenue curve of investment for males is just equal to the discounted present value of a, the rental price of a unit of general human capital.

A change in H_g implies a change in the wage rate: $W = aH_g$. If the proportion of time women allocate to market work is responsive to the wage rate, then marginal revenue of investment in general human capital for women is

$$MR_f = a\Sigma(1/1+r)^t \left[p + (aH_{gf} - W_h)\frac{\partial p}{\partial W}\right] = a/r(p + (aH_{gf} - W_h)\frac{\partial p}{\partial W}). \quad (22)$$

MR_f, marginal revenue curve of investment for females is equal to the discounted present value of the change in wage modified by the proportion of time spent in the market plus the value of increased time in the market less the loss in home product. Since men are assumed to always be in the market full time, no increase in participation is associated with an increase in wage. The marginal revenue curves for males and females are illustrated in Figure II. We assume men and women to be equally able in the production of human capital by giving them a common marginal cost curve.

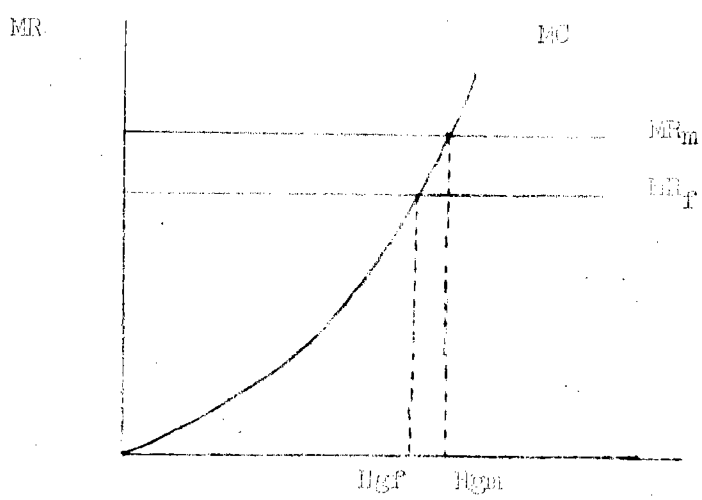

Figure 2

If a zero correlation between home wage and proportion of time spent in the market is postulated a priori, positive correlation between proportion of time spent in the market and general investment undertaken arises from two different sources: higher marginal revenue curves for women who expect ex ante to be in the market a larger proportion of their lifetime, and the responsiveness of labor force participation to higher wage rates. The women who do anticipate spending more time in the market will select higher investment occupations. In addition, those women in higher investment occupations will spend more time in the market because of their higher wages. The net result is that these women have more "masculine" labor market characteristics, i.e., p_f/p_m is higher, implying greater relative quantity of training and therefore a higher relative wage.

A change in the rental price per unit of general human capital, caused by increased demand for skilled labor, will shift the marginal revenue curves upward for both males and females.

$$\frac{dMR_m}{MR_m da} = 1/a \tag{23}$$

$$\frac{dMR_f}{MR_f da} = 1/a + \frac{2H_{gf} \frac{\partial p}{\partial W}}{p + (aH_{gf} - W_h) \frac{\partial p}{\partial W}} .$$

The marginal revenue curve for females is found to have a greater proportional upward shift than that for males, leading to a greater proportional increase in female investment relative to male investment, and therefore to a higher relative wage.

The implications of general training across occupations and over time are different from those generated by the specific human capital model. The women found in occupations requiring a greater volume of general investment will be more "masculine" in their characteristics, i.e., will expect to spend a larger proportion of their time in the market and will invest more in themselves relative to men than women with higher expected turnover. The higher relative quantity of investment undertaken implies a higher relative wage as well. Therefore, the relative wage and relative quantity of general investment will vary directly with the volume of general investment across occupations. It will be helpful to keep in mind the distinctly different implications of general and specific human capital investment for relative wage of women when interpreting the results of the empirical testing of the specific human capital model.

V. Summary of Implications of the Specific Human Capital Model

1. The joint existence of employer financed training and sex differences in turnover is sufficient to produce wage differentials between men and women in the absence of any taste for discrimination.

2. The quantity of firm specific investment in women relative to men will vary inversely with the volume of specific human capital across occupations, holding constant the relative turnover rates of men and women.

3. The relative wage of women and proportion hired will vary inversely with the volume of specific human capital across occupations, holding constant the relative turnover rates of men and women.

4. As the labor force characteristics of women approach those of men across occupations and over time, their relative wage, skill, and occupational distribution will improve.

CHAPTER 3

Empirical Formulation and Testing of Implications of the Specific Human Capital Model for Relative Wage and Occupational Distribution of Women

I. Problems of Empirical Formulation

The theoretical model developed in Section I, Chapter 2, suggests that the appropriate unit of observation in the empirical formulation of the model would be the firm, since the term "specific training" implies training specific to the firm. However, detailed firm data compensation by sex are impossible to obtain. In addition, firms do not provide training in only one skill, but employ and train workers in a range of jobs. Carl M. Rahm[17] argues that the natural embodiment of skill is the occupation; a basic hypothesis of his work is that occupational earnings reflect different investment levels. For the purpose of testing the model presented in Chapter 2 of this paper, occupation is the unit of analysis available from the data which best represents a homogeneous range of skills. Aggregate occupational data represents the "average" firm which produces the bundle of skills requisite for that occupation. In Chapter 2, the behavior of firms predicted by the model was aggregated to market predictions. Using aggregate occupational data for empirical estimation tests the validity of the firm model against the behavior of the market.

Additional problems of formulation arise from limitations of data. No measure of the volume of on-the-job training acquired by individual workers exists. Even continuous labor force experience cannot be exactly measured from available bodies of data. Continuous time since

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[17] Carl M. Rahm, "Investment in Training and the Occupational Structure of Earnings," (Unpublished Ph.D. thesis, Columbia University, 1971).

completion of schooling, "exposure" to the labor market, is the estimate of labor force experience generally used. For prime age males whose high labor force attachment leads to almost continuous participation over the life cycle, this definition of experience has proved to be satisfactory. However, for females, whose participation is intermittent over the life cycle, exposure diverges widely from true labor force experience. Since market experience has been shown in the human capital literature to be a strong determinant of wages, the lack of a direct measure[18] presents a severe problem for the explanation of female wages. One means of adjustment to this problem is to include the number of children born to the average woman in an occupation as a proxy variable for average years out of the labor force.

Another problem for analysis of the wage differential between males and females is the lack of information on turnover rates by occupation and sex. From data on average job tenure by occupation and sex, we could make rough estimates of turnover rates. Such data has been published for major occupation groups by the Bureau of the Census for 1951, and by the Bureau of Labor Statistics for the years 1963, 1966, and 1968, and are presented in Table 1. Simple assumptions described in the footnote to that table translate the job tenure data into expected attrition data presented in Table 2.

The implications of the model with respect to training refer particularly to specific training. It is crucial to the analysis to properly

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[18] Mincer and Polachek, Ibid, find that when they use the segmented work histories of women available in the National Longitudinal Survey of Work Experience of Women, 30-44, the explanatory power of the earnings function for women is greatly increased, and that children do not add any information to the equation.

define a variable corresponding to such on-the-job training. From the human capital literature, we know the effects of on-the-job training on the experience-earnings profile of individuals. Greater post-school investments in human capital imply steeper dollar earnings profiles with peaks later in the life cycle than do smaller quantities of training.[19]

Fuchs used a measure of steepness of the experience-earnings profile as an indication of training in his paper on male-female differentials in hourly earnings.[20] However, the steepness of the profile basically reflects general training. In order to use such a measure for our analysis, we must make the assumption that general and specific training are positively correlated across occupations. This assumption does not seem unreasonable in view of the positive correlation between schooling and post-school investment (in dollar terms) across individuals.[21] Individuals with higher education also undertake greater post-school investment; assume this correlation is positive with respect to both general and specific investment. Then occupations in which workers of higher educational quality are employed must involve more of both forms of training, and we should observe a positive correlation between the dollar quantities of general and post-school investment across occupations. There are two additional problems with working with the experience-earnings profile in this context. One is that simply because of the smaller average experience of women than men, in occupations involving higher returns to experience,

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[19]Jacob Mincer "Schooling, Experience, and Earnings, (New York: National Bureau of Economic Research, 1974).

[20]V. Fuchs, Ibid.

[21]J. Mincer, Ibid.

women will earn less than men. This effect will be somewhat counteracted by the positive selection of women on the basis of their own labor force characteristics to occupations involving self-financed human capital investment. The second problem arises from the fact that one is not observing the same individuals in cross section. Certain occupations may be "stepping-stone" occupations, in which the payoff to early investment does not come from within the occupation, but from graduating to another, better paying occupation. The individuals observed in the higher experience classes of these occupations are the "losers", the ones who remained in the occupations rather than graduating, and therefore received little payoff to their earlier investment. However, this problem is of little importance for demand considerations.

II. Empirical Results for the 1967 Survey of Economic Opportunity

The 1967 Survey of Economic Opportunity is a survey of household units conducted by the Office of Economic Opportunity in 1967 which is comprised of a national probability sample and a supplementary sample of low income, primarily nonwhite households. One benefit of the supplementary sample is that it provides data for blacks in sufficient quantity to permit running regressions for blacks and whites separately. Because of the higher observed relative wage and stronger labor force attachment of black women compared to white women, we would expect, a priori, quite different empirical results for the two groups.

Regressions for the white and nonwhite samples are estimated separately on data for employed civilian males and females with positive hourly earnings, not currently enrolled in school. The data were grouped separately by sex and race, and aggregated within detailed occupation groups.

The 1967 SEO estimates hourly earnings of respondents by dividing weekly earnings during the survey week from all gainful activity by total hours worked during the week. In individual data subsequently grouped by primary occupation, this procedure of estimation introduces error into the estimate of hourly wage rate associated with an occupation. In addition, random variations in hours worked by individuals during the survey week may cause an over- or understatement of the hourly wage of wage and salary workers.

The large variance in the number of males and females across occupations suggests using weighted regressions. All regressions presented are weighted by the square root of the number in the occupation.

TABLE 7

Average Job Tenure by Sex and Race for
the Years 1951, 1963, 1966, and 1968

	Median Years on Same Job		
	Male	Year	Female
White:	4.0	1951[a]	2.3
Nonwhite:	3.1		1.7
White:	5.9	1963[b]	3.0
Nonwhite:	4.1		2.9
White:	5.5	1966[c]	2.8
Nonwhite:	3.4		2.8
White:	5.0	1968[d]	2.4
Nonwhite:	3.3		2.0

Source: See Table 1

Following the experience-earnings model developed by Jacob Mincer, I have employed the log of wage as the dependent variable in the following equations. Although the demand model developed in this paper does not mandate this specification, empirically we will be estimating a reduced form rather than pure demand equation, and the literature (Mincer, Rahn, Polachek) suggests that the proper reduced form specification is log-linear.

The experience and earnings variable included in the male and female regressions serve a dual purpose: they provide estimates of the rate of return across occupations, and, in addition, hold constant quality of male and female workers. Because of the discontinuous nature of labor force participation by women, the average number of children is included in the female equation in order to modify female experience. The simplest assumption to make about the effect of children on experience is to interpret true experience to be equal to observed experience minus δ_c years per child times the number of children. Consider the post-school investment model of earnings.[22]

$$E_j = E_s \prod_{0}^{j-1} (1+r_t k_t)(1-k_j) = E_s \prod_{0}^{j-1-\delta_c C} (1+r_t k_t)(1-k_j) \qquad (24)$$

$$\log E_j = \log E_s + \sum_{0}^{j-1-\delta_c C} (1+r_t k_t) + \log(1-k_j) \quad .$$

[22]Mincer, Ibid.

Applying the convention that log(1+x) = x for small x, and assuming constant,

$$\log E_j = \log E_s + r\sum_{0}^{j-1-\delta_c C} k_t + \log(1-k_j) \quad . \tag{25}$$

Assume k, time equivalent investment, to be a linear declining function of experience, illustrated in Figure 3

$$k_t = a - bt \quad . \tag{26}$$

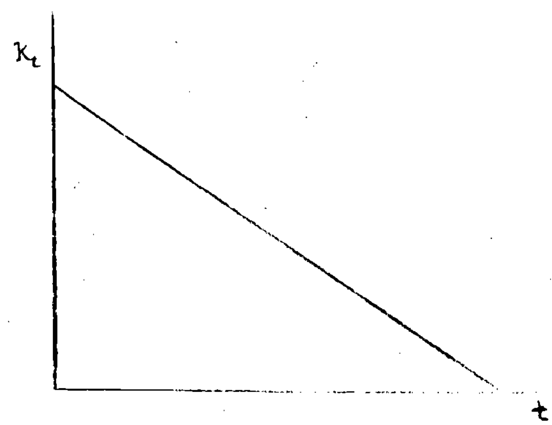

Figure 3

During the period out of the labor force for women with children, assume that no investment takes place. Then the investment profile for women with children would be as in Figure 4. The existence of the profile below the horizontal axis indicates that depreciation or disinvestment may be taking place during the period out of the labor force.

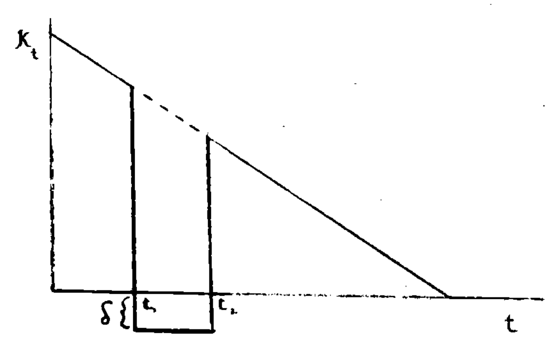

Figure 4

The dotted line represents the investment profile in the absence of children. The distance between points t_1 and t_2 is equal to $\delta_c C$, where δ_c is the number of years out of the market for each child, and C is the number of children. The total stock of investment at any point t is equal to

$$K_t = \int_0^{t_1} (a - bt)dt - \int_{t_1}^{t_2} \delta dt + \int_{t_2}^{t} (a - bt)dt \quad . \qquad (27)$$

The second integral term represents possible depreciation of skills. If we let $t_1 = t_0 - \delta_c C/2$ and $t_2 = t_0 + \delta_c C/2$, then

$$K_t = at - b/2t^2 - (a - bt_0 + \delta)\delta_c C \quad . \qquad (28)$$

This specification implies that the children variable should be entered into the log linear equation in arithmetic form.

In addition to serving as a proxy for length of time spent out of the labor force, the average number of children variable may also serve as a proxy for the number of "trips" in and out of the labor force women have made on average. Inter-labor force turnover is a key variable for explaining the effects of human capital on female wages. Although no direct measure of such turnover exists in the data, there are several proxy variables which can be constructed from the Survey of Economic Opportunity. One such measure is the variance of weeks worked in 1966 by men and women in each occupation (FVAR, MVAR); large variance would indicate greater inter-labor force mobility. We would expect such mobility to be more costly for men than for women because of the greater investment in general human capital by men than women. Another turnover proxy provided by the SEO is the proportion of those who have left the longest job they held in 1966 (FTR1, MTR1). This variable captures both the inter- and intra-labor force mobility of men and women. Because voluntary intra-labor force mobility is a form of investment in human capital, i.e., job mobility induced by better opportunities, we would expect to find this mobility less costly to men than women, for whom such mobility might have a larger exogenous component. A third variable, the percent of males and females who worked full time hours when they worked in 1966, (FTF,FTM), is a measure of previous labor force attachment. Log of hours worked during the survey week (LFHRS, LMHRS) serves the dual purpose of controlling for random fluctuations in hours and of acting as a measure of present labor force attachment.

FSO,MSO, variables which attempt to standardize for regional dispersion of the individuals in the sample are also included in the regression equations.

The variable measuring the volume of investment associated with an occupation (DWAGE) is constructed from the experience-wage profile of white males within the occupations. DWAGE is the difference in average hourly wage between white males with 10-20 years of experience and white males with 0-10 years of experience. Most investment takes place during the early years of labor force experience. DWAGE measures the difference between the early training wage when investment is being financed and the later wage which includes some return to investment.

Regressions are run separately by sex and race; the dependent variable is the log of average hourly wages of males and females for each occupation (LFWAGE,LMWAGE). Table 8 summarizes the variables used in the regressions and their definitions. All regressions are weighted by the square root of cell size.

Table 8

Variables Appearing in Regressions

Variable Name	Variable Definition
LMWAGE,LFWAGE	Log of the average wage of males and females, respectively, for the occupation.
MSCHL,FSCHL	Average number of years of schooling completed by men and women in the occupation
MEXP,FEXP	Average number of years since completion of formal schooling by men and women, respectively, in the occupation.
LMHRS,LFHRS	Log of average hours worked by men and women in the occupation during the week prior to interview.
FTM,FTF	Percent of males and females in the occupation who worked full time (i.e., 35 hours or more per week) when employed in 1966.
MTR1,FTR1	Percent of men and women in the occupation who reported having left the longest job of 1966.
MVAR,FVAR	Variance in weeks worked in 1966 by men and women in the occupation.
KIDS	The average number of children born to the women in an occupation
DWAGE	The difference in average hourly wage between white males who have 10-20 years of experience and those who have 0-10 years of experience.
XXM,XXF	MVAR*DWAGE, FVAR*DWAGE
XYM,XYF	MTR1*DWAGE, FTR1*DWAGE
LMNUM,LFNUM	Log of the number of men and women in each occupation, respectively.

A. Empirical Results for White Males and Females: Wages

The average wages of males and females within occupations are not independently determined; whatever market forces affect the demand for male labor also affect the demand for female labor in an occupation or industry. The model developed in this paper suggests how such effects may differ for men and women across occupations. Because of the simultaneous determination of wages for males and females within occupations, the method of joint generalized least squares estimation of seemingly unrelated equations, developed by Zellner[22], is employed to estimate the log wage equations for males and females. This method is designed to estimate jointly a combination of equations which appear to be unrelated, but are in fact related because their residual disturbance terms are correlated. Theoretically, such estimation results in more efficient estimates. The joint GLS results are presented in Tables 9 and 10. OLS results are included in the appendix. Surprisingly, the empirical correlation between the residuals of the male and female equations is quite small, although statistically significant. Therefore, the results of the two estimation procedures do not differ much.

TURNOVER

The first equations of Tables 9 and 10 do not include the training proxy or its interaction terms. The turnover variables all behave in the expected manner in the male and female equations, except for the log of hours variable (LFHRS,LMHRS) which has an unexpected negative

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[22] A. Zellner, "An Efficient Method of Estimating Seemingly Unrelated Regressions and Tests for Aggregation Bias." Journal of the American Statistical Association, 57, 1962, pp. 348-368

For an exposition of this technique, see H. Theil, Principles of Econometrics, New York: John Wiley and Sons, Inc. 1971. Chapter 7.

Table 9

Regression Results

Dependent Variable: LFWAGE

Joint GLS Estimates

	1	2	3	4	5
FSCHL	.9770D-01	.93460-D1	.90730-D1	.92860-D1	.9014D-01
	(11.31)	(10.23)	(9.792)	(10.08)	(9.648)
FEXP	.3116D-02	.2022D-02	-.8503D-02	.1020D-02	-.9658D-02
	(.1538)	(.9958D-01	(.3939)	(4951D-01)	(.4421)
FEXP2	.4066D-04	.6927D-04	.2546D-03	.8230D-04	.2757D-03
	(.9269D-01)	(.1466)	(.5524)	(.1859)	(.5985)
LFHRS	-1.191	-1.251	-1.254	-1.244	-1.246
	(5.820)	(5.887)	(5.956)	(5.831)	(5.898)
FTF	1.091	1.124	1.101	1.120	1.096
	(6.892)	(7.058)	(6.933)	(7.003)	(6.877)
FSO	-.2240D-02	-.2470D-02	-.2516D-02	-.2508D-02	-.2541D-02
	(1.709)	(1.881)	(1.933)	(1.907)	(1.949)
FTR1	-.3581D-02	-.3844D-02	-.2803D-02	-.4021D-02	-.2961D-02
	(1.668)	(1.781)	(1.234)	(1.822)	(1.277)
FVAR	0.2477D-03	-.2801D-03	-.3221D-03	-.1471D-03	-.2041D-03
	(.4503)	(.5115)	(.5924)	(.2007)	(.2810)
KIDS	-.4050D-01	0.4301D-01	-.3254D-01	-.4318D-01	-.3267D-01
	(1.089)	(1.162)	(.8671)	(1.163)	(.8686)
DWAGE		.2448D-03	.5401D-03	.3575D-03	.6401D-03
		(1.309)	(1.893)	(.7255)	(1.208)
XXF				-.1127D-05	-.1007D-05
				(.2547)	(.2295)
XYF			-.2073D-04		0.2077D-04
			(1.359)		(1.362)
CONSTANT	3.125	3.377	5.548	3.365	3.537
	(4.633)	(4.884)	(4.884)	4.656	4.863

Table 10

Dependent Variable: LMWAGE

Joint GLS Estimates

	1	2	3	4	5
MSCHL	.1045	.9443 D-01	.9406 D-01	.9532 D-01	.9500 D-01
	(7.612)	(7.330)	(7.307)	(7.406)	(7.383)
MEXP	.1043	.1114	.1102	.1069	.1060
	(3.458)	(3.940)	(3.945)	(3.781)	(3.751)
MEXP2	-.1917 D-02	-.2119 D-02	-.2098 D-02	-.2025 D-02	-.2010 D-02
	(3.278)	(3.905)	(3.861)	(3.677)	(3.651)
LMHRS	-1.027)	-1.152)	-1.150	-1.162	-1.157
	(4.380)	(5.264)	(5.250)	(5.324)	(5.299)
FTM	1.999	2.054	2.056	2.167	2.122
	(3.628)	(4.038)	(4.038)	(4.147)	(4.141)
MSO	-.1114 D-02	-.7106 D-03	-.7684 D-03	-.7615 D-03	-.7202 D-03
	(.6122)	(.4224)	(.4478)	(.4542)	(.4211)
MTR1	-.8081 D-04	.5216 D-03	.8322 D-03	-.1101 D-04	-.1540 D-03
	(.2752 D-01)	(.1919)	(.2850)	(.3917 D-01)	(.4918 D-01)
MVAR	-.2150 D-02	-.2169 D-02	-.2209 D-02	-.1669 D-02	-.1654 D-02
	(2.593)	(2.832)	(2.862)	(1.750)	(1.659)
DWAGE		.8770 D-03	.9386 D-03	.1059 D-02	.1071 D-02
		(4.206)	(3.279)	(3.604)	3.303
XXM				-.6084D-05	-.6379 D-05
				(.8716)	(.8684)
XYM			-.5670 D-05		-.6088 D-06
			(.3326)		(.3402 D-01)
CONSTANT	.6729	1.079	1.088	1.039	1.079
	(.6421)	(1.109)	(1.119)	(1.113)	(1.114)

coefficient in all equations. This phenomenon can be partially explained by the construction of the dependent variable. Hourly wage is constructed by the SEO by dividing weekly earnings by weekly hours. The interviewers did attempt to get a "permanent" measure of wage by excluding overtime hours and pay. This effort would reduce any expected positive correlation between hourly wage and hours worked. However, it is clear that there may still exist a negative correlation between hours and wage; individuals may receive weekly or monthly salaries which are independent of any random fluctuations in hours worked during the week prior to interview. Therefore, the benchmark value for testing the effect of hours worked on hourly wage should be one rather than zero. In none of the male or female equations is the coefficient of log hours significantly different from unity in absolute value. Interpreting log of hours as a turnover variable leads us to conclude that it has no significant effect on wage. Hours worked during a specific week is simply an observation at a point in time; wages, however, depend on long-run patterns of turnover behavior. Therefore the statistical insignificance of this variable is not surprising.

The three other turnover variables employed in the equations involve more than an observation at a point in time; they all capture turnover behavior in 1966, the year preceding the survey. Interestingly, the coefficients of these three turnover variables differ between the male and female equations in a pattern consistent with the expected underlying differences in investment in human capital. While the effect of having left the longest job of 1966 is insignificantly different from zero in all the male equations, it is consistently negative and significant at at least a 10% level of confidence in three of the five female equations. It is insignificant only when its interaction with training is also included in the equation. Intra-labor force mobility may be interpreted as a form of human capital investment for men, who presumably change jobs in order to exploit better opportunities. Such mobility offers a smaller payoff to women than men, because of their own shorter expected duration of jobs. Therefore, we would expect a greater proportion of women than men who have changed jobs to have done so for exogeneous reasons. Hence the stronger decrease in earnings associated with changing jobs in the female equations. Of course, some proportion of males who changed jobs may also have done so because they were fired or experienced some unemployment in 1966. For males, exogenous job mobility is better captured by the variance in weeks worked during 1966. The negative effect of this turnover variable is significant in all the male equations, although the coefficient merely borders on significance when the interaction of MVAR with DWAGE is included in the equation. Because of the high labor force participation of white males, the variance in weeks is quite probably a measure of involuntary turnover. For females, the variance in weeks worked during 1966 would represent exogenous mobility to a lesser extent; periods of no work in the market do not necessarily represent periods of unemployment for women, but of alternative employment in the home. Women may select occupations in which intermittent participation is not costly in terms of wage reduction, in which skills do not depreciate during periods out of the labor force, or in which the loss in terms of foregone investment is small. Therefore we expect and find a small, insignificant effect of variance of weeks worked on female wage.

The percent of males and females who worked full time hours when they worked in 1966 (FTF,MTM) is a measure of past attachment to the labor force. Although positive and significant for both males and females, the effect of previous attachment on present wage is almost twice as large for males. This difference is consistent with the hypothesis that men both invest more in themselves and have more invested in them by employers than women, as is predicted by the model. The stronger the previous attachment, as measured by FTM and inversely by MVAR, the greater the previous stock of human capital. We expect such a positive effect to be smaller for females than males because they invest less in themselves and have less invested in them by firms during employment. While greater past attachment implies greater stock of capital for women as well as men, the implicit addition to stock is nonetheless smaller for women than that made by men. If we were to accept the ratio of the female to male coefficients as the ratio of their total average stocks of human capital, both specific and general, the total human capital investment of women relative to men would be about 50%.

TRAINING

The coefficients on the interaction terms between training and turnover are all negative, as expected, although insignificant for both males and females. The partial effect of training on wage cannot be read from the coefficient of DWAGE along, since interaction terms are present. Table 11 presents the effect of DWAGE on log of male and female wage when the turnover variables are evaluated at the mean. A difference of $.01 per hour per year in the slope of the earning profile, equivalent to $20.00 per year per year in annual earnings, at 2000 full time hours per year, implies a difference of approximately .877% in male wages and .2448% in female wages, or a difference in relative wage of about .6322%. A difference of $.10 per hour per year between two occupations, equivalent to $200.00 per year per year in the experience earnings slope, implies a difference in relative wage of 6.3% between the two occupations.

The effects of training and turnover on relative wage at the mean is measured in Table 12. Between 13.3 and 30.21 percentage points of the mean relative wage can be explained by the joint existence of sex differences in turnover rates and training, depending on whether the male or female values of the turnover variables are used. Measured in terms of the relative wage differential, 29.49% at the mean,* the combined effect of training and turnover explains between 45.10% and 102.44% of the differential, depending on whether the male or female turnover values are employed in the calculations. Of course, levels of turnover and the coefficients on turnover are not unrelated in these equations. When the female values of turnover are employed in the male equation, the predicted relative wage results in the higher estimate of the joint effect of training and turnover. This result is due to the fact that the male equation reflects the greater human capital investment undertaken by men, and therefore the greater cost to them of a given change in turnover. In fact, as the labor force behavior of women approached that of men over time, presumably the coefficients in the female wage equation would approach those of the male equation. Therefore, the cross-section estimate of the joint effect of training and turnover, when using the male values and the female regression coefficients is an underestimate. Both the estimates are, of course, point estimates, with no associated confidence intervals. Nevertheless, they are quite large, at the extreme explaining the entire wage differential, suggesting the empirical importance of training and turnover for the relative wage of females.

The measured effect of training and turnover on relative wage of females within occupations cannot be ascribed entirely to specific human capital alone. Polachek has demonstrated the importance of differential labor force behavior for investment in general human capital and its consequences for the relative earnings of women. However, the greater part of the difference in general-human capital investment made

Table 11

Equation	$\frac{\partial\ LFWAGE}{\partial\ DWAGE}*100\%$	$\frac{\partial\ LMWAGE}{\partial\ DWAGE}*100\%$	$(\frac{\partial\ LFWAGE}{\partial\ DWAGE} - \frac{\partial\ LMWAGE}{\partial\ DWAGE})*100.0\%$
2	.02448%	.08770%	- .06322% *
3	.03121	.08719	- .055982
4	.02880	.08108	- .05228
5	.03492	.08032	- .04540

* Significantly different from zero at a .05 level of confidence

Source: Tables 9 and 10

Table 12

	$\hat{RWAGE}$*100.0%	($\hat{RWAGE}$ - $\overline{RWAGE}$)*100.0%	$\frac{(\hat{RWAGE}-\overline{RWAGE})}{(1-RWAGE)}$*100.0%
1. FTF = $\overline{FTM}$ FTR1=$\overline{MTR1}$ FVAR=$\overline{MVAR}$ DWAGE= 0	83.87%	13.30%	45.10%
2. FTM =$\overline{FTF}$ MTR1=$\overline{FTR1}$ MVAR=$\overline{FVAR}$ DWAGE =0	100.72%	30.21%	102.44%

$\overline{RWAGE}$ * 100.0% = 70.51%

(1-$\overline{RWAGE}$) * 100.0% = 29.44%

Calculations are based on regression equations 2 of Tables 9 and 10.

by mean and women may be captured in occupational selection itself. Clearly, there is variation in the amount of general training acquired by individuals within occupations; however, by investigating the relative wage within occupations, we are holding general investment constant to some extent.

In chapter 2, the implications of pure general training for the relative wage were contrasted with those of specific training. Those women who enter occupations involving large amounts of self-financed investment should have labor market characteristics more similar to those of men than women on average; hence, their investment relative to men in those occupations would be larger than for women on average. In addition, their stronger labor force attachment would lead them to suffer less depreciation of their human capital from intermittent periods out of the labor force. Therefore, the equations in which the interactive effect of training and turnover were not included would be expected to predict a positive effect of training on relative wage of women, on the basis of general human capital alone, since only more "masculine" women would be found in these occupations. However, the economic effect of DWAGE on relative wage in these equations is negative, and statistically significant, as predicted by the specific human capital hypothesis. Therefore, although we cannot measure the separate effects of general and specific training on relative wage in these equations, the negative effect of DWAGE on relative wage supports interpreting the slope coefficient as capturing the effect of the specific component of training on relative wage.

Marital Status and Children

In none of the equations for log of female wage is marital status of women included as an independent variable. The rationale for including marital status of women in a female earnings function is as a proxy variable for labor force attachment and turnover. However, early experimentation with the percent of women never married as an additional independent variable resulted in an unexpected negative coefficient which was never significant. The simple correlation between percent never married and the other turnover variables was quite high, so that marital status added no information on expected turnover to the equation. In addition, the other proxy variables for turnover and labor force attachment were more straightforward and empirically more powerful than marital status. Therefore, it was omitted in the final equations.

Essentially the same factor can explain the consistently insignificant coefficient of the average number of children variable. The direct information provided by the turnover proxies contain the information otherwise provided by KIDS. Although, statistically insignificant in all equations, the coefficient of KIDS suggests that each additional child implies about a 4% reduction in female wage.

Discrimination

Differential labor force behavior of males and females has implications for relative wages apart from those that work through specific human capital investment. In that most women work in the home as well as the market, they may select occupations which offer lower wages in exchange for more flexible hours; the variance in average female hours relative to the mean was .996 against .373 for males in the sample. They may choose occupations which offer easier exit and entry, so that intermittent periods of withdrawal from the labor force incur minimal loss in wages. In addition, part of the differential may be due to discrimination against women by employers or consumers. If men and women were identical in all respects--in their work, in home production, in their labor force behavior--the only variables affecting their relative wage would be years of schooling and years of experience. Since men and women are not identical, however, we expect and find the coefficients on experience to differ between males and females in the earnings functions we have estimated. One possible indicator of discrimination against women would be a smaller proportionate increase in earnings per unit of schooling capital for women than men. Even in the absence of discrimination, women with equal levels of schooling as men might choose lower paying occupations for the reasons mentioned above; this factor is accounted for in the equations of Table 9 and 10, because the observations are occupational averages. In addition, a unit of schooling capital may not be the same to men and women in terms of its market directed content. In none of the equations presented in Table 9 and 10 are the coefficients on schooling significantly different between the male and female equations. T-values for these differences average about .25. This evidence directly contradicts the common allegation of increasing discrimination at higher education levels. Widening earnings differentials between men and women with increasing education, to the extent that they exist, must be attributed solely to differences in post-school investment.

B. Regression Results: The Occupational Distribution

The model developed in Chapter 2 implies that wages, turnover, and quantity of training are optimally decided independently of the number of males and females hired. Given these optimal values, the proportion of males and females hired is determined by relative turnover rates, by α, the importance of training in production, and by the relative cost of hiring them, specifically search costs. We have no a priori notion of relative costs of searching for male and female labor; in the model these costs were assumed to rise at the same rate in both pools. For the empirical analysis, turnover rates and the volume of investment associated with an occupation are the relevant variables affecting the desired number of males and females.

Demand analysis leads us to expect a strong negative relationship between turnover and relative number of females employed, as well as between volume of specific investment and relative number of women in an occupation. When we consider the interaction of the supply of females to occupations with the demand effect, the relationship between turnover and relative number may be reversed. Women in high investment occupations, where there are relatively few women employed, should be more "masculine" in their labor force characteristics, i.e. have lower labor force turnover. This phenomenon could lead to a positive correlation between turnover and relative number of women.

The partial effect of training, holding costant turnover, is also not unambiguous in the occupational distribution equations. To the extent that optimal wage differentials compensate firms for fighter losses due to higher turnover, the relative number of females to males may be unrelated to training across occupations. Firms that are fully compensated by differential wages may determine the relative number of males and females solely on the basis of relative cost of hiring them.

Tables 13 and 14 present the joint GLS estimates for the occupational distribution regressions where the wage differential is not included in the estimating equations. OLS estimates are presented in the Appendix.

In the female equations, the turnover variables are of conflicting sign. FVAR, the variance in weeks worked has a statistically significant, positive effect in all equations; presumably this variable is capturing the supply response of women to occupations permitting greater variation in participation. The coefficient of FVAR in the efficient results implies an elasticity of supply with respect to variation in weeks of about 2.

FTR1 and KIDS have negative coefficients, indicating that holding constant supply effects, greater turnover leads to fewer women employed. Although DWAGE is not significant when entered into the equations alone, its effect is stronger when entered in conjunction with interaction terms. The negative interaction terms are in accordance with those found in the wage equations.

The relative effect of training for males and females, evaluated at the mean value of the turnover variables, is presented in Table 15. The effect of training on relative number of females employed is never significant and varies in sign depending upon the equation employed. The effect is negative when the interaction between training and turnover characteristics of women is not held constant, as would be expected. However, one suspects that these equations are mis-specified since they do not control for the wage differential.

In order to enter the wage differential into the occupational distribution equations, Two Stage Least Squares estimation procedure was necessary, since wage and number hired are both endogeneous to the system. In the first stage, FHAT and MHAT, the log of female and male wage, respectively, are predicted. The predicted log of relative wage, DIFF, is the difference between FHAT and MHAT. Tables 16 and 17 present joint GLS results for the regressions of log of numbers on turnover and training variables alone, where the wage differential, DIFF, is held constant in both the male and female equations. Two Stage Least Squares results are presented in the Appendix.

The coefficient on DIFF behaves in the expected manner for both the male and female equations; it is positive in the former and negative in the latter. Holding constant DIFF, the relative wage, an increase in MHAT or FHAT in the equation of the opposite sex has a negative effect

Table 13

Regression Results

Dependent Variable: LFNUM

Joint GLS Estimates

	1	2	3	4	5
FSCHL	-.1949	-.2073	-.2092	-.2287	-.2289
	(3.334)	(3.331)	(3.279)	(3.723)	(3.634)
FEXP	.4933	.5009	.5035	.4890	.4852
	(3.744)	(3.776)	(3.514)	(3.653)	(3.397)
FEXP2	-.1131D-01	-.1137D-01	-.1143D-01	-.1121D-01	-.1125D-01
	(3.964)	(3.971)	(3.773)	(3.937)	(3.736)
LFHRS	1.893	1.874	1.874	2.327	2.359
	(1.423)	(1.349)	(1.344)	(1.695)	(1.709)
FTF	.6373D-01	.1504	.1494	-.8031D-01	-.9112D-01
	(.6143D-01)	(.1435)	(.11410)	(.7768D-01)	(.8718D-01)
FSO	.9084D-02	.8310D-02	.7968D-02	.7295D-02	.7474D-02
	(1.057)	(.9594)	(.9128)	(.8555)	(.8709)
FTR1	-.1828D-01	-.1765D-01	-.1741D-01	-.2730D-01	-.2784D-01
	(1.307)	(1.298)	(1.150)	(1.918)	(1.825)
FVAR	.1767D-01	.1755D-01	.1769D-01	.2506D-01	.2529D-01
	(4.887)	(4.851)	(4.861)	(5.303)	(5.301)
KIDS	-.5879	-.6235	-.6231	-.6125	-.6115
	(2.421)	(2.562)	(2.493)	(2.547)	(2.480)
DWAGE		.6262D-03	.8381D-03	.6584D-02	.6658D-02
		(.4831)	(.4247)	(2.053)	(1.919)
XXF				-.5959D-04	-.6110D-04
				(2.096)	(2.116)
XYF			-.1393D-04		.3499D-05
			(.1330)		(.3410D-01)
CONST	-5.663	-5.607	-5.623	-7.139	-7.274
	(1.289)	(1.187)	(1.167)	(1.534)	(1.531)

Table 14

Regression Results

Dependent Variable: LMNUM

Joint GLS Estimates

	1	2	3	4	5
MSCHL	-.2196	-.2573	-.2580	-.2280	-.2272
	(2.192)	(2.564)	(2.557)	(2.216)	(2.199)
MEXP	.5440	.5834	.5787	.5673	.5692
	(2.475)	(2.690)	(2.648)	(2.526)	(2.522)
MEXP2	-.1247D-01	-.1350D-01	-.1341D-01	-.1302D-01	-.1306D-01
	(2.922)	(3.193)	(3.149)	(2.974)	(2.970)
LMHRS	4.842	4.398	4.353	4.149	4.168
	(2.840)	(2.599)	(2.553)	(2.398)	(2.398)
FTM	1.756	1.988	2.171	3.541	3.616
	(.4343)	(.7999)	(.5429)	(.8626)	(.8800)
MSO	.1182D-01	.1992D-01	.1871D-01	.1938D-01	.2014D-01
	(1.420)	(1.528)	(1.398)	(1.456)	(1.478)
MTR1	.5381D-02	.7408D-02	.1143D-01	.5238D-02	.2773D-02
	(.2525)	(.3521)	(.5044)	(.2340)	(.1118)
MVAR	-.2531D-02	-.2508D-02	-.2865D-02	.3318D-02	.3887D-02
	(.4222)	(.4258)	(.4809)	(.4427)	(.4945)
DWAGE		.3296D-02	.4063D-02	.5356D-02	.5087D-02
		(1.926)	(1.732)	(2.260)	(1.919)
XXM				-.6478D-09	-.6938D-09
				(1.169)	(1.185)
XYM			-.6617D-04		.3437D-04
			(.4819)		(.2337)
CONSTANT	-18.47	-17.19	-17.14	-18.20	-18.39
	(2.424)	(2.284)	(2.268)	(2.368)	(2.387)

Table 15

EQUATIONS	1 $\frac{\partial \text{ LFNUM}}{\partial \text{ DWAGE}}$ *100%	2 $\frac{\partial \text{ LMNUM}}{\partial \text{ DWAGE}}$ *100%	1-2
2	.06262%	.3296%	-.2670% *
3	.06484	.3343	-.2695
4	.2910	.2712	.0198
5	.2930	.2655	.0275

* Significant at a .05 level of confidence.

Source: Tables 13 and 14

on the number employed. At first this may seem surprising. However, a higher male wage, holding constant the relative wage and the turnover characteristics of females, amy imply "better quality" males in the occupation and therefore a lower demand for women. Similarly, a higher female wage, holding constant the relative wage of females, may imply "better", i.e., lower turnover, females, and therefore reduced demand for men.

When the compensating sex differential in wages is included in the equations explaining occupational distribution of men and women, the effect of greater training on the relative njmber of women becomes consistently negative. These calculations are presented in Table 18. The negative effect becomes quite large when the interactive effect of training and turnover are not held constant. A $.10 per hour per year difference between two occupations in the slope of the experience wage profile of white males in the occupation implies a difference of 16.3% points in the relative number of females employed in the two occupations, if the interactive effect between training and turnover is not held constant.

C. Summary

The effect of training on relative wage of women and relative number of women hired, measured in Tables 11 and 18 of this chapter, suggests the empirical importance of training for the relative position of women in the labor force, given sex differences in labor force behavior, specifically in turnover behavior. In the cross-section of occupations, higher training leads to reduced relative demand for women, reflected both in lower relative wages and lower relative number employed.

Table 16

Regression Results

Dependent Variable: LFNUM

Joint GLS Estimates

	1	2	3	4
FTF	.9575	.9098	1.250	1.187
	(1.536)	(1.457)	(1.954)	(1.847)
FTR1	-.2264D-01	-.1519D-01	-.3225D-01	-.2489D-01
	(1.695)	(1.069)	(2.311)	(1.660)
FVAR	.8104D-02	.8438D-02	.1580D-01	.1505D-01
	(2.382)	(2.474)	(3.387)	(3.186)
KIDS	-.3165	-.3210	-.4016	-.3984
	(1.781)	(1.809)	(2.169)	(2.145)
DWAGE	.1097D-02	.3307D-02	.6373D-02	.7445D-02
	(.9368)	(1.934)	(2.126)	(2.401)
XXF			-.5218D-04	-.4500D-04
			(1.979)	(1.657)
XYF		-.1590D-03		-.1334D-03
		(1.724)		(1.418)
DIFF	-1.257	-1.429	-1.563	-1.682
	(2.464)	(2.758)	(2.939)	(3.120)
MHAT	-1.608	-1.782	-1.883	-2.018
	(3.222)	(3.513)	(3.637)	(3.913)
CONSTANT	5.340	5.373	4.797	4.921
	(6.131)	(6.155)	(5.189)	(5.277)

Table 17

Regression Results

Dependent Variable: LFNUM

Joint GLS Estimates

	1	2	3	4
FTM	1.503	1.890	2.927	3.075
	(.3534)	(.4407)	(.6397)	(.6686)
MTR1	.1379D-02	.1181D-01	.1935D-02	.6624D-02
	(.7111D-01)	(.5637)	(.9108D-01)	(.2796)
MVAR	-.3800D-02	-.4417D-02	.5992D-03	.4496D-04
	(.6442)	(.7431)	(.8112D-01)	(.5859D-02)
DWAGE	.3881D-02	.6341D-02	.5742D-02	.6988D-02
	(2.073)	(2.569)	(2.229)	(2.444)
XXM			-.5362D-04	-.5217D-04
			(.9757)	(.8807)
XYM		-.2047D-03		-.1109D-03
		(1.529)		(.7353)
DIFF	1.547	1.609	1.456	1.537
	(1.760)	(1.818)	(1.566)	(1.639)
FHAT	-2.427	-2.499	-2.255	-2.343
	(2.882)	(2.946)	(2.548)	(2.689)
CONSTANT	5.826	5.396	4.098	4.006
	(1.524)	(1.395)	(.9907)	(.9630)

Table 18

EQUATION	1 $\frac{\partial LFNUM}{\partial DWAGE}$ *100.0%	2 $\frac{\partial LMNUM}{\partial DWAGE}$ *100.0%	1 - 2
1	.1097%	.3882%	-.2784%*
2	.1558	.3956	-.2398
3	.3156	.3553	-.0397
4	.3192	.3666	-.0474

Source: Tables 16 and 17

*Significant at a .05 confidence level

III. Regression Results for Nonwhite Males and Females

Two characteristic differences exist between white and black females in the labor force: black women have higher earnings relative to their male counterparts than white women and also higher labor force participation rates. Bowen and Finegan found that after adjusting for many factors such as education, husband's income and employment status, and number of children, there was still a 6.8% average difference in participation rates between black females and white females.

The specific human capital model developed in Chapter 2 suggests three factors which could give rise to the observed differences in relative earnings.

1. The expected lower investment in on-the-job training, both specific and general, by blacks than whites.
2. The smaller sex differences in turnover for blacks than whites. From Table 7 we find the average job tenure of black females to be higher relative to black males than for white females relative to white males in three of the reported years.
3. The smaller discrepancy between observed and actual experience of black women than white women, because of their stronger labor force attachment, implying a smaller difference between male and female experience than in the white population.

A fourth factor may also be smaller differential discrimination against black women. This is a point raised by Bowen and Finegan to explain the remaining differences between the labor force participation rates of black women and white women.

As was expected, the mean value of DWAGE, the measure of occupational investment, is lower in the black sample than the white, indicating the smaller investment in training by blacks. The stronger labor force attachment of black women, however, is not apparent in the SEO sample. Both the variance in weeks worked in 1966 and the percent who left the longest job of 1966 were higher for black than white women on average. The sample of blacks in the SEO was substantially drawn by oversampling low income areas. Women, as well as men, in low income areas may have low incomes because of histories of intermittent or little participation in the labor force. In addition, welfare may be a feasible alternative form of "employment" for lower income blacks, leading to a greater number of trips in and out of the market. Because of the nature of this sample, we expect the model to be less useful in explaining occupational wages of nonwhites.

Regressions identical in structure to those estimated on the white sample were estimated for black males and females, over sixty occupations. Joint GLS results are presented in Tables 19 and 20; OLS regression results are presented in the Appendix.

Turnover

We expect to find turnover a less important factor in explaining the wages of black males and females than white because of the smaller investment in human capital undertaken by blacks than whites. In fact, we find the coefficients on both FTR1, FVAR and MTR1, MVAR to be similar to those in the white female equation. The selection of occupations for the sample is constrained by the requirement of finding both men and women in the occupation. Because of the occupational concentration of women, the sample is biased toward "feminine" occupations. The constraint was more limiting in the case of blacks than whites, restricting the black sample to only 60 occupations. The "feminine" bias of the occupations, therefore, may be responsible for the close similarity of both the black male and female equations to the white female equations.

Table 19

Regression Results

Dependent Variable: LFWAGE

Joint GLS Estimates

	1	2	3	4	5
FSCHL	.1350	.1426	.1522	.1408	.1668
	(13.29)	(12.95)	(12.33)	(12.76)	(14.14)
FEXP	-.2175D-01	-.2525D-01	-.2026D-01	-.2862D-01	-.2746D-01
	(1.055)	(1.238)	(1.007)	(1.401)	(1.508)
FEXP2	.8860D-03	.9569D-03	.9381D-03	.9995D-03	.1167D-02
	(1.882)	(2.059)	(2.059)	(2.163)	(2.819)
LFHRS	-.8350	-.8581	-.9481	-.8765	-1.229
	(3.988)	(4.173)	(4.551)	(4.279)	(6.040)
FTF	.6829	.6848	.7642	.6780	.9196
	(4.355)	(4.452)	(4.819)	(4.442)	(6.184)
FSO	-.4352D-02	-.4356D-02	-.4466D-02	-.4191D-02	-.4028D-02
	(5.028)	(5.129)	(5.340)	(4.893)	(5.268)
FTR1	-.2906D-02	-.2682D-02	-.2831D-02	-.2938D-02	-.4275D-02
	(1.766)	(1.654)	(1.781)	(1.807)	(2.869)
FVAR	.2214D-04	.6394D-02	.1313D-03	.2514D-03	.1265D-02
	(.5182D-01)	(.1519)	(.3149)	(.5594)	(2.693)
KIDS	-.3214D-01	-.2832D-01	0.2531D-01	-.3031D-01	-.2704D-01
	(1.103)	(.9872)	(.8977)	(1.064)	(1.064)
DWAGE		-.3756D-03	-.8463D-03	.1858D-03	.6694D-03
		(1.645)	(2.284)	(.3262)	(1.285)
XXF				-.5899D-05	-.2760D-04
				(1.078)	(3.799)
XYF			.2804D-04		.9339D-04
			(1.619)		(4.014)
CONSTANT	1.927	1.966	2.016	2.092	2.687
	(2.568)	(2.671)	(2.794)	(2.826)	(3.960)

Table 20

Regression Results

Dependent Variable: LMWAGE

Joint GLS Estimates

	1	2	3	4	5
MSCHL	.8407D-01	.9054D-01	.8760D-01	.9149D-01	.8883D-01
	(6.720)	(7.025)	(7.047)	(6.955)	(6.980)
MEXP	.2371D-01	.1818D-01	.2465D-01	.1830D-01	.2741D-01
	(.7252)	(.5643)	(.7932)	(.5691)	(.8867)
MEXP2	-.1384D-03	.3732D-04	-.9339D-04	.3454D-04	-.1456D-03
	(.1977)	(.5368D-01)	(.1394)	(.4979D-01)	(.2185)
LMHRS	-1.717	-1.569	-1.407	-1.562	-1.374
	(5.042)	(4.522)	(4.132)	(4.503)	(4.049)
FTM	3.262	3.221	3.332	3.258	3.309
	(6.972)	(7.027)	(7.523)	(6.930)	(7.245)
MSO	-.3491D-02	-.3519D-02	-.3063D-02	-.3376D-02	-.3043D-02
	(2.158)	(2.221)	(1.997)	(2.077)	(1.947)
MTR1	-.4061D-02	-.4289D-02	-.1373D-02	-.4385D-02	-.1291D-02
	(1.399)	(1.507)	(.4521)	(1.530)	(.4186)
MVAR	.1051D-02	.1172D-02	.8504D-03	.1297D-02	.9184D-03
	(1.380)	(1.555)	(1.157)	(1.544)	(1.111)
DWAGE		-.6661D-03	.9066D-03	-.4787D-03	.8401D-03
		(1.632)	(1.129)	(.6954)	(.9326)
XXM				-.3030D-05	.1182D-06
				(.3250)	(.1305D-01)
XYM			-.1110D-03		-.1074D-03
			(2.264)		(2.170)
CONSTANT	3.011	2.487	1.681	2.400	1.524
	(2.329)	(1.895)	(1.284)	(1.805)	(1.160)

Training

The partial effect of training on female and male wage is presented in Table 21. Higher levels of investment across occupations, as measured by DWAGE, seem to imply lower wages for both black men and black women. This result is contrary to the implications of the model and to the results found for whites. However, blacks comprise a small fraction of the labor force. The negative effect of DWAGE may, to some extent, capture substitution effects not between black men and women, but between blacks as a group and whites as a group. Apparently, the fall in demand for blacks relative to whites, because of higher training, has a stronger effect on black males than black females, implying a rise in demand for black females relative to black males.

As was expected, the combined effect of training and turnover explains a smaller proportion of the relative wage differential for blacks than whites. Both point estimates of this effect are smaller in Table 22 than the comparable estimates for whites, presented in Table 12.

Discrimination

In section II of this chapter, the proportionate increase in earnings due to education estimated in the regressions did not differ for white males and females, providing evidence to counter allegations of increasing discrimination with increasing education. In the black sample, however, the measured proportionate increase in wage for additional years of schooling is significantly higher for women than men, perhaps implying reverse sex discrimination among blacks. More likely, it reflects the sharp difference in occupational distribution between younger, more educated black women and older, less educated black women.

Table 21

EQUATION	1 $\frac{\partial LFWAGE}{\partial DWAGE}$ *100.0%	2 $\frac{\partial LMWAGE}{\partial DWAGE}$ *100.0%	1 - 2
2	-.03756%	-.06661%	.02905%
3	-.03773	-.06805	.03032
4	-.02315	-.06014	.03699
5	.02791	-.06907	.09698

Source: Tables 19 and 20

Table 22

	$\hat{RWAGE}*100.0\%$	$(\hat{RWAGE} - \overline{RWAGE})*100.0\%$	$\frac{(\hat{RWAGE}-\overline{RWAGE})}{(1 - \overline{RWAGE})}*100.0\%$
1. $FTF = \overline{FTM}$ $FTR1 = \overline{MTR1}$ $FVAR = \overline{MVAR}$ $DWAGE = 0$	80.32%	3.34%	14.51%
2. $FTM = \overline{FTF}$ $MTR1 = \overline{FTR1}$ $MVAR = \overline{FVAR}$ $DWAGE = 0$	90.31	13.35	57.91

$\overline{RWAGE}*100.0\% = 76.98\%$

$(1 - \overline{RWAGE})*100.0\% = 23.02\%$

Calculations are based on regression equations 2 of Tables 19 and 20.

Chapter 4

The Specific Human Capital Model: An Additional Test of Its Implications for Wages and Occupational Distribution of Black Men Relative to White Men

Although the specific human capital model developed in Chapter 2 is formulated in terms of males and females, it is clear that the model can be applied to any two groups who differ in labor force turnover behavior. In this chapter, we employ the model to explain the wages and occupational distribution of black men relative to white men. The behavior of women is characterized by their unique role in the household. This is not true of black men; nevertheless, they do show higher turnover rates than white men and somewhat lower labor force participation rates.[23]

Table 7 of Chapter 3 reveals that differences in job tenure are smaller between black and white men than between white men and women. Smaller differences in labor force behavior necessarily imply smaller differences in investment behavior, ceteris paribus. Therefore, although we expect results in this chapter qualitatively similar to those of chapter 3, the model should explain a smaller proportion of the race-differential in wages than the sex differential.

I. The Relative Wage

Regressions were run on the log of wages of black and white males, identical in structure to those run for white males and females in Chapter 3. Variable names and definitions are listed in Table 23. Joint GLS

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[23]The Statistical Abstract of the United States, 1972 shows the labor force participation rates of white males to be 80.4%, 79.7%, and 79.2% for the years 1960, 1970, and 1971 respectively, compared to 77.4%, 74.7%, and 73.2% for black males. These figures are taken from Table 341, Section 8, and are unadjusted for the different age distributions of the two races.

results are presented in Tables 24 and 25, OLS results appear in the appendix.

Turnover

The coefficients on the turnover variables in the black and white male equations of Tables 24 and 25 behave in the same manner as they did in the white male-female equations. The coefficient of log of hours does not differ significantly from unity in any of the equations for either blacks or whites. Log of hours is a measure at a particular point in time, the week prior to the interview. Therefore, its insignificance as a turnover variable for wages, which reflect long-run patterns of behavior, is not surprising.

The disparity between the coefficients of the percent who left the longest job of 1966 found in the male-female equations is not found in the equations for blacks and whites. An increase of one percent in BTR1 has an effect on LBWAGE comparable in magnitude and statistical significance to the effect of a one percent increase in WTR1 on LWWAGE. Although the negative coefficinets are consistently stronger in the black equations than the white equations, the difference is not statistically significant. The significant negative coefficient of WTR1 is surprising, since it was not found in the smaller sample of occupations used for the white male-female equations. Nevertheless, it is not inconsistent with interpreting WTR1 and BTR1 as measures of voluntary intra-labor force mobility. Changing jobs may be a means of acquiring more training; individuals move from jobs with smaller investment opportunities to jobs offering greater investment possibilities. The immediate effect on wage of entering a new job may be negative, since the new worker has entered a training period in which he is financing part of the investment through a lower wage.

Variance of weeks worked by workers in an occupation reflects exogenous mobility for males, who have characteristically high labor force participation rates. Although negative and significant in the white equations, the effect of variance of weeks worked on log of black wage is positive and non-significant. The difference in costliness of exogenous mobility for black and white men implies different amounts of investment, consistent with the results found for white males and females.

Also consistent with results of the analysis of wages of white males and females, is the difference between the coefficients of FTB and FTW. The percent of workers who worked fulltime hours when they worked in 1966 is a measure of past attachment to the labor force. Although positive and significant for both blacks and whites, the coefficient of FTB on LBWAGE is between .76 and .83 that of FTW and LWWAGE. This difference is consistent with the hypothesis that because of their lower turnover, white men both invest more in themselves and have more invested in them by employers. The stronger the previous attachment of either blacks or whites, as measured by FTB and FTW, the greater the stock of previously acquired human capital. We find this effect to be smaller for black men than white men, just as it was smaller for white women than white men; the implicit addition to capital stock resulting from stronger past attachment to the labor force is smaller both for black men and for white women than for white men. However, because of the smaller difference in labor force behavior between black and white men than between white men and women, the difference between these coefficients is also smaller for the black-white sample than for the male-female sample. If we were to accept the ratio of the black to white coefficients as the ratio of their total average stock of human capital, both specific and general, the total human capital investment of black men relative to white men would be about .8. This same ratio was found to be about .5 for females relative to males.

Table 23

Variables Appearing in Regressions

Variable Name	Variable Definition
LBWAGE,LWWAGE	Log of the average wage of blacks and white, respectively for the occupation.
BSCHL, WSCHL	Average number of years of schooling completed by blacks and whites in the occupation.
BEXP, WEXP	Average number of years since completion of formal schooling for blacks and whites, respectively, in the occupation.
LBHRS, LWHRS	Log of the average hours worked by blacks and whites in the occupation during the week prior to interview.
FTB, FTW	Percent of blacks and whites in the occupation who worked full time (35 hrs. or more per week) when they worked in 1966.
BTR1, WTR1	Percent of blacks and whites in the occupation who reported that this job was not the same as the longest job they held in 1966, either because they changed employers or occupations.
BSO, WSO	Percent of blacks and whites in an occupation residing in the South.
BVAR, WVAR	Variance in weeks worked in 1966 by blacks and whites in the occupation.
DWAGE	The difference in average hourly wage between white males who have 10-20 years of experience and those who have 0-10 years of experience.
XXB, XXW	BVAR*DWAGE, WVAR*DWAGE.
XYB, XYW	BTR1*DWAGE, WTR1*DWAGE.
LBNUM, LWNUM	Log of the number of blacks and whites in each occupation respectively.

Table 24

Regression Results

Dependent Variable: LBWAGE

Joint GLS Estimates

	1	2	3	4	5
BSCHL	.9459D-01	.9192D-01	.9280D-01	.8960D-01	.9042D-01
	(10.52)	(9.713)	(9.702)	(9.381)	(9.351)
BEXP	.2199D-01	.2327D-01	.2416D-01	.2683D-01	.2754D-01
	(1.338)	(1.452)	(1.480)	(1.637)	(1.680)
BEXP2	-.2158D-03	-.2641D-03	-.2647D-03	-.3452D-03	-.3515D-03
	(.6487)	(.7992)	(.8015)	(1.034)	(1.053)
LBHRS	-.9224	-.9235	-.9305	-.9155	-.9158
	(5.990)	(5.645)	(5.442)	(5.433)	(5.374)
FTB	1.696	1.680	1.684	1.601	1.604
	(7.693)	(7.648)	(7.672)	(7.012)	7.027
BSO	-.3272D-02	-.3312D-02	-.3260D-02	-.3426D-02	-.3377D-02
	(4.007)	(4.084)	(4.009)	(4.216)	(4.141)
BTR1	-.4400D-02	-.4099D-02	-.4327D-02	-.3991D-02	-.4191D-02
	(3.602)	(3.376)	(3.438)	(3.289)	(3.327)
BVAR	.3067D-03	.2806D-03	.2865D-03	-.9120D-04	-.7311D-03
	(.7370)	(.6731)	(.6870)	(.1756)	(.1438)
DWAGE		.2552D-03	.1360D-03	-.1996D-04	-.1221D-03
		(1.043)	(.4501)	(.6093D-01)	(.3337)
XXB				.5575D-05	.5392D-05
				(1.160)	(1.120)
XYB			.8566D-05		.7762D-05
			(.7170)		(.6524)
CONSTANT	1.605	1.624	1.628	1.690	1.667
	(2.301)	(2.289)	(2.381)	(2.378)	(2.331)

Table 25

Regression Results

Dependent Variable: LWWAGE

Joint GLS Estimates

	1	2	3	4	5
WSCHL	.9871D-01	.9150D-01	.9312D-01	.9136D-01	.9355D-01
	(11.87)	(11.33)	(11.38)	(11.29)	(11.40)
WEXP	.8280D-01	.8494D-01	.8720D-01	.8080D-01	.8257D-01
	(3.742)	(4.054)	(4.156)	(3.785)	(3.885)
WEXP2	-.1461D-02	-.1548D-02	-.1582D-02	-.1465D-02	-.1485D-02
	(3.249)	(3.634)	(3.715)	(3.371)	(3.436)
LWHRS	-.9445	-.9886	-.9988	-.9845	-.9983
	(6.414)	(7.071)	(7.154)	(7.030)	(7.154)
FTW	2.045	2.069	2.066	2.099	2.101
	(4.900)	(5.235)	(5.246)	(5.294)	(5.331)
WSO	-.1304D-03	-.1681D-03	-.1693D-04	-.3052D-03	-.1399D-03
	(.1132)	(.1542)	(.1548D-01)	(.2784)	(.1277)
WTR1	-.3392D-02	-.2617D-02	-.2834D-02	-.2772D-02	-.3071D-02
	(2.411)	(1.942)	(2.093)	(2.047)	(2.255)
WVAR	-.1287D-02	-.1312D-02	-.1298D-02	-.1085D-02	-.9941D-03
	(2.561)	(2.757)	(2.736)	(2.001)	(1.830)
DWAGE		.6529D-03	.4602D-03	.7426D-03	.5361D-03
		(4.135)	(1.942)	(3.674)	(2.127)
XXW				-.3985D-05	-.5392D-05
				(.8570)	(1.133)
XYW			.1942D-04		.2472D-04
			(1.081)		(1.341)
CONSTANT	.6175	.7935	.7803	.7996	.7903
	(.8226)	(1.115)	(1.100)	(1.121)	(1.145)

Training

Table 26 presents the effect of DWAGE on log of black and white wage when the turnover variables are evaluated at the mean. The values in the third column of Table 26, measuring the effect of training on relative wage of blacks to whites, are smaller than the comparable values for white females and males presented in Table 11. This result is consistent with the implications of the model, since smaller differences in turnover imply a smaller differential effect on wages of differences in training across occupations. A difference of $.10 per hour per year in the experience-wage slope implies a difference in relative wage of blacks to whites of about 4%.

The combined effect of training and turnover on relative wage at the mean is measured in Table 27. Between 7.73 and 10.83 percentage points of the mean relative wage can be explained by the joint existence of training and race differences in turnover rates, depending on whether the black or white values of the turnover variables are used. In absolute terms, training and turnover have a smaller effect on the relative wage of blacks to whites than on the relative wage of females to males. In terms of the wage differential, 15.31% at the mean for blacks, training and turnover jointly explain between 50% and 70%. Although proportionately smaller than the explanatory effect of training and turnover for the relative wage differential of females, this is not a small effect. These are again point estimates with no associated confidence intervals. However, they attest the empirical importance of training and turnover for relative wage of blacks.

Discrimination

The unique role of women in the home is a primary factor in the determination of their role in the market place. In comparing black men to

Table 26

Equation	1 $\frac{\partial LBWAGE}{\partial DWAGE}$ X 100.0%	2 $\frac{\partial LMWAGE}{\partial DWAGE}$ X 100.0%	1 - 2
2	.2552 D-01	.6529 D-01	-.3977 D-01*
3	.3760 D-01	.7218 D-01	-.3458 D-01
4	.1768 D-01	.5668 D-01	-.3900 D-01
5	.2857 D-01	.6313 D-01	-.3456 D-01

*Statistically significant at a .05 confidence level.

Table 27

	(1) $\hat{RWAGE}$ X 100.0%	(2) ($\hat{RWAGE}-\overline{RWAGE}$) X 100.0%	((2)/1-$\overline{RWAGE}$) X 100.0%
FTB = $\overline{FTW}$			
BTR1 = $\overline{WTR1}$	95.52%	10.83%	70.74%
BVAR = $\overline{WVAR}$			
DWAGE = 0			
FTW = $\overline{FTB}$			
WTR1 = $\overline{BTR1}$	92.42%	7.73%	50.49%
WVAR = $\overline{BVAR}$			
DWAGE = 0			

RWAGE X 100.0% = 84.69%

Calculations based on regression (2) of Tables 23 and 24.

$\overline{RWAGE}$ = 84.61

(1 - $\overline{RWAGE}$) = 15.39

white man, however, no household division of labor exists to provide behavioral reasons for market differentials. Clearly, racial discrimination is one factor which may affect the relative wage differential of black men. One indicator of discrimination against black men would be a lower proportionate increase in earnings associated with education for blacks than whites. This is not apparent from the regression results presented in Tables 24 and 25. In none of these equations is the coefficient on education significantly higher for whites than blacks. Therefore widening earnings differentials between black and white men with increasing education, to the extent they exist, must be attributed to differences in post-school investment. In addition, there is no evidence that blacks compensate for discrimination by being better educated than their white counterparts; the average education of blacks is .5 years lower than whites across occupations.

II. The Occupational Distribution

The specific human capital model developed in Chapter 2 implies that relative wages, turnover, and investment are optimally decided independently of the number of blacks and whites hired. Given these optimal values, the proportion of blacks and whites hired would be determined by their relative turnover rates and by α, the importance of training in production. We expect to find a negative relationship between volume of specific investment and relative number of blacks, across occupations. Joint GLS estimates of the occupational distribution equations are presented in Tables 28 and 29; OLS estimates appear in the appendix. Independent variables in the equations are identical to those of the wage equations. The turnover and training variables appear to have no effect on black employment across occupations in the equations presented in Table 28, with the exception of BVAR, which has a positive effect. Presumably the positive coefficient on BVAR represents self-selection by black men to occupations in which variation in participation is less costly. In the white equations, both current attachment to the labor force, measured by hours worked, and previous attachment, measured by the percent who worked full-time hours in 1966, have a positive and significant effect on employment across occupations. Variance in weeks worked, although insignificant in its linear form, has a significant negative interactive effect with training. The economic effect of training on relative number of blacks to whites across occupations is presented in Table 30.

In equilibrium, optimal wage differentials set by firms compensate employers for higher losses due to the higher turnover of blacks. Because the occupational distribution equations of Tables 28 and 29 do not control for the wage differential, we suspect that they are misspecified. In Tables 31 and 32, joint GLS estimates of an alternative specification of the occupational distribution equations are presented. Log of the number hired is run as a function of training and turnover variables, of DIFF, the predicted relative wage, and of BHAT or WHAT, the predicted log of black or white wage. Two State Least Squares estimates appear in the appendix.

Including the compensating wage differential in the equation strengthens the effect of training and turnover on the black wage, although only BTR1 ever approaches statistical significance. The coefficient on DIFF, the predicted relative wage of blacks is significant as expected, negative in the black equation and positive in the white equations. Holding constant turnover and training, a one percent increase in relative wage of blacks across occupations implies an increase in white employment of 2.14% and a decrease in black employment of 1.5%, or a fall in relative number of blacks employed of about 3.64%.

The effect of training on relative number of blacks employed across

Table 28

Regression Results

Dependent Variable: LBNUM

Joint GLS Estimates

	1	2	3	4	5
BSCHL	-.2775	-.2806	-.2647	-.2710	-.2544
	(4.149)	(3.993)	(3.727)	(2.830)	(3.561)
BEXP	.3046	.3070	.3126	.3085	.3150
	(2.667)	(2.717)	(2.767)	(2.735)	(2.799)
BEXP2	-.6275D-02	-.6283D-02	-.6261D-02	-.6216D-02	-.6199D-02
	(2.708)	(2.740)	(2.732)	(2.700)	(2.699)
LBHRS	.3961	.5719	.4322	.6935	.6369
	(.3312)	(.4782)	(.3573)	(.5843)	(.5306)
FTB	.8958	.9394	.9640	1.117	1.145
	(.5736)	(.6060)	(.6225)	(.6983)	(.7181)
BSO	.3481D-02	.3113D-02	.3954D-02	.3595D-02	.4509D-02
	(.6066)	(.5488)	(.6948)	(.6356)	(.7964)
BTR1	-.3946D-02	-.2131D-02	-.6083D-02	-.2781D-02	-.6876D-02
	(.4549)	(.2482)	(.6792)	(.3250)	(.7732)
BVAR	.5010D-02	.5171D-02	.5224D-02	.6816D-02	.7086D-02
	(1.689)	(1.749)	(1.765)	(1.879)	(1.958)
DWAGE		.2379D-03	-.1742D-02	.1290D-02	-.6280D-03
		(.1259)	(.7699)	(.5161)	(.2277)
XXB				-.3235D-04	-.3541D-04
				(.9548)	(1.048)
XYB			.1428D-03		.1495D-03
			(1.627)		(1.718)
CONSTANT	.8445	.1010	.3086	-.7702	-.9109
	(.1717)	(.2029D-01)	(.6159)	(.1551)	(.1824)

Table 29

Regression Results

Dependent Variable: LWNUM

Joint GLS Estimates

	1	2	3	4	5
WSCHL	-.7062D-01	-.1068	-.9290D-01	-.9690D-01	-.7677D-01
	(1.072)	(1.610)	(1.390)	(1.474)	(1.162)
WEXP	.6140	.6232	.6389	.5714	.5874
	(3.663)	(3.815)	(3.914)	(3.499)	(3.631)
WEXP2	-.1282D-01	-.1322D-01	-.1342D-01	-.1209D-01	-.1225D-01
	(3.755)	(3.972)	(4.043)	(3.629)	(3.716)
LWHRS	3.502	3.316	3.280	3.285	3.223
	(3.072)	(2.978)	(2.957)	(2.984)	(2.956)
FTW	4.932	5.064	5.065	5.452	5.473
	(1.538)	(1.619)	(1.628)	(1.765)	(1.791)
WSO	.1345D-01	.1311D-01	.1472D-01	.1285D-01	.1488D-01
	(1.538)	(1.540)	(1.722)	(1.522)	(1.767)
WTR1	.3728D-02	.8254D-02	.5397D-02	.6424D-02	.2472D-02
	(.3324)	(.7456)	(.4831)	(.5843)	(.2229)
WVAR	-.7378D-03	-.9377D-03	0.5567D-03	.3074D-02	.4013D-02
	(.2024)	(.2520)	(.1501)	(.7345)	(.9602)
DWAGE		.3207D-02	.1445D-02	.5219D-02	.3028D-02
		(2.343)	(.7319)	(3.133)	(1.469)
XXW				-.7313D-04	-.8267D-04
				(2.005)	(2.224)
XYW			.1802D-03		.2524D-03
			(1.209)		(1.671)
CONSTANT	-19.75	-19.00	-19.30	-18.90	-19.24
	(3.452)	(3.399)	(3.470)	(3.431)	(3.531)

Table 30

Equation	1 $\frac{\partial LBNUM}{\partial DWAGE}$ X 100.0%	2 $\frac{\partial LWNUM}{\partial DWAGE}$ X 100.0%	1 - 2
2	.02379 %	.3207 %	-.2969 %
3	.05964	.3872	-.3276
4	.01481	.1994	-.1846
5	.05702	.2728	-.2158

occupations, calculated from these equations, is presented in Table 33. As in Table 30, the effect of training is consistently negative. A $.10 per hour per year difference in the slope of the experience-wage profile between two occupations implies a difference in relative number of blacks employed of about 17% between the two occupations, when the interactive effects of training and turnover are not held constant. This is smaller than the 27.8% difference found for relative number of women in Table 18.

III. Summary

The empirical results of this chapter show the impact of training and turnover on the relative wage of blacks and relative number employed to be strong and significant. Because of the smaller differences in turnover behavior between black and white males than between white males and females, the joint effect of training and differences in turnover was found to explain a smaller proportion of the race differential in wages than the sex differential. In addition, when the compensating wage differential was included in the occupational distribution equations, the average effect of a $.10 difference per hour per year between two occupations in the experience-wage profile on the relative number of black men employed was 16.93% as compared to 27.84% for the relative number of white women employed.

Table 31

Regression Results

Dependent Variable: LBNUM

Joint GLS Estimates

	1	2	3	4
FTB	1.818	1.649	2.102	2.034
	(1.000)	(.8995)	(1.153)	(1.095)
BTR1	-.9277D-02	-.1323D-01	-.1050D-01	-.1482D-01
	(1.148)	(1.568)	(1.291)	(1.732)
BVAR	.1651D-01	.1709D-02	.3537D-02	.3610D-02
	(.6243)	(.6426)	(1.100)	(1.112)
DWAGE	.2720D-02	.9291D-03	.4101D-02	.2289D-02
	(1.359)	(.4059)	(1.557)	(.7972)
			-.3779D-04	-.3700D-04
			(1.171)	(1.138)
XYB		.1450D-03		.1471D-03
		(1.693)		(1.716)
DIFF	-1.524	-1.495	-1.470	-1.474
	(2.410)	(2.352)	(2.243)	(2.220)
WHAT	-2.113	02.087	02.076	-2.082
	(3.560)	(2.995)	(3.382)	(3.342)
CONSTANT	4.904	5.092	4.554	(4.6-7)
	(3.377)	(3.469)	(3.109)	(3.133)

Table 32

Regression Results

Dependent Variable: LWNUM

Joint GLS Estimates

	1	2	3	4
FTW	6.595	6.662	7.014	7.102
	(2.046)	(2.072)	(2.194)	(2.228)
WTR1	-.25234D-02	-.6237D-02	-.4191D-02	-.8487D-02
	(.2469)	(.5934)	(.4123)	(.8134)
WVAR	-.2357D-02	-.2096D-02	.5177D-02	.9191D-03
	(.6998)	(1.633)	(.1405)	(.2493)
DWAGE	.4413D-02	.3153D-02	.6175D-02	.4578D-02
	(2.960)	(1.633)	(3.579)	(2.248)
XXW			-.6036D-04	-.6500D-03
			(1.805)	(1.901)
XYW				.1916D-03
				(1.343)
DIFF	2.143	2.159	2.130	2.141
	(3.593)	(3.632)	(3.613)	3.650
BHAT	-3.031	-3.059	-2.881	-2.895
	(4.078)	(4.092)	(3.944)	(3.985)
CONSTANT	(1.340)	1.327	.7627	.7220
	(.4508)	(.4475)	(.2584)	(.2453)

Table 33

Equation	1 $\frac{\partial LBWUM}{\partial DWAGE}$ X 100.0%	2 $\frac{\partial LWNUM}{\partial DWAGE}$ X 100.0%	1 - 2
2	.2720 %	.4413 %	-.1693
3	.3303	.5082	-.1779
4	.2767	.3513	-.0746
5	.3392	.4292	-.0900

Chapter 5

Summary and Conclusions

The dramatic change in labor force activity of women during the post war period has brought into sharp relief the different patterns of employment and compensation existing between men and women in the American labor market. In the past decade, economists have turned their attention to this problem, focusing primarily on identifying and measuring discrimination as the dominant force behind these differences. More recently, Jacob Mincer and Solomon Polachek have investigated the relationship between individual investments in human capital and sex differences in earnings, establishing a clear and strong argument that more than fifty percent of the existing differences in earnings may be caused by sex differences in self-investment.

In this paper, I pursue the human capital argument by analyzing the effect of differences in male and female labor force behavior on the firm's incentive to invest in workers. The model developed utilizes two assumptions: 1) The firm invests in the training of its workers; hence employee turnover represents depreciation on human capital, and 2) the firm can affect the turnover rate of its employees by offering them a wage above the opportunity wage. Differences in expected turnover behavior of men and women are shown to be an important determinant of the incentive to the employer to hire and train women as well as men. The major implications of the model are the following:

1. The joint existence of employer financed training and sex differences in turnover is sufficient to produce wage differentials between men and women in the absence of any taste for discrimination.
2. The relative wage of women and quantity of training invested in

them will vary inversely with the volume of specific human capital across occupations, holding constant relative turnover rates of men and women.

3. The relative number of women employed will vary inversely with the volume of specific human capital investment across occupations, holding constant sex differences in turnover behavior.
4. As the labor force characteristics of women approach those of men, across occupations and over time, their relative wage and occupational distribution will improve.

Despite data limitations on crucial variables such as true labor force experience for women and labor turnover rates for both males and females, empirical testing of the model on aggregate occupational data constructed from the 1967 Survey of Economic Opportunity confirmed the theoretical implications of the model. Several proxy variables to capture labor force turnover behavior were constructed: variance in weeks worked in 1966 by men and women in a given occupation, percent of males and females in an occupation whose current job is not the same as the longest job held in 1966, and percent of males and females who worked 35 hours or more per week when employed in 1966. A measure of the volume of on-the-job training across occupations was constructed from the experience-wage profile of white males within occupations: the difference in average hourly wage between those in each occupation with ten to twenty years of experience and those with zero to ten years of experience. Investment in on-the-job training is presumed to be concentrated early in the experience history; therefore this measure captures the difference between the average wage early in employment, when investment is presumably being financed, and a later wage which includes returns to investment. Major empirical findings of the analysis are the following:

1. Holding constant turnover rates of males and females, a difference between two occupations of $.10 per hour per year in the slope of the experience-wage profile, equivalent to a difference of $200.00 per year per year in the experience-earnings profile, at 2000 full time hours per year, implies an inverse difference of 6.3 percent in the relative wage of women and 27.84 percent in the relative number of women employed.

2. At the mean, training and sex differences in turnover combine to explain between 45.10 percent and 102.44 percent of the relative wage differential of women. Although these are point estimates, with no associated confidence intervals, there is strong reason to suspect the lower number to be an underestimate: as the labor force behavior of women truly approached that of men, the coefficients of the female earnings function would also approach those of the male earnings function. Given differences in behavior, women act in such a way that their own higher turnover is less costly to them. Therefore, in asking the question: 'What would the wage of females be at arbitrarily lower turnover rates?', we can only obtain an underestimate. The greater the difference between the value of turnover we propose and the mean value for females, the more severe is the underestimate.

As an additional test, the model was employed to explain the earnings and employment of black males relative to white males. Although formulated in terms of males and females, it is clear that the model should apply to any two groups who differ in labor force turnover behavior. Because of the smaller differences in turnover characteristics between black and white men than between white men and women, we expect training to have a smaller effect on relative wage of black men and relative number employed. The empirical findings of this analysis were:

1. Holding constant turnover rates of black and white men across occupations, a difference between two occupations of \$.10 per hour per year in the slope of the experience-wage profile, equivalent to \$200 per year per year in the experience-earnings profile, implies an inverse difference of 3.98 percent in the relative wage of black men and 16.93 percent in the relative number of black men employed. Both these effects are smaller than those observed for white women.

2. Training and differences in turnover behavior between black and white men combine to explain between fifty and seventy percent of the relative wage differential of black men.

In addition to measuring the effects of training and differences in turnover on wages and employment, an attempt was made to discern the effect of discrimination on wages of white women relative to white men and of black men relative to white men. One indicator of discrimination against women, or against blacks, would be a lower proportionate increase in earnings associated with increases in education for them than for white men. However, in none of the equations presented in Tables 8 and 9 for white men and women and in Tables 23 and 24 for black and white men, does the coefficient on education differ significantly between sexes or races. Therefore, there is no evidence of increasing discrimination against women or against blacks with increasing education. Widening earnings differentials with increasing education, to the extent that they exist, must be attributed to differences in post school investment. In addition, neither women nor black men appear to compensate for discrimination by being better educated than white men, since the average education of white men is higher than that of black men and not significantly different from that of white women, across occupations.

Appendix

A-I.

Let $a = 0$. Taking the total differential of the first order conditions and making appropriate substitutions, the bordered Hessian is represented by H:

$$H = \begin{bmatrix} -2c & 0 & 0 & 0 & \frac{-1}{(1-p_f)} & 0 & 0 & 0 \\ 0 & -2c & 0 & 0 & & \frac{-1}{(1-p_m)} & 0 & 0 \\ 0 & 0 & (\alpha-2)bI_f & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & (\alpha-2)bI_m & 0 & 0 & 0 & 0 \\ \frac{-1}{(1-p_f)} & 0 & 0 & 0 & \frac{I_f}{(1-pf)}\frac{\partial^2 pf}{\partial W_f^2} & 0 \; \frac{\partial^2 p_m}{\partial W_m^2} & \frac{\partial pf}{\partial W_f} & 0 \\ 0 & \frac{-1}{(1-p_m)} & 0 & 0 & \frac{\partial pf}{\partial W_f} \; 0 & \frac{I_m}{(1-p_m)} \frac{\partial p_m}{\partial W_m} & 0 & \frac{\partial p_m}{\partial W_m} \\ 0 & 0 & 0 & 0 & \frac{\partial pf}{\partial W_f} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{\partial p_m}{\partial W_m} & 0 & 0 \end{bmatrix}$$

$$= \begin{bmatrix} \frac{-bq_f^2}{\alpha}\frac{dk}{k} & -\frac{1}{\frac{\partial p_f}{\partial W_f}} \frac{dp_f}{(1-p_f)} & -bq_f^2 \log q_f \frac{d\alpha}{\alpha} & +dW_{of} \\ -\frac{bq_m^2}{\alpha}\frac{dk}{k} & -\frac{1}{\frac{\partial p_m}{\partial W_m}} \frac{dp_m}{(1-p_m)} & -bq_m^2 \log q_m \frac{d\alpha}{\alpha} & +dW_{om} \\ -bq_f \frac{dk}{k} & -bq_f \frac{dp_f}{(1-p_f)} & -bq_f(1+\alpha \log q_f)\frac{d\alpha}{\alpha} & \\ -bq_m \frac{dk}{k} & -bq_m \frac{dp_m}{(1-p_m)} & -bq_m(1+\alpha \log q_m)\frac{d\alpha}{\alpha} & \\ & -I_f \frac{dp_f}{(1-pf)} & & \\ & -I_m \frac{dp_m}{(1-p_m)} & & \\ & dp_f & & \\ & dp_m & & \end{bmatrix}$$

A.

Using Cramer's Rule:

$$dI_f = \frac{bq_f^2}{2c\alpha}\frac{dk}{k} + \frac{bq_f^2}{2c}\log q_f \frac{d\alpha}{\alpha} - \frac{dWof}{2c}$$

$$dI_m = \frac{bq_m^2}{2c\alpha}\frac{dk}{k} + \frac{bq_m^2}{2c}\log q_m \frac{d\alpha}{\alpha} - \frac{dWo_m}{2c}$$

$$dqf = \frac{qf}{(2-\alpha)}\frac{dk}{k} + \frac{qf}{(2-\alpha)}\frac{dpf}{(1-pf)} + \frac{q_f}{(2-\alpha)}(1+\alpha\log q_f)\frac{d\alpha}{\alpha}$$

$$dq_m = \frac{q_m}{(2-\alpha)}\frac{dk}{k} + \frac{q_m}{(2-\alpha)}\frac{dpm}{(1-p_m)} + \frac{q_m}{(2-\alpha)}(1+\alpha\log qm)\frac{d\alpha}{\alpha}$$

$$dW_f = \frac{dp_f}{\frac{\partial p_f}{\partial Wf}}$$

$$dW_m = \frac{dp_m}{\frac{\partial p_m}{\partial W_m}}$$

$$d\gamma f = \frac{dI_f}{(1-p_f)\frac{\partial p_f}{\partial W_f}} - \gamma_f\left[\frac{\partial^2 p_f}{\partial W_f 2}/\left(\frac{\partial pf}{\partial W_f}\right)^2 + \frac{1}{(1-p_f)}\right]dp_f$$

$$d\gamma_m = \frac{dI_m}{(1-p_m)\frac{\partial p_m}{\partial W_m}} - \gamma_m\left[\frac{\partial^2 p_m}{\partial W_m 2}/\frac{\partial p}{\partial W}\right)^2 + \frac{1}{(1-p_m)}\ [\ dp_m$$

B.

$$\frac{dqf}{q_f d\alpha} - \frac{dq_m}{q_m d\alpha} = \frac{\log qf - \log q_m}{(2-\alpha)} < 0$$

$$\frac{dI_f}{d\alpha} - \frac{dI_m}{d\alpha} = \frac{bqf^2\log q_f - bq_m^2\log q_m}{2c\alpha} < 0$$

If $\frac{\partial pf}{\partial W_f}\cdot\frac{W_f}{(1-pf)} = \frac{\partial p_m}{\partial W_m}\cdot\frac{W_m}{(1-p_m)}$, then

$$\frac{dI_f}{I_f d\alpha} / \frac{dI_m}{I_m d\alpha} = \frac{\log qf}{\log q_m} < 1$$