Opportunities and outcomes in the U.S. labor market, 1967-1981
by Charles John Romeo

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Applied Economics
Montana State University

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Tests of hypotheses presented in the literature indicate that the "baby boom" cohort and increasing labor force participation among women are the two most important factors influencing relative wages. Results also suggest that affirmative action and increasing career orientation among women are important factors. Increasing educational attainment among young people, on the other hand, was not found to be very influential.

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Charles John Romeo

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ABSTRACT

Recent demographic and social changes have affected relative opportunities and outcomes of the various labor force groups. Opportunities are given by offered wages, and outcomes by accepted wages. White males still hold the dominant position in the labor force, though some whittling away at this position has occurred. Relative opportunities of white females and non-whites have increased, while relative outcomes show mixed results.

Tests of hypotheses presented in the literature indicate that the "baby boom" cohort and increasing labor force participation among women are the two most important factors influencing relative wages. Results also suggest that affirmative action and increasing career orientation among women are important factors. Increasing educational attainment among young people, on the other hand, was not found to be very influential.

INTRODUCTION

Major changes have occurred in the demographic composition of the labor force over the last quarter century. Researchers have found that these changes, coupled with affirmative action programs, have had a strong impact on opportunities available to various labor force groups. A few major demographic factors stand out as being the most influential. Berger (1983), Easterlin (1978), Freeman (1979), and Welch (1979) have found that the post World War II "baby boom" cohort has both depressed the relative wages of young adults and reduced their career opportunities. Increasing labor force participation among women has depressed their own relative wages, and those of young males as well (Berger, 1983; Grant and Hammermash, 1981). However, greater career orientation of women has at least partially countered the downward pressure on their wages (Shapiro and Shaw, 1983). And finally, Freeman (1977), Stapleton and Young (1984), and Welch (1979) conclude that increasing educational attainment has exerted further downward pressure on the wages of young college educated workers. In each case, increased competition for better jobs, and therefore greater difficulty in realizing career aspirations, is implied with each of these demographic changes.

The economic explanation for changes in relative wages and opportunities due to demographic changes is that different types of workers are imperfect substitutes in production. A relative increase

in the supply of one worker type reduces relative wages paid to that type (Berger, 1983; Grant and Hammermash, 1981). Changes in relative wages and opportunities due to affirmative action legislation, on the other hand, are explained as a response to increases in the cost of discrimination (Becker, 1971; Beller, 1982).

The purpose of this thesis is to examine changes in relative opportunities and observed outcomes of various labor force groups. Opportunities are assumed to be given by offered wages and outcomes by accepted wages. The gap between opportunities and outcomes arises from the fact that not all wage offers are accepted. What constitutes an acceptable wage offer to an individual varies by personal characteristics and constraints, and varies over time as well. Examining offered wages corrects changes in relative wages for behavioral changes and allows opportunities to be focused on. Estimates of real offered wages across years, for individuals with constant characteristics, are directly comparable. Examining accepted wages, on the other hand, gives information on changes in the labor force behavior of each demographic group.

The model developed here is similar to Heckman's (1974, 1979) procedure to correct for selection bias. Fixed costs of working are accounted for by the addition of a third equation. Also, since the March Current Population Survey (CPS) data used in this study do not contain wage data, further complications arise in the estimation process (Stapleton and Young, 1984).

The outline of this thesis is as follows. Theory is presented in Chapter 1, as it provides the framework for what comes after.

Chapter 2 is a review of the literature. This review is organized as a discussion of relevant hypotheses in the literature. The model is presented in Chapter 3. Chapter 4 contains the empirical findings, which are presented as tests of the hypotheses in Chapter 2. Chapter 5 is summary and conclusions.

CHAPTER 1

THEORY

The purpose of this section is to discuss certain topics from neoclassical theory of labor supply and labor demand. Treatment of labor supply theory is limited to topics that are relevant to the present study. Empirical analysis of labor demand is beyond the scope of this study, but a short theoretical treatment is given here to show how changes in the demand for labor affect labor supply decisions.

Labor Supply

Labor supply theory focuses on factors that influence an individual's allocation of time between market and non-market alternatives. If it is assumed that individuals make a tradeoff between the purchase of market goods and services (g) and time spent in non-market activities (l), then time allocation can be viewed as a utility maximization problem;

$$(1) \qquad \underset{g,l}{\text{Max}} \quad U(g,l)$$

subject to:

$$T-h-l = 0,$$

$$y_n + wh = g \geq 0,$$

and

$$l \geq 0, \; g \geq 0.$$

Where it is assumed that $U(g,1)$ is strictly quasi-concave, $T-h-1 = 0$ is a time constraint, which specifies that total time (T) is fully divided between market (h) and non-market activities; and $y_n + wh - g \geq 0$ is the budget constraint, where y_n is non-labor income and w is the real wage rate. Fixed costs of working, f, are assumed to be zero in this initial formulation.

An interior solution to the maximization problem is obtained if

$$U_g = \frac{U_1}{w} \tag{2}$$

at $h>0$, where U_g and U_1 are the marginal utilities of goods and leisure respectively. Rearranging terms yields

$$\frac{U_1}{U_g} = w, \tag{3}$$

which reads, the marginal rate of substitution between goods and leisure equals the wage rate, $MRS_{gl} = w$. Figure 1 illustrates this result. The budget constraint is given by line g,y_n, where the slope equals the negative of the real wage rate. The vertical line starting at T is the time constraint. $MRS_{gl} = w$ implies that there exists a tangency point between $U(g^*,1^*)$ and budget line g,y_n at some interior point.

On the other hand, if $MRS_{gl} > w$ at zero hours of work, no interior solution obtains. The inequality indicates that the shadow price of the person's time is greater than the real offered market wage. A corner solution results, as is displayed in Figure 2. The wage rate at

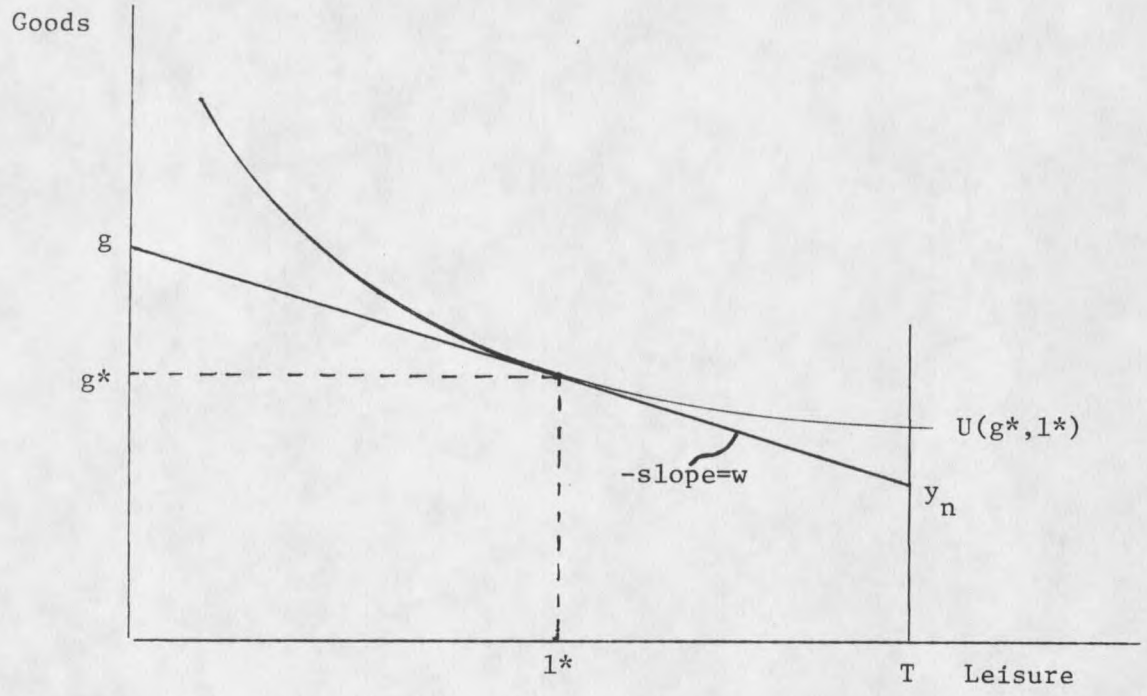

Figure 1. Interior solution.

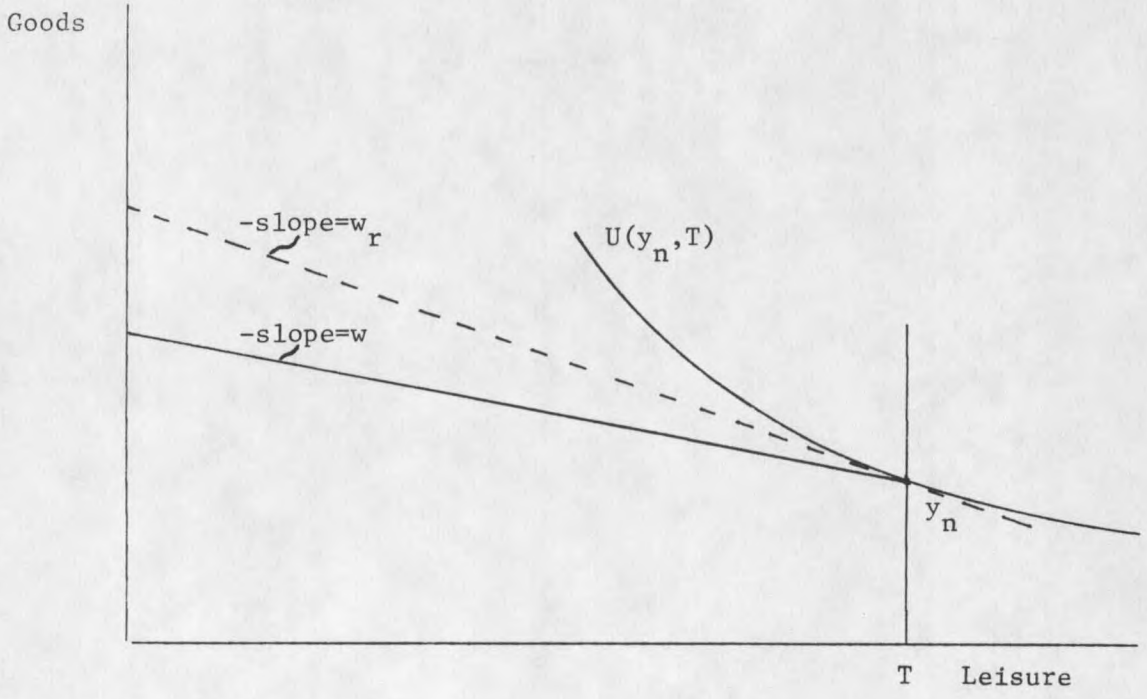

Figure 2. Corner solution.

which an individual is indifferent between spending time in market or non-market activities is called the reservation wage, w_r.

If $w \leqq w_r$, then individuals choose not to work (as shown); if $w > w_r$, then individuals choose to work.

The effect of adding fixed costs to the problem will now be analyzed. Fixed costs are incurred only if the individual chooses to work; if so, the budget constraint in (1) becomes

$$y_n - f + wh - g \geqq 0. \tag{4}$$

Thus an individual is faced with a discontinuous budget constraint. If he or she chooses not to work, he or she consumes his/her non-labor income, y_n, and leisure T; utility is $U(y_n,T)$. If the individual works, he or she chooses among points along (4).

Figure 3 illustrates the effect of adding fixed costs to an interior solution. Subtracting fixed costs is shown to be equivalent to a reduction in non-labor income. Analysis of $\frac{\partial h^*}{\partial y_n}$, therefore, will show the effect of fixed costs on labor supply.

The above assumption of strict quasi-concavity of the utility function insures that indifference curves mapping the tradeoff between goods and leisure are strictly convex. If goods and leisure are both assumed to be normal goods, it can be shown that

$$\left.\frac{\partial h^*}{\partial y_n}\right|_{dw=0} < 0, \tag{5}$$

which implies that the effect of adding fixed costs of working, for those who work, is to increase labor supply. If, on the other hand, leisure is an inferior good, the effect of adding fixed costs will be

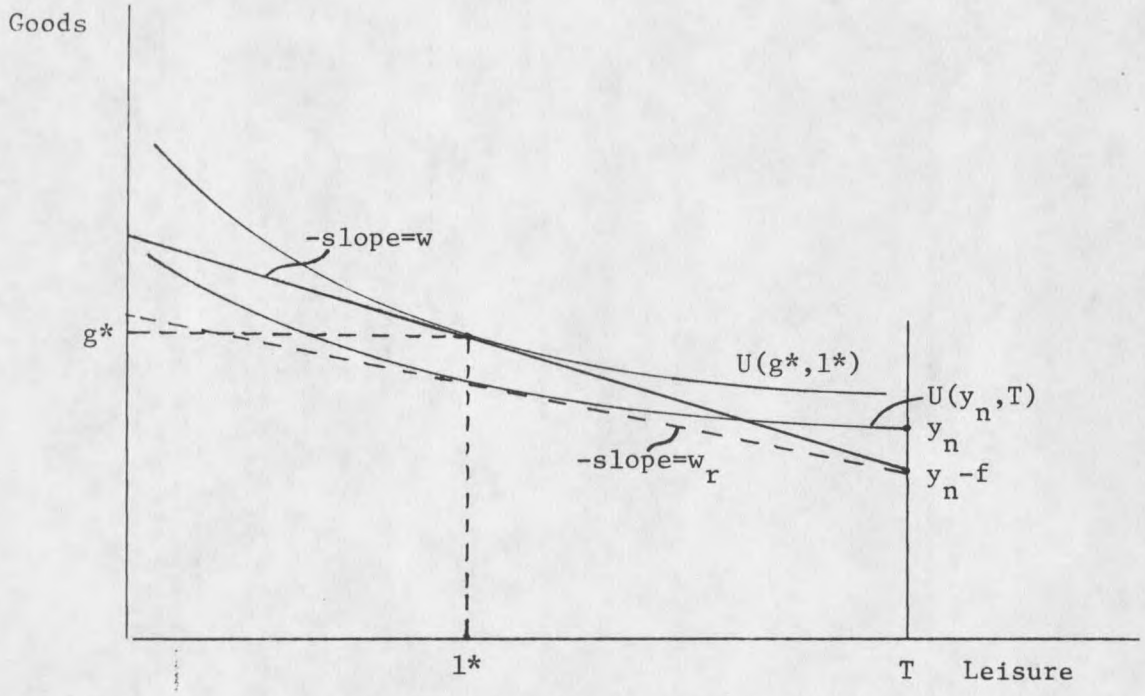

Figure 3. Interior solution with fixed costs included.

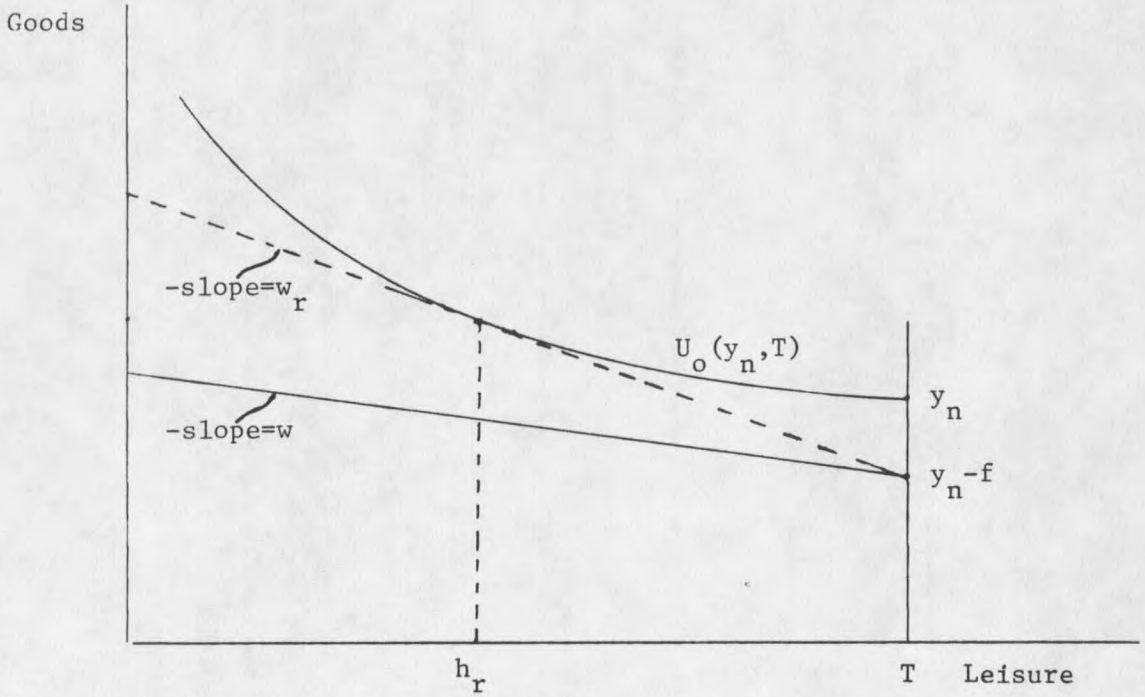

Figure 4. Corner solution with fixed costs included.

to decrease the labor supply of those who work. That is,

$$\left.\frac{\partial h^*}{\partial y_n}\right|_{dw=0} > 0, \tag{6}$$

when leisure is inferior.

For non-workers, bringing fixed costs into the problem implies that an additional condition be met for an individual to enter the labor market. Figure 4 illustrates this point. At $w = w_r$ individuals are indifferent between working zero hours or working h_r hours, where h_r is reservation hours. Entry costs, which reduce the initial endowment by f, imply that indifference curve $U_o(y_n,T)$ which is obtained at h=0 can only be obtained at $h = h_r$, if $w = w_r$. At $w > w_r$ indifference curves higher than U_o can be attained at $h \gtrless h_r$ depending on whether leisure is a normal or inferior good.

A Slutsky equation is used to analyze the effect of a change in the real wage rate on hours worked. We may write,

$$\frac{\partial h^*}{\partial w} = \left.\frac{\partial h}{\partial w}\right|_{du=0} + h\,\frac{\partial h^*}{\partial y_n}, \tag{7}$$

where $\frac{\partial h}{\partial w}$ holding utility constant is the substitution effect, and $h\frac{\partial h^*}{\partial y_n}$ is the income effect. It has been shown above that the sign on the income effect depends on whether leisure is a normal or inferior good. Since $h \geq 0$ depending on whether a corner or interior solution obtains, the whole second term of (7) will be negative for an interior solution when leisure is normal, positive for an interior solution when leisure is inferior, and zero otherwise. The substitution effect on hours

worked, however, is positive whether leisure is normal or inferior, and is positive for both an interior and corner solution. Figure 5 illustrates this discussion. Given convex indifference curves, an increase in the real wage rate from w_0 to w_1 will cause an individual to substitute goods for leisure, moving from point A to point B. The income effect moves the individual from point B to point C, with the total effect being a move from point A to point C. Whether point C is to the right or the left of point B depends on whether leisure is a normal or inferior good. If leisure is normal, as the figure illustrates, the substitution and income effects are in opposite directions, and point C is to the right of point B. Alternatively, if leisure is inferior, the

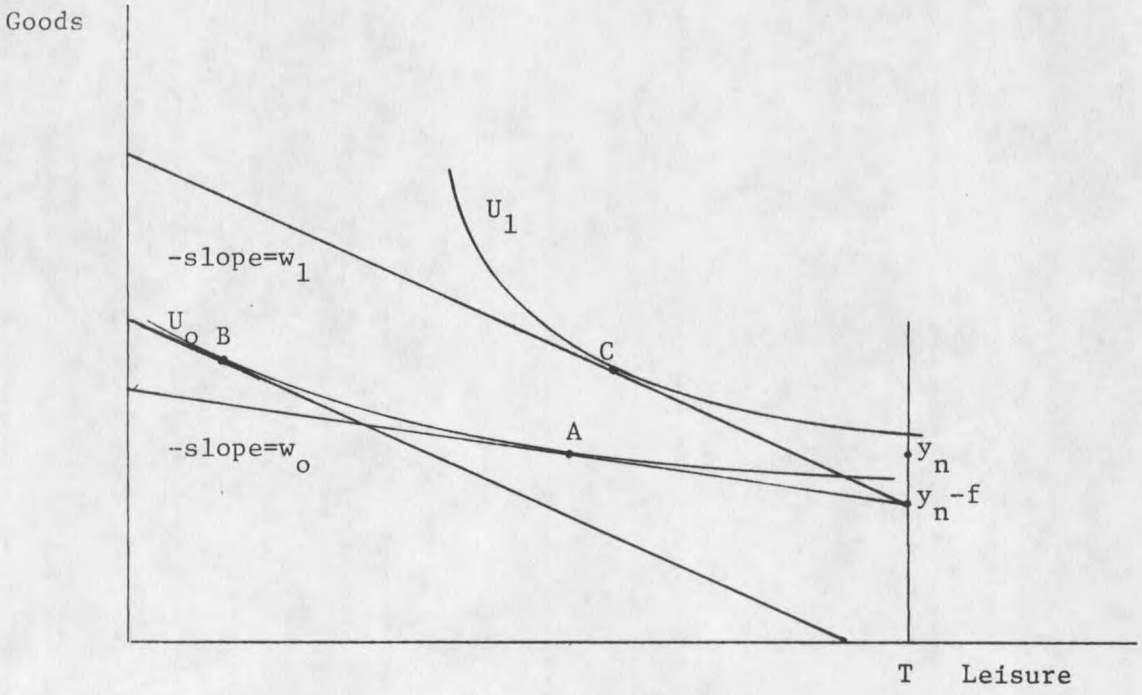

Figure 5. Income and substitution effects.

substitution and income effects move in the same direction, point C will fall to the left of point B, and it can be unequivocally stated that hours worked will increase.

For a corner solution, the effect on hours worked is entirely given by the substitution effect. Since the substitution effect requires that utility remains constant, hours worked will not be positive until $w \geq w_r$, then h_r hours will be worked.

The last topic to be discussed in the area of labor supply is selection bias. A general discussion of this problem will be given in Chapter 2. Development of the concept here is limited to formulating the problem in mathematical terms and explicitly showing the relationship between offered and accepted wages.

Having established w_r as the reservation wage, we observe

$$h > 0_r \text{ if } w > w_r$$

and

$$h = 0 \text{ if } w < w_r.$$

Assume an offered wage equation of the form

$$w = \mu + \varepsilon, \quad E(\varepsilon) = 0 \tag{8}$$

where $\mu = f(x)$, and x is a vector of personal characteristics relevant to the determination of offered wages. We seek to estimate μ, the average offered wage, given characteristics x. But, w is only observed

(9) $$\text{if } w > w_r,$$

that is, $$\text{if } \mu + \varepsilon > w_r,$$

or $$\varepsilon > w_r - \mu.$$

Labor force participation decisions are not completely random; positive hours of work and market wages are only observed for individuals who are offered wages higher than their reservation wages. Accepted market wages then are conditional on $w > w_r$, and their expectation can be written as

(10) $$E(w|w>w_r) = \mu + E(\varepsilon|\varepsilon>w_r-\mu),$$

where $$E(w|w>w_r) > E(w) = \mu,$$

which indicates that selection affects the expectation of ε, the $E(\varepsilon|\varepsilon>w_r-\mu) \neq E(\varepsilon)$. This result implies that average accepted wages are greater than average offered wages. Figure 6 illustrates this result.

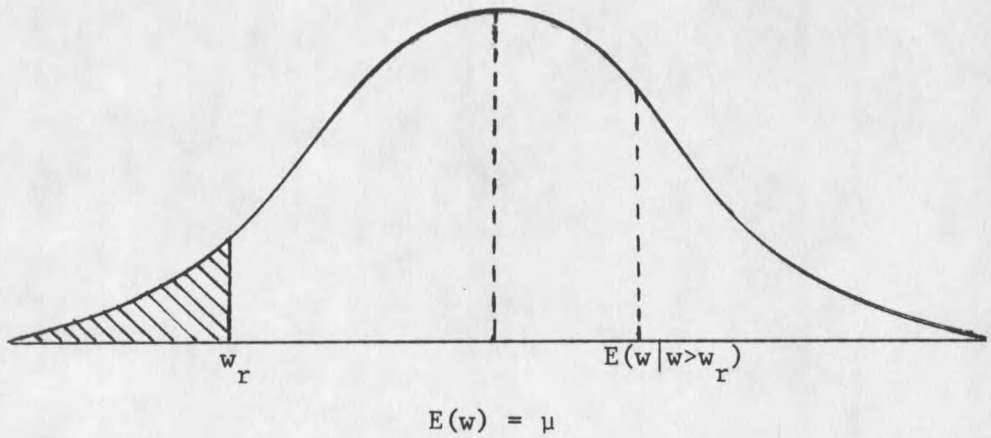

Figure 6. Means of offered and accepted wages.

Assuming that the distribution of offered wages is normal, if LFP decisions were completely random, offered wages would be accepted over the entire range of the distribution. Offered would equal accepted wages and the $E(w) = \mu$ would be the mean of the observed distribution. But, since $w \leqq w_r$ are not accepted, the lower tail of the distribution is not observed. The lower range of offered wages are not accepted, and the observed wage distribution is truncated. The average accepted wage is greater than the average offered wage, $E(w \mid w > w_r) > E(w)$. Intuitively, for a given set of characteristics, the higher the wage offered to an individual, the higher the probability that positive hours of work will be observed.

Labor Demand

The development of labor demand theory here will be limited to a discussion of the effects of changes in relative quantities of various types of labor on labor supply. Assuming a single output economy, where output g is the consumption good, and that the labor market is perfectly competitive, we can write

$$MP_i = w_i \qquad i = 1,\ldots,n. \tag{11}$$

That is, the marginal product of the ith labor type equals the real wage rate. Further, it can be shown

$$MP_i = \frac{\partial F(x_1 \ldots x_n, k),}{\partial x_i} \tag{12}$$

where $F(x_1 \ldots x_n, k)$ is a production function with n labor inputs and capital.

The focus here is on changes in the MP_i resulting from increases in the jth labor type relative to the ith labor type, where j = (1...n), and j can equal i. Relative increases in the jth labor type will either increase, decrease, or not affect MP_i depending on whether i and j are technically complementary, technically competitive, or technically independent respectively (Beattie and Taylor, 1984).

$$(13) \qquad \frac{\partial MP_i}{\partial x_j} = f_{ij} = \frac{\partial f(x_1 \ldots x_n, k)}{\partial x_j \partial x_i} \gtrless 0.$$

Changes in MP_i imply like changes in w_i and, as equation (7) indicates, changes in w_i will affect hours worked as well. If two labor types are either technically complementary or technically competitive in production, an increase in the quantity of labor supplied by one type will affect the labor demand for and, hence, quantity supplied of the other type.

The elasticity of complementarity, c_{ij}, is a particular measure of how a change in the quantity of factor j affects wages paid to factor i (Sato and Koizumi, 1973). It is defined as

$$(14) \qquad c_{ij} = \frac{\partial \ln MP_i}{\partial \ln X_j} \cdot \frac{1}{S_j}$$

$$= \frac{\partial MP_i}{\partial X_j} \cdot \frac{X_j}{MP_i} \cdot \frac{1}{S_j}$$

$$= \frac{f\, f_{ij}}{MP_i\, MP_j},$$

where $S_j \equiv w_j X_j / f$ is the share of factor j in output, f. It is the percentage change in the wage of i when input j is increased by one percent, divided by the share of input j. If $c_{ij} > 0$, then the two inputs i and j are q-complements (technically complementary); if $c_{ij} < 0$, then i and j are q-substitutes (technically competitive).

CHAPTER 2

LITERATURE SURVEY

This survey is organized as a discussion of hypotheses that have emerged to explain recent changes in relative wages between different demographic groups in the labor force. Groups are broken down by race, sex, education, experience and marital status. (In each category white males serve as the benchmark: all differentials and ratios are measured relative to them.)

Eight hypotheses will be discussed and can be stated as follows:

1) Since the 1950's, relative offered wages of females to males have increased more (decreased less) than relative accepted wages. This narrowing of the gap between offered and accepted wages for females relative to males suggests either that relative opportunities for females have increased, or mean reservation wages among women have decreased, or both.

2) The effects of government affirmative action programs are discussed. Three arguments concerning the effects of these programs on minority groups are analyzed.

i) Program effects are negative for low skill minorities and positive for high skill minorities.

ii) Programs have virtually no effect.

iii) The form of job discrimination has merely changed, the extent has not abated.

3) Increasing education levels of young blacks relative to young whites and decreasing labor market discrimination against blacks have narrowed the gap in entry level wages between blacks and whites. Consequently, life cycle age-earnings profiles of young blacks should be closer to that of young whites than the age-earnings profiles of older blacks were to older whites.

4) As the number of women workers increases relative to men, a decrease in the relative offered wages of women should result.

5) The coming of working age of the post World War II baby boom cohort has shifted the age composition of the labor force. The ratio of young to old workers has increased substantially. As a result the relative earnings of young to old workers have decreased.

6) In recent years, the number of workers with college educations have increased relative to those with high school educations. This implies that there will be a decrease in the wages of college educated workers relative to workers with a high school education.

7) Studies suggest that increasing LFPRs of women have had their greatest impact on the wages of young high school graduates, while the wages of young college graduates are most influenced by their absolute increase in numbers. The total effect implied by these changes on the wages of young male high school and college graduates relative to each other, and relative to their older counterparts, is that young high school graduates have fared worse relative to their older counterparts, while young college graduates have fared worse overall.

8) It has been argued that women are becoming more career oriented. If this is so, we should observe two things:

a) The quantity and quality of education, as well as occupational choices of women, are closer to those of men. This implies that entry level wages of women relative to men have increased.

b) The accumulation of on-the-job training (OJT) among women will be closer to men as well. The implication here is that the growth in wages with experience for women should have increased relative to men.

Selection Bias

Labor force participation rates (LFPRs) of women have historically been much lower than those of men. When making labor supply decisions, women are subject to a number of constraints that do not affect LFP decisions of men. Child bearing and rearing, social attitudes, and additional fixed costs incurred when both spouses work all increase the reservation wages of women relative to men.

On the demand side, average wages offered to women relative to men have historically been low. Lack of market oriented education and training, short work horizons, part-time and discontinuous employment, and discrimination have all reduced wage offers to women. In many cases, wage offers are less than the reservation wage, and, as such, we observe zero hours of work for many women. This implies that the mean wage offered to women in the aggregate is less than the mean accepted wage.

Not accepting wages below one's reservation wage causes a statistical problem known as selection bias. A range of positive hours

worked is observed for anyone who works, while exactly zero hours are observed for all non-workers. The distribution of hours is said to be censored at zero. Not correcting for selection bias either by ignoring it or discarding all observations on non-workers introduces a bias into estimated coefficients of the offered wage equation (Keeley, 1981, 23-32).

Changing opportunities for women in the labor market are best characterized by offered as opposed to accepted wages. There are two reasons for this. First, in choosing whether or not to accept an offer, one's reservation wage, the determinants of which are exogenous to the labor market, comes into play. Second, offered wages give information on real wages offered to individuals with certain characteristics, while accepted wages give the variety of individuals that will accept an offer. Over time, who will and will not accept a certain real wage offer will vary with the mean level of selection bias. Therefore, the set of individuals being observed at any two points in time is not the same.

A change in the level of selection bias can occur from either a change in real wages offered to women with constant characteristics or a shift in the labor supply of women given constant real offered wages. Between 1955 and 1978, the percentage of women of working age who work full-year, full-time (FY-FT) has increased from 36.7 percent to 49.4 percent (Mallan, 1983). The increase in the LFPR of women over this period implies that selection among women has decreased: offered and accepted wages are converging. Whether this decrease has resulted from higher real wage offers to women (better opportunities) or lower mean

reservation wages among women is unclear. Results in the literature suggest both reasons. This study will attempt to determine if predicted values of real offered wages have increased for the period 1967-1981.

Government Influence

In the 1960's and 1970's a number of pieces of anti-discrimination legislation were passed by Congress, and anti-discrimination victories were won in the Supreme Court as well. The two most important legislative enactments in this area were the 1964 Civil Rights Act (Title VII) and the Equal Employment Opportunity Act of 1972 (Title IX). Title VII prohibited firms as well as unions and employment agencies from discrimination on the basis of race, color, sex, religion, or national origin. Title IX added the federal and state and local governments, education institutions, and small firms (15 or more employees) to the list of covered employments, and it gave the "right to sue" to individuals who experienced discrimination (Welch, 1981).

The effectiveness of affirmative action legislation has been debated by researchers. On the one hand, it has been suggested that this legislation has increased the expectation of incurring costs from discriminatory practices. Figure 7 illustrates this argument. Assuming an employer's demand for discrimination is not a Giffen good, an increase in the price of discrimination will reduce the equilibrium quantity. The increase in the number of discrimination cases reaching

federal district courts with the enactment of Title IX supports this argument. In 1971, 759 cases were heard compared with 5,931 in 1977.[1]

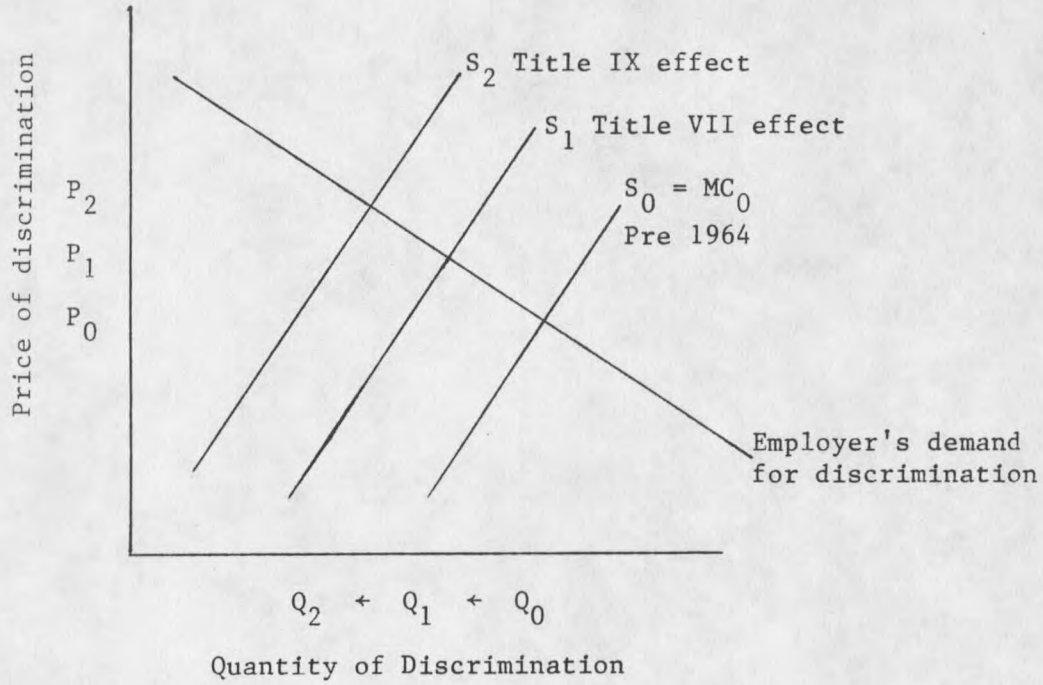

Figure 7. Effect of affirmative action legislation on demand for discrimination.

Andrea Beller (1982) gives further support to this argument with her finding that the passage of Titles VII and IX had an immediate negative impact on occupational segregation. Her findings indicate that between 1967 and 1974 the sex differential in the probability of being employed in a male occupation narrowed by 6.2 percent.

Haworth, Gwartney, and Haworth (1975) (HGH) attribute a six percent increase in the black-white earnings ratio in the 1960's to a decrease in employment discrimination resulting from affirmative action

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[1] This argument holds only if it is assumed that the demand for discrimination has not shifted out during this period.

legislation. However, the amount of change in discrimination due to legislation and the amount due to changing social attitudes is not discernible by their model.

On the other side, there are arguments that suggest such legislation has been ineffective, or at least has not had its desired effect. For one, Welch (1981) argues that affirmative action gives employers contrasting incentives in the hiring of minorities. There is a positive impact on the skilled positions and a negative impact on unskilled positions. Employers are given the incentive to ensure proportionate representation in skilled or highly paid positions and at the same time ensure that minorities are not over-represented in unskilled positions lest they be open to charges of "shunting."

Second, a study done by Smith and Welch (1977) indicates that the effect of affirmative action legislation has been minimal. They examine changes in black-white male wage ratios in different industries. Breakdown of industries is into public and private sectors. The public sector is given by government jobs (federal, state, local) and regulated industries. The only private sector industries that are examined are those that supply products to government. Using these breakdowns they can analyze differences in earnings ratio changes between the public and private sectors, and between industries that do a large percentage of their business with government (federal contractors) and those that do not. The logic here is that with enactment of Executive Orders #11246 (1965) and #11379 (1967) large scale federal contractors were made to comply with affirmative action legislation or risk losing their contracts. If the

legislation has been effective, the largest gains by blacks should be registered by those who work for federal contractors.

Their findings indicate that affirmative action has not been effective. Black-white earnings ratios in government have remained constant for the period 1960-1970, while ratios in the private sector have increased. However, among private sector industries which are regarded as federal contractors, black-white earnings ratios fall at an annual rate of three to six percent. In other private industries this ratio has increased at a rate of about one percent per year.

Finally, Edward Lazear (1979) argues that affirmative action legislation has merely changed the form of discrimination. The reaction of employers to legislation that makes observed wage discrimination difficult is to discriminate in the unobserved area of on-the-job training (OJT). Lazear finds that while entry level wages of whites and blacks have converged between 1966 and 1974, the gap in OJT between the two groups has increased enough to more than offset the entry level wage gains. Table 1 summarizes Lazear's findings.

Table 1. Black-white wage and on-the-job training differences.[a]

	White			Black			Differences (W-B)		
	Entry wage	OJT	Total	Entry wage	OJT	Total	Entry wage	OJT	Total
1966	2.14[b]	1.42[b]	3.56	1.57	.87	2.44	.57	.55	1.12
1974[c]	2.45	3.99	6.44	2.45	2.20	4.65	.00	1.79	1.79

[a] Table is derived from Lazear's results.
[b] Units are in dollars/hour.
[c] Numbers are adjusted for inflation. Results differ slightly from Lazear's because of rounding.

The results show that entry level wages for blacks have reached parity with those of whites during the eight-year period. OJT differences though have increased enough to widen the total wage gap. Since the shape of age-earnings profiles are largely dependent on OJT received early in one's working career, these differences translate into much flatter age-earnings profiles for blacks than for whites. Earnings between the two groups then are expected to diverge over the life cycle.

In terms of this study a number of implications come out of this series of arguments. The effects of affirmative action should be observable in changes in the slope of the age-earnings profiles of minorities relative to white males. Welch's (1981) argument implies that the age-earnings profiles of low-skill minorities decreased relative to white males, while the opposite is implied for high-skill minorities. Beller's (1982) and HGH's (1975) arguments suggest that affirmative action has effectively decreased the gap in age-earnings profiles between white males and minority groups. Lazear's findings, on the other hand, indicate that the entry level wage gap between white and black males has closed, but that the slope of the age-earnings profiles of black males has decreased relative to what it was before affirmative action legislation took effect. Finally, Smith and Welch's (1977) study implies that no changes in the age-earnings profiles of white males relative to minorities have occurred from affirmative action programs.

Cohort Improvement and the Vintage Hypothesis

Recent changes in the black-white earnings ratio have been given sufficient attention in the literature so as to merit a separate section here. Some arguments have been advanced that suggest results similar to Lazear's, while others suggest the opposite.

A study by Duncan and Hoffman (DH) (1979) reports findings similar to Lazear's. Using a single cross section,[2] they estimate returns to experience and amounts of OJT received by blacks and women. Their results are reported in Table 2. The experience coefficient for black males is less than three-fourths of that for white males, and the coefficients for women of both races are less than two-thirds of that for white males. Returns to experience are thus shown to be much higher for white males than for any of the other groups.

Table 2. OJT measures, experience, and training coefficients for 1975 by race and sex.

	White males	Black males	White females	Black females
Experience coefficients	.0478[a]	.0343	.0293	.0262
Average years of training	2.25	.99	.94	.81
Training coefficient	.0538	.0592	.0853	.0664

[a] Experience and training coefficients are the fractional increase wages/year due to an increase in experience or on-the-job training.

Source: Duncan and Hoffman (1979, pp. 595 and 597).

[2] Using a single cross section, Duncan and Hoffman cannot measure the changes in OJT as Lazear does. Rather, they can only measure the differences at a point in time.

If we recognize that returns to experience are returns to productivity increases due to OJT, the analysis can be extended further. The Panel Study of Income Dynamics data used by DH includes a measure of OJT by occupation, as well as information on the occupations of respondents. Using this information, DH construct estimates of average years of training received by race and sex. Their estimates, given in Table 2, indicate that white males receive more than two and one-quarter times as much training as any other group. Running a second regression using years of training completed as a variable, they are able to estimate returns to training. As the results in Table 2 show, training coefficients are higher for the three minority groups than for white males.

Based on the above results, DH conclude that there is no evidence of discrimination in returns to training, but there may be discrimination in choosing who gets trained. This accords with Lazear's findings, in that the OJT gap between white men and others is large and will lead to a divergence of age-earnings profiles over the life cycle.

Arguments have also been advanced that indicate that age-earnings profiles between blacks and whites are converging. A body of evidence has emerged to support the "vintage" hypothesis developed by Finis Welch (1973). The vintage hypothesis can be stated in three parts: (1) young blacks (newer vintages) are much closer to young whites in income producing characteristics than older blacks were to older whites; (2) young blacks are faced with considerably less labor market discrimination than their older counterparts were; and (3) because of

the above changes, a single data cross section does not accurately represent life cycle age-earnings profiles; vintage effects have to be accounted for.

Using data on both the quantity and quality of schooling as measures of income-producing characteristics, Welch shows convergence among blacks and whites. Table 3 gives the rate of increase in schooling levels for blacks relative to whites from 1930 to 1970. The data clearly show that levels of schooling for blacks and whites have converged and by 1970 were nearly equal. To estimate schooling quality Welch uses information on length of school term, enrollment and grade completion levels, and expenditures. Data for the period 1919-1954 showed almost complete convergence by the end of the period.

Table 3. Years of school completed at estimated time of labor market entry, selected years, 1930-1970.

Item	Year of labor market entry				
	1930	1940	1950	1960	1970
Mean schooling of blacks	5.9	8.0	9.9	11.1	11.4
Mean schooling of whites	9.6	11.1	12.0	12.6	12.6
Proportion of blacks with less than 9 years of school	.78	.58	.31	.15	.11
Proportion of whites with less than 9 years of school	.42	.22	.15	.10	.07
Proportion of blacks with more than 12 years of school	.03	.07	.13	.19	.19
Proportion of whites with more than 12 years of school	.08	.20	.32	.37	.38

Source: Smith and Welch (1978, p. 10).

Smith and Welch (1977) tabulate data in support of the vintage hypothesis. Table 4 is reproduced from their study. Their data indicate both convergence of age-earnings profiles of blacks and whites over the life cycle and that newer vintages fare significantly better than older vintages. The within cohort column gives the life cycle changes in earnings ratios of blacks relative to whites. It is clear that blacks have made significant gains during the 1960's. Of the sixteen school-experience divisions listed, only one showed a decline relative to whites, and the average increase was 4.5 percent. The between cohort column, which is not corrected for vintage effects, shows even greater increases. All twenty-four divisions were positive, and the average vintage gain over the decade was 8 percent.

Other relevant information in Table 4 includes: (1) Gains were greater at higher education levels. This is probably in part due to affirmative action programs, as employers worked to increase minority representation at skill positions. (2) Weekly earnings ratios are higher than annual ratios. This is attributable to the higher rates of unemployment among blacks.

In summary, Smith and Welch's data on vintage effects indicate that Duncan and Hoffman's estimates of average OJT received by minorities is biased downward.[3] Another study done by Hoffman (1979) confirms this. He measures vintage effects by comparing cross section and pooled data coefficients using data from the Panel Study of Income

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[3] White males show vintage effects as well, but estimates by Hoffman (1979) show them to be much smaller than those for blacks.

Table 4. Black-white earnings ratios for cohorts in 1960 and 1970.

Cohort experience as of 1970 (years out of school)	Average annual earnings		Average weekly earnings		Within[a] cohort 1970,60	Between[b] cohort 1970-60
	1970	1960	1970	1960		
I. All school completion levels						
1-5	.653		.702			.134
6-10	.648		.677			.104
11-15	.621	.510[c]	.641	.568	.073	.060
16-20	.601	.529	.618	.573	.045	.031
21-30	.594	.545	.616	.585	.031	.042
31-40	.604	.540	.620	.574	.046	.046
II. Elementary school graduates (8 years completed)						
1-5	.835		.865			.162
6-10	.779		.802			.089
11-15	.708	.673	.737	.703	.034	.013
16-20	.710	.688	.717	.713	.004	.021
21-30	.749	.671	.763	.708	.055	.022
31-40	.721	.719	.740	.741	.001	.030
III. High school graduates (12 years completed)						
1-5	.775		.806			.092
6-10	.769		.791			.077
11-15	.729	.654	.749	.714	.035	.067
16-20	.731	.676	.750	.714	.036	.060
21-30	.678	.655	.698	.685	.013	.050
31-40	.675	.623	.690	.648	.042	.100
IV. College graduates (16 years completed)						
1-5	.716		.775			.120
6-10	.647		.692			.110
11-15	.662	.618	.688	.655	.033	.106
16-20	.654	.559	.675	.582	.093	.158
21-30	.519	.446	.557	.470	.087	.136
31-40	.504	.389	.522	.421	.101	.100

[a] First difference of the corresponding entries in columns 3 and 4.

[b] First difference of entries in columns 3 and 4 of groups with same experience, e.g., .134 = .702 - .568.

[c] Data in 1960 columns has been pushed down 2 rows so that a single cohort can be read straight across.

Source: Smith and Welch (1977, p. 324).

Dynamics 1967-1974. The pooled model still shows evidence of increasing differences in age-earnings profiles of blacks and whites, but they are considerably less than those estimated by the cross-sections.

Hoffman, then, finds that vintage effects are relevant, but argues that Smith and Welch overstate their magnitude. Smith and Welch, he argues, find convergence as opposed to a decreased rate of divergence of age-earnings profiles of blacks and whites because their results were influenced by the specific characteristics of their observation years. The base year used by Smith and Welch, 1959, was a high unemployment year, while their comparison years 1966 and 1969 were years of relatively low unemployment.

This potpourri of results suggests that this study should find returns to education and experience for non-whites and white females to be lower than those for white males. Vintage effects will not be corrected for; rather, evidence of vintage and life cycle gains by minorities will be indicated by a narrowing of the gap in age-earnings profiles between white males and others. Also, since no correction is made for unemployment in this study, Hoffman's argument that this will affect the magnitude of the observed effects is relevant here. However, unlike Smith and Welch's study, the base year of this study was a low unemployment year while the comparison year was a high unemployment year.[4] Vintage effects, as such, will be understated.

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[4] Unemployment rates in 1967 and 1981 for blacks were 7.4 percent and 14.2 percent respectively, and for whites the rates stood at 3.4 percent and 6.7 percent.

Effect of Increasing LFPRs on the Relative Wages of Women

Figure 8 displays the increase in the percentage of female relative to male FY-FT workers for the period 1956-1978. While the percentage of males working FY-FT has fluctuated around the mean, the percentage of female FY-FT workers has climbed steadily. This increase among females is distributed among all working age groups. Table 5 gives the LFPRs for females of different age groups for the period 1955-1977. The data show that LFPRs have increased for all age groups, with the largest increases occurring in the two youngest categories.

Assuming that this approximately 6 percent increase in the LFPR of FY-FT workers reflects a shift in supply more than an increase in demand for women workers, relative wages of females should decline. The extent of the relative decline of the wages of young women and of women on the whole is determined by two factors: (1) the substitutability between the various age groups of women; and (2) the substitutability of women for men.

Women are generally highly substitutable for each other across age groups.[5] Short work horizons and periods of interrupted labor force activity tend to reduce the amount of OJT invested in by women over their life-cycles.[6] Following Rosen (1972) and Welch (1979), investments in OJT largely determine the career phases one goes through.

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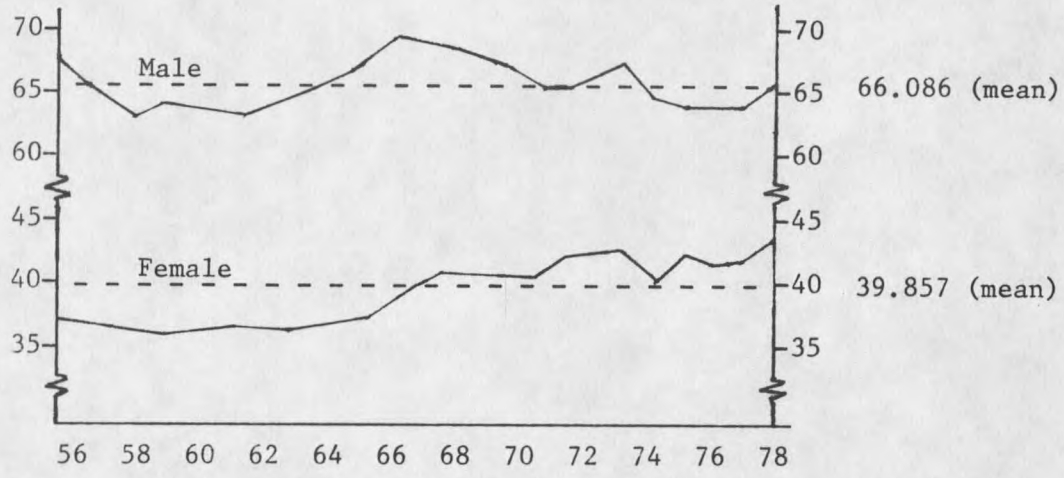
[5] Analysis changes considerably when women are broken down by marital status. This will be examined in a subsequent section.

[6] The question of whether lower OJT investment for women is due to discrimination or rational decision is ignored for the present.



Source: Romeo (1983, p. 2).

Figure 8. Percent full-year, full-time workers (male-female).

Table 5. Annual total money income ratios for full-year, full-time workers, and women's labor force participation by age, selected years.

Age	1955	1960	1965	1970	1975	1977
			Annual income: Women's/men's			
20-24	83.9	90.6	78.9	74.0	77.8	78.0[a]
25-34	66.1	6.25	62.1	64.9	65.8	67.5
35-44	63.2	55.8	56.6	53.9	54.9	55.0
45-54	62.2	57.7	57.8	56.3	53.9	53.7
55-64	65.5	55.9	62.4	60.3	57.6	56.4
			Labor force participation			
20-24	45.9	46.1	49.2	57.7	65.4	67.7
25-34	34.9	36.0	36.3	43.2	53.5	58.3
35-44	41.6	43.4	44.3	49.9	54.9	58.9
45-54	43.8	49.8	49.9	53.7	54.3	55.4
55-64	32.5	37.2	40.3	42.6	40.7	40.8

[a] Ages 18-24.

Sources: Lucy Mallan (1983). Originally in Current Population Survey, P-60 for earnings. For labor force participation 1966-1977, BLS Bulletin, Handbook of Labor Statistics, 1978, Table 3. For 1978, BLS Report 565, Employment in Perspective: Working Women.

Large investments in OJT result in a career which can be thought of as a series of occupations. At each phase workers perform different tasks which are not perfect substitutes for each other. Low investments in OJT, on the other hand, result in career phases that are much less distinct and more highly substitutable.

A study by Mark Berger (1983) examines the substitutability of women for men. His results indicate that females are most substitutable for younger, less-educated males. This finding is consistent with results of Grant and Hammermash (1981), who argue that young workers and adult females are highly substitutable.[7] Results from both studies indicate that the substitutability of females for older or highly educated males (16+ years of schooling) is extremely limited.

Two implications on the effect of increasing LFPRs of women on their wages relative to men can be drawn from the above studies.[8] One, there should not be significant relative wage movements between age groups for women. This expectation is consistent with Freeman's (1979) finding that "large changes in the age-structure of the population would have little or no impact on the [women's] profiles" (Freeman, 1979, p. 298). And two, relative wage changes between women and men will be similar to changes between young less educated males and other

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[7] Freeman (1979) finds females and young males to be slightly complementary. This finding is inconsistent with the findings of both Berger and Grant and Hammermash. Freeman, though, unlike Berger, does not disaggregate by schooling, nor does he disaggregate by race as Grant and Hammermash do.

[8] This analysis assumes that women are not becoming more career oriented. Changes in the career orientation of women are examined below.

male labor force groups. A positive (negative) change in relative wages of young, less educated males relative to other males suggests a positive (negative) change for females relative to males generally. Cohort effects, to be examined below, have decreased the wages of young males relative to prime age males: a decline in the wages of females relative to prime age males is therefore expected as well.

Cohort Effects

The absolute increase in numbers of younger to older workers as a result of the post World War II baby boom has been well documented. The data in Table 6 show the extent of the increases in young relative to prime age workers. In the period from 1966-1976 there has been a greater than 40 percent increase in the number of young relative to older male workers. The increase for females has been even more

Table 6. The changed age structure of the work force by sex.

	Male workers				Female workers			
	Numbers (in 000's)		Relative to workers 35+		Numbers (in 000's)		Relative to workers 35+	
	20-24	25-34	20-24	25-34	20-24	25-34	20-24	25-34
1966	6,139	10,761	.201	.352	3,601	4,516	.220	.276
1968	6,788	11,376	.221	.371	4,251	5,104	.251	.301
1970	7,378	11,974	.241	.391	4,893	5,704	.276	.322
1972	7,795	12,806	.257	.423	5,337	6,525	.298	.365
1974	8.105	13,993	.270	.465	5,867	7,826	.322	.430
1976	8,421	14,990	.282	.502	6,339	9,183	.336	.487
% change 1966-1976	37.2	39.3	40.2	42.6	76.0	103.3	52.7	76.4

Source: Richard Freeman (1979, p. 292).

pronounced. The number of 25 to 34-year-olds relative to those 35+ has nearly doubled during this 10-year period.

As discussed above, the high degree of substitutability among female age groups indicates that large changes in the age structure have little impact on their relative wages. With males, on the other hand, this change in the age structure has had a substantial impact on relative wages. Freeman (1979) argues that age-earnings profiles for males have "twisted" in favor of older workers. Table 7 gives the weekly wages of new entrants to peak earners by years of schooling for the period 1967-75. With the exception of males with one to three years of college, decreases are shown to be on the order of 14 percent.

Table 7. Weekly wages of new entrants relative to peak earners by years of schooling, 1967-75.

Years of school completed	Year									Percent change
	1967	1968	1969	1970	1971	1972	1973	1974	1975	
Grade school										
8-11 years	.56	.52	.50	.46	.41	.45	.44	.47	.48	-14
12 years	.65	.63	.62	.58	.56	.55	.54	.55	.55	-15
College										
1-3 years	.59	.62	.58	.53	.50	.51	.49	.53	.55	-6
4 or more years	.63	.63	.63	.59	.58	.55	.54	.54	.54	-14

Source: Welch (1979, p. 573).

Some permanent effects of cohort size are likely as well. Freeman (1979) gives three reasons why he expects this to be the case. (1) Many firms give standard pay raises. This type of pay policy will mean

that groups entering the market with low earnings compared to others will never catch up. (2) Getting the job one has aspired to is more difficult for members of a large cohort. Increased competition for better jobs pushes some individuals into jobs with flatter age-earnings profiles than are normally chosen by young workers. (3) The rates of promotions and raises will be depressed by increased competition of a large pool of workers of the same age group. This implies that large cohorts will lose ground relative to smaller cohorts that follow.

This present study examines the period 1967-1981. Since the baby boom peaked at 4.7 million births in 1957, the greatest cohort effects should be found in this period. In 1967 the first of the baby boomers were just entering the labor market; by 1981 the 1957 group was already 24 years old. Significant cohort effects which depress the wages of young workers relative to their older counterparts should be observable in this period.

Educational Attainment

The cohort effects discussed above have not affected all education groups equally. Increased educational attainment of youths caused the baby boom effects to fall disproportionately on college graduates. Table 8 shows the increase of young college and young high school educated workers relative to their older counterparts. The relative increase of young to older college educated workers is twice that of young to older high school educated workers for the 20-24 age group, and over five times as high for the 25-34 age group. With females the data depicts much the same story. The increase in young to old college

Table 8. The changed structure of the work force by sex and education.

	College graduate work force, by age				High school graduate work force, by age			
	Numbers (in 000's)		Relative to college workers 35+		Numbers (in 000's)		Relative to high school workers 35+	
	20-24	25-34	20-24	25-34	20-24	25-34	20-24	25-34
				Male workers				
1966	280	1,067	.129	.493	2,057	3,929	.247	.475
1968	290	1,137	.131	.514	2,066	4,220	.232	.473
1970	376	1,200	.161	.514	2,324	4,529	.248	.483
1972	567	1,393	.232	.569	2,772	4,792	.288	.497
1974	585	1,725	.222	.655	3,011	5,110	.289	.507
1976	686	2,203	.242	.779	3,334	6,309	.330	.525
% change 1966-1976	145.0	106.5	84.7	59.0	62.1	60.5	42.2	11.0
				Female workers				
1966	331	444	.352	.472	1,879	2,063	.311	.342
1968	436	526	.397	.479	2,104	2,358	.317	.356
1970	515	614	.483	.576	2,400	2,764	.322	.371
1972	620	801	.540	.698	2,593	3,068	.331	.392
1974	699	1,101	.565	.890	2,598	3,452	.319	.424
1976	757	1,388	.565	1.04	2,935	3,958	.346	.466
% change 1966-1976	128.8	121.6	60.5	120.3	56.2	91.9	11.3	36.3

Source: Richard Freeman (1979, p. 292).

educated workers is more than five times the increase in young to old high school educated workers for the 20-24 group, and nearly four times as high for the 25-34 age group.

For college educated workers of both sexes, the increase in numbers relative to both prime age workers in the same schooling group and own cohort workers in the high school graduate schooling group have been great. In addition, the substitutability of young college for older college educated workers is less than the substitutability of young for older high school educated workers. This is to be expected, given that occupational differences between young and older college workers are greater than those between young and older high school workers (Welch, Rosen). The implication to be drawn here for males is that own cohort effects on wages will be greater for college than for high school educated workers. For females, what is to be expected is not so clear. If increased educational attainment is reflected in increased occupational attainment and labor force attachment, the wages of young female college graduates should rise relative to their older counterparts, ceteris paribus.

In considering cohort effects on black males distinctly from white males, the question of whether "vintage" improvement and reductions in discrimination will dominate negative cohort effects must be looked into. If cohort effects dominate, relative wage changes between old and young blacks should be the same as those between old and young whites. If, on the other hand, reductions in discrimination and vintage improvements dominate, then the wages of young blacks should increase relative to their older counterparts.

Combined Effects

In this section an examination of which educational group of young males experienced the greatest relative decline in respect both to each other and to their older counterparts is undertaken. The above discussions indicate that the increasing LFPRs of women have the greatest effect on the wages of young high school educated males. The strongest influence on the wages of young college educated males, on the other hand, has been their absolute increase in numbers; the baby boom cohort effect combined with increasing educational attainment of young workers has depressed the wages of this group. The effects of these demographic changes, though, are not limited to young high school and college educated males. Table 9 gives the estimated elasticities of complementarity for females, young high school and college graduate males, relative to themselves, other labor force groups, and capital. The data clearly show that, while females are most substitutable for young high school educated males (X_{yhs}), they are substitutable for all other labor force groups as well. For young college graduates (X_{yc}), the data indicate that the increase in their own quantity is the most important factor contributing to their decline in earnings relative to their older counterparts. However, in all cases a change in the quantity of one factor affects the wage rates of that factor and all others.

Table 9. Estimated elasticities of complementarity.

Factors[a]	X_{yhs}	X_{yc}	X_{ohs}	X_{oc}	X_f	X_k
X_{yhs}	-.506	-.232	-.047	-.851	-1.27	.751
X_{yc}	-.232	-3.45	-.430	.680	-.132	.613
X_f	-1.27	-.132	-.400	-.144	-.294	.767

[a] Factors represent quantities of each input.

Source: Mark Berger (1983, p. 187).

To determine what relative wage changes occurred between young high school and young college educated males, the combined effects of demographic changes on both groups must be known. Further, the additional information of how demographic changes affected the wages of older males is needed to calculate how younger workers fared relative to older workers. Table 10 contains this information. Percentage changes in relative wages, for the period 1967-1974, are given for younger relative to older males of the same schooling group, and for some cohort males across schooling groups. The predicted and actual change results both show that young high school graduates experienced a greater decline relative to their older counterparts than young college graduates did. Berger's estimates imply that the most important factors in the declines of younger relative to older workers is once again the increase in the number of female workers for high school graduates, and their own increase in numbers for college graduates.

Table 10. Mean shares, factor quantity changes, and decomposition of predicted log relative earnings changes, 1967-1974.

			Relative earnings change decompositions[a]			
	(1) S_1	(2) $\Delta \ln X_1$	(3) $\Delta \ln(P_{yhs}/P_{ohs})$	(4) $\Delta \ln(P_{yc}/P_{oc})$	(5) $\Delta \ln(P_{yc}/P_{yhs})$	(6) $\Delta \ln(P_{oc}/P_{ohs})$
X_{yhs}	.113	.227	-.012	.016	.007	-.021
X_{yc}	.035	.528	.004	-.076	-.060	.021
X_{ohs}	.267	-.045	-.009	.003	.005	-.007
X_{oc}	.055	.225	-.008	.027	.019	-.016
X_f	.135	.212	-.025	.000	.033	.007
X_k	.395	.880	-.001	.012	-.048	-.062
Predicted change:			-.051	.018	-.044	-.078
Actual change:			-.055	-.029	-.062	-.088

[a] P's represent factor prices.

Source: Mark Berger (1983, p. 189).

The table shows declines in the wages of college relative to high school graduates for both age categories. For the younger age group, the combination of the increase in the number of college graduates and the increase in the capital stock caused the relative decline. For older workers, the decline was largely caused by the increase in the capital stock. The negative effect of increases in the capital stock on the relative wages of college graduates is attributable to the greater estimated complementarity of less educated workers with capital (Berger, 1983).

In total, the data indicate that while young high school graduates fared worse relative to their older counterparts, they gained relative

to young college graduates. The results of this present study should accord with those given here. The time frame of our study is longer (1967-1981), but the demographic changes that were taking place between 1967 and 1974 have continued.

Career Orientation of Women

Thus far, increases in the LFPRs of females and the resultant effects on male wages have been discussed. The discussion is now turned to the question of changing career orientation of women. Are women looking at longer term, better paying, male dominated careers, as opposed to low paying, dead end, traditional women's jobs? To determine this from the data, two questions must be asked. One, have there been changes in entry level wages of women relative to men? A decrease in the gap of entry level wages would indicate that women are making inroads into male occupations. And second, have returns to experience increased for women relative to men? Lower returns to experience for women historically have been a reflection of lower quantities of OJT received by women. Traditional women's jobs do not have extended career ladders and do not require large investments in OJT. If OJT for women has increased relative to men, it should follow that the gap between women's and men's age-earnings profiles should be smaller than in the past.

Using two data cross-sections (1967 and 1981), this present study will examine, one, entry level wage differences between men and women in the two years; and two, cross-sectional age-earnings profiles of women and men for the two years.

Reported findings in the literature suggest a number of hypotheses. A study by Lucy Mallan (1983) determined that experience levels of women have increased along with LFPRs. The average number of years worked in a decade increased from 7.1 in 1956-1965 to 8.3 in 1966-1975 for women; the increase for men was from 9.4 to 9.5 years during that same period. From this information she determines that the pay gap that has been maintained between women and men is the result of role differentiation and occupational discrimination. The implication here is that there has been little or no change in the degree of occupational segregation among women and men. A study by Nancy Rytina (1981) bears out this implication. Table 11 gives her results. As of 1975, the data show that 61 percent of FY-FT working women are lumped

Table 11. Employment among full-time, year-round workers in occupations ranked by the percent of women employed, 1975.

	All occupations		
		Percent of employed	
Percent of women	Number of occupations	Women	Men
Total	419	100	100
91-100	41	40	1
81-90	15	11	1
71-80	19	10	3
61-70	13	5	2
51-60	18	8	4
41-50	31	6	5
31-40	36	7	8
21-30	29	3	5
11-20	38	7	22
0-10	179	2	49

Source: Nancy Rytina (1981, p. 50).

into 75 "female occupations" at one end of the occupational spectrum, while 71 percent of men work in 217 occupations at the other end. The results of Mallan and Rytina suggest that returns to experience for women probably have not changed much. Women are still employed in occupations that require less investment in OJT on the average.

Victor Fuchs (1971) suggests that occupational attainment and career orientation of women differs greatly by marital status. Using a cross section of data from the 1960 Census of Population, he finds that single women have age-earnings profiles that maintain at approximately 85 percent of those of men. Married women, on the other hand, have entry level wages that measure about 80 percent of those of men, but that decline relative to men steadily throughout their life cycle. This indicates that differences in investment in OJT for women are closely related to marital status.

Mincer and Polacheck (1974) derive estimates of experience coefficients for men and single and married women. Using the 1966 cross section of data from the Survey of Economic Opportunity, they report findings in accordance with those of Fuchs. Their reported coefficients for 30-44 year old men, single and married women are .034, .026, and .012 respectively[9]. The implication from these two studies is that single women receive more OJT than married; which suggests that single women have been more successful at breaking into men's occupations than married women have.

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[9] Experience coefficients are the fractional increase in wages/year.

Summary

The above hypotheses suggest that a number of relative wage movements have occurred in response to recent demographic changes and affirmative action legislation. White males still hold the dominant position in the labor force, but some whittling away at this position is indicated by reported findings.

Women are entering the labor force in ever increasing numbers, and there is some evidence that they are becoming more career oriented. The "gender wage gap," however, has not changed significantly over the last thirty years. Explanations that have emerged to explain this gap range from charges of discrimination against women and support for affirmative action to arguments suggesting that females make rational decisions in choosing jobs requiring less education and OJT. The findings that females compete with baby boom cohort males is also given as a partial explanation.

In reference to opportunities for women, data on occupational attainment indicates that there has been little change. Examination of offered as opposed to accepted wages should give us more information in this area.

Findings on how non-whites have fared relative to whites are mixed. Observations of some researchers indicate that the racial wage gap is closing and that opportunities for non-whites are increasing. Newer vintages of non-whites, it is argued, are subject to less discrimination and are closer to whites in educational levels and quality than older vintages were. The findings of other researchers,

though, suggest the opposite. Some results indicate that opportunities for OJT are not open to all, and that discrimination has not abated; rather, it has just taken more covert forms since the passing of affirmative action legislation.

CHAPTER 3

MODEL DEVELOPMENT AND ESTIMATION

The purpose of this section is to develop a model to estimate offered and accepted wages. Estimation of the model is a three-step process. The first step, estimation of probit coefficients to correct for sample selectivity, is common in current literature. The second step is the estimation of a predicted value of hours for each individual who works. This step is made necessary by two characteristics of the early Current Population Survey (CPS) data: (1) only data on earnings is included; CPS data do not contain data on wages. Hence a measure of wages is constructed from earnings and hours data. (2) The data on hours is subject to large measurement error. The third step is the estimation of wage equations and the determination of predicted values of wages for individuals with specified characteristics.

This section is developed in three parts. First, the data is discussed; second, the model is specified; and, third, alterations made to the model during actual estimation are explained.

Data

Source and treatment of data are described in Appendix D; this section is limited to a discussion of data limitations that affect the estimation process. As stated above, there are two major data

problems: large measurement error of the hours variable and the lack of a wage variable.

CPS data contain two different hours measures: hours last week (HLW) and usual hours worked per week last year (USH). Both variables are suspected of containing large measurement error because unreasonable estimates result from the use of either variable as an hours measure.

An[10] ideal measure of hours worked last year would be weeks worked last year (WEEKS) multiplied by the average hours per week. The latter number, however, is not available. The HLW variable which is available is constructed by survey recipients answering the question, "How many hours did you work last week?" For full-year workers, HLW is a reasonable estimate of average hours per week for weeks worked. But for part-year workers, HLW is at best a reasonable estimate of average hours per week, including both weeks in which the individual worked and weeks in which he or she did not work. Consequently, simply multiplying HLW times WEEKS would produce a measure of hours worked last year (HLY) that is biased downward for part-year workers. Stapleton and Young (1984) develop a procedure for constructing HLY from HLW times WEEKS that reduces the downward bias for part-year workers. For each year, race, and sex, the mean of HLW is computed separately for full-year/full-time and full-year/part-time workers. The means are then assigned to individuals who reported zero hours last week and were

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[10] This discussion is based on work done by Stapleton and Young (1984). Much of it is taken verbatim from their notes.

part-year/full-time and part-year/part-time workers last year respectively. This is how the measured hours worked last year variable used in this study is constructed.

The USH variable by comparison is suspected of having an upward bias. This variable is constructed by surveyors asking individuals what their usual hours per week last year were. Since individuals are unlikely to average in weeks in which they worked less than usual, this variable probably overstates average hours.

A test done by Stapleton and Young using 1976 CPS data found that the mean of an HLY variable constructed using USH times WEEKS (HLY2) was ninety-two hours greater than the mean of an HLY variable constructed using the adjusted HLW variable times WEEKS (HLY1) for both men and women. The standard deviation of HLY1, on the other hand, is 11 percent higher for men and 2 percent higher for women. Given the suspected upward bias in HLY2, Stapleton and Young argue that the smaller means for HLY1 are of no serious concern. They conclude that their constructed hours measure is at least as reasonable as one utilizing usual hours.[11]

Table 12. Comparing means and standard deviations of two measures of hours worked last year (1976).

	HLY1		HLY2	
	Mean	Standard deviation	Mean	Standard deviation
Men	1666	907	1758	786
Women	1195	808	1287	768

[11] For further details on the tests performed by Stapleton and Young refer to the data appendix available from either author.

Two additional equations are required to complete the model because of measurement error on the hours variable and the lack of a wage variable. The one equation specifies the difference between measured and actual or desired hours; and the other equation specifies the construction of a wage variable. Both equations will be given below.

Model Specification

Letting w^*, w^r, and h^* equal offered wages, reservation wages, and desired hours respectively, the following system of equations is formed (Keeley, 1981, pp. 22-32; Heckman, 1979, p. 222):

$$w^* = \Pi' x + \varepsilon_1 \tag{1}$$

$$w^r = \Theta' x + \varepsilon_2 \tag{2}$$

$$h^* = \alpha' x + \gamma w^* + \varepsilon_3. \tag{3}$$

Equation (1) determines the wage offered to an individual with characteristics x. Equation (2) is the reservation wage, which also depends on an individual's characteristics and may reflect fixed costs of working discussed earlier. Finally, equation (3) is the labor supply function; desired hours depend on an individual's characteristics and the offered wage. The disturbances ε_1, ε_2, and ε_3 are assumed to be independently and identically distributed normal variates with mean zero and covariance matrix

$$\sum = \begin{pmatrix} \sigma_{11} & \sigma_{12} & \sigma_{13} \\ \sigma_{21} & \sigma_{22} & \sigma_{23} \\ \sigma_{31} & \sigma_{32} & \sigma_{33} \end{pmatrix}$$

The characteristics of CPS data discussed above are such that the following additional specifications for measured hours and earnings are required.

(4) $$h = \begin{cases} h^* + e \text{ if } w^* > w^r \\ 0 \quad \text{otherwise} \end{cases}$$

(5) $$y = \begin{cases} w^*h^* + f \text{ if } w^* > w^r \\ 0 \quad \text{otherwise,} \end{cases}$$

where h and y are measured hours and earnings respectively, e and f are measurement errors with $E(e|w^*>w^r) = 0$, $E(f|w^*>w^r) = 0$, and both e and f are assumed to be uncorrelated with disturbances ε_i, i = 1,2,3, and each other.

Given $w^* > w^r$, (1) and (2) imply

(6) $$\varepsilon \equiv \varepsilon_1 - \varepsilon_2 > (\theta - \pi)'x \equiv \sigma\beta x,$$

and $\text{var}(\varepsilon) = \sigma_{11} + \sigma_{22} - 2\sigma_{12} \equiv \sigma^2$. The major focus in the development of this model is to estimate the coefficients, π, and to determine predicted values for the following selection corrected wage equation:

(7) $$E(w^*|w^*>w^r) = \pi'x + \frac{\sigma_{11}-\sigma_{12}}{\sigma}\lambda,$$

where $\lambda = \frac{\phi(\beta'x)}{\Phi(\beta'x)}$, and ϕ and Φ are the standard normal density and

cumulative distribution functions (Heckman, 1979, p. 214). The term $\frac{\sigma_{11}-\sigma_{12}}{\sigma}\lambda$ is the conditional expectation of ε, given that an individual works. This result indicates that the expected value of ε_1 is affected by the selection process (the expected values of ε_2 and ε_3 are affected as well). Intuitively, individuals who are offered higher than average wages for a given set of measured characteristics would have a higher probability of working, and a positive value of the disturbance term, and vice versa. The same type of reasoning applies to the hours equation. For people who work, those who are offered higher than average wages would be inclined to work more or less hours (depending on the slope of the labor supply function) than someone who is offered the average wage for their measured characteristics. The expectation is therefore given by,

$$(8) \qquad E(\varepsilon_i | w^* > w^r) = \frac{\text{cov}(\varepsilon_i,\varepsilon)}{\text{var}(\varepsilon)} \cdot E(\varepsilon | w^* > w^r), \quad i=1,2,3$$

(Johnson and Kotz, 1972, p. 70). The $\text{cov}(\varepsilon_i,\varepsilon) = E(\varepsilon_i\varepsilon_1 - \varepsilon_i\varepsilon_2) = \sigma_{i1}-\sigma_{i2}$; and it can be shown that $E(\varepsilon | w^* > w^r) = \sigma\lambda$. These results, and the variance given above, are substituted into (8) to obtain $\frac{\sigma_{11}-\sigma_{12}}{\sigma}\lambda$.

To estimate (7), estimates of β and w must first be obtained. β can be consistently estimated by probit giving us $\hat{\beta}_{ML}$, and thus consistent estimates of λ, $\hat{\lambda}$, are attained as well.

The procedure for estimating $\hat{\beta}_{ML}$ and $\hat{\lambda}$ is as follows. Assume that a person works if $w^* > w^r$, that is, if

$$(9) \qquad \beta' x + \varepsilon/\sigma > 0.$$

Next, define a dummy variable which equals one if an individual works, and zero otherwise,

$$\text{(10)} \qquad \text{LFP} = \begin{cases} 1 \text{ if EARN} > 0 \\ 0 \text{ otherwise.} \end{cases}$$

Given a sample of T individuals in which the first T_1 are workers ($T_1<T$), define a probit likelihood function to derive $\hat{\beta}_{ML}$:

$$\text{(11)} \qquad L = \prod_{t=1}^{T_1} \Phi(\beta' x_t) \cdot \prod_{t=T_1+1}^{T} [1 - \Phi(\beta' x_t)].$$

Maximization of (11) with respect to β yields a consistent and asymptotically efficient estimator, $\hat{\beta}_{ML}$.

To estimate w, first define $\bar{h} \equiv E(h|w^*>w^r)$. If $\bar{h}$ were available, then for individuals who work,

$$\text{(12)} \qquad w \equiv \frac{y}{\bar{h}} = \frac{w^*(\bar{h}+v) + f}{\bar{h}},$$

where f is from (5) above, $h^* = \bar{h}+v$, and v is a disturbance term[12] with $E(v|w^*>w^r) = 0$. The expected value of the wage given that an individual works is,

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[12] To show that the conditional expectation of v = 0, rewrite $h^* = \bar{h}+v$ as $v = h^*-\bar{h} = (\alpha+\gamma\pi)'x + \gamma\varepsilon_1+\varepsilon_3 - [(\alpha+\gamma\pi)'x + \gamma(\frac{\sigma_{11}-\sigma_{12}}{\sigma} + \frac{\sigma_{31}-\sigma_{32}}{\sigma})\lambda]$

$$= \gamma\varepsilon_1+\varepsilon_3 - [\gamma(\frac{\sigma_{11}-\sigma_{12}}{\sigma} + \frac{\sigma_{31}-\sigma_{32}}{\sigma})\lambda]$$

Taking the conditional expectation, the right-hand side will equal zero.

$$(13)\quad E(w|w^*>w^r) = \pi'x + \frac{\pi'x}{\bar{h}} \cdot E(v|w^*>w^r) + E(\varepsilon_1|w^*>w^r) + \frac{1}{\bar{h}} \cdot E(\varepsilon_1 v|w^*>w^r) + \frac{1}{\bar{h}} \cdot E(f|w^*>w^r)$$

$$= \pi'x + 0 + \frac{(\sigma_{11}-\sigma_{12})}{\sigma}\lambda + \eta\bar{h}^{-1} + 0,$$

where $\eta = \gamma\sigma_{11}+\sigma_{13} - \frac{(1-k)}{\sigma^2}(\sigma_{11}-\sigma_{12})[\gamma(\sigma_{11}-\sigma_{12}) + \sigma_{13}-\sigma_{23}]$ (Johnson and Kotz, 1972, p. 70), γ is from (3) above, and $k \equiv var(\varepsilon|w^*>w^r)/\sigma^2 = (1 - \lambda(\beta'x) - \lambda^2)$ (Amemiya, 1973, p. 1001).

This would be the end of the estimation procedure if $\bar{h}$ were known, but it is not. A consistent estimator of $\bar{h}$, $\hat{\bar{h}}$, can be obtained from the reduced form hours equation. Substituting (1) into (3) and this result into (4) gives,

$$(14)\quad h = \Gamma'x + \gamma\varepsilon_1 + \varepsilon_3 + e,$$

where $\Gamma = \alpha + \gamma\pi$. The expected value of hours for workers is,

$$(15)\quad E(h|w^*>w^r) = \Gamma'x + \gamma\frac{(\sigma_{11}-\sigma_{12})}{\sigma}\lambda + \frac{(\sigma_{31}-\sigma_{32})}{\sigma}\lambda + 0.$$

$$= \Gamma'x + \psi\lambda,$$

where $\psi = \frac{[\gamma(\sigma_{11}-\sigma_{12}) + (\sigma_{31}-\sigma_{32})]}{\sigma}$.

If λ in (15) is replaced by $\hat{\lambda}$ from probit, then the consistency of the $\hat{\beta}_{ML}$ for β implies consistency of $\hat{\Gamma}$ and $\hat{\psi}$ for Γ and ψ. The coefficient vector $\begin{pmatrix}\hat{\Gamma}\\ \hat{\psi}\end{pmatrix}$ is now estimated using ordinary least squares, and a

predicted value for the expected value of hours, $\hat{\bar{h}}$, is determined. Then w in (12) is replaced by $\tilde{w}$, where $\tilde{w} \equiv y/\hat{\bar{h}}$. The asymptotic mean of $\tilde{w}$ equals w.[13] The wage equation is rewritten as,

$$\tilde{w} = \pi'x + \delta\hat{\lambda} + \eta\hat{\bar{h}}^{-1} + \tilde{u}, \tag{16}$$

where $\delta = \frac{\sigma_{11}-\sigma_{12}}{\sigma}$. Consistency of $\hat{\bar{h}}$ for $\bar{h}$ and $\hat{\lambda}$ for λ implies that the OLS estimates of $\hat{\pi}$, $\hat{\delta}$, and $\hat{\eta}$ are consistent for π, δ, and η. The standard errors of the coefficient vector $\begin{pmatrix}\hat{\pi}\\ \hat{\delta}\\ \hat{\eta}\end{pmatrix}$ are biased, however. This results from the fact that selection bias makes u heteroscedastic, and from the fact that $\hat{\lambda}$ and $\hat{\bar{h}}$ are themselves estimates.

The development of the model is now complete. Predicted values of offered and accepted wages can now be determined for individuals with

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[13] Proof of consistency of $\tilde{w}$ for w. If we had w, λ, and $\bar{h}^{-1}$, (16) could be rewritten as,

$$w = \pi'x + \delta\lambda + \eta\bar{h}^{-1} + u, \tag{16a}$$

where $u = w - E(w|w^*>w^r)$, and $E(u|w^*>w^r) = 0$. $\tilde{w}$ is equal to w plus the difference between estimates of λ and $\bar{h}^{-1}$ and the actual parameter values, yielding

$$\tilde{w} = \pi'x + \delta\lambda + \eta\bar{h}^{-1} + u + \delta(\lambda-\hat{\lambda}) + \eta\left(\frac{1}{\bar{h}} - \frac{1}{\hat{\bar{h}}}\right). \tag{16b}$$

Since $\underset{T_1\to\infty}{\text{plim}}\ \lambda - \hat{\lambda} = 0$ and $\underset{T_1\to\infty}{\text{plim}}\ h - \hat{\bar{h}} = 0$, it is implied that $\underset{T_1\to\infty}{\text{plim}}\ \tilde{w} = w$. Hence OLS estimators are consistent.

specified characteristics. Equation (17) is the offered wage equation, and (18) is the accepted wage equation.

$$\hat{w}^* = \hat{\pi}'x \tag{17}$$

$$\hat{w}^* = \hat{\pi}'x + \hat{\delta}\hat{\lambda} \tag{18}$$

For the offered wage equation, predicted values for each race and sex are determined for individuals with twelve and sixteen years of schooling, and with five and twenty-five years of experience. Region and child variables are set to zero, indicating that predicted values are for individuals not living in the south, and for individuals with no children.

For the accepted wage equation, estimates of lambda also have to be determined in order to get predicted values. Lambda is estimated for each race, sex, and year. To estimate lambda, probit coefficients are multiplied by the mean 1981 values of some of the probit variables. The mean 1981 values of FAMY, FAME, CHILDØ5, CHILD2, HEAD, and MARR are used. Region is set to zero, and education and experience variables are set to the same values as in the offered wage equation.[14] Using the 1981 mean values for individuals in both 1967 and 1981 allows us to compare estimates of lambda for individuals with the same characteristics over time.

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[14] Full descriptions of these variables are given in the data appendix.

Actual Estimation

Two changes were made to (16) for actual estimation. One, δ, the coefficient on λ, was constrained to be the same across years; all other coefficients were allowed to vary over time. δ was constrained because it fluctuated wildly when allowed to vary over time. Estimates of selectivity bias are very sensitive to variations in δ; constraining δ gave selection estimates that appear to be much more reasonable. Given that δ is composed entirely of variance and covariance terms, this constraint assumes that the distribution of random disturbances is the same across years.

Two, the variable $\bar{h}^{-1}$ was dropped from the equation. It is suspected that collinearity between it and $\hat{\lambda}$ caused coefficients on both terms to fluctuate greatly, and wage predicted values were too low to be believable. Coefficients on $\hat{\lambda}$ were negative in three out of four equations when $\hat{\bar{h}}^{-1}$ was included, while all were positive when it was dropped. Predicted wage values increased to what appeared to be more reasonable estimates when $\hat{\bar{h}}^{-1}$ was dropped as well. And, as a further justification in the case of males for whom selection bias is very small, $\hat{\bar{h}}^{-1}$ loses most of its components. The covariance terms are very close to zero, and studies have shown that γ, which measures the change in hours worked given a change in the wage rate, is also essentially zero (Hausman, 1981).

CHAPTER 4

EMPIRICAL RESULTS

This section begins with a discussion of estimated wage coefficients, while the body of this chapter is organized as a comparison of our results and the hypotheses presented in Chapter 1.

Estimated coefficients given in Appendix A are in agreement with our expectations. For one, wages are shown to increase with education levels. Important diploma effects occur at high school and college graduation, and females are shown to get large wage increases for graduate level education as well. Two, estimated coefficients for experience are positive for the first twenty years for males and for the first ten years for females in all cases. Wage increases with experience are the largest in these early experience categories. Paybacks to experience after twenty years for males are still positive, but very small. For females, on the other hand, paybacks after ten years are shown to be negative in all cases. Negative paybacks to greater than ten years experience for women are partly explainable by the crude experience measure used in this study: experience = age - education - six. This measure is reasonably accurate for males because of their high degree of labor force attachment. For females, however, it probably overstates experience in many cases and, hence, biases the coefficient downward. A number of children variable (CHILD2) was added

to the female wage equations to partially correct for the overstating of experience among women.

In reference to age-experience profiles, the results indicate that the profiles of white males are the steepest rising, and reach a higher level than any other group examined. Coefficients for early experience for females are shown to have increased greatly relative to white males, but given that returns to experience are negative for females after ten years, the gap between male and female profiles is still large and increases with age. Once again, though, it must be noted that the gap might be overstated because of the crude experience measure.

Three, the estimated coefficient for lambda is positive and significant in all cases. This finding indicates that selection is relevant for males, even if the offered and accepted wage gap is very small. Four, the region[15] variable has a negative estimated coefficient in all cases for both 1967 and 1981, but 1981 coefficients are shown to be less negative. The implication is that the penalty in wage rates for living in the south has declined over this period, although it still ranges from twenty cents for white females to 1.83 dollars for non-white males. And, finally, the CHILD2 variable in the female equations, which indicates the wage penalty for each child born, is shown to be negative and significant in three of four cases. The penalties for white females are much higher than those for non-white

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[11] Region is a dummy variable which equals one if an individual lives in the south and zero otherwise. See data appendix for specifics.

females. This suggests that white females on the average take more time out for child rearing and therefore suffer larger wage losses. These results all make intuitive sense, and they suggest that the estimated equations do have explanatory power.

Analysis will now turn to a discussion of the results of this study relative to the hypotheses presented above. Tables 13 and 14, the predicted values for offered and accepted wages for males and females respectively, will be referred to throughout this section. Note, not every hypothesis is discussed separately. Examination of our results relative to the hypotheses imply that the same tests be done in a few cases. Discussion is limited to relevant comments, if any, in these cases.

Selection Bias

Two questions are posed in the above discussion on selection bias among women. One, are offered and accepted wages converging? And, two, is the increase in LFPRs among women the result of higher real wage offers, lower reservation wages, or both?

The results in Table 14 show that offered and accepted wages follow substantially different trends for white women. Accepted wages, which correspond to what is observed, show declines for young white females and minimal increases for older white females. Offered wages, on the other hand, have increased for all categories of white females. The difference in the absolute change between offered and accepted wages ranges from thirty-two to sixty cents for the four categories of

Table 13. Predicted values of wages for males: 1967 and 1981.

Race	ED	EX		Predicted value 1967	Predicted value 1981	Absolute change	Percentage change
W	12	5	Offered	6.43	6.49	.06	.93
			Accepted	6.47	6.61	.14	2.16
W	12	25	Offered	9.80	10.88	1.08	11.02
			Accepted	9.83	11.03	1.20	12.21
W	16	5	Offered	9.40	9.48	.08	.85
			Accepted	9.49	9.53	.09	.95
W	16	25	Offered	14.17	14.53	.36	2.54
			Accepted	14.20	14.62	.42	2.96
NW	12	5	Offered	5.98	6.84	.86	14.38
			Accepted	6.08	7.16	1.08	17.76
NW	12	25	Offered	8.03	9.52	1.49	18.56
			Accepted	8.09	9.80	1.71	21.14
NW	16	5	Offered	7.84	8.47	.63	8.04
			Accepted	7.85	8.64	.79	10.06
NW	16	25	Offered	9.89	11.89	2.00	20.22
			Accepted	9.90	12.07	2.17	21.92

Table 14. Predicted values of wages for females: 1967 and 1981.

Race	ED	EX		Predicted value 1967	Predicted value 1981	Absolute change	Percentage change
W	12	5	Offered	4.33	4.51	.18	4.16
			Accepted	5.35	5.21	-.14	-2.62
W	12	25	Offered	4.69	5.23	.54	11.51
			Accepted	6.30	6.33	.03	.48
W	16	5	Offered	6.45	6.83	.38	5.89
			Accepted	7.36	7.14	-.22	-2.99
W	16	25	Offered	6.62	7.11	.49	7.40
			Accepted	7.93	8.02	.09	1.13
NW	12	5	Offered	4.56	5.09	.53	11.62
			Accepted	4.97	5.72	.75	15.09
NW	12	25	Offered	4.74	6.19	1.45	30.59
			Accepted	5.20	6.73	1.53	29.42
NW	16	5	Offered	7.18	7.43	.25	3.48
			Accepted	7.60	7.79	.19	2.50
NW	16	25	Offered	7.55	8.88	1.33	17.62
			Accepted	7.84	9.32	1.48	18.88

white females. This indicates that observed wage changes are highly misleading measures of the trend in opportunities for white females.

Alternatively, the results for non-white females show offered and accepted wages following much the same trend. In fact, the absolute increase in accepted wages outpaced that of offered wages in three out of the four categories analyzed.

In reference to the convergence of offered and accepted wages, the results for white females show convergence, while those for non-white females show divergence in three out of four cases. Convergence of offered and accepted wages among white females is attributed both to higher offered wages, which indicates that there has been an increase in demand for white female workers, and to constant or decreased reservation wages, which indicates either a constant or increasing supply of white female workers. Both effects work in the same direction to increase labor force participation among white females and to cause convergence of offered and accepted wages.

For non-white females, offered wages have increased, but reservation wages have remained constant or increased as well. These effects work in opposite directions and result in decreased labor force participation and divergence of offered and accepted wages in three out of four cases.

Table 15 gives the predicted values of LFPRs, $\widehat{LFPR}$, for women for the period; where $\widehat{LFPR}$ is given by the cumulative distribution function, $\Phi(\beta'x)$, for each group. $\Phi(\beta'x)$ is the probability that a person person with specific measured characteristics works in the market; or restated differently, $\Phi(\beta'x)$ is the predicted percentage of persons with a specific set of measured characteristics that work in the market.

Table 15. Predicted values of LFPRs for women: 1967 and 1981.

Race	ED	EX	Predicted value		Absolute change
			1967	1981	
W	12	5	70.31[a]	80.89	10.58
W	12	25	51.35	67.72	16.37
W	16	5	73.71	92.75	19.04
W	16	25	60.75	73.74	12.99
NW	12	5	71.23	54.06	-17.17
NW	12	25	67.35	61.17	-6.18
NW	16	5	70.50	75.22	4.72
NW	16	25	80.69	68.92	-11.77

[a] Numbers given are the percentage of women in each group that work in the market.

$\widehat{LFPR}$s are shown to have increased for all categories of white females, while for non-white females, increases are shown only for those who are young and hold a college degree. There are a number of possible explanations for the decrease in $\widehat{LFPR}$ for non-white females.

Changes in things not measured in this study, such as rules for transfer programs, taxation of transfer benefits, and the effects of affirmative action programs, are all possible explanations. Also, 1981 was a year of relatively high unemployment compared to 1967, and non-whites tend to be hit harder by recessions than whites do.[16] All of these factors probably contributed to both the decreases in LFPR and the increases in accepted wages for non-white females.

Government Influence

Two hypotheses relating to affirmative action programs are approximately testable in this study. (1) Welch argues that program effects are negative for low skill minorities and positive for high skill minorities. If this argument is accurate, we should find that the change in the wage ratio of non-whites to whites has risen more (fallen less) for college graduates than for high school graduates. (2) Lazear argues that affirmative action has resulted in increased discrimination in OJT. This implies that experience coefficients for non-whites have risen less (fallen more) than those for whites.

In reference to Welch's argument, the results indicate that non-white to white offered wage ratios by sex have risen for all groups except young college educated non-white females. Table 16 gives these results. The overall picture is that blacks have made substantial gains relative to whites for the period. These results do not support

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[16] Unemployment rates for white females in 1967 and 1981 were 4.6 and 6.9 percent respectively; for non-white females the rates were 9.1 and 14.3 percent in those years (Economic Report of the President, 1984).

Table 16. Percentage changes in ratios of black to white offered wages.

Sex	ED	EX	Percentage change	Sex	ED	EX	Percentage change
M	12	5	12.39	F	12	5	7.55
M	12	25	5.56	F	12	25	17.29
M	16	5	5.94	F	16	5	-2.53
M	16	25	12.04	F	16	25	10.85

Welch's argument. In fact, non-whites with twelve years of education made greater relative gains than did non-whites with sixteen years of schooling. However, if Welch's argument is interpreted as affecting the hiring of minorities only, and not their wages, support is given by the changes in LFPRs. Table 15 above gives the change in LFPRs for females. The data indicate both that the largest decrease in LFPR among non-white women occurred in the young high school educated group, while the smallest increase in LFPR among white women was also found in this group. Table 17 shows changes in LFPRs for males. Decreases in LFPRs are indicated to be much greater for non-white males than for white males; and decreases among high school educated non-whites are substantially larger than those for college educated non-whites. Hence, some support is indicated for Welch's argument that affirmative action programs have led to the "shunting"[17] of low skill minorities.

[17] Shunting refers to low skill minorities being put out of work by employers so that it does not appear that firms have an overabundance of minorities at low skill positions.

Table 17. Percentage changes in the predicted values of LFPRs for males: 1967 and 1981.

Race	ED	EX	Percentage change	Race	ED	EX	Percentage change
W	12	5	-1.63	NW	12	5	-11.26
W	12	25	-2.35	NW	12	25	-10.63
W	16	5	-.20	NW	16	5	-6.84
W	16	25	-1.06	NW	16	25	-6.95

To analyze Lazear's argument, wage experience coefficients given in Appendix A and summarized in Table 18 are used. The data do not indicate any clear pattern of discrimination against non-whites for either males or females. For males, paybacks to experience for white high school graduates increased more in absolute terms than paybacks

Table 18. Changes in initial experience coefficients[a] for the period 1967-1981.

Sex	Race	ED	Change[b]	Sex	Race	ED	Change
M	W	12	.07	F	W	12	.11
M	W	16	.05	F	W	16	.18
M	NW	12	.05	F	NW	12	.17
M	NW	16	.12	F	NW	16	.15

[a] Coefficients measure the value of another year of experience for the first ten years of experience for females, and the first twenty years for males.

[b] Changes are measured in dollars per year.

to non-whites; but when the changes are examined as percentage increases, the changes are 30 percent and 36 percent for white and non-white males respectively. For females with a college education, changes for whites outstep those for non-whites, but examining the coefficients reveals that returns to experience for non-white females are much greater than those for white females both in 1967 and 1981. Hence, there is no evidence in the results of this study to support Lazear's argument.

Cohort Improvement and the Vintage Hypothesis

Direct tests of cohort improvement or vintage effects are beyond the scope of this study. However, the results obtained here do not reject Finis Welch's (1973) argument that a single data cross section does not accurately reflect the life-cycle age-earnings profiles of the various cohorts within the cross section. Also, our results support Welch's (1973) and Smith and Welch's (1977) finding that wage differences between whites and non-whites are decreasing.

Table 19. Offered wage ratios of minority labor force groups relative to white males.

		White females		Non-white males		Non-white females	
ED	EX	1967	1981	1967	1981	1967	1981
12	5	.67	.69	.93	1.05	.71	.78
12	25	.48	.48	.82	.88	.48	.57
16	5	.69	.72	.83	.89	.76	.78
16	25	.47	.49	.70	.82	.53	.61

Table 19 gives the offered wage ratios for white females and non-whites relative to white males for 1967 and 1981. The results indicate that the offered wage gap between white males and non-whites has closed significantly, while the gap between white males and white females has narrowed only slightly. The argument of the vintage hypothesis suggests that these results overstate the remaining gap at the twenty-five year experience level.

An individual who has accumulated five years experience in 1981 was born in the late 1950's or early 1960's; while someone who has twenty-five years of experience was born in the late 1930's or early 1940's. For non-whites and females, date of birth, period of education, and time of entrance into the labor force indicate both the quality of education received and the quantity of discrimination faced. Minority group individuals born in the 1930's have encountered less opportunities in the labor market than those born in the 1950's or 1960's. Newer vintages of minorities, therefore, should do better throughout their life cycles than older vintages did. The twenty-five year experience group is an older vintage than the five year group is in each year. The gap between older minorities and white males overstates what the gap between younger minorities and white males will be when they reach the twenty-five year experience level.

Increasing LFPRs of Women

The above discussion on increasing LFPRs of women suggests, one, that offered wages to women should decrease relative to offered wages to men. Two, since women traditionally have had relatively flat

age-earnings profiles and are highly substitutable across ages, relative wage movements between age groups of women should be minimal. And three, reported findings indicate that females are most substitutable for young, less educated males. Our results, therefore, should find that relative wage changes for females on the whole are in the same direction as wage changes of young high school educated males relative to their older counterparts.

The earlier analysis of selection bias indicates that LFPRs have risen for white females and young college educated non-white females. It was also noted, then, that increased LFPRs resulted from a combination of increased demand for women workers (higher offered wages), and constant or decreased reservation wages (relatively constant or decreased accepted wages). To the extent that demand has increased, upward pressure will be exerted on women's wages, while decreased reservation wages will have the opposite effect. Table 19 above shows that offered wage ratios of all female groups have increased relative to white males. Hence, the hypothesis that increasing LFPRs of women should result in decreased relative wages for females is rejected.

Table 20 contains data relevant to the second hypothesis. In it is given the ratio of offered wages of young to older females within education categories. The data indicates that wage ratio changes have been substantial for all groups examined except white females with sixteen years of education. Older females are gaining relative to young females. One explanation is that the age composition of the labor force is relevant to females. As the baby boom cohort enters the

labor market, the relative wages of young women are being depressed. These changes are on the order of those found by Freeman (1979). However, he argues that the wage ratio changes between females are small when compared to those for males.

Table 20. Young-older female offered wage ratios.

	White females		Non-white females	
ED	1967	1981	1967	1981
12	.92	.86	.96	.82
16	.97	.96	.95	.84

An alternative explanation for the rise in wages of older relative to younger females is that females who are "old" in 1981 are more career oriented than those who were "old" in 1967. Thus the 1981 "old" group accumulated more experience-OJT-human capital as they aged than did their predecessors. Consequently, cross section age-wage profiles have steepened. The data in Table 21 are consistent with this explanation. Women who are "old" in 1981 had much higher LFPRs when they were 25-44 than did the cohort which was "old" in 1967.

Table 21. Average LFPRs for females ages 25-44: 1948-1980.

	"Old" in 1967[a]		"Old" in 1981	
Age	Years	LFPR (Average for years)	Years	LFPR (Average for years)
25-34	1948-56	34.5	1961-70	39.9
35-44	1957-66	44.4	1971-80	57.6

[a] "Old" implies approximately equal to forty-five years of age.

Source: Bureau of Labor Statistics, Handbook of Labor Statistics, Bulletin 2175, 1983.

The question of how females have fared relative to prime age males can be looked at two ways: one, both white and non-white females can be examined relative to prime age white males; or, two, examinations can be made within racial groups. If absolute changes in the predicted values of offered wages are examined within racial groups, Tables 12 and 13 show females to have lost relative to prime age males in all cases except for white females relative to white males with sixteen years of education. If the examination is made across racial lines, non-white females with twenty-five years experience in both education groups are shown to have gained relative to white prime age males as well.

Our results show that changes in offered wages to older high school graduate males have greatly outpaced those to their younger counterparts. The argument, then, that changes in the wages of females relative to prime age males will be in the same direction as changes in the wages of young high school relative to older high school educated males is not given clear support here.

Cohort Effects

The question to be discussed here is, have the wages of young relative to older workers declined over the period of the study? The results in Tables 12 and 13 clearly indicate that they have. For young white males there has been almost no increase in offered wages for the period; while for other groups increases for young workers have averaged only about half of what they are for older workers. Results of this study, therefore, give support to the hypothesis that baby boom

cohort effects have depressed the wages of young relative to older workers.

Combined Effects[18]

The effect on relative wages of young versus old resulting from both increasing LFPRs among women and the baby boom cohort has varied by sex,[19] race, and educational attainment. For white males, findings in the literature indicate that young high school graduates have fared worse relative to their older counterparts, while young college graduates have fared worse in absolute terms (Freeman, 1979). Results in Table 13, summarized in Table 22, support the first finding, but not the second. In absolute terms young white male high school and college graduates have fared about the same; but since the absolute increase in wages of older high school graduates was three times that of older

Table 22. Young-old male offered wage ratios.

	White males		Non-white males	
ED	1967	1981	1967	1981
12	.66	.60	.74	.72
16	.66	.65	.79	.71

[18] Results pertaining to hypotheses six and seven are combined here. The model used in this study cannot discriminate between relative wage effects due only to the baby boom cohort and increasing educational attainment, and those effects due to increasing LFPRs among women as well.

[19] Examination of relative wage changes for females was done in section 4 above.

college graduates, young high school graduates have fared worse in relative terms.

For young non-white males, the question of which effect dominates, vintage improvement and reductions in discrimination or baby boom cohort effects and increasing LFPRs of women, will determine whether relative wages of young versus old increase or decrease. The results in Tables 13 and 22 suggest that both sets of effects are very strong. The increases in offered wages to non-white males outpace those to white males at all levels indicating that vintage improvements and discrimination reductions were important factors. However, declines in relative wages of young versus old are apparent among non-whites as well, indicating the importance of cohort effects. The data also indicate that among non-white males, young college graduates have fared the worst in both relative and absolute terms. The smaller absolute increase in the wages of young non-white college graduates can be explained by the combination of increased educational attainment of young people and baby boom cohort effects, while a plausible explanation for the large increase in the wages of older non-white college graduates is a combination of discrimination reduction and vintage improvement. The gap between white and non-white males is widest at this level (though it had narrowed substantially by 1981), indicating that discrimination is the strongest in the better jobs, or that few non-whites previously qualified for better jobs.[20]

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[20] There may well be a causal relationship between discrimination and non-whites not being qualified for better jobs, but this will not be investigated here.

Career Orientation of Women

Changes in the career orientation of women are examined by looking at three things: (1) changes in entry level offered wages of women relative to men; (2) changes in the offered wage gap between males and females at the twenty-five year experience level; and (3) relative changes in returns to experience for women.

Table 23 gives the percentage changes in female to male offered wage ratios at both the entry level and the twenty-five year experience level. For whites, the data indicate that females have made minimal relative gains. For non-whites, the picture is one of relative losses for females in three out of four cases. Overall, the gap between the wages of females and males of both races dominates any minimal gains or losses. Little or no relative progress is indicated.

Table 23. Percentage changes in the ratios of female to male offered wages.

Race	ED	EX	Percentage change	Race	ED	EX	Percentage change
W	12	5	2.15	NW	12	5	-1.84
W	12	25	.21	NW	12	25	5.99
W	16	5	3.43	NW	16	5	-3.86
W	16	25	2.21	NW	16	25	-1.66

However, changes in returns to experience, given in Table 18 above, do show substantial relative gains for females. In each case

examined, changes for females far outstepped those for males. In fact, experience coefficients in Appendix A indicate that returns to initial experience for non-white females have surpassed those to non-white males for both education categories.

The results then show that females have only made minimal wage gains relative to males, but they are getting higher relative returns to experience. Given the poor experience measure used, increases in returns to experience for women are probably more of an indication of higher LFPRs than of increased career opportunities.

CHAPTER 5

SUMMARY AND CONCLUSIONS

The results of this study indicate that white males still hold the dominant position in the labor force, though some whittling away at this position has occurred. Wage offers to white males are much higher than those to other groups at most levels; this suggests that job opportunities for white males are better as well.

Female to male offered wage ratios have not shown any substantial change over the period. For whites, gains registered by females have ranged from 1/2 to 5 percent. Non-white females, on the other hand, have registered losses relative to their male counterparts ranging from 2.5 to 4.5 percent, except for older high school educated non-white females, who registered a 12 percent relative gain. This picture, it must be noted, is much brighter for females than an examination of accepted wage ratios. The correction for selection changes the picture from one of relative declines for females to the maintenance of a steady state.

Non-white to white offered wage ratios, by comparison, show substantial gains for most groups. No evidence was found to support hypotheses arguing that affirmative action affected the earnings of low skill minorities, or that affirmative action negatively affected minority group age-wage profiles. In fact, non-whites posted relative gains ranging from 7 to 18 percent for all groups except young college

educated females, who showed a 2.4 percent decline relative to their white counterparts.

In reference to changes in college versus high school offered wage ratios, the results of this study show declines from 4 to 13 percent in five out of eight categories. Our results are substantially in agreement with those of Freeman (1977) and Stapleton and Young (1984), though declines are not as concentrated among the young as their studies found. In fact, young white college educated males showed no relative decline.

Offered wage ratios of young to older workers also showed relative declines. Our results indicate declines in all eight categories ranging from 1.5 to 19 percent. These findings are generally consistent with those of other researchers; however, declines were not found to be the largest in college educated groups as Freeman (1979), Stapleton and Young (1984), and Welch (1979) found.

Variations in findings of this study relative to others is at least partially attributable to the period examined. Mark Berger's (1983) study, for example, is for the period 1967-1974. Freeman's (1977, 1979) two studies cover the years 1969 to 1974 and 1966-1976 respectively. Stapleton and Young's (1984) paper examines the period 1967-1977, and Welch's (1979) paper looks at the years 1967-1975. Our study examines a longer time period than any of these, 1967-1981. Different time periods relate to different labor market conditions. Each study is done at a different point in the business cycle, cohort effects vary over time, and the response of the labor market to demographic and social changes varies over time as well.

The question of relative wages is important for a variety of reasons. For one, studies in this area are important for both policy analysis and design. Two, studies impart information as to how "fair" the market and government mechanisms are when it comes to distributing economic opportunities. And, three, specific differences that exist among demographic groups are brought to fore, and the effects of these differences in terms of labor market opportunities are discussed.

Data deficiencies are the greatest impediment to being able to give definitive answers in studies of this sort. CPS data suffers from not having an experience or wage measure, and also from having such a poor hours measure. Measures of skills and special abilities that are important determinants in wage offers to individuals are just not capturable in data generally. However, consistent, sensible findings that advance knowledge in the areas of relative wage and opportunity changes are still determinable.

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APPENDICES

APPENDIX A

Wage Regression Coefficients

Table 24. Wage Coefficients - Males[a]

Independent variables	White		Non-white	
	1967	1981	1967	1981
ED08	.202 (2.54)	.315 (3.53)	.233 (4.35)	.492 (4.44)
ED911	.479 (4.71)	.631 (4.67)	.205 (1.99)	.231 (1.50)
ED12	1.477 (5.73)	.927 (3.14)	.881 (3.22)	1.74 (5.01)
ED1315	.031 (.19)	.319 (2.16)	.668 (2.72)	-.047 (.22)
ED16	2.486 (6.01)	1.725 (4.87)	-.222 (.34)	1.38 (2.61)
ED1718	.553 (2.64)	-.246 (1.52)	1.27 (3.38)	.660 (2.38)
REGION	-1.078 (7.09)	-.764 (5.17)	-2.04 (12.85)	-1.83 (9.74)
EX0	.240 (17.27)	.313 (20.97)	.145 (9.03)	.198 (9.38)
EX21	.021 (1.51)	.014 (.78)	.013 (.96)	.045 (2.28)
EX46	-.198 (4.47)	-.486 (8.95)	-.100 (2.99)	-.012 (.26)
EX0ED1315	.078 (3.93)	.061 (3.15)	.016 (.49)	.078 (2.65)
EX21ED12	-.065 (3.49)	-.075 (3.78)	-.038 (1.38)	-.101 (3.54)
EX21ED16	.044 (1.33)	-.049 (1.76)	-.046 (.74)	-.086 (1.58)
INTERCEPT	.700 (1.08)	-.417 (1.19)	1.904 (3.82)	-.526 (2.37)
LAMBDA	2.20 (6.16)		1.17 (3.74)	
$\bar{R}^2$	.183		.221	
S.E.E.	5.584		4.014	
SAMPLE SIZE	7112	7139	2903	1945

[a] Absolute t-statistics (in parentheses) are biased.

Table 25. Wage Coefficients - Females[a]

Independent variables	White		Non-white	
	1967	1981	1967	1981
CHILD2	-.333	-.559	.0311	-.196
	(5.35)	(9.10)	(.679)	(3.27)
ED08	.052	.185	.073	.0012
	(.53)	(1.82)	(1.20)	(.013)
ED911	.291	.272	.220	.234
	(2.92)	(2.27)	(2.22)	(2.08)
ED12	.708	.906	.529	.790
	(3.22)	(3.91)	(2.24)	(3.29)
ED1315	.367	.520	.594	.439
	(3.68)	(6.77)	(3.82)	(4.48)
ED16	1.42	.818	.396	.678
	(2.63)	(1.94)	(.49)	(1.13)
ED1718	1.10	.838	.588	.897
	(3.32)	(4.44)	(1.19)	(3.50)
REGION	-.555	-.206	-1.48	-.898
	(4.13)	(1.75)	(9.85)	(6.80)
EX0	.158	.272	.097	.271
	(5.77)	(10.56)	(2.99)	(7.96)
EX11	-.029	-.043	-.020	-.017
	(3.45)	(5.51)	(2.18)	(2.01)
EX46	-.207	-.345	-.036	-.137
	(5.06)	(6.73)	(1.05)	(3.16)
EXOED16	-.079	-.011	.089	.683
	(1.13)	(.21)	(.91)	(.94)
EX11ED16	.013	-.026	-.017	-.035
	(.54)	(1.21)	(.40)	(1.21)
EX11ED1718	.048	.030	.148	.042
	(1.38)	(.97)	(2.22)	(.99)
INTERCEPT	1.771	.337	2.272	2.123
	(2.30)	(1.34)	(4.11)	(.017)
LAMBDA	2.074		.862	
	(9.14)		(3.00)	
$\bar{R}^2$	.095		.192	
S.E.E.	4.236		3.60	
SAMPLE SIZE	4983	6346	2711	3301

[a] Absolute t-statistics (in parentheses) are biased.

APPENDIX B

Hours Regression Coefficients

Table 26. Hours Coefficients - Males[a]

Independent variables	White		Non-white	
	1967	1981	1967	1981
FAMY	-22.898	-25.444	-113.03	-41.079
	(2.27)	(7.36)	(3.55)	(3.09)
FAME	-8.238	-1.036	1.551	3.060
	(3.11)	(1.09)	(.313)	(1.46)
CHILDØ5	94.611	-12.235	184.44	2.204
	(3.00)	(.41)	(3.41)	(.041)
CHILD2	7.702	-4.139	7.549	-23.738
	(1.02)	(.37)	(.80)	(1.16)
HEAD	340.56	265.76	287.59	337.52
	(7.30)	(6.96)	(5.10)	(4.17)
MARR	95.249	166.33	197.12	86.256
	(2.38)	(5.34)	(4.35)	(1.54)
DAGE	-467.43	-495.41	-693.69	-255.40
	(5.74)	(5.05)	(5.65)	(1.26)
EXØ	36.885	19.923	33.997	30.379
	(14.04)	(7.32)	(7.84)	(5.89)
EX21	-6.994	-24.049	-13.148	-12.201
	(.83)	(1.85)	(1.17)	(.66)
EX46	.718	-31.891	-20.467	-38.529
	(.066)	(2.67)	(.169)	(2.64)
EXØED1315	-3.205	-.526	-7.030	-5.434
	(1.16)	(.20)	(1.10)	(.96)
EX21ED12	18.193	-23.881	-6.492	-36.853
	(1.21)	(1.55)	(.19)	(1.17)
EX21ED16	-4.065	-9.166	17.105	-2.483
	(.70)	(1.91)	(1.12)	(.17)
EX/5	43.784	28.583	17.131	38.728
	(4.44)	(3.14)	(1.03)	(2.09)
EX2138	(2.461	22.738	7.593	9.246
	(.24)	(1.51)	(.54)	(.42)
EX2138ED12	-35.714	13.306	-14.455	28.280
	(2.10)	(.73)	(.38)	(.77)
EX2138ED1718	18.638	-1.808	11.738	-12.274
	(2.09)	(.25)	(.51)	(.58)
EDØ8	42.930	1.610	13.301	-15.890
	(3.88)	(.127)	(1.24)	(.72)
ED911	24.55	27.589	40.273	6.847
	(1.74)	(1.44)	(1.98)	(.23)
ED12	205.73	266.34	241.76	242.49
	(5.70)	(6.42)	(4.49)	(3.22)
ED1315	11.911	20.829	38.596	107.53
	(.53)	(1.01)	(.79)	(2.55)
ED16	135.07	175.33	113.87	4.174
	(2.36)	(3.54)	(.88)	(.041)
ED1718	8.862	74.452	14.075	82.802
	(.28)	(2.96)	(.17)	(1.45)
REGION	75.486	46.861	45.277	97.496
	(3.61)	(2.30)	(1.43)	(2.44)
LAMBDA	332.66	237.68	275.93	129.20
	(2.51)	(1.72)	(1.22)	(.517)
INTERCEPT	600.15	959.85	630.97	810.86
	(6.14)	(9.39)	(4.64)	(3.17)
$\bar{R}^2$	.233	.1632	.208	.1594
S.E.E.	758.49	768.02	778.82	758.98
SAMPLE SIZE	7156	7141	2942	1945

[a] Absolute t-statistics are in parentheses.

Table 27. Hours Coefficients - Females[a]

Independent variables	White		Non-white	
	1967	1981	1967	1981
FAMY	-38.969	-29.144	-171.68	-42.116
	(3.14)	(8.15)	(3.11)	(2.85)
FAME	-13.634	-6.253	-2.171	1.311
	(3.47)	(6.84)	(.36)	(1.08)
CHILD0	-268.41	-441.53	-206.07	-221.07
	(4.22)	(8.15)	(2.24)	(3.95)
CHILD2	-130.52	-135.95	-73.364	-56.899
	(6.27)	(9.26)	(4.25)	(2.73)
HEAD	58.168	--	52.546	--
	(1.23)		(1.10)	
MARR	-181.78	-243.22	-285.52	-9.183
	(4.75)	(8.09)	(5.64)	(.29)
DAGE	-583.42	-696.31	-527.07	-715.21
	(5.94)	(5.87)	(3.12)	(3.50)
EX0	67.612	105.05	82.851	123.42
	(4.82)	(7.99)	(3.95)	(3.56)
EX11	-30.185	-53.811	-21.043	-41.674
	(2.41)	(4.38)	(1.66)	(2.50)
EX46	17.785	-58.727	-24.535	-31.616
	(1.26)	(3.65)	(1.54)	(1.48)
EX0ED12	-57.050	-79.471	-90.760	-74.096
	(6.84)	(7.97)	(5.55)	(3.31)
EX0ED16	53.409	4.720	77.935	-20.604
	(1.64)	(.24)	(1.46)	(.69)
EX11ED16	-2.679	-10.997	-25.142	-7.088
	(.56)	(2.52)	(2.55)	(1.07)
EX11ED1718	5.706	11.801	1.820	2.724
	(.89)	(2.10)	(.12)	(.31)
EX02	137.61	46.453	236.67	85.122
	(3.80)	(1.36)	(4.12)	(1.51)
EX35	161.22	80.728	209.69	132.92
	(4.16)	(2.56)	(3.85)	(2.86)
EX35ED16	-214.96	-81.515	-120.84	-114.81
	(2.36)	(1.49)	(.85)	(1.34)
EX1138	35.966	41.682	29.155	45.928
	(2.81)	(3.54)	(2.17)	(2.78)
ED08	-13.344	-11.949	62.964	51.214
	(.73)	(.64)	(4.52)	(2.48)
ED911	6.506	102.46	64.357	16.836
	(.36)	(4.02)	(2.69)	(.71)
ED12	698.67	934.72	1010.6	1105.3
	(8.45)	(9.63)	(6.59)	(3.78)
ED1315	29.118	58.386	19.693	150.12
	(1.63)	(3.88)	(.59)	(3.26)
ED16	161.84	350.90	207.60	480.17
	(1.66)	(4.52)	(1.20)	(3.63)
ED1718	35.965	71.610	79.350	129.84
	(.60)	(2.05)	(.75)	(2.08)
REGION	88.623	105.58	37.174	88.262
	(3.67)	(5.00)	(.74)	(1.75)
LAMBDA	-30.465	905.30	758.44	825.79
	(.17)	(4.74)	(2.17)	(1.88)
INTERCEPT	546.82	31.930	-903.86	-1258.0
	(3.26)	(.15)	(2.81)	(1.92)
$\bar{R}^2$	.193	.124	.139	.117
S.E.E.	757.04	754.60	771.49	749.21
SAMPLE SIZE	5116	6347	2821	3301

[a] Absolute t-statistics are in parentheses.

APPENDIX C

Probit Coefficients

Table 28. Male Probits[a]

Independent variables	White		Non-white	
	1967	1981	1967	1981
FAMY	-.150	-.049	-.251	-.096
	(13.90)	(17.87)	(11.91)	(16.03)
FAME	.016	.006	.005	.009
	(2.36)	(2.79)	(.43)	(3.94)
CHILDØ5	.326	.070	.342	.060
	(1.53)	(.67)	(1.53)	(.61)
CHILD2	.020	-.015	.005	.071
	(.66)	(.45)	(.20)	(2.10)
HEAD	.392	.381	.462	.479
	(3.80)	(4.66)	(4.21)	(6.19)
MARR	.508	.399	.175	.279
	(5.75)	(5.87)	(1.80)	(3.92)
DAGE	-.391	-.194	-.469	-.446
	(3.51)	(1.94)	(3.02)	(3.12)
EXØ	.028	.011	.036	.018
	(3.51)	(1.58)	(3.77)	(2.55)
EX21	-.338	-.105	-.050	-.068
	(1.78)	(5.73)	(2.16)	(3.26)
EX46	-.089	-.071	-.056	-.033
	(11.36)	(9.30)	(5.48)	(3.38)
EXØED15	-.009	-.008	-.026	.003
	(.99)	(1.13)	(1.29)	(.32)
EX21ED12	-.079	-.017	-.002	.003
	(2.89)	(.76)	(.041)	(.09)
EX21ED16	.028	-.001	-.049	-.020
	(2.14)	(.17)	(1.33)	(1.32)
EXØ5	.056	.035	.046	.032
	(1.46)	(1.29)	(1.14)	(1.20)
EX2138	.0001	.076	.033	.058
	(.004)	(3.13)	(1.05)	(2.13)
EX2138ED12	.046	-.007	-.036	-.029
	(1.28)	(.26)	(.54)	(.71)
EX2138ED1718	-.004	-.018	.051	.027
	(.17)	(1.05)	(.50)	(.91)
EDØ8	-.007	-.044	.035	.011
	(.40)	(2.34)	(2.02)	(.57)
ED911	.134	.097	.106	.033
	(3.72)	(3.01)	(2.26)	(.91)
ED12	.348	.337	.194	.413
	(2.76)	(3.62)	(1.30)	(4.54)
ED1315	.042	.089	.267	.092
	(.48)	(1.46)	(1.51)	(1.43)
ED16	-.122	.143	.264	.128
	(.47)	(.83)	(.38)	(.69)
ED1718	.063	.168	.143	.099
	(.34)	(1.33)	(.18)	(.68)
REGION	-.159	-.009	.158	.228
	(2.85)	(.20)	(2.28)	(4.52)
CONSTANT	.874	1.069	.350	-.164
	(4.91)	(6.17)	(1.89)	(.88)
SAMPLE SIZE	8270	9086	3511	4258

[a] Absolute t-statistics are in parentheses.

Table 29. Female Probits[a]

Independent variables	White		Non-white	
	1967	1981	1967	1981
FAMY	-.096	-.028	-.244	-.051
	(10.07)	(12.40)	(12.97)	(11.76)
FAME	-.035	-.007	-.022	.001
	(11.44)	(7.34)	(3.55)	(.98)
CHILDØ5	-.552	-.529	-.399	-.181
	(9.92)	(12.01)	(5.11)	(3.58)
CHILD2	-.173	-.099	-.079	-.067
	(14.29)	(6.25)	(6.16)	(3.76)
HEAD	.354	--	.106	--
	(7.04)		(1.82)	
MARR	-.296	-.223	-.185	.028
	(6.05)	(5.71)	(3.25)	(.68)
DAGE	-.232	-.412	-.383	-.433
	(2.46)	(4.63)	(2.86)	(3.52)
EXØ	-.012	.053	.058	.106
	(.58)	(2.84)	(2.30)	(4.89)
EX11	-.095	-.066	-.038	-.048
	(9.64)	(6.63)	(2.82)	(3.89)
EX46	-.068	-.063	-.042	-.043
	(9.15)	(8.30)	(4.52)	(4.77)
EXØED12	-.070	-.065	.067	-.051
	(6.18)	(5.12)	(4.31)	(3.23
EXØED16	.057	-.018	.172	-.036
	(1.15)	(.44)	(2.07)	(.75)
EX11ED16	-.010	-.021	-.028	-.012
	(1.72)	(4.08)	(2.19)	(1.57)
EX11ED1718	.015	-.0003	.031	-.006
	(1.39)	(.04)	(1.23)	(.48)
EXØ2	-.098	.011	.094	-.023
	(1.49)	(.17)	(1.10)	(.30)
EX35	-.023	.004	.020	-.028
	(.38)	(.07)	(.26)	(.45)
EX35ED16	-.152	.008	-.394	.051
	(.98)	(.06)	(1.63)	(.35)
EX1138	.089	.043	.034	.042
	(8.07)	(3.85)	(2.20)	(3.01)
EDØ8	.046	.030	.025	.031
	(2.76)	(1.67)	(1.73)	(1.77)
ED911	.005	.115	.066	-.003
	(.22)	(4.54)	(2.38)	(.11)
ED12	.794	.759	.667	.869
	(7.43)	(6.41)	(4.77)	(5.98)
ED1315	.005	.076	.035	.200
	(.19)	(3.56)	(.70)	(6.47)
ED16	.263	.419	.201	.007
	(1.16)	(2.17)	(.59)	(.03)
ED1718	.156	.215	.052	.213
	(1.31)	(2.73)	(.27)	(2.09)
REGION	-.031	.019	.219	.181
	(.99)	(.62)	(5.10)	(5.10)
CONSTANT	.797	.113	-.077	-.926
	(5.11)	(.64)	(.44)	(4.58)
SAMPLE SIZE	10007	11562	4683	6318

[a] Absolute t-statistics are in parentheses.

APPENDIX D

Data

DATA[a]

The purpose of this appendix is to describe the source and treatment of data used in this study. The source of data for this study is the Current Population Survey (1967-1981), conducted by the U.S. Bureau of Census in conjunction with the Bureau of Labor Statistics.

Each annual survey contains information on approximately 40,000 households interviewed during the month of March. Since the primary unit of analysis in this study is the individual person, the first step in processing the data was to make extracts reorganizing the data by persons rather than households. Also, only data relevant to this study were included in the extracts. Selected variables will be described below.

The second step in processing the CPS data was to create eight subsamples from each of the annual extracts. The subsamples contain transformed data which is directly utilized in the estimation procedures. The description of this step is divided into two parts: a) criteria for selection and b) the data transformations.

a) Criteria for selection.

The eight subsamples created for each year are:

a.1) white male workers

a.2) non-white male workers

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[a] This appendix is a takeoff on work done by Stapleton and Young (1984).

a.3) white female workers

a.4) non-white female workers

a.5) white male non-workers

a.6) non-white male non-workers

a.7) white female non-workers

a.8) non-white female non-workers.

A worker is an individual classified as a private wage and salary worker. In addition, an individual was included in the subsamples only if all of the following criteria were met.

1) Not self employed, or working without pay in a family business.

2) Non-farm self-employment income equals zero.

3) Farm self-employment income equals zero.

4) Income was not allocated by the Census Bureau.

5) Not presently in school.

Self-employed workers are excluded because of the difficulties involved in distinguishing between returns to human and physical capital.

Because of the size of the CPS surveys and the computational burden of non-linear estimation, the subsamples were reduced in size by selecting a random sample of those individuals meeting all of the selection criteria. Specifically, the subsamples contain 25 percent of the eligible observations.

In summary, the selection procedure yields eight subsamples of individuals for each year, 1967 and 1981, which exclude the self-employed, those for whom income has been "allocated" by the Census Bureau, military personnel, and persons presently in school.

b) Data transformations.

This subsection describes the transformations of the CPS data that resulted in the variables utilized in estimation.

FAMY is unearned family income, defined to be total family income minus family earnings.

FAME is other family earnings, defined to be family earnings minus individual earnings.

CHILDØ5 is a dummy variable equal to one if a child less than six years old is present; zero otherwise.

CHILD2 is the number (0-9) of own children ever born in the family.

HEAD is a dummy variable equal to one if the individual is a head of household; zero otherwise. Note, an error in creating the 1982 extracts for females resulted in the loss of this variable for this group.

MARR is a dummy variable equal to one if the individual is married (including widowed); zero otherwise (divorced, separated, or never married).

EARN is the individual's wage and salary income (earnings.

HLY is an estimate of hours worked last year. Construction of this variable is explained in Chapter 3.

REGION is a dummy variable equal to one if the individual is from the south; zero otherwise. Southern states are Florida, North and South Carolina, Georgia, Alabama, Louisiana, Mississippi, Arkansas, and Tennessee.

DAGE is a dummy variable equal to one if an individual is sixty-five years of age or older; zero otherwise.

The Census Bureau reports two education variables, highest grade attended (ED = one + highest grade attended and EDD, a dummy variable equal to one if the individual completed the highest grade attended; two if not). The completion variable, EDD, is subtracted from ED to create ED* which equals the number of years of schooling completed. The following six education variables are then defined:

ED08 ranges from zero to eight depending on the number of years of grammar school completed.

ED911 is a dummy variable equal to zero if no high school grades were completed. Ranges from one to three for each high school grade completed.

ED12 is a dummy variable equal to one for high school graduation; zero otherwise.

ED1315 is a dummy variable equal to zero if no years of college were completed. Ranges from one to three for each year of college completed.

ED16 is a dummy variable equal to one for college graduation; zero otherwise.

ED1718 is a dummy variable equal to one or two for years of graduate school completed; zero otherwise.

Since the Census Bureau does not report an experience variable, experience is simply measured as age minus education minus six:

EX = AGE - ED* - 6. Five experience variables are then defined for males, and six are defined for females. They are:

EXØ has range zero to ten for females and zero to twenty for males.

EX11 is used for females only. It ranges from zero to thirty-five and measures experience accumulations of eleven to forty-five years.

EX21 is used for males only. It ranges from zero to twenty-five and measures experience accumulation from twenty-one to forty-five years.

EX46 ranges from zero to forty-eight and measures experience accumulations in excess of forty-five years for both males and females.

EXØ5 and EX2138 range in value from zero to five and zero to eighteen respectively. EXØ5 measures the first five years of experience while EX2138 measured accumulated experience greater than twenty and less than thirty-nine years. These additional breakdowns were used in the male probit and hours equations.

EXØ2, EX35, and EX1138 are additional experience variables used in the female probit and hours equations. They range from zero to two, zero to three, and zero to twenty-eight respectively.

Finally, a number of experience-education interaction variables are created (five each for males and females).

$EX_i ED_j$ where i and j are selected from the above groupings.

In summary, the CPS data are transformed so that each observation in the subsample contains information on the individual's income and earnings, labor force behavior, and demographic characteristics.

DATE	ISSUED TO