POTENTIAL BIASES IN MEASURING MALE-FEMALE DISCRIMINATION*

SOLOMON WILLIAM POLACHEK

ABSTRACT

By addressing the problem of life-cycle division of labor within the family, this study considers the question of the effect of family characteristics on both male and female earnings capacities. The paper illustrates both theoretically and empirically that being married and having children have opposite effects on the wage rates of husbands and wives, and further that these diverging wage patterns are perpetuated over the length of the marriage. Neglecting the fact that family characteristics have opposite effects on male and female wage structures leads to biases in the computation of the male-female discrimination coefficient.

I. INTRODUCTION

Recently much interest has developed concerning the analysis of the male-female wage differential. Although the approaches used to study this problem have been varied, the intent of each study has been similar—namely, to ascertain what proportion of the observed wage gap can be attributed to sets of economic factors. For the most part, the economic factors chosen have been governed by theoretical considerations regarding notions as to the causes of wage differentials. While some studies concentrate on a smaller number of factors such as male-female occupational differences [4, 5, 8, 27, 29], possible monopsonistic

The author is Assistant Professor of Economics at the University of North Carolina, Chapel Hill.

* The author has benefited from conversations with John Akin, Gary Becker, Arthur Benavie, Lee Benham, Russell Hill, Donald Keesing, Jacob Mincer, and Peter Schmidt. He wishes to express thanks to two anonymous referees for their numerous comments while at the same time taking responsibility for any errors that might remain. William Daland and Judy Poole of the Institute for Research in the Social Sciences of the University of North Carolina provided competent computational assistance. In part, this research was financed by the Ford Foundation; however, their views need not coincide with those expressed in this paper. [Manuscript received April 1974; accepted October 1974.]

behavior on the part of firms [24], differences in labor force turnover rates [15, 17], or differences in life-cycle labor force participation [14, 20, 23, 26, 28], other studies adjust by a multitude of factors restricting themselves only by the exogenous limitations imposed by the data [6, 7, 9, 18, 22, 25]. The general approach used in some of these latter studies [6, 9, 18, 22] to measure the explanatory power of these economic variables has been to assume one's earnings ability to be governed by a specific functional form relating individual characteristics (for example, education, experience, occupation, industry, marital status, family size, etc.) to earnings. The differences in earnings generated by "female" as opposed to "male" characteristics would represent that amount of the male-female earnings gap that could be explained. While the unexplained portion generally has been attributed to market discrimination (that is, differences in wages holding productivity constant), no one can deny that any such estimation of discrimination may be biased upward or downward depending on the existence of possible specification errors of this procedure.

Although certain suggestions are given, the purpose of this paper is not to refine these techniques of measuring discrimination, but instead to point out one inherent specification bias that, although being of major importance, has received little if any attention in the literature. Specifically, we wish to show that because certain characteristics (namely, marital status and the number and spacing of children within the family) have opposite effects on the wages of males and females, then adjusting only by differences in male-female characteristics, but neglecting the structural differences in the male-female earnings function, overstates the amount of discrimination.

Credence is given to the contention that structural differences exist, first, by means of a theoretical model showing how the division of labor within the household could yield differences in the labor force and investment behavior of husbands and wives, and second, by an empirical implementation of this model. Accordingly, while this model of the division of labor within the household predicts that family characteristics affect labor force participation and wages differently for males than for females, we illustrate empirically that these family characteristics do indeed have opposite effects on male and female wages. This result is important, because assuming the same structure of male and female earnings implies that family characteristics would have identical effects on both their earnings capacities; yet the theory of division of labor within the household as well as its empirical implementation dictate the opposite result.

This paper therefore concludes that when assuming the same structure of male and female earnings, biases occur in measuring the market discrimination coefficient by lumping the effects of household division of labor into the estimate. Clearly, even if this division of labor is a result of discrimination in the form of unequal wages for equal work, traditional estimates overstate the original wage gap by assuming males and females specialize in the same way. To the extent that the division of labor is caused by other factors such as societal

preconditioning, the bias becomes more serious. In part, an indication of the magnitude of such biases results in the comparison of the wage differentials of single as opposed to married males and females.

II. THE DIVISION OF LABOR WITHIN THE HOUSEHOLD: AN ANALYTICAL APPROACH TO MALE-FEMALE EARNINGS

Following the logic of Becker [2] and Ghez and Becker [11], one can view households as efficient firms maximizing the discounted value of production of commodities over the family lifetime. That is, families behave so as to maximize[1]

$$\text{(1)} \qquad \text{Max} \int_0^T e^{-\rho t} Z_t dt = \int_0^T e^{-\rho t} f(X_t, T_{M_t}, T_{F_t}) dt$$

where $\rho \equiv$ within-family perceived rate of commodity discount; $Z_t \equiv$ commodities produced by the family; $f \equiv$ within-family production function of commodities Z_t (assumed invariant to change over the family life cycle); $X_t \equiv$ market goods consumed in period t in the production of Z_t; $T_{M_t} \equiv$ husband's time in period t spent at home in the production of Z_t; and $T_{F_t} \equiv$ wife's time in period t spent at home in the production of Z_t—subject to human as well as physical capital asset equations serving as budgetary constraints on the production and consumption of Z_t:

$$\text{(1a)} \qquad K_{M_t} = g(s_{M_t}, K_{M_t})$$

$$\text{(1b)} \qquad K_{F_t} = g(s_{F_t}, K_{F_t})$$

$$\text{(1c)} \qquad \dot{A} = w_M(1 - T_{M_t} - s_{M_t})K_{M_t} + w_F(1 - T_{F_t} - s_{F_t})K_{F_t} - P_x X + rA$$

where $\dot{K}_{M_t} = (\partial K_{M_t}/\partial t)$, $\dot{K}_{F_t} = (\partial K_{F_t}/\partial t)$, $\dot{A} = \partial A/\partial t$; $K_{M_t} \equiv$ husband's stock of human capital at time t; $K_{F_t} \equiv$ wife's stock of human capital at time t; $s_{M_t} \equiv$ time spent by husband investing in time period t; $s_{F_t} \equiv$ time spent by wife investing in time period t; $w_M \equiv$ husband's rental value per unit of human capital; $w_F \equiv$ wife's rental value per unit of human capital; $A_t \equiv$ family assets at time t; $(1 - T_{M_t} - s_{M_t}) \equiv$ husband's time spent at work in period t; and $(1 - T_{F_t} - s_{F_t}) \equiv$ wife's time spent at work in period t.

Such a model envisages a complex decision process within the household. As an entity, it must determine for each period of the life cycle both the

1 Although it is true that the objective function could be stated in terms of a utility function of Z_t, we choose not to do so in order to avoid problems of interpretation of the utility function when the model is applied to a one-person family. For a description of some of these technical problems, e.g., the interpretation of whose utility we are dealing with before versus after marriage, see Nerlove [21].

husband's and the wife's allocation of time to work both in the household and in the labor market, as well as the allocation of time to human capital investment—the process by which members of the household can increase their future earnings. To solve such a problem, the Hamiltonian (written without time subscripts)[2]

$$(2)\quad H = e^{-\rho t} f(X, T_M, T_F) + \lambda_M g(s_M, K_M) + \lambda_F g(s_F, K_F) + \mu[(1 - T_M - s_M)w_M K_M + (1 - T_F - s_F)w_F K_F - P_x X + rA]$$

is maximized with respect to the instrumental decision variables, X_T, T_M, T_F, s_M, and s_F, yielding a set of optimality conditions implying the following for within-period allocation decisions:

$$(3a)\quad \mu = \frac{e^{-\rho t}(\partial f/\partial x)}{P_x} = \frac{e^{-\rho t}(\partial f/\partial T_M)}{w_M K_M} = \frac{e^{-\rho t}(\partial f/\partial T_F)}{w_F K_F} = \frac{\lambda_M(\partial g/\partial T_M)}{w_M K_M} = \frac{\lambda_F(\partial g/\partial T_F)}{w_F K_F}$$

where the shadow prices are governed by the following set of differential equations:

$$(3b)\quad \dot{\lambda}_M = -\mu w_M(1 - T_M - s_M) - \lambda_M(\partial g/\partial K_M)$$

$$(3c)\quad \dot{\lambda}_F = -\mu w_F(1 - T_F - s_F) - \lambda_F(\partial g/\partial K_F)$$

$$(3d)\quad \dot{\mu} = -\mu r$$

The closed form solution of these equilibrium conditions depends on both the set of initial conditions for the system and the precise functional forms of each of the human capital and commodity production functions.

Although specified in a family context as a husband and wife team who, by starting at year zero, determines its allocation of time to consumption, investment, and work under nonstochastic conditions, the model works equally well for a single-person family.[3] Under such conditions the variables pertaining to one's spouse are constrained to zero during the relevant periods.[4] Whether the

2 Although the equilibrium conditions are set up assuming an interior solution exists, the arguments presented are more general and even stronger if corner solutions are explicitly permitted.

3 Although the model could also deal with male and female heads of household, we explicitly ignore these possibilities because of the complications involved in switching and reswitching marital status. In fact, in the empirical section we include only those single-never-married and married-once-spouse-present.

4 No doubt because, in general, $\partial f(X, T_M, T_F)/\partial T_M \neq \partial f(X, T_M\ 0)/\partial T_M$, differing equilibrium results would occur in the male or female allocation process when comparing those married versus those single. For singles, to the extent that $\partial f(X, T_M, 0)/\partial T_M = \partial f(X, 0, T_F)/\partial T_F$, differences in allocation would depend only on differences in initial stocks and rental value of human capital.

model is applied to a single individual, a couple, or two individuals who choose to marry at a given date, it should be emphasized that the innate symmetry within the model implies that male-female life-cycle labor force participation, investment, and wages would be identical if husbands and wives were equally efficient in the production of both household goods $[Z]$ and human capital $[K]$, and similarly faced the same husband-wife initial budgetary conditions $[w_M K_M = w_F K_F]$.

However, such assumptions of equality within the household may not be realistic. Already evidence exists illustrating husband-wife differences even at the outset of marriage. Although, on the average, only small husband-wife educational differences exist, the average age differential exceeds two and one-half years; and of those first married in 1959–60, husbands earned at least a third more per year than their wives.[5] Whether or not these initial conditions are caused by market discrimination in wage rates, societal preconditioning with respect to the marriage decision, or even as a result of optimal sorting through efficient mating, such initial differences in the earnings potential of the husband

5 These data have been derived from the 1/1,000 Public Use sample of the 1960 and 1970 U.S. Census of Population and Housing. For the population of all married whites in 1970, within-family education differential is such that husbands have on the average 0.104 years more schooling than their wives. For those married for the first time in 1959–60, the education gap is 0.156 years, while for those first married in 1969–70, the gap is 0.422. Although it is true that these differences in level of education are small, they appear to be rising over the decade. Regression analysis of the 1960 and 1970 cross-sectional data respectively yield:

EDDIF (Education of male minus education of female)	= 0.202 – 0.013 *YRS MAR* (.0012)	F = 132.51 R = .07
EDDIF	= 0.568 – 0.021 *YRS MAR* (.0010)	F = 405.18 R = .11

where the standard error of the coefficient is in parentheses. To the extent that neither husband nor wife return to school after marriage, the negative coefficients can be interpreted to imply a larger husband-wife difference in schooling for the more recently married cohorts. Aside from differences in quantity, some have speculated that quality differences exist between male and female education. Data indicate that males tend to specialize in subjects that are more market-oriented than do females. For example, see the distribution of fields studied in *1969 Handbook on Women Workers*, pp. 193–94. On the other hand, age differentials are significant and falling only slowly over time. Regressions of age differentials on years married indicate that over each decade the age gap has decreased by between 0.08 and 0.22 of a year. That is,

AGE DIF (Age of male minus age of female)	= 2.89 + 0.008 *YRS MAR* (.002)	F = 17.07 R = .02
AGE DIF	= 2.27 + 0.022 *YRS MAR* (.002)	F = 151.57 R = .07

for 1960 and 1970 Census data.

and wife are sufficient to cause the symmetry of the model to break down and the life-cycle decisions of the husband and wife to differ. Even if household productivity of the husband and wife are the same,[6] the difference in the market value of embodied human capital ($w_M K_{M_o} > w_F K_{F_o}$) would cause a specialization within the family whereby the family member with a greater stock of market earnings potential (in this case the husband [M]) would specialize more in market activities (that is, $T_{M_t} < T_{F_t}$), thereby implying a greater gain from future investment ($\lambda_{M_o} > \lambda_{F_o}$), and hence greater market investment.

Thus, if husbands and wives are truly equal in all respects except regarding initial endowments of either human capital or market wage rates, then despite the reasons for such initial differences, optimal behavior would dictate a scenario consisting of a certain specialization which would be manifested over time as the husband (or the spouse with greater initial market efficiency) continues to invest relatively more in the market and less in the home (that is, consumption time of Z) compared to his wife (spouse with lesser initial market efficiency). This specialization in market activities raises husband's earnings and creates the incentive for market investment which tends to increase the husband's hourly earnings relative to those of his wife. Thus we should observe a declining market investment of both husband and wife over the life cycle with the husband's earnings rising more quickly ($s_{M_t} > s_{F_t}$).

Although these results of diverging earnings streams were derived by assuming differing initial husband-wife human capital as perceived by the market, such an assumption need not be strictly the case. In fact, such a divergence may be strengthened if males and females differed in their productivities of household goods [Z] and human capital [K], for in such a case, according to equilibrium equations (3), the added conditions that $(\partial f/\partial T_F) > (\partial f/\partial T_M)$ and $(\partial g/\partial T_M) > (\partial g/\partial T_F)$ would increase M's specialization in the market and F's specialization at home.

Whether or not our original assumption of innate differences in the market value of initial stocks of human capital may be augmented by the additional assumptions of differing household and market productivities is an empirical question. While little evidence exists on any differences in g,[7] both implicit and explicit evidence has been found consistent with the assumption of greater wife's as opposed to husband's productivity in the manufacturing of Z. Evidence exists that the mother's attributes (for example, education) has a greater effect on increasing the IQ and education of children than those of the father. For example, Leibowitz [15] finds that the education of the mother is four times

6 By equal husband-wife productivity, we mean that the household production function is symmetric with respect to T_M and T_F: $\partial f(X, T_M, T_F)/\partial T_M = \partial f(X, T_F, T_M)/\partial T_M$.

7 The only attempts to measure g—the production function of human capital—have been carried out for males (Heckman [12]). However, as yet, he has not made comparisons of the male and female parameters within the human capital production function.

more powerful in raising the IQ of children than the father's level of education.[8] Therefore, for the purpose of this model, assume that the existence of children within the family serves to increase home productivity of the wife more than that of the husband, thereby causing a greater division of labor. Certainly evidence from the *National Longitudinal Survey of Work Experience of Women 30–44* [20] and the results of Hill and Stafford [13] support such a hypothesis.

The case of single males and single females, and the comparison of their investment and earnings paths with those of married males and females, may be more difficult to visualize. Yet the decision process for the single person may be considered merely as an application of the "family" model in which an additional constraint restricting the control variables to those of only one individual are imposed. Under these conditions, and by barring economies of scale in the production of Z, the optimal trajectories of the control variables would be identical to the case of complete male-female symmetry. Thus, never-married males and never-married females should have the same investment patterns. These patterns diverge only to the extent of innate differences in market versus household productivity, or to the extent that some finite probability of marriage may act as an expectation that alters the dynamic process. In fact, even explicit differences in market discrimination ($w_M \neq w_F$) need not cause a divergence in life-cycle investment paths. To the extent of neutrality within g,[9] s and T are not affected by differences in w. As such, differences in the level of single male and female profiles would better measure market discrimination. The degree to which these single male-female profiles are not parallel would be an indication of innate differences in market versus household productivity as well as the probability of marriage. On the other hand, differences in the slopes of married male

8 Of course, it is true that part of the husband-wife differential in productivity of preschool investment may be attributed to differences in the quantity of time devoted by the husband and wife to child rearing. Indeed, according to cross-sectional analysis, Hill and Stafford [13] find that while children have a negligible effect on husband's time allocation, mothers spend both significantly more time on household activities as well as less time in the labor market. Similarly, according to the *National Longitudinal Survey of Work Experience of Females 30–44*, Mincer and Polachek [20] observe that both the quantity and spacing of children are negatively related to female life-cycle labor force experience. Yet these facts do not contradict the assumptions of greater female home productivity; instead, these assumptions are reinforced. First, according to equation (3a), greater home participation on the part of married females (and especially married females with children) would result directly from a greater home productivity (i.e. $f'_{T_F} > f'_{T_M}$) of wives as compared to husbands; second, regardless of the reason for the greater home participation (especially over the life cycle), equations (3b) and (3c) would dictate a smaller female gain from market investment. Hence, according to the last two terms of (3a), we would observe less investment and thus smaller female market wage rates.

9 We define neutrality as does Ben-Porath [3]. That is, an increase in market wage rates affects the marginal cost and marginal revenue of investment equally so that the rate of investment does not change with changes in the wage rate.

TABLE 1

PERCENTAGE EFFECT OF INDICATED VARIABLES ON WAGES[a]

Population	Sex	Years Married	No. of CH<6	No. of CH6–11	No. of CH12–17	No. of CH>18	Spacing of Children Std. Dev.
1. Single (never-been-married) males & females[b]	−.187*						
2. Married-once-spouse-present males & females[b]	−.616*						
3. Married-once-spouse-present–males[b]		.0039*	.0240*	.0301*	.0115**	.0064	
4. Married-once-spouse-present–females[b]		−.0032	−.0548**	−.0669	−.0252**	−.0112	
5. Married-once-spouse-present–males							
a. 1–2 children less than 18[c]		.0034*					.0064
b. 3 or more children less than 18[c]		.0019					−.0023
6. Married-once-spouse-present–females							
a. 1–2 children less than 18[c]		−.0081***					−.0065
b. 3 or more children less than 18[c]		−.0092					−.0167

Note: The percentages are coefficients of regression equations of the indicated dependent variable on ln(wages/year) for the given population subgroup. Tables containing the full regressions from which these results are derived are available from the author.

Key: Sex ≡ dummy variable (1 ≡ female, 0 ≡ male); Years married ≡ length of marriage; No. of CH<6 ≡ number of children less than 6 years of age; No. of CH6–11 ≡ number of children between 6 and 11 years of age; No. of CH12–17 ≡ number of children between 12 and 17 years of age; No. of CH>18 ≡ dummy variable (1 ≡ the existence of children greater than 18 years of age); Spacing of children ≡ standard deviation of ages of the children.

[a]Computed from 1960 Census 1/1000 sample for those white individuals under age 65 at work with positive earnings.

[b]In addition standardizing for education, exposure to the labor force, hours of work, occupation, industry, region of country, and size of city.

[c]In addition standardizing for education, exposure to the labor force, hours of work, region of country, and size of city.

* = Significant at greater than 1 percent level of significance; ** = significant at greater than 5 percent level of significance; *** = significant at greater than 10 percent level of significance.

and female profiles encompasses each of these phenomena. Therefore, when studying married males and females, it becomes difficult to decipher pure market discrimination from its tertiary effects, or pure market discrimination from societal discrimination manifested by differences in relative productivities.

In summary, the family model of dynamic collaboration predicts that certain marital status characteristics alter the investment decision within the household in different ways for males compared to females. Differing market values of initial stocks of human capital at the outset of marriage implies a general division of labor perpetuated over the marriage such that married males specialize more in market activities than either their single counterparts or their wives. Further, if the existence of children increases female productivity in nonmarket activities to a greater extent than it increases male nonmarket productivity, this specialization may be intensified. Thus it is hypothesized that the wage differential within the family increases with family size, and especially so when the children are spaced widely apart. Surely market discrimination such that the rental value per unit of human capital differs also represents a sufficient stimulus to set off the dynamics of specialization within the family. However, even in this case the resulting wage differentials would overstate market discrimination by the tertiary effects caused by specialization.

III. AN EMPIRICAL ANALYSIS OF THE EFFECTS OF FAMILY CHARACTERISTICS ON MALE AND FEMALE WAGES

To test these hypotheses of husband-wife specialization, the 1960 and 1970 U.S. Census of Population data were analyzed to determine the differing impact of family characteristic variables on male and female wages. Unlike other studies [6, 9, 22, 26], emphasis is placed on the interaction between family characteristics and wages, first, by measuring the effects of family characteristics on earnings using individual data viewed in a static context, and second, by measuring the propagation of husband relative to wife earnings using family data viewed in a life-cycle context. Such an approach enables one to discern the effects of marriage and children on male and female earnings separately as well as to ascertain their importance over the marriage cycle.

Stratification by Sex, Marital Status, and Family Size

As can be seen from Table 1, family characteristics affect wages differently for males and females. The measures are summaries of ordinary least squares regressions of the given independent variables (sex, years married, number of children less than six, etc.) as well as standardizing variables found in previous studies to be important determinants of the logarithm of annual wages:[10]

10 The variables include: education, exposure to the labor market (measured as age minus

$$(4) \qquad \ln Y = \alpha_0 + \alpha_1 E + \alpha_2 X + \alpha_3 X^2 + \alpha_4 S + \alpha_5 \ln(H) + \underline{\alpha}_6 \underline{Z} + \epsilon$$

where $\ln Y \equiv$ natural logarithm of annual earnings; $E \equiv$ years of education; $X \equiv$ exposure to the labor force (age minus education minus 6); $X^2 \equiv$ exposure squared; $S \equiv$ dummy variable ($0 \equiv$ male; $1 \equiv$ female); $\ln(H) \equiv$ natural logarithm of a measure of hours worked per year; and $Z \equiv$ a vector of other variables. By stratifying by marital status, we observe that the wage gap between those married-once-spouse-present is over three times the magnitude of the gap between single never-been-married males and females (−.62 versus −.19).[11] Such a

education minus six years), hours of work per year, dummy variables representing occupation and industry as well as region of the country and city size where indicated.

11 Obviously these results could be achieved without stratification, by creating interaction terms between marital status, family characteristics, and the sex dummy. However, such a specification with interaction terms does not permit the other coefficients to vary. Thus stratification allows for complete interaction.

Some may object to the pooling of single men and women because of alleged differences in characteristics. In Table 1 we pooled the data to obtain a notion of the gap in wages for single males and females. The table below contains 1960 results when the data are not pooled. These indicate relatively small differences in profile level between single males and females compared to married males and females. The nontrivial differences in slope could reflect societal discrimination, expectations of marriage, or (to the extent that g is nonneutral) discrimination.

LN (EARNINGS) REGRESSIONS FOR SINGLE MALES AND SINGLE FEMALES

	Males	Females	Males*	Females*
Constant	1.3796	0.8235	1.4770	1.4830
	(16.44)	(7.51)	(13.80)	(11.23)
Education	.1004	.0702	.0841	.0537
	(23.60)	(12.70)	(18.56)	(8.83)
Experience	.0592	.0390	.0537	.0364
	(21.47)	(13.88)	(20.73)	(13.79)
Experience^2	−.0009	−.0006	−.0008	−.0005
	(−15.41)	(−10.48)	(−14.27)	(−9.46)
Ln (Hrs/Yr.)	.6481	.7739	.6190	.6662
	(51.84)	(51.51)	(52.07)	(45.38)
R^2	.58	.61	.65	.67
N	4977	3265	4977	3265

*Adjusted by region, city size, nativity, occupation, and industry.

difference in earnings by marital status is consistent with the division of labor hypothesis set out in Section II. Equally consistent with this hypothesis are the differing effects of length of marriage and number of children variables. For those males who are married-once-spouse-present, even when holding constant years of labor market exposure, wages rise for each additional year of marriage. On the other hand, when holding constant the same variables for females, the length of marriage is found to have the opposite effect. That is, married female wages are diminished as the length of marriage increases. In fact, although not statistically significant, it seems that the greater the family size, the greater the depressant effect of length of marriage on female wages (see lines 6a and 6b of Table 1). When lines 3 and 4, and 5 and 6 of Table 1 are compared, a similar consistency exists with respect to the opposite effects of number of children on wage rates. Each child is correlated with up to a 3 percent increase of husbands' earnings, but up to a 6.7 percent decrease in the earnings of wives. Although less significant in magnitude, a wider spacing of children has the same impact.

Within-Family Data

Over the marriage life cycle, these findings are perpetuated. In spite of certain data limitations, these results remain discernible and were tested using the 1960 and 1970 Census data on married-once-spouse-present women and *their* husbands by regressing family and marital status characteristics as well as length of marriage on a measure of relative female to male earnings.[12] The exact functional form can be derived from equation (4) which implies

$$Y_t = Y_0(e^{\alpha_1 E + \alpha_2 X + \alpha_3 X^2 + \alpha_4 S + \underline{\alpha}_6 \underline{Z}}) \cdot H^{\alpha_5}$$

The ratio of wife/husband earnings could thus be expressed as

$$\begin{aligned}(5)\ln(Y_F/Y_M)_t = {} & \alpha_0' - \alpha_{1M}E_M + \alpha_{1F}E_F - \alpha_{2M}X_M + \alpha_{2F}X_F - \alpha_3 X_M{}^2 \\ & + \alpha_4 X_F{}^2 + (\alpha_{5F}/\alpha_{5M}) \ln (H_F/H_M) + (\alpha_{6F} - \alpha_{6M})m \\ & + (\alpha_{7F} - \alpha_{7M})K_6 + (\alpha_{8F} - \alpha_{8M})K_{6-18} + \epsilon\end{aligned}$$

where the subscripts F and M refer to wife and husband, and Y_F and Y_M refer to the wife's and husband's annual wage, salary, and self-employment income.[13]

12 The data were obtained by choosing as observations from the 1960 and 1970 Public Use samples of the U.S. Census only those households with both a husband and wife present where each has not been married more than once. Such data represent a unique sample in the sense that relative wife-husband wages can then be viewed in a within-family context over the life cycle of the marriage. To my knowledge, this paper represents the first time the techniques of allocation over time have been applied in a family context to the marriage life cycle.

13 This regression was also performed using the ratio of hourly wages. These results are reported in Table 3. Also results appear in both Tables 2 and 3 for the case when the

The remainder of the variables are defined in Tables 2 and 3 where the results appear. When α_5 is restricted to 1, equation (5) represents the specification for the ratio of wife/husband hourly wages. We see that at the outset of marriage a certain wage difference exists,[14] and that over the course of the marriage this result is intensified. Holding constant both husband and wife exposure[15] to the labor force, the length of marriage acts to increase the gap in earnings. In those families with children, this wage differential is intensified to a still greater extent as illustrated by the negative coefficients for the number of children.[16] This result implies that the wife-husband wage gap within a family is positively associated with the number and spacing of the children and therefore is consistent with the model presented of life-cycle division of labor within the home. As should be expected, because both supply and human capital responses are measured in the earnings regressions, while only human capital responses are observed in the wage equations, the effects appear greater in the regressions on annual as compared to hourly wages.

To the extent that completion of the child-rearing period causes productivity in the home to decline, one should observe a renewed interest in labor

male and female coefficients are restricted to be the same [i.e., the coefficients for the $(E_M - E_F)$ and $(X_M - X_F)$ variables.]

14 The negative constant coefficients in regressions (1) to (4) have this implication. For these regressions, a comparison of the anti-logarithm of the constant terms from 1960 to 1970 gives some indication of the change of within-family relative wife-husband earnings over the decade. However, for the other regressions, to obtain a more precise estimate of the change in wages, one should add in the effects of the changes in absolute levels of male and female education, family size, etc., that occurred over the decade.

15 In these regressions exposure to the labor force is defined as age minus education minus six—a measure of one's potential experience in the labor force. Because one point of this paper is to illustrate the effects of division of labor within the household on labor force participation and human capital investment, the use of this measure of labor force exposure is more useful than actual experience (which, incidentally, is not available in the Census data). Thus, one implication of the empirical results is that specialization within the marriage causes females to spend more of the possible years in which they can work out of the labor force, and hence, partially because of this reason, they have diminishing wages relative to their husbands over the life cycle of their marriages. To the extent that marriage and children only reflect this specialization in nonmarket versus market activities of females, their coefficients reflect the biases that would occur when interpreting X as actual labor market experience. For example, as pointed out by a reviewer of this manuscript, if no female works during marriage, then "true experience" would be X minus years married, and hence "years married" would completely measure the bias in the use of X as a proxy for female experience. To the extent that marriage and number of children also reflect specialization on the part of the husband toward market investment, the coefficients reflect the sum of each of these effects.

16 In other regressions, not reported here, the spacing of children (measured by the variance in the ages of the children) was also found to increase the size of the husband-wife differential.

TABLE 2a

RELATIVE WIFE/HUSBAND EARNINGS STRUCTURE, 1960

(t-values in parentheses, N = 5845)

	Regression Number					
	(1)	(2)	(3)	(4)	(5)	(6)
E_M						−.0617
						(11.93)
E_F						.0455
						(7.33)
$E_M - E_F$	−.0569	−.0487	−.0547	−.0493	−.0538	
	(11.56)	(11.52)	(9.68)	(10.13)	(10.67)	
X_M						
X_F						
$X_M - X_F$					−.0197	
					(3.15)	
$X_M{}^2$						
$X_F{}^2$						
$X_M{}^2 - X_F{}^2$			.00004	−.00001	.0003	
			(.80)	(.25)	(2.80)	
K_6	−.2422	−.1348	−.2420	−.1348	−.1367	−.2475
	(10.74)	(6.90)	(10.73)	(6.89)	(6.97)	(10.89)
K_{6-18}	−.1746	−.1154	−.1745	−.1154	−.0949	−.1749
	(14.67)	(11.18)	(14.66)	(11.18)	(8.19)	(14.79)
m	−.0059	−.0049	−.0062	−.0049	−.0192	−.0071
	(4.39)	(4.26)	(4.25)	(4.06)	(4.78)	(5.06)
m^2					.0003	
					(3.35)	
$\ln(m)$						
$\ln(H_F/H_M)$		.4023		.4024	.4007	
		(45.26)		(45.26)	(45.12)	
C	−.5551	−.3895	−.5563	−.3892	−.2806	−.3481
R^2	.072	.314	.073	.314	.316	.074

Notes: Dependent variable: $\ln(Y_F/Y_M)$ ≡ natural logarithm of wife relative to husband earnings (wage, salary, and self-employment income).

Independent variables: E_M ≡ husband's years of schooling; E_F ≡ wife's years of schooling; $E_M - E_F$ ≡ difference in husband's and wife's years of schooling; X_M ≡ husband's years of labor force exposure (age minus education minus 6); X_F ≡ wife's years of labor force exposure (age minus education minus 6); $X_M - X_F$ ≡ husband-wife difference in years of exposure to the labor force; $X_M{}^2$ ≡ husband's years of labor force exposure squared; $X_F{}^2$ ≡

TABLE 2a
(*Continued*)

Regression Number						
(7)	(8)	(9)	(10)	(11)	(12)	(13)
−.0484	−.0655	−.0519	−.0664	−.0524	−.0522	−.0522
(10.85)	(10.47)	(9.63)	(10.62)	(9.72)	(9.68)	(9.68)
.0495	.0494	.0547	.0516	.0564	.0563	.0560
(9.24)	(7.12)	(9.17)	(7.45)	(9.45)	(9.43)	(9.40)
	−.0034	−.0030	−.0322	−.0216	−.0189	−.0187
	(1.04)	(1.08)	(4.16)	(3.23)	(2.73)	(2.75)
	.0045	.0064	.0160	.0110	.0156	.0153
	(1.23)	(2.05)	(2.00)	(1.59)	(2.04)	(2.12)
			.0005	.0003	.0003	.0003
			(4.33)	(3.40)	(2.66)	(2.66)
			−.0002	−.00007	−.0002	−.0002
			(1.43)	(.58)	(1.19)	(1.37)
−.1345	−.2439	−.1294	−.2495	−.1349	−.1342	−.1233
(6.87)	(10.63)	(6.50)	(10.85)	(6.76)	(6.72)	(6.09)
−.1153	−.1739	−.1131	−.1521	−.0955	−.0916	−.0901
(11.18)	(7.58)	(10.87)	(11.50)	(8.33)	(7.77)	(7.69)
−.0049	−.0081	−.0080	−.0086	−.0084	−.0176	
(4.02)	(2.61)	(3.00)	(2.79)	(3.17)	(2.53)	
					.0002	
					(1.42)	
						−.0966
						(3.53)
.4025		.4028		.4015	.4012	.4010
(45.12)		(45.16)		(45.06)	(45.03)	(45.01)
−.4029	−.3484	−.4373	−.1854	−.3157	−.3267	−.2799
.314	.074	.314	.078	.316	.316	.316

wife's years of labor force exposure squared; $X_M^2 - X_F^2 \equiv$ difference in husband's labor force exposure squared minus wife's labor force exposure squared; $K_6 \equiv$ number of children under 6 years of age (own children for 1970 data and related children for 1960 data); $K_{6-18} \equiv$ number of children between the ages of 6 and 18 (own children for 1970 data and related children for 1960 data); $m \equiv$ years married; $m^2 \equiv$ years married squared; $\ln(m) \equiv$ logarithm of years married; $\ln(H_F/H_M) \equiv$ logarithm of relative wife-husband hours worked per year; and C ≡ constant.

TABLE 2b
RELATIVE WIFE/HUSBAND EARNINGS STRUCTURE, 1970
(t-values in parentheses, N = 8747)

	Regression Number					
	(1)	(2)	(3)	(4)	(5)	(6)
E_M						−.0610
						(13.30)
E_F						.0520
						(9.26)
$E_M - E_F$	−.0586	−.0505	−.0530	−.0467	−.0512	
	(13.29)	(12.81)	(10.86)	(10.73)	(11.05)	
X_M						
X_F						
$X_M - X_F$					−.0120	
					(2.40)	
${X_M}^2$						
${X_F}^2$						
${X_M}^2 - {X_F}^2$			.0001	.00007	.0002	
			(2.50)	(2.33)	(3.04)	
K_6	−.2942	−.2189	−.2942	−.2190	−.2223	−.2975
	(14.16)	(11.75)	(14.16)	(11.76)	(11.94)	(14.46)
K_{6-18}	−.1808	−.1290	−.1806	−.1289	−.1045	−.1814
	(21.32)	(16.86)	(21.30)	(16.84)	(11.96)	(21.39)
m	−.0041	−.0044	−.0047	−.0048	−.0229	−.0047
	(3.85)	(4.58)	(4.36)	(4.92)	(6.81)	(4.24)
${m}^2$					.0005	
					(5.43)	
$\ln(m)$						
$\ln(H_F/H_M)$		.3555		.3552	.3530	
		(47.09)		(47.05)	(46.79)	
C	−.6428	−.4648	−.6454	−.4667	−.3572	−.5220
R^2	.087	.272	.087	.272	.275	.087

Note: See Table 2a for variable definitions.

market participation and investment. Mincer and Polachek [20] illustrate this renewed market investment for females by showing that experience-earnings profiles are steeper in the latter part of the life cycle than in the prechild-bearing period. By experimenting with quadratic and logarithmic terms for years married

TABLE 2b
(*Continued*)

Regression Number						
(7)	(8)	(9)	(10)	(11)	(12)	(13)
−.0509	−.0559	−.0471	−.0574	−.0484	−.0482	−.0487
(12.37)	(10.25)	(9.66)	(10.47)	(9.86)	(9.82)	(9.97)
.0494	.0512	.0500	.0548	.0529	.0533	.0531
(9.86)	(8.28)	(9.06)	(8.84)	(9.54)	(9.60)	(9.57)
	.0049	.0037	−.0192	−.0152	−.0125	−.0134
	(1.80)	(1.51)	(3.23)	(2.86)	(2.25)	(2.46)
	.0005	.0020	−.0038	−.0004	.0037	.0024
	(.17)	(.76)	(.61)	(.07)	(.61)	(.42)
			.0004	.0003	.0003	.0003
			(5.25)	(4.13)	(3.53)	(3.71)
			.0001	.00007	−.0000	.0000
			(1.10)	(.78)	(.03)	(.03)
−.2194	−.2905	−.2120	−.3000	−.2195	−.2183	−.2058
(11.73)	(13.76)	(11.19)	(14.23)	(11.60)	(11.52)	(10.64)
−.1291	−.1794	−.1269	−.1470	−.1030	−.0988	−.0963
(16.85)	(20.98)	(16.44)	(15.53)	(12.10)	(11.13)	(11.00)
−.0044	−.0101	−.0100	−.0071	−.0078	−.0172	
(4.53)	(3.70)	(4.13)	(2.59)	(3.20)	(2.80)	
					.0002	
					(1.67)	
						−.0876
						(3.53)
.3554		.3554		.3529	.3527	.3524
(47.02)		(47.08)		(46.81)	(46.74)	(46.73)
−.4457	−.6096	−.5319	−.4294	−.3963	−.4062	−.3532
.272	.087	.272	.095	.276	.276	.276

(regressions 5, 12, and 13 of Tables 2a and 2b, and regressions 4, 8, and 9 of Tables 3a and 3b), confirmation is obtained that the husband-wife wage gap rises at a decreasing rate.

Although this model of life-cycle behavior is by no means beyond reproach, nevertheless the hypotheses generated as well as their empirical implementation

TABLE 3a

RELATIVE WIFE/HUSBAND WAGE STRUCTURE, 1960

(t-values in parentheses, N = 5845)

	Regression Number								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
E_M					−.0287	−.0318	−.0315	−.0314	−.0316
					(4.84)	(4.44)	(4.39)	(4.39)	(4.42)
E_F					.0553	.0625	.0635	.0630	.0625
					(7.78)	(7.88)	(7.98)	(7.94)	(7.89)
$E_M - E_F$	−.0366	−.0432	−.0433	−.0433					
	(6.50)	(6.42)	(6.44)	(6.43)					
X_M						−.0025	−.0057	−.0020	−.0027
						(.66)	(.64)	(.54)	(.73)
X_F						.0092	.0035	.0094	.0082
						(2.23)	(.33)	(2.27)	(2.10)
$X_M - X_F$		−.0062	−.0097	−.0093					
		(1.79)	(1.16)	(1.12)					
$X_M{}^2$							.00007		
							(.50)		
$X_F{}^2$							.00012		
							(.75)		
$X_M{}^2 - X_F{}^2$			−.00006						
			(.46)						
K_6	.0248	.0255	.0262	.0242	.0306	.0404	.0360	.0384	.0468
	(.96)	(.99)	(1.01)	(.93)	(1.18)	(1.87)	(1.36)	(1.46)	(1.77)

K_{6-18}	−.0274	−.0267	−.0262	−.0196	−.0269	−.0230	−.0112	−.0126	−.0116
	(2.00)	(1.96)	(1.91)	(1.28)	(1.98)	(1.67)	(.74)	(.81)	(.77)
m	−.0035	−.0033	−.0036	−.0084	−.0016	−.0078	−.0081	−.0156	
	(2.26)	(2.13)	(.12)	(1.56)	(.98)	(2.22)	(2.30)	(2.38)	
m^2				.00012				.0002	
				(.93)				(1.40)	
$\ln(m)$									−.0768
									(2.37)
C	−.1435	−.1293	−.1233	−.0969	−.4843	−.5691	−.5099	−.5431	−.4934
R^2	.009	.009	.009	.009	.012	.013	.013	.013	.013

Notes: Dependent variable: $\ln(W_F/W_M) \equiv$ logarithm of relative wife/husband hourly wage rate. See Table 2a for variable definitions.

TABLE 3b

RELATIVE WIFE/HUSBAND WAGE STRUCTURE, 1970

(t-values in parentheses, N = 8747)

	Regression Number								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
E_M					−.0324	−.0311	−.0319	−.0309	−.0320
					(5.83)	(4.71)	(4.79)	(4.68)	(4.87)
E_F					.0448	.0479	.0492	.0484	.0479
					(6.59)	(6.41)	(6.54)	(6.46)	(6.40)
$E_M - E_F$	−.0357	−.0373	−.0384	−.0374					
	(6.70)	(5.99)	(6.11)	(6.00)					
X_M						.0014	−.0079	.0017	.0001
						(.43)	(1.10)	(.51)	(.04)
X_F						.0047	.0059	.0049	.0029
						(1.31)	(.78)	(1.38)	(.86)
$X_M - X_F$		−.0015	−.0010	−.0015					
		(.49)	(1.43)	(.48)					
$X_M{}^2$							.0002		
							(1.60)		
$X_F{}^2$							−.0000		
							(.08)		
$X_M{}^2 - X_F{}^2$			.00013						
			(1.30)						
K_6	−.0824	−.0822	−.0812	−.0832	−.0778	−.0670	−.0722	−.0703	−.0591
	(3.28)	(3.27)	(3.23)	(3.31)	(3.09)	(2.73)	(2.82)	(2.75)	(2.29)

K_{6-18}	−.0350	−.0349	−.0338	−.0297	−.0342	−.0316	−.0223	−.0240	−.0209
	(3.42)	(3.40)	(3.28)	(2.52)	(3.33)	(3.06)	(1.95)	(2.00)	(1.82)
m	−.0048	−.0048	−.0054	−.0087	−.0040	−.0100	−.0091	−.0160	
	(3.78)	(3.74)	(3.96)	(1.91)	(3.04)	(3.03)	(2.75)	(2.77)	
m^2				.0001				.0002	
				(.90)				(1.27)	
$\ln(m)$									−.0771
									(2.69)
C	−.1421	−.1392	−.1267	−.1189	−.3074	−.3909	−.3356	−3742	−.3082
R^2	.008	.008	.008	.008	.009	.009	.010	.009	.009

Notes: Dependent variable: $\ln(W_F/W_M) \equiv$ logarithm of relative wife/husband hourly wage rate. See Table 2a for variable definitions.

yield suggestive results. To summarize, we find that family characteristics affect husbands and wives differently. Marital status, the length of marriage, the number of children, and the spacing of children each tend to increase husband's wages while having a very significant negative effect on wife's wages. Although, because of certain specification biases, some may question the exact magnitudes of these effects, the coefficients are sufficiently robust to enable one to conclude at the very minimum that marital status and family characteristics are indeed associated with male-female wage differentials. Further, when one looks at male-female wages separately, this association is the opposite for males and females.

IV. IMPLICATIONS AND CONCLUSIONS

The model presented should not be viewed as a comprehensive one, predicting deterministically life-cycle wage, investment, and labor force participation differences by sex. Rather, it should be taken as suggestive and the empirical results as consistent with the model. What is important about the findings is not necessarily the scenario of events which traces out a logical explanation of earnings differentials through a human capital investment process, and not necessarily the exact magnitudes of the percentages generated, but rather the fact that family characteristics affect male and female wages differently over the life cycle. Neglecting such differences causes biases in computing measures of the discrimination coefficient between males and females.

In most studies to date [18, 22], but even more explicitly in [6], a discrimination coefficient is defined as

$$d = 1 - (\bar{Y}_M - \bar{Y}_F)/(\bar{Y}_M - \bar{Y}_F) \tag{6}$$

for which

$$\bar{Y}_M \equiv g_M(\bar{E}_M, \bar{X}_M, \bar{X}_M^2, \bar{H}_M, \bar{Z}_M)$$
$$\bar{Y}_F \equiv g_F(\bar{E}_F, \bar{X}_F, \bar{X}_F^2, \bar{H}_F, \bar{Z}_F)$$
$$\tilde{\bar{Y}}_F \equiv g_M(\bar{E}_F, \bar{X}_F, \bar{X}_F^2, \bar{H}_F, \bar{Z}_F)$$

where the subscript F refers to females and the overbar denotes mean value. $\bar{Y}_M$ can be interpreted as the mean male market wage rate, $\bar{Y}_F$ as the mean female market wage rate, and $\tilde{\bar{Y}}_F$ as the mean female market wage rate had she a male wage structure defined by equation (4). Alternatively, $\tilde{\bar{Y}}_F$ can be thought of as the wage males would obtain had they female characteristics. As indicated in [6], this measure of discrimination is composed of two parts: (1) that wage differential caused by differences in the male-female earnings structure (that is, the coefficients in the regression equation), and (2) that part unexplained by either differences in male-female coefficients or endowments (that is, the con-

stant of the regression equation). Yet, at least one question pervades in the use of such a measure. Why should structural differences in the male-female earnings function represent a measure of market discrimination?[17]

According to arguments presented in this paper, structural differences between males and females need not necessarily be attributed solely to direct market discrimination; for even if the initial husband-wife wage gap is caused by market discrimination, the resulting within-family specialization causes differences in market productivity which would overstate the original degree of discrimination. Therefore, according to the model presented, such structural differences would be attributed in part to the division of labor within the household which could come about either because of direct market discrimination, societal discrimination, or the optimal mating process. Thus, if division of labor implies differences in husband-wife labor force participation over the life cycle, and hence differences in human capital investment, wages, and earnings, one could hardly claim such an optimization of life-cycle output to measure discrimination directly. At most, one obtains a measure of discrimination plus tertiary effects; at minimum, one obtains the effects of societal discrimination. It is because of such a division of labor that we hypothesize and illustrate empirically that family characteristics have differing effects for males and females. For this reason—namely, the assumption that family characteristics have the same effect on both male and female wages—many of the current estimates of the male-female discrimination coefficient are seriously biased.[18] These are the biases that this paper in part addresses.

REFERENCES

1. G. Becker. *The Economics of Discrimination,* 2d. ed. Chicago: University of Chicago Press, 1971.
2. _____. "A Theory of the Allocation of Time." *Economic Journal* (September 1965): 493–517.
3. Y. Ben-Porath. "The Production of Human Capital and the Life Cycle of Earnings." *Journal of Political Economy* (August 1967): 352–65.

17 With respect to this definition, we might also ask why differences in male-female endowments are not part of the definition of discrimination. Is it not possible that society discriminates in amount of educational training available to females? The answer is obvious. Past studies have considered these differences in endowments as societal or effects of market discrimination. Our point is that at least some of the differential in wages attributed to structure is also either societal or tertiary forms of discrimination.

18 Although this bias is especially prevalent in the studies that use $[A - E - 6]$ as a proxy for experience, it would still exist (however, to a smaller extent) in studies with actual measures of experience. The reason is that children could impart effects on the intensity of investment even while the parents are at work. For example, such differences in investment could be manifested by differences in occupational choice and job turnover.

4. B. Bergmann. "The Effect on White Incomes of Discrimination in Employment." *Journal of Political Economy* (March/April 1971).
5. ———. "Occupational Segregation, Wages, and Profits When Employers Discriminate by Race or Sex." Working paper, Project on the Economics of Discrimination, University of Maryland.
6. A. S. Blinder. "Wage Discrimination: Reduced Form and Structural Estimates." *Journal of Human Resources* (Fall 1973): 436–55.
7. M. S. Cohen. "Sex Differences in Compensation." *Journal of Human Resources* (Fall 1971): 434–47.
8. F. Y. Edgeworth. "Equal Pay for Men and Women for Equal Work." *Economic Journal* (December 1922): 431–57.
9. V. Fuchs. "Male-Female Differentials in Hourly Earnings." *Monthly Labor Review* (May 1971): 9–15.
10. ———. "Short-Run and Long-Run Prospects for Female Earnings." Paper presented at the American Economic Association meetings, New York, 1973.
11. G. Ghez and G. Becker. *The Allocation of Time and Goods over the Life Cycle.* New York: Columbia University Press for the National Bureau of Economic Research, forthcoming.
12. J. Heckman. "Estimates of a Human Capital Production Function Embedded in a Life Cycle Model of Labor Supply." Paper presented at the National Bureau of Economic Research Conference on Income and Wealth, November 1973.
13. C. R. Hill and F. Stafford. "Allocation of Time to Preschool Children and Educational Opportunity." *Journal of Human Resources* (Summer 1974): 323–41.
14. G. Johnson and F. Stafford. "The Earnings and Promotion of Women Faculty." Paper presented at the Econometric Society meetings, New York, 1973.
15. E. Landes. "Male-Female Differentials in Wages and Employment: A Specific Human Capital Model." Ph.D. dissertation, Columbia University, 1974.
16. A. Leibowitz. "Production Within the Household." Paper presented at the American Economic Association meetings, New York, 1973.
17. H. V. Lewis. "The Importance of Turnover in the Male-Female Wage Differential." Ph.D. dissertation, University of Rochester, 1971.
18. B. Malkiel and J. Malkiel. "Male-Female Pay Differentials in Professional Employment." *American Economic Review* (September 1973): 693–705.
19. D. McNulty. "Differences in Pay Between Men and Women Workers." *Monthly Labor Review* (December 1967): 40–43.
20. J. Mincer and S. Polachek. "Family Investments in Human Capital: Earnings of Women." *Journal of Political Economy* (March/April 1974): S76–108.
21. M. Nerlove. "Household and Economy: Toward a New Theory of Population and Economic Growth." *Journal of Political Economy* (March/April 1974): S200-21.

22. R. Oaxaca. "Sex Determination in Wages." In *Discrimination in Labor Markets,* eds. O. Ashenfelter and A. Rees. Princeton: Princeton University Press, 1973.
23. S. Polachek. "Differences in Expected Post-School Investment as a Determinant of Market Wage Differentials." *International Economic Review,* forthcoming.
24. J. Robinson. *The Economics of Imperfect Competition,* 2d. ed. New York: St. Martin's Press, 1969. Ch. 26.
25. H. Sanborn. "Pay Differences Between Men and Women." *Industrial and Labor Relations Review* (July 1964): 534–50.
26. I. Sawhill. "The Economics of Discrimination Against Women: Some New Findings." *Journal of Human Resources* (Summer 1973): 383–97.
27. R. Strauss and F. Horvath. "Testing for Wage Rate Discrimination Against Blacks and Women in the U.S., 1960, 1967, 1970." Manuscript, 1973.
28. L. Suter and H. Miller. "Components of Income Differences Between Men and Women in the United States." Paper presented at the American Sociological Association meetings, Denver, 1971.
29. H. Zellner. "Discrimination Against Women, Occupational Segregation, and the Relative Wage." *American Economic Review* (May 1972): 157–60.