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Occupational Segregation Among Women: Theory, Evidence, and A Prognosis

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It is currently well established that within the economy occupational segregation exists at least by race and sex. Bergmann (1971) describes in great detail how blacks are segregated into menial occupations, while Zellner (1972) demonstrates that this same phenomenon holds for women. By measuring the overlap of male-female occupational distributions, Fuchs' (1971) indices of occupational dissimilarity lend credence to these findings. These estimates show occupational segregation to be a greater problem for males and females than for whites and blacks.

More recently Boskin (1974) and Schmidt and Strauss (1975b) apply multiple-logit analysis to predict essentially the same results by estimating the effect of sex and race on the probability of being in a given occupational category. They find that even with adjustments for age and education, blacks have a higher probability of being in service and operative jobs as opposed to professional and managerial occupations, while females have a higher probability of being in clerical jobs as opposed to other occupations.

Although such occupational segregation has been reported to exist at least

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resulting system of simultaneous differential equations that describes the optimal paths. Further, because these paths depend on the specific functional forms, only ambiguous results can be achieved. It is for this reason that early models of human capital accumulation by Ben-Porath (1967) assume utility maximization to be synonymous with earnings maximization, impose a constant per period labor force participation ($N_t = N$), and ignore the accumulation of nonhuman capital assets. This variant of equation (9.1) can be stated as

$$\underset{S_t}{\text{Max}} \int_0^T (N - S_t) W K_t e^{-rt} dt \tag{9.3}$$

subject to

$$\dot{K} = f(S_t, K_t, X_t) - \xi K_t \tag{9.4}$$

By concentrating on S_t, these models indicate a monotonically declining investment intensity over the life cycle. While the more general specification yields insight into the relationship between labor force participation, investment, and consumption, the basic conclusions of the model remain unchanged. Still, except for the cases of noncontinuous participation (Polachek, 1975a), abnormally high rates of impatience (Blinder and Weiss, 1976), or the incorporation of specific training due to job mobility (Bartel and Borjas, 1977), investment declines monotonically with age.

In each analysis of the human capital accumulation process, as well as the resulting empirical studies, human capital is analyzed as being homogeneous and produced by a unique production function *independent* of occupation (or job). I contend that such a view of human capital is too narrow. In the analysis to follow, this traditional notion that human capital accumulation occurs at the same rate regardless of occupation is relaxed. Instead, it is assumed that human capital production varies with occupation. Specifically, by assuming that occupations can be characterized hedonically by the existence of varying human capital "atrophy" rates (measuring the loss of market skills attributable to periods of labor force intermittency), I incorporate the occupational choice decision into the human capital framework.[1] ***The main theorem to be derived is that greater life cycle labor force intermittency is associated with a higher probability of being in an occupation with a relatively low degree of atrophy.***

Occupational Choice Embedded in the Human Capital Model

Including occupational choice necessitates adding an additional control variable so as to render the characteristics of one's occupation endogenous to the lifetime income maximization process. I achieve this goal by creating a hedonic index ($\underline{\delta}_t$) which is assumed to uniquely describe one's occupation in time period t.[2] Assuming that the creation of human capital in any time period is dependent on occupation, equation (9.4) governing the rate of change of human capital stock is modified so as to account for interoccupational differences in the production of human capital. Thus

$$\dot{K} = f(S_t, K_t, X_t, \underline{\delta}_t, N_t, \xi) \tag{9.5}$$

where

$\underline{\delta}_t \equiv$ a vector of occupational characteristics.

Maximization of equation (9.3) with $\underline{\delta}_t$ as an additional control variable subject to equation (9.5) yields optimal life cycle paths of human capital investment and occupation.[3] Earnings functions can also be derived.

Rather than mapping out entire life cycle paths of each variable, my goal is to concentrate *solely* on life cycle labor force intermittency as a cause of occupational segregation by sex. As such my notion of occupational characteristics ($\underline{\delta}_t$) is simplified and more structure on equations (9.3) and (9.5) is imposed.

First, my original notion of occupational characteristics is narrowed and only one component of the $\underline{\delta}_t$ vector, denoted as atrophy (δ_t) is dealt with. Unique atrophy rates are defined for each occupation to measure the diminution of human capital (or potential earnings growth) when skills are not used to capacity in each period. Thus equation (9.5) is rewritten to account for interoccupational differences in atrophy:[4]

$$\dot{K} = f(S_t, K_t) - [\xi + (1 - N_t)\delta_t] K_t \tag{9.6}$$

where

$\delta_t \equiv$ atrophy of occupation in period t

As can be seen in equation (9.6), when labor force participation is full in each period (i.e., when $N_t = 1$ for all t), no atrophy occurs beyond the normal depreciation (ξ) associated with aging. Thus human capital accumulation differs across occupations because of differences in net rates of production over the working lifetime.

Second, I assume that the rental rate (wages) per unit of human capital (W) depends on one's occupation. Given that occupation is denoted by index δ, then

$$W = W(\delta) \qquad (9.7)$$

such that

$$W' > 0$$

$$W'' < 0$$

As will be seen, these two assumptions are necessary to obtain nontrivial solutions for optimal δ. However, economic justification exists as well. If it is true that losses of human capital stock yield lower earnings, then the market would compensate the rental rates of occupations for which the price of such intermittency is high. Those with expectations of full participation have a non-zero probability of dropping out of the labor force, even if only for health reasons. Thus to compensate for the non-zero probability of atrophy, I assume $W' > 0$.

The problem of occupational choice becomes one of choosing the life cycle paths for occupation (δ_t) and investment (S_t) which maximize lifetime income. Such a model can be expressed as:

$$\underset{S_t,\delta_t}{\text{Max}} \int_0^T (N_t - S_t)\, W(\delta_t) K_t e^{-rt}\, dt \qquad (9.8)$$

subject to equations (9.6) and (9.7).

Given that my main concern lies with better modeling of existing cross-sectional sex differences in occupation, I simplify further by ignoring the question of life cycle occupational mobility.[5] Therefore, although I need not do so, I assume that δ represents a one-time decision at the initial stage of the investment horizon, so that occupation, once picked, applies to one's whole life.[6]

As currently stated, the life cycle decision of

$$\underset{S_t,\delta}{\text{Max}} \int_0^T (N_t - S_t)\, W(\delta) K_t e^{-rt}\, dt \qquad (9.9)$$

subject to equations (9.7) and

$$\dot{K} = f(S_t, K_t) - [\xi + (1 - N_t)\delta] K_t \qquad (9.10)$$

reduces to a two-stage optimization process. First, an individual chooses the optimal S_t path (S_t^*). Second, he chooses δ contingent on S_t^*. As such, the occupational decision representing the determination of δ reverts into the static problem. In accordance with this framework, an individual chooses the occupation associated with the optimal depreciation rate that maximizes the present value of lifetime income subject to human capital formation constraints. The optimal δ is obtained by

$$\underset{\delta}{\text{Max}} \int_0^T (N_t - S_t^*)\, W(\delta) K_t^* e^{-rt}\, dt \qquad (9.11)$$

subject to

$$K_t = \int_0^t K_\tau d\tau = K_0 + \int_0^t \{f(S_\tau^*, K_\tau^*) - \xi K_\tau - (1 - N_\tau)\delta K_\tau^*\}\, d_\tau \qquad (9.12)$$

or when substituting the K_t constraint into the objective function, by

$$\underset{\delta}{\text{Max}}\; F(\delta | N_t, S_t^*) = \underset{\delta}{\text{Max}} \int_0^T (N_t - S_t^*) w(\delta) \Big[K_0 + \int_0^t \{f(S_\tau, K_\tau^*) - [\xi + (1 - N_\tau)\delta] K_\tau^*\}\, d\tau \Big] e^{-rt}\, dt \qquad (9.13)$$

The first order conditions are:

$$\frac{\partial F}{\partial \delta} = \int_0^T (N_t - S_t^*) \frac{\partial w}{\partial \delta} K_0 e^{-rt}\, dt + \int_0^T (N_t - S_t^*) \int_0^t \frac{\partial w}{\partial \delta} f(S_\tau^* \cdot K_\tau^*)\, d\tau dt$$
$$- \int_0^T (N_t - S_t^*) \frac{\partial w}{\partial \delta} \int_0^t \xi K_\tau^{-r\tau}\, d\tau dt \qquad (9.14)$$
$$- \int_0^T (N_t - S_t^*) \int_0^t (1 - N_\tau) w + \delta \frac{\partial w}{\partial \delta} K_t^*\, d\tau dt = 0$$

or

$$H(\delta, \underline{N}, \underline{S}^*) = 0 \qquad (9.15)$$

Expression (9.15) implies that the optimal δ is chosen such that the present value of increased earnings associated with an incremental change in δ (i.e., the marginal revenue) just equals the marginal cost associated with incrementally higher depreciation during periods of labor force intermittency.

The main objective is to explore the impact of labor force intermittency on occupational choice. Perturbation of the first order condition about an exogenous change in $\underline{N}$ yields measures of the impact of differing labor force participation. If it is assumed that the optimal S_t path is fixed and invariant to changes in $\underline{N}$, then the effect of differing levels of labor force participation on the optimal choice of δ may be examined by totally differentiating equation (9.15):

$$\frac{\partial H}{\partial \underline{N}} d\underline{N} + \frac{\partial H}{\partial \delta} d\delta = 0 \qquad (9.16)$$

Solving for $d\delta / d\underline{N}$ yields[7]

$$\frac{d\delta}{d\underline{N}} = - \frac{\partial H/\partial \underline{N}}{\partial H/\partial \delta} \geqslant 0 \qquad (9.17)$$

Since $\partial H/\partial \delta$ represents the second-order conditions of maximizing equation (9.7), $\partial H/\partial \delta < 0$. The sign of (9.17) is then identical to the sign of $\partial H/\partial N$, which is positive provided that the depreciation term ξ is not extraordinarily large.[8]

Although an explicit solution for occupational characteristics was not analytically derived, certain relationships, each amenable to empirical testing, have been ascertained. When individual tastes and abilities are held constant, occupational choices are determined in part by labor market variables. *In particular, if life cycle labor force participation differs across individuals, and if the costs of these varying degrees of labor force intermittency vary across occupations, then individuals will choose those occupations with the smallest penalty for their desired lifetime participation.* According to the model of human capital accumulation outlined above, if these costs of intermittency are measured by the deterioration of earnings potential occurring from nonuse of human capital (atrophy), then the effect of differences in life cycle labor force participation on occupational choice would be greater the greater the atrophy rate. These are the implications which are tested in this article.

EMPIRICAL ANALYSIS

Much of the theoretical model has been devoted to predicting the existence of a relationship between patterns of life cycle labor force participation, occupation, and atrophy. It is hypothesized that lifetime labor force participation is related to one's occupation, and that this relationship between labor force intermittency and the probability of entering a given occupation is negatively associated with that occupation's atrophy rate. This section establishes the empirical plausibility of such a contention.

The Data

The data are obtained from the Income Dynamics Panel already well documented in the literature.[9] This sample was chosen because of its recent inclusion of retrospective work history information, and because the results serve to corroborate my past analyses of occupational choice using the National Longitudinal Survey (see Polachek, 1977). For this latter reason this study deals only with women between the ages of 30 and 50. By examining the impact of differences in *female* occupational patterns, the problem of implicitly picking up the impact of direct sex discrimination is avoided. The calculated effect of intermittent participation on occupational choice cannot be measuring sex discrimination if only females are being considered.[10]

Both because of the limited number of observations in the self-employed business, craft, farmer, and miscellaneous categories, and because of the vagueness in the definition of these occupations, the analysis was limited to the following five broad occupations: (1) professional, (2) managerial, (3) clerical and sales, (4) operative, and (5) unskilled labor and service workers. These occupations constitute 96 percent of female and 70 percent of male workers. In addition, concentrating on broad occupational categories minimizes the amount of occupational mobility within the data, so that lifetime occupational choices can be dealt with explicitly.

The Relation Between Home Time and Occupational Choices

Occupation is a discrete, nonordered variable. Thus any a priori ranking of the set of occupations can only be arbitrary. Given the polytomous nonordered nature of the dependent variable, traditional approaches do not yield efficient estimates of the impact of causal factors.[11]

Instead, since occupational groupings can be broken into mutually exclusive categories, the logistic approach can be applied to estimate the impact of independent variables on being in a particular occupation. Since each individual chooses one and only one occupation at a given time, a linear dependency arises such that the determination of occupation can be viewed as a system of $(M - 1)$ independent equations:

$$\ln\left(\frac{P_{jt}}{P_{1t}}\right) = X_t\beta_j \qquad (9{,}18)$$

where

$j \equiv 2, \ldots, M$ (the number of occupations),
$t \equiv$ the observation index,
$X \equiv$ a vector of independent factors (c, s, e, h) affecting the logit,
$c \equiv$ constant,
$s \equiv$ years of schooling,
$e \equiv$ exposure to the labor market (age minus S minus 6)[12] and
$h \equiv$ years not in the labor force.[13]

Equation (9.18) can be estimated by maximum likelihood techniques.[14] The probability of an individual's being in any occupation can be calculated as

$$P_{1t} = \frac{1}{1 + \sum_{j=2}^{M} \exp(X_t\beta_j)}$$

$$P_{it} = \frac{\exp(X_t\beta_i)}{1 + \sum_{j=2}^{M} \exp(X_t\beta_j)} \qquad i = 2, \ldots, M \qquad (9.19)$$

These results (table 9.1) illustrate a strong relationship between life cycle labor force participation and occupational choice. Interpreting the home time coefficients as the effect of greater (percentage) home time upon the odds of being in occupation i relative to being professional, more home time increases the probability of being in all except managerial (and possibly operative) occupations relative to being a professional. The relative magnitudes of the coefficients shows that more home time increases the odds of being both

Table 9.1.
Multiple Logit Equations for Occupational Choice, Income Dynamics Panel, White Married Women, $N = 482$

	c	s	e	h
ln (Managerial/Professional)	.416	-.219	.075	-.035
	(.21)	(-1.87)	(1.68)	(-.92)
ln (Clerical/Professional)	2.664	-.242	.047	.043
	(2.46)	(-3.76)	(1.73)	(1.88)
ln (Operative/Professional)	6.812	-.649	.065	-.010
	(4.84)	(-6.97)	(1.95)	(-.38)
ln (Unskilled/Professional)	6.208	-.574	-.005	.099
	(4.57)	(-6.47)	(-1.47)	(3.46)
	c	s	e	h^*
ln (Managerial/Professional)	0.760	-.229	0.060	-.544
	(.38)	(-1.92)	(1.47)	(-.69)
ln (Clerical/Professional)	2.572	-.255	0.056	1.124
	(2.30)	(-3.89)	(2.40)	(2.52)
ln (Operative/Professional)	6.968	-.651	0.051	0.175
	(4.83)	(-6.94)	(1.74)	(3.13)
ln (Unskilled/Professional)	5.485	-.604	0.036	2.551
	(3.87)	(-6.64)	(1.28)	(4.34)

$c \equiv$ constant
$s \equiv$ years of schooling
$e \equiv$ labor force exposure
$h \equiv$ years of exposure *not* in the labor force (home time)
$h^* \equiv$ percent of exposure *not* in the labor force

unskilled and household service relative to clerical and sales workers, and clerical and sales workers relative to operatives. Indeed, continuous labor force participation is most important for managerial and professional workers. (Table 9.8 contains the OLS estimates for each occupation.) Thus even after marital status, age, and education *among white women* are adjusted for, differences in life cycle labor force behavior patterns are associated with the probability of being in a given occupation.[15] Yet the relationship differs among occupations.

According to the theory outlined, a unique rate of atrophy can be attached to each occupation. Further, those individuals with expectations of greater home time would find relatively large losses associated with occupations with high atrophy rates.[16] A negative correlation, then, between atrophy and the home time coefficients is predicted.

Because no data exist which measure rates of atrophy in each occupation,

TABLE 9.2.
Atrophy Estimates, Income Dynamics Data (Whites Only)

	δ_1	δ_2	h^*	N
Professional	.27	.004	.20	63
Managerial	.42	.024	.29	20
Self-Employed Business	–	–	.32	4
Clerical-Sales	.24	.004	.44	152
Craft	–	–	.56	3
Operative	.18	.014	.38	62
Unskilled	.15	–.007	.55	81
Farmer	–	–	.97	1
Miscellaneous	–	–	.60	5

$\delta_1 \equiv$ depreciation calculated with h defined as a percent
$\delta_2 \equiv$ depreciation calculated with h defined chronologically
$h^* \equiv$ percent home time
$N \equiv$ number of observations

these rates were estimated by techniques developed in an earlier publication (see Mincer and Polachek, 1974) (table 9.2).[17] Each atrophy rate is negative except for household work, which appears slightly positive. Moreover, the managerial and skilled occupations tend to have greater atrophy rates than the nonskilled occupations.[18]

The correlation coefficients between these atrophy rates and the home time coefficients (table 9.1) are found to be negative (table 9.3), indicating that women with higher home time have a higher probability of being in an occupation with lower atrophy.[19] This negative correlation holds even when using individual observations and standardizing for exogenous factors. OLS regression results run on the entire sample of 482 women using the atrophy rate as the dependent variable likewise yield a negative relation between atrophy and home time:[20]

$$\delta_1 = 0.086 - .001h + .0009e + .011s - .006y \quad R^2 = .20 \qquad (9.20)$$
$$(4.1) \quad (-2.8) \quad (1.7) \quad (9.3) \quad (-.9)$$

Table 9.3.
Simple Correlation Between Atrophy and Home Time Coefficients

	Table 9.1(h)	*Table 9.1(h*)*
δ_1	–.71	–.75
δ_2	–.99	–.99

and

$$\delta_2 = 0.003 - .0003h + .0002e + .00001s + .001y \quad R^2 = .06 \qquad (9.21)$$
$$(1.1) \quad (-5.2) \quad (2.8) \quad (0.1) \quad (0.6)$$

where t-values are in parentheses, and $h \equiv$ years home time, $e \equiv$ labor market exposure, $s \equiv$ years of schooling, and $y \equiv$ the existence of young children in the household.

One criticism of this approach could be that little attention is given to the question of causality between home time and occupational choice. Obviously causality could run in both directions. It is hypothesized that greater home time expectations result in choosing an occupation with a smaller atrophy. Yet it could be argued that being in an occupation with low atrophy implies relatively low costs of dropping out, and hence causes one to spend less time in the labor force. The next section applies simultaneous equations techniques in an attempt to decipher possible biases inherent within the single-equation approach.

A Simultaneous Equations Approach

In order to account for the possibility that occupational choice and the amount of home time are jointly determined, a model simultaneously relating home time and occupational choice is created. When equation (9.18) is augmented by the addition of

$$h = h(c, \Omega_2, \ldots, \Omega_5, s, e) \qquad (9.22)$$

where

$c \equiv$ constant
$\Omega \equiv$ occupation (1 if in occupation i; 0 otherwise)
$s \equiv$ years of schooling, and
$e \equiv$ exposure,

home time (h) is posited to be related to occupational choice. To the extent that occupation is given, home time can be considered a response to occupational choice. Thus in this model home time can be viewed as determining as well as being determined by occupational choice. The advantages of estimating the system are twofold: first, to alleviate possible upward biases in the magnitude of the β_{ij} coefficients in equation (9.18); and second, to base the estimated coefficients and standard errors on the likelihood function of a more realistic model.

Simultaneous estimation of equations (9.18) and (9.22) is more difficult than is apparent. In a system with one continuous endogenous variable and one polytomous endogenous variable, it is difficult to specify the likelihood function. In this article the problem is simplified (as described in Schmidt and Strauss 1975a) by assuming that h_t can be broken into a dichotomous variable $\tilde{h}$ where

$$\tilde{h}_t = \begin{cases} 2 \text{ if } h_t > \bar{h} \\ 1 \text{ if } h_t \leq \bar{h} \end{cases} \quad (9.23)$$

where $\bar{h}$ equals the sample mean of h_t. The log of the odds ratio can be specified as

$$\ln\left(\frac{P(\tilde{h} = 2|\Omega)}{P(\tilde{h} = 1|\Omega)}\right) = \gamma_0 + \sum_{j=1}^{M} \gamma_{1j} S + \gamma_2 e + \gamma_{3j}\Omega_j \quad (9.24)$$

Equation (9.18) can be respecified as

$$\ln\left(\frac{P(\Omega = j|\tilde{h})}{P(\Omega = 1|\tilde{h})}\right) = \alpha_{0j} + \alpha_{1j}\tilde{h} + \alpha_{2j} S + \alpha_{3j} e$$

$$j = 1, \ldots, M \text{ number of occupations} \quad (9.25)$$

Equations (9.24) and (9.25) can be estimated by maximizing the nonlinear likelihood function[21]

$$L = \prod_{i=1}^{2} \prod_{j=1}^{M} \prod_{t \in \Theta_{ij}} P(\tilde{h}_t = i, \Omega = j) \quad (9.26)$$

where

$M \equiv$ number of occupations,
$\Theta_{ij} \equiv \{t | \tilde{h}_t = i \text{ and } \Omega_t = j\}$
$P(\tilde{h}_t = 1, \Omega_t = 1) = 1/\Delta_t$
$P(\tilde{h}_t = 1, \Omega_t = j) = \exp(\alpha_0 + \alpha_2 S_t + \alpha_3 e_t)/\Delta_t$
$P(\tilde{h}_t = i, \Omega_t = 1) = \exp(\gamma_0 + \gamma_2 S_t + \gamma_3 e_t)/\Delta_t \qquad i = 1, 2$
$P(\tilde{h}_t = i, \Omega_t = j) = \exp(\alpha_{0j} + \alpha_{2j} S_t + \alpha_{3j} e_t + \alpha_{ij})/\Delta_t$
$j = i, \ldots, M$

and

$$\Delta_t = 1 + \exp(\gamma_0 + \gamma_2 S_t + \gamma_3 e_t) + \sum_{j=2}^{M} \exp(\alpha_{0j} + \alpha_{2j} S_t + \alpha_{3j} e_t)$$
$$+ \sum_{j=2}^{M} \exp(\gamma_0 + \gamma_2 S_t + \gamma_3 e_t + \alpha_{0j} + \alpha_{2j} S_t + \alpha_{3j} e_t + \gamma_{1j})$$

The estimates, presented in tables 9.4 and 9.5 do not differ appreciably from those in table 9.1. Still, home time is negatively correlated with the probability of being in professional occupations but is positively correlated with being in the more menial occupations.[22] The correlation between these home time coefficients and the atrophy rates (table 9.2) is even more strongly negative (table 9.6).

The continuous analogue to this simultaneous logit model is to specify occupation not as a polytomous variable but in terms of atrophy rates suggested by the original human capital model. Atrophy and home time as such can be hypothesized to be simultaneously related, and equations (9.20) and

TABLE 9.4.
Joint Determination of Home Time and Occupation, Simultaneous Logit Approach, $N = 482$
(Asymptotic t-Values in Parentheses)

	c	s	e	h_2
ln (Managerial/Professional)	7.566	-.589	-.119	-.707
	(3.69)	(-5.00)	(-.27)	(-1.48)
ln (Clerical/Professional)	13.613	-.851	-.739	0.695
	(10.56)	(-11.91)	(-2.63)	(4.38)
ln (Operative/Professional)	17.595	-1.260	-.691	0.222
	(10.83)	(12.26)	(-1.99)	(0.93)
ln (Unskilled/Professional)	17.862	-1.261	-1.011	1.242
	(11.50)	(-12.67)	(-3.02)	(6.15)
	c	s	e	
ln (h_2/h_1)	-5.498	.145	1.684	
	(-8.33)	(3.58)	(8.75)	
	managerial	*clerical*	*operative*	*unskilled*
	-.7072	0.695	0.222	1.242
	(-1.48)	(4.38)	(0.93)	(6.15)

$c \equiv$ constant
$s \equiv$ years schooling
$e \equiv$ years exposure to the labor force
$h_2 \equiv$ dichotomous variable (1 if h is less than mean home time; 2 if h exceeds $\bar{h}$)

TABLE 9.5.
Joint Determination of Home Time and Occupation, Simultaneous Logit Approach, $N = 482$
(Asymptotic t-Values in Parentheses)

	c	s	e	h_2^*
ln (Managerial/Professional)	5.577	-.437	-.065	-1.210
	(2.65)	(-3.58)	(-.15)	(-2.75)
ln (Clerical/Professional)	10.364	-.665	-.183	-.152
	(8.22)	(-9.53)	(-.66)	(-.98)
ln (Operative/Professional)	14.473	-1.053	-.277	-.661
	(8.89)	(-10.25)	(-.80)	(-2.99)
ln (Unskilled/Professional)	14.269	-1.083	-.331	0.639
	(9.28)	(-10.82)	(-.99)	(3.04)
	c	s	e	
ln (h_2/h_1)	-1.331	0.143	0.159	
	(-1.78)	(3.19)	(0.83)	
	managerial	*clerical*	*operative*	*unskilled*
	-1.210	-.152	-.661	0.639
	(-2.75)	(-.98)	(-2.99)	(3.04)

$c \equiv$ constant
$s \equiv$ years schooling
$e \equiv$ years exposure to labor force
$h_2^* \equiv$ dichotomous variable (1 if $h^* < \bar{h}^*$; 2 if $h^* > \bar{h}^*$)

(9.21) can be estimated by two-stage least squares. Again, the partial correlation between home time and atrophy is negative:

$$\delta_1 = .086 - .002\hat{h} + .002e + .011s - .005y \quad (9.27)$$
$$\quad (4.1) \quad (-1.7) \quad (1.6) \quad (8.4) \quad (-.8)$$

and

$$\delta_2 = 0.003 - .0005\hat{h} + .0004e - .0001s + .0006y \quad (9.28)$$
$$\quad (1.1) \quad (-2.7) \quad (2.5) \quad (-.4) \quad (0.7)$$

where the variables are defined as in equations (9.20) and (9.21) and

$$\hat{h} = -4.89 + .76e + 1.3k - .45s - .57y + .26s_h$$
$$\quad (-1.9) \quad (9.1) \quad (6.0) \quad (-2.8) \quad (-.7) \quad (2.0)$$
$$+ .001w_h + .020e_h \qquad R^2 = .45 \quad (9.29)$$
$$\quad (1.3) \quad (0.3)$$

TABLE 9.6.
Simple Correlation Between Atrophy and Home Time Coefficient

	Table 9.5	*Table 9.5*
δ_1	-.88	-.79
δ_2	-.99	-.99

where $k \equiv$ number of children, $s_h \equiv$ husband's schooling, $w_h \equiv$ husband's wage rate, and $e_h \equiv$ husband's labor market exposure.

AN APPLICATION TO OCCUPATIONAL SEGREGATION: A PROGNOSIS

Recently there has been much interest in explaining why within most societies women are by and large relegated to different occupations than men. The theoretical model outlined in this article is in part designed to shed light on this question.

It is hypothesized that, at least for females, duration of time in and out of the labor force is related to occupation. This implication stems from a model which for the first time explicitly embeds the occupational choice decision into the human capital framework. Empirically, this hypothesis is tested by measuring the effect of home time on occupational choice.

The question still pervades as to how important intermittent labor force behavior really is in explaining occupational segregation. To answer this question, male-female occupational dissimilarity can be compared before and after adjustments are made for differences in labor force intermittency.[23] In comparing the actual male and female occupational distributions and the actual male and adjusted female distributions (table 9.7), it can be seen that differences in labor force commitment alone account for much of the difference in sexual employment patterns. If women were to have a "full" commitment to the labor force, the number of women professionals would increase by 35 percent, the number of women in managerial professions

TABLE 9.7.
Occupational Distribution by Sex, Unadjusted and Adjusted by Home Time

	Observed Female	*Predicted[a] Female*	*Adjusted[b] Female*	*Predicted[c] Female*	*Adjusted[d] Female*	*Observed Male*
Professional	18.5%	19.1	23.6	19.1	25.7	23.5
Managerial	4.6	4.5	8.8	4.5	8.6	17.4
Clerical-Sales	41.3	41.1	34.2	41.2	35.1	15.0
Operative	16.4	16.1	26.0	16.1	23.9	28.0
Unskilled	19.3	19.0	7.4	19.1	6.7	16.1
	100.1	99.8	100.0	100.0	100.0	100.0

[a] Predicted from table 9.1 (top) by substituting mean variable values into the equation.
[b] Predicted from table 9.1 assuming zero years home time.
[c] Predicted from table 9.1 (bottom) by substituting mean variable values into the equation.
[d] Predicted from table 9.1 (bottom) assuming zero percent home time.

TABLE 9.8.
OLS Home Time Coefficients

	h	h^*
Professional	-.003	-.108
Managerial	-.002	-.041
Self-Employed Business	-.0008	-.012
Clerical-Sales	.0032	.123
Craft	.0005	.007
Operative	-.008	-.136
Unskilled	.009	.136
Farmer	.001	.019
Miscellaneous	.0005	.005
Correlation Coefficients Between Atrophy and Home Time Coefficients		
	h	h^*
δ_1	-.28	-.27
δ_2	-.71	-.60

would more than double, and the number of women in unskilled occupations would decrease by more than 60 percent.

While large sex differences still exist in the clerical occupations, the changes in this and other occupations are in the predicted direction. Such results illustrate that life cycle labor force participation patterns are related to career choices *even* on as aggregated a level as the five occupations chosen. Because jobs can be viewed as investment opportunities (see Rosen, 1972) with greater ease in switching between narrow opportunity differences than between broader opportunity differences, the estimates presented here of the importance of life cycle behavior are probably the lower limit.

Obviously female intermittency is not expected to decline to zero. Nor, even if it did, would an immediate change be expected in occupational patterns of all women. Instead I suspect that occupational choices would be most affected among the younger cohorts. First, educational choices would change; second, entry-level jobs would change; and finally, these changes would be perpetuated over the life cycle. Already some evidence (Mason, Czajka, and Arber, 1976) exists of women's changing sex roles predominating among the younger cohorts.

NOTES

1. In the empirical section, two measures of atrophy are used. The first concentrates solely on the direct depreciation of market skills caused by labor

force intermittency. The second augments that measure by the indirect loss of wage growth attributed to lost seniority. For a more detailed description of direct and indirect components of atrophy, see Polachek (1975b). It should be emphasized that in addition to atrophy, other occupational characteristics such as specific working conditions, task assignments, hours, or other job attributes could be included in the hedonic index. However, because this article concentrates *solely* on the importance of intermittent labor force participation on occupational choice, these other factors are ignored.

2. In the analysis presented here, I assume that each occupation can be mapped into one and only one element ($\underline{\delta}$) of the n dimensional real space (R^N). In reality occupation is a discrete variable, and an optimal value of δ need not map into any one occupation. To avoid this problem I assume optimal $\underline{\delta}$ to map into a set of job attributes whose mean can be represented by $\underline{\delta}$.

3. I assume that f in equation (9.5) is specified so that nontrivial optima exist. Also, as I shall illustrate shortly, the parameters of f (such as $\underline{\delta}_t$) can affect the human capital rental rate (W) defined in equation (9.3).

4. Equation (9.6) is only one particular form of equation (9.5). Thus it should be noted that other aspects of human capital production can vary by occupation. If such were the case, then the f function of equation (9.6) would contain δ and/or N as arguments, thereby leading to variations in the exact interpretation of δ. Because of the desire to make the model simple and because the main conclusions would be unaffected, this latter possibility is not pursued. However, in the empirical work to follow, two related definitions of δ are used.

5. Some of my current work in progress examines the more general question of life cycle occupational mobility. One interesting theorem I derive provides a rationale for the observed mobility of many workers to administrative type jobs (e.g., foreman, manager). Another application of this framework regarding geographic mobility is given in Polachek and Horvath (1977).

6. This assumption is made to simplify the mathematics. In the empirical work to follow, account is explicitly taken of possible occupational mobility.

7. Equation (9.17) implicitly considers the case of an exogenous increase in *each* period's labor force participation. Obviously, since $\partial H/\partial N_i \neq \partial H/\partial N_j$ (for $i \neq j$), the extent of occupational change depends crucially on the exact periods within the life cycle that intermittent participation occurs. Presumably, since $\partial H/\partial N_i > \partial H/\partial N$ for $i < j$, occupation will be less affected for those women with expectations of intermittency in the more distant future. Nevertheless, occupation will differ if intermittency occurs in *any* life cycle period.

8. The case for which the assumption $dS/dN \neq 0$ also yields the same results. However, the mathematics is much more cumbersome.

9. A detailed description of the data is given in the Institute for Social Science Research (1975).

10. Obviously, societal discrimination can cause certain women to drop

out of the labor force, thereby affecting their occupation. If firms are prejudiced more against women with intermittent labor force participation, then implicit measures of such discrimination can be obtained. However, for the purpose of this analysis we do *not* assume that firms discriminate unequally against women on the basis of their lifetime labor force participation. In addition we concentrate *only* on *white married* women.

11. See Theil (1969) or Nerlove and Press (1973) for a more detailed explanation of the shortcomings of OLS estimates.

12. Exposure to the labor market is included to adjust for possible remaining age-associated occupational mobility not filtered out by using broad occupational categories.

13. An alternative measure: the *percent* of time *not* in the labor force

$$\left\{h^* = \left[1 - \frac{\text{actual labor market experience}}{\text{labor market exposure}}\right]\right\}$$

is also used where indicated. The coefficient of this percentage home time variable measures the partial correlation between the logarithmic odds of being in a given occupation and *both* direct and indirect costs of intermittent labor force participation.

14. The likelihood function is

$$\left[L = \prod_{t \in \Omega_1} P_{t1} \prod_{t \in \Omega_2} P_{t2} \cdots \prod_{t \in \Omega_M} P_{tM}\right]$$

where the P's are defined in equation (9.19). The Ω_i represents each possible occupation. The program used was developed by Peter Schmidt and Robert Strauss (1975b) and is comparable, except the normalization, to techniques of Theil (1969), McFadden (1974), and Nerlove and Press (1973).

15. Again, because the sample pertains *only* to females, the home time coefficient is not measuring sex discrimination.

16. Obviously the relationship could be the reverse. That is, those persons who by chance enter occupations with a high atrophy would tend to work to a greater extent because labor force intermittency would be costly. This question of causality is explored in the next section with simultaneous equation logit models.

17. Estimates are obtained for each of the five occupations from the following equations:

(*a*) $\ln W_j = \alpha_{0j} + \alpha_{1j}S + \alpha_{2j}e + \delta_{2j}h + \epsilon_a \qquad j = 1, \ldots, 5$

(*b*) $\ln W_j = \beta_{0j} + \beta_{1j}S + \delta_{1j}h^* + \epsilon_b$

where $Y \equiv$ wage rate, $s \equiv$ years of schooling, $e \equiv$ exposure to the labor force (age minus education minus 6), and $h \equiv$ home time. Two variations are used. One in which $h \equiv$ years out of the labor force, and the other in which $h^* \equiv$ percent of time out of the labor force. The home time coefficient (δ_2) when h is measured as number of years represents a measure of net atrophy—namely the effect on earnings of being out of the labor force a greater amount of one's lifetime. (This estimate of atrophy is not pure. It includes other forms of investment, and depreciation caused by the natural aging process.) The home time coefficient (δ_1) when h^* is measured as the *percentage* of postschool years out of the labor force represents the *combined* direct and indirect wage diminution associated with seniority losses caused by intermittent labor force participation. See Polachek (1975b) for a further description of direct and indirect components of atrophy.

18. Siv Gustafsson (1977) presents corroborative evidence supporting the existence of varying atrophy rates across occupations. However, for the Swedish data she presents, women exhibit *less* intermittent labor force behavior than in the United States, and the keen differences in atrophy across occupations seems less discernable. Nevertheless, she too finds higher atrophy in the managerial professions (e.g., her occupation number 120).

19. The correlations using the OLS home time coefficients are presented in table 9.8.

20. Weighting each observation by the standard error of the dependent variable did not alter these results. It should be emphasized that disaggregation into more detailed occupational categories would strengthen these results even further.

21. Symmetry conditions imply that $\gamma_{1j} = \alpha_{1j}$. See Schmidt and Strauss (1975a) for the derivation.

22. The exact interpretation of the home time coefficients is a bit muddled because of the restriction that $\gamma_{1j} = \alpha_{1j}$ in equations (9.24) and (9.25). Therefore these coefficients do not separate the cause and effect analogously to the simultaneous equations techniques of continuous variables. I have not at this time used other techniques to measure simultaneity, such as the simultaneous probit models approach proposed by Heckman (1977a). I hope to be able to report on such estimates in future work.

23. This comparison is made by using table 9.1 to predict what the female occupational distribution would be were females not to drop out of the labor force.