Family Investments in Human Capital: Earnings of Women

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Source: *Journal of Political Economy*, Mar. - Apr., 1974, Vol. 82, No. 2, Part 2: Marriage, Family Human Capital, and Fertility (Mar. - Apr., 1974), pp. S76-S108

Published by: The University of Chicago Press

Stable URL: https://www.jstor.org/stable/1829993

# Family Investments in Human Capital: Earnings of Women

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## I. Introduction

It has long been recognized that consumption behavior represents mainly joint household or family decisions rather than separate decisions of family members. Accordingly, the observational units in consumption surveys are "consumer units," that is, households in which income is largely pooled and consumption largely shared.

More recent is the recognition that an individual's use of time, and particularly the allocation of time between market and nonmarket activities, is also best understood within the context of the family as a matter of interdependence with needs, activities, and characteristics of other family members. More generally, the family is viewed as an economic unit which shares consumption and allocates production at home and in the market as well as the investments in physical and human capital of its members. In this view, the behavior of the family unit implies a division of labor within it. Broadly speaking, this division of labor or "differentiation of roles" emerges because the attempts to promote family life are necessarily constrained by complementarity and substitution relations in the household production process and by comparative

Research here reported is part of a continuing study of the distribution of income, conducted by the National Bureau of Economic Research and funded by the National Science Foundation and the Office of Economic Opportunity. This report has not undergone the usual NBER review. We are grateful to Otis Dudley Duncan, James Heckman, Melvin Reder, T. W. Schultz, and Robert Willis for useful comments, and to George Borjas for skillful research assistance.

advantages due to differential skills and earning powers with which family members are endowed.

Though the levels and distribution of these endowments can be taken as given in the short run, this is not true in a more complete perspective. Even if each individual's endowment were genetically determined, purposive marital selection would make its distribution in the family endogenous, along the lines suggested by Becker in this volume. Of course, individual endowments are not merely genetic; they can be augmented by processes of investment in human capital and reduced by depreciation. Indeed, a major function of the family as a social institution is the building of human capital of children—a lengthy "gestation" process made even longer by growing demands of technology.

Optimal investment in human capital of any family member requires attention not only to the human and financial capacities in the family, but also to the prospective utilization of the capital which is being accumulated. Expectations of future family and market activities of individuals are, therefore, important determinants of levels and forms of investment in human capital. Thus, family investments and time allocation are linked: while the current distribution of human capital influences the current allocation of time within the family, the prospective allocation of time influences current investments in human capital.

That the differential allocation of time and of investments in human capital is generally sex linked and subject to technological and cultural changes is a matter of fact which is outside the scope of our analysis. Given the sex linkage, we focus on the relation within the family between time allocation and investments in human capital which give rise to the observed market earnings of women. Whether these earnings, or the investments underlying them, are also influenced or reinforced by discriminatory attitudes of employers and fellow workers toward women in the labor market is a question we do not explore directly, though we briefly analyze the male-female wage differential. Our major purposes are to ascertain and to estimate the effects of human-capital accumulation on market earnings and wage rates of women, to infer the magnitudes and course of such investments over the life histories of women, and to interpret these histories in the context of past expectations and of current and prospective family life.

The data we study, the 1967 National Longitudinal Survey of Work Experience (NLS), afford a heretofore unavailable opportunity to relate family and work histories of women to their current market earning power. Accumulation of human capital is a lifetime process. In the post-school stage of the life cycle much of the continued accumulation of earning power takes place on the job. Where past work experience of men can be measured without much error in numbers of years elapsed since leaving school, such a measure of "potential work experience" is clearly inadequate for members of the labor force among whom the length and continuity of work experience varies a great deal. Direct information on work histories of women is, therefore, a basic requirement for the analysis of their earnings. To our knowledge, the NLS is the only data set which provides this information, albeit on a retrospective basis. Eventually, the NLS panel surveys will provide the information on a current basis, showing developments as they unfold.[1]

## II. The Human-Capital Earnings Function

To the extent that earnings in the labor market are a function of the human-capital stock accumulated by individuals, a sequence of positive net investments gives rise to growing earning power over the life cycle. When net investment is negative, that is, when market skills are eroded by depreciation, earning power declines. This relation between the sequence of capital accumulation and the resulting growth in earnings has been formalized in the "human-capital earnings function." A simple specification of this function fits the life cycle "earnings profile" of men rather well. The approach to distribution of earnings among male workers (in the United States and elsewhere) as a distribution of individual earnings profiles appears to be promising.[2]

For the purpose of this paper, a brief development of the earnings function may suffice:

Let $C_{t-1}$ be the dollar amount of net investment in period $t - 1$, while (gross) earnings in that period, before the investment expenditures are subtracted, are $E_{t-1}$. Let $r$ be the average rate of return to the individual's human-capital investment, and assume that $r$ is the same in each period. Then

$$E_t = E_{t-1} + rC_{t-1}. \tag{1}$$

Let $k_t = C_t/E_t$, the ratio of investment expenditures to gross earnings, which may be viewed as investment in time-equivalent units. Then

$$E_t = E_{t-1}(1 + rk_{t-1}). \tag{2}$$

[1] For a description of the NLS survey of women's work histories, see Parnes, Shea, Spitz, and Zeller (1970). For an analysis of earnings of men, using "potential" work-experience measures, see Mincer (1974). Though less appropriate, the same proxy variable was used in several recent studies of female earnings. Direct information from the NLS Survey was first used by Suter and Miller (1971). The human-capital approach was first applied to these data by Polachek in his Columbia Ph.D. thesis, "Work Experience and the Difference between Male and Female Wages" (1973). This paper reports a fuller development of the analysis in that thesis.

[2] See, for instance, Rahm (1971), Chiswick and Mincer (1972), Chiswick (1973), Mincer (1974), and a series of unpublished research papers by George E. Johnson and Frank P. Stafford on earnings of Ph.D.'s in various fields.

By recursion $E_t = E_0(1 + rk_0)(1 + rk_1) \ldots (1 + rk_{t-1})$. The term $rk$ is a small fraction. Hence a logarithmic approximation of $\ln(1 + rk) \simeq rk$ yields

$$\ln E_t = \ln E_0 + r \sum_{i=0}^{t-1} k_i. \tag{3}$$

Since earnings net of investment expenditures, $Y_t = E_t(1 - k_t)$, we have also

$$\ln Y_t = \ln E_0 + r \sum_{i=0}^{t-1} k_i + \ln(1 - k_t). \tag{4}$$

Some investments are in the form of schooling; others take the form of formal and informal job training. If only these two categories of investment are analyzed, that is, schooling and postschool experience,[3] the $k$ terms can be separated, and

$$\ln E_t = \ln E_0 + r \sum_{i=0}^{s-1} k_i + r \sum_{j=s}^{t-1} k_j \tag{5}$$

where the $k_i$ are investment ratios during the schooling period and the $k_j$ thereafter. With tuition added to opportunity costs and student earnings and scholarships subtracted from them, the rough assumption $k_i = 1$ may be used.[4] Hence,

$$\ln E_t = \ln E_0 + rs + r \sum_{j=s}^{t-1} k_j. \tag{6}$$

The postschool investment ratios $k_j$ are expected to decline continuously if work experience is expected to be continuous and the purpose of investment is acquisition and maintenance of market earning power. This conclusion emerges from models of optimal distribution of investment expenditures $C_t$ over the life cycle (see Becker 1967 and Ben-Porath 1967). A sufficient rationale for our purposes is that as $t$ increases, the remaining working life $(T - t)$ shortens. Since $(T - t)$ is the length of the payoff period on investments in $t$, the incentives to invest and the magnitudes of investment decline over the (continuous) working life. This is true for $C_t$ and a fortiori for $k_t$, since with positive $C_t$, $E_t$ rises, and $k_t$ is the ratio of $C_t$ to $E_t$.

In analyses of male earnings, a linearly (or geometrically) declining approximation of the working-life profile of investment ratios $k_t$ appears to be a satisfactory statistical hypothesis.

[3] The inclusion of other categories in the earnings function is an important research need, since human capital is acquired in many other ways: in the home environment, in investments in health, by mobility, information, and so forth.

[4] According to T. W. Schultz, this assumption overstates $k$, especially at higher education levels, leading to an understatement of $r$.

It will be useful for our purpose of studying earnings of women to decompose net investments explicitly into gross investments and depreciation. Let $C_{t-1}^*$ be the dollar amount of gross investment in period $t - 1$, $\delta_{t-1}$ the depreciation rate of the stock of human capital, hence of earnings $E_{t-1}$ during that period, and $k_t^* = C_t^*/E_t$, the gross investment ratio. Hence

$$E_t = E_{t-1} + rC_{t-1}^* - \delta_{t-1}E_{t-1}$$

and

$$\frac{E_t}{E_{t-1}} = 1 + rk_{t-1}^* - \delta_{t-1} = 1 + rk_{t-1}, \quad \text{by equation (2),} \tag{1a}$$

thus

$$rk_t = rk_t^* - \delta_t. \tag{2a}$$

The earnings function (3) can, therefore, be written as

$$\ln E_t = \ln E_0 + \sum_{i=0}^{t-1} (rk_i^* - \delta_i). \tag{3a}$$

In transferring the analysis to women, we face two basic facts: (1) After marriage, women spend less than half of their lifetime in the labor market, on average. Of course, this "lifetime participation rate" varies by marital status, number of children, and other circumstances, and it has been growing secularly. (2) The lesser market work of married women is not only a matter of fewer years during a lifetime, and fewer weeks per year, or a shorter work week. An important aspect is discontinuity of work experience, for most of the married women surveyed in 1967 reported several entries into and exits from the labor force after leaving school.

The implications of these facts for the volume and the life-cycle distribution of human-capital investments can be stated briefly:[5]

1. Since job-related investment in human capital commands a return which is received at work,[6] the shorter the expected and actual duration of work experience, the weaker the incentives to augment job skills over the life cycle. With labor-force attachment of married women lasting, on average, about one-half that of men, labor-market activities of women are less likely to contain skill training and learning components as a result both of women's own decisions and decisions of employers, who may be expected to invest in worker skills to some extent.

2. Given discontinuity of work experience, the conclusion of optimization analysis to the effect that human-capital investments decline

[5] For a mathematical statement of the optimization analysis applied to discontinuous work experience, see Polachek (1973, chap. 3).

[6] For the sake of brevity, the term "work" refers to work in the job market. We do not imply that women occupied in the household do not work.

TABLE 1
LABOR-FORCE PARTICIPATION OF MOTHERS: PROPORTION WORKING, WHITE MARRIED WOMEN WITH CHILDREN, SPOUSE PRESENT

| AGE | PROPORTION WORKING (%) In 1966 | After First Child | Ever | SAMPLE SIZE |
|---|---|---|---|---|
| 30–34 | 43 | 64 | 82 | 925 |
| $S < 12$ | 46 | 71 | 75 | 294 |
| $S = 12$ | 43 | 63 | 84 | 446 |
| $S > 12$ | 40 | 59 | 88 | 185 |
| 35–39 | 47 | 67 | 87 | 945 |
| $S < 12$ | 45 | 66 | 82 | 336 |
| $S = 12$ | 49 | 68 | 88 | 422 |
| $S > 12$ | 47 | 67 | 92 | 187 |
| 40–44 | 53 | 70 | 88 | 1,078 |
| $S < 12$ | 52 | 72 | 78 | 465 |
| $S = 12$ | 54 | 70 | 91 | 446 |
| $S > 12$ | 51 | 68 | 93 | 167 |

SOURCE.—NLS, 1967 survey.
NOTE.—$S$ = years of schooling.

continuously over the successive years of life after leaving school is no longer valid. Even a continuous decline over the years spent in the job market cannot be hypothesized if several intervals of work experience rather than one stretch represent the norm.

3. The more continuous the participation, the larger the investments on initial job experience relative to those in later jobs.

Women without children and without husbands may be expected to engage in continuous job experience. But labor-force participation of married women, especially of mothers, varies over the life cycle, depending on the demands on their time in the household as well as on their skills and preferences relative to those of other family members. The average pattern of labor-force experience is apparent in tables 1–3, which are based on the NLS data reported by women who were 30–44 years of age at the time of the survey. According to the data:

1. Though less than 50 percent of the mothers worked in 1966, close to 90 percent worked sometime after they left school, and two-thirds returned to the labor market after the birth of the first child (table 1). Lifetime labor-force participation of women without children or without husbands is, of course, greater.

2. Never-married women spent 90 percent of their years after they left school in the labor market, while married women with children spent less than 50 percent of their time in it. In each age group, childless women, those with children but without husbands (widowed, divorced, or separated), and those who married more than once spent less time in the market than never-married women, but more than mothers married once, spouse present (table 2).

TABLE 2

WORK HISTORIES OF WOMEN AGED 30–44 BY MARITAL STATUS (AVERAGE NUMBER OF YEARS)

| Group | Variable | | | | | | | | | | Sample Size |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | $h_1$ | $e_1$ | $h_2$ | $e_2$ | $h_3$ | $e_3$ | $\Sigma e$ | $\Sigma h$ | $S$ | $N_c$ | |
| White, with children: | | | | | | | | | | | |
| Married once, spouse present | 0.57 | 3.55 | 6.71 | 1.14 | 1.22 | 1.69 | 6.4 | 10.4 | 11.8 | 3.16 | 2,398 |
| Remarried, spouse present . . . | 0.54 | 2.43 | 7.85 | 2.60 | 2.02 | 2.00 | 7.1 | 10.3 | 10.6 | 3.28 | 341 |
| Widowed . . . . . . . . . . . . . . . . | 1.11 | 4.25 | 9.37 | 1.51 | 1.44 | 2.56 | 8.4 | 11.9 | 12.0 | 2.44 | 45 |
| Divorced . . . . . . . . . . . . . . . . . | 0.94 | 2.96 | 6.54 | 4.24 | 2.38 | 2.92 | 10.1 | 9.8 | 10.8 | 2.98 | 133 |
| Separated . . . . . . . . . . . . . . . . | 0.74 | 3.97 | 7.81 | 2.71 | 1.14 | 2.08 | 8.7 | 9.6 | 10.1 | 2.86 | 65 |
| White, childless: | | | | | | | | | | | |
| Married once, spouse present | 1.01 | 5.18 | . . . | 4.39 | 3.35 | 4.90 | 14.5 | 3.3 | 11.7 | . . . | 147 |
| Never married . . . . . . . . . . . . | . . . | 7.08 | . . . | . . . | 1.46 | 7.48 | 14.5 | 1.5 | 12.9 | . . . | 153 |
| Black, with children: | | | | | | | | | | | |
| Married once, spouse present | 1.12 | 3.00 | 7.12 | 2.95 | 2.14 | 3.26 | 9.1 | 10.3 | 10.0 | 4.59 | 563 |
| Remarried, spouse present . . . | 0.96 | 2.44 | 7.43 | 4.93 | 2.05 | 3.36 | 10.7 | 11.7 | 9.6 | 4.22 | 170 |
| Widowed and divorced . . . . . . | 1.19 | 2.23 | 7.67 | 4.36 | 1.90 | 3.68 | 10.3 | 10.8 | 9.8 | 4.20 | 149 |
| Separated . . . . . . . . . . . . . . . . | 1.28 | 2.86 | 6.24 | 5.57 | 2.38 | 2.81 | 11.2 | 9.8 | 9.4 | 4.22 | 191 |
| Black, childless: | | | | | | | | | | | |
| Married once, spouse present | 2.33 | 4.75 | . . . | 3.83 | 4.58 | 4.77 | 13.4 | 6.9 | 10.9 | . . . | 71 |
| Never married . . . . . . . . . . . . | . . . | 7.15 | . . . | . . . | 4.74 | 6.45 | 13.6 | 4.7 | 10.9 | . . . | 47 |

NOTE.—$h_1$ = years not worked between school and first marriage; $e_1$ = years worked between school and first marriage (for never-marrieds, = years worked prior to current job); $h_2$ = interval of nonparticipation following birth of first child; $e_2$ = years worked after $h_2$ prior to current job; $h_3$ = interval of nonparticipation just prior to current job; $e_3$ = years on current job; $\Sigma e$ = years worked since school; $\Sigma h$ = years of nonparticipation since school; $S$ = years of schooling; $N_c$ = no. of children.

3. Table 3 shows the characteristic work histories of mothers,[7] spouse present (MSP), who represented over two-thirds of the women in the sample. We show chronologically the length of nonparticipation ($h_1$) during the interval between leaving school and marriage; the years of market work between school and the birth of the first child ($e_1$); an uninterrupted period of nonparticipation, $h_2$, starting just before the first child was born, followed by $e_2$ and $h_3$, which sum intermittent participation and nonparticipation, respectively; and finally $e_3$, the present job tenure of women working at the time of the survey.

It is clear from the tabulations that, after their schooling, the life cycle of married women features several stages which differ in the nature and degree of labor-market and home involvement. There is usually continuous market work prior to the birth of the first child. The second stage is a period of nonparticipation related to childbearing and child care, lasting between 5 and 10 years, followed by intermittent participation before the youngest child reaches school age. The third stage is a more permanent return to the labor force for some, though it may remain intermittent for others. In our data, which were obtained from women who were less than 45 years old, only the beginning of the third stage is visible.

The following conjectures about investment behavior in each of these stages are plausible in view of the described patterns which are to some extent anticipated by the women.

1. Prospective discontinuity may well influence many young women during their prematernal employment ($e_1$) to acquire less job training than men with comparable education, unless they do not expect to marry or have an overriding commitment to a work career.

2. During the period of childbearing and child care, prolonged nonparticipation may cause the skills acquired at school and at work to depreciate. Some revisions of expectations and of commitments may also take place.[8] Little investment, if any, can be expected during the episodic employment period $e_2$.

3. There is likely to be a stronger expectation of prospective continuity of employment after the children reach school age. To the extent that the current job ($e_3$) is more likely to represent this more-permanent return to the labor force than $e_2$ does, strong incentives to resume investments in job-related skills should reappear.

[7] The six intervals shown in table 3 are aggregated from eight available ones. Both sets are described in the Appendix.

[8] We are reminded by T. W. Schultz that erosion of market skills during periods of nonparticipation is likely to be associated with growth in nonmarket productivity. If so, the longer the time spent out of the labor force the greater the excess of the reservation or "shadow" price over the market wage, hence the smaller the probability of subsequent labor-force participation.

TABLE 3

WORK HISTORIES OF MARRIED WOMEN BY AGE, EDUCATION, AND CURRENT WORK STATUS

| Age and Category | Variable $h_1$ | $e_1$ | $h_2$ | $e_2$ | $h_3$ | $e_3$ | $\Sigma e$ | $\Sigma h$ | $N_c$ | Sample Size |
|---|---|---|---|---|---|---|---|---|---|---|
| 30–34: | | | | | | | | | | |
| Worked in 1966: | | | | | | | | | | |
| $S < 12$ | 1.93 | 2.37 | 5.80 | 3.18 | 2.20 | 1.90 | 7.45 | 9.93 | 3.42 | 135 |
| $S = 12–15$ | 0.90 | 2.84 | 5.41 | 2.21 | 1.39 | 2.31 | 7.36 | 7.70 | 2.89 | 233 |
| $S \geq 16$ | 0.37 | 2.57 | 2.65 | 2.22 | 1.22 | 2.00 | 6.79 | 4.24 | 2.39 | 35 |
| Did not work in 1966, but worked since birth of first child: | | | | | | | | | | |
| $S < 12$ | 1.67 | 2.23 | 6.29 | 1.31 | 5.09 | ... | 3.54 | 13.05 | 3.50 | 68 |
| $S = 12–15$ | 0.81 | 2.90 | 4.65 | 1.23 | 4.75 | ... | 4.13 | 10.21 | 3.49 | 93 |
| $S \geq 16$ | 0.50 | 1.85 | 3.57 | 1.71 | 3.57 | ... | 3.56 | 7.64 | 3.00 | 14 |
| Has not worked since birth of first child: | | | | | | | | | | |
| $S < 12$ | 4.54 | 1.42 | 9.64 | ... | ... | ... | 1.42 | 14.18 | 3.24 | 85 |
| $S = 12–15$ | 2.28 | 3.21 | 7.93 | ... | ... | ... | 3.21 | 10.21 | 3.03 | 211 |
| $S \geq 16$ | 1.95 | 1.11 | 7.20 | ... | ... | ... | 1.11 | 9.15 | 3.14 | 34 |
| 35–39: | | | | | | | | | | |
| Worked in 1966: | | | | | | | | | | |
| $S < 12$ | 1.94 | 2.78 | 7.98 | 3.47 | 2.78 | 3.40 | 9.65 | 12.70 | 3.37 | 152 |
| $S = 12–15$ | 0.98 | 3.42 | 6.85 | 3.09 | 2.01 | 3.70 | 10.21 | 9.84 | 2.99 | 250 |
| $S \geq 16$ | 1.01 | 2.95 | 4.72 | 2.04 | 1.25 | 5.46 | 10.45 | 6.98 | 2.72 | 43 |
| Did not work in 1966, but worked since birth of first child: | | | | | | | | | | |
| $S < 12$ | 2.15 | 2.96 | 9.00 | 1.80 | 6.40 | ... | 4.76 | 17.55 | 3.70 | 65 |
| $S = 12–15$ | 1.20 | 3.74 | 7.42 | 1.18 | 5.94 | ... | 4.92 | 14.56 | 3.51 | 101 |
| $S \geq 16$ | 0.38 | 5.75 | 6.50 | 1.15 | 2.62 | ... | 6.90 | 9.50 | 2.87 | 8 |
| Has not worked since birth of first child: | | | | | | | | | | |
| $S < 12$ | 4.23 | 3.54 | 13.53 | ... | ... | ... | 3.54 | 17.76 | 3.58 | 113 |
| $S = 12–15$ | 2.97 | 3.85 | 11.62 | ... | ... | ... | 3.85 | 14.59 | 3.16 | 170 |
| $S \geq 16$ | 1.88 | 2.65 | 10.15 | ... | ... | ... | 2.65 | 12.03 | 3.50 | 26 |

TABLE 3 (*Continued*)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 40–44: | | | | | | | | | | |
| Worked in 1966: | | | | | | | | | | |
| $S < 12$ | 2.41 | 3.29 | 10.38 | 3.94 | 2.95 | 4.93 | 12.16 | 15.74 | 3.18 | 240 |
| $S = 12–15$ | 1.55 | 4.16 | 8.74 | 3.57 | 2.63 | 4.43 | 12.16 | 12.92 | 2.72 | 297 |
| $S \geq 16$ | 0.93 | 3.20 | 6.89 | 3.06 | 1.86 | 4.89 | 11.15 | 9.68 | 3.65 | 29 |
| Did not work in 1966, but worked since birth of first child: | | | | | | | | | | |
| $S < 12$ | 2.35 | 3.31 | 12.95 | 1.51 | 6.89 | ... | 4.82 | 22.19 | 3.41 | 89 |
| $S = 12–15$ | 1.39 | 3.68 | 10.43 | 1.24 | 8.23 | ... | 4.92 | 20.05 | 3.36 | 82 |
| $S \geq 16$ | 3.19 | 1.19 | 9.80 | 1.34 | 4.80 | ... | 2.53 | 17.79 | 3.59 | 5 |
| Has not worked since birth of first child: | | | | | | | | | | |
| $S < 12$ | 6.23 | 2.63 | 17.66 | ... | ... | ... | 2.63 | 23.89 | 3.93 | 130 |
| $S = 12–15$ | 3.36 | 4.88 | 15.12 | ... | ... | ... | 4.88 | 18.48 | 3.12 | 141 |
| $S \geq 16$ | 3.03 | 2.67 | 13.35 | ... | ... | ... | 2.67 | 16.38 | 2.96 | 31 |

NOTE.—See notes to table 2 for explanation of variables.

These conjectures imply that the investment profile of married women is not monotonic. There is a gap which is likely to show negative values (net depreciation) during the childbearing period and two peaks before and after. The levels of these peaks are likely to be correlated for the same woman, and their comparative size is likely to depend on the degree of continuity of work experience. The whole profile can be visualized in comparison with the investment profiles of men and of single women. For never-married women, stage 1 ($e_1$) extends over their whole working life, and the investment profile declines as it does for men. To the extent, however, that expectation of marriage and of childbearing are stronger at younger ages and diminish with age, investment of never-married women is likely to be initially lower than that of men. At the same time, given lesser expectations of marriage on the part of the never-married, their initial on-the-job investments exceed those of the women who eventually marry, while the profile of the latter shows two peaks.

The implications for comparative-earnings profiles are clear: Greater investment ratios imply a steeper growth of earnings, while declining investment profiles imply concavity of earnings profiles. Hence, earnings profiles of men are steepest and concave, those of childless women less so, and those of mothers are double peaked with least overall growth.

## III. Women's Wage Equation

To adapt the earnings function to persons with intermittent work experience we break up the postschool investment term in equation (6) into successive segments of participation and nonparticipation as they occur chronologically. In the general case with $n$ segments we may express the investment ratio $k_i = a_i + b_i t$, $i = 1, 2, \ldots, n$, and

$$\ln E_t = \ln E_0 + rs + r \sum_{i=1}^{n} \int_{ti}^{t_{i+1}} (a_i + b_i t)\, dt. \tag{7}$$

Here $a_i$ is the initial investment ratio, $b_i$ is the rate of change of the investment ratio during the $i$th segment: $(t_{i+1} - t_i) = e_i =$ duration of the $i$th segment. Note that in (7) the initial investment ratio refers to its projected value at $t_1 = 0$, the start of working life. In a work interval $m$ which occurs in later life there is likely to be less investment than in an earlier interval $j$, though more than would be observed if $j$ continued at its gradient through the years covered by $m$. In this case, $a_m$ in equation (7) will exceed $a_j$.

Alternatively, $a_j$ and $a_m$ can be compared directly in the formulation

$$\ln E_t = \ln E_0 + rs + r \sum_{i=1}^{n} \int_{0}^{e_i} (a_i + b_i t)\, dt, \tag{8}$$

since $a_i$ is the investment ratio at the beginning of the particular segment $i$.

While the rate of change in investment $b_i$ is likely to be negative in longer intervals, it may not be significant in shorter ones. Since the segments we observe in the histories of women before age 45 are relatively short, a simplified scheme is to assume a constant rate of net investment throughout a given segment, though differing among segments. The earnings function simplifies to

$$\ln E_t = \ln E_0 + rs + r \sum_i a_i e_i. \tag{9}$$

Whereas $(ra_i) > 0$ denotes positive net investment (ratios), $(ra_i) < 0$ represents net depreciation rates, likely in periods of nonparticipation.

The question whether the annual investment or depreciation rates vary with the length of the interval is ultimately an empirical one. Even if each woman were to invest diminishing amounts over a segment of work experience, those women who stay longer in the labor market are likely to invest more per unit of time, so that $a_i$ is likely to be a positive function of the length of the interval in the cross section.

Thus, even if $k_{ij} = a_{ij} - b_{ij}t$ for a given woman $j$, if $a_{ij} = \alpha_j + \beta_j t$ across women, on substitution, the coefficient $b$ of $t$ may become negligible or even positive in the cross section. On integrating, and using three segments of working life as an example, earnings functions (7), (8), and (9) become:

$$\begin{aligned}\ln E_t = a_0 + rs + r[a_1 t_1 + \tfrac{1}{2}b_1 t_1^2 + a_2(t_2 - t_1) \\ + \tfrac{1}{2}b_2(t_2^2 - t_1^2) + a_3(t - t_2) + \tfrac{1}{2}b_3(t^2 - t_2^2)],\end{aligned} \tag{7a}$$

$$\begin{aligned}\ln E_t = a_0 + rs + r(a_1 e_1 + \tfrac{1}{2}b_1 e_1^2 + a_2 e_2 \\ + \tfrac{1}{2}b_2 e_2^2 + a_3 e_3 + \tfrac{1}{2}b_3 e_3^2),\end{aligned} \tag{8a}$$

$$\ln E_t = a_0 + rs + r(a_1 e_1 + a_2 e_2 + a_3 e_3). \tag{9a}$$

In this example, $t$ is within the last (third) segment, and the middle segment, $e_2 = h$, is a period of nonparticipation or "home time." The signs of $b_i$ are ambiguous in the cross section, as already indicated; the coefficients of $e_1$ and of $e_3$ are expected to be positive, but those of $e_2$ (or $h$) negative, most clearly in (9a).

The equations for observed earnings ($\ln Y_t$) differ from the equations shown above by a term $\ln(1 - k_t)$—as was shown in the comparison of equations (3) and (4). With $k_t$ relatively small, only the intercept $a_0$ is affected, so the same form holds for $\ln Y_t$ as for $\ln E_t$.

It will help our understanding of the estimates of depreciation rates to express earnings function (9a) in terms of gross-investment rates and depreciation rates:

$$\begin{aligned}\ln E_t &= \ln E_0 + \sum_i (rk_i^* - \delta_i) \\ &= \ln E_0 + (rs - \delta_s) + (rk_1^* - \delta_1)e_1 \\ &\quad + (rk_h^* - \delta_h)h + (rk_3^* - \delta_3)e_3.\end{aligned} \tag{9b}$$

This formulation suggests that depreciation of earning power may occur not only in periods of nonparticipation ($h$), but at other times as well. On the other hand, market-oriented investment, such as informal study and job search, may take place during home time, so that $k_h^* > 0$. Positive coefficients of $e_1$ and $e_3$ would reflect positive net investment, while a negative coefficient of $h$ is an estimate of net depreciation. If $k_h^* > 0$, the absolute value of the depreciation rate $\delta_h$ is underestimated.

## IV. Empirical Findings

Tables 4–8 show results of regression analyses which apply our earnings function to analyze wage rates of women who worked in 1966, the year preceding the survey. The general specification is $\ln w = f(S, e, h, x) + u$, where $w$ is the hourly wage rate; $S$ is the years of schooling; $e$ is a vector of work-experience segments; $h$ is a vector of home-time segments and $x$ is a vector of other variables, such as indexes of job training, mobility, health, number of children, and current weeks and hours of work; $u$ is the statistical residual.

The findings described here are based on ordinary least-squares (OLS) regressions. The tables show shorter and longer lists of variables without covering all the intermediate lists. In view of a plausible simultaneity problem we attempted also a two-stage least-squares (2SLS) estimation procedure, which we describe in the next section. Since the 2SLS estimates do not appear to contradict the findings based on OLS, we describe them first below.

### 1. *Work History Detail and Equation Form*

When life histories are segmented into five intervals (eight is the maximum possible in the data), three of which are periods of work experience and two of nonmarket activity,[9] both nonlinear formulations (equation forms [7] and [8]) are less informative than the linear specification (9). Rates of change in investment (coefficient $b$) are probably not substantial within a short interval, and the intercorrelation of the linear and quadratic terms hinders the estimation. Dropping the square terms reduces the explanatory power of the regression slightly but increases the visibility of the life-cycle investment profile. Conversely, when the segments are aggregated, the quadratic term becomes negative but does not quite acquire statistical significance by conventional standards. The quadratic term for current work experience is negative and significant. In the case

[9] Tables 2 and 3 show six intervals, including a very short nonparticipation interval $h_1$ between school and marriage. This interval is aggregated in other home time in the regressions.

of never-married women, one segment of work experience usually covers most of the potential working life. Here the nonlinear formulation over the interval is as natural and informative as it is for men.

## 2. *Investment Rates*

Table 4 compares earnings functions of women by marital status and presence of children, tables 5 and 6 by level of schooling, and table 7 by lifetime work experience. In each table we can compare groups of women with differential labor-force attachment. According to human-capital theory, higher investment levels should be observed in groups with stronger labor-force attachment.

We can infer these differences in investment by looking at the coefficients of experience segments, $e_1$ (prematernal), $e_2$ (intermittent, after the first child), and $e_3$ (current). These increase systematically from married women with children to married women without children to single women in table 4, and from women who worked less than half to those who worked more than half of their lifetime in table 7. An exception is the coefficient of $e_3$ which appears to be somewhat higher for the group who worked less (see table 7). Note, however, that these coefficients are investment ratios (to gross wage rates), not dollar volumes. Since wage rates are higher in the groups with more work experience, the conclusions about increasing investment hold for dollar magnitudes, a fortiori, and the anomaly in table 7 disappears.[10]

Classifications by schooling show mixed results. In table 5, where schooling is stratified by $<12$, 12–15, and 16+, investment ratios (coefficients of $e_i$) are lower at higher levels of schooling (with the exception of the coefficient of $e_1$). Translated into dollar terms,[11] no clear pattern emerges. At the same time in table 6, where the schooling strata are $\leq 8$, 9–12, and 13+, a positive relation between investment volumes and levels of schooling is somewhat better indicated. Note that the sample size for the highest-schooling groups (10+) is quite small in table 5, as is that for the lowest-schooling groups ($\leq 8$) in table 6.

## 3. *Investment Profiles*

Another implication of the human-capital theory refers to the shape of the investment profile: it is monotonically declining in groups with continuous participation, hence earnings are parabolic in aggregated

[10] The coefficient of $e_3$, calculated as $\partial \ln W/\partial e$, is 15 percent higher in the right-hand group. However, the wage rate of this group is about 25 percent lower.

[11] Wage rates are roughly 30 percent higher in successive schooling groups.

TABLE 4
EARNINGS FUNCTIONS, WHITE WOMEN

| With Children | | | | | | | | | No Children | | Never Married | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Var. | b (1) | t | Var. | b (2) | t | Var. | b (3) | t | b (4) | t | b (5) | t |
| $C$ | .38 | | $C$ | .21 | ... | $C$ | .09 | ... | −.42 | ... | .55 | ... |
| $S$ | .076 | 11.5 | $S$ | .063 | 10.5 | $S$ | .064 | 12.0 | .081 | 4.4 | .077 | 4.9 |
| $(A\text{-}S\text{-}6)$ | .014 | 3.8 | $e$ | .012 | 1.6 | $e_1$ | .008 | 2.8 | .014 | 1.6 | .026* | 1.5 |
| $(A\text{-}S\text{-}6)^2$ | −.001 | −4.2 | $e^2$ | −.0002 | −0.5 | $e_2$ | .001 | 0.3 | .011 | 1.3 | −.0007† | −1.1 |
| | | | $e_3$ | .021 | 2.8 | $e_3$ | .012 | 2.7 | .015 | 2.2 | .009 | 1.5 |
| $R^2$ | .16 | ... | $e_3^2$ | −.0008 | −1.9 | $h_1$ | −.012 | −2.5 | −.005‡ | −1.5 | −.009‡ | −0.6 |
| | | | $h$ | −.007 | −1.5 | $h_2$ | −.003 | −0.7 | .002§ | 0.7 | ... | ... |
| | | | $h^2$ | .000 | 0.2 | $etr$ | .0002 | 1.5 | .0003 | 2.4 | .0003 | 1.7 |
| | | | | | | $ect$ | .010 | 3.2 | −.003 | −1.2 | −.011 | −1.8 |
| | | | $R^2$ | .25 | ... | $hlt$ | −.0003 | −1.3 | −.002 | −1.3 | −.0008 | −1.2 |
| | | | | | | $res$ | .001 | 1.2 | .006 | 1.7 | −.012 | −2.2 |
| | | | | | | $loc$ | .044 | 2.7 | −.021 | −0.4 | −.02 | −0.3 |
| | | | | | | ln $Hr$ | −.11 | −3.7 | −.15 | −1.6 | −.43 | −4.4 |
| | | | | | | ln $Wk$ | .03 | 1.6 | .25 | 2.2 | .21 | 1.4 |
| | | | | | | $N_c$ | −.008 | −1.0 | ... | ... | ... | ... |
| | | | | | | $R^2$ | .28 | ... | .39 | ... | .41 | ... |
| | | | | | | $N$ | 993 | ... | 147 | ... | 138 | ... |

NOTE.—Var. = variable; $C$ = intercept; $S$ = years of schooling; $A$ = age; $e$ = total years of work; $e_1$ = years of work before first child; $e_2$ = years of work after first child; $e_3$ = current job tenure; $h$ = total home time; $h_1$ = home time after first child; $h_2$ = other home time; $etr$ = experience × training (months); $ect$ = experience × certificate (dummy); $hlt$ = duration of illness (months); $res$ = years of residence in county; $loc$ = size of place of residence at age 15; ln $Hrs$ = (log of) hours of work per week on current job; ln $Wks$ = (log of weeks per year on current job; $N_c$ = no. of children; $b$ = regression coefficient; $t$ = $t$-ratio; $R^2$ = coefficient of determination; $N$ = sample size.

* Total work experience, $e$.

† $e^2$.

‡ Total home time, $h$.

§ $h^2$.

TABLE 5
EARNINGS FUNCTIONS OF WMSP, BY SCHOOLING

| VAR. | S < 12 | | | | S = 12–15 | | | | S = 16+ | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | b | t | b | t | b | t | b | t | b | t | b | t |
| $C$ | −.095 | ... | −.98 | ... | −.61 | ... | −.03 | ... | .86 | ... | .36 | ... |
| $S$ | .046 | 4.7 | .039 | 3.8 | .105 | 5.1 | .086 | 4.0 | .038 | 0.4 | .107 | 1.1 |
| $e_1$ | .016 | 3.1 | .015 | 2.2 | .012 | 1.7 | .008 | 1.3 | .023 | 1.5 | .010 | 0.5 |
| $e_2$ | .014 | 2.8 | .012 | 1.8 | .006 | 1.2 | 0 | 0 | −.013 | −2.3 | −.016 | −3.0 |
| $e_3$ | .021 | 4.7 | .019 | 3.2 | .015 | 3.7 | .011 | 1.9 | .002 | 1.6 | .004 | 2.4 |
| $h_1$ | −.002 | −0.6 | .001 | 0.2 | −.013 | −3.4 | −.018 | −2.8 | −.023 | −2.2 | −.012 | −1.7 |
| $h_2$ | .002 | 0.5 | .003 | 0.5 | −.001 | −0.2 | −.006 | −1.0 | .006 | 0.4 | .002 | 1.0 |
| *etr* | ... | ... | .0004 | 1.2 | ... | ... | .0004 | 2.0 | ... | ... | .0007 | 0.5 |
| *ect* | ... | ... | .016 | 2.4 | ... | ... | .008 | 1.9 | ... | ... | .032 | 2.1 |
| *hlt* | ... | ... | −.0006 | −1.7 | ... | ... | 0 | 0 | ... | ... | 0 | 0 |
| *res* | ... | ... | .001 | 0.5 | ... | ... | .002 | 1.3 | ... | ... | .008 | 1.2 |
| *loc* | ... | ... | .06 | 2.4 | ... | ... | .036 | 1.6 | ... | ... | .05 | 0.8 |
| ln *Hrs* | ... | ... | −.044 | −0.9 | ... | ... | −.11 | −3.9 | ... | ... | −.16 | −3.4 |
| ln *Wks* | ... | ... | .045 | 1.5 | ... | ... | .031 | 1.2 | ... | ... | .05 | 0.7 |
| $N_c$ | ... | ... | −.004 | −0.4 | ... | ... | −.002 | −0.2 | ... | ... | −.05 | −1.5 |
| $R^2$ | .17 | ... | .22 | ... | .14 | ... | .18 | ... | .16 | ... | .39 | ... |
| $N$ | 435 | ... | ... | ... | 622 | ... | ... | ... | 83 | ... | ... | ... |

NOTE.—WMSP = white married women, spouse present. See table 4 for key to symbols.

TABLE 6
EARNINGS FUNCTIONS OF WMSP (WITH CHILDREN), BY SCHOOLING

| VAR. | $S \leq 8$ | | | | $S$ = 9–12 | | | | $S$ = 13+ | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *b* | *t* | *b* | *t* | *b* | *t* | *b* | *t* | *b* | *t* | *b* | *t* |
| $S$ | .049 | 1.6 | .044 | 1.3 | .051 | 3.2 | .055 | 3.4 | .068 | 2.8 | .079 | 2.7 |
| $e_1$ | .007 | 0.4 | −.002 | −0.4 | .013 | 1.7 | .012 | 1.5 | .021 | 1.4 | .018 | 1.2 |
| $e_2$ | −.004 | −2.1 | −.028 | −1.8 | .009 | 1.6 | .003 | 0.6 | −.020 | −1.5 | −.020 | −1.4 |
| $e_3$ | −.002 | −0.3 | −.008 | −0.5 | .013 | 0.7 | .009 | 0.5 | .009 | 2.0 | .011 | 2.2 |
| $h_1$ | −.011 | −1.5 | −.007 | −1.2 | −.014 | −1.8 | −.010 | −1.6 | −.043 | −3.1 | −.031 | −2.8 |
| $h_2$ | −.006 | −0.4 | −.003 | −0.2 | −.002 | −0.4 | −.002 | −0.4 | −.005 | −0.4 | −.004 | −0.3 |
| $hlt$ | ... | ... | −.0007 | −0.7 | ... | ... | −.0011 | −2.3 | ... | ... | −.009 | −0.6 |
| ln $Hrs$ | ... | ... | −.050 | −0.7 | ... | ... | −.090 | −1.8 | ... | ... | −.130 | −1.1 |
| ln $Wks$ | ... | ... | −.070 | −0.6 | ... | ... | .060 | 1.6 | ... | ... | .090 | 1.2 |
| $N_c$ | ... | ... | −.008 | −0.2 | ... | ... | −.019 | −0.4 | ... | ... | −.010 | −2.0 |
| $R^2$ | .26 | ... | .32 | ... | .21 | ... | .26 | ... | .27 | ... | .33 | ... |
| $N$ | 182 | ... | ... | ... | 593 | ... | ... | ... | 218 | ... | ... | ... |

NOTE.—WMSP = white married women, spouse present. See table 4 for key to symbols.

TABLE 7
EARNINGS FUNCTIONS OF WMSP BY LIFETIME WORK EXPERIENCE

| Var. | Worked More than Half of Years | | | Worked Less than Half of Years | | |
|---|---|---|---|---|---|---|
| | *b* | *t* | *M* | *b* | *t* | *M* |
| $C$ | −.28 | ... | ... | −.10 | ... | ... |
| $S$ | .073 | 9.4 | 11.8 | .059 | 7.9 | 11.0 |
| $e_1$ | .009 | 2.1 | 4.9 | .003 | 0.4 | 2.2 |
| $e_2$ | .006 | 1.4 | 5.6 | −.005 | −0.6 | 1.5 |
| $e_3$ | .017 | 2.0 | 4.9 | .022 | 3.8 | 1.6 |
| $e_3^2$ | −.0002 | −0.7 | ... | −.001 | −1.5 | ... |
| $h_1$ | −.014 | −2.3 | 2.2 | −.010 | −2.6 | 10.7 |
| $h_2$ | .011 | 1.7 | 2.1 | −.004 | −0.9 | 4.7 |
| $hlt$ | −.0008 | −2.1 | 10.8 | −.0001 | −0.3 | 13.7 |
| $res$ | .002 | 1.1 | 12.1 | .002 | 1.0 | 11.8 |
| $loc$ | .064 | 2.8 | 0.97 | .024 | 1.0 | 0.90 |
| ln $Hrs$ | −.08 | −2.0 | 3.52 | −.13 | −4.4 | 3.40 |
| ln $Wks$ | .07 | 1.9 | 3.71 | .023 | 1.0 | 3.29 |
| $N_c$ | −.015 | −1.4 | 2.21 | −.001 | −0.2 | 3.18 |
| $R^2$ | .22 | ... | ... | .21 | ... | ... |
| $N$ | 536 | ... | ... | 604 | ... | ... |

NOTE.—WMSP = white married women, spouse present. See table 4 for key to symbols.

experience for men and never-married women.[12] In the groups with discontinuous participation, the profiles are not expected to be monotonic.

We can summarize the implicit profiles schematically, in terms of the coefficients of $e_1$, length of work experience before the first child, $h_1$, uninterrupted nonparticipation after the first child, and $e_3$, the current work interval. We find (table 4, col. 3) that white married women with children (with spouse present) have current investment (ratio which exceeds the investment (ratio) incurred in experience before the first child.[13] Presumably, current participation in the labor force, which takes place when most of the children have reached school age, is expected to last longer than the previous periods of work experience. This is certainly true of women over age 35, and it holds in regressions with or without standardization for age.

Looking at regressions within three education levels (tables 5–6), we find that coefficient of prematernal experience ($e_1$) exceeds the coefficient of current work experience ($e_3$) at the highest level of schooling (in the short equations, though not in the long ones), and the opposite is true at lower levels. For women without children the coefficient of prematernal work experience equals that of current work experience. The investment profile of never-married women has a downward slope. Comparable

[12] In the earnings regressions, the quadratic term of aggregated experience is often negative, but not significant statistically.

[13] All statements about differences in coefficients refer to point estimates. The differences are mentioned because they are suggestive, though they would not pass strict tests of statistical significance within a given equation.

early segments of their post school job experience contain higher investment ratios—indeed, the fit implies a linear decline of such ratios over the life cycle. Evidently, women who intend to spend more time in the labor force invest more initially. This is true, presumably, even if their plans are later changed following marriage and childbearing.

### 4. *Depreciation Rates*

The coefficient of home time is negative, indicating a net depreciation of earning power. During the home-time interval ($h_1$), associated with marriage or the birth of the first child, this net depreciation amounts to, on average, 1.5 percent per year. In table 5 the depreciation rate is small ($-0.2$ percent) and insignificant for women with less than high school education, larger ($-1.3$ percent) for those with 12–15 years of schooling, and largest ($-2.3$ percent) for those with 16+ years of schooling. In table 6, the net depreciation rate is $-1.1$ percent for women with elementary schooling or less, $-1.4$ percent for women with some high school, and $-4.3$ percent for women with at least some college. Sampling differences probably account for the different estimates in the two tables. The depreciation rate also appears higher in the group who worked more than half the years (table 7).

It would seem that the depreciation rate is higher when the accumulated stock of human capital is larger. An exception appears in the comparison of women without children (married and single) with women with children. The former have a lower depreciation rate. Of course, these women spend much less time out of market work, and some of this time might be job-oriented (e.g., job search).

It is useful to return to the formulation (9b) of the earnings function for a closer analysis of the depreciation rates: $\ln E_t = \ln E_0 + (rs - \delta_s) + (rk_1^* - \delta_1)e_1 + (rk_h^* - \delta_h)h + (rk_3^* - \delta_3)e_3$. Our coefficient of home time measures the depreciation rate only if market-oriented investment $k_h^*$ is negligible. This is likely to be true for the period of child caring, the period defined as $h_1$ in the regression ($h_2$ in the tabulations).

An interesting question is whether the depreciation rate ($\delta_h$) during nonparticipation is different from the depreciation that occurs at work as well. The question is whether depreciation due to nonuse of the human capital stock (atrophy?) exceeds the depreciation due to use (strain?) or to aging (?). We are inclined to believe that depreciation through nonuse ("getting rusty") is by far more important, particularly in groups of the relatively young (below age 45). Moreover, the atrophy aspect suggest that depreciation due to nonparticipation is strongest for the market-oriented components of human capital acquired on the job, and weakest for the inborn, initial, or general components of the human-capital stock. If so, a fixed rate of "home-time depreciation" applicable to on-the-job accumulation of human capital would appear as a varying rate in the earnings function: given the volume of other human capital, the larger the on-the-job accumulated component of human capital, the higher the observed (applied to the total earning power) depreciation rate.[14]

This may be an explanation of the observed higher depreciation rates at higher schooling and experience levels of mothers. In particular, there is a positive relation between the coefficients of $h_1$ (in absolute value) and of $e_1$ across schooling groups (table 6), experience groups (table 7), and race groups (compare tables 4 and 8).

## 5. *Effect of Family Size*

Do family size and number of children currently present affect the accumulation of earning power beyond the effect on work experience? The answer is largely negative: when numbers of children and some measures of their age are added to work histories in the equations, the children variables are negative but usually not significant statistically. Their inclusion reduces the absolute values of the coefficients of experience and of home time and does not add perceptibly to the explanatory power of the regression. Note, however, that the children variable does approach significance in the relatively small groups of highly educated women (tables 5–6), and more generally among women with stronger labor-force attachment (table 7). Possibly, shorter hours or lesser intensity of work are, to some extent, the preferred alternatives to job discontinuity.

## 6. *Formal Postschool Training*

The coefficients of experience, $a_i$, represent estimates of $rk_i$, where $k_i$ is the average investment ratio across women over the segment and $r$ is the average rate of return. Individual variation in $k_i$ is not available to us. We have some individual information, however, on months of formal job training received after completion of schooling as well as on possession of professional certificates by, among others, registered nurses, teachers, and beauticians. If the length of training and possession of a certificate are positive indexes of $k$, we may represent $a_i = a_0 + \beta \cdot tr$, where $tr$ is the length of training. The term $a \cdot e$ in that equation becomes

$$(a_0 + \beta tr) \cdot e = a_0 \cdot e + \beta(tr \cdot e).$$

Thus, an interaction term $(tr \cdot e)$ can be added to the equation, and if the hypothesis is correct, the coefficient $\beta$ should be positive. This is indeed

[14] Where $\delta$ is the observed depreciation rate, $\delta_j$ the rate applicable to job-accumulated capital $H_j$, and $H_0$ the volume of other human capital, $\delta = (\delta_j H_j)/(H_j + H_0) = \delta_j/[1 + (H_o/H_j)]$. With a fixed rate $\delta_j$ for all individuals, the larger $H_j$ the larger $\delta$.

the case in most of our equations, confirming the training interpretation of the experience coefficients in the earnings function. Both interactions with months of job training and with possession of a certificate are significant for married women. The training interaction variable is also positive in the earnings function of single women, but the certificate variable is negative. Whereas the negative coefficient of the certification-experience variable implies less than average investment behavior among persons who work continuously, the corresponding positive coefficient for intermittent workers implies more than average investment behavior.

### 7. *Effects of Mobility*

Research in mobility has shown that, so long as mobility is not involuntary—resulting from layoffs—it is associated with a gain in earnings. However, geographic labor mobility of married women is often exogenous, due to job changes of the husband. In that case, it may militate against continuity of experience and slow the accumulation of earning power. We used the information on the length of current residence in a county or a Standard Metropolitan Statistical Area (SMSA) as an inverse measure of mobility. This variable has a small positive effect on wage rates of white MSP women and a significant negative effect for single women. To the extent that mobility is job oriented for single women and exogenous for married women, the differential signs provide a consistent interpretation.

### 8. *Hours and Weeks in Current Job*

When (logs of) weeks and hours worked in the survey year are included in the regression, a negative sign appears for the weekly-hours coefficient and a positive but less significant one for the weeks-worked coefficient. The hours' coefficients are smaller for married women than for single women and smaller for white than for black women. The negative sign of weekly hours may be partly or wholly spurious since some pay periods indicated by respondents were weeks or months and the hourly wage rate was obtained by division through hours. Of course, the direction of causality is suspect: it is more likely that women with lower wage rates work longer hours than the converse. Deletion of the variables, however, has a minimal effect on the equations.

### 9. *Other Variables*

Three other variables were included in the equations:

1. Twenty percent of the married women who worked in 1966 dropped out of work in 1967. We used a dummy variable with value 1 if persons

TABLE 8
EARNINGS FUNCTIONS OF BLACK WOMEN

| MSP WITH CHILDREN Var. | $b$ | $t$ | NEVER MARRIED Var. | $b$ | $t$ |
|---|---|---|---|---|---|
| $C$ | −.02 | ... | $C$ | −.48 | ... |
| $S$ | .095 | 11.2 | $S$ | .110 | 3.7 |
| $e_1$ | .005 | 0.8 | $e$ | .004 | 0.1 |
| $e_2$ | .001 | 0.3 | $e^2$ | −.0003 | −0.2 |
| $e_3$ | .006 | 1.4 | $e_3$ | .001 | 0.2 |
| $h_1$ | −.006 | −1.2 | $h$ | −.02 | −.05 |
| $h_2$ | −.005 | −0.9 | $h^2$ | .001 | 1.1 |
| *etr* | .0005 | 1.3 | *etr* | .0006 | 1.4 |
| *ect* | .008 | 1.9 | *ect* | .003 | 0.4 |
| *hlt* | −.0002 | −0.5 | *hlt* | −.001 | −1.8 |
| *res* | .002 | 0.9 | *res* | .001 | 0.2 |
| *loc* | .11 | 4.0 | *loc* | .23 | 2.7 |
| ln *Hrs* | −.30 | −7.4 | ln *Hrs* | −.13 | −0.7 |
| ln *Wks* | .08 | 2.2 | ln *Wks* | .03 | 0.2 |
| $N_c$ | .005 | 0.6 | $N_c$ | ... | ... |
| $R^2$ | .39 | ... | $R^2$ | .46 | ... |
| $N$ | 550 | ... | $N$ | 70 | ... |

NOTE.—MSP = white married women, spouse present. See table 4 for key to symbols.

working in 1966 stopped working in 1967, and 0 otherwise.[15] This variable had a negative sign, since it indicated a shorter current job experience compared with the prospective work interval of others who continued to work in 1967—the completed interval of those dropping out was not longer than the interval of stayers. In effect, women who dropped out of the labor force in 1967 had wage rates about 5 percent lower than women who continued working, given the same characteristics and histories.[16] The proportion of dropouts is somewhat larger at lower education levels.

2. The size of community in which the respondent lived at age 15 had a positive effect on earning power of married women but no effect on that of single women.

3. Duration of current health problem in months was used as a measure of health levels. It is an imperfect measure for retrospective purposes and shows a very small negative effect on the wage rate.

## 10. *Black Women*

The regressions for black MSP (table 8) show experience coefficients about half the size of the corresponding white population. Home time or depreciation coefficients are not significant; neither are the children

[15] Not shown in the tables.

[16] Without standardization, women who had dropped out had wage rates about 10 percent lower than women who continued working.

variables. The implication is that there is less investment on the job, even though black women spent more time than white women in the labor market. They had more and younger children, on average. The other variables behave comparably with those in the white regressions except that hours of current work and location at age 15 show stronger effects. In contrast to white women, the size of community of residence at age 15 has a positive effect for never-married women as well. Again, the experience coefficients are smaller for black single women than for whites. Perhaps contrary to expectations, neither health problems nor rates of withdrawal from the labor force in 1966 differ for black as compared to white married women with children, spouse present. Rates of return to schooling appear, if anything, to be higher for black women.

## V. Lifetime Participation and the Simultaneity Problem

The earnings function, as we estimate it, relates wages of women to investments in schooling and on-the-job training and to a number of additional variables already discussed.

The interpretation of some of the independent variables as factors affecting earning power may be challenged on the grounds that they may just as well be viewed as effects rather than causes of earning power. Presumably, women with greater earning power have stronger job aspirations and work commitments than other women throughout their lifetimes. Hence, what we interpret as an earnings function may well be read with causality running in the opposite direction—as a labor-supply function. This argument is most telling for concurrent variables, such as last year's hours and weeks worked in relation to last year's wage rate. But these variables are of only marginal importance in the wage equation of married women. All other independent variables temporally precede the dependent variable (current wage rate), which makes the earnings function interpretation less vulnerable, though not entirely so for there is a serial correlation between current and past work experience and current and past earning power. Since lifetime work experience depends, in part, on prior wage levels and expectations, our experience variables are, in part, *determined* as well as *determining*. If so, the residual in our wage equations is correlated with the experience variables, and the estimates of coefficients which we interpreted as investment ratios are biased.

How serious this problem is for our analysis depends on the strength of individual correlations between current and past levels and expectations of earning power and on the strength of effect of these prior levels on subsequent work histories of individuals. Of course, when the data are grouped these correlations and effects are likely to be strong. Better-educated women tend to have higher wage rates than less educated women throughout their working lives, (see, for instance, Fuchs 1967) and as our table 3 shows, they spend a larger fraction of their lives in the labor force. Table 3 also shows that married mothers who currently do not work, spent, on average, less of their lifetime working than those who currently work.

One econometric approach to an estimation of the earnings function in the presence of endogeneity of "independent" variables is the two-stage least-squares (2SLS) approach. We estimate work experience as a variable dependent on exogenous variables, some of which are in the earnings function and others outside of it. In effect, we estimate a "lifetime labor-supply function." The second step is to replace the work-experience variables ($e$) in the earnings function by the estimated work experience($\hat{e}$) from the labor-supply function. Parameter estimates in this revised earnings function are theoretically superior to the original, simple least-squares estimates.[17]

Our application of a 2SLS procedure is far from thorough, for two reasons:

1. It is difficult to implement it on the segmented function, since each of the segments would have to be estimated by exogenous variables. For this purpose we aggregate years of work experience and compare the reestimated earnings function with the original, using aggregated experience.

2. One of the variables in our lifetime labor-supply function is the number of children, which is not exogenous. In principle, we should expand the equation system to three to include the earnings function, the labor-supply function, and the fertility function. At this exploratory level we prefer not to do it, particularly since the fertility function would be estimated by the same variables as the labor-supply function.

The supply function obtained for all white MSP women was

$$\frac{e}{e_p} = \underset{}{.514} + \underset{(5.1)}{.020\, S_F} - \underset{(1.8)}{.0064\, S_M} - \underset{(12.0)}{.062\, N_c},$$

where $e$ is total years of work, $e_p$ is "potential job experience," that is, years since school, $S_F$ is education of wife, $S_M$ is education of husband, and $N_c$ is number of children. The addition of earnings of husband reduced the coefficient of $S_M$ to insignificance without changing the coefficient of determination, which was $R^2 = .14$.

Estimated values of the numerator ($\hat{e}$) are used to reestimate the earnings function. A comparison of 2SLS and OLS estimates of the earnings function is shown in table 9. If anything, the reestimated function shows larger positive coefficients for (total) experience and stronger negative coefficients for home time. The children variable becomes even less significant (in terms of $t$-values) than before. The reestimation leaves our conclusions, based on the OLS regressions, largely intact.

[17] Since $\hat{e}$ is a function of exogenous variables, it is not correlated with the stochastic term in the reestimated earnings function.

TABLE 9
EARNINGS FUNCTION, WMSP WOMEN, OLS AND 2SLS

| | OLS | | 2SLS | | OLS | | 2SLS | |
|---|---|---|---|---|---|---|---|---|
| VAR. | *b* | *t* | *b* | *t* | *b* | *t* | *b* | *t* |
| *C* | −.20 | ... | −.06 | ... | .19 | ... | .26 | ... |
| *S* | .069 | 12.8 | .063 | 12.0 | .053 | 9.4 | .048 | 8.5 |
| *e* | .010 | 3.2 | .012 | 2.7 | .008 | 2.8 | .010 | 1.9 |
| $h_1$ | −.008 | −3.0 | −.015 | −7.7 | −.007 | −1.9 | −.013 | −5.5 |
| $h_2$ | .0006 | 0.2 | −.006 | −2.3 | .001 | 0.5 | −.006 | −1.9 |
| $e_3$ | .009 | 3.2 | .009 | 3.5 | .009 | 3.4 | .010 | 3.7 |
| *tr* | ... | ... | ... | ... | .005 | 2.2 | .006 | 2.2 |
| *cert* | ... | ... | ... | ... | .18 | 5.1 | .18 | 5.1 |
| *hlt* | ... | ... | ... | ... | −.0003 | −1.3 | −.0003 | −1.4 |
| *res* | ... | ... | ... | ... | .001 | 1.3 | .021 | 1.4 |
| *loc* | ... | ... | ... | ... | .044 | 2.8 | .042 | 2.5 |
| ln *Hrs* | ... | ... | ... | ... | −.11 | −5.0 | −.11 | −4.9 |
| ln *Wks* | ... | ... | ... | ... | .03 | 1.5 | .03 | 1.6 |
| $N_c$ | ... | ... | ... | ... | −.010 | −1.3 | .003 | 0.3 |

NOTE.—WMSP = white married women, spouse present; *tr* = months of training; *cert* = certification (dummy); see table 4 for key to other symbols.

## VI. Prediction

A test of the predictive power of the earnings function was performed on a small sample of women who did not work in 1966 but were found in the same first NLS survey to have returned to work in 1967. They were not included in our analyses, but their life histories and 1967 wage rates are available. The latter were predicted with several variants of the earnings function and compared to the reported wage rates. On average, the prediction is quite close, and the mean-square error is even smaller—relative to the variance of the observed wage rates—than the residual variance in the regressions.[18] In other words, the predictive power outside the data utilized for the regressions is no smaller than within the regressions. The test, however, is weak, because the sample is so small (45 observations). Similar tests will be performed on larger samples of women who return to the labor market in subsequent surveys.

## VII. Earnings Inequality and the Explanatory Power of Earnings Functions

As table 10 indicates, the earnings function is capable of explaining 25–30 percent of the relative (logarithmic) dispersion in wage rates of white married women and about 40 percent of the inequality in the rather small sample of wage rates of single women in the 30–44 age group who worked in 1966. The earnings function is thus no less useful in understanding the structure of women's wages than it is in the analysis of wages of males.

[18] The (squared) correlation between predicted and actual wage rates was .37. The mean of actual rates was 5.196, with $\sigma = .335$; the mean of predicted wages was 5.187, with $\sigma = .204$.

TABLE 10
EARNINGS INEQUALITY AND EXPLANATORY POWER OF WAGE FUNCTIONS, 1966

| Group | $\sigma^2$ (ln $W$) | $R^2_W$ | $\sigma^2$ (ln $Y$) | $R^2_Y$ | $\sigma^2$ (ln $H$) | $N$ |
|---|---|---|---|---|---|---|
| Married women by education (yrs): | | | | | | |
| < 12 | .17 | .21 | .81 | .76 | .64 | 435 |
| 12–15 | .18 | .17 | .92 | .78 | .74 | 622 |
| +16 | .17 | .16 | .77 | .74 | .60 | 83 |
| Total | .22 | .28 | .97 | .78 | .75 | 1,140 |
| Single women | .30 | .41 | .62 | .66 | .32 | 138 |
| Married men | .32 | .30 | .43 | .50 | .11 | 3,230 |

NOTE.—$\sigma^2$ (ln $W$) = variance of (log) wages; $\sigma^2$ (ln $Y$) = variance of (log) annual earnings; $\sigma^2$ (ln $H$) = variance of (log) annual hours of work; $R^2_W$ = coefficient of determination in wage rate function; $R^2_Y$ = coefficient of determination in annual earnings function.

The dispersion of hours worked during the survey year is much greater among married women, $\sigma^2$ (ln $H$) = .75, than among men, $\sigma^2$ (ln $H$) = .11. The (relative) dispersion in annual earnings of women is, therefore, dominated by the dispersion of hours worked. This factor is also important in the inequality of annual earnings of single women and of men of comparable ages, but much less so. It is not surprising, therefore, that the inclusion of hours worked in the earnings function raises the coefficient of determination from 28 percent in the hourly-wage equation to 78 percent in the annual-earnings equation of married women, from 41 percent to 66 percent for that of single women, and from 32 to 50 percent for that of men.

The lesser inequality in the wage-rate structure of working married women than in the structure of male wages is probably due to lesser average, and correspondingly lesser variation in, job investments among individuals. At the same time, the huge variation in hours, reflecting intermittency and part-time work as forms of labor-supply adjustments, creates an annual earnings inequality among women which exceeds that of men. However, the meaning of that inequality, both in a causal and in a welfare sense, must be seen in the family context. As was shown elsewhere (Mincer 1974), the inclusion of female earnings as a component of family income narrows the relative inequality of family incomes compared with that of incomes of male family-earners.

## VIII. Some Applications

### 1. *The Wage Gap*

To compare wage rates of women with wage rates of men, we analyzed earnings of men from the Survey of Economic Opportunity (SEO) for the same year (1966). We find that the average wage rate of white married men, aged 30–44, was \$3.18, compared with \$2.09 for white married women and \$2.73 for white single women in our NLS data.

TABLE 11
EXPERIENCE AND DEPRECIATION COEFFICIENTS, 1966, AGES 30–44

| VAR. | MARRIED WOMEN | | SINGLE WOMEN | | MARRIED MEN | |
|---|---|---|---|---|---|---|
| | $b$ | $M$ | $b$ | $M$ | $b$ | $M$ |
| $S$ | .063 | 11.3 | .077 | 12.5 | .071 | 11.6 |
| $\hat{e}$ | .012 | 9.6 | ... | ... | ... | ... |
| $e$ | ... | ... | .026 | 15.6 | .034 | 19.4 |
| $e^2$ | ... | ... | −.0006 | 258 | −.0006 | 409 |
| $e_3$ | .009 | 3.2 | .009 | 8.0 | ... | ... |
| $h_c$ | −.015 | 6.7 | ... | ... | ... | ... |
| $h_0$ | −.006 | 3.5 | ... | ... | ... | ... |

SOURCES.—Women: NLS, 1967; men: SEO, 1967.
NOTE.—$S$ = years of schooling; $h_c$ = home time following birth of first child; $h_0$ = other home time; $e$ = years of work experience since completion of schooling; $e_3$ = current job tenure; $\hat{e}$ = 2SLS estimate of total work experience; $b$ = regression coefficient; $M$ = means.

TABLE 12
EFFECTS OF WORK EXPERIENCE ON WAGE RATES

| | RELATIVE CONTRIBUTIONS OF | | PERCENT OF WAGE GAP EXPLAINED | |
|---|---|---|---|---|
| | Actual Experience (1) | Men's Experience (2) | (3) | (4) |
| Married women | +.02 | +.26 | 45 | 42 |
| Single women | +.32 | +.33 | 7 | 40 |
| Married men | +.42 | ... | ... | ... |

We inquired to what extent the larger wage ratio (152 percent) of married men to married women and the smaller one (116 percent) of married men to single women can be explained by differences in work histories and by differences in job investment and depreciation. For this purpose we estimated a single earnings function of men, aged 30–44, in SEO. The coefficients and means of the variables for these men are shown in table 11, which also gives the NLS estimates for both married and single women.

Note that married men and married working women have just about the same average schooling, while never-married women are somewhat better educated (by 1 year, on average). The coefficients of schooling are somewhat lower for married women but higher for single women. The big differences are in years of work experience since completion of schooling. These are 19.4 for men, 15.6 for single women, and 9.6 for married women. The coefficients of initial experience are .034 for men, .026 for single women, and about half as much for married women.

Multiplying the coefficients by the variables (table 11) and summing yields contributions of postschool investments to the (log of) wage rates as shown in table 12. These differences, roughly 40 percent between husbands and wives and 10 percent between married men and single women, are about 70 percent of the observed difference in wage rates between married men and married women and a half of the difference between married men and single women.

If one prefers to be agnostic about the human-capital approach, one can treat the earnings function simply as a statistical relation and the regression coefficients as average "effects" of work experience and of nonparticipation on wages, without reading magnitudes of investment or depreciation into them. In that case we may ask how much the sex differential in wage rates would narrow if work experience of women were as long as that of men, but the female coefficients remained as they are. A multiplication of the female coefficients by the male variables in table 11 yields the following answers: for married women, 45 percent of the gap would be erased; for single women, only 7 percent of the much smaller gap (table 12, col. 3). The answer is similar for married women if the converse procedure is used, that is when the work experience of women is multiplied by the male coefficients (table 12, col. 4). For single women, the reduction of the gap is larger than in the first procedure.

We believe, however, that the weight of the empirical analysis of female earnings supports the view that the association of lower coefficients with lesser work experience is not fortuitous: a smaller fraction of time and energy is devoted to job advancement (training, learning, getting ahead) per unit of time by persons whose work attachment is lower. Hence, the 45 percent figure in the explanation of the gap by duration-of-work experience alone may be viewed as an understatment.

Indeed, comparing the annual earnings of year-round working women and men in the 30–40 age groups, Suter and Miller found a female-to-male earnings ratio of 46.7 percent. However, the ratio rose to 74 percent for women in this group who worked all their adult lives. The same comparison for high school educated persons yielded 40.5 as against 74.9 percent. Thus lifelong work experience reduces the wage gap by 51 or 58 percent, respectively.[19]

At this stage of research we cannot conclude that the remaining (unexplained) part of the wage gap is attributable to discrimination, nor, for that matter, that the "explained" part is not affected by discrimination. More precisely, we should distinguish between the concepts of direct and indirect effects of discrimination. Direct market discrimination occurs when different rental prices (wage rates) are paid by employers for the same unit of human capital owned by different persons (groups). In this sense, the wage-gap residual is an upper limit of the direct effects of market discrimination. Indirect effects occur in that the existence of

[19] Suter and Miller (1971, table 1). Their figures are not quite comparable with ours: their male data come from the Current Population Survey (CPS), and ours from SEO. They compare full-time earnings rather than wage rates, and they compare men and women without regard to marital status.

market discrimination discourages the degree of market orientation in the expected allocation of time and diminishes incentives to investment in market-oriented human capital. Hence, the lesser job investments and greater depreciation of female market earning power may to some extent be affected by expectations of discrimination.

Of course, if division of labor in the family is equated with discrimination, all of the gap is by definition a symptom of discrimination. Otherwise, the analyses of existing wage gaps and of their changes over time remain meaningful, not tautological.

Our data on work histories show some interesting trends which suggest a prospective narrowing of the wage differential. Table 3 shows that the uninterrupted period of nonparticipation which starts just prior to the birth of the first child has been shrinking when older women are compared with younger ones. Women aged 40–44 who had their first child in the late 1940s stayed out of the labor force about 5 years longer than women aged 30–34 whose first child was born in the late 1950s. Family size is about the same for both groups, but higher for the middle group (35–39) whose fertility marked the peak of the baby boom. Still, the home-time interval in that group is shorter (by about 2 years) than in the older group and longer than in the younger. Thus, the trend in labor-force participation of young mothers was persistent. If, by the time the 30–34-year-old women get to be 40–44 (i.e., in 1977), they will have had 4 years of work experience more than the older cohort, and their wage rates will rise by 6 percent on account of lesser depreciation and by another 2–4 percent due to longer work experience. Thus, the total observed wage gap between men and women aged 40–44 should narrow by about one-fifth, while the gap due to work experience should be reduced by one-quarter.[20]

## 2. *The Price of Time and the Opportunity Costs of Children*

The loss or reduction of market earnings of mothers due to demands on their time in child rearing represents a measure of family investment in the human capital of their children. This investment cost has been measured by valuing the reduction of market time at the observed wage rate. As pointed out by Michael and Lazear (1971), this valuation is incomplete for two reasons. First, if job investments take place at work, the observed wage rate understates the true foregone wage (gross or capacity wage) by the amount usually invested during the period when

[20] Two opposing biases mar this conjecture: The shorter home-time interval for younger women is an average duration for those who already returned to work. It will lengthen with the passage of time as additional women return to the labor force. It can be shown, however, that the apparent trend is genuine. At the same time, the assumption of unchanged job-investment behavior leads to an understatement.

earnings are foregone. Second, as is clear from earnings-function analysis, the reduction of market time in turn reduces future wage rates because of a depreciation in earning power during the period of nonparticipation. The present value of future earnings lost through depreciation is a component of the opportunity cost of time, hence of children.[21]

The data and the estimated wage functions permit a tentative, perhaps only an illustrative, empirical assessment of the opportunity cost of women's time and of children. Specifically, the marginal opportunity cost per hour of a year spent at home—rather than in the market—consists of (1) the gross wage rate ($W_g$), that is the observed but foregone wage ($W$) augmented by currently foregone investment costs, and (2) the present value of the reduction of the future gross wage through current depreciation:[22]

1. We can estimate $W_g$ since $W = W_g(1 - k)$, and $rk$ is estimated in the earnings function by $a_1$, the coefficient of work experience ($e_1$) preceding the interruption $k = a_1/r$, where $r$ is the rate of return.

2. The present value of the reduction in $W_g$ due to depreciation, using $r$ as the discount rate, is $d/r \cdot W_g$, where $d$ is the (depreciation) coefficient of home time in our wage equations.[23]

The estimates of marginal opportunity costs of a year (in dollars per hour) are shown in panel I of table 13 for three education groups of white mothers, aged 35–39. In panel II we calculate total opportunity expenditures incurred during the nonparticipation period following the birth of the first child. This is the period for which the earnings functions show significant depreciation coefficients. The length of the period depends, in part, on the number of children. Though interpreting all of the foregone earnings this period as an opportunity expenditure on children may be an overstatement, we impose an opposite bias by ignoring subsequent periods of non participation[24] which may also be child induced. Figures in panel II are the marginal costs per hour (per year) multiplied by $h$, the duration of home time. Figures in panel III are average opportunity expenditures per child ($N_c$) in each group. Since $h$ is in years, the dollar figures in panels II and III should be multiplied by annual hours of work. For example, with 1,500 hours of work per year, the opportunity investment expenditures per child range from about \$8,000 spent in 8.8 years by mothers with less than high school education to \$17,000 spent in 5.2 years by mothers with college education or more.

[21] As Robert Willis suggested to us, this is strictly correct for the excess of depreciation during home time over the depreciation at other times. As we stated earlier, we believe that the latter is negligible in our age groups.

[22] Note that we are looking at household productivity as the return, the purpose of reducing market work, not as a negative element in costs.

[23] A 10 percent discount rate was used in these calculations.

[24] Inclusion would lead to a 20–25 percent increase in expenditures for the age group.

TABLE 13

MARGINAL PRICE OF TIME AND OPPORTUNITY COSTS OF CHILDREN, 1966, WORKING WHITE MOTHERS (AGED 35–39)—BY YEARS OF SCHOOLING ($)

| | Price of Time per Hour | | | Total Opportunity Expenditures on Children | | | Opportunity Expenditures per Child | | |
|---|---|---|---|---|---|---|---|---|---|
| | < 12 | 12–15 (I) | 16+ | < 12 | 12–15 (II) | 16+ | < 12 | 12–15 (III) | 16+ |
| 1. Observed wage | 1.66 | 2.25 | 3.54 | 14.60 | 16.33 | 18.51 | 4.23 | 5.52 | 6.60 |
| 2. Capacity wage | 1.96 | 2.59 | 4.60 | 17.25 | 18.87 | 24.05 | 5.00 | 6.41 | 8.57 |
| 3. Depreciation | 0.05 | 0.30 | 1.40 | 0.44 | 2.18 | 7.32 | 0.13 | 0.73 | 2.63 |
| Sum (2 + 3) | 2.01 | 2.89 | 6.00 | 17.69 | 21.05 | 31.37 | 5.13 | 7.14 | 11.20 |
| Assuming 1,500 hr work per year | ... | ... | ... | ... | ... | ... | 7,740 | 10,710 | 16,800 |
| $h_c$ | ... | ... | ... | 8.80 | 7.26 | 5.23 | ... | ... | ... |
| $N_c$ | ... | ... | ... | 3.45 | 2.96 | 2.81 | ... | ... | ... |
| $h_c/N_c$ | ... | ... | ... | 2.55 | 2.45 | 1.86 | ... | ... | ... |

NOTE.—$h_c$ = duration of home time; $N_c$ = no. of children.

Only panel I represents the marginal price of time. Note that the observed wage rate[25] represents 80 percent of the marginal price of an hour below college levels and only 60 percent at higher levels. The same proportions hold in the other two panels. However, figures in these panels are not prices but expenditures which depend on both the price of time and the number of children and the average home-time interval per child. Both of these variables can be viewed as responses to the marginal price of time. As the table indicates, observed wage rates and, even more so, marginal prices of time (panel I) increase with education. Lesser fertility and closer spacing of children are the responses:[26] both numbers of children and interval of home time per child diminish. Consequently, the differences in total expenditures by education level are reduced. While the marginal price of time of the highest education group is three times as high as that of the lowest, the expenditures per child are a little over twice as high, and total expenditures are only 70 percent higher.

Since the opportunity costs of labor-force withdrawal ("home time") are not quite the same thing as the opportunity costs of children, we again caution the reader to view the estimates of table 13 as largely illustrative. They clearly illustrate the point which the title of this paper intends to convey: foregone market-oriented human capital of mothers is a part of the price of acquiring human capital in children, and more generally, a price exacted by family life. Of course, the greater market specialization, longer hours, and greater intensity of work and of job training on the part of husbands and fathers can be viewed as a "price exacted by family life" in exactly the same sense.

Implicitly, families balance such prices against perceptions of received benefits.[27] Of course, both perceptions of net benefits and prices change. While perceptions are matters of individual psychology and of cultural climate, the marginal opportunity cost of time has risen secularly with the rise in real wages and with the growth of human capital. It is natural for economists to connect to this basic fact both upward trends in labor-force participation of women and downward trends in fertility,[28] changes in the family, and even some of the rhetoric which accompanies these developments.

[25] In principle, wage rates just before the period *h* are required. The wage at ages 35–39 represents, on average, a small overstatement: wage profiles of married women with children are relatively flat in the age span 25–39 within education groups.

[26] Direct evidence on closer spacing at higher levels of education is shown in research for a Columbia Ph.D. dissertation by Sue Ross (1973). In the NLS data, there is a strong correlation between the length of home time and the birth interval from oldest to youngest child.

[27] Some of these benefits are analyzed in the papers of Lee Benham and Arleen Leibowitz in this volume.

[28] For economic analyses which bear on the upward secular trends in labor-force participation of married women, see Mincer (1962) and Cain (1966). For analyses bearing on fertility trends, see "New Economic Approaches to Fertility," *J.P.E.*, vol. 81, no. 2, suppl. (March/April 1973).

## Appendix

### Note on the Construction of Work-Experience Intervals

The 1967 NLS survey of women aged 30–44 permits a division of time elapsed since leaving school into, at most, eight intervals. The following information was used in constructing these intervals: (*a*) Dates were available for school leaving ($S$), first marriage ($M$), birth of first child ($C$), start of first job, return to labor force after birth of first child, start of current job, and end of last job, if currently not working. (*b*) Number of years during which the woman worked at least 6 months between: (1) school leaving and first marriage, (2) marriage and birth of first child, (3) return to labor force after the first child, and (4) the start of current job.

On this basis, we describe the intervals in the order of their chronological placement: interval $h_1$ (on average, half a year) is the interval between school and first job; $e_1$ is the number of years of work between school and marriage. The placement and continuity of this interval checks rather closely with the data, though direct statements are absent; $e_2$ is years worked (similarly defined) between first marriage and birth of first child; $h_2$ is the residual home time, given information on the length of interval between first marriage and birth of first child. The assumption of continuity and order of placement of $e_2$ and $h_2$ are somewhat arbitrary. They are justified by evidence of frequent identity of job $e_1$ and $e_2$ and the plausibility of $h_2$ starting during pregnancy. Indeed, $h_2$ is a fraction of a year, on average; $h_3$ is the uninterrupted interval of home time following the birth of the first child. It is placed by direct information; $e_3$ is years of work and $h_4$ the residual amount of time in the interval between returning to the labor force at the end of $h_3$ and start of current job. However, neither $e_3$ nor $h_4$ needs to be continuous. The succession of $h_4$ after $e_3$ is more plausible than the converse. Also $(e_3 + h_4)$ is, on average, about 3 years altogether; $e_4$ is clearly defined and placed as the current job interval.

In tables 2 and 3 we aggregate $(e_1 + e_2)$ and call it $e_1$, $(h_2 + h_3)$ is $h_2$, and the other intervals are correspondingly renamed.

In the regressions we added $h_1$ to $h_3$ to get $h_2$ other home time. Separately, or together, these intervals are quite short and show little effect in our analysis.