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Family Background and Lifetime Earnings

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I. INTRODUCTION

Family background, as measured by variables such as education of parents, income of parents, and family size, is generally believed to be an important direct or indirect determinant of lifetime economic capacity and earnings of individuals. In the case where background is a direct determinant of earnings, family variables can be thought of as measures of marketable human capital which exists apart from that represented by education and training on-the-job. This view has relatively weak empirical support to date and the major issues are now: Which parental

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background variables represent forces that are important in determining a child's ability to develop later economic capacities? Are these variables measures of environmental or genetic factors? How does background influence the paths of lifetime training and earning as well as their levels?

In this paper, we advance the hypothesis that many of these background variables which have been used reflect, to a large extent, environmental forces, and that these environmental forces are in fact quite well measured, as a first approximation, by time inputs to the children particularly prior to grade school and particularly by the mother. We also argue that background factors influence ability to learn economic skills and that a particular pattern of life-cycle earnings is implied. Namely, persons from backgrounds where there is a greater input to child care will have greater attainment of education and training, and hence will have earnings which, over the life cycle, diverge from the earnings of those in whose backgrounds less emphasis has been placed on child care.

Belief in the importance of environmental influences or, more generally, experience, on the development of economic capacities of individuals has a long as well as distinguished history. If we consider capacities which require learning one must include in a history John Locke's well-known *Essay Concerning Human Understanding* (1689). Locke argued, in an unequivocal fashion, for the importance of experience in individual learning.[1] Locke's theme was certainly acceptable to later writers such as David Hume and Adam Smith. It is (or should be) well-known that Smith believed that "the difference . . . between a philosopher and a common street porter, for example, seems to arise not so much from nature as from habit, custom, and education."[2] In fact, Smith ascribed such importance to environmental influences that he attributed the great beauty he perceived in London prostitutes to their diet of potatoes![3]

The experience theme emphasized by Smith is still very much a part of thought in research on lifetime earning capacity by economists who utilize the human capital framework. To date the forms of experience which have received most emphasis in the human capital literature are those relating to formal schooling and on-the-job training. More recently, there has been increased research on the influence of parental preschool investments in children on the child's subsequent educational attainment and earnings. While ability to acquire economic skills is often discussed in the human capital literature, until recently very little effort has gone toward distinguishing whether an acquired or inherited ability is being discussed.

A more extensive literature exists in sociology and psychology with respect to the influence of parental characteristics and child-rearing

practices on child development. This literature contains a running debate about the relative importance of innate abilities versus acquired abilities and motivation. While a comprehensive review of this literature is not possible within the scope of this paper, we can comment on some of the most well-known work. This will provide some basis for comparison of our approach and findings with those in other disciplines, as well as with those of other economists.

What we plan to do is, first, to review a general framework for interpreting the influence of background on lifetime earnings (Section II). The basic model relies on multiple forms of human capital: inherited ability, early human capital produced by investments of time and money by the parents directed to the child's ability to learn, and later on, marketable human capital which is used by the child from the point in time when he is making his own decisions about training and labor market participation. The reason for introducing several forms of human capital and particularly early human capital rests on the empirical fact noted earlier that the most important parental influences on the adult earnings of their children have been consistently shown to be indirect rather than direct. That is, parental inputs (often measured only by father's education or occupation) appear to be related to such measures of later human capital as educational attainment but are typically found not to have a major direct impact on adult earnings. This evidence is reviewed in Section III. In terms of the psychological literature, the debate on the relative importance of environmentally versus genetically determined abilities cannot be resolved simply by noting that parental variables in some way affect ability to learn, which, in turn, affects adult skills and earning capacity. What is needed is a classification of background influences into those that can be considered genetic and those that can be considered environmental. Further, which early environmental variables are most important in determining ability to learn?

We do not have some ideal data set (such as a large lifetime panel of relevant variables for monozygotic twins raised under widely varying conditions) but plan to demonstrate the potential influence of home inputs of parental time by using data from a recent panel study conducted for the Office of Economic Opportunity (OEO) by the Survey Research Center (SRC) of the University of Michigan (Section IV). This survey provides information on housework time, and through regression analysis, we infer the amounts of husband's and wife's time in child care for preschool children across various socioeconomic groups. We then relate these different levels of child care time to what is known about educational attainment and lifetime earnings of adults with parents in the different socioeconomic groups.

II. A GENERAL APPROACH TO LIFETIME INVESTMENT IN SKILLS

A. A Life-Cycle Model with Home Inputs Exogenous

To begin our discussion, we can specify a model of lifetime skill acquisition beginning with the individual's inherited or genetic endowment and going through two time periods. During the first time period, the individual's parents or other adults invest in his ability to learn. In this stage the individual is not making explicit decisions about his own "career" but, rather, is having these decisions made for him. In our discussion, we will first treat these investments as simply given. This is partly because complete specification of the process would be very difficult even if there were clear evidence on the factors influencing childhood development as it pertains to acquisition of economically productive learning capacities. More importantly, we choose not to address ourselves to the problem here, since a proper specification would also imply specification of a model of inter-generational transfers of money and time. Given the current rather limited knowledge of parental behavior in providing time and money to young children, a large number of fairly general models could be proposed, and hence, it seems prudent to postpone such a project to a later date. As will become apparent, even our less ambitious approach rests on many easily contended elements.[4]

To illustrate our approach we start by defining three types of human capital and four time points which define two time intervals.

K_0 = initial inherited endowment of ability;

K_1 = early human capital from home investments;

K_2 = later or "marketable" human capital;

and

T_0 = initial time period (birth);

T_1 = point in time ending the home investment process (given);

T_2 = point in time beginning the self-investment or training process and market earnings (given) $T_2 \leqq T_1$;

T_3 = end of the training and market earning period.

During the home interval ($T_0 \leqq T < T_1$), a stock of skills relating to the ability to learn (K_1) is built up by parental investments of time (h) and market inputs (M). In a more general specification, time paths of these variables as well as the end of the home interval (T_1) could be made

endogenous. We shall discuss some of the economic forces which determine h, M, and T_1 in part B. To simplify the discussion, we shall treat T_1 as given, and, during the home period, the stock of early human capital is accumulated by the following equation of motion:

(A1) $\dot{K}_1 = Q_1 = Q_1(K_0, h_1, h_2, M, K_1; t) \qquad T_0 \leqq t < T_1$

h_1 = home time on child by wife;

h_2 = home time on child by husband; and

t = a time index to portray age of child or time-dependent developmental process.

The presence of the fixed factor, K_0, generates rising marginal costs of producing increments to early human capital per unit time. Here we ignore possible depreciation. Note also that, in general, positive output should not require a positive level of K_1. At time T_2 and beyond, the individual makes his own decisions about training time, consumption time and (labor) market time. The financial assets available for consumption (and market inputs to investment) can be defined by $R(T_2)$ or in the form of an interest rate. Individuals from high-income backgrounds have more financial assets available for consumption and out-of-pocket costs of training, or they can be viewed as having the opportunity to borrow at a lower interest rate.[5]

During the later period marketable capital is produced with own time (s), market inputs (D) and human capital of all three types.

(A2) $Q_2 = Q_2(K_0, K_1, K_2, s, D; t)$

The equation of motion for capital is:

(A3) $\dot{K}_2 = Q_2 - \delta K_2$

The production function, $Q_2(\cdot)$, has the fixed factors K_0 and K_2 which assures rising marginal costs, and in general, positive output need not require a positive level of K_2. A unit budget of own time is divided between training (s) and labor supply ($l = 1 - s$) in models where the objective function is simply maximum present value of lifetime earnings. In a somewhat more general approach, maximization of a utility function with arguments of leisure time and market expenditures can be developed.[6] Still more ambitiously, one can specify leisure time, market expenditures on own consumption, and child care (produced by time and market expenditures on children) as arguments of the objective function. Specification of this third possibility would provide a partial representation of an inter-generational model; a model which we shall forgo at this point, since we are treating parental decisions in a limited context.

Let us consider the case where the objective function is the integral of utility over the later period. Given levels of R, K_0 and K_1 at T_2 the preference function to be optimized by the individual is[7]

$$\text{(A4)} \quad J = \int_{T_2}^{T_3} U(c, X)\, dt$$

subject to the equations of motion for financial assets and human capital which are

$$\text{(A5)} \quad \dot{R} = (1-c-s)\alpha K_2 - pX + rR$$

$$\text{(A6)} \quad \dot{K}_2 = Q_2(s, K_2; K_0, K_1, D, t) - \delta K_2$$

and the condition that $R \geqq 0$ at $t = T_3$. The definitions of new variables and parameters are:

c = leisure time;

X = market goods (physical quantities);

p = price of market goods;

α = rental value of a unit of K_2; and

r = interest rate.

The Hamiltonian for this control problem is

$$\text{(A7)} \quad H = U(\cdot) + \lambda_{K_2}[Q_2(\cdot) - \delta K_2] + \lambda_R[(1-s-c)\alpha K_2 - pX + rR]$$

For the individual, an optimal path of the control variables ($\hat{X}$. $\hat{s}$, $\hat{c}$, and, by our budget identity, $1-\hat{s}-\hat{c} = \hat{I}$) should be chosen to maximize the performance index given an inherited ability level, K_0, and home human capital, K_1. If the parents have as an argument in their utility the welfare of their children, then in choosing a level of home training they will "look at" the incremental value of the optimized performance index for each of their N children in determining their decision to increase the amount of home inputs. That is, they consider

$$\text{(A8)} \quad \Delta J^* = J^*(K_1^2) - J^*(K_1^1)$$

where

K_1^1 = some given level of home training;

K_1^2 = some higher level of home training; and

$J^*(\cdot)$ = the value of the performance index as optimized by the offspring for given levels of K_1.

Thus, a person's lifetime welfare is partly produced by his parents through home training, and usual arguments about consumer behavior

apply to the actions of the parents. That is, a higher level of "wealth," or what Becker has termed "full income," of the parents will induce them to purchase more offspring welfare (J) via child care, on the assumption that children's lifetime welfare is a normal good. Also, the substitution effect of a higher price of offspring welfare (as embodied in the price of market goods for child care and, more importantly, the price of time of the parents) will induce them to buy less child care. The effects of income and prices on time inputs to children within the context of a static model of time allocation are analyzed further in Section IIB.

Up to this point, the discussion has been very general. To be more explicit is difficult, because we are discussing a complex dynamic process. From previous work in the area, however, we can illustrate some basic points concerning life-cycle earnings patterns and home background. To begin, we ignore market inputs in the production of human capital, restrict the human capital production function (A2) to the simple functional form of Cobb-Douglas [$Q_2 = A_1(sK_2)^{\beta}$], introduce parental inputs and inherited genetic endowment as a neutral technical shift in efficiency in producing human capital, and set $T_1 = T_2$. Further, if we impose a particular simple functional form on the utility function [$U = \ln(A_0 c^{\theta_1} X^{\theta_2})$] then in a recent paper Stafford and Stephan have shown that for interior solutions and for a zero interest rate and no time preference, the equations of motion for human capital and its shadow value are[8]

$$\text{(A9)} \qquad \dot{\lambda}_{K_2} = \lambda_{K_2}\delta - \lambda_K \alpha + \theta_1 / K_2$$

$$\text{(A10)} \qquad \dot{K}_2 = A_1[\beta \lambda_{K_2} A_1 / (\lambda_R \alpha)]^{\beta/(1-\beta)} - \delta K_2$$

To determine the qualitative behavior over the interval $T_2 < t \leqq T_3$ the loci for $\dot{\lambda}_{K_2} = \dot{K}_2 = 0$ can be plotted in λ_{K_2}, K_2 space. For these loci, it is apparent that if one specifies A_1 as being a measure of ability to learn which is increased by parental inputs during $T_0 < t \leqq T_2$ the individual would, for an initial endowment of K_2, choose a more extended training period as part of his optimal strategy in maximizing lifetime consumption.[9] Alternatively, if one were to specify the parental function as teaching the child directly marketable skills (a high level of K_2 at time T_2) but not increasing ability to learn (produce human capital), the children from backgrounds with more parental inputs would then initially train less and rent out a higher proportion of their human capital stock, but later in life have earnings which converged toward those who initially received less home training. This basic result holds as well for models which specify discounted lifetime earnings as the objective function.[10] Thus, existing theoretical work can be interpreted as consistent with the view that parental inputs to early training (and/or genetic ability) which

increase ability to augment one's own marketable skills will result in lifetime human capital and net earnings profiles which are more precipitous. That is, age-market capital profiles of those who receive much home inputs will fan out from (or even cross) profiles of those with less home investment.

B. The Allocation of Time and Market Inputs to Children

If parents derive satisfaction from the expected level of child welfare as suggested by (A8), household time allocation models of demographic behavior which are addressed to the question of "child quality" can be used to portray parental investment in children's home or early human capital. In this section of our paper, we shall review a model of consumer choice as applied to intrafamily time allocation. The object here is to determine what, if any, implications such a model has regarding differentials among socioeconomic status groups in the time allocated to the care of children. The basic model discussed here has been developed in detail by Willis and Becker and Lewis.[11] The reader should, therefore, consult these papers for detailed derivations. Basically, the household can be viewed as maximizing a utility function of the following form

(B1) $U = U(N, Q, S)$

where N is the number of children, Q can be interpreted as their quality or early home investment (assumed to be the same for all children), and S is the rate of consumption of all other commodities. While N and Q enter as separate arguments in the parent's utility function via their determination of number of children and their lifetime welfare, it is "child services," $C = NQ$, whose production and consumption we are interested in here. We will assume that both C and S are produced according to the following linearly homogeneous household production functions

(B2) $C = C(h_c, M_c)$

(B3) $S = S(h_s, M_s)$

where h_i and M_i ($i = C, S$) are, respectively, vectors of time and goods devoted to the production of the two commodities.

We will view the time inputs to household production as being those of the wife and, consequently, view the husband as devoting his entire time budget to labor market activity. While this is a strong restriction on the general model as well as somewhat of a departure from reality, empirical evidence from several time-use surveys suggests that it is not far from the truth. Finally, the family maximizes (B1) subject to the following full

income, F, constraint

(B4) $$F = \pi_c C + \pi_s S = H + wT$$

where the π_i are the full prices of the two commodities, H is the sum of the family's nonlabor wealth and the husband's income from earnings, $T = h_c + h_s + L$ is the total amount of time available to the wife which is divided between household production ($h = h_s + h_c$) and labor market activity, L, and w is the average market wage received by the wife. We will assume here that the wife's price of time is equal to w and this, in turn, is independent of her hours spent at work in the market. For the wife who does not allocate time to L, the price of time is quite likely understated by w. We shall ignore this important point here, for it is not central to our discussion. The reader should, however, consult two recent papers by Reuben Gronau for the implications of this point for a more general model of intrafamily time allocation.[12]

The importance of Becker and Lewis' model is that it makes clear the importance of the interaction between the quantity (N) and quality (Q) of children in understanding both cross-sectional and time-series data on fertility. A central point of their paper concerns the difference between "true" and "observed" income and price elasticities of the demand for N and Q. They demonstrate that observed income elasticities, which are derived by changing F while holding π_c and π_s constant, are on the average, smaller than the true elasticities, which are derived by changing the total expenditure on N, Q, and S, holding constant their respective shadow prices. Further, if it is assumed, as seems plausible, that the true income elasticity with respect to Q is larger than that with respect to N, then the observed Q elasticity will exceed the observed N elasticity. Just the opposite is true for observed compensated (negative) price elasticities, however. Here the observed income-compensated elasticity of N tends to be numerically greater than the corresponding Q elasticity. These relationships provide consistent interpretations of the empirical work of economic demographers and, in particular, fully explain the anomaly of zero or negative income elasticities with respect to the number of children, observed in much of the literature. The implication of these points for our analysis is that socioeconomic status groups which are characterized by relatively high prices of time and full income are likely to produce child services (C) through a process of relatively large resource investments in the quality of existing children, rather than increasing the number of children.

The effects of changing income and prices on the allocation of time to child services (h_c) can be analyzed in a straightforward way, given the model sketched in above. If full income is held constant, the compensated

price (wage) elasticity of child-care time can be shown to be the following

$$\text{(B5)} \qquad \left|\frac{\partial_{h_c}}{\partial_w} \cdot \frac{w}{h_c}\right|_F \equiv \varepsilon = -(1-\alpha_c)\gamma_c + (1-k)\sigma(\alpha_s - \alpha_c)$$

where $\alpha_c = wh_c/\pi_c C$ is the time intensity parameter for the production of $C = NQ$ (α_s is analogously defined for the production of S); γ_c is the elasticity of substitution between h_c and M_c in the production of C, $k = \pi c C/F$ and σ is the elasticity of substitution in consumption between C and S. The first term on the right-hand side of (B5) indicates that a compensated increase in w will lead to a reduction in h_c reflecting the substitution of M_c for h_c in production. The algebraic sign of the second term on the right-hand side of (B5) depends on the difference in time intensity parameters in the production of C and S. We shall argue here (as does Willis) that particularly in the preschool years, $\alpha_s - \alpha_c < 0$. While an increase in w raises the marginal cost of producing both S and C, it raises it relatively more for the commodity which is most time intensive. For $\sigma > 0$ this will lead to a substitution away from C.

An increase in the wife's price of time also increases real full income and, consequently, leads to increases in the demand for all commodities and inputs, assuming the existence of no inferior factors. The sign of the uncompensated price elasticity for C is, therefore, unknown a priori. However, if we find (as we do in Section IV) that high-status mothers allocate a larger amount of time to child care than do low-status mothers, and if socioeconomic status serves as a reasonable index of the wife's price of time, then the consumption of C must be relatively income elastic. Further, as distinct from other household activities, the production of C (at least during the preschool years) probably exhibits a smaller elasticity of substitution (γ_c) between goods and time and accounts for a larger fraction of the family's full income (k). Both of these phenomena will lead to a smaller absolute value of ε for given values of α_c, α_s, and σ, thereby increasing the relative importance of the income effect in assessing the effects of changes in w on h_c.

Families of differing socioeconomic status differ both in terms of full income (F) and in the prices of their members' time. The model outlined above makes it clear that increased full income (through, say, an increase in H) leads to increased consumption of all commodities (assuming no inferiority) and the inputs used to produce them. The effects of changes in w on the allocation of time are more problematic. However, the characteristics of preschool child care give one some reason to expect the income effect to be dominant. Consequently, the model outlined above suggests that differentials in family background which are typically measured by some type of socioeconomic status index should be

associated with differentials in the consumption (production) of child care (C) and in its time and goods inputs.

To summarize our discussion in Section II of the role of family background on lifetime earning capacity, we can note four basic points.

1. The parents' motivation to care for children (demand high quality) can be developed by treating the child's lifetime welfare as one argument in the parents' own lifetime utility function. Parents' contribution to early human capital provides part of the means by which their offspring can develop adult capacities, including marketable skills. Thus, parental choices regarding this consumer good can be analyzed within a broadened household decision-making model. Recent work along these lines has been the focus in much of the development of an economic theory of demographic behavior, and we have shown a relation between this literature and the issues of investments in early human capital.
2. The influence of parental inputs (of either the inherited type [K_0] or home inputs to early human capital [K_1]) on adult earning capacity is primarily indirect. Parents determine the ability to learn much more than the directly marketable skills of their offspring.
3. Whether the individual's (lifetime) utility function has as its argument simply market earnings net of investment costs, or has leisure and consumption of market goods, the life-cycle human capital accumulation models support, or are at least consistent with, the view that the lifetime earnings of more able persons will diverge from those of less able persons.
4. While 3 holds without explicit regard to the relative importance of genetic factors or home investments in determining ability, there is the issue of which inputs matter. Is ability to learn a genetically fixed capacity at the one extreme or is it something which, as Smith argued, is largely determined by habit and custom? How important is the input of parental time? We now turn to a review of the existing social-science literature as it pertains to these four topics.

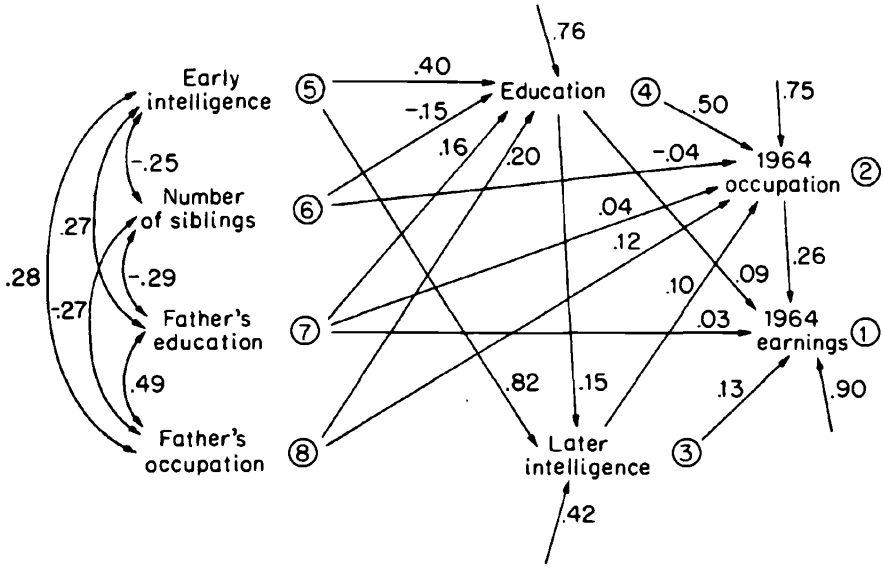
III. BACKGROUND VARIABLES AND PERSONAL DEVELOPMENT

A. A Sample of the Sociological and Psychological Literature

The sociological work which appears to have the most direct bearing on the topic of family variables and their influence on adult earnings and

economic status is that of O. D. Duncan and his associates. The basic framework used is a recursive model wherein: "father's occupation, the number of siblings, and the early intelligence level of the respondent are taken to be 'predetermined' variables with respect to the later achieved statuses and intelligence as measured at maturity . . . . It would be much more difficult to represent the correlation of early intelligence with parental status as an outcome of a causal process. The solution to this problem would be tantamount to a solution of the 'heredity-environment' problem with respect to measured intelligence."[13] These background variables relate to education, later intelligence, occupation, and earnings as represented by a path diagram, which is given by Duncan and is presented as Figure 1.

FIGURE 1 Path Diagram Representing Dependence of Status Achievement on Family Background and Intelligence (Path Coefficients Estimates for U.S. White Men 25–34 Years Old, 1964)



SOURCE: O. D. Duncan, "Ability and Achievement." *Eugenics Quarterly* (Mar. 1968), p. 7.

While there are numerous differences between the approach we have set forth in Section II and that of the Duncan model, the points of comparability are in the emphasis on parental characteristics and number of siblings on educational attainment, and the very minor magnitude assigned to the *direct* influence of background variables on adult

economic capacity (occupation and earnings).[14] This basic model has been used in subsequent studies by economists, as will be discussed below, but in most of the research to date the actual predetermined parental variables used have been *father's* education and occupation rather than education and occupation of *both* parents. Another feature of the Duncan specification is that "Figure 1 merely shows [the background] variables 5–8 as intercorrelated among themselves—the correlations are depicted by the curved lines with arrowheads at both ends—and it is not considered as part of the task at hand to explain how these correlations arise."[15] By using recent work on economic demography, we have shown that it is possible to include in a general framework a specification of how parental time and money inputs vary across families and how these, in turn, can influence the stock of early human capital (early intelligence and ability). In our life-cycle model of Section IIA, educational attainment and lifetime training are heavily dependent on these behavioral patterns in the home, and the influence of educational policies is presumably dependent on the "initial conditions" which children bring with them into the school system.[16]

When one turns to the psychological literature for help in specifying the way in which genetic endowments versus family environmental factors influence early development, several features are apparent. First, the literature is enormous. Second, the literature is certainly as controversial as it is large. Third, the literature is of some use to economists. The piece by Arthur Jensen contains all three elements.[17] The paper, while itself lengthy (123 pages), refers the reader to 153 references and argues that no less than 80 percent of the variation in basic intelligence can be explained by genetic factors, leaving environmental influences 20 percent. The minor role of environmental factors as well as Jensen's argument for genetic differences by race are of little comfort for those who believe that Adam Smith was by and large correct.

This psychological research should be of interest to economists, because it does deal with the role of parental and other inputs in the intellectual development of children. The key empirical studies focus on the comparison between monozygotic twins reared apart and reared together. Such data, as one can readily imagine, are rather scarce and hence the studies are subject to the criticism that they are not based on consistently collected sample points. Also a question of great importance is how one measures the variation in environments between those reared together and those reared apart. In the approach which we follow, one of the critical measures is time input by the parents and, particularly, by the mother. If variations in father's education or family income are used (the latter measured by "the material conditions of their homes"),[18] these may serve as only poor measures of variations in home inputs.

Even relying on Jensen's work, we can find some support for the importance of inputs of time into child care. In his discussion of the importance of educational intervention for development of children who are disadvantaged, he notes that "ordinary nursery school attendance, with a rather diffuse enrichment program but with little effort directed at development of specific cognitive skills, generally results in a gain of 5 or 6 I.Q. points in typical disadvantaged preschoolers. If special cognitive training, especially in verbal skills, is added to the program, the average gain is about 10 points. . . . Average gains rarely go beyond this, but when the program is extended beyond the classroom into the child's home, and there is instruction in specific skills under short but highly attention-demanding daily sessions . . . about a third of the children have shown gains of as much as 20 points."[19] The potential importance of early home inputs in influencing I.Q. exists because ". . . I.Q. is not constant, but, like all other developmental characteristics, is quite variable early in life and becomes increasingly stable throughout childhood."[20] Recent work by psychologists which supports the view that development is influenced substantially by parent-infant interaction will be discussed more fully in relation to our own empirical findings in Section IV.

Quite apart from the extent to which I.Q. is subject to change through parental and other inputs, there is the issue of the economic significance of I.Q. Many of the studies which deal with I.Q. or achievement seem to have a ring of "score for score's sake" to them. The issue of whether I.Q., especially adult I.Q., has strong implications for adult economic capacities is never really treated adequately. For example, while Jensen does at some points distinguish between generalized intelligence and marketable skills,[21] he apparently feels it is sufficient to note that average I.Q. scores of high-status, high-paying occupations are also high.[22] This problem of "score for score's sake" characterizes much of the work by sociologists and economists who have concerned themselves with whether different educational programs raise achievement scores (or I.Q.). This is a major failing of the work by Christopher Jencks.[23] Apart from his failure to understand the distinction between goodness of fit and importance, there is the issue of whether achievement scores really measure economic capacities, including the capacities necessary to develop marketable skills.

Within the field of research on I.Q., there is a serious debate as to whether important dimensions to basic mental ability are measured by even the most sophisticated of current I.Q. tests. Work on the physiological level demonstrates that there is important functional specialization of the two hemispheres of the brain with respect to different types of mental tasks; "the hemispheric specializations have been described as 'gestalt-synthetic' for the right hemisphere and 'logical-analytic' for the left. . . . In

a culture where most individuals are exposed to intensive education of the left hemisphere potential for reading, writing, grammar, and so on, we could reasonably expect a tendency for the propositional mode to dominate, even when dealing with problems for which it is less appropriate. Conversely, persons raised in a nonliterate culture emphasizing different training, in spatial skill for example, should exhibit a reverse [appositional] tendency."[24]

This research implies that there is more to intelligence or ability to learn than what is measured by conventional tests, but the relative importance of propositional versus appositional skills in developing earning capacities is certainly not clear at this point. However, it is quite clear that environmental or background influences can be viewed as important in developing the different kinds of abilities. Bogen et al. found that when given a Street test, which involves identification of silhouettes that have been partially obliterated so as to make their recognition difficult, and which is interpreted as measuring appositional skills, Hopi Indians and blacks scored higher than middle-class whites. Conversely, middle-class whites performed better on a standard I.Q. test (WAIS similarities, a similarities test), which is believed to serve as a measure of propositional skills. One reason given for observing these differences is that "subdominant groups in a technological society are provided less access to propositionising and consequently must rely more often upon the alternative appositional strategy."[25]

Family background and associated early environment can be important not only for their influence on learning ability, but also as representative of a set of factors which influences motivation. Willingness to learn new skills can obviously be of great importance in human capital formation. Representation of this willingness could be aggregated with ability-to-learn parameters of our general model in Section IIA, but may require particular types of inputs to young children by the parents. Qualitative aspects of parent-child interaction are stressed in the literature on achievement motivation, which concerns itself with how people acquire an interest in improving their capabilities in areas where a standard of performance can be identified.

Heckhausen, in his review of the parental influences in achievement motivation, emphasizes the influence of parental approval, affection, and encouragement of trust as important determinants of motivation.[26] The role of quantity of time by parents in developing achievement motivation is left as a more open question. It seems possible that in addition to qualitative aspects of the parent-child interaction, actual quantity of time per child may be important as well. Thus, our empirical work on quantity of time to children in Section IV may be worth considering for future work on achievement motivation.

To summarize our brief review of the sociological and psychological literature as it relates to the development of economic capacities as influenced by early or background factors, we can note five points:

1. The work by Duncan is consistent with the view that parental inputs have an important but indirect influence on adult earning capacity, but his empirical work does not attempt to identify the separate influences of background, such as time inputs by the mother and father. In Section IV, as a supplement to our own findings, we review the recent evidence of education of mother and father on children's educational attainment.
2. The role of environmental factors or home inputs can be seen in psychological research, even if one relies on the work of those who assign the least importance to home or other environmental influences vis-à-vis genetic endowment of mental abilities. As we shall argue in Section IVC, for low-income families, a larger number of children results in lower input of time per child. Hence, lower I.Q. (which is associated with family size), insofar as I.Q. is important in developing economic capacities, can be viewed as subject to important environmental influences.
3. There is no clear evidence of the extent to which I.Q. measures basic mental skills. Recent research demonstrates that another important skill—the ability to extract an integrated image from a variety of fragmented inputs—appears to be more closely related to the facility of the right hemisphere of the brain, or integrative thinking, whereas standard I.Q. measures relate to facility with left brain, or propositional, thinking.
4. The relation between various mental abilities as measured by achievement test scores and subsequent economic capacities—or, in terms of the model in Section II, the capacity to learn economic capacities—is not obvious.
5. The achievement motivation literature is consistent with our human capital approach but has tended to emphasize qualitative aspects of parent-child interaction. It seems reasonable that some quantity of time is required to develop achievement motivation as well as learning abilities.

B. A Review of the Economic Literature

Many of the empirical studies by economists on the influence of background variables on adult earnings are basically consistent with the work of Duncan in two ways. First, the model used is recursive, and second, the major influence of parental background is indirect, through

its influence on acquired marketable human capital, as indexed by years of schooling. The work of Bowles[27] and Griliches and Mason[28] provides examples of what has been done, and here we find that the variables used as background measures include father's occupation and father's schooling. The empirical findings of the Griliches and Mason study are diverse, because they are based on a very complex data set. For our purposes, their central findings include the following: a measure of adult I.Q., the Armed Forces Qualification Test (AFQT), though positively correlated with personal background variables, has a small net contribution to earnings (p. S-88). Second, there were rather large effects of religion, color, and schooling before service on AFQT, and minor effects of parental status variables (p. S-91). The first point provides additional support for the work of Duncan, which emphasizes the indirect role of ability. The second point emphasizes environmental influences on one measure of ability but is inadequate for our purposes, because the status variables may be only poor measures of time inputs by the parents. The model of household production and demand for child quality, as measured by inputs to children, demonstrates the role of family income potential (Section IIB). From the model and previous empirical work, we know that father's status variables should influence time to children via the implied income effects on the wife's time allocation. Thus, it is somewhat surprising that there is such a minor influence of status variables. However, if time inputs are important and the wife is the major provider of these inputs, then sole reliance on measures of father's status will provide only a rough measure of time inputs.

The work of Sam Bowles also uses the recursive framework and provides strong support for the importance of indirect effects of background on adult earning capacity. He argues as well for a strong *direct* influence of background on adult earnings through his attempt to correct, via an errors-in-variables approach, for the response error in reporting background. This finding has been criticized by Gary Becker, who noted that successful persons could have an upward bias in the recall of their parents' status,[29] and, in any event, the finding is dependent on the accuracy of the correction, which Bowles admits is quite imperfect.[30] The major problem of the Bowles study, like that of Griliches and Mason, is that variables for father's status were included but not mother's status.[31]

Another way of providing support for our general specification of background as influencing ability to learn marketable skills is to examine the shape of the capital and earnings paths for individuals. For a given initial level of marketable skills, individuals with greater ability or motivation to learn should have capital and earnings profiles which diverge from those who are less able.

In studies of the general labor force, John Hause has found that persons with higher initial ability to learn (as indexed by tests prior to formal schooling) have earnings profiles which diverge from those of less initial ability.[32] In Hause's studies, the question of whether ability to learn is environmentally determined is answered only weakly, if at all, but the importance of environmental inputs is given some potential support. Within educational attainment categories and accounting for test score, those whose religion was Catholic or Jewish had higher current earnings.[33] The results are not well suited to our purposes, since measured ability and years of schooling attained are in our view influenced by background. Therefore, important indirect effects of parental time inputs through their influence on acquired ability and education cannot be identified. At this stage, the Hause study seems to provide potential evidence for the influence of time allocation. If Catholic and Jewish families allocate more time per child to child care than other families, then we shall have some confidence that our approach is valid.

Using a very specialized panel of children who had an I.Q. of 140 or higher in the early 1920s and who were followed into adult life over a period of almost forty years, Arleen Leibowitz has reported several pertinent results.[34] If only heredity determined the ability of children, then one could expect *either* parent's education (as a proxy for ability) to be equally important in determining ability of the children. From the results of Bogen et al., there is reason to believe that I.Q. is, at best, only a proxy for acquired general ability. Subject to this qualification, it is still significant to note that mother's education has a greater influence on educational attainment of children than does father's education. This is important because prior work by Leibowitz and Hill and Stafford has demonstrated that mothers, and particularly those who are highly educated, change their market and nonmarket time allocation to care for young children, whereas fathers, by and large, do not. Leibowitz also found that parental background variables had a minor *direct* influence on earnings even though they have important indirect effects through increasing ability to learn (as measured by I.Q.) and through their influence on years of schooling attained.

While the study by Leibowitz relies on a very special sample, a recent study by Richard Morgenstern[35] uses data from the 1968 Urban Problems Survey conducted by the Survey Research Center of the University of Michigan. Morgenstern also relies on a recursive model to analyze the data and consequently has a regression of educational attainment on various personal background variables. Mother's education and father's education are both found to be important in determining education attained. This is certainly consistent with the time allocation approach, and for blacks, mother's education was found to be more important than

father's education in affecting educational attainment. This is consistent with Leibowitz's finding of greater influence of mother's education and provides some additional support for the importance of environmental inputs and particularly time inputs. However, for whites, Morgenstern did not find a greater influence of mother's education and, in fact, claims that while "mother's education is a better predictor of educational attainment among blacks, . . . father's educational attainment is a better predictor for whites." Two explanatory points seem appropriate. First, as noted earlier in Section II, father's education, via income effects, can have an important influence on mother's time devoted to children. Second, the Urban Problems Survey, being restricted to central cities, is less likely to represent a cross section of whites than of blacks, because successful whites (those with large time inputs from their mothers?) can more easily obtain housing outside the central city.

To summarize our review of the use of background factors in the studies of lifetime earnings by economists, we can note first that the indirect nature of the influence seems to be observed universally and explains the popularity of the recursive model. Second, there does seem to be evidence, particularly from the work of Hause, that the earnings of those with greater ability diverge over time from those with less ability, rather than being higher by a constant proportion throughout the working life.[36] These results we take as support for the ability-to-learn interpretation of background influences (equations [A2] and [A10]). Third, there is scattered evidence that background variables which correlate with likely variables in parental time inputs to children during early years in the home have a bearing on earnings through their influence on ability to develop marketable capacities. What we hope to encourage is work on an explicit link between time inputs, ability to learn, and subsequent lifetime earnings. One issue in this work is the future role of recursive model building.

The recursive model is attractive primarily because of its statistical simplicity, which permits single-equation estimation and provides fairly straightforward interpretation. This simplicity is desirable and probably warranted, given the enormous data problems in studying lifetime earnings. It can be argued that under these circumstances, there is a high marginal payoff to better data as compared with better model specification. Indeed, given the data problems, it seems difficult to have great confidence in checking any structural phenomenon, a fact which is not without strong empirical implications. Nonetheless, the recursive model does have some problems which should be kept in mind.

Use of a recursive system is justified by arguing that there is an unequivocal causal ordering to events: what happens to you as a preschooler is prior to what happens to you while in school, which is prior

to what happens to you as an adult. However, it seems reasonable to suppose that parents derive satisfaction from the child's lifetime welfare, and they know that what the child will choose to do as an adult will depend in part on what they do for him while he is still a preschooler. Therefore, while there is a temporal ordering to activities, it is still not correct to look at these activities as if they were independent of one another in their effect on lifetime earning capacity. Consider the analogy of a crop with the three inputs of land, seed and fertilizer, and harvesting effort. Even though there is an obvious temporal sequence of: first the land, then the seed and fertilizer, and then the harvesting effort, the marginal products of each are, in general, interdependent and the relative contribution of each factor cannot be assessed simply by noting a temporal ordering.

IV. TIME INPUTS TO CHILDREN

In an earlier section of this paper, we presented a model of lifetime skill acquisition that is initiated through parental time and goods investments in the children. We have also reviewed empirical evidence from economists and other social scientists regarding the effect of family background on subsequent earnings and occupational achievement. In this section, we shall demonstrate that there is a striking relationship between the family background variables as they are usually measured (education and occupation of parents) and the amount of time allocated to preschool children. Indeed, we shall argue that the environmental forces which the family background variables are measuring in earnings functions are, in fact, largely a reflection of differentials in parental time inputs to children. And while we do not have any direct evidence concerning the effects of the preschool child-care time we measure here on the child's future economic and social status, we do present some provocative, though indirect, evidence from child psychologists and others that this time is important.

The measurement of parental time inputs to children requires a data source with detailed time-use information. Such data sets are, unfortunately, still rather rare. While the Office of Economic Opportunity (OEO) *Panel Study of Income Dynamics* we use here does provide data on the time spent on housework as well as in the labor market, it is not as detailed as we should like. In particular, housework time spent on children is not available directly from the data but must be estimated, and nonhousework time allocated to the children is not available at all. We have discussed our method of estimation in detail elsewhere and so will

not review it at length here.[37] Suffice it to say that our basic method is to regress hours of housework on the number of children in different age categories. The estimated coefficients then represent the increment to housework due to the presence of a child of specified age; it is this increment which we interpret as child care time.

Our sample consists of families headed by a male with wife present where both were between the ages of 21 and 45 in 1969. In addition, the head was employed in that year in one of seven occupational groups discussed below. The specification of the regression model is very simple with the only independent variables being the number of children within specified age ranges. Nevertheless, the results are very robust, changing little with the inclusion of additional regressors. In addition, our basic methodology has now been used to estimate preschool time inputs from two quite different data sets and the results have been reassuringly consistent.[38] Regressions were initially estimated for both male family heads and wives within groups defined by the male head's occupation or the educational attainment of the head and wife. As noted in the previous sections of this paper, both occupation and educational attainment are commonly used indicators of family background or socioeconomic status. Consequently, our technique is to estimate time inputs to children within socioeconomic status groups and then make comparisons across groups.

The first result of interest was that fathers allocate little time to preschool children within any of the socioeconomic status groups. Our regressions do not reveal any consistent pattern of change of the head's child-care time as the child grows older and indicate that the head spends only about 10 to 20 percent of the time spent by the mother in child-care time in the preschool years. To the extent, then, that family background variables in earnings functions reflect early environmental influences, they would probably be more accurately measured by variables relating to the mother's, rather than the father's, characteristics.[39]

The regressions were initially estimated using as independent variables the number of children aged 0–2, 3–4, 5–6, and 7–17, and the annual hours of housework and labor market work as dependent variables. These regressions indicated a strong response in terms of time allocation away from market work and toward housework by the wife when preschool children were present. Generally, the increase in housework was greater than the corresponding reduction in market work within each of the socioeconomic status groups. This occurs because child-care time can come not only out of market time but also leisure time. We found that in low-status groups (defined by the head's occupation) there was a sharp fall in housework time for older preschool children (ages 3–4 and 5–6) in comparison with the time allocated to infants. High-status mothers, however, allocated a relatively steady and high level of time throughout

the preschool years. The reasons for this differential age-of-child-dependent shape to housework time between social classes are discussed in detail though not conclusively in our earlier work. As our main interest here is with the total time allocated to the preschool child and how it differs across social classes, the regressions we report here use only the number of children 0–6 and 7–17 as independent variables, and only the annual hours of housework time as the dependent variable. While this hides some interesting age-specific detail, it does yield the information we seek. Estimates of time spent in the physical care of children by social class and several related topics are presented below.

A. Allocation of Time to Preschool Children by Head's Occupation and Parent's Education

Our sample consists of 1,261 families with the characteristics discussed above. The male head's occupation in 1969 was used to define three status groups which closely compare to the socioeconomic status groups derived by O. D. Duncan, particularly for the high and low groups. Regression of the wife's annual hours spent on housework on the number of children 0–6 and 7–17 within each of these three groups are presented in Table 1.[40] These regressions exhibit the basic pattern that we have found consistently: striking "social class" or "full income" differentials

TABLE 1 Regressions of Annual Hours of Housework for Married Women, 21–45, by Occupation of Head, 1969

Variable	Professionals, Managers, Self-Employed	Clerical, Craftsmen	Operatives, Laborers
CHILDREN 0–6	445	219	200
	(88)	(72)	(70)
CHILDREN 7–17	108	90	42
	(50)	(46)	(25)
Constant	1,198	1,534	1,517
	(79)	(87)	(88)
Number of observations	403	430	428
S.E.E.	899	995	1,019
R^2	.188	.056	.049

NOTE: The data source for this and all subsequent regressions is the *Panel Study of Income Dynamics* collected by the University of Michigan's Survey Research Center under contract from the Office of Economic Opportunity. In this and all subsequent tables, estimated standard errors are found in parentheses below the estimated coefficient.

in the time allocated to preschool children. The coefficients indicate, for example, that a preschool child in a high-status family has 445 hours of maternal time allocated to him during each of the preschool years. In contrast, the low-status child is the recipient of only 200 hours per preschool year. Again, we would point out that these numbers obscure interesting patterns of time use within the preschool years (ages 0–6), but the basic character of class differentials is unchanged. The ratio of time inputs to preschool children between high- and low-status groups is 2.25 : 1 and this is significantly different from unity.[41]

Much the same pattern exists when we stratify the sample on the basis of the head's and wife's educational attainment. A stratification by educational attainment seems particularly meaningful in the context of a study of the allocation of time. The head's education is a useful proxy for a family's "permanent" income, while the wife's education is a stong predictor of her price of time and potential market wage rate.[42] The total sample size is smaller in Table 2 than in Table 1, for we have deleted families in which the wife's education was a missing variable.

TABLE 2 Regressions of Annual Hours of Housework for Married Women, 21–45, by Education of Head and Wife, 1969

Variable	LOLO	LOHI	HILO	HIHI
CHILDREN 0–6	156	299	343	434
	(33)	(104)	(72)	(74)
CHILDREN 7–17	49	119	45	128
	(20)	(74)	(47)	(50)
Constant	1,566	1,106	1,584	1,078
	(68)	(189)	(130)	(108)
Number of observations	805	65	179	165
S.E.E.	1,020	866	990	842
R^2	.031	.131	.118	.186

NOTE: The educational strata are defined as follows:
LOLO: both head and wife have not attended college;
LOHI: head has not attended college but the wife has;
HILO: head has attended college but the wife has not;
HIHI: both head and wife have attended college.

The income elasticity of preschool child-care time is clearly evident when the educational strata are employed. Comparing groups in which the wife's price of time is held "constant" and family permanent income increases (comparing, e.g., LOLO with HILO and LOHI with HIHI), there is a pronounced increase in the mother's time allocated to preschool

children. The income effect resulting from an increase in the wife's price of time, holding constant other family income through the head's education, also appears to dominate the substitution effect when one compares the time allocation between LOLO and LOHI and also between HILO and HIHI.

B. Time Allocation by Sex of Child

A persisting and well-documented earnings differential is that between men and women. Even after standardizing for differences in labor market participation and other factors, women still receive earnings which are about 71 percent of those received by men.[43] There are several reasons that can be, and have been, offered for this phenomenon; we are concerned here with how this differential might relate to environmental forces in the home via sex differentials in the time allocated to preschool children. This was investigated by regressing annual housework hours on the number of sons and the number of daughters 0–6 and 7–17 in each of the four head-wife education groups defined above. The comparison of most interest is between the estimated coefficients of the variables SONS 0–6 and DAUGHTERS 0–6. Systematic differences between these two coefficients by parents' educational attainment may give some insight into one effect of family background on earnings differentials by sex. The regression results are found in Table 3.

TABLE 3 Allocation of Time to Housework for Married Women, 21–45, by Age and Sex of Child, 1969

Variable	LOLO	LOHI	HILO	HIHI
DAUGHTERS 0–6	100	526	278	551
	(48)	(152)	(111)	(106)
DAUGHTERS 7–17	31	−148	8	133
	(32)	(127)	(80)	(87)
SONS 0–6	210	174	410	334
	(46)	(117)	(106)	(99)
SONS 7–17	67	326	87	127
	(32)	(116)	(77)	(85)
Constant	1,568	1,089	1,570	1,070
	(68)	(179)	(131)	(108)
Number of observations	805	65	179	165
S.E.E.	1,019	821	993	841
R^2	.035	.244	123	.198

NOTE: For definition of educational strata see NOTE to Table 2.

There are two interesting implications of these results. First, holding the wife's education constant and moving from low to high levels of the head's education (comparing, e.g., LOLO with HILO and LOHI with HIHI), it is clear that the total time allocated to preschool children increases for both sexes of children. Second, holding father's education constant reveals that wives with at least some college education spend more time with their preschool daughters than with their sons, while the reverse is true for non-college-educated mothers. Further, these differences are, for the most part, statistically significant.[44] Again, as in the results shown in Table 2, the husband's education apparently served primarily as an income proxy leading to increased consumption (production) of the child services commodity and a resultant increase in its time inputs. The mother's education serves to determine the allocation of time by sex within the total determined by the head's "income."

Given the results of Table 3 and the presumption that family background factors operating through parental time inputs to children influence the child's ability to learn, we would now expect that daughters of well-educated mothers would receive substantially more formal schooling than daughters of less-educated women, holding constant the father's income or education. Testing this hypothesis is, in general, difficult, for in most data sources only the male has been interviewed, and he is presumed to be the head of household. As a consequence the surveys obtain detailed information on only his family background and subsequent schooling. Fortunately, however, a recent paper by Greg Duncan, using the panel data that we employ here, was able to investigate in some detail the effects of family background on daughter's educational attainment.[45] Duncan obtained a sample of children between the ages of 18 and 30 who had completed their formal education, and who had lived in one of the panel's interviewed families in 1968 but had become heads or wives in their own households by 1972. Information on the educational attainment of the children was obtained from them directly in 1972, while information on their parents' characteristics were obtained from the parents themselves during the years 1968–72.

Duncan finds that the effects of parental education on the educational attainment of their children differ considerably between males and females. While father's education is predominant in affecting the son's education, this is not the case for daughters. Holding constant family income, family size, and several other factors, the effects of father's education on the educational attainment of daughters is negligible. The net effect of mother's education on the daughter's attainment is strong and significant, however, and shows that having a college-educated mother rather than a grade-school educated mother is associated with slightly more than one extra year of schooling for daughters.

Duncan's results seem to be generally consistent with those of Sewell and Shaw.[46] Using logitudinal data for a sample of Wisconsin high school seniors, they find that the mother's education has a stronger independent effect in influencing her daughter's, rather than her son's, educational plans and attainment. In addition, they find that in discrepant situations where one parent has some college education but the other does not (as in our LOHI and HILO groups), mother's, rather than father's, education seems to exert the greater influence on the educational aspirations and achievements of their childen, and especially their daughter.

We would suggest that our results on parental time allocation by sex of child give additional insights into the effects of family background on educational attainment reported by Duncan and Sewell and Shaw. While the evidence is still, given the lack of the requisite data, somewhat fragmented, there is now considerable circumstantial evidence that the ability to learn and the educational aspirations and achievements of the children are affected by environmental forces within the household. Further, it appears that there are sex differentials in the effects of these forces and they are initially a reflection of differential time investments in the children by the mother.

C. Time Allocation to Preschool Children by Size of Family

The number of a child's siblings has consistently been shown to have an important and adverse effect on the child's educational attainment.[47] The environmental explanation usually offered for this phenomenon is one associated with the financial burden a large number of children imposes on the family and the consequent disability of the family head to finance investments in formal schooling for his children.[48] It now seems reasonable to expect that the allocation of time to a preschool child, as well as market-purchased resources, may be influenced by the number of other children in the family. In this section we shall offer some additional results on this topic, using data from the 1969 wave of the panel, and shall discuss their implications for inequality of educational attainment.

A test for the presence of diminishing marginal time inputs to preschool children is provided by including a quadratic term in CHILDREN 0–6 in our regressions. Table 4A illustrates the results of this addition when the data are stratified by the head's occupation. In contrast to the occupational stratification used above, the HIGH SES (Socioeconomic Status) group includes only professionals, managers, and self-employed businessmen. LOW SES includes every other coded occupation. The data are again stratified by head's and wife's educational attainment in Table 4B.

TABLE 4A Tests for Diminishing Marginal Time Inputs to Preschool Children, by Occupation of Head, 1969

Variable	HIGH SES	LOW SES
CHILDREN 0–6	331	294
	(132)	(83)
CHILDREN 7–17	98	60
	(30)	(19)
(CHILDREN 0–6)^2	41	−46
	(47)	(24)
Constant	1,258	1,498
	(90)	(72)
Number of observations	389	825
S.E.E.	908	1,020
R^2	.179	.037

NOTE: Occupations included in these SES strata are as follows:
HIGH SES: Professionals, managers, and self-employed businessmen
LOW SES: Clerical, craftsmen, operatives, and laborers

TABLE 4B: Tests for Diminishing Marginal Time Inputs to Preschool Children, by Education of Head and Wife, 1969

Variable	LOLO	LOHI	HILO	HIHI
CHILDREN 0–6	262	919	524	282
	(85)	(314)	(199)	(190)
CHILDREN 7–17	50	111	54	120
	(20)	(73)	(49)	(51)
(CHILDREN 0–6)^2	−33	−233	−62	63
	(24)	(112)	(64)	(73)
Constant	1,526	973	1,514	1,118
	(74)	(194)	(149)	(118)
Number of observations	805	65	179	165
S.E.E.	1,019	843	990	843
R^2	1.033	.189	.122	.189

NOTE: For definition of educational strata, see NOTE to Table 2.

In the strata in which the head is relatively well educated or employed in a high-status job (HIGH SES in Table 4A and HILO, HIHI in Table 4B), there is no evidence of significant diminishing time input to preschool children as their number increases. In contrast, the three strata

containing less-educated or low-status heads do indicate a significant decline in the time input per preschool child as the number of these children increases. It would be difficult to argue, we believe, that low-status families are more efficient in the provision of child services and that this is reflected in the existence of "economies of scale." What the results do indicate is that the wives in high-status (as defined by the head's education and/or occupation) families spend essentially a constant amount of time per preschool child regardless of their number, while very young children in low-status households receive a smaller amount of parental time than did their older preschool siblings.[49] To the extent that preschool time inputs do have a positive influence on educational attainment and subsequent earnings, the results of Tables 4A and 4B have important implications for studies of inter-generational income inequality.

In a recent paper, Johnson and Stafford have shown again that the level of educational attainment on the part of individuals is systematically determined by a set of economic and demographic variables pertaining to early childhood development. In particular, for a sample of white males in 1964 taken from the *Productive Americans* data source, they have demonstrated that the number of brothers and sisters (BROSIS) has a negative effect on individuals' educational attainment (ED), other things being equal.[50] Our results imply that if the individual is raised in a family whose head has a high level of education, he will receive a constant and relatively large level of preschool time inputs independent of the number of his siblings. Given this result, the negative effect of BROSIS on ED should be attenuated for these high-status families. To test this, we have estimated a regression explaining ED much like that appearing in Johnson and Stafford, except that we have added a dummy variable HIEDFATHER (=1 if the respondent's father graduated from high school) and an interaction term between this variable and BROSIS. High school rather than college education of the father has been used as the variable "breakpoint" given that high status and/or high educational attainment is more properly reflected by this level of educational attainment in the first half of this century. The results of the regression are as follows[51]

$$
\begin{aligned}
ED = {} & 1.03 \ln(EXP) + 1.42\,HIEDFATHER - 0.046\,AGE \\
& \quad (0.283) \qquad (0.301) \qquad\qquad (0.006) \\
& - 0.375\,BROSIS + 1.05\,GRURB \\
& \quad (0.043) \qquad (0.170) \\
& + 0.136\,OLDBR + 0.174\,HIEDFATHER \times BROSIS \\
& \quad (0.047) \qquad (0.083) \\
& + 8.02 \\
& \quad (1.60)
\end{aligned}
$$

with $R^2 = 0.311$ and S.E.E. = 2.52. The positive and significant coefficient of the interaction term indicates that the negative effect of BROSIS on ED is substantially weakened for individuals from high-status families.[52] While we do not have direct evidence that this is due to the constancy of preschool time inputs in these households, this regression result together with Tables 4A and 4B provides circumstantial evidence for this.

D. Religious Preferences

In Section IIIB of this paper we described some recent evidence that Catholics have higher earnings than Protestants for a given level of formal schooling. In the context of our investigation, this fact leads us to test for the presence of differentials in preschool time inputs by parents' religious preference. In the context of our discussion in Section II, religion can serve as an index of parental preferences for child development, and to the extent that we find such differentials, it will provide us with an appealing explanation of the observed subsequent earnings differentials by religious background. Hopefully, this result and the others presented above will lead to an interpretation of the background variables which are usually included in earnings functions in a manner which is consistent with their relationship to preschool investments in human capital.

TABLE 5 Allocation of Time to Market Work and Housework, Married Women 21–45, by Religious Preference, 1969

Variable	Housework	Market Work
CHILDREN 0–6	182	−155
	(32)	(26)
CHILDREN 7–17	66	−13
	(17)	(13)
CATH	87	−0.15
	(99)	(80)
CATH 0–6	111	−76
	(62)	(50)
Constant	1,451	846
	(56)	(46)
Number of observations	1,111	1,111
S.E.E.	976	976
R^2	.075	.058

Using our same basic sample—husband/wife families between the ages of 21 and 45 where the husband was employed in 1969—we have eliminated all families with religious preference other than Protestant and Catholic.[53] Our basic functional form is by now familiar, given the previous discussion; we add here a dummy variable CATH (=1 if the family is Catholic) and the interaction between CATH and CHILDREN 0–6 (CATH 0–6). A positive sign on the estimated coefficient of CATH 0–6 would indicate that, across our sample, Catholic mothers allocate more housework time to preschool children than do Protestants. As is apparent from Table 5, this is precisely what we observe with the null hypothesis that the coefficients of the Catholic dummy and interaction variable are both zero being rejected at the 1 percent level in the housework regression ($F = 6.57$). We cannot reject this hypothesis in the market work regression at the 5 percent level where the calculated $F = 2.35$. In conjunction with the work of Hause,[54] Table 5 again provides some evidence of the relationship between preschool time inputs into children and postschool economic well-being.

E. Educational Expectations

In Section II, we hypothesized that in choosing a level of home training or quality for their children, parents "look at" the incremental effect of their time and goods inputs to the children in the home on the child's lifetime welfare, given the child's initial inherited endowment of ability and family wealth. The model implies, then, that parental home investments in the child's training are influenced by their expectations and aspirations concerning the child's future educational attainment and market earnings. In this section, we provide some empirical evidence of the effect of educational expectations on the mother's time allocated to preschool children.

A variable, COLEXP, was constructed on the basis of the answer to the following question in the 1969 wave of the panel: "About how much education do you think the children will have when they stop going to school?" If the parents answered that some or all of their children will go to college, the variable COLEXP was set equal to one. The relative importance of the mother's characteristics is again shown here through a simple regression of COLEXP on the head's and wife's educational attainment. The wife's education was a much stronger indicator of the parents' educational expectations for their children.[55] The variable, COLEXP, and an interaction term between it and the number of children 0–6 was added to our basic regression model. If parents view time inputs as important in influencing the child's future economic and social

well-being, this should be reflected by way of a positive coefficient on the interaction term in the regressions explaining annual hours of housework and a negative coefficient in the market work regressions. The sample was again stratified by head's occupation and grouped into HIGH SES and LOW SES (see Table 4A). The mean value of COLEXP was 0.38 and 0.25 in the two subsamples, respectively. The regression results are found in Table 6.

TABLE 6 Allocation of Time to Housework and Market Work, Married Women, 21–45, by Educational Expectations, 1969

	HIGH SES		LOW SES	
Variable	Housework	Market Work	Housework	Market Work
CHILDREN 0–6	388	−162	118	−125
	(60)	(48)	(36)	(29)
CHILDREN 7–17	102	−13	33	6
	(40)	(32)	(23)	(18)
COLEXP	−159	354	−340	260
	(164)	(133)	(129)	(103)
COLEXP*CHILD 0–6	163	−242	126	−130
	(99)	(180)	(71)	(57)
Constant	1,262	682	1,676	761
	(124)	(100)	(84)	(67)
Number of observations	403	403	858	858
S.E.E.	896	723	1,009	807
R^2	.194	.121	.045	.054

NOTE: For definition of SES strata, see NOTE to Table 4A.

The regression results confirm the hypothesis that we maintained regarding the effect of college expectations held by the parents for their children on the mother's allocation of time to preschoolers. They also, we believe, provide support for the life-cycle model we presented above, in that home investments in children are determined, in part, by a lifetime planning process in which educational expectations play a part. In addition, the work of Harvey Brazer and Martin David[56] has shown that the educational expectations held by parents are an important determinant of the children's subsequent educational attainment, so we again have a link between preschool home investments and investments in formal schooling.[57]

F. Time Inputs and Child Development[58]

In the previous pages, we have presented a considerable amount of evidence on the relationship between family background variables as they are typically measured (e.g., occupation, education, family size, and religion) and preschool time investments in children. We have, in effect, argued that while the usual family background variables do describe the general characteristics of the home environment, they are most importantly an index of preschool home investments made in the children by the parents, and it is this investment which is the important environmental force in influencing the child's subsequent economic and social well-being. In this section, we present some evidence from child psychologists on the effects of parental time on the child's cognitive and affective abilities. Again, we would point out that a lifetime panel of representative individuals is not available to us, so that a direct link between preschool time inputs and subsequent educational attainment and earnings cannot be shown. Nevertheless, we have presented a considerable body of circumstantial evidence of this link and here present a brief review of experimental research on the relationship between parental time and child development.

The traditional view in the child development literature attributed the child's intellectual ability largely to genetic factors. However, recent research has consistently shown the importance of parent-infant interaction as a source of stimulation, emotional satisfaction, and reinforcement for the child.[59] The interaction between parent and child develops within the infant the expectancy that his behavior can affect his environment and this, in turn, motivates the infant to produce and utilize behaviors and skills not reinforced in his past experience.[60] The most dramatic effects resulting from the lack of parental time during the preschool years have been demonstrated among children in grossly deprived circumstances. This research has demonstrated that the infant needs a one-to-one relationship with an adult or he may suffer cognitive and affective loss that may never be recouped.[61] Within the normal range of parent-child interaction, a few studies have shown that the expressive and vocal stimulation and response that the mother gives to the infant affects its development. Of particular interest here is the fact that while attempts to increase cognitive performance through day care programs have not been very successful, increasing the mother-infant interaction in the home does appear to have more enduring positive effects.[62] Arleen Leibowitz, using the longitudinal data on high I.Q. individuals discussed in Section IIIB, has shown that the quantity of time allocated to them as preschool children was a significant determinant of their I.Q. as measured at age eleven. I.Q., in turn, had a significant positive effect on the years of

schooling completed, holding constant several other family economic and demographic characteristics. The work of James Guthrie et al.[63] reviews evidence that suggests that the lack of parental time devoted to the physical care of preschoolers is closely associated with both physical and mental deficiencies and a consequent reduction of the child's ability to succeed in school.

There is no evidence that the time devoted to preschool children must be that of the mother, or that this role is better filled by a male or a female. There is some evidence that the child benefits from predictability in handling, but it is not clear whether different handling has any long-lasting effects. Thus, while our data indicate that it is only the mother's housework time which responds to the presence of preschool children, the evidence from the research of child psychologists suggests that if it were supplied, the father's time could be as important as the mother's in affecting the child's future well-being.

The evidence presented above concerning the importance of the parent-child interaction is not, it should be pointed out, conclusive. The problem of not having comparable groups plagues studies of the effects of the intensity of maternal care on the child's cognitive development. In particular, there are no studies available which have permitted intensity of maternal contact to vary while controlling for other factors (such as maternal personality and amount and type of paternal contact) which might affect the results. Nevertheless, the child development literature does provide some useful and important insights into how environmental factors in the home, as measured by maternal time devoted to children, influence the child's ability to learn.

V. CONCLUSION

In this paper, we have tried to set forth a consistent explanation of the role of family background variables in the earnings functions estimated by economists. These variables have generally been entered in a rather ad hoc manner, with little justification for their inclusion. It is clear, however, that influences of family background, particularly as measured by parental time inputs to the care of children, fit well into the theory of investments of human capital (although our preliminary efforts to integrate these and subsequent investments into a lifetime human capital model can certainly be improved upon). In particular, we have shown here that besides the well-known relation between investments in formal schooling and family of origin variables, investments of time in preschool human capital are also related to these variables (e.g., parental education, occupational status, family size, religion).

Preschool investments in time and goods are, according to the work of child psychologists, associated with a child's ability to learn (as partly indexed by I.Q.). In our interpretation, this ability to learn results in a larger sustainable adult human capital stock as well as more extensive investment of time in learning new skills early in life and over a longer period of one's lifetime. Greater ability to learn is reflected in greater educational attainment and lifetime earnings profiles which are more precipitous and fan out with age (and possibly experience) from those with less investments.

The achievement literature of psychologists implies that parental orientation or *qualitative* aspects of the parent-child interaction are important in developing the child's motivation and ability. The research which we have presented, while not inconsistent with this view, suggests that the *quantity* of time is also important in child development. It would seem that future research ought to be directed toward measurement of both quantity and quality of parental time as it influences child development. In addition, the extent to which variations in quantity and quality of parent-child interaction (per child) influence development *within* a given occupational grouping of the parents should be determined.

It is often alleged that parental social status (or occupation) per se determines subsequent adult status of the child. Yet, we have evidence consistent with the view that parental time makes a difference within occupational grouping of the parents. First, within admittedly broad SES groups, those parents who expect their children to attend college put in more time on these children while they are preschoolers. Second, larger families within the lower SES group put in less time per child. This effect of family size results in lower educational attainment of the children. Although this can be partly rationalized by smaller financial resources per child as well as less time per child, these findings are consistent with the view that time is important. Third, cultural differences as indexed by religion are related to differences in time per child. If the findings of Hause on earnings and education differentials by religious preference are substantiated by further research, this will provide additional support for our hypothesis of home time as an important input to children. Fourth, women who are more educated put in more time with their preschool daughters and this appears to influence the daughters' educational attainment. These results obtain for a given status of the father and suggest that highly educated women succeed in teaching their daughters how to learn even in the case where the husband is of moderate to low educational attainment.

Another aspect of the study of parental time to preschoolers is the potential role it has in effecting inter-generational links in education and income. While parental income allows greater money expenditure on

children (e.g., greater educational quality), inter-generational influences through quantity and quality of time inputs are likely to be important as well. In this regard our finding on time differentials by sex, if substantiated by additional research, is important. Suppose women who are highly educated grew up in homes where they as preschool daughters were "high quality" children and received sizably larger inputs of time than did sons. Then, the fact that these women put in more time on their own daughters suggests that familial patterns of time input to children can be an important source of inter-generational stability in economic capacities. More generally, if inputs by parents are important in influencing lifetime achievement of their children, it is not surprising that in examining demographic behavior a high quality elasticity with respect to family income is observed. If parents adopt the child-rearing practices they themselves experienced and if quality matters for later development then this provides an apparent explanation for the high elasticity.

Our study also suggests that high parental income, by inducing a greater demand for child quality (inputs of time and money), contributes to inter-generational correlation in economic capacities. Consequently, income effects inducing greater child care may be one of the important benefits of income maintenance programs.

NOTES

1. As one example of his argument he cited the following problem posed and answered by a friend: "Suppose a man *born* blind, and now adult, and taught by his *touch* to distinguish between a cube and a sphere [and] . . . suppose then the cube and sphere [to be] placed on the table, and the blind man be made to see: *quaere*, whether *by his sight, before he touched them*, he could now distinguish and tell which is the globe, which the cube? . . . Not. For though he has obtained the experience of how a globe, how a cube affects his touch, yet he has not yet obtained the experience that what affects his touch so or so must affect his sight so or so . . ." (John Locke, *An Essay Concerning Human Understanding* [New York: World Publishing Co., Meridian Books Edition, 1964], pp. 121–122).
2. Adam Smith, *The Wealth of Nations* (New York: Random House, Modern Library Edition, 1937), p. 15.
3. Ibid., p. 161.
4. As Duncan notes: "The presumption is that improvements in knowledge [of the socioeconomic life cycle] will result in modifications and complications of the models" (O. D. Duncan, "Inheritance of Poverty or Inheritance of Race?" in *On Understanding Poverty*, D. P. Moynihan, ed. [New York: Basic Books, 1964]), p. 89.
5. See G. S. Becker, *Human Capital and the Personal Distribution of Income* (Ann Arbor: University of Michigan, 1967).
6. Some work along these lines has been done recently. See Gilbert Ghez and Gary S. Becker, "The Allocation of Time and Goods Over the Life Cycle," processed,

University of Chicago, Apr. 1972; Michael Landsberger and Ury Passy, "Human Capital, Its Shadow Price and Labor Supply," mimeograph series No. 138, Israel Institute of Technology, 1973; Frank Stafford and Paula Stephan, "Labor, Leisure and Training Over the Life Cycle," paper presented at the 1972 Meetings of the Econometric Society (revised November 1973).

7. To introduce time preference or other age-dependent changes in preferences one can specify the general function as $U = U(c, X, t)$.
8. Stafford and Stephan, "Labor, Leisure and Training," p. 12. With a zero interest rate, the shadow value of financial assets, λ_R, is a constant throughout.
9. If parents' home training increases β, this will also motivate an earnings profile which rises dramatically over time.
10. See Paula Stephan, "Life Cycle Training Paths Subsequent to Formal Schooling" (Ph. D. diss., University of Michigan, 1971), pp. 22–24 and 126–127. See also her "Human Capital: A Productive Function with Factor Substitution" (Working Paper No. 7374-17, Department of Economics, Georgia State University, February 1974). Jacob Mincer discusses this issue in *Schooling, Experience, and Earnings* (New York: NBER, 1974), pp. 11–23.
11. Robert J. Willis, "A New Approach to the Economic Theory of Fertility Behavior"; and Gary S. Becker and H. Gregg Lewis, "On the Interaction Between the Quantity and Quality of Children"; both appearing in *Journal of Political Economy* 81 (March/April 1973); Willis, pp. S14–S64; Becker and Lewis, S279–S288.
12. R. Gronau, "The Effect of Children on the Housewife's Value of Time," *Journal of Political Economy* 81 (March/April 1973): S168–S199; and "The Intra-family Allocation of Time: The Value of the Housewife's Time," *American Economic Review* 63 (Sept. 1973): 634–651.
13. Otis Dudley Duncan, "Ability and Achievement," *Eugenics Quarterly* 15 (Mar. 1968), pp. 1–11.
14. Henry Levin has called to our attention one recent sociological study which does report substantial direct influences of parental background (as measured by income) on son's earnings. See William Sewell and Robert Hauser, "Causes and Consequences of Higher Education: Models of the Status Attainment Process," *American Journal of Agricultural Economics* 54 (Dec. 1972): 851–861. They report that son's income ten years subsequent to high school graduation is $93 higher for each $1,000 of parents' income. However, it is well known that richer parents purchase higher quality schooling for their children and we would expect higher earnings for graduates of higher quality school systems (given *years* of schooling).
15. Otis Dudley Duncan, "Ability and Achievement," p. 6.
16. See J. S. Coleman, "Equal Schools or Equal Students," *The Public Interest*, no. 4 (Summer 1966): 70–75.
17. Arthur R. Jensen, "How Much Can We Boost I.Q. and Scholastic Achievement," *Harvard Educational Review* 39 (Winter 1969): 1–123.
18. Jensen, "How Much Can We Boost I.Q.," p. 52.
19. Ibid., p. 97.
20. Ibid., p. 18. This result is consistent with the negative influence of number of siblings on early intelligence reported by Duncan. Also, a recent article by Joe D. Wray ("Population Pressure on Families: Family Size and Child Spacing," in National Academy of Sciences, *Rapid Population Growth* [Baltimore: Johns Hopkins Press, 1971]) demonstrates the influence of family size on children's I.Q.
21. Jensen, "How much Can We Boost I.Q.," pp. 16, 17.
22. Ibid., pp. 13–15.
23. Christopher Jencks et al., *Inequality* (New York: Basic Books, 1972).

24. J. E. Bogen, R. DeZure, W. D. Tenhouten, and J. F. Marsh, "The Other Side of the Brain and the A/P Ratio," *Bulletin of the Los Angeles Neurological Societies* 37 (Apr. 1972): 49–61.
25. Bogen et al., "Other Side of the Brain," p. 50.
26. See Heinz Heckhausen, *The Anatomy of Achievement Motivation* [New York: Academic Press, 1967], pp. 150–162.
27. Samuel Bowles, "Schooling and Inequality from Generation to Generation," *Journal of Political Economy* 80 (May/June 1972): S219–S251. See also his "The 'Inheritance of I.Q.' and the Intergenerational Reproduction of Economic Inequality," *Review of Economics and Statistics* 56 (Feb. 1974): 39–51.
28. Zvi Griliches and William Mason, "Education, Income and Ability," *Journal of Political Economy* 80 (May/June 1972): S74–S103.
29. G. S. Becker, "Comment," *Journal of Political Economy* 80 (May/June 1972): S-253. Also see Sewell and Hauser, "Causes and Consequences," p. 858.
30. E.g., Bowles, "Schooling and Inequality," p. S-235.
31. Father variables but not mother variables are also used in Ritchie H. Reed and Herman P. Miller, "Some Determinants of the Variation in Earnings for College Men," *Journal of Human Resources* 5 (Spring 1970): 177–190.
32. See John C. Hause, "Ability and Schooling as Determinants of Lifetime Earnings or If You're So Smart, Why Aren't You Rich?" *American Economic Review* 61 (May 1971): 289–298. See also John C. Hause, "Earnings Profile: Ability and Schooling," *Journal of Political Economy* 80 (May/June 1972): S108–S136. Taubman and Wales, using some of the same data which Hause used, found that with an alternate measure of ability the interaction between ability and subsequent earnings was weakened considerably. They do comment that "ability initially has little effect on earnings but that over time the effect grows, and perhaps grows more rapidly for those with graduate training and high ability." See Paul Taubman and Terence J. Wales, "Higher Education, Mental Ability and Screening," *Journal of Political Economy* 81 (Jan./Feb. 1973): 28–55.
33. Hause, "Earnings Profile," pp. S134–S137. See also Daniel C. Rogers, "Private Rates to Return to Education: A Case Study," *Yale Economic Essays* 9 (Spring 1969): 89–134.
34. Arleen Leibowitz, "Home Investments in Children," *Journal of Political Economy* 82 (Mar./Apr. 1974): S111–S131.
35. Richard Morgenstern, "Direct and Indirect Effects on Earnings of Socioeconomic Background," *Review of Economics and Statistics* 55 (May 1973): 225–233.
36. See George E. Johnson and Frank P. Stafford, "Lifetime Earnings in a Professional Labor Market: Academic Economists," *Journal of Political Economy* 82 (May/June 1974): 549–569, for the influence of graduate school "quality"/personal "ability" on lifetime earnings.
37. See "Allocation of Time to Preschool Children and Educational Opportunity," *Journal of Human Resources* 9 (Summer 1974): 324–341, and "Time Inputs to Children," in J. N. Morgan, ed., *5000 American Families—Patterns of Economic Progress*, Vol. II (Ann Arbor: Institute of Social Research, 1974).
38. Our initial efforts were with the *Productive Americans* data from 1964 (*Productive Americans*, James N. Morgan et al., Survey Research Center Monograph No. 43 [Ann Arbor: Institute for Social Research, 1966]) and more recently with the OEO panel data from 1969. The results from these two data sets are compared in Hill and Stafford, "Time Inputs to Children."
39. Due to the tendency of people of similar characteristics (education, for example) to marry (G. S. Becker, "A Theory of Marriage: Part I," *Journal of Political Economy* 81

[July/Aug. 1973]: 813–846) the errors involved in using the father's characteristics alone are probably not large. However, it is clear that especially in the case of status discrepancy between the husband and wife (see W. H. Sewell and V. P. Shah, "Parents' Education and Children's Educational Aspirations and Achievement," *American Sociological Review* 33 [Apr. 1968]: 191–209) and in several more general instances discussed below, the characteristics of the mother have an independent effect on the child's educational attainment and earnings.

40. In our regressions we present only one or two independent variables at a time. In principle, we have run one large regression with all independent variables but we chose to look at one or two for the purpose of more simply describing the level of time inputs as a function of the particular independent variables.
41. A Chow test was performed to test for equality of regression slopes between the high- and low-status groups. The null hypothesis of status equality was rejected at the one percent level with an $F = 5.88$.
42. See Gronau, "The Effect of Children," and "The Intra-family Allocation of Time."
43. See, e.g., Ronald Oaxaca, "Sex Discrimination in Wages," in *Discrimination in Labor Markets*, A. Rees and O. Ashenfelter, eds. [Princeton: Princeton University Press, 1973].
44. Using a one-tailed test at the 0.05 level, the estimated difference between the coefficients of DAUGHTERS 0–6 and SONS 0–6 is significantly *greater* than zero for LOHI ($t = 1.98$) and HIHI ($t = 1.53$) and significantly *less* than zero for LOLO ($t = 1.64$). The null hypothesis that the coefficients are equal could not be rejected for HILO ($t = 0.82$). The existence of substantial differences in inputs across children (by sex) is not consistent with the Willis and Becker/Lewis quality models in Section IIB, which assume constant quality for each child. This was pointed out to us by Dennis DeTray.
45. G. Duncan, "Educational Attainment," in *5000 American Families—Patterns of Economic Progress*, J. N. Morgan, ed. [Ann Arbor: Institute of Social Research, 1974]. See p. 321 (Table 7-2) of Volume I.
46. Sewell and Shaw, "Parents' Education."
47. See, e.g., O. D. Duncan, "Inheritance of Poverty" and "Ability and Achievement," and S. Bowles, "Schooling and Inequality."
48. It has been shown that I.Q. is related to birth order, with earlier parities scoring higher on standard I.Q. tests. That this reflects more than the obvious fact that firstborns are also more likely to be in small families can be seen in Lillian Belmont and Francis A. Morolla, "Birth Order, Family Size, and Intelligence," *Science* 182 (Dec. 1973): 1096–1100.
49. The lowered "quality" per child as number of children increases in low-income families is not consistent with the assumed constant quality level across children in the Willis and Becker/Lewis models.
50. Johnson and Stafford, "Social Returns to Quantity and Quality of Schooling," *Journal of Human Resources* 8 (Spring 1973): 139–155.
51. The variables are defined as follows: EXP = per pupil educational expenditure by region of origin, AGE = age of respondent in 1964, GRURB = dummy variable if grew up in an urban area, OLDBR = number of older brothers and sisters. Numbers in parentheses are standard errors. For additional details, see Johnson and Stafford, "Social Returns" (pp. 142–147).
52. Belmont and Marolla in "Birth Order" demonstrate that larger family size results in a lower I.Q. but that this family-size effect is attenuated for nonmanual workers and is greater for manual workers.

53. A separate analysis of Jewish families was undertaken but the sample size was too small (N = 33) to provide meaningful estimates of the parameters.
54. Hause, "Earnings Profile." However, he shows an effect of religion beyond the influence of years of schooling. To be fully consistent with our view, the time input should have an influence on years of schooling attained as well.
55. The estimated regression is as follows

$$\underset{}{\text{COLEXP}} = \underset{(.058)}{-.101} + \underset{(.006)}{.024}\ \text{EDW} + \underset{(.004)}{.009}\ \text{EDH}$$

with $R^2 = .039$ and S.E.E. = .443 and where EDW (EDH) is the educational attainment of the wife (head). The hypothesis that the coefficient of EDW is greater than that of EDH could not be rejected at the 1 percent level ($t = 3.06$).
56. "Social and Economic Determinants of the Demand for Education," in *Economics of Higher Education*, S. Mushkin, ed. [Washington, D.C.: Government Printing Office, 1962].
57. It should be noted that college expectations in the *absence* of preschool children induces a reallocation of time away from housework and into the labor market. This is consistent with research on how families pay for college. See John B. Lansing, Thomas Lorimer and Chikashi Moriguchi, *How People Pay for College* [Ann Arbor: Survey Research Center, 1960].
58. The authors are indebted to Lois W. Hoffman of the University of Michigan's Department of Psychology for her help in guiding us through the child development literature.
59. In some work currently under way at Stanford University, Eleanor Maccoby and Carol Jacklin are attempting to assess the relation between hormonal balance, early physical and emotional interaction, and subsequent development through a panel study of children starting at infancy. There is some evidence that direct physical contact with infants alters the hormonal balance and influences development.
60. M. Lewis and S. Goldberg, "Perceptual-Cognitive Development in Infancy: A Generalized Expectancy Model as a Function of the Mother-Infant Interaction," *Merrill-Palmer Quarterly* 15 (Jan. 1969): 81–100.
61. L. J. Yarrow, "Separation from Parents During Early Childhood," in *Review of Child Development Research*, M. L. Hoffman and L. W. Hoffman, eds. [New York: Russell Sage Foundation, 1964].
62. P. Levenstein, "Cognitive Growth in Preschoolers through Verbal Interaction with Mothers," *American Journal of Orthopsychiatry* 40 (Apr. 1970): 426–432.
63. *Schools and Inequality* [Cambridge: Massachusetts Institute of Technology Press, 1971], pp. 140–144.

13 COMMENTS

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I. INTRODUCTION

Hill and Stafford devote half of their paper to a conceptual mapping of the link from family background to individual lifetime earnings. That this link appears to be long, indirect, and intricate may surprise some who view income as a largely inherited characteristic. This is not to say that genetic and economic inheritance is unimportant, but the view of earnings as a rental on the human capital stock does shift the focus of attention from direct transfers to parental efforts toward accumulation of the human capital stock of their children. This leads to research questions about (1) the nature and scope of parental efforts, (2) the productivity of these efforts in adding to the human capital stock of children, and (3) the relative importance of parental contributions in the ultimate level of the capital stock achieved by the children.

The empirical work reported by Hill and Stafford relates to the first research question, and only to a partial measure of parental efforts, namely the *time* aspect of parental inputs in early child development. On the second question, the effects of these inputs, the authors cite fragmentary evidence related to educational attainment of children. The last step, the ultimate connection with lifetime earnings, is not attempted at all. So, the itinerary charted in the first half of the paper is traversed only a small part of the way, but this is not for lack of imagination or courage. The problem is that available data fade out long before the destination is in sight.

Even if short, I find this excursion into a large and ramified subject very interesting, not only in the negative sense of highlighting the need for kinds of data economists rarely dream about, but also positively in terms of the findings, particularly as they complement the authors' previous findings and those of other explorers who are very much on the same trail.

II. FINDINGS ON PARENTAL TIME INPUTS

Hill and Stafford visualize the early production function of a child's human capital as consisting of three inputs: the genetic endowment of the child, parental contributions of market goods, and parental inputs of their own time. Their research is confined to the estimation of parental time inputs, and of their relation to parental characteristics. No attempt is made to study the other inputs and the relations among them.

It is worth noting, at this point, that interest in the mere quantity of time, which Hill and Stafford focus on, was originally provoked by observations of labor force

data. These showed not only that mothers of preschool children withdraw from the labor market, but that the more educated mothers tend to withdraw from market work to a greater extent than less educated mothers, despite their higher market wage rates and, on average, stronger lifetime attachment to the labor force. Here was a tip of an iceberg that appeared to promise a cluster of riches below the surface; such as: insights into fertility behavior, especially its quantity-quality tradeoff or interaction, and human capital transfers within the family, particularly from mothers to children, with implications for the earnings of each.

In her 1972 Columbia doctoral dissertation Arleen Leibowitz has drawn the attention of economists to these facts and promises. The intimation of measurability of opportunity costs of child care and of their relation to parental characteristics opened the door to (a) a better understanding of the role of forgone market experience in the earnings functions of women, and (b) to an enrichment of the human capital earnings function by the inclusion of "home investments," along with schooling and postschool investments, as determinants of earning capacity. However, for such research leads to be taken seriously, it is first necessary to ascertain whether the time patterns suggested by the labor force data do, indeed, reflect child care activities in the household. This is where Hill and Stafford come in.

In the present paper, they report results of an analysis of the Office of Economic Opportunity (OEO) Panel Study of Income Dynamics, which replicates and extends their previous work on the *Productive Americans* data. Both the 1964 (*Productive Americans*) and the 1969 (OEO Panel) surveys provide reports by parents of hours of housework and of market work during the preceding year. Reports from close to a thousand husband-wife families were studied in each survey. In both Hill and Stafford studies, the method of estimating time parents devoted to their children was indirect: a regression of hours of housework on the number of children in particular age intervals yielded coefficients which represent the increment to housework associated with the presence of a child of specified age. This coefficient was interpreted as child care time.

In the 1964, but not the 1969, study the same analysis was performed for market time as well as for housework time. Also father's housework was studied in addition to that of the mother.

In terms of the regression coefficients of housework time, in 1964 fathers apparently contributed very little time to preschool children, so they were evidently not worthy of attention in the 1969 study. Related work (by H. Ofek and J. Smith) showed that fathers' market work actually increases when there are preschool children in the household, as mothers' market earnings diminish or vanish—an example of intrafamily substitution in the household production function.

I shall return to the matter of father's time and market time of mothers after reviewing the findings in the present paper in which the authors report only on housework time of mothers.

Very briefly, the findings—as interpreted from the regression coefficients—are:

1. Maternal child-care time devoted to a preschool child amounts to several hundred hours per year.
2. The amount of time devoted per child by mothers is almost twice as large in families with professional and college educated parents than in other families. Time inputs into *preschool* children are larger by similar amounts when either the father's or the mother's education increases. However, and this is something the authors did not note: for school-age children (age 7–17) time inputs increase with mother's, but not with father's, education (Table 2).
3. The panel feature of the OEO data makes possible an attempt to verify the inferences from cross sections in observing changes over time in the same families. It appears that in families who did not have children (age $\leqq 2$) in 1969 but had them in 1971, mothers increased their housework by amounts comparable to those observed in the cross section. Also, the differences by occupational status of fathers are comparable. The new finding here is that presence of older children reduces housework of mothers at the lowest socioeconomic levels, but not elsewhere (Table 2).
4. Child care time declines as the child ages, but significant time inputs continue to be provided to school-age children of more educated parents, particularly of more educated mothers—as noted before (point 2).
5. Child care time is less per child in families with more children—mainly at the lower, not the higher, socioeconomic levels.
6. At given levels of father's education, more educated mothers devote more time to preschool daughters. While for given levels of mother's education, more time is devoted to preschool sons (by mothers always) as father's education rises.

III. DISCUSSION OF RESULTS AND OF SOME COMPARATIVE FINDINGS

Now, how do the estimates of incremental housework time compare with differentials in market work associated with the presence of children? As already noted, in the 1964 study, Hill and Stafford ran regressions of mothers' time in market work in addition to the housework time regressions. It appeared that mothers' market time reductions associated with additional children paralleled the estimates of additional housework time by socioeconomic status of parents and by age of children, but no findings were shown for numbers of siblings or sexes of children. Also, the reduction of market work time was, on average, half the size of the increase in housework, with greater reductions in market work at higher socioeconomic level per unit increase in housework time.

If these findings are reliable, they encourage research based on market work statistics which are much more abundant than time budgets. They suggest, however, that reliance on market work data would lead to an underestimate of time inputs to children. Regrettably, Hill and Stafford do not replicate or do not

show the market time regressions in the present paper, particularly with respect to their more provocative findings on effects of sexes and number of children.

There are, of course, problems with the meaning of the indirect measures of child care time, as the authors surely realize but do not spell out in the present paper. To list a few:

1. Any time not reported as housework, but spent with children in joint consumption or leisure activities, is left out. Clearly, both estimates of time inputs and of opportunity costs would change if joint consumption time were included, as it ought to be.
2. Substitution of child care for other categories of housework is likely to impart a downward bias to the regression estimates of time inputs to children. On the other hand, housing space and "household production" surely increase concurrently with the number of children as income grows in the life cycle, particularly in the middle and upper socioeconomic strata families. This imparts an upward bias to the coefficients, and may account for the attenuation of the negative effect of siblings on child care time which Hill and Stafford observe in the more affluent families.
3. The quality of familial interactions obviously cannot be gauged by the quantitative measures alone. If they could, the implication would be that fathers could be replaced by money disbursing agencies. Perhaps this is happening, and the nature or absence of effects is a testable hypothesis. But, even in quantitative terms, part of the problem with the Hill and Stafford data is that they tend to emphasize physical care of children and largely leave out the recreational, social, and educational interactions, in which both parents tend to participate.

Indeed, this distinction is observed by Arleen Leibowitz, who analyzed the details of child care more directly in time budgets collected from over 1,000 Syracuse, New York, families by Kathryn Walker at Cornell. Leibowitz calculated time per day devoted to physical and "other" child care—the latter defined as time spent with parents in social and educational activities. Her estimates translated to an annual basis show roughly similar orders of magnitude as those of Hill and Stafford, but the differences by education of mother seem much smaller. Those differences are more pronounced in "other care" than in physical care. Incidentally, Leibowitz finds that fathers, while contributing little (about 10 percent of total) to physical care, contribute as much as 30 percent of total time to "other" child care. Both high- and low-education groups spend decreasing amounts of time as children age, but the lesser decline in higher education groups found by Hill and Stafford is not clearly confirmed in the Syracuse data. The other findings of Hill and Stafford were not replicated as shown.

IV. INFERENCES AND CONJECTURES

Having learned something about parental time allocation to children, we must still relate these inputs to the output, from which the significance of the inputs

presumably derives. Returning to the production function and assuming we can define the output, we must hold the other inputs fixed to observe the effects of parental time in increasing the early human capital of children. If the other factors, genetic endowment, parental money expenditures, and the quality of time inputs are ignored, we must be assuming that the observed time inputs are positively correlated with the others, or dominating their effects, so as to constitute an index of scale of production.

Actually, Hill and Stafford show no direct relation between parental time inputs and measures of child's development or achievement. Some evidence to that effect was shown by Arleen Leibowitz in the very special Terman sample in a simplified recursive scheme. Briefly, she found that (1) parental time inputs as well as education of the mother affected the child's I.Q. measure, (2) once I.Q. and both parental educations are taken into account, the time-input measures have no further effect on educational attainment of the child, and (3) once education and experience of the adult son or daughter are taken into account, none of the parental variables are of much consequence in affecting earnings.

The evidence which Hill and Stafford cite on the relation between family background variables and educational attainment of children is indirect. It utilizes the positive correlation they found between time inputs and education of each of the parents. But since parental education variables represent factors such as income and quality of child care, it is difficult to read their effects as being primarily reflections of time inputs, since these other things are factors of production in their own right.

Nevertheless, Hill and Stafford are right to emphasize that since mothers spend more time in child care than fathers, the traditional focus on father's socioeconomic level in analyses of family background effects on education should be broadened to include the characteristics of the mother. Indeed, effects of mother's education tend to be more pronounced than that of father's in several studies which hold family income constant. On the other hand, the evidence on differences in these effects by sex of children or by number is quite tenuous.

Other studies, and especially a recent one by Rosenzweig based on state urban populations, contradict the notion of a stronger effect of mother's education on the educational attainment of daughters than of sons. And the Population Council survey by Wray on the effects of numbers of siblings on various measures of child quality (such as health and I.Q.) does not exempt the upper socioeconomic levels from the observed negative correlations.

In sum, the findings are, as yet, fragile, and the power of statistical evidence tends to diminish as we try to move along the progression of links between family background and lifetime earnings. All the more should the efforts of Hill, Stafford, and Leibowitz be encouraged, especially by economists. Their work makes a strong case for an economic analysis of the role of family in the formation of economic capacities of children. It also lays the groundwork for an economic analysis of social mobility, an important aspect of income distribution, and a problem on which, thus far, only some light of sociologists and much heat of ideologues has been brought to bear.

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