3.0 PRODUCTION THEORY

This chapter deals with the concepts of income which play a role in the analysis of production by household members. In Chapter 1 it was pointed out that decisions regarding labor supply are one of the prime determinants of the size of the budget (income) constraint which the household faces in making its consumption decisions. The thrust of modern work has been to explain the determinants of the time allocation decision. In so doing, the income constraint is removed. Households can, within limits, determine their income. The ultimate resource constraint which they face in making this decision involves the time and talents of household members.

A basic theme of much of the modern work has been the integration of several different aspects of household behavior within a single conceptual model. Thus decisions regarding labor supply, educational attainment, fertility (family size), and home activities are explained jointly. This makes more difficult the structuring of the discussion of these questions within the sequential framework of this chapter. The approach which will be followed examines first the income concepts which play a role in the explanation of the supply of labor. In Section 3.2, demand factors which affect earnings are considered. Important among these is racial and sexual discrimination. Section 3.3 deals with the impact of education on earnings. Section 3.4 examines the growing literature dealing with home production.. The final section reviews the role of these concepts in the economic theory of fertility.

The key income concept in the analysis of production is earnings (the items which are included in earnings are shown in Table 3.1). Earnings account for approximately seventy-five percent of income from production. Earnings depend on (1) the education, experience, and ability of the worker, which together with demand factors (Section 3.2) determine the wage rate which he/she can command, and (2) the worker's decision as to the number of hours of labor they choose to supply. Educational attainment also represents a decision by the worker, based on his/her' expectations regarding the return to an investment of time and money in education (Section 3.3). Experience, of course, will depend on past decisions regarding labor supply, as well as the time required to complete one's education. Labor supply (Section 3.1) will depend on the wage available, as well as the competing claims of nonmarket

TABLE 3-1

EARNINGS
UNIT OF ANALYSIS: INDIVIDUAL
ACCOUNTING PERIOD: SHORT TERM (MONTHLY)

INCOME

A. Labor Income

A.1 Civilian Wages
A.2 Civilian Salaries
A.3 Tips and Gratuities
A.7 Active Military Pay-Nonhazardous Duty
A.0 Active Military Pay-Hazardous Duty
A.9 Military Reserve Pay
A.10 Insurance Provided by Employer
A.11 Employer Contributions to Pension Plan
A.12 Earnings Paid in Kind
A.13 Value of Bargain Purchases from Employer

B. Business Income

B.1 Net Income from Business Proprietorship
B.2 Net Income from Business Partnership
B.3 Net Income from Farm Proprietorship
B.4 Net Income from Farm Partnership

C. Property Income

None

D. Public Cash Transfer Payments

None

E. Public In-kind Transfers

None

F. Private Transfers in Cash and In Kind

None

EXPENDITURES

None

ASSETS AND LIABILITIES

None

activities on the individual's available time. Chief among these competing uses are home production (Section 3.4) and child bearing and child raising (Section 3.5).

Not all economists accept the validity of the model of production behavior presented above. Each section will begin by presenting the arguments of supporters of the integrated model. Following this, the criticisms and alternative hypotheses which have been brought to bear against the model will be discussed.

3.1 Labor Supply

Earnings are the product of the individual's wage rate and hours of labor supplied. This section examines the latter factor, and the income concept(s) which play a role in its determination. Robbins (1930) laid out the essential details of the theory of labor supply. Given the individual's basic preference set between leisure and goods, and the wage rate he/she can command, there will exist an optimal amount of labor to supply and a consequent amount of leisure to *enjoy*. The impact of an increase in the wage rate *is* twofold: (1) it increases the amount of goods which an hour of labor will provide, thus inducing a substitution of goods for leisure (the substitution effect); and (2) it increases total income, which may lead to a desire to increase leisure, if the income elasticity of leisure is positive (i.e., if leisure is a normal good). Thus the net effect of a change in the wage rate on labor supplied is indeterminate theoretically.

Mincer (1963a, 1963b) examined the labor force participation of married women. His findings suggest that the substitution effect is dominant for this important group of workers.

In a massive study of labor force participation, Bowen and Finegan (1969) present findings on the determinants of participation for adult males and females, teenagers and the older working population. Their discussion of the theoretical concepts which underlie their empirical findings is unusually detailed and bears quotation. They point out that the ultimate resource constraint is the total time of each household member. The expected market "earnings" rate is defined thus:

> This term must be understood to encompass the working condi.ons associated with various possible jobs, as well as the accompanying set of money wage rates and fringe benefits. The relevant earnings concept is of course net of all expenses associated with the earning of the income, including taxes and the money, time, and psychic costs of finding employment. It is an "expected" earnings concept in that there is inevitably some probability of error associated with the earning forecast. (Bowen and Finegan, 1969, p. 17)

And later, "The total *resource* constraint . . . is a function of (1) total number of hours to be allocated, (2) the set of prospective earnings rates, (3) whatever other income the household expects to receive, and the monetary value of the household's saleable assets." (p. 18) One recognizes here one statement of an important new income concept -- potential (or full) income.

Potential Income

It has long been recognized that *to* attempt to explain labor supply by income represents a serious empirical problem of simultaneity, since the higher the labor hours supplied, the higher are earnings and therefore income. One solution, to ignore earnings and use only unearned income, is commonly adopted (Boskin, 1973). *However,* when one recognizes that unearned income is derived from (1) property income (which is dependent on wealth, age, and life cycle status), (2) pensions (which depend on age and prior work experience, and (3) transfers (which depend on age and current and past earnings), it is clear that no component of income is unaffected by labor supply decisions.

Hence, a group of labor theorists (beginning *with* Theodore W. Schultz (1960, 1961), Jacob Mincer (1962), and Gary Becker (1965), but *now* grown to include many students and converts) began an effort to define an income concept that satisfactorily met the objections raised against commonly used definitions of income. Their work has led to a consensus, that for certain analytic purposes the definition of income should be invariant with respect to decisions regarding labor supply, fertility, and even education (in some contexts).

The potential income measure may be defined as the future stream of actual or imputed income available to an individual were he/she to devote all available time to pursuing the activities in which his or her time has the

highest valued use, plus the income received from inherited wealth. Permanent potential income would then be the income in perpetuity which could be derived from the wealth equivalent to the present discounted value of this future stream.

Table 3-2 displays the income components included in potential income. The theoretical assumption of perfect foresight, coupled with the lifetime accounting period, requires that data be collected not only on current sources of income but on future sources of income which the unit may expect to receive. Establishing the appropriate set of wage rates to use involving the time of unit members may require data on earnings and work expenses for those currently employed; for others, data on previous employment, education and work experience have been used to compute a wage rate.

Nonearned income sources include not only transfer income currently received, but the present value equivalent to retirement benefit and other deferred compensation expected later. This includes social security and veteran's payments as well as pensions.

A related concept, discussed in more detail in Section 3.3, is human capital. This is the present discounted value of the flow of future earnings available to the individual, should he/she devote all free time to market activity. The exploration of the concept of potential income and human capital has dominated the labor literature in the 1960s and 1970s.

Operationalizing the concept of potential income requires several items of data. The exact method differ; among researchers. For instance, Bowen and Finegan (1969) include the value of time as noted above, plus income from assets, gifts, inheritances, pensions and welfare payments. Hall (1973) distinguishes his concept of "whole income" from the full income concept of Becker (1965) by including the value of only 2,000 hours of annual work (a 40 hour workweek times. 50 weeks). Becker would utilize total available time (168 hours per week or 8,736 hours per year) in operationalizing his full income concept. The obvious impact of the latter is to increase the value of time from human capital relative to the returns from physical capital or the contribution of transfers.

Additional research on labor supply has followed the lead set by Mincer and Becker. Sweet (1973) finds that the participation rate of women increases

TABLE 3-2

POTENTIAL INCOME
UNIT OF ANALYSIS: INDIVIDUAL OR ADULT UNIT (FN L)
ACCOUNTING PERIOD: LIFETIME

INCOME

A.	**Labor Income**
A.1	Civilian Wages
A.2	Civilian Salaries
A.3	Tips and Gratuities
A.4	Honoraria and Awards
A.5	Sick Pay
A.6	WIN Payments
A.7	Active Military Pay--Nonhazardous Duty
A.8	Active Military Pay--Hazardous Duty
A.9	Military Reserve Pay
A.10	Insurance Provided by Employer
A.11	Employer Contributions to Pension Plan
A.12	Earnings Paid in Hind
A.13	Value of Bargain Purchases from Employer
A.14	Imputed Income from Home Activity
A.15	Imputed Income While Attending School
A.16	Value of Leisure Time
B.	Business Income
B.l	Net Income from Business Proprietorship
8.2	Net Income from Business Partnership
B.3	Net Income from Farm Proprietorship
B.4	Net Income from Farm Partnership
B.5	Value of Food *Produced* and Consumed by Owner of Farm
B.6	Gambling Winnings or Losses
C.	Property Income
C.1	Interest
C.2	Dividends
C.3	Net Income from Rental Property
C.4	Royalties
C.5	Realized Capital Gains or Losses
C.6	Unrealized Capital Gains or Losses
C.7	Imputed Rent on Owner-Occupied Home
C.8	Imputed Service Value of Durable Goods
C.9	Receipts from Private Pension Plan
C.10	Receipts from Public Pension Plan

[1] Authorities differ--Becker (1968) argues for the household while Mincer (1974) would use the individual.

D. Public Cash Transfer Payments

D.1 Social Security Retirement Benefits
D.2 Social Security Disability Benefits
D.3 Social Security Survivor's Benefits
D.4 Railroad Retirement Benefits
D.5 Unemployment Benefits
D.6 Workmen's Compensation Payments
D.7 Veteran's Disability Pension--Service Connected
D.8 Veteran's Disability Pension--Nonservice Connected
D.9 Pension for Survivors of Veterans
D.10 Veteran's Educational Benefits
D.11 Aid to Families with Dependent Children
D.12 Supplemental Security Income
D.13 General Assistance
D.14 Other Public Assistance

E. Public In-kind Transfers

E.1 Bonus Value of Food Stamps
E.2 School Meal Subsidy
E.3 Medicare Benefits
E.4 Medicaid Benefits
E.5 Medical Care Provided by Veterans Administration
E.6 Public Housing Subsidy
E.7 Assistance to Homeowners (Section 235 and 502)
E.8 Assistance to Renters (Section 8.101.236.515)
E.9 *Subsidy from* Public Higher Education
E.10 Scholarships and Fellowships

F. Private Transfers in Cash and in Rind

F.1 Alimony and Child Support Receipts
F.2 Gifts
F.3 Bequests
F.4 Damages (Net of Associated Costs)
F.5 Scholarships and Fellowships
F.6 Training Provided by Employer
F.7 Prizes and Awards
F.8 Support Provided by Others
F.9' Proceeds from Life Insurance

EXPENDITURES (FN 2)

G.1 Commuting Cost
6.2 Child Care--Within the Home
G.3 Child Care--Outside the Home
G.4 Union Dues
G.5 Dues to Professional Organizations
G.6 Clothing and Tools Required in Work

[2] Work-related expenditures should be deducted from gross earnings to compute the net wage.

G.7 Educational Expenses
G.14 Federal Income Taxes
G.15 F.I.C.A. Taxes
G.16 State Income Taxes
G.17 Local Wage or Income Taxes
G.20 Moving Expenses
G.23 Alimony and Child support Payments
G.24 Casualty Losses

ASSETS AND LIABILITIES

None

with the age of the youngest child (up to age 12-13). Stafford and Cohen (1974) examine the relationship of wage and work effort on the supply of productive labor over the working day. More recently, Bell (1974) has examined the causes of differential labor force participation of black and white women. Rosen (1976) has pointed out that the wage variable for married women must be adjusted for the marginal tax rate imposed on her earnings because of her husband's and other family income. Gregory and Thomas (1977) have found that attitudes toward women working play as important a role as children in the determination of participation. A review of recent studies in this area is found in Lewis (1975).

3.2 Demand Factors

In contrast to the work on labor supply, labor demand analysis has been somewhat static in recent years. What new theories have emerged have not impacted income concepts to a significant degree. A major focus for work has been the impact of discrimination on wages and occupational choices. Discrimination impacts the concept of income by creating a difference between the earnings a worker might receive in the absence of discrimination and their actual earnings. This difference may be positive or negative. For those subect to discrimination, the difference is the individual cost of discrimination.[1] Workers not subject to discrimination may receive psychic benefits from avoiding contact with the former group. In addition, they may receive real benefit in the form of higher earnings for the restriction of entry to others.

Lewis (1963) presents the empirical evidence on the impact of unionism on the relative wage structure of the United States. Doeringer and Piore (1971) have challenged the neoclassical theory of perfectly competitive labor markets by discussing the "internal labor market." In their view, the equality of wage and marginal productivity of labor holds true, if at all, only for groups of workers within the firm. Thus access to the internal labor market will normally grant consequent promotion and wage increase which accrue to the group. Above and below average performance cannot be easily detected

[1] This differs from the social cost of discrimination, the loss of output resulting from a misallocation of human resources.

and rewarded or penalized. This may be construed as a theory of discrimination in favor of existing employees and against potential hirees.

Studies of discrimination have more typically focused on the effect on minorities and women. Becker (1957/1971) presents a theory of discrimination. He points out that discrimination may not represent solely the influence of an employer. A desire to discriminate on the part of other employees or of customers may make it in the economic interest of the employer to discriminate. Net income is defined by him as the sum of money earnings and psychic costs associated with integration. Chiswick (1973) tests the theory advanced by Becker and finds that the variance in earnings within skill classes is positively related to the fraction of nonwhites in the class.

Arrow (1973a) notes that if discrimination takes the form of restricting entry to certain occupations and forcing workers subject to discrimination to seek other occupations, wage rates will be driven downward in'the latter occupations. The quantitative impact of discrimination will depend on the degree to which there is a mismatch between the supply of available jobs and the distribution of the population between racial groups, as well as the distribution of abilities within each group.

Additional studies on the causes and effects of discrimination include studies by Welch (1973a, 1973b), Bergman (1974), and Masters (1975) which deal with racial discrimination, and that of Oaxaca (1973) on sex discrimination.

3.3 Education and Earnings

An important concept which elaborates on the basic life-cycle model is the theory of human capital accumulation through education and work experience.[1] Basically, the theory hypothesizes that individual's incomes are (1) concentrated during the working years only, and (2) governed by a rising secular trend during this period (the wage-earning profile). The higher the level of education and earning potential, the greater is the slope of the profile. During the early years of working life, and especially during the prior

[1] See T. Schultz (1971).

period of training, debt is incurred in order to sustain consumption levels' above current income; in the later working years, this debt is retired and wealth is accumulated sufficient to provide an annuity for the retirement period.

Treating accumulated knowledge and skill as human capital is important to the concept of income in several respects. First, it rationalizes the education31 process as an investment outlay (considering both direct costs and foregone earnings as the relevant investment cost). Second, it demonstrates that the accumulation of financial wealth over one's lifetime is, to some extent, balanced by the liquidation of the stock of human capital. Third, it explains why the distribution of income is so much closer to equality than is the distribution of financial wealth. Human capital is distributed more equitably than is physical capital.

Concern with the impact of education on earnings stems primarily from the role of differences in educational attainment in explaining inequality of earnings.[1] Early research on income distribution focused on the functional distribution of income (wages,' profits, rents). In Ricardo's time (1819/1951), these sources of income were identifiable with distinct social classes:

> The produce of the earth--all that is derived from its surface by the united application of labour, machinery, and capital, is divided among three classes of the community; namely, the proprietor of the land, the owner of the stock or capital necessary for its cultivation; and the laborers by whose industry it is cultivated. (Ricardo, 1819, vol. i, p. 5)

Thus it also served to explain the personal distribution of income. In the modern developed economy, this distinction is no longer of much value for the latter analytic purpose. Variance of labor income can be attributed in part to different "advantages and disadvantages of work" (Smith, 1776/1970) and different attitudes toward risk (Friedman, 1953)'. However, the primary determinant is the differential cost of training *for* different occupations (Mincer, 1957 and 1958). Mincer points out that if individuals act rationally in choosing an additional year of schooling, the present discounted value of the increment in earnings which that schooling provides must equal

[1] This section benefits from the survey article by Mincer (1970) which describes research on the distribution of labor incomes. The article is a valuable exposition of Mincer's and others' work, which admirably lays out the state of economic knowledge on this question at the time it was written.

the earning which the individual could have otherwise earned during the year (the opportunity cost of the year of education) plus the pecuniary cost of education.[1] This relationship may be simplified to

$$\ln \text{ Earnings} = \text{Constant} + r \text{ Years of Schooling}$$

That is, the logarithm of earnings is a linear function of years of schooling. This relationship is consistent with the empirical evidence that earnings distribution is more highly skewed than is the distribution Of educational attainment. It also predicts that variance in earnings will be higher, the higher the variance in educational attainment and the higher the rate of return(r) to education. Becker (1962 and 1964) extends the model to include post schooling investments in additional training, and makes the distinction between gross earnings (which include current investments in human capital) and net earnings (which exclude the value of time and money invested in human capital).

Table 3-3 presents Mincer's net earnings concept. From gross earnings paid in cash on in-kind (A.10A.13 on the table) or net business income (B.1-B.5) must be subtracted not only the ordinary costs of work (G.1-G.6) and taxes (G.14-G.17), but educational expenses (G.7) incurred to maintain or improve one's human capital. If moving is undertaken to improve one's wages, those costs (G.20) should also be deducted. The value of on-the-job training (F.6) should be added to earnings.

In discussing his empirical work, Mincer (1958) says:

> For defining units of income and income recipients, it is clear that earnings rather than total incomes and persons rather than families correspond to the theoretical concepts. It is also desirable to restrict the income recipients to persons between the ages of twenty-five and sixty-five years, so as to include all training groups after most have entered the labor force and before a sizeable number have retired. (p. 292)

> when incomes other than earnings are considered the positive 'association of property incomes with occupational level and age magnifies income differences in a way which is likely to accentuate the empirical regularities implied by the training factor alone. (p. 302)

[1] See Miller and Horseth (1967) for tabulations of the present value of lifetime earnings.

TABLE 3-3

NET EARNINGS (MINCER'S CONCEPT)
UNIT OF ANALYSIS: INDIVIDUAL
ACCOUNTING PERIOD: CURRENT (ANNUAL)

INCOME

A. Labor Income

A.1 Civilian Wages
A.2 Civilian Salaries
A.3 Tips and Gratuities
A.7 Active Military Pay--Nonhazardous Duty
A.8 Active Military Pay--Hazardous Duty
A.9 Military Reserve Pay
A.10 Insurance Provided by Employer
A.11 Employer Contributions to Pension Plan
A.12 Earnings Paid in Kind
A.13 Value of Bargain Purchases from Employer

B. Business Income

B.l Net Income from Business Proprietorship
B.2 Net Income from Business Partnership
B.3 Net Income from Farm Proprietorship
B.4 Net Income from Farm Partnership
B.5 Value of Food Produced and Consumed by *Owner* of Farm

C. Property Income

None

D. Public Cash Transfer Payments

None

E. Public In-kind Transfers

None

F. Private Transfers in Cash and in Kind

F.6 Training Provided by Employer

EXPENDITURES

G.1 Commuting Cost
G.2 ChildCare-Within the Home
G.3 Child Care--Outside the Home
G.4 Union Dues
G.5 Dues to Professional Organizations
G.6 Clothing and Tools Required in Work
G.7 Educational Expenses
G.14 Federal Income Taxes
G.15 F.I.C.A. Taxes
G.16 State Income Taxes
G.17 Local Wage or Income Taxes
G.20 Moving Expenses

ASSETS AND LIABILITIES

Not Applicable

Building on the Becker-Mincer model of schooling, Ben-Porath (1967) considers the implications of the model for the dynamic path of investment in human capital over the life cycle. He points out that observed earnings are larger than disposable ("net") earnings by the direct costs of work, and smaller than earning capacity by foregone earnings. Since it is optimal to concentrate investment in human capital in the early years of life, the rate of increase in observed earnings exceeds the rate of increase in earnings capacity while both are rising. In the later working years, one may consume (fail to maintain) one's human capital, just as one may consume one's physical capital. During this period, the normal decline in earnings understates the actual decline in earning capacity because of this capital consumption effect,

Numerous empirical studies, in addition to those mentioned already, have been made of the human capital model. Among these should be mentioned the study of individual earnings by Becker and Chiswick (1966); the paper by Mincer (1972); Mincer's monograph (Mincer, 1974); the volume by Lydall (1968), which presents some international data; and Johnson and Hebein (1974), who relate the growth of human capital to the growth of aggregate personal income. See also Chapter 6, where attempts to include human capital within the national income and product accounts are described.

Work-Related Expenses

Mincer (1974) points out that the costs of earning income should properly be deducted from gross income to arrive at a measure of net income. For a self-employed proprietor or for such occupations as salesmen, it is relatively straightforward to define these costs. For the household, the problem is complicated considerably by the joint product aspect Of many expenditures. It is conceptually impossible to distinguish the consumption and cost elements of certain outlays- Clothing is one example. Specific types of clothing are required for some jobs and the executive is obligated to spend more on his clothes than the clerk. However, another determinant of expenditures on clothing is the tastes and preferences of the individual; it is not always possible to separate these two factors.

Clothing is an extreme example of the confounding of cost and consumption.

Other expenditures are more clearly work related, and require closer examination. These include the costs of commuting, certain costs incurred in the home, and costs of child rearing.[1]

The costs of getting to work include both out-of-pocket outlays and the time spent traveling. Outlays will vary depending on the choice of transportation mode, and distance from work. There may be a tradeoff between time and money in commuting. Oi (1976) discusses this issue. Definitions of net income which exclude the value of time will thus bias the income measure upward for those choosing to spend time rather than money. The individual who bicycles to work will incur lower money costs than the individual who prefers to take taxis.

There is also considerable latitude in the choice of residence, in terms of distance from work. The person who lives at a great distance from work in a suburban or rural area has revealed his willingness to incur higher commuting costs in exchange for the consumption of site-specific characteristics of his place of residence. The compensating manner in which urban land markets function is another factor arguing against the deduction of commuting expenses in arriving at a measure of net earnings. If differences in accessibility are capitalized into site rents, the individual who chooses to live close to his workplace will pay a higher unit price for housing than the individual with the longer commute. Thus, to deduct the costs of commuting and not the higher site rent would bias the measure. These considerations illustrate the severe conceptual and measurement difficulties inherent in any attempt to net out commuting expenses.

For the household, the cost of labor force participation is the opportunity cost of the time which must be withdrawn from productive activity in the home. Included among such activities are the preparation of meals, maintenance of a clean home, child rearing, and do-it-yourself work. The decision to work implies some combination of an increase in out-of-pocket expenditures for these activities and a reduction in the time available for other activities, notably leisure. For the objective of defining net income, many of the costs are indistinguishable from ordinary consumption outlays. The household production function approach (Michael and Becker, 1973) stresses the factor

[1] Child care costs are discussed in Section 3.5.

substitution possibilities in the production of household services. One approach to separating costs from consumption outlays would lie in the estimation of actual household production functions. This is, given available knowledge and data, probably beyond the state of the art in this field. However, it is not conceptually very different from the approaches now being experimented with for valuing in-kind transfers (see Section 4.5).

Educational Expenses

Expenditures for commuting are incurred continuously during the working period. A different category of work-related expenditures are the costs of education and training incurred in order to increase earning capacity. This investment in human capital has two major cost components. The first is money outlays for tuition and fees, books and supplies, and travel. The second and most important component is the earnings foregone while studying.

Foregone earnings are automatically excluded from taxable income, or from any measure of money income. However, it should be noted that measures of full or potential income which are based on the household's stock of human and physical capital would not exclude these foregone earnings. While future 'potential income would depend *on* current investment in human capital, current potential income is a function of the individual's existing stock of human capital.' The time currently being invested in education would be valued at the wage rate which the individual's existing stock of human capital would command.

If investment in human capital is viewed as analogous to investment in physical capital, then the costs of that investment should be capitalized and written off *against* earned income over some suitable period of the individual's working life. In this context, capitalization means that the individual (or his parents) converts assets (incurs debts) to create a form of capital which is specific to the individual. Even if the educational outlays are financed by the parents, a proper measure of net income would require that depreciation be taken against the future earnings of the student, rather than being subtracted from the parents' income.

[1]For an example of the use of human capital in developing a concept of net earnings capacity, see Garfinkel and Haveman (1975).

There are two major problems with this approach to the treatment of educational expenditures. The first constitutes a basic critique of the human capital approach -- namely that a large part of education expenditures are actually consumption rather than investment. The implication for the definition of income is that they should be treated like any other consumption expenditures.[1]

While some part of expenditures are undoubtedly consumption, it is also the case that a non-negligible rate of return has been estimated for educational expenditures. Recent empirical evidence suggests, however, that the rate of return has fallen, reflecting an increase in the supply of individuals with college and higher degrees. This change in the rate of return suggests the second objection to amortizing education expenditures against the stream of earned income. While it is possible to estimate the average return to education, there is a large within-group variance in this return. For any individual, it is difficult to determine what portion of earned income is due to educational investment, as opposed to factors such as ability, motivation, or family background. The amortization of all education expenditures against all earned income introduces a large random element into the computation of net income.

Leibowitz (1976) criticizes the assumption that during years of schooling 100 percent of gross potential earnings are invested in human capital. In fact, her findings show that the ratio of investment to potential earnings is not only less than one (i.e., most students work part of the year, and apply the income from that work to consumption outlays other than education), but also that the ratio of investment increases with years of schooling. This *creates* a positive bias in estimates of the return to schooling. A second source of positive bias is the possibility that students of above average ability may choose higher than normal intensities of schooling investment. By completing their education sooner, they achieve a longer working life and consequently'higher lifetime earnings. Thus part of the return attributed to education is due instead to ability.

[1] See Schaffer (1962).

Moving Expenses

Another expenditure related to work is for moving expenses. Schultz (1971) and others have considered internal migration as an investment in human capital, similar to education or health expenditures. The logic of such a treatment argues for the capitalization of moving expenses, just as for education expenditures. In the U.S. tax code, moving is viewed as a current expense of earning income. An exclusion from adjusted gross income is allowed when the change of residence is required to begin a new job. The tax code allows a deduction even if the person is unsuccessful in finding a new job. From the human capital perspective, so long as the move reflects a desire to find a "better" job, whether better is defined in pecuniary or non-pecuniary terms, the cost of investment in a new location should be recoverable. However, once again there is the problem of distinguishing between the consumption and investment aspects of moving. A move may reflect a combination of personal preference and job opportunity, with no clear indication as to which of the two motives is dominant. To treat education and moving expenses solely as investment in human capital requires the acceptance of the potential or full income concept.

The Screening Hypothesis

That much of the return attributed to education is instead a return to innate ability is one of the major tenets of those scholars who have contributed to the theory of screening. Arrow (1973b) sets out the argument concisely. It is costly for employers to devise mechanisms to distinguish among individuals of different ability. It is also costly to hire the first available individual and test their ability on the job. A cheap means of differentiating is to (1) only hire individuals who have received a given amount of formal 'education, and (2) within this class, hire first the individuals with the highest school performance. In this way, the costs of testing are borne by society rather than the firm. The more highly correlated are educational attainment and school performance with work ability (marginal productivity), the more efficient is the procedure. If the

hypothesis is correct, the higher earnings which are attributed to schooling are in fact returns to high ability, rather than the formal inputs of education.

Stiglitz (1975) has elaborated on this idea. He adopts the idea of Doeringer and Piore (1971) that firms can only measure the productivity of groups of employees (teams). An individual with a higher measurable characteristic (say educational attainment) receives a higher wage because, as a group, more highly educated individuals have higher productivity. The difference between individual and productivity may be thought of as a subsidy to less productive individuals, and a tax on more productive ones. Like any tax-subsidy system, this leads to distortions in the allocation of resources, distortions in consumption-leisure choices, and a loss of economic efficiency.

Layard and Psacharopoulos (1974) criticize the screening hypothesis and argue for the human capital model. They cite three facts which seem to contradict the screening argument: (1) rate of return to educational attainment for college dropouts are as high as those for graduates. (2) Earnings differentials with respect to education rise with age (experience). If the screening hypothesis were correct, they would be expected to fall as employers learn more about their employees' true abilities. (3) If testing is the only valuable aspect of education, the profit motive would have led to the establishment of credentialing organizations (diploma mills (?)) which would have replaced the formal education system.

The concern with the relative contribution of ability and training to earnings is rooted in the proposition that ability may be transmitted genetically. Bowles (1972) and later, Bowles and Nelson (1974) address the question of the inheritance of IQ and the intergenerational transmission of income inequality. Using data from the Thorndike-Hagen sample, Taubman and Wales (1973) and Taubman (1975) provide important evidence on the relative contribution of ability and training. These findings suggest that earnings variance is strongly influenced by ability; if so, treating education as investment in human capital and deducting educational expenditures from earnings is not appropriate.

Social Benefits-of Education

Weisbrod (1962) expresses concern with the focus of research on only the private benefits of education. His identification of the benefits to education stresses some individual benefits which are not always recognized, as well as the benefits to other persons. In the former category are such things as the option value of continuing education (i.e., a college degree is necessary to enter graduate school, and a high school diploma or equivalent to enter college); an expansion of life style choices; a greater adaptability in response to technical change and occupational obsolescence, and increase in home productivity for those not engaged in market work. Benefits which accrue to others include day care services to parents, the benefits to children of a more educated parent, an increase in the possession of desirable social values, externalities in production which accrue to other workers, support for the citizen base of democracy, and improvements in the transmission of information, necessary for a viable market system of trade and commerce. These external benefits may be extremely important in justifying schooling for low achievers (Hansen, Weisbrod and Scanlon, 1970).

Differences by Occupation, Race, and Sex

The return to education will differ among occupations, and may show differences according to the race and sex of the individual. Duncan (1961) examines the impact of occupation on educational differences in income (of course, education also impacts strongly on the set of occupations open to the individual). Welch (1973a) and Link and Ratledge (1975) present evidence bearing on the way in which investments in children act to limit the experience and earnings of-men.

On-The-Job-Training

Employees in many cases receive formal and informal on-the-job training (Mincer, 1962). While some training is job-specific, it is often the case that skills acquired in one job can be transferred to another. Whether this training constitutes a pure transfer, an expenditure by the employee, or some mixture of the two depends on the degree to which'the employee's wage is lowered due to the substantial enhancement of his skills through such

training. An extreme example is provided by the individual who receives pilot training while serving in the Air Force. His current salary may be lower than alternative employment possibilities, but the enhancement of his skills will be reflected in later salary levels. More commonly, firms may attract new college graduates at low salaries if their prospective job environment offers a mix of formal training and experience which promises future career enhancement. Theoretically, the value to the employee of such training is the increase in human capital (i.e., the present value of the increase in future earnings) resulting from the training. However, it is difficult to estimate with any degree of accuracy this increase or to distinguish increments to human capital due to specific provision of on-the-job training from those which accrue generally to experience in performing tasks (learning by doing).

3.4 Home Production

Of major interest to students of labor economics in recent years has been the examination of the economics of home production.' An early examination of the issue is found in Reid (1934). Home production includes the provision of domestic services (cooking, cleaning, etc.), the proviiion of child care and education, the maintenance of consumer durable goods (homes and cars in particular), and managerial functions, including purchasing, bookkeeping, and entertainment planning. Hawrylyshyn (1976) points out that the methods advanced to place a value on these functions may be grouped into two classes: (1) those using the opportunity cost approach and (2) those using the replacement cost approach.

Opportunity Cost

An analysis by Sirageldin (1969) uses the opportunity cost 'approach to measure the aggregate value of household activity. Time spent in household tasks is multiplied by the wage rate for a person with comparable education and experience in the market. Sirageldin defines "full income" as disposable personal income plus the value of housework and home production, volunteer

'For a more extended discussion of this area, see the survey articles by Kahne and Kohen (1975) and Hawrylyshyn (1976).

work, time spent pursuing an education, and the services provided by automobiles. To this may be added an adjustment for excess leisure and an adjustment when the individual is sick or disabled. The resultant measure he terms "potential income."

Leibowitz (1972, 1974b) focuses on the impact of education on the allocation of time between home and market activity. She uses time budget data to show that more educated women devote less time to household production over the life cycle, but more time to child care.' Leibowitz uses a family income concept, but recognizes the deficiencies of this measure. She experiments with husband's education and size of home as proxies for income.

Gronau (1973b) presents a formal model of the allocation and valuation of housewife's time. He notes that the market wage she might otherwise earn is only a lower bound on the value of time for a women who chooses not to work. Michael and *Becker* (1973) present in their model a discussion of full income (the sum of property income, transfer income, and the product, for each household member, of their wage rate and total time available). They claim:

> The production model not only emphasizes that the household is the appropriate basic unit of analysis in consumption theory, it also brings out the interdependence of several household decisions: . . . family labor supply, . . . expenditures, . . . marriage, family size, labor force attachment, ... human capital investments in a life cycle analysis. (p. 388)

Michael (1973) echoes Leibowitz in deducing that education must yield a return in nonmarket as well as market activity. Using the model and income concept discussed above, he examines the effect of education on expenditure patterns and full income, using data from the Consumer Expenditure Survey.

Pollak and Wachter (1975) note that application of this model depends on the existence of stable household production functions exhibiting constant returns to scale and not involving joint production. As an alternative they suggest that the value of services in the home be made a function of goods prices, the wage rate and nonlabor income. They define implicit income as

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-See Michaelson and Reed (1974) for a discussion of time budget data and their use in social research.

the cost of the commodity bundle consumed valued at the implicit commodity prices so defined. They also point out that the full income concept requires that the market wage rate be independent of the choice of consumption bundle.

Linder (3970) argues that the increasing value of market time for women will force changes in the allocation of time in the home. Economizing on home time may lead to the substitution of goods for time, best epitomized by the substitution of convenience foods for unprocessed meat and produce.

The Relacement Cost Approach

Another approach to valuing time spent in home production involves determining the market value'of replacements for the services provided. Hawrylyshyn (1974, 1976) points out that these methods typically yield higher numbers for the aggregate national value of home production. First, one may assume the duties are assumed by a housekeeper who is paid prevailing market wages. This is the approach of Clark (1958) and Rosen (1974). Second, one may estimate the separate services performed in the home and determine the value of each if provided in the market. Sirageldin (1969), Walker and Gauger (1973) provide examples of careful application of the latter method.1

3.5 Fertility and Child Care

One of the most important uses of time in the home is bearing and raising children. Fertility (the number of children a woman bears in her lifetime) has been explained by demographers and sociologists by biological, attitudinal, and family background variables. The economic theory of the household would suggest instead that economic variables (income, the opportunity cost of time spent on children, the price of children, the costs associated with bearing and raising them, as compared with the general cost of other goods

[1] Hawrylyshyn (1976) points out that tbis is the favorite method of journalists, since carelessly performed studies often yield extremely high values due to double counting of functions performed simultaneously. For example, one may include both the value of child care services and meal preparation even when these functions are performed simutaneously. A 1972 Chase Manhattan Bank study had the harried housewife spending 235 (out of a possible 168) 'hours per week on home activities.

and services, etc.) should also play an important role. The theoretical models used to explain fertility are similar to those used in home production generally. Full income and the net wage (earnings rate) play the major role. Surveys of this literature are found in Schultz (1973b), Ben-Porath (1974), and Cochrane (1975). Ben-Porath's comments are instructive:

> Having a child implies a commitment of resources over long periods as well, so the proper framework is a life-cycle model, where both preferences and resources over the life cycle are considered . . . The relevant resources constraint would . . . not be the family's current income, but a broader concept that extends over longer periods and that encompasses the nonmarket resources of the family . . . The household production model (Becker, 1965) has been regarded by many as a useful framework to take account of the role of . . . time. (p. 303)
>
> A fundamental unsolved problem is that in economics the "consumer" or the decision marker speaks with one voice in the theory, but the household, the couple, the family where decisions are being made on education, food, and shelter has more than one voice . . . Thus the behavior of families can change as the weight in decision-making shifts toward or away from the wife. (p. 306)

Child *rearing is an* example of an activity for which a great deal of substitution is possible between dollar outlays for day care or house sitters and the time of the adult members of the household. Since for most individuals it is not possible to vary continuously the number of hours worked, the decision to enter the labor force is likely to imply a significant increase in dollar outlays for child care.

Conceptually, it is desirable to adjust earnings by the portion of the expenses incurred for child rearing which are work related. Here again, it is difficult to distinguish that portion from ordinary consumption expenditures.[1] If children are viewed as consumption goods for the parents, then

[1] It is also difficult to distinguish child care from housecare. The income tax code once made this separation by the criterion that child care expenses were deductible only if they were not done in the home. However, such a distinction is no longer made.

Another distinction between the income tax treatment of child care expenses and the theoretically *appropriate* treatment lies in the fact that allowable expenses result in a tax credit, rather than an exclusion in computing adjusted gross income.

a large element of personal preference enters into the choice of type and level of child-care expenditures.1

3.6 Summary: 'Data Requirements Stemming from Advances in Production Theory

Research on the production behavior of household members has focused extensively in recent years on the allocation of time. Extending the income constraint of simple consumption theory has led to the full income concept, which integrates nonwage income and the value of time into a single measure. Use of this model has contributed to our understanding of labor supply, education, fertility and home production. Even critics who do not accept the model of the utility maximizing household have been forced to structure their research around the concept in order to combat it. Other disciplines as well have been influenced. Jacoby, Szybillo, and Berning (1976) present an interesting review of the role of time in social science research, which pursues developments in other disciplines which have not been mentioned in this study.

One persistent criticism of the "new home economics" model is that existing data bases are woefully inadequate to provide a real test of its predictions. The data needed to implement the theory properly are enormous; scholars have been very inventive in their attempts to make use of the data at hand. A catalogue of the data one would have to have is instructive.

For each individual household member'over the age of fourteen, information is required on

- current employment status
- hours and weeks worked in the previous year
- wage rate and overtime provisions
- annual earnings
- work history (data on all previous employment, including occupation, wage rate, or salary and period of employment
- educational history (years of education, type and quality of schooling)
- intelligence quotient (measures of ability)

[1] For a discussion of alternative sources of supply of day care, and the wide range of costs among these different methods, see Krashinsky (1973).

- current uses of time outside of work (time spent pursuing an education, doing work at home, enjoying leisure, commuting to work, etc.)
- income other than earnings accruing to the individual (see Table 3-2 for details)
- wealth owned by the individual
- expenses associated with earnings income (see Table 3-3 for details).

Data on current employment status is required to determine the appropriate technique to be used in determining the net wage rate, or value of time, for each household member. For those currently employed, data on gross earnings must be adjusted for overtime provisions, costs of work, and actual hours and weeks of work in order to accurately calculate the net aggregate. For those not currently employed, the net wage must be imputed based on previous work experience and education. For both groups, measures of ability and the quality of education are needed to test theories of the determinants of earnings. Data on normal income and on wealth are required to supplement the above data in constructing potential income.

For the household as a whole, in addition to the above, data is needed on

- home furnishings and appliances
- wealth owned jointly by two or more individuals
- sources of income received jointly.

Whether any one survey can combine this enormous set of information into one instrument is questionable. However, much of the information required (work and education histories and IQ) need to be determined only once. Thus a longitudinal survey has the opportunity to collect-this information over several interviewing sessions, spanning a number of years.

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