

# Household Production

## A. Overview

1. the standard static model allows for two uses of time – market and non-market time; we will extend the static model to
  - a. allow for different objects of preferences
  - b. allow for additional uses of time
  - c. allow for more complicated interactions of goods and the uses of time
  
2. we will also discuss
  - a. data on the various uses of time
  - b. how time data are collected

## B. Model

1. assumptions
  - a. people have preferences defined over a set of  $m$  commodities,  $Z_1, Z_2, \dots, Z_m$  such that
$$U = U(Z_1, Z_2, \dots, Z_m)$$
  - b. commodity production functions
    - 1) each commodity is produced with inputs of goods,  $X_i$ , and time,  $T_i$ , according to the production function  $Z_i = f_i(X_i, T_i)$ ,  $i = 1, m$
    - 2) household acts as a small factory that combines raw inputs (goods and members' time) to produce a final product (the commodity)

- 3) same commodity can be produced with different combinations of goods and time; commodities can be time or goods intensive
  - 4) time associated with a commodity includes time necessary for production of the commodity and time necessary for consumption
  - 5) goods and time in this model are intermediary or instrumental factors, not direct objects of preferences—commodities are the direct objects
  - 6) production functions represent a set of technological constraints on the household
- c. time constraint
- 1) needs to be modified to account for additional possible uses of time
  - 2) new constraint is  $K = H + \sum_{i=1}^m T_i$
- d. budget constraint is  $WH + N = \sum_{i=1}^m P_i X_i$

## 2. maximization problem

- a. individual chooses inputs of time and goods to maximize utility subject to the technological, time, and budget constraints
- b. specifically,

$$\begin{aligned}
\text{Max}_{T_1, \dots, T_m, X_1, \dots, X_m} L &= U(Z_1, Z_2, \dots, Z_m) \\
&+ \lambda \left( W K + N - W \sum_{i=1}^m T_i - \sum_{i=1}^m P_i X_i \right) \\
&= U(f_1(X_1, T_1), f_2(X_2, T_2), \dots, f_m(X_m, T_m)) \\
&+ \lambda \left( W K + N - W \sum_{i=1}^m T_i - \sum_{i=1}^m P_i X_i \right)
\end{aligned}$$

c. first-order conditions

$$\frac{\partial U}{\partial Z_i} \frac{\partial f_i}{\partial T_i} - \lambda W = 0 \quad \text{for } i = 1, m$$

$$\frac{\partial U}{\partial Z_i} \frac{\partial f_i}{\partial X_i} - \lambda P_i = 0 \quad \text{for } i = 1, m$$

d. rearranging terms, we can re-express the first-order conditions for each commodity

$$\frac{\partial f_i / \partial T_i}{\partial f_i / \partial X_i} = \frac{W}{P_i} \quad \text{for } i = 1, m$$

1) these are the *efficiency in production conditions*

2) people balance the marginal productivity of goods and time against the marginal cost

e. we can also rearrange terms to examine pairs of commodities; doing this yields

$$\frac{\partial U / \partial Z_i}{\partial U / \partial Z_j} = \frac{\partial f_j / \partial T_j}{\partial f_i / \partial T_i}$$

$$= \frac{(\partial f_j / \partial X_j) / P_j}{(\partial f_i / \partial X_i) / P_i} \quad \text{for all } i \text{ and } j$$

- 1) these are the *efficiency in consumption* conditions
  - 2) indicate that people balance the relative time and goods costs in selecting levels of commodities
  - 3) also show that the productivity of times and goods into household production are important components of the implicit prices of commodities
3. effect of a change in unearned income,  $N$
- a. expands entire production possibility curve but leaves relative prices unchanged
  - b. consumption of normal commodities increases; consumption of inferior commodities decreases
  - c. if a sufficient number of commodities are normal, total non-market time increases and  $H$  decreases
  - d. however, if a sufficient number of commodities are inferior and time intensive, total non-market time may decrease and  $H$  may increase
  - e. this latter result runs counter to the predictions of the static labor model – changes in income may have ambiguous effects on labor supply
4. An increase in the wage rate,  $W$ , leads to ...
- a. an income effect as described previously

- b. changes in the efficiency in production conditions which lead to a substitution from time inputs to goods inputs
- c. changes in the efficiency in consumption conditions which lead to substitution from time-intensive to goods-intensive commodities
- d. net effects on labor supply are ambiguous

### C. Applications of the time use model

1. model is very useful for describing unremunerated activities within households
2. some applications include modeling health outcomes for individuals, especially children, within families
  - a. health production literature
  - b. health is treated as a commodity
3. also used to examine determinants of children's development and families' use of child care
  - a. child "quality" is treated as a commodity
  - b. important determinant of the cost of fertility
4. used generally to examine women's labor supply
5. used to examine transportation decisions
  - a. transportation mode choices
  - b. optimal tolls

6. used to examine behavior in developing and rural economies
  - a. examples include analyses of household agricultural activities and work in informal markets
  - b. seldom observe formal wages for either of these activities; nevertheless, the activities may reflect economic decision making

#### D. Some data

1. table of cross-country comparisons

Activity	U.S. (1981)		Japan (1985)		U.S.S.R. (1985)		Sweden (1984)	
	men	women	men	women	men	women	men	women
Market work	44.0	23.9	52.0	24.6	53.8	39.3	39.8	23.7
HH work	13.8	30.5	3.5	31.0	11.9	27.0	18.1	31.8
Soc. interact.	14.9	17.6	8.0	7.0	7.8	9.6	9.6	11.2
Passive leisure	20.8	19.8	25.5	27.5	21.7	16.8	21.2	17.9

Source: Juster and Stafford (1991)

2. findings from Juster and Stafford
  - a. total work time is higher on average for men than for women only in high-income countries
  - b. women's market work tended to be highest in eastern bloc countries

- c. time spent in housework tends to be very similar across countries with women's hours being higher than men's

### 3. Trends in weekly housework hours

	1965	1975	1985	1995
All women	30.0	23.7	19.7	17.5
Married women	33.9	26.1	21.9	19.4
All men	4.9	7.2	9.8	10.0
Married men	4.7	6.7	10.4	10.4

Source: Bianchi et al. (2000)

- a. note that the 1965 figures come only from urban residents; it is not clear why Bianchi et al. (2000) and Juster and Stafford (1991) report different figures
- b. figures show that women's housework declined by nearly half while men's doubled; while the differences have narrowed, they have not disappeared
- c. patterns for married people not that different from those for unmarried people
- d. multivariate analyses show that the decline in women's housework is associated with
  - 1) increased market work
  - 2) later marriage
  - 3) fewer children
- e. harder to explain increase in men's work

## E. Measurement of time use

1. time diary approach
  - a. 24-hour or one week logs where people record what they are doing as or soon after they do it
  - b. generally very accurate
  - c. some limitations such as
    - 1) recording multiple activities
    - 2) generating distributions of infrequent activities
  - d. method is also somewhat intrusive
  - e. a variation on this approach is to use a pager to prompt people to enter their activities into a diary
2. recall surveys
  - a. surveys like the CPS ask about activities during the previous week or year
  - b. inexpensive but inaccurate
  - c. scheduled work hours appear to be reported accurately
  - d. actual work hours and some other activities are over-estimated
  - e. some infrequent activities such as household repairs tend to be under-estimated
3. implications for standard labor supply analyses
  - a. actual labor supply may be poorly measured in conventional surveys
  - b. diary data suggest that work hours are more variable and fewer than recall surveys

- c. diary data appear to be more sensitive to differences between actual and scheduled hours
- 4. for some activities it is important to account for joint uses of time and for the intensity of time use
  - a. Bianchi (2000) describes trends in mothers' time spent caring for children; despite changes in rise in women's employment and single parenthood, Bianchi found that time mothers spent caring for children was virtually the same in 1965 and 1995
  - b. Bianchi reports other evidence that
    - 1) mothers' employment reduces time spent *with* children
    - 2) however, it has little effect on child care as a primary activity
    - 3) main reduction occurs in child care as a passive or secondary activities; suggests a quality/quantity trade-off

#### F. Issues in the valuation on non-market time

- 1. production-oriented approach
  - a. uses the cost to obtain an equivalent service to value household time
  - b. alternatively, could look at money saved by a household from do-it-yourself projects
  - c. does not capture household welfare
  - d. does not capture differences in the productivity of households or differences between households and professionals

2. opportunity cost approach
  - a. can value time in terms of foregone opportunities; specifically, can value time in terms of the after-tax wage rate
  - b. trouble approximating value of time for individuals (at corner solutions) who do not work
  - c. also, some conceptual difficulties – e.g., if a lawyer (\$100/hr) and a dishwasher (\$6/hour) each spend an hour in household repairs, is the lawyer's repair really worth more?
  
3. unresolved issues
  - a. valuation systems generally ignore individual preferences
  - b. systems also tend to make very simple assumptions about the trade-offs between market and non-market productivity
    - 1) ignores set-up time
    - 2) ignores transportation costs
    - 3) ignores time required to develop skills
  - c. hard to get some data on equivalent services

## G. Econometric issues

1. Framework has been very useful in motivating loose, reduced-form approximations for empirical models
  - a. typical study regresses either
    - 1) a measure of a commodity such as children's physical or developmental well-being or

- 2) a measure of an input such as time spent caring for children or amount spent on child care
  - b. measures regressed against wages, prices, non-labor incomes
  - c. models use some convenient functional form (linear, log-linear, etc.)
  - d. models are useful for motivating the inclusion of explanatory variables
2. Theoretical model distinguishes between derived demands and direct demands
  - a. theoretical distinction is between goods that are desired because they are used in the production of commodities (i.e., like factors of production in firms) and goods that are just valued for their own sake
  - b. distinction arises because preference function and production functions are different
3. Empirically, however, it is virtually impossible to distinguish between the preference and production functions
  - a. Pollak and Wachter (1975) show that very strong assumptions (e.g., constant returns to scale in the production functions and no joint production) are necessary to identify each element
  - b. advocate a direct demand approach

## Appendix. Sources of Time Use Data in the U.S.

### Maryland Time Use Surveys

- conducted in 1965, 1975, 1985 and 1995
- personal interviews used in 1965 and 1975; phone interviews used in 1985 and 1995
- 1965 survey limited to urban residents
- relatively small samples
- used time diaries
- source of data for Bianchi et al. (2000)

### Institute for Survey Research Time Use Longitudinal Panel Study

- conducted in 1975 and 1981
- relatively small sample
- source of longitudinal data
- used time diaries
- collected data on several people in household
- source of data for Juster and Stafford (1991)

### Bureau of Labor Statistics American Time Use Survey

- ongoing monthly time use survey, began in 2003
- large samples drawn from outgoing rotation groups of the Current Population Survey
- will use time diaries
- only interviews one person per household
- new survey, published studies just beginning to appear

## References

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