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The Effect of the Value of Time on Food Consumption Patterns in Developing Countries: Evidence from Sri Lanka

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This study shows that the opportunity cost of women's time can affect household food consumption patterns in developing countries. Demand equations for rice, bread, and the ratio of bread to total cereal consumption are estimated for urban Sri Lankan households. The demand specification, which is based on the "New Household Economics," includes as explanatory variables the woman's estimated market wage and the household's "full income," and alternatively "observed income." Wages are estimated using the Heckman procedure to correct for sample selection bias.

Key words: food demand, New Household Economics, Sri Lanka, value of time, wheat consumption.

A fundamental transformation has been occurring in the food consumption patterns of many developing countries. Diets have been shifting away from traditional coarse grains and root crops and increasingly include more wheat products. Much of the increased wheat consumption is eaten in the form of commercially supplied bread. Between 1961–65 and 1975–77, developing country consumption of wheat increased at an average annual rate of 2.3% per capita (CIMMYT). The similar figure for rice was 0.4% and for coarse grains other than maize, −1.3%. There are many factors which may be affecting this shift toward increasing wheat consumption including rising incomes, changing relative prices, increased urbanization, food aid, and the general impact of Western culture.

However, one possibly important factor in this shift which has not been given sufficient attention is the rising value of human time, particularly of women, who are the primary food preparers, as economic development occurs. With economic development, general labor productivity increases and labor force opportunities improve, especially for women. Many of the traditional foods are time-intensive, in some cases extremely so, requiring long preparation times by the food preparer(s) in the household. Many wheat products, particularly bread, when purchased from a bakery or store, offer substantial time savings in comparison to many traditional foods.

The value of time and household production activity can be incorporated into economic analysis in a manner pioneered by Becker, along with contributions by several other economists (e.g., Mincer, Muth). This approach, referred to as the "New Household Economics," has been refined and applied in a broad range of economic research (Michael and Becker; Pollack and Wachter; Gronau 1974, 1977; F enson; Nerlove). Some studies have specifically examined the implications of the Becker model and the value of time for U.S. food consumption patterns, particularly the increasing consumption of food away from home (Prochaska and Schrimper, Fletcher, Kinsey). The potential role that the changing value of human time might play in worldwide food consumption patterns was suggested by Thompson and Schuh (p. 8). As yet, though, no one has empirically examined the possible

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impact of the changing value of time on developing country food consumption patterns.

The general objective of this study is to test the hypothesis that the opportunity cost of time affects developing country food consumption patterns. The specific hypothesis tested is that the bread consumption of urban Sri Lankan households will increase and their rice consumption decrease, *ceteris paribus*, as the opportunity cost of time of the primary woman in the household increases. The primary woman is defined as either the household's head or the spouse of the head and between fifteen and sixty-five years of age.

The first section of this paper outlines the underlying theory and its empirical implications. The second section discusses the data and presents descriptive statistics for the major variables. The third discusses the derivation of the opportunity cost of time by estimating labor force participation and wage determination equations. The fourth presents the estimated household demand equations for rice, bread, and the ratio of bread to total cereal consumption. The conclusion discusses the implications of the research.

The Underlying Theory

Becker's model of the household is well known and has been widely used as the basis for empirical research. The essence of the Becker model is that the actual consumables from which utility is derived are nonmarket commodities which are produced in the household through a production process which combines market goods and household production time. In addition to the production functions, two other constraints are operative, the traditional budget constraint and a time constraint.

More formally, the household has a preference ordering denoted by

$$U = u(Z, t_c), \tag{1}$$

where Z is a vector of household commodities and t_c represents the household's total leisure. The above utility function is maximized subject to a set of household production functions of the form:

$$z_i = f_i(X_i, t_i), \quad \text{with } i = 1 \ldots m \text{ commodities}, \tag{2}$$

where X_i is a vector of market goods and services and t_i represents the necessary household time inputs used to produce the ith household commodity. The combination of the traditional budget constraint and the time constraint yields the following "full income" constraint:

$$S = v + \sum_{j=1}^{n} w_j T_j = \sum_{j=1}^{n} w_j t_{jc} + \sum_{j=1}^{n} w_j \sum_{i=1}^{m} t_{ji} + PX, \tag{3}$$

in which S represents the household's "full income," which equals the sum of any nonlabor income (v) and the total time allotment of each individual (T_j) valued at his or her opportunity cost of time as represented by the market wage rate (w_j), summed across the $j = 1, \ldots, n$ household members. This "full income" is allocated to leisure (t_{jc}), household production activity (t_{ji}), summed across the $i = 1, \ldots, m$ household commodities, and via the budget constraint to total expenditures (PX), where P is the vector of prices and X the vector of market goods and services purchased.

Based on Pollack and Wachter (p. 267) and Deaton and Muellbauer (pp. 245–50), the derived demand function for market goods obtained from the above model would be

$$x_r = h_r(P, W, S), \tag{4}$$

in which the demand for market good (x_r) is a function of the price vector (P), the vector of wage rates (W), and the household's "full income."

Although equation (4) includes the wage rates of all members of the household, in the empirical demand equations only the estimated market wage rate of the primary woman in the household was included. Due to specialization, the predominant responsibility for the preparation of food in the household usually falls on the woman who is either the household head or the spouse. In addition, to the extent that the opportunity cost of time of individuals in the same household is typically correlated, the inclusion of each individual's wage rate is unnecessary and would also be econometrically impractical because of multicollinearity. The intrahousehold distribution of commodities and activities or the manner in which a household preference ordering is formed with multiple individuals are outside the purview of this study (Jones, McElroy and Horney).

Table 1. Means and Standard Deviations of Major Variables

Mnemonic	Description	Mean	Standard Deviation
BREADQ	Annual quantity of bread per capita (lbs.)	77	57
RICEQ	Annual quantity of rice per capita (lbs.)	203	93
BREADP	Price of bread (Rs./lb.)	2.17	.12
RICEP	Price of rice (Rs./lb.)	2.57	.53
FLOURP	Price of wheat flour (Rs./lb.)	2.42	.21
AEU	Household size in adult equivalent units	4.5	1.9
HHSIZE	Household size in persons	5.7	2.2
AGEWP	Age of primary woman (years)	39.5	11.8
EDUCWP	Education of primary woman	2.7	1.1
WAGEWP	Estimated wage of primary woman (Rs./hour)	2.17	1.52
WAGEMP	Estimated wage of primary man (Rs./hour)	3.67	1.59
SP	Annual "full" income per capita (Rs.)	9,975	5,554
YP	Annual household income per capita (Rs.)	2,984	2,959
NONLYP	Annual nonlabor income per capita (Rs.)	300	681

The Data

Rice is the major food in the diet of Sri Lankans. However, the consumption of bread has become increasingly important in recent years, particularly in the urban sector. In a one-week period, 98.9% of the urban households were consumers of rice, and rice expenditures accounted for an average 16.8% of their budgets (Sahn, pp. 33–36). For bread, 87.3% of urban households were consumers, and the average budget share devoted to bread was 5.3%. On the other hand, only 59.7% of rural households were consumers of bread. The bread category refers to commercially supplied bread obtained from a bakery or store and does not include wheat flour purchased to prepare home-baked goods. Our empirical analysis deals with only the urban sector.

The household time required for the preparation of milled rice is far less than for many traditional foods, especially the unmilled coarse grains and some of the root crops. However, rice still requires substantially more household preparation time than commercially supplied bread. In addition, as a meal, rice is frequently accompanied by a curry or other condiments, which require further preparation time. Bread has most frequently been substituted for rice at the morning or midday meal in Sri Lanka.

The empirical analysis in this study is based on the data tapes for the 1980/81 labor force and socioeconomic survey, conducted by the Sri Lankan Department of Census and Statistics. This nationally representative survey collected both individual labor force participation and earnings data and seven-day household food consumption information (Sahn).[1] Food consumption was measured in both expenditure and quantity terms.

Table 1 presents descriptive statistics for the major variables involved in the analysis. The sample of urban households with a primary woman used to estimate the demand equations contained 724 observations. The annual per capita consumption of rice was almost three times the level of bread consumption. However, bread consumption was a rather substantial 77 pounds per capita in the urban sector. The prices shown were derived by the common practice of dividing a household's expenditures by quantity for that category. Since the data were obtained in different regions and at different times in the year, prices reflect both regional and seasonal differences.[2] Prices are given in rupees per pound. For households which did not consume a particular food category during the one-week survey period, the average price derived for consuming households in the same geographic region was utilized.

The adult equivalent unit (AEU) variable was created in the standard method of transforming each family member into a fraction of an AEU based on age and sex. The 1973 FAO/

[1] Since the consumption data were converted to an annual basis by multiplying by 52, it is somewhat inappropriate to consider the estimated relationships as representing annual variation in consumption. However, this issue is minimized because of the very small proportion of households which reported no consumption of bread or rice in the seven-day survey period.

[2] The problem of spurious price variation due to quality differences or other manifestations appeared to be minimal, since the prices paid by different households for a specific commodity at a particular time in the year were very similar within a given region.

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WHO-recommended calorie requirements were used as the basis for the transformation. Education level was specified as a quasi-continuous variable with the following categories: 1 = no schooling, 2 = primary (grades 1–5), 3 = middle grades (grades 6–10), 4 = passed General Certificate Exam—Ordinary Level (high school), 5 = passed General Certificate Exam—Advanced Level, 6 = passed degree, and 7 = postgraduate degree or diploma. The predicted wage for primary women (*WAGEWP*) is substantially lower than the estimated wage for primary men (*WAGEMP*), as expected. The primary man in a household was defined as the household head, the spouse of a female household head; and, if neither was present, then the male member of the household, age 15–65, with the highest estimated wage rate was used.

"Full income" (*SP*) was derived by multiplying the estimated wage for each household member, aged 15–65, by 5,840 hours and then adding any nonlabor income (*NONLYP*). The number of hours represents 16 hours per day for 365 days per year. The concept of full income has rarely been implemented empirically. The assumption of 16 hours per day as potentially available for productive activity is admittedly arbitrary and would be of particular concern were we studying the demand for leisure. However, since nonlabor income is relatively minor in most households, our assumption concerning hours acts approximately as a scalar. The average "full income" per capita is over three times greater than actual per capita income (*YP*). At an exchange rate of 18 rupees equaled one U.S. dollar in December 1980, average per capita income was equivalent to $166 per year.

Wage Rate Estimation

The wage estimation covered women and men 15–65 years old in the urban sector. This age category was chosen because labor force participation falls off sharply below age 15 and also over age 65. The Sri Lankan survey contains the requisite data to calculate an hourly wage rate for those women and men who were employed in the labor force. However, only 14.9% of the women and 52.8% of the men ages 15–65 had earnings from labor force employment in the month of the survey. For this reason, an individual's value of time was predicted from a wage determination equation which was estimated for those who were employed. The estimation procedure raises the issue of sample selection bias, since an individual's employment status reflects self-selection, thus producing a nonrandom sample (Heckman 1974, 1979).

For this reason, the Heckman procedure to correct for sample selection bias was utilized in the estimation of wages. The Heckman approach first involves the estimation of a probit equation for labor force participation, with the dependent variable set equal to one if the individual is employed in the labor force and zero otherwise. The probit analysis, which provides information on the probability of labor force activity, can be used to obtain what is referred to in statistical literature as the inverse of the Mills' ratio, which is the ratio of the ordinate of a standard normal to the tail area of a distribution. It reflects the probability that a population observation with specific characteristics will be selected into the observed, truncated sample (Heckman 1980, p. 214). As shown by Heckman, inclusion of the inverse of the Mills' ratio as an additional variable in the ordinary least squares (OLS) wage estimation equation for the truncated sample of employed individuals eliminates the potential sample selection bias (Heckman 1976, 1979, 1980). An alternative technique has been suggested by Olsen.

Table 2 presents the results of the probit analysis on labor force employment of urban women. The explanatory variables are the woman's age in years (*AGEW*), her age squared $(AGEW)^2$, education (*EDUCW*), her education squared $(EDUCW)^2$, ethnic group or race (*RACE*1 is Sinhalese, which is omitted, *RACE*2 is Ceylon Tamil, *RACE*3 is Indian Tamil, and *RACE*4 is other), the number of children in the household age six and under (*CHILD*), the relation of the woman in the household (*REL*1 is household head, *REL*2 is wife of household head, which is omitted, *REL*3 is daughter, *REL*4 is parent, *REL*5 is other including servants), household nonlabor income (*NONLY*), and the predicted wage rate of the primary man in the household (*WAGEMP*).

Only variables which are statistically significant at a 10% level are discussed. Both age and age squared and education and education squared are statistically significant. In addition, women who are Ceylon Tamils (*RACE*2) or members of another race (*RACE*4) are less likely to work outside the

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Table 2. Results of the Probit Analysis on Labor Force Activity of Urban Women, Ages 15–65

Independent Variables	Parameter Estimates
Constant	−3.267
	(6.41)
AGEW	.120
	(5.41)
$(AGEW)^2$	−.001
	(5.07)
EDUCW	−.559
	(3.46)
$(EDUCW)^2$	.120
	(4.85)
RACE2	−.199
	(1.85)
RACE3	.091
	(.24)
RACE4	−.808
	(4.76)
CHILD	−.103
	(1.76)
REL1	.202
	(1.06)
REL3	.387
	(3.04)
REL4	−3.572
	(1.60)
REL5	.748
	(5.90)
NONLY	−.000005
	(.36)
WAGEMP	.112
	(3.53)

Notes: N = 1,608; −2log likelihood ratio = 215.10. The dependent variable was equal to one if the woman had earnings from employment in the last month and zero otherwise. In the sample, there were 239 women in the former category and 1,369 in the latter. Variables are defined in the text. The *t*-statistics are given in parentheses.

household than Sinhalese women. Women with young children (*CHILD*) are less likely to be employed. Daughters (*REL3*) and *REL5*, which includes other relations, are more likely to be in the labor force than women who are wives of a male household head. Employed women are more likely to be in a household with a primary man who has a higher earning capacity as measured by his predicted wage rate.

Table 3 presents the results of the wage equation estimation for urban women aged 15–65 for the sample employed in the labor force. As suggested by previous research, the dependent variable was specified as the natural logarithm of the market wage (Heckman 1974, p. 685, and Smith). The education-squared term was dropped as an explanatory factor because both the *EDUCW* and $(EDUCW)^2$ terms when included in the same equation were not statistically significant. Education has the expected positive effect. Both age and age squared are significant. *RACE4*, which includes Europeans, has a positive impact on the woman's wage rate. The inverse of the Mills' ratio is also statistically significant, which implies that its inclusion is necessary to avoid a missing variable or sample truncation bias. The R^2 is remarkably high for a wage equation estimated with cross-sectional data. The coefficient of multiple determination for the wage estimation equation is .25 in the Heckman study (1976, p. 487), .20 in Gronau (1977, p. 1116), and .31 for Behrman and Wolfe's earnings function (p. 272).

Table 3. Results of the Wage Equation for Urban Women with Labor Force Earnings, Ages 15–65

Independent Variables	Parameter Estimates
Constant	−3.270
	(6.06)
AGEW	.118
	(4.69)
$(AGEW)^2$	−.001
	(3.85)
EDUCW	.429
	(10.47)
RACE2	.136
	(1.14)
RACE3	−.233
	(.75)
RACE4	.516
	(1.97)
Mills ratio	.363
	(2.69)
R^2	.45

Notes: N = 220. The dependent variable was the log of the wage rate for those women with labor force earnings. The *t*-statistics are given in parentheses.

The regression coefficients in table 3 were then used to derive an estimated wage rate for each woman aged 15–65, whether she was employed or unemployed in the labor force. An estimated wage was derived even for those who were employed to avoid creating any asymmetry in the variable. A similar procedure was used to establish a predicted wage for each man. The estimated wage of the primary woman was not included in the man's labor participation probit, given that the decision of men to pursue labor force employment is more automatic than for women, and the man's employment decision is typically less

Table 4. Regression estimates of demand equations

Independent Variables	*BREADQ*	*RICEQ*	Ratio	*BREADQ*	*RICEQ*	Ratio
Constant	−93.67	−87.61	0.87	−45.09	108.81	.036
	(1.75)	(1.00)	(.57)	(1.13)	(1.65)	(.31)
Ln*SP*	17.18	47.89	−.006			
	(3.54)	(6.01)	(.43)			
Ln*YP*				14.13	30.31	.0002
				(4.81)	(6.24)	(.03)
Ln*WAGEWP*	10.10	−13.71	.038	9.97	−8.30	.035
	(2.43)	(2.01)	(3.23)	(2.63)	(1.33)	(3.22)
AEU	−1.66	−.44	−.005	−1.27	−.05	−.005
	(1.63)	(.26)	(1.82)	(1.24)	(.03)	(1.71)
Ln*RICEP*	7.92	−135.38	.142	5.20	−140.27	.141
	(.82)	(8.51)	(5.11)	(.54)	(8.81)	(5.07)
Ln*BREADP*	−57.81	12.96	−.111	−59.76	10.66	−.112
	(1.75)	(.24)	(1.18)	(1.83)	(.20)	(1.19)
Ln*FLOURP*	75.47	−22.50	.255	77.59	−12.05	.252
	(2.45)	(.44)	(2.90)	(2.55)	(.24)	(2.87)
RACE2	−22.55	−3.93	−.052	−23.15	−5.15	−.052
	(4.68)	(.50)	(3.77)	(4.84)	(.65)	(3.77)
RACE3	−1.75	−24.74	.027	−5.81	−35.11	.027
	(.11)	(.98)	(.60)	(.38)	(1.39)	(.62)
RACE4	.99	−25.22	.029	1.26	−26.84	.030
	(.18)	(2.85)	(1.86)	(.24)	(3.05)	(1.95)
R^2	.11	.15	.10	.12	.16	.10
F Ratio	9.54	14.43	8.93	10.84	14.79	8.91

Notes: N = 724; *t*-statistics are given in parentheses.

influenced by his wife's earnings potential.[3] Interestingly, nonlabor income had the expected, statistically significant negative effect on the probability of labor force participation of men. The same explanatory factors could not explain as high a proportion of the variation in wages for men as for women. The R^2 in the wage equation run across the truncated sample of 808 employed men was .23. However, this result is comparable to the goodness of fit obtained by previous researchers for their estimation equations, as indicated previously.

Demand Equations

The demand equations, presented in table 4, were estimated first with "full income" and then, for comparison, with "observed income." "Full income" is exogenous to the household members' time allocation decisions, whereas money income is not. If the household preparation time of foods varies, then the households' food consumption and time allocation decisions are not independent. Therefore, money income is an endogenous variable. However, given these theoretical arguments, the practical question remains as to whether the use of "full" or "observed income" makes a notable difference in the empirical results.

The demand equations are specified as semilogarithmic functions with the dependent variable and income placed on a per capita basis by dividing by household size and with the number of adult equivalent persons entered as an additional explanatory variable. This specification reflects the previous estimating equations of George and King (p. 75), West and Price (p. 726), and Hyman and Shapiro (pp. 260–61). The *RATIO* dependent variable indicates the proportion of total cereal consumption accounted for by bread and is defined as *BREADQ*/(*RICEQ* + *BREADQ* + other wheat products, primarily flour).

The parameter estimates and *t*-statistics are

[3] An argument can be made that for modeling consistency the primary woman's predicted wage should be included in the male's probit participation equation. The simultaneous solution of the Heckman procedure for men and women would be required, which would necessitate a computationally complex procedure. Such a simultaneous approach to estimating male and female wages has never been previously employed (Smith). Furthermore, there is no reason to expect that this alteration in what is an intermediate step would have any meaningful effect on the results of the demand equations.

reported in table 4. The income elasticities with respect to "full income" (*SP*), evaluated at the mean, are .22 for bread and .24 for rice. With money income (*YP*), the respective elasticities are .18 and .15. Mincer showed that estimates of the income elasticity of demand will be biased due to specification error if the opportunity cost of time is ignored. The ratio equation represents the ratio of two demand functions: the numerator is the demand for bread and the denominator the demand for total cereals. Consequently, the income elasticity from the ratio equation should be equal to the income elasticity of bread demand minus the income elasticity of total cereals. This interpretation would also hold for the other ratio equation coefficients when converted to elasticities.

With regard to the central hypothesis of this study, the value of time of the primary woman (*WAGEWP*) has the expected positive impact on bread consumption and the ratio and the anticipated negative impact on household rice consumption. The effect of the woman's value of time does not appear to be particularly sensitive to the alternative specifications of income (*SP* or *YP*) utilized in the demand equations. In each case, the effect is statistically significant at the 5% level, except in the specification for rice with observed income. The appropriate interpretation of the wage coefficient is somewhat different in the "full income" and "observed income" equations, though. In the former case, the wage coefficient has the usual Slutsky relation interpretation. In the latter, the interpretation is different, but the coefficient does not represent a pure substitution effect.

Based on the first two equations in table 4, the elasticity with respect to the woman's value of time is .13 for bread, at the mean, and −.07 for rice. In an earlier specification an additional independent variable was included which interacted the woman's estimated wage with her employment status, as was done by Prochaska and Schrimper (p. 597). This term was added to allow the wage effect to vary if the woman actually held a labor force job. The term was not statistically significant, though, and was dropped.

In terms of the other variables, adult equivalent units, which serve to adjust for sex and age composition differences between households, are statistically significant only with the ratio-dependent variable and then only at the 10% level. The consistently negative sign of the AEU coefficient would appear to indicate the existence of possible economies of scale. The commodity price effects have the expected sign in every instance, except for the impact of ln*FLOURP* on rice consumption, but that effect is clearly not significant.[4] Based on the coefficients in the "full income" equations, the own-price elasticities are −.75 for bread and −.67 for rice. The impact of the ethnic and racial variables conforms to expectations. Ceylon Tamils consume less bread, while other races, which include Europeans, consume less rice.

Conclusions

The empirical results for Sri Lanka provide strong support for the hypothesis that the opportunity cost of time of women can be an important determinant of food consumption patterns. The increased value of human time must be considered one of the factors underlying the shift from time-intensive traditional foods to time-saving foods, especially commercially baked bread, which is occurring quite generally in developing countries. As economic development progresses, the rising value of time can be expected to exert a sustained positive impact on bread consumption, and hence on wheat imports in many nonproducing developing countries.

Further research is needed to confirm these results for other countries. The analysis also needs to be extended to a complete demand system approach which covers a comprehensive bundle of food categories. The former is suggested because the strength of the effect may vary across countries and cultures. The latter is important because the opportunity cost of time can be expected to affect the entire range of foods, which vary in their household time intensity. Incorporation of the value of time into demand analysis, however, requires consumption and expenditure surveys which collect the necessary data on individual earnings and employment. These results for Sri Lanka clearly suggest that the value of time is a potentially significant factor in explaining changing food consumption patterns

[4] Since prices were derived by dividing expenditures by quantity, this creates a right-hand-side variable in the demand equations which includes the endogenous variable, and hence the potential for simultaneous equation bias results. However, there is no good way around this problem, given standard cross-sectional data.

and should be a factor in future research and food policy considerations.

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References

Becker, Gary S. "A Theory of the Allocation of Time." *Econ. J.* 75(1965):493–517.

Behrman, Jere R., and Barbara L. Wolfe. "Labor Force Participation and Earnings Determinants for Women in the Special Conditions of Developing Countries." *J. Develop. Econ.* 15(1984):259–88.

CIMMYT (International Maize and Wheat Improvement Center). *1983 World Wheat Facts ana Trends, Report Two: An Analysis of Rapidly Rising Third World Consumption and Imports of Wheat.* London, 1983.

Deaton, Angus. "Inequality and Needs: Some Experimental Results for Sri Lanka." *Population and Development Review*, a supplement to vol. 8 on Income Distribution and the Family, ed. Yoram Ben-Porath, 1982, pp. 35–52.

Deaton, Angus, and John Muellbauer. *Economics and Consumer Behavior.* Cambridge: Cambridge University Press, 1980.

Evenson, Robert E. "On the New Household Economics." *J. Agr. Econ. and Develop.* 6(1976):87–107.

Fletcher, Stanley M. "Economic Implications of Changing Household Away-from-Home and At-Home Food Expenditure Patterns." Ph.D. thesis, North Carolina State University, 1981.

George, P. S., and G. A. King. *Consumer Demand for Food Commodities in the United States with Projections for 1980.* Giannini Foundation Monograph No. 26, University of California, Berkeley, March 1971.

Gronau, Reuben. "Leisure, Home Production, and Work—The Theory of the Allocation of Time Revisited." *J. Polit. Econ.* 85(1977):1099–1123.

———. "The Effect of Children on the Housewife's Value of Time." *Economics of the Family*, ed. T. W. Schultz. Chicago: University of Chicago Press, 1974.

Heckman, James J. "Sample Selection Bias As a Specification Error." *Female Labor Supply: Theory and Estimation*, ed. James P. Smith. Princeton NJ: Princeton University Press, 1980.

———. "Sample Selection Bias As Specification Error." *Econometrica* 47(1979):153–61.

———. "Shadow Prices, Market Wages, and Labor Supply." *Econometrica* 42(1974):679–94.

———. "The Common Structure of Statistical Models of Truncation, Sample Selection, and Limited Dependent Variables and a Single Estimation for Such Models." *Ann. Econ. and Soc. Measure.* 5/4(1976):475–93.

Hyman, Saul, and Harold Shapiro. "The Allocation of Household Income to Food." *Five Thousand American Families: Patterns of Economic Progress*, vol. 2, ed. Greg J. Duncan and James N. Morgan. Ann Arbor: Institute for Social Research, University of Michigan, 1974.

Jones, Christine. "The Mobilization of Women's Labor for Cash Crop Production: A Game-Theoretic Approach." *Amer. J. Agr. Econ.* 65(1983):1049–54.

Kinsey, Jean. "Working Wives and the Marginal Propensity to Consume Food Away from Home." *Amer. J. Agr. Econ.* 65(1983):10–19.

McElroy, Marjorie, and Mary Jean Horney. "Nash-Bargained Household Decisions: Toward a Generalization of the Theory of Demand." *Int. Econ. Rev.* 22(1981):333–50.

Michael, Robert T., and Gary S. Becker. "On the New Theory of Consumer Behavior." *Swedish J. Econ.* 75(1973):378–96.

Mincer, Jacob. "Market Prices, Opportunity Costs, and Income Effects." *Measurement in Economics: Studies in Mathematical Economics and Econometrics in Memory of Yehuda Grunfeld*, ed. C. Christ et al., Stanford CA: Stanford University Press, 1963.

Muth, Richard F. "Household Production and Consumer Demand Functions." *Econometrica* 34(1966):699–708.

Nerlove, Marc. "Household and Economy: Toward a New Theory of Population and Economic Growth." *J. Polit. Econ.* 82(March/April 1974, part 2):200–18.

Olsen, Randall J. "A Least Squares Correction for Selectivity Bias." *Econometrica* 48(1980):1815–20.

Pollack, Robert A., and Michael L. Wachter. "The Relevance of the Household Production Function and Its Implications for the Allocation of Time." *J. Polit. Econ.* 83(1975):255–77.

Prochaska, Frederick J., and Ronald A. Schrimper. "Opportunity Cost of Time and Other Socioeconomic Effects on Away-from-Home-Food Consumption." *Amer. J. Agr. Econ.* 55(1973):595–603.

Sahn, David E. "Food Consumption Patterns and Parameters in Sri Lanka: The Causes and Control of Malnutrition." Mimeographed. Washington DC: International Food Policy Research Institute, Oct. 1984.

Smith, James P., ed. *Female Labor Supply: Theory and Estimation.* Princeton NJ: Princeton University Press, 1980.

Thompson, Robert L., and G. Edward Schuh. "A Metademand Function." Paper presented at AAEA annual meetings, Columbus OH, 10–13 Aug. 1975.

West, Donald, and David Price. "The Effects of Income, Assets, Food Programs, and Household Size on Food Consumption." *Amer. J. Agr. Econ.* 58(1976):725–30.

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