The Role of Time Use Data in Estimating Household Production

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Introduction

Why measure household production?

Household production represents "income," but is not reflected in measures that include only money income.

This presentation examines the use of time diary data to supplement income and welfare measures with measures of the values of household production.

I discuss Frazis and Stewart (2011) as an application.

Definition of household production

Third-party test:

Household production is defined as the output of activities where the service could be provided by hiring a third person rather than doing it oneself.

Valuation approaches

Input vs. output approach (will not be discussing output)
Opportunity cost vs. replacement cost approach.

Opportunity-cost approach values time spent in household production at the individual's market wage

Difficulties:
- Implicit assumption that hours of paid work are freely variable at the margin may not hold
- Assumes that people who are highly productive in market work are just as productive doing household work
- Necessary to impute a wage for nonworkers

Valuation (cont'd)

Replacement-cost approach: Time spent in household production is valued at the cost it would take to purchase the production in the market

Options:

- Specialist wage that corresponds to purchasing the specific activity

- Generalist wage

American Time Use Survey

Time diaries most reliable method of gathering time-use data. The American Time Use Survey (ATUS) is a time-diary survey funded by BLS and conducted by the Census Bureau beginning in January 2003

- Current Population Survey (CPS) household sample, civilians 15 and over
- Households are selected using CPS reference person characteristics
- One **Designated Person** (DP) per household is selected for ATUS.
- Survey in conducted continuously throughout year.

Time Diary

- Respondents are asked to describe what they did yesterday, beginning at 4:00AM and continuing through 4:00AM on the day of the interview

- For each episode, ATUS collects:
  - Primary activity (verbatim description coded to 3-tier codes)
  - Start and stop times of episode (diary day starts at 4:00AM)
  - Location of activity
  - Who was with the respondent

- ATUS does not collect information about secondary activities with exception of childcare

Data Issues

ATUS data present an incomplete picture of household production.

- One person per household
- One day per person

Application

• "How Does Household Production Affect Measured Income Inequality?", Harley Frazis and Jay Stewart, Journal of Population Economics (2011)

• Examine distribution of extended income (money + hh production)

• How associate measured time in hh production with income?

Imputation of household production using regression.

• A subset of the 2003 ATUS sample can be matched to their March Income Supplement data, so can associate household production with money income.

Regression imputation

The value of household production was imputed using the following specification:

$$P_i = f(Z_i, X_i) + u_i, \text{ where}$$

$$f(Z, X) = a + bZ + cZ^2 + X\beta$$

and

Z = Log of annual family income

X = Vector of covariates (demographic characteristics and earnings information for each adult in household)

Imputation of Household Production (continued)

Separate regressions were run for each sex × marital status × week(day,end) cell (8 cells total)

For each sex × marital status cell, the imputed value of household production is given by

$$\hat{P}_i = 5\hat{f}_D(Z_i, X_i) + 2\hat{f}_E(Z_i, X_i)$$

where D,E denotes weekday/weekend day

For each person in the sample:

Extended Income = Earnings + Value of household production $(\widehat{P_i})$

Average Household Production

- Two definitions of household production- with and without secondary child care
- Two valuation approaches - generalist wage (Maids and Housekeepers) and specialist wage

	Household Money Earnings	Household Production			
		Generalist Wage		Specialist Wage	
		Secondary Childcare Excluded	Secondary Childcare Included	Secondary Childcare Excluded	Secondary Childcare Included
All	70,492	21,396	31,303	23,273	32,758
Single	38,078	9,323	11,523	10,412	12,429
Married	82,531	25,880	38,649	28,050	40,309

Household Production is Important

The value of household production is large compared with earnings:

All	30-47 percent of earnings
Singles	25-34 percent of earnings
Married couples	31-48 percent of earnings

Put differently, if we add the value of household production to earnings, household production would equal:

All	23-32 percent of extended income
Singles	20-25 percent of extended income
Married couples	24-33 percent of extended income

Comparison of Money and Extended Income

Extended income is more equally distributed than money income. This result is invariant to:

- Definition of household production
- Wage used to value household production
- Equivalence scale used

Comparison of Money and Extended Income

	Income Measure	Generalist Wage and Secondary Childcare Excluded		Specialist Wage and Secondary Childcare Included	
		OECD Equivalence	Sq. Root Equivalence	OECD Equivalence	Sq. Root Equivalence
Gini Coefficient	Money	0.42	0.41	0.42	0.41
	Extended	0.33	0.33	0.30	0.30
90th/50th percentile	Money	2.44	2.39	2.44	2.39
	Extended	2.06	2.02	1.93	1.88
50th/10th percentile	Money	3.26	3.21	3.26	3.21
	Extended	2.10	2.07	1.87	2.04
90th/10th percentile	Money	7.95	7.67	7.95	7.67
	Extended	4.32	4.17	3.60	3.83

All differences between Family Income and Extended Income are statistically significant at the 1% level.

Comparison of Money and Extended Income (Means)

The reduction in inequality is due to the addition of mean household production to earnings, rather than any variation in production between high-wage and low-wage households.

	Household Production Measure	Generalist Wage and Secondary Childcare Excluded		Specialist Wage and Secondary Childcare Included	
		OECD Equivalence	Sq. Root Equivalence	OECD Equivalence	Sq. Root Equivalence
Gini Coefficient	Imputed	0.33	0.33	0.30	0.30
	Mean	0.33	0.32	0.30	0.29
90th/50th percentile	Imputed	2.06	2.02	1.93	1.88
	Mean	2.06	2.02	1.95	1.91
50th/10th percentile	Imputed	2.10	2.07	1.87	2.04
	Mean	2.05	2.03	1.85	1.82
90th/10th percentile	Imputed	4.32	4.17	3.60	3.83
	Mean	4.22	4.10	3.60	3.48

Simulating the Effect of Person-Specific Variation in Household Production

• Regression imputation ignores residual variance of household production.

• The variance of the error in our estimating equation can be decomposed into a person-specific component (m_i) and day-to-day variation (e_{it}): $P_{it} = f(Z_i, X_i) + m_i + e_{it}$

If Var(e_{it}) = 0 ➜ No day-to-day variation

Var(m_i) = 0 ➜ No permanent (residual) variation

• Can use these relations to simulate effect of varying Var(m_i) from minimum to maximum possible value.

Adding the person-specific effects matters, but the effect is small

	Household Production Measure	Generalist Wage & Secondary CC Excluded		Specialist Wage & Secondary CC Included	
		OECD Equivalence	Sq. Root Equivalence	OECD Equivalence	Sq. Root Equivalence
Gini Coefficient	Imputed	0.33	0.33	0.30	0.30 **
	Imputed + 0.5s	0.34 **	0.33 **	0.31 **	0.31 **
	Imputed + 1.0s	0.35 **	0.34 **	0.32 **	0.32 **
90th/50th percentile	Imputed	2.06	2.02	1.93	1.88
	Imputed + 0.5s	2.07	2.02	1.94	1.89
	Imputed + 1.0s	2.08	2.03	1.97	1.92
50th/10th percentile	Imputed	2.10	2.07	1.87	2.04 **
	Imputed + 0.5s	2.14 *	2.16 **	1.95 **	2.09 **
	Imputed + 1.0s	2.28 **	2.30 **	2.14 **	2.25 **
90th/10th percentile	Imputed	4.32	4.17	3.60	3.83 **
	Imputed + 0.5s	4.43	4.37 *	3.78 *	3.96 **
	Imputed + 1.0s	4.73 **	4.67 **	4.22 **	4.32 **

* Statistically different from Mean version of extended income at 5% level
** Statistically different from Mean version of extended income at 1% level

Can we link time-use data with other datasets using common covariates?

Only possible if residual variance does not contain person-specific component (i.e., residual is all day-to-day variation).

Some evidence on this in recent paper by Han, Meyer, and Sullivan (2020), which concerns leisure rather than household production.

They use panel time-use data from 1970s to show that person-effects are small in magnitude.

- Does using household production rather than leisure affect this result?
- Has variance structure changed since the 70s?

Conclusions

- Can come up with reasonable measure of household production and its relation to income using time-diary data.

- General features of distribution can be bounded.

- More exact description of distribution relies on more difficult to observe features of data (variance structure).