

How Large Are Household Economies in Time?

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Background: Living together saves money

- Previous research focused on economies in expenditures
- **Engel (1897)**: per capita food expenditures fall as households grow
- Two adults together spend 31-35% less than single individuals (**Lazear and Michael, 1977, 1980**)
 - largest savings are in food and shelter expenditure
 - smaller savings in personal care
- Larger household spend less per capita on food, all else equal, in developed and developing countries (**Deaton and Paxson, 1998**)
 - Puzzling since food is a private good which can not be shared
- Three sources of economies in expenditure for larger families:
 - Household “public” goods that can be shared
 - Less waste
 - Lower unit prices if buying in bulk is possible
- Expenditure and time are substitutes in food production:
 - **Aguiar and Hurst (2004)**: 17% decline in expenditures at the time of retirement is matched by an even more dramatic 53% increase in time spent shopping and preparing food while quality and quantity of food intake remains the same.
- No previous research has examined economies in time

Why do we care about economies in time?

Consider the following food example:

- Average U.S. household spends over 13% of its total expenditures on food
 - Cost of food is on average \$6,881 per year, or \$19/day per household (BLS)
- Average married couple in the U.S. spends 145 hours/month buying food, cooking and consuming meals (**Gronau and Hamermesh, 2003**)
 - Food preparation and eating time is 2.4 hours per person per day, or about 15% of individuals' total waking time.
 - At an average US hourly wage rate of \$15, the opportunity cost of preparing daily meals is \$36 per person, or \$72 per couple.
- The value of the time inputs into household food production is high relative to the cost of market inputs
- As two adults move in together, each of them may spend less time in all household production tasks such as
 - Food: cooking and grocery shopping
 - Household maintenance: house cleaning, repairs, non-food shopping, errands
 - Childcare: childcare tasks may be divided between two adults
- The same level of consumption may be achieved in larger households at lower per capita expenditures and perhaps even lower time.
 - Time saved may be spent on private uses like leisure.
 - In this case, measures of welfare that do not include time may *underestimate* welfare of larger households.
 - Expenditure-based equivalence scales may *overestimate* welfare of larger households if larger families spend more time in household production at the expense of leisure

Goals of this research

To answer the following questions:

- How do men and women reallocate their time in response to a change in household size?
- How do the observed economies or diseconomies vary for different activities and for men and women?
- What do larger families do with their extra time saved as a result of such economies? Or, in case of diseconomies, where does the extra time come from?

Contributions of this research:

- Model of household economies in time and goods within a household production framework
- Empirical evidence on in the data on household production time and expenditure for single adults and married couples

The Model

- n identical individuals live in a unitary household and enjoy consumption of final commodity z
- z is produced out of market-purchased inputs and time, x and t , with possible economies in both inputs:
 - α and β are scale elasticities.
 - $\alpha=0$ and $\beta=0$ mean there are no economies in purchased goods or time
 - Ex: restaurant meals have no economies in time and in food
 - $\alpha=1$ and $\beta=1$ mean there are full economies in purchased market goods.
 - Ex: a couple shares the cost of housing and durable goods
 - Ex: it takes the same time to prepare a meal for n household members as it does for one person. Likewise if it takes as much time to take care of two or more children as it takes to take care of one child
- Each individual maximizes his/her utility s.t. constraints:

$$\begin{aligned} \text{Max } & U(z) \\ & z = f(n^\alpha x, n^\beta t) \\ & T = l + t \\ & px = wl \end{aligned}$$

Effective quantities and prices:

$$x^* = xn^\alpha \quad t^* = tn^\beta \quad p^* = \frac{p}{n^\alpha} \quad w^* = \frac{w}{n^\beta}$$

Solution is (x^*, t^*) such that

$$\begin{aligned} x^* &= \frac{1}{n^\alpha} g_x \left(\frac{p}{n^\alpha}, \frac{w}{n^\beta}, I \right) \\ t^* &= \frac{1}{n^\beta} g_t \left(\frac{p}{n^\alpha}, \frac{w}{n^\beta}, I \right) \end{aligned}$$

Where g^* is a single person's allocation of money to market goods and time to household production

Elasticities of demand with respect to household size

$$\frac{\partial \ln x}{\partial \ln n} = -\alpha(1 + \varepsilon_{xp}) - \beta\varepsilon_{xw}$$

Elasticity of demand for market input is negative since market input has own price elasticity between 0 and 1. Larger in absolute value for larger economies in goods and time.
Empirically: this elasticity is negative in previous studies

$$\frac{\partial \ln t}{\partial \ln n} = -\beta(1 + \varepsilon_{tw}) - \alpha\varepsilon_{tp}$$

Elasticity of time input is negative when wage elasticity of household production time is > -1 , and positive when wage elasticity of household production time is < -1 and larger positive when economies in time are relatively large

Income effect of household size on household production time:

- Economies in purchased goods and household production time allow a larger families to maintain the same level of consumption of the final commodity while spending less per capita time and/or money on household production
 - an increase in household size leads to an increase in consumption of all final commodities (normal goods). Time and market input increase

Substitution effect of household size on household production time:

- Larger families substitute toward relatively cheaper input (time or goods, the one with higher economies in size), in production of each final commodity, and substitute toward consumption of those commodities production of which is intensive in the cheaper input
 - the substitution should be larger in production of those commodities for which economies in market substitutes are small and the market goods are more expensive
- Net effect on market inputs: Ambiguous. It is an empirical issue

Data: American Time Use Survey 2003

Sample: Single and married individuals ages 25-65, living in one and two adult households, non-disabled, excluding full time students and retired

Total time is divided into:

- Household Production
 - Food
 - Food at home: cooking, buying food, related travel
 - Food away from home: buying meals, waiting for meals, related travel
 - Eating
 - Housework
 - All housework indoors and outdoors, gardening, pet care, care for adults, repairs, non-food shopping, purchase of services, related travel
 - Primary Childcare
 - Childcare, related travel
- Market Work
- Leisure
- Sleep

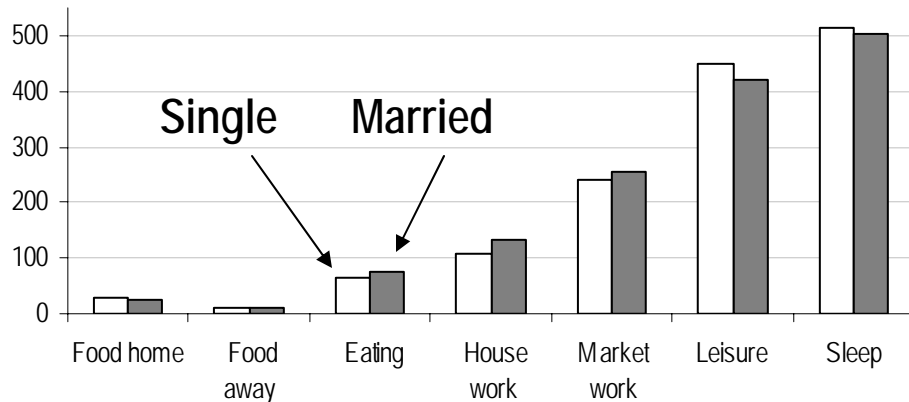
In this model, household size affects the allocation of time and money through its impact on the productivity of labor in household production.

- If men and women have different marginal productivities in household production, then larger household size would induce larger substitution of women's time for goods

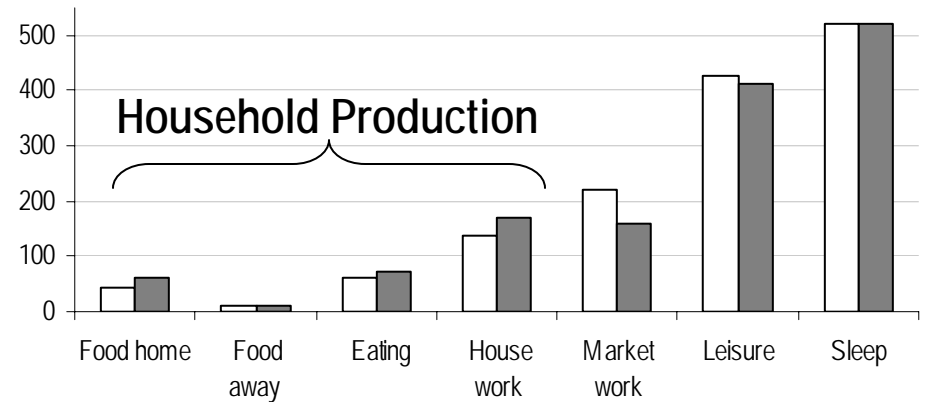
Time Use Sample Means, min/day

Compared to single women, married women spend on average more time in all household production activities, more time with children, less time in market work, and enjoy less leisure. Compared to single men, married men spend less time cooking and shopping for food, more time in market work, more time with children, more (men without children) or less (men with children) time in housework and enjoy less leisure.

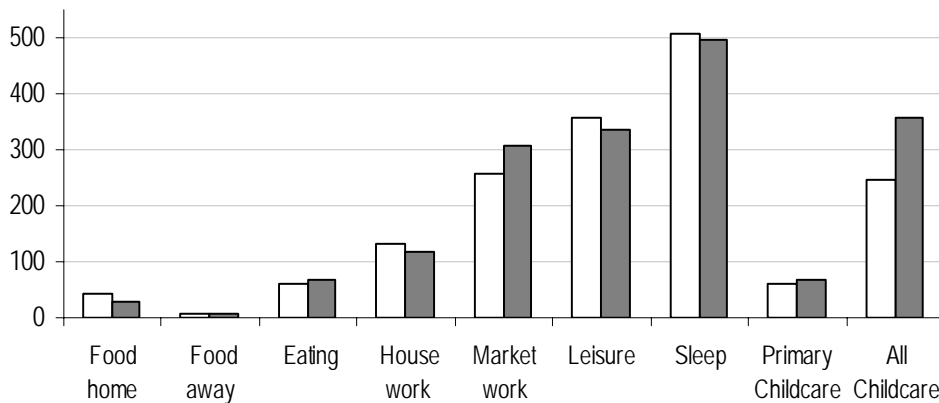
Men, No Children



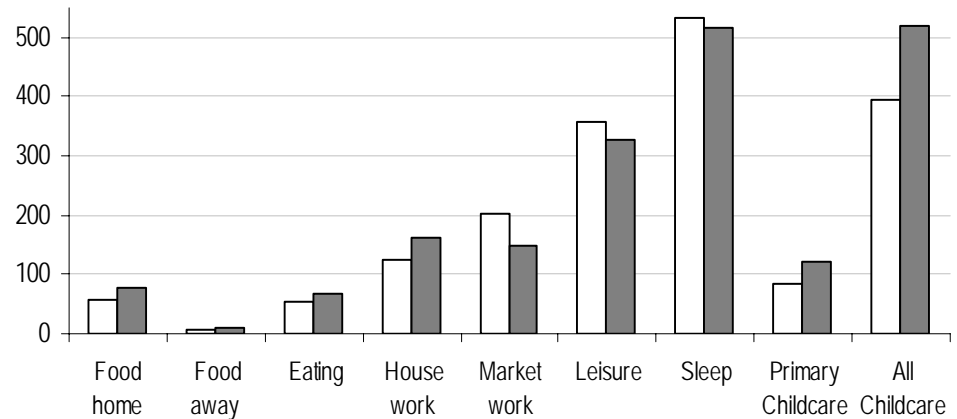
Women, No Children



Men, With Children



Women, With Children



Married Couples vs Single Adults

Difference between the average time use of a synthetic couple's and two single adults:

$$\text{Married Man's time} + \text{Married Woman's time} - (\text{Single Man's time} + \text{Single Woman's time})$$

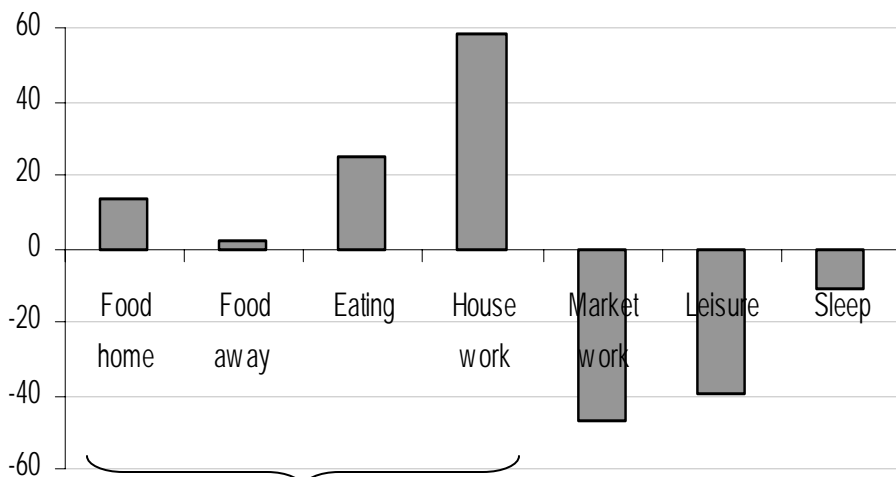
Married couple spends *more time* in all household production activities and less time in market work, leisure and sleep. Married couples with no children spend

- 1 hour more time in housework
- over 20 min more time eating
- 15 min more time cooking and grocery shopping
- about the same time on food away from home

Compared to single parents, married couples with children spend

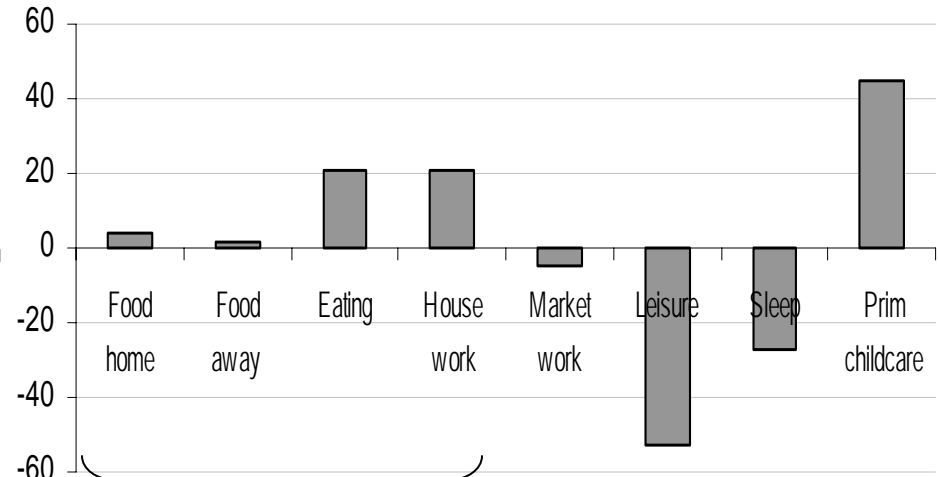
- 20 min more in housework and eating, each
- about same time preparing food and eating out

Households without Children



Household Production

Households with Children



Household Production

Regression Analysis

The following demand equations are estimated for different time use categories separately for men and women:

$$t = \beta_0 + \beta_1 d_1 + \beta_2 d_2 + \beta_3 X + \xi_1$$

- Dependent variables: time spent in all household production (food, housework, childcare), leisure, sleep
- Dummies d_1 and d_2 are indicators for “married, spouse employed” and “married, spouse non-employed”
- Vector X corrects for age, race, education, family composition, region of residence, employment status, day of the week, US citizenship status
- Censored regressions (dependent variables have many zero values) are estimated using tobit regressions
- Tobit coefficients are marginal effects of covariates on the latent variable that takes observed values for non-zero observations and non-positive values when zeros are observed
- Slopes given censoring have the same signs as tobit coefficient but smaller in absolute value

Sample Characteristics

	<u>Mean</u>	<u>St Dev</u>
<u>N=9975</u>		
Male	0.45	0.5
Married	0.69	0.46
Age	43.8	10.8
Employed	0.78	0.42
Children <18 present	0.53	0.5
Children <6 present	0.25	0.43
Black	0.11	0.31
Asian	0.03	0.16
Hispanic	0.1	0.3
No high school	0.09	0.28
College Degree	0.23	0.42
Graduate Degree	0.13	0.34
US citizenship	0.89	0.31
North East	0.2	0.4
Midwest	0.26	0.44
West	0.2	0.4
Metro	0.8	0.4
Friday	0.09	0.29
Saturday	0.25	0.43
Sunday	0.27	0.44

Regression Results, ATUS, Women, N=5500

Variable \ Equation	Food home	Eating	Food out	House work	Primary childcare*	All HP	Leisure	Sleep	All Childcare*
	tobit	tobit	tobit	tobit	tobit	ols	ols	ols	tobit
Married, spouse employed	26.5	10.1	3.8	32.5	26.8	69.5	-20.4	-10.2	118.8
Married, spouse non-emp	20.5	11.2	-6.6	20.2	14.4	46.9	-25.0	5.4	93.8
Non-employed status	28.9	4.6	-4.2	35.1	42.9	80.1	109.6	28.4	136.2
Presence of children <18	14.3	-3.1	-0.2	2.5		46.2	-10.2	-0.9	
Presence of children <6	2.5	3.4	-5.6	-13.3	99.7	79.4	-48.6	-12.9	177.5
Child/adult ratio	13.5	0.8	-1.7	7.1	31.9	36.1	-21.8	-6.4	84.7
Age	1.4	-1.1	-1.8	1.6	3.9	2.0	-5.1	-2.3	2.7
Age-sq/100	-0.5	1.6	1.9	-0.7	-6.9	-0.8	7.0	1.1	-13.1
Black	-3.0	-17.1	-13.9	-67.7	-48.1	-86.7	68.6	10.8	-67.5
Asian	22.0	6.0	-8.8	-66.9	-19.8	-28.9	21.4	-13.9	11.8
Hispanic	2.4	-2.3	-3.3	-37.9	-32.5	-49.7	14.1	11.3	-24.7
No high school diploma	10.4	-9.8	-20.5	-24.4	-33.6	-29.4	7.2	23.6	-73.4
College degree	-3.4	6.7	4.0	-1.6	35.1	17.7	-8.1	-8.7	39.4
Graduate degree	-12.9	16.9	13.5	-9.1	45.4	19.0	-14.5	-10.2	20.7
Friday	-16.9	4.7	15.0	11.4	10.8	-10.6	30.9	-9.0	7.6
Saturday	5.2	9.5	15.2	96.5	-76.5	77.9	96.9	43.3	108.8
Sunday	9.6	10.8	9.7	33.9	-71.7	25.2	134.3	79.4	111.1

Not shown in regressions for men and women: intercept and scale, three regional dummies, metropolitan status, US citizenship status, a dummy for housing other than house or apt

Regression Results, ATUS, Men, N=4475

Variable \ Equation	Food home	Eating	Food out	House work	Primary childcare*	All HP	Leisure	Sleep	All Childcare*
	tobit	tobit	tobit	tobit	tobit	ols	ols	ols	tobit
Married, spouse employed	-16.1	6.6	-3.7	26.5	-1.1	25.5	-11.6	-7.8	156.3
Married, spouse non-emp	-34.5	9.1	-3.3	-5.4	-16.3	-3.9	2.7	-0.7	134.6
Non-employed status	23.3	-1.4	-9.2	42.9	63.3	59.7	180.6	47.4	158.0
Presence of children <18	12.7	-9.2	-4.8	-5.0		10.2	-37.5	5.0	
Presence of children <6	8.3	6.5	-1.6	-8.8	82.2	47.0	-40.8	-8.1	89.3
Child/adult ratio	4.7	0.8	-2.4	11.0	33.9	31.3	-1.2	-7.6	93.8
Age	3.5	-1.9	-1.3	7.0	13.4	6.0	-5.4	-0.8	36.3
Age-sq/100	-3.1	2.4	1.2	-6.8	-17.8	-5.6	5.8	0.1	-50.7
Black	-2.3	-24.7	-10.5	-66.1	-5.3	-69.6	75.1	13.4	2.0
Asian	-8.2	7.0	0.2	-59.9	-19.8	-38.8	28.6	20.9	-4.2
Hispanic	-5.3	-1.5	7.5	-4.5	-13.2	-11.6	22.1	1.6	-30.1
No high school diploma	3.5	-11.2	-11.2	-40.1	-48.6	-49.3	14.6	35.9	-1.7
College degree	6.0	7.2	12.0	8.7	35.3	23.1	-10.7	-10.1	30.5
Graduate degree	3.0	14.1	11.8	-11.7	56.4	17.0	-12.9	-21.4	67.3
Friday	-8.0	7.2	17.4	5.1	22.1	6.9	26.3	-13.2	31.0
Saturday	12.7	14.2	14.4	96.1	-2.3	115.5	150.3	38.7	252.8
Sunday	20.8	9.5	7.0	73.8	-17.6	83.3	178.3	85.1	258.1

Significant at 5% coefficients in bold

*For households with children only

Results

- **Does getting married and living together save men and women time in non-market activities compared to being single?**
- **NO.**
- **Working couples living together spend 1 hour 35 min more total time in household production than two single adults**
 - **Men's household production time increases by a net of 26 min/day**
 - This increase is mostly due to more time in housework
 - Small part of this increase is due to more time spent eating
 - Married men spend less time preparing food at home
 - Married status does not affect men's time spent eating out or take care of children
 - **Women's household production time increases by 1 hour 10 min/day**
 - Mostly due to more time spent in housework, food preparation and childcare
 - Married status does not affect women's time spent eating out
- **Couples who specialize labor (working men, non-working women) spend 2 hour 30 min more time in household production than single adults**
 - This increase is entirely at the expense of women's time
 - Men's total household production time does not change compared to being single, men reduce time spent cooking and increase time spent eating
- **Non-traditional couples (wife works for pay, husband stays home) spend total of 2 hours more time in household production compared to two single adults**
 - Wife spends 47 min more increasing her time in housework, food preparation and eating, but not in childcare and not in eating out
 - Husband spends 1 hour and 25 min more, due to more time spent in childcare, food preparation and housework

Additional Results

- Extra household production time for married women comes at the expense of reduction in market work time, leisure and even sleep:
 - Married women sleep 10 min less and enjoys 20 min less leisure than single women
 - Men's leisure and sleep are not significantly different from single men's
- Married parents spend substantially more time with children compared to single parents
- Less educated men and women spend less time in household production and more time sleeping
- More educated women spend less time on cooking and grocery shopping and more time eating out
- Black men and women spend less time in housework and spend more time in leisure and sleep
- Women spend less time in primary childcare on weekends compared to weekdays
- Most housework is done on weekends, mostly on Saturdays, while Sundays are more popular for food preparation
- Summary from Consumer Expenditure Survey 1995 below shows that married couples spend per adult less on food, household maintenance and childcare
 - Largest relative savings for couples without children are on restaurant meals and household maintenance, smaller in groceries
 - Working couple without children saves $245+373= \$618$ per quarter ($\$6.80/\text{day}$) on what may be viewed as inputs into household production compared to single adults
 - Women spend 20% less, men spend 34% less than single counterparts
 - Largest savings are in food eaten out for men who marry a non-working wife while a working woman will enjoy the least savings on this item
- Couples spend less money but not less time on food eaten out. There must be a "leisure" component in time spend on restaurant meals

Evidence from Consumer Expenditure Survey

Sample to match the ATUS sample: Singles and couples, one and two adult households, ages 25-65, non-disables, non-retired, no full time students.

Food : food and drinks, no alcohol, at home and away from home

House: household services, vehicle maintenance, service flow from small durables based on flat rate 5 yr depreciation (rent and utilities not included because home production can not a substitute for those)

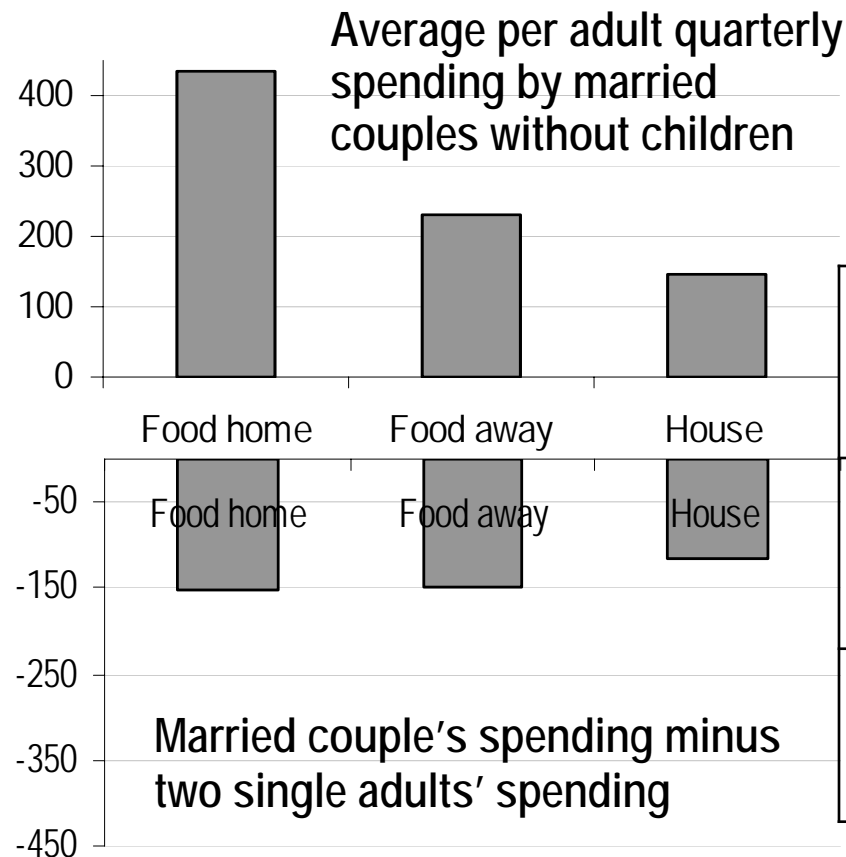
Childcare: cost of daycare and babysitters

Demand equations estimated:

$$x = \alpha_0 + \alpha_1 d_1 + \alpha_2 d_2 + \alpha_3 X + \xi_2$$

Vector X is selected as similar as possible to covariates in the time use equations

Couples expenditures are divided equally between men and women



Expenditure coefficient estimates	Food Home	Food Away	House Maint	Child Care	Total HP
WOMEN, N=8299	ols	tobit	tobit	tobit	ols
Married, spouse emp	-97	-30	-54	-281	-245
Married, sp non-emp	-117	-66	-85	-438	-315
MEN, N=7552					
Married, spouse emp	-149	-146	-59	-69	-373
Married, sp non-emp	-119	-178	-64	-397	-432

Conclusions

- Households re-allocate their expenditure and time in response to a change in household size
 - Couples spend less money per adult on all inputs into household production: food, households services and childcare
 - Married couples' combined household production time exceeds single individual's time spent in similar activities
- There are no net time economies in living together compared to living apart for married couples
 - Larger household size increases productivity of household production, especially for women, and induces substitution away from expenditure towards household production time
 - There are some economies in food preparation time for working men with non-working spouses, but the increase in the spouse's food preparation time more than offsets the decrease in men's time
 - Expenditure-based equivalence scales may slightly underestimate welfare of married couples relative to singles because of a 30 min/day decrease in women's leisure and sleep
- Finding presented above help explain the food consumption paradox (Deaton and Paxson, 1998):
 - Paradox: Larger household can afford to spend per capita more on private goods like food but choose to spend less, all else constant. Lower food consumption is inconsistent with utility maximization.
 - Solution: Larger household choose to reduce capita expenditure on food because they can achieve the same level of consumption with more time-intensive food production