Economics 152, Lecture 5: Economics of the Household

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The Economics of the Household

- Before moving on to labor demand, we will consider one more labor supply topic: the economics of the household
- Households make many decisions that determine the supply of labor
  - Labor supply of couples
  - Home production
  - Fertility choices
- We'll look at some theory and empirical evidence

Home Production

- Classic topic in the economics of the household: **home production**
- Many households produce goods for their own consumption
- Some split work between home and the market
- Increasing female LFP: trend away from home production in favor of market work

Home Production

- Consider someone choosing how to split T total hours between leisure L, market work h_M, and non-market work h_N (home production)
- The person gets utility from consumption and leisure
- He or she can work in the market for a wage of w, and has non-labor income V
- If s/he works at home, the person can produce goods with production function $f(h_N)$
- Suppose $f'(h_N) > 0$ and $f''(h_N) < 0$ (interpretation?)
- How should we write the person's maximization problem?

Home Production

- Maximization problem:

$$\max_{C,L,h_M,h_N} U(C,L)$$

s.t.

$$C \leq wh_M + f(h_N) + V$$

$$L + h_N + h_M = T$$

Home Production

- Substitute $h_M = T - L - h_N$ into the usual budget constraint:

$$\max_{C,L,h_N} U(C, L)$$

$$\text{s.t.}$$

$$C \leq w(T - L - h_N) + f(h_N) + V$$

- How should we solve this?

Home Production

- Lagrangean:

$$\mathcal{L} = U(C, L) + \lambda \left(w(T - L - h_N) + f(h_N) + V - C \right)$$

- Now take first-order conditions with respect to all choice variables: C, L, and h_N

Home Production: First-order conditions

$$MU_C = \lambda$$

$$MU_L = \lambda w$$

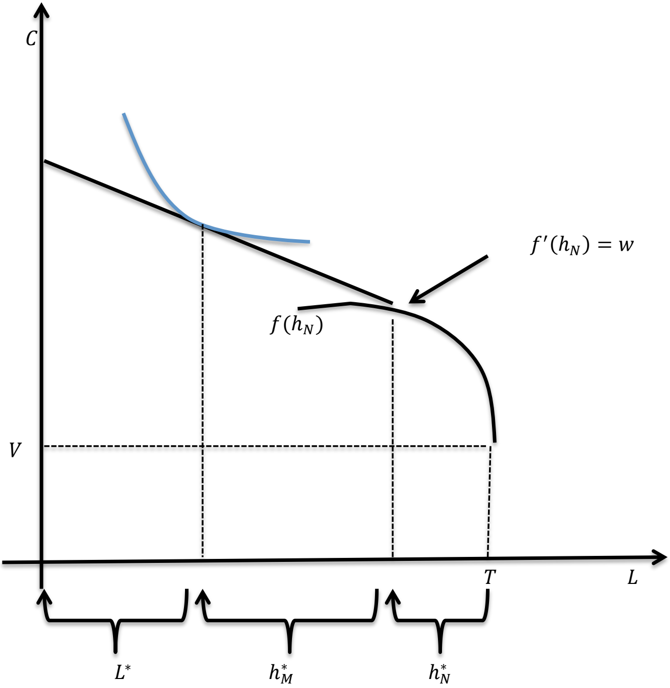
$$f'(h_N) = w$$

Home Production: First-order conditions

- Rearrange first-order conditions:

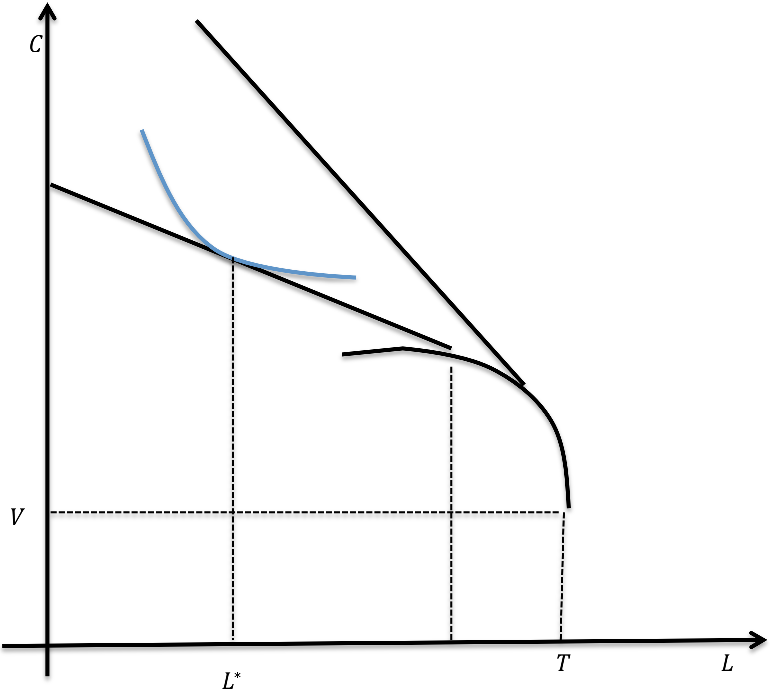
$$MRS_{LC} = f'(h_N) = w$$

- Interpretation: Each hour of work yields the same consumption value at the margin
- As usual, let's depict the solution in a graph

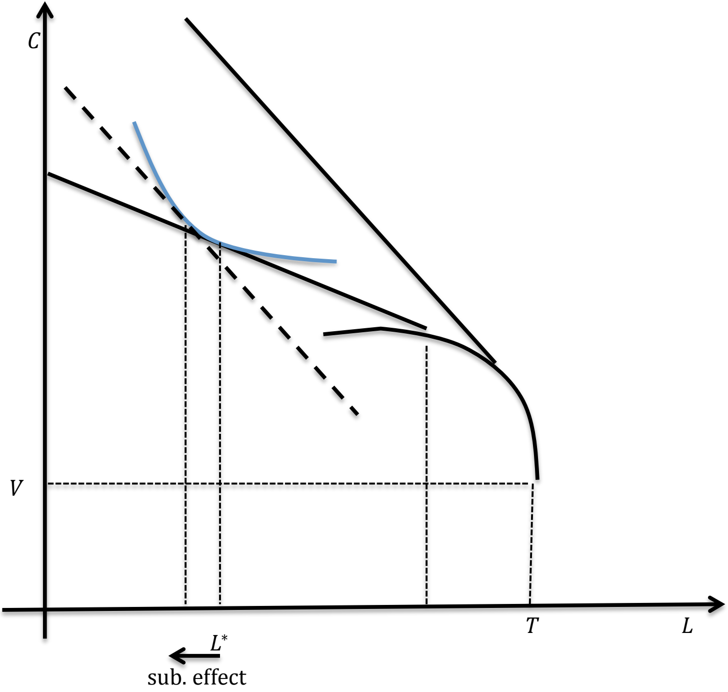

C
V
T
L
$f'(h_N) = w$
$f(h_N)$
L^*
h_M^*
h_N^*

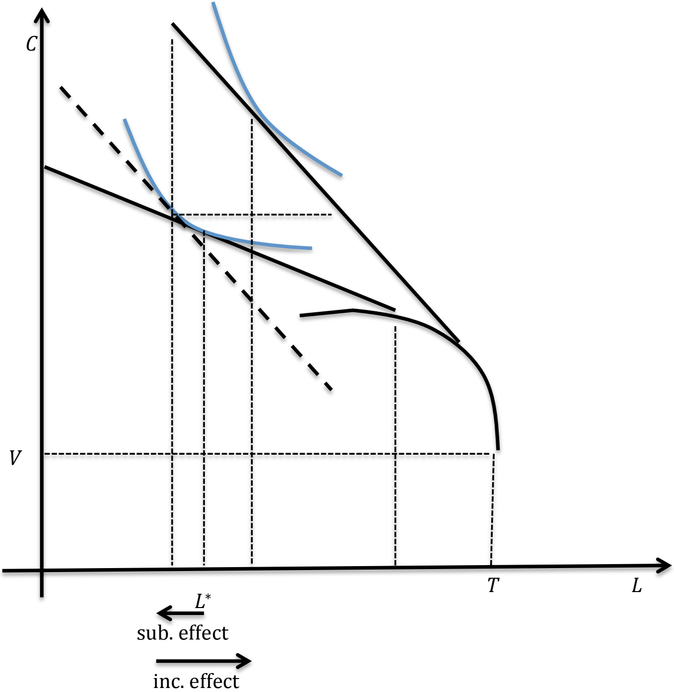
Home Production: Comparative Statics

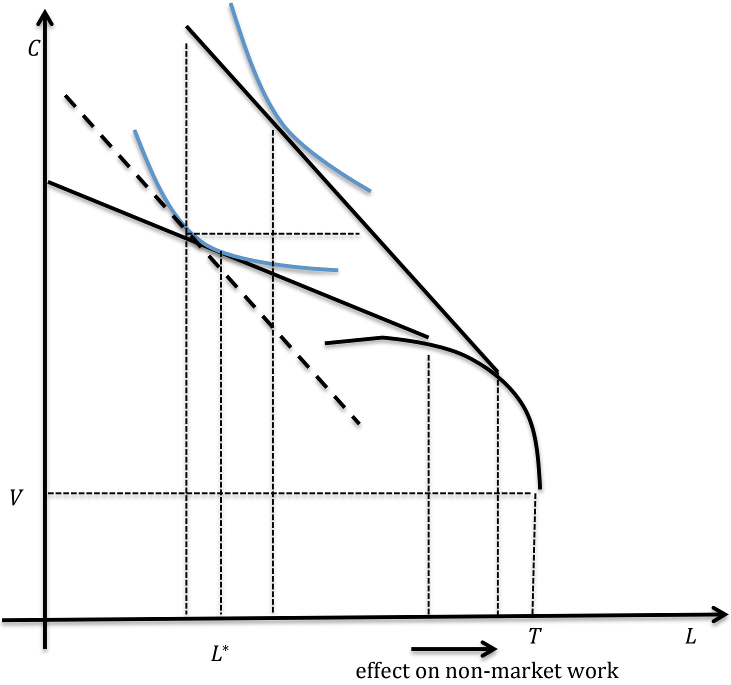
- What happens when the person's wage increases?



C
V
L^*
T
L


C
V
T
L
L*
sub. effect


C
V
T
L
L*
sub. effect
inc. effect



C
V
L*
T
L
effect on non-market work

Home Production: Comparative Statics

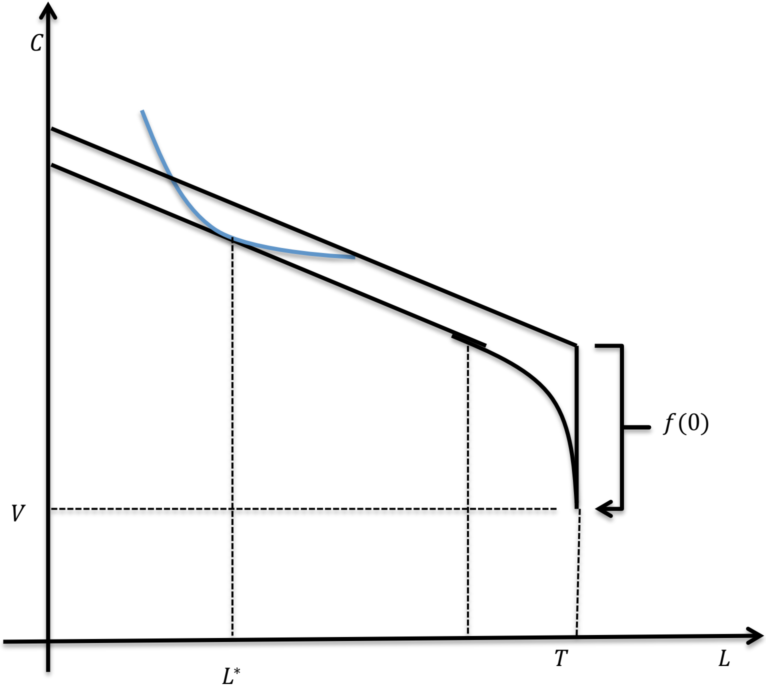
- A wage increase leads to:
    - A decrease in non-market work
    - An ambiguous effect on leisure
    - An ambiguous effect on market work

Home Production: Comparative Statics

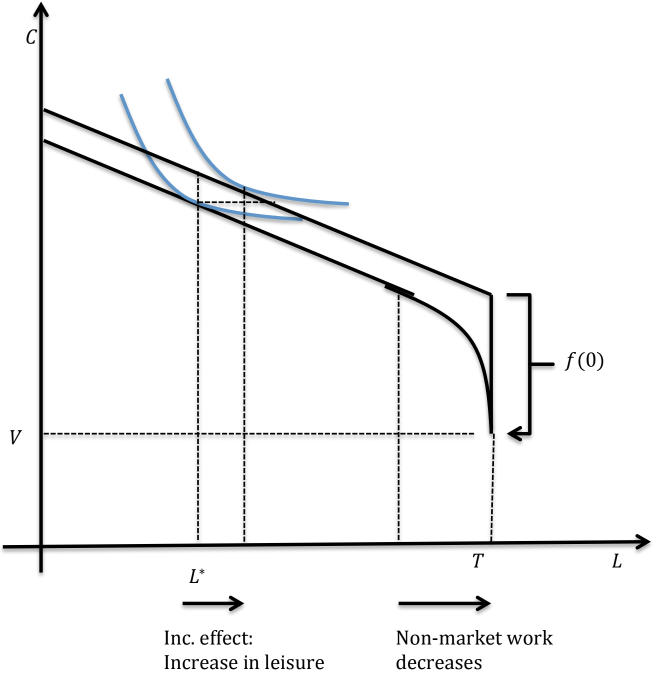
- Interpret $f(h_N)$ as production from doing chores, e.g. washing clothes
- Suppose the person acquires a washing machine that instantly washes all clothes
- How should we model this?

Home Production: Comparative Statics

- We can think of the washing machine technology as an increase in $f(0)$, and a decrease in $f'(h_N)$, perhaps to zero
- What will this do to labor supply?



C
$f(0)$
V
L^*
T
L


C
V
f (0)
T
L
L*
Inc. effect:
Increase in leisure
Non-market work
decreases

Home Economics: Empirics

- Recent decades have seen a trend towards higher female labor force participation, and lower fertility
- Can we understand this using our simple model?

Home Economics: Empirics

- Recent decades have seen a trend towards higher female labor force participation, and lower fertility
- Can we understand this using our simple model? Think of $f(h_N)$ as child production
    - Wages have increased, which should decrease home production
    - On the other hand, maybe decreases in fertility have caused increasing labor supply (lower $f'(h_N)$ with fewer kids around)
- The observed relationship between labor supply and fertility is difficult to interpret. These variables are chosen simultaneously

Fertility and Labor Supply: Angrist and Evans (1998)

- Angrist and Evans (1998) provide evidence on the causal effect of fertility on labor supply
- To understand their strategy, we need to add another econometric technique to our toolbox: **instrumental variables**

Fertility and Labor Supply: Empirics

- Think of a causal equation relating hours worked, Y_i, to number of children, N_i:

$$Y_i = \alpha + \beta N_i + \epsilon_i$$

- β is the causal effect of an additional child on hours worked
- ϵ_i is other factors that affect labor supply
- Can we estimate this equation by OLS regression?

Fertility and Labor Supply: Empirics

$$Y_i = \alpha + \beta N_i + \epsilon_i$$

- Probably not.
- People who have more kids are different for many reasons. Maybe people have more kids if they are not planning to work much.
- This means $Cov(\epsilon_i, N_i) \neq 0$, and regression will not tell us the causal effect of family size
- We wish we could randomly assign fertility, but we can't

Instrumental Variables

$$Y_i = \alpha + \beta N_i + \epsilon_i$$

- Suppose we find a third variable, Z_i, with the following two properties:
  1. $Cov(Z_i, N_i) \neq 0$. Z_i is correlated with family size. This is called the **first stage** property.
  2. $Cov(Z_i, \epsilon_i) = 0$. Z_i is uncorrelated with *everything else* that affects labor supply. This is called the **exclusion restriction**.
- Under these assumptions, Z_i is an **instrument** for family size, and we can use it to estimate β.

Instrumental Variables

- The covariance between the outcome Y_i and the instrument Z_i is:

$$Cov(Y_i, Z_i) = Cov(\alpha + \beta N_i + \epsilon_i, Z_i)$$

$$= \beta Cov(N_i, Z_i) + Cov(\epsilon_i, Z_i)$$

- The first stage property implies that the first term is not zero
- The exclusion restriction implies that the second term is zero, so

$$Cov(Y_i, N_i) = \beta Cov(N_i, Z_i)$$

$$\implies \frac{Cov(Y_i, Z_i)}{Cov(N_i, Z_i)} = \beta$$

- To get the effect of family size on labor supply, we just need the ratio of two covariances!

Instrumental Variables

$$\frac{Cov(Y_i, Z_i)}{Cov(N_i, Z_i)} = \beta$$

- Let's divide the top and bottom by the variance of Z_i:

$$\frac{Cov(Y_i, Z_i)/Var(Z_i)}{Cov(N_i, Z_i)/Var(Z_i)} = \beta$$

Instrumental Variables

$$\frac{Cov(Y_i, Z_i)/Var(Z_i)}{Cov(N_i, Z_i)/Var(Z_i)} = \beta$$

- The numerator is the coefficient from regressing Y_i on Z_i
- The denominator is the coefficient from regressing N_i on Z_i
- The ratio of these regression coefficients identifies the causal effect of N_i
- Intuition: If Z_i only affects Y_i through N_i, then any relationship between Z_i and Y_i must be driven by the effect of N_i
- Dividing by the effect of Z_i on N_i reveals the effect of N_i

Angrist and Evans (1998)

- Finding an instrument for family size is easier said than done
- Angrist and Evans (1998) consider two instruments:
    - Twins
    - Sibling sex composition

Angrist and Evans (1998): The Twins Instrument

- AE's twins "experiment:"
  - Consider a set of families that have decided to have a child
  - Compare the families that had twins to the families that didn't
- Why is twins a plausible instrument for family size?

Angrist and Evans (1998): The Twins Instrument

- Twinning is correlated with family size – parents that have twins end up with more kids
- The first stage requirement is therefore satisfied
- What about the exclusion restriction?

Angrist and Evans (1998): The Twins Instrument

- Twinning is fairly random (though not entirely, as we'll see)
- It's therefore likely to be unrelated to unobserved factors that affect labor supply
- It's plausible to think that twinning only affects parents' labor supply through family size, which is the exclusion restriction

Angrist and Evans (1998): Sibling Sex Composition

- AE's sibling sex composition "experiment:"
    - Consider a set of families that have one child, and have decided to have another
    - Compare families in which the sex of the second child matched the sex of the first to families in which the sexes do not match
- Why is sibling sex composition a plausible instrument for family size?

Angrist and Evans (1998): Sibling Sex Composition

- It turns out that families have a preference for diversity: people are more likely to have a third child if the sexes of the first two match
- This generates a correlation between the sex of the second child and family size, satisfying the first stage requirement
- The sex of the second child is random, and therefore unrelated to unobserved determinants of labor supply
- As with twins, it's plausible that family size is the only channel through which sibling sex composition affects labor supply (what might violate this?)

TABLE 2—DESCRIPTIVE STATISTICS, WOMEN AGED 21–35 WITH 2 OR MORE CHILDREN

	Means and (standard deviations)					
	1980 PUMS			1990 PUMS		
		Married couples			Married couples	
Variable	All women	Wives	Husbands	All women	Wives	Husbands
Children ever born	2.55 (0.81)	2.51 (0.77)	—	2.50 (0.76)	2.48 (0.74)	—
More than 2 children (=1 if mother had more than 2 children, =0 otherwise)	0.402 (0.490)	0.381 (0.486)	—	0.375 (0.484)	0.367 (0.482)	—
Boy 1st (s_1) (=1 if first child was a boy)	0.511 (0.500)	0.514 (0.500)	—	0.512 (0.500)	0.514 (0.500)	—
Boy 2nd (s_2) (=1 if second child was a boy)	0.511 (0.500)	0.513 (0.500)	—	0.511 (0.500)	0.512 (0.500)	—
Two boys (=1 if first two children were boys)	0.264 (0.441)	0.266 (0.442)	—	0.264 (0.441)	0.265 (0.441)	—
Two girls (=1 if first two children were girls)	0.242 (0.428)	0.239 (0.427)	—	0.241 (0.428)	0.239 (0.426)	—
Same sex (=1 if first two children were the same sex)	0.506 (0.500)	0.506 (0.500)	—	0.505 (0.500)	0.503 (0.500)	—
Twins-2 (=1 if second birth was a twin)	0.0085 (0.0920)	0.0083 (0.0908)	—	0.012 (0.108)	0.011 (0.105)	—

Sex of first two children in families with two or more children	1980 PUMS (394,835 observations)	
	Fraction of sample	Fraction that had another child
one boy, one girl	0.494	0.372 (0.001)
two girls	0.242	0.441 (0.002)
two boys	0.264	0.423 (0.002)
(1) one boy, one girl	0.494	0.372 (0.001)
(2) both same sex	0.506	0.432 (0.001)
difference (2) − (1)	—	0.060 (0.002)

TABLE 4—DIFFERENCES IN MEANS FOR DEMOGRAPHIC VARIABLES BY *SAME SEX* AND *TWINS*-2

	Difference in means (standard error)		
	By *Same sex*		By *Twins*-2
Variable	1980 PUMS	1990 PUMS	1980 PUMS
Age	−0.0147	0.0174	0.2505
	(0.0112)	(0.0112)	(0.0607)
Age at first birth	0.0162	−0.0074	0.2233
	(0.0094)	(0.0114)	(0.0510)
Black	0.0003	0.0021	0.0300
	(0.0010)	(0.0011)	(0.0056)
White	0.0003	−0.0006	−0.0210
	(0.0012)	(0.0013)	(0.0066)
Other race	−0.0006	−0.0014	−0.0090
	(0.0005)	(0.0009)	(0.0041)
Hispanic	−0.0014	−0.0007	−0.0069
	(0.0009)	(0.0010)	(0.0047)
Years of education	−0.0028	0.0100	0.0940
	(0.0076)	(0.0074)	(0.0415)

	1980 PUMS		
		Wald estimate using as covariate:	
Variable	Mean difference by *Same sex*	*More than 2 children*	*Number of children*
More than 2 children	0.0600 (0.0016)	—	—
Number of children	0.0765 (0.0026)	—	—
Worked for pay	−0.0080 (0.0016)	−0.133 (0.026)	−0.104 (0.021)
Weeks worked	−0.3826 (0.0709)	−6.38 (1.17)	−5.00 (0.92)
Hours/week	−0.3110 (0.0602)	−5.18 (1.00)	−4.07 (0.78)
Labor income	−132.5 (34.4)	−2208.8 (569.2)	−1732.4 (446.3)
ln(*Family income*)	−0.0018 (0.0041)	−0.029 (0.068)	−0.023 (0.054)

	All women	
Model	(1)	(2)
Instrument for *More than 2 children*	*Same sex*	*Twins-2*
Dependent variable:		
Worked for pay	−0.125	−0.079
	(0.026)	(0.013)
Weeks worked	−5.82	−3.64
	(1.15)	(0.60)
Hours/week	−4.76	−3.33
	(0.98)	(0.51)
Labor income	−1961.7	−1262.2
	(560.5)	(292.8)
ln(*Family income*)	−0.021	−0.071
	(0.067)	(0.035)