Lecture 3: Labor Supply(II))(updated)

Labor Economics, Fall 2025

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Review

Review: Basic Labor Supply Model

Each of us in modern economic society faces two fundamental decisions:

1. Whether to work — The participation decision
2. How many hours to work if employed — The intensive margin decision

- Individual labor supply theory builds on the neoclassical framework of utility maximization subject to time and budget constraints.
- The key insight was that individuals face a trade-off between consumption and leisure, and they choose the optimal combination based on their preferences, wage rates, and non-labor income.
- We use this framework to evaluate some social welfare programs as the most popular applications of labor supply theory.

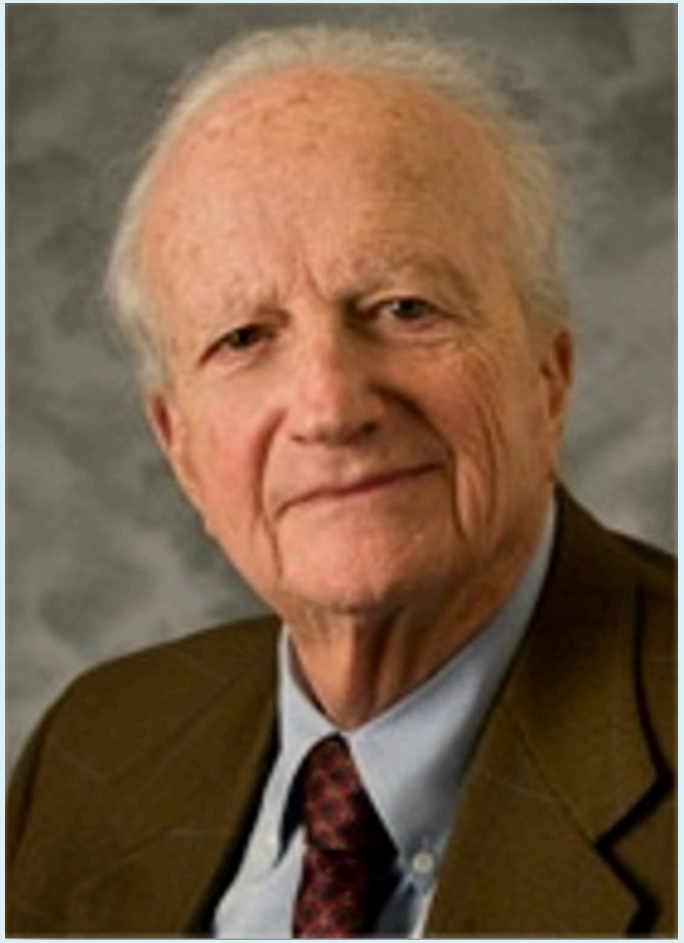
Motivation

Family as the Basic Economic Unit

- The family (or household) is the basic unit in the modern economic world
- Labor supply decisions are not made individually, but within the family context
- Family/household economics has evolved into an independent sub-discipline in economics since the 1960s

It is reasonable to extend the individual labor supply model to household context.

Gary Becker: A Great Economist



Gary Becker (1930-2014)

- Professor at University of Chicago and 1992 Nobel Prize Laureate in Economics
- He is considered as one of the founders of modern labor economics.
- Pioneered research in many topics:
  - *Human Capital Theory*
  - *Economics of the Family*
  - *Economic Analysis of Crime*
  - *Economic Analysis of Discrimination*

Extensions of Labor Supply Theory

Since the 1960s, labor supply models have been extended in two major directions within family/household economics:

1. Home Production Model

- Developed by Gary Becker (1965) and Reuben Gronau (1977)
- Recognizes that households produce valuable goods and services through home production
- Time allocation includes market work, home production, and leisure

2. Family Labor Supply Model

- Developed by Gary Becker (1983) and Chiappori (1988, 1992)
- Analyzes joint labor supply decisions within households
- Considers bargaining power and decision-making mechanisms

Home Production

Home Production: Basic Concepts

- Time devoted to household tasks is generally distinguished from leisure
- Many household services can also be purchased in the market
  - Cleaning services
  - Meal preparation (restaurants, delivery)
  - Childcare
  - Elderly care

Therefore, an individual's labor supply decisions depend on their *relative effectiveness* at:

- Performing household tasks (home productivity)
- Doing paid work (market productivity)

Time Use in American Households 2005

	Households with Children < 6		Households with Children 6–17		Households with No Children < 18	
	Women	Men	Women	Men	Women	Men
Paid Work[a]	19	39	25	39	22	29
Household Work[b]	43	23	34	19	25	17
Leisure[c]	29	32	33	35	42	45
Personal Care[d]	74	72	74	72	76	74

[a]Includes commuting time

[b]Includes time spent purchasing goods and services

[c]Includes time spent in volunteer activities

[d]Includes time spent sleeping and eating

Source: U.S. Department of Labor, Bureau of Labor Statistics, "American Time Use Survey, 2005," Table 8 at http://www.bls.gov/news.release/atus.toc.htm.

Purpose of Household Production Model

The household production framework helps us understand and explain:

1. Patterns of household time allocation
    - How individuals divide time between market work and home production
2. The division of labor within households
    - Who specializes in which activities
3. Fertility behavior
    - How childbearing decisions relate to time allocation

Home Production Model: Preferences

An individual's preferences are determined by utility over consumption and leisure:

$$U = U(C, L)$$

However, consumption goods C now can be obtained in two ways:

- Market-purchased goods, C_M (bought with labor income)
- Home-produced goods, C_D (produced using household time)

Therefore, total consumption is:

$$C = C_D + C_M$$

Time Allocation with Home Production

Total time endowment T is divided into three parts:

1. Market work time: h_M (working in the labor market for wage)

1. Household work time: h_D (domestic production activities)

2. Leisure time: L (pure leisure activities)

The time constraint becomes:

$$T = h_M + h_D + L$$

Home Production Function

The efficiency of household tasks is represented by a production function:

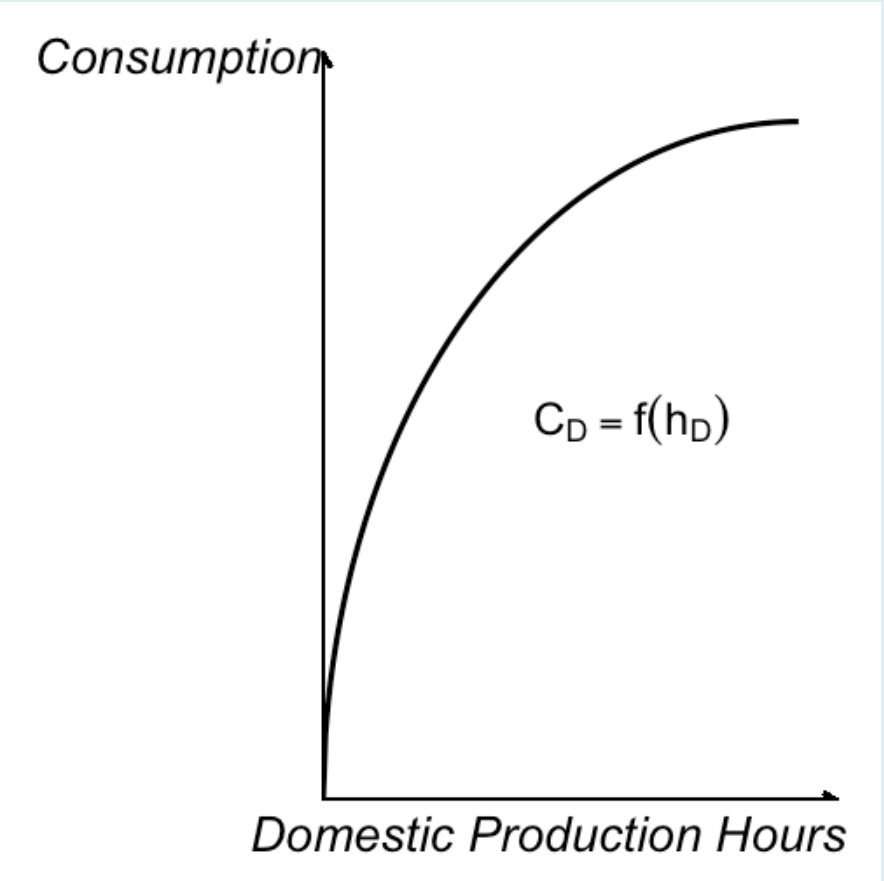
$$C_D = f(h_D)$$

This production function satisfies the standard properties:

- Positive marginal product: $f'(h_D) > 0$
  - Additional time in home production increases output
- Diminishing marginal product: $f''(h_D) < 0$
  - Each additional hour is less productive than the previous one

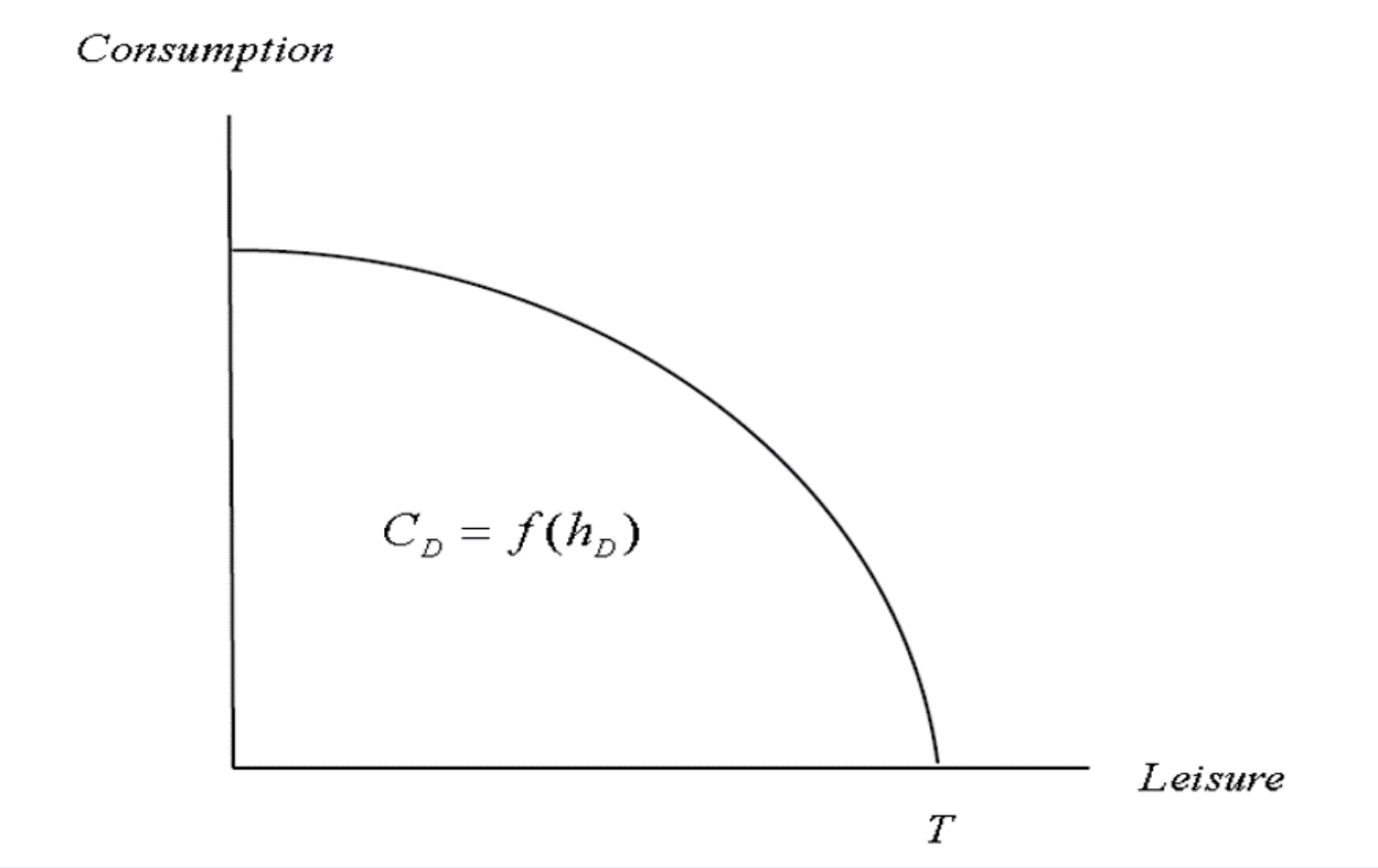
This is analogous to a firm's production function with labor as the only input

Home Production Function



- The concave shape reflects diminishing marginal productivity of time in home production.

Home Production Function



- The X-axis can be changed to `Leisure` to represent the time spent on leisure.

Market Budget Constraint

Income from market work is spent on market consumption:

$$C_M \leq w \cdot h_M + V$$

- C_M = consumption purchased in the market
- h_M = hours worked in the labor market
- w = wage rate per hour
- V = non-labor income

Substituting the time constraint $h_M = T - h_D - L$ into the budget constraint:

$$C_M + wL \leq w(T - h_D) + V$$

Total Budget Constraint

- Recall $C_M = C - C_D$ (market consumption equals total consumption minus home production) and $C_D = f(h_D)$ (home production function)
- Substituting these into our budget constraint:

$$(C - C_D) + wL \leq w(T - h_D) + V$$

- Rearranging:

$$C + wL \leq wT + V + [f(h_D) - wh_D]$$

- Let $M = wT + V$ represent potential income (maximum possible earnings).Then the total budget constraint is:

Interpretation of Total Budget Constraint

$$C + wL \leq M + [f(h_D) - wh_D]$$

Total income consists of two parts:

1. Potential income $M = wT + V$
   - What you could earn if you worked all available time in the market
   - Plus non-labor income
2. **Profit** from household activities $[f(h_D) - wh_D]$
   - Value of home production $f(h_D)$
   - Minus opportunity cost of time wh_D

Home production is like running a small business.

The Optimization Problem

- The individual chooses consumption C, leisure L, and home production time h_D to:

$$\max_{\{C, L, h_D\}} \quad U(C, L)$$

- Subject to the total budget constraint:

$$C + wL \leq M + [f(h_D) - wh_D]$$

Key insight : Home production enters the optimization problem only through the budget constraint, by affecting total available income.

Step 1 — Choosing Home Production Time

- First, maximize the total income in the budget constraint by choosing optimal h_D:

$$\max_{\{h_D\}} \left\{ M + [f(h_D) - wh_D] \right\}$$

- The first-order condition with respect to h_D:

$$f'(h_D^*) = w$$

Economic interpretation:

- Allocate time to home production until the marginal product of home production time equals the wage rate
- This ensures you're using time most efficiently between home and market work

Step 2 — Maximized Income

Once we've found optimal home production time h_D^*, we can calculate total potential income:

$$\tilde{M} = M + f(h_D^*) - wh_D^*$$

- This $\tilde{M}$ represents the maximum possible income given:
  - Market opportunities (wage w), Home production technology $f(\cdot)$, and Non-labor income V
- Now the problem becomes as follows:

$$\max_{\{C,L\}} \; U(C, L) \quad \text{s.t.} \quad C + wL \leq \tilde{M}$$

Step 3 — Optimization Solution

The complete solution is characterized by:

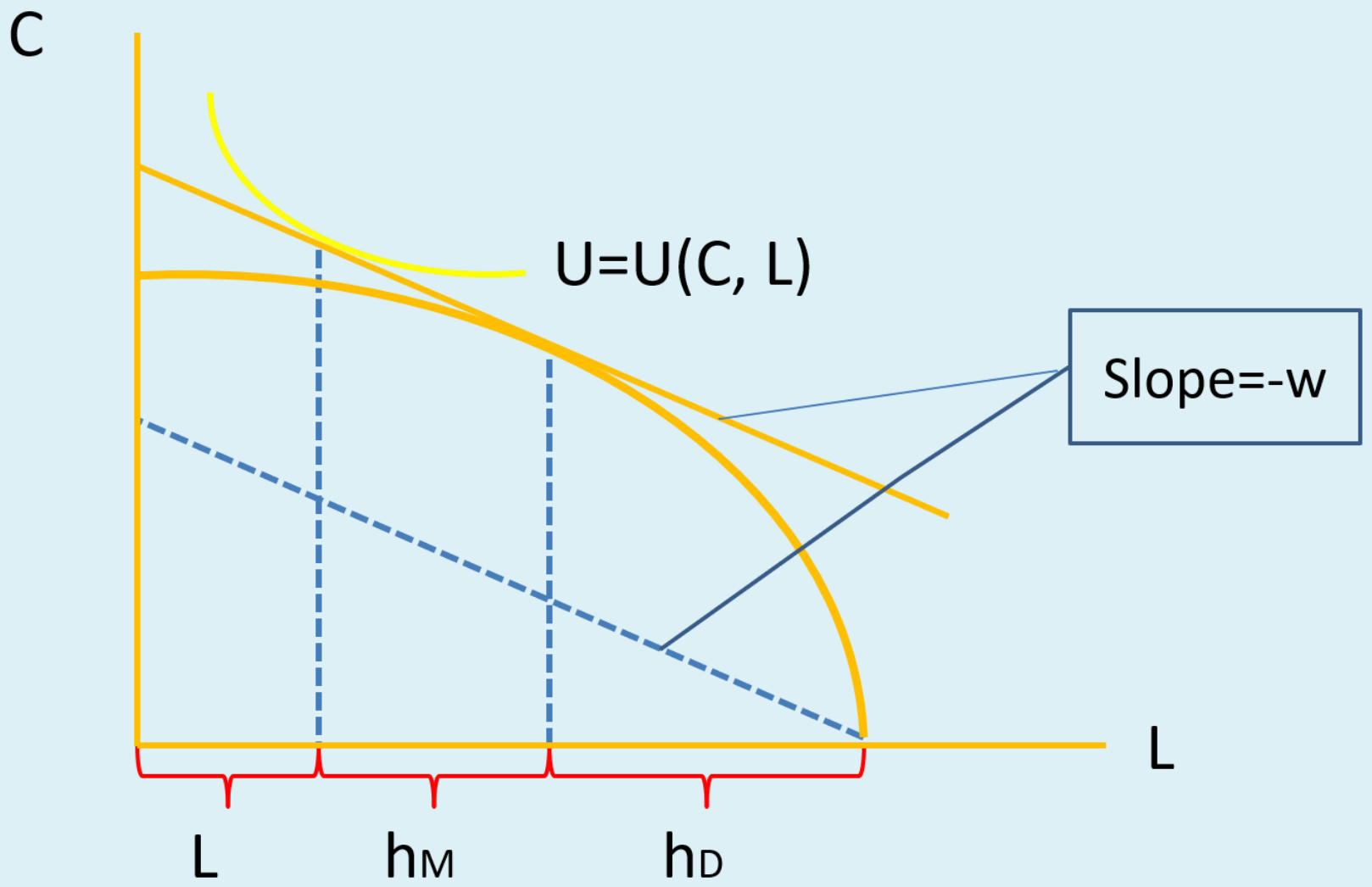
$$\frac{U_L(C^*, L^*)}{U_C(C^*, L^*)} = w = f'(h_D^*)$$

- Three equalities at the optimum:

1. MRS (between consumption and leisure) $= w$
2. Marginal product of home production time $= w$
3. Both equal the wage rate

- Finally, the optimal market labor supply is:

Graphical Analysis of Optimization: Step 3



Comparative Static Analysis

- To see how the optimal solution changes when the parameters change, we can use comparative statics.
  - Wage rate (w)
  - Non-labor income (V)
  - Home production efficiency ($f(\cdot)$)

Family Labor Supply

Interfamily Decisions

An individual who has a family makes labor supply decisions not individually but within the family context

Empirically, many important economic variables are measured at the household level:

- Consumption expenditures
- Asset holdings
- Saving behavior
- Income and taxation

How do families make collective labor supply decisions?

Two Approaches to Family Decision-Making

The analysis of family choices has developed along two different lines:

1. The Unitary Model

- Assumes altruistic parents or a household welfare function.
- Family acts as a single decision-making unit.
- Traditional approach by Samuelson and Becker.

2. The Collective Model

- Recognizes potential conflicts and bargaining within the family
- Non-consensus decision-making
- Modern approach (Chiappori, Browning)

Today we focus on the Unitary Model

The Unitary Model: Basic Assumptions

- The traditional unitary approach assumes one of two conditions:

(a) Family members have the same preferences

- Husband and wife share identical utility functions
- No conflict over resource allocation

(b) Individual preferences can be aggregated into a household welfare function

- Even if preferences differ, they can be combined
- The family maximizes this household welfare function as a whole

Key implication: We don't care about the distribution of welfare **within the household**, only about **the aggregate level**.

Unitary Model: Utility Function

Consider a typical family with a husband and wife. The household utility function is:

$$U = U(C, L_m, L_f)$$

- C = household consumption (aggregate)
- L_m = husband's (male's) leisure
- L_f = wife's (female's) leisure

Note: This specification assumes we care about:

- Total consumption (not how it's distributed)
- Individual leisure for each spouse

Unitary Model: Optimization Problem

The household chooses C, L_m, and L_f to:

$$\max_{\{C, L_m, L_f\}} \quad U(C, L_m, L_f)$$

Subject to the household budget constraint:

$$C + w_m L_m + w_f L_f \leq Y + (w_m + w_f)T = M$$

- w_m, w_f = husband's and wife's wage rates
- Y = household non-labor income
- M = household potential income (if both husband and wife worked forfull time)

Unitary Model: First-Order Conditions

The Lagrangian is:

$$\mathrm{L} = U(C, L_m, L_f) - \lambda[C + w_m L_m + w_f L_f - M]$$

First-order conditions:

$$U_C(C, L_m, L_f) - \lambda = 0$$
$$U_{Lm}(C, L_m, L_f) - \lambda w_m = 0$$
$$U_{Lf}(C, L_m, L_f) - \lambda w_f = 0$$

Optimal solution:

$$w_m = \frac{U_{Lm}(C^*, L_m^*, L_f^*)}{}$$

Unitary Model: Key Insights

In the Unitary Model, each spouse's labor supply depends on:

1. Own wage rate (w_m or w_f)
    - Direct substitution and income effects.
2. Spouse's wage rate
    - Cross-wage effects matter because household income is pooled.
3. Non-labor income (Y)
    - Affects both partners' labor supply through income effects.

- Now let's combine Home Production with the Unitary Model to understand labor supply and specialization within families

Specialization and Exchange in Marriage

Gains from Specialization

Based on comparative advantage theory from international trade:

- It is more efficient when husband and wife specialize in different activities
- Each spouse focuses on the activity where they have a comparative advantage
- They then exchange their output or pool their goods and income to maximize their common utility.

Just as countries gain from trade, families gain from specialization

Absolute vs. Comparative Advantage

TABLE 3-1 An Illustration of the Gains from Specialization and Exchange

(a) Case 1: ABSOLUTE ADVANTAGE

Separate Production

	Value of Market Goods		Value of Home Cooking		Total Income
John	(6 hrs. × $10)		(2 hrs. × $5)		
	$60	+	$10	=	$70
Jane	(7 hrs. × $5)		(1 hr. × $10)		
	$35	+	$10	=	$45
Total (John and Jane)	$95		$20		$115

Specialization and Exchange

	Value of Market Goods		Value of Home Cooking		Total Income
John	(8 hrs. × $10)		(0 hrs. × $5)		
	$80	+	$0	=	$80
Jane	(5 hrs. × $5)		(3 hr. × $10)		
	$25	+	$30	=	$55
Total (John and Jane)	$105		$30		$135

(b) Case 2: COMPARATIVE ADVANTAGE

Separate Production

	Value of Market Goods		Value of Home Cooking		Total Income
Dave	(6 hrs. × $10)		(2 hrs. × $5)		
	$60	+	$10	=	$70
Diane	(7 hrs. × $15)		(1 hr. × $15)		
	$105	+	$15	=	$120
Total (Dave and Diane)	$165		$25		$190

Specialization and Exchange

	Value of Market Goods		Value of Home Cooking		Total Income
Dave	(8 hrs. × $10)		(0 hrs. × $5)		
	$80	+	$0	=	$80
Diane	(6 hrs. × $15)		(2 hr. × $15)		
	$90	+	$30	=	$120
Total (Dave and Diane)	$170		$30		$200

Example: Jack and Jill

Two people: Jack and Jill

Two goods: Market goods and home goods

Jack is more productive in the market than Jill:

$$X_M^{Jack} = 20L_M^{Jack}, \quad X_M^{Jill} = 15L_M^{Jill}$$

Jill is more productive at home than Jack:

$$X_H^{Jack} = 10L_H^{Jack}, \quad X_H^{Jill} = 25L_H^{Jill}$$

Both have a time constraint of 10 hours:

$$L_M^{Jack} + L_H^{Jack} = 10, \quad L_M^{Jill} + L_H^{Jill} = 10$$

Deriving Production Frontiers

For Jack:

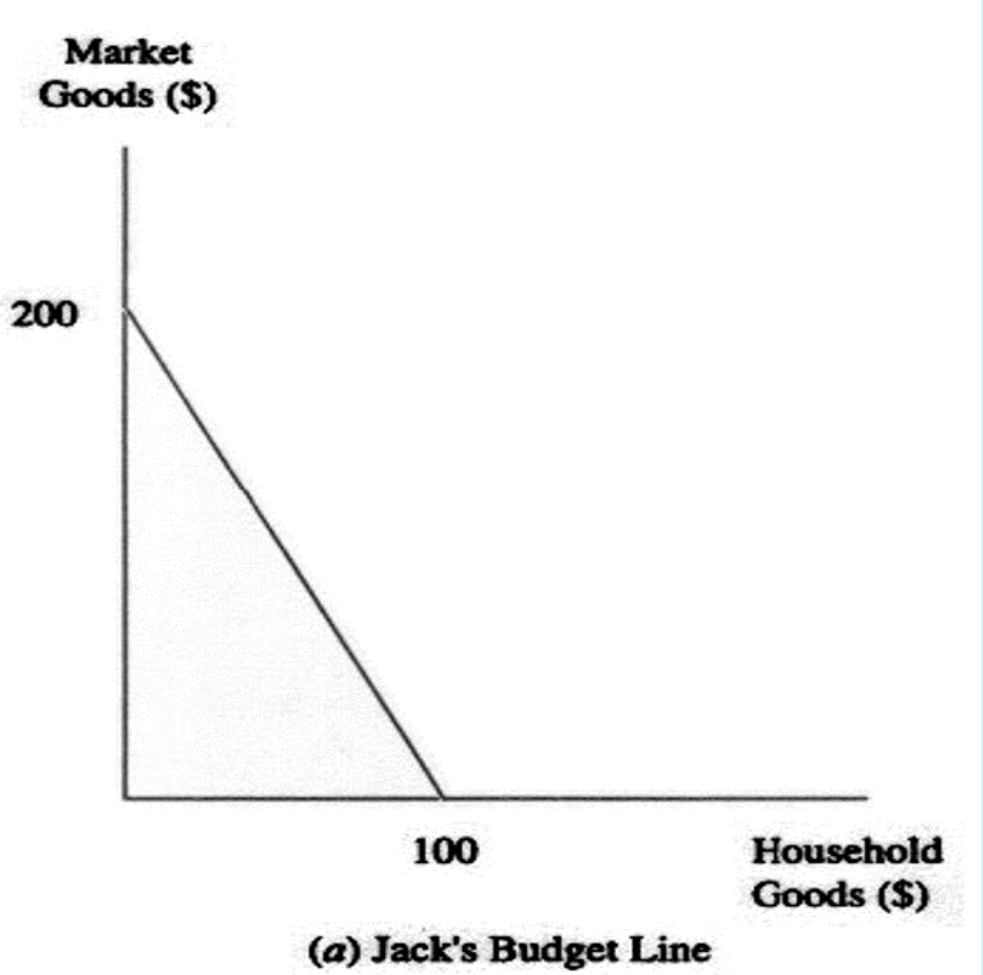
$$\frac{X_M^{Jack}}{20} + \frac{X_H^{Jack}}{10} = 10$$

$$\Rightarrow X_M^{Jack} + 2X_H^{Jack} = 200$$

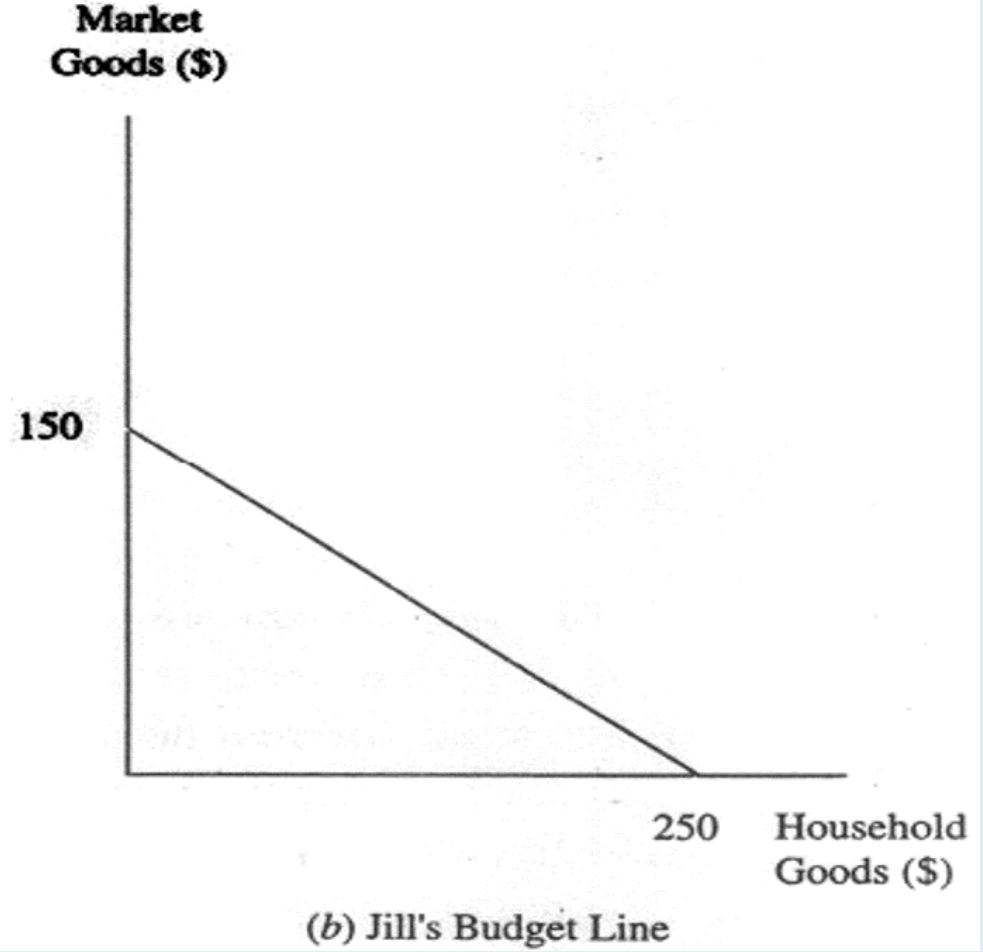
For Jill:

$$\frac{X_M^{Jill}}{15} + \frac{X_H^{Jill}}{25} = 10$$

Jack and Jill's Production Sets

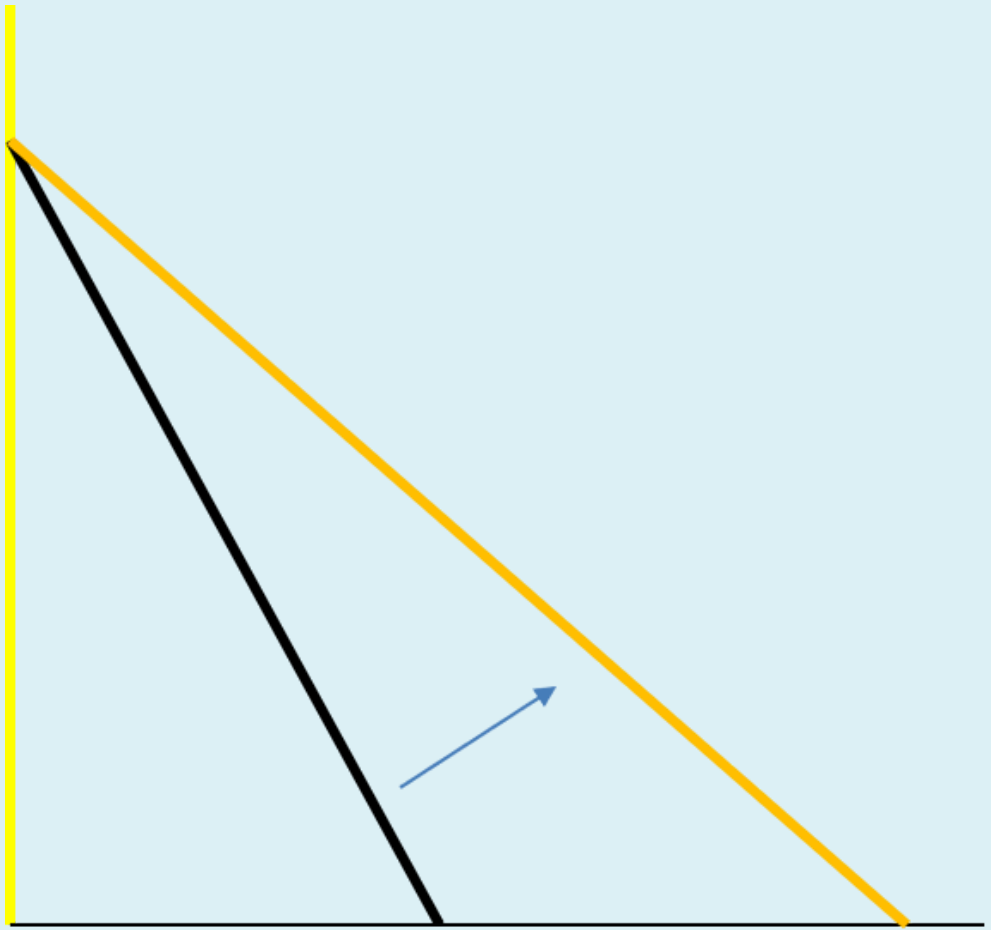


(a) Jack's Budget Line

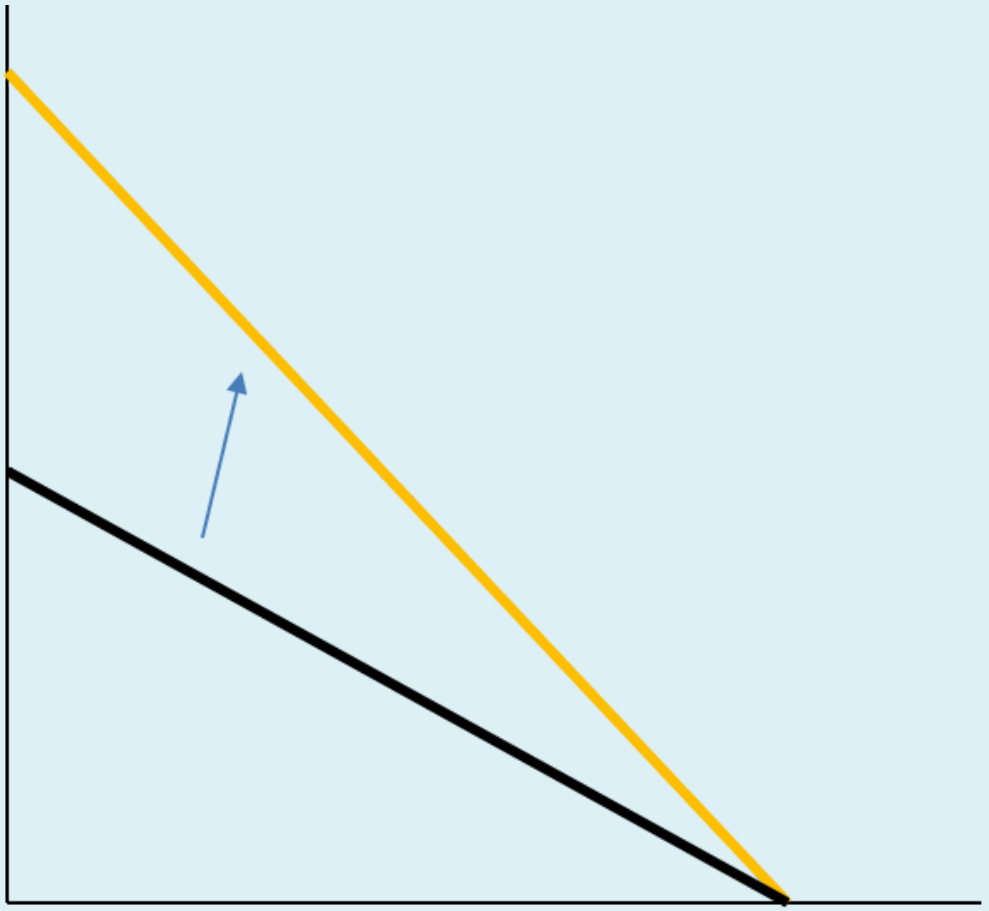


(b) Jill's Budget Line

Changes in Market Wages or Home Productivity

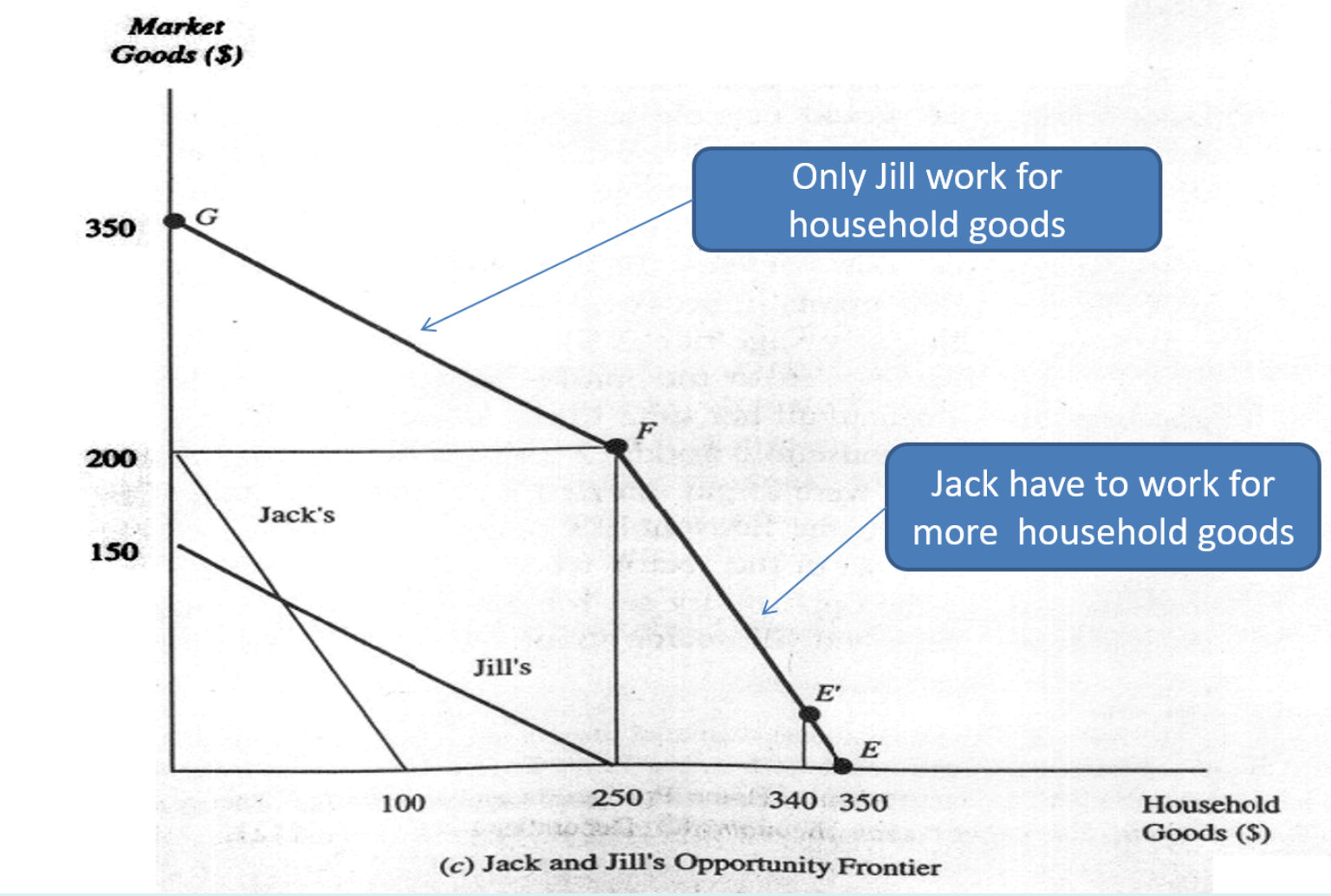


Home productivity increases

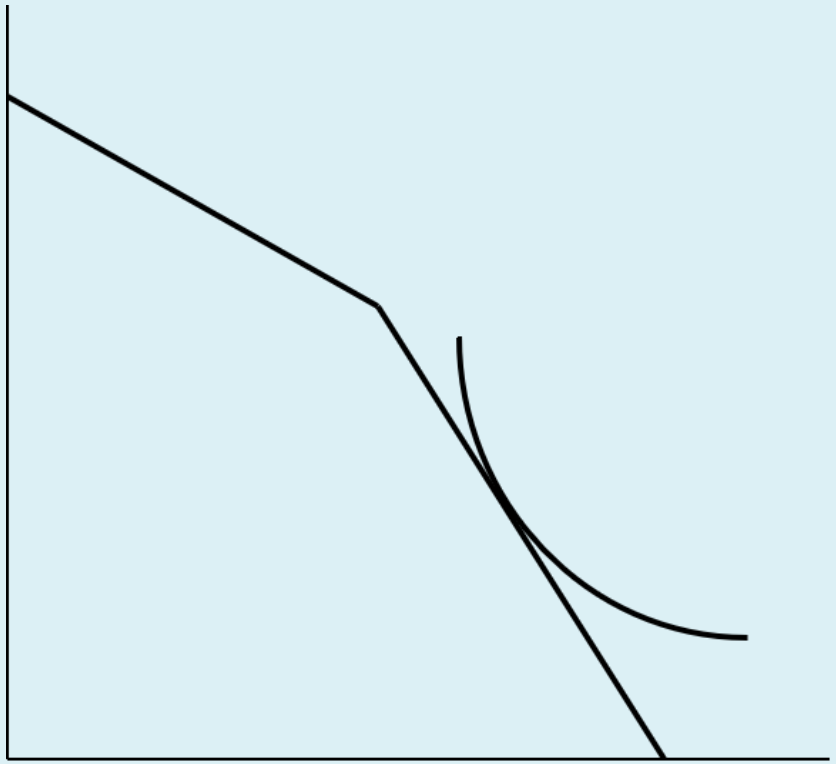


Market wage increases

When Jack and Jill Marry

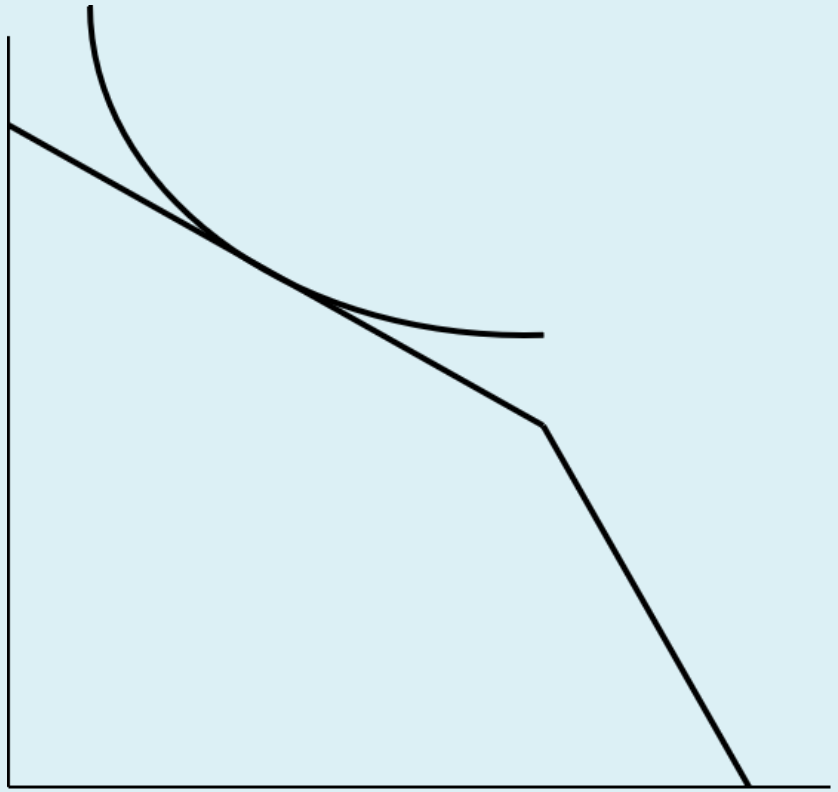


Division of Labor in the Household



Jill specializes in household sector

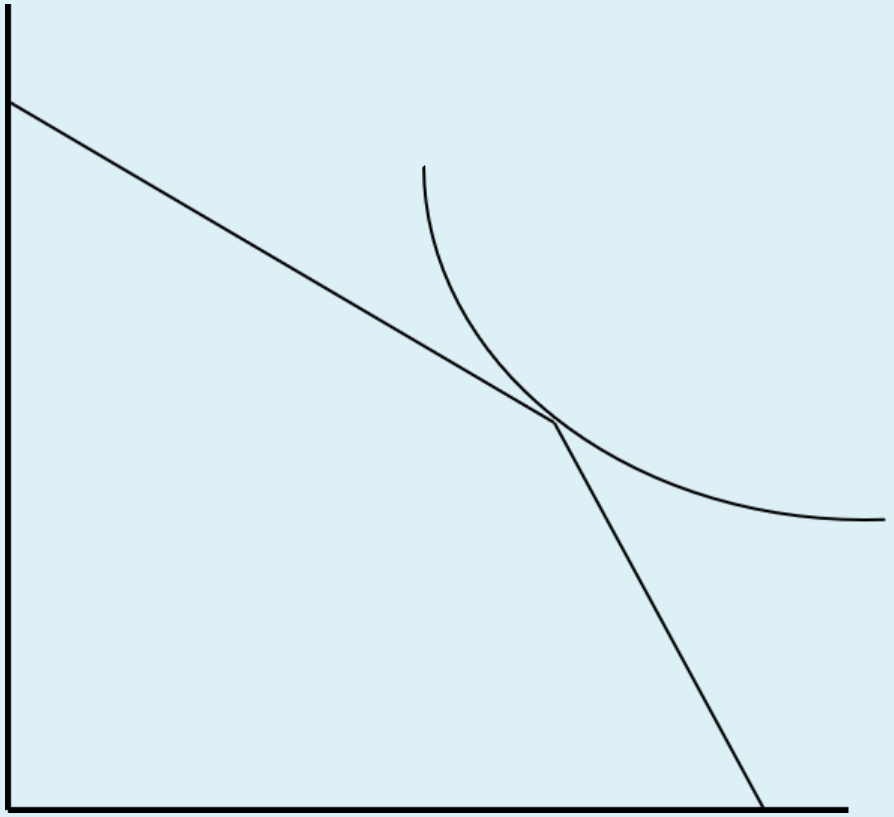
Jack divides his time



Jack specializes in labor market

Jill divides her time

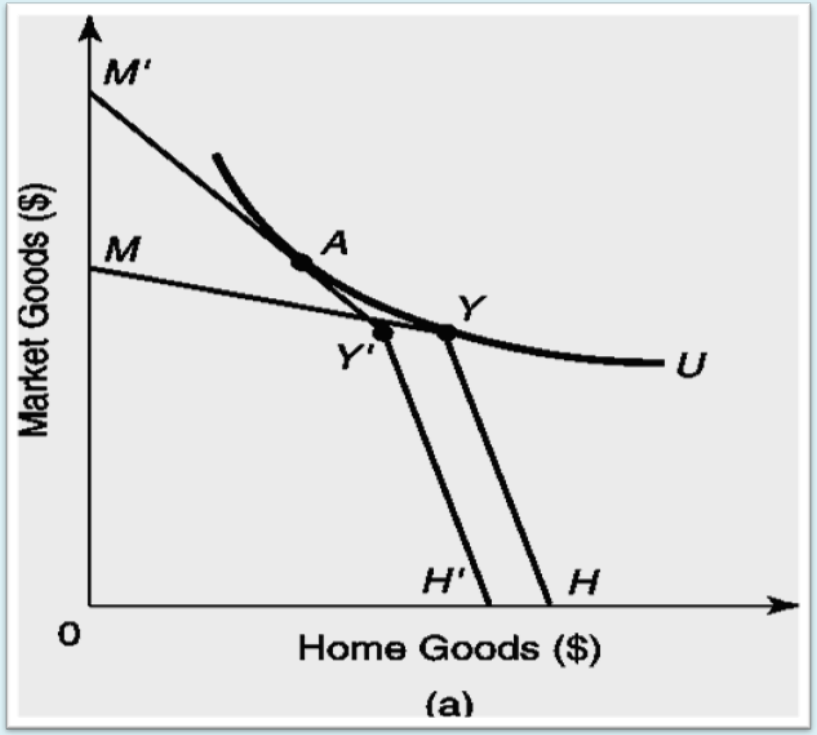
Complete Specialization



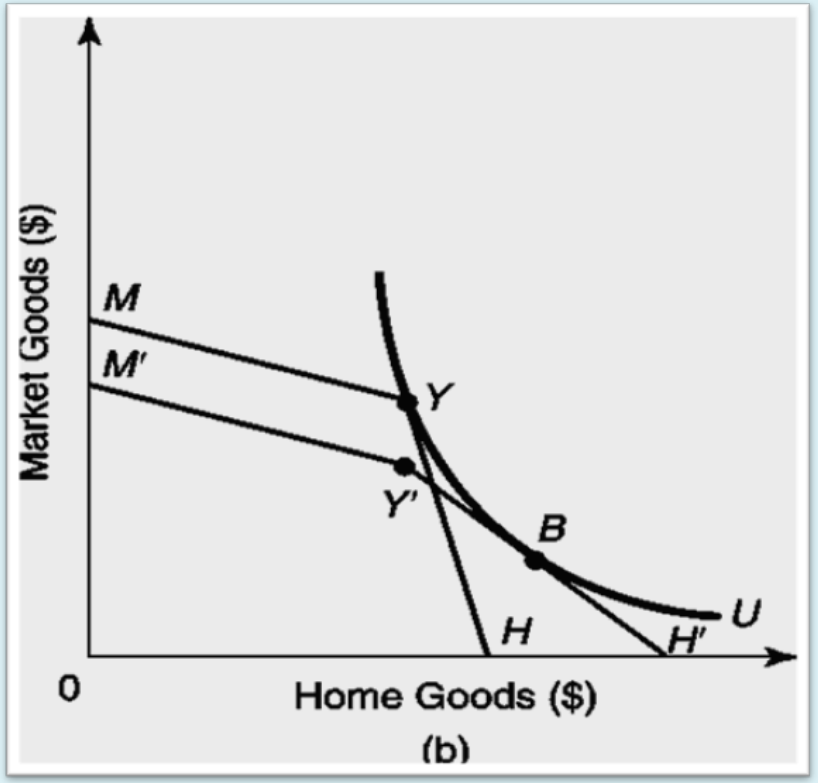
Jack specializes in the market sector

Jill specializes in the household sector

Partial Specialization Scenarios



When market productivity increases for Jill relative to home productivity, she does some market work and all



When home productivity increases for Jack relative to market productivity, he still does all market work and some

Conclusions from Specialization Model

1. Specialization is driven by comparative advantage
   - Differences in market wages and/or home productivities
   - Not absolute advantage

1. If relative productivities are equal, no specialization occurs
   - Both spouses divide their time similarly

1. The spouse with lower relative market productivity (or higher relative home productivity) tends to specialize in home production

This framework explains traditional gender roles but also predicts changes as wage gaps narrow.

Empirical Evidence

Empirical Evidence

- *How does husbands' wages affect wives' labor supply decisions in urban China?*
- Zhu, M., Xing, C., & Li, Y. (2023). Husbands' wages and married women's labor supply in urban China. China Economic Review, 82
- Data: CHIP 1995, 2002, 2013, 2018 Pooled Cross-Sectional Data
- Method: IV and Wage Deciles Regression
- Conclusion: Husbands' wages have a **negative effect** on wives' labor supply decisions.

Empirical Evidence: labor participation

- OLS regression for wife's labor participation:

$$Y_{ict}^{wife} = \beta_0 + \beta_1 ln(w_{ict}^{husband}) + \gamma_1 X_{it}^{wife} + \gamma_2 X_{it}^{husband} + \gamma_3 X_{it}^{family} + \delta_c + \gamma_t + \epsilon_{ict}$$

- where Y_{ict}^{wife} = wife's labor participation, equals 1 if the wife of household i in city c at time t is in the labor force and 0 otherwise.
  - $w_{ict}^{husband}$ = husband's wage in city c at time t
  - X_{it}^{wife} = wife's covariates
  - $X_{it}^{husband}$ = husband's covariates in city c at time t
- δ_c = city fixed effects
- γ_t = year fixed effects
- ϵ_{ict} = error term

Empirical Evidence: labor participation

Table 3
Husband's wage and female labor force participation, OLS.

	(1)	(2)	(3)	(4)	(5)
Husband's wage	0.0308***	−0.0111**	−0.0093**	−0.0177***	−0.0235**
	(0.0047)	(0.0047)	(0.0047)	(0.0052)	(0.0092)
Wife's education		0.0237***	0.0241***	0.0226***	0.0231***
		(0.0010)	(0.0010)	(0.0012)	(0.0014)
PrWifeEarnsMore					−0.0151
					(0.0178)
Husband's hours worked	NO	NO	NO	YES	YES
Husband's age & education	NO	NO	NO	YES	YES
Husband works in the public sector	NO	NO	NO	YES	YES
Number of children	NO	NO	YES	YES	YES
Number of elderly individuals	NO	NO	YES	YES	YES
Wife's age	NO	YES	YES	YES	YES
City FE	NO	YES	YES	YES	YES
Obs.	18,484	18,484	18,484	17,646	17,646
R-squared	0.0287	0.2608	0.2667	0.2566	0.2567

Notes: 1). The wife's age and its square and cubic terms are controlled in Columns 2–5, and the husband's age and its square and cubic terms are controlled in Columns 4 and 5. 2). Year dummy variables are controlled in each column. 3). Standard errors in parentheses; significance levels are *0.10, **0.05, and ***0.01.

- Negative effect: if husband's wage increases 1%, wife's labor participation decreases by 2.35%.

Empirical Evidence: working hours

- OLS regression for wife's hours of work:

$$H_{ict}^{wife} = \beta_0 + \beta_1 ln(w_{ict}^{husband}) + \beta_2 ln(w_{ict}^{wife}) + \gamma_1 X_{it}^{wife} + \gamma_2 X_{it}^{husband} + \gamma_3 X_{it}^{family} + \delta_c + \gamma_t$$

- Where H_{ict}^{wife} = wife's hours of work
- w_{ict}^{wife} = wife's wage in city c at time t
- $w_{ict}^{husband}$ = husband's wage in city c at time t
  - X_{it}^{wife} = wife's covariates
  - $X_{it}^{husband}$ = husband's covariates in city c at time t
- δ_c = city fixed effects
- γ_t = year fixed effects
- ϵ_{ict} = error term

Empirical Evidence: working hours

Table 4
Husbands' wages and married women's hours worked, OLS.

	(1)	(2)	(3)
Husband's wage	−112.7***	−145.0***	−194.1***
	(11.65)	(11.62)	(18.90)
Wife's education	−28.02***	−25.38***	−21.26***
	(2.423)	(2.355)	(2.652)
Wife's wage	196.0***	213.5***	216.1***
	(12.43)	(12.43)	(12.48)
PrWifeEarnsMore			−121.2***
			(33.11)
Husband hours worked	NO	YES	YES
Husband's age & education	NO	YES	YES
Husband works in the public sector	NO	YES	YES
Number of children	YES	YES	YES
Number of elderly individuals	YES	YES	YES
Wife's age	YES	YES	YES
City FE	YES	YES	YES
Obs.	14,342	13,994	13,994
R-squared	0.114	0.261	0.262

Notes: 1). The wife's age and its square and cubic terms are controlled in each column. 2). Year dummy variables are also controlled in each column, but estimates are not presented due to space constraints. 3). Standard errors in parentheses; significance levels are *0.10, **0.05, and ***0.01.

- Positive effect: if wife's wage increases 1%, wife's hours of work increases by 2.13 hours.
- Negative effect: if husband's wage increases 1%, wife's hours of work decreases by 1.45 hours.

Key Takeaways from Empirical Evidence

The Chinese data strongly supports the family labor supply model:

1. Cross-wage effects are significant
    - Husbands' wages negatively affect wives' labor supply
    - Evidence of income pooling within households
2. Own-wage effects are positive
    - Substitution effects dominate for married women's intensive margin
3. Effects vary over time
    - The magnitude of cross-wage effects has changed as China's economy developed
    - Suggests changing family structures and norms