Labour Supply

ECON0004: Introductory Econometrics & Microeconomics

UCL

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Based on: Lecture notes (Lecture 9); Blundell & MaCurdy (1999) *Labor Supply: A Review of Alternative Approaches*.

Outline

Labour Supply as Consumer Choice

Labour supply is an application of Lecture 6's consumer demand theory, but now the two goods are **leisure** and **consumption**.

A worker decides how many hours to work by trading off:

- **Leisure** L — hours not working (rest, recreation, household production)
- **Consumption** C — goods purchased with labour and non-labour income

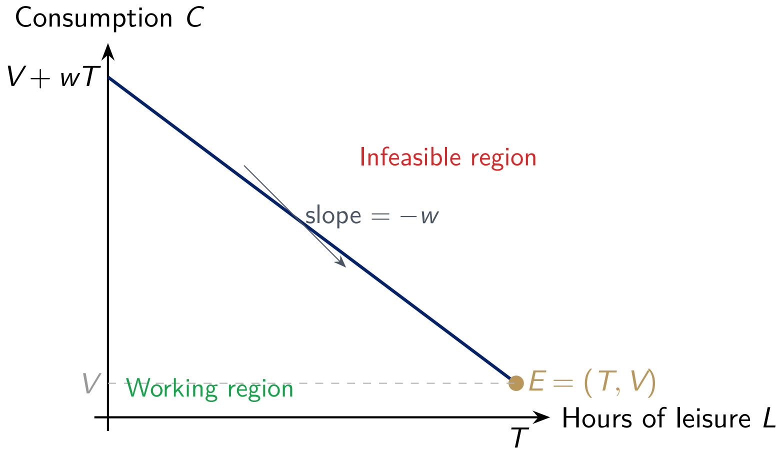
Work yields disutility but enables consumption through labour income.

Determinants of hours of work:

- **Preferences** (indifference curve shape — MRS of leisure for consumption)
- **Budget constraint:** wage rate w, non-labour income V, price of consumption goods p_c

Socratic question: Why is leisure classified as a normal good? What implication does this have for how hours worked respond to non-labour income?

Budget Line: Graphical Representation



The endowment point E is where the consumer takes *all* time as leisure — consuming only non-labour income V without working.

The Labour-Supply Budget Constraint

Assumptions:

- Utility: $U = f(C, L)$; non-satiation; leisure and consumption are normal goods
- Total time endowment: T (e.g. 168 hours/week)
- Hours of work: $h = T - L$; leisure: $L = T - h$
- Expenditure $=$ income (no saving)

Budget constraint:

$$C = V + wh = V + w(T - L)$$

Rearrange to express in (L, C) space:

$$C + wL = V + wT \qquad \iff \qquad C = -wL + (V + wT)$$

- Slope $= -w$ (opportunity cost of leisure is the wage rate)
- Y-intercept $= V + wT$ (maximum consumption if $L = 0$, work all the time)
- **Endowment point** $E = (T, V)$: consume only non-labour income, take all time as leisure

Constrained Optimisation

The consumer chooses (C^*, L^*) to maximise $U(C, L)$ subject to $C + wL = V + wT$.

Optimality Condition: MRS = MRT

At the interior optimum:

$$MRS_{LC} = \frac{MU_L}{MU_C} = w$$

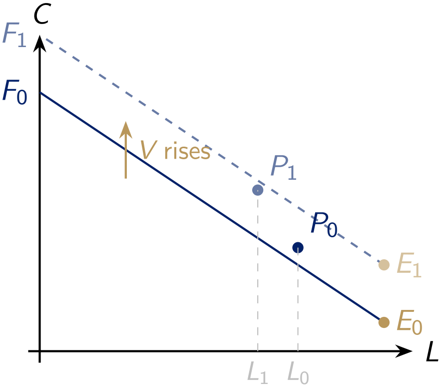
The marginal rate of substitution of leisure for consumption equals the wage rate (the opportunity cost of leisure).

Interpretation:

- $MU_L/MU_C =$ marginal value of leisure in consumption units
- $w =$ market price of an hour of leisure (opportunity cost)
- At the optimum: the consumer values one more hour of leisure exactly at the wage rate

Effect of Non-Labour Income (V): Pure Income Effect

An increase in V shifts the budget line *upward in parallel*. The slope (i.e. w) is unchanged — opportunity cost of leisure unchanged.



Leisure and consumption are normal goods $\Rightarrow$ **both L and C increase**. Hours of work fall: $h = T - L$ decreases.

Effect of a Wage Increase: SE vs. IE

A rise in wage w **pivots** the budget line at the endowment point $E = (T, V)$: the Y-intercept rises; X-intercept stays at T.

Substitution Effect (SE)

w rises $\Rightarrow$ leisure is more expensive (opportunity cost $\uparrow$). Consumer substitutes *away* from leisure toward consumption. $\Rightarrow$ L falls, h rises. **SE is always negative for leisure.**

Income Effect (IE)

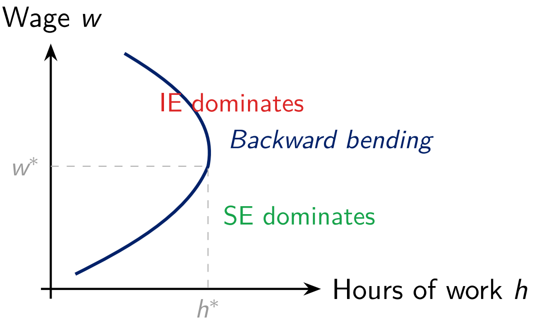
Higher w increases real purchasing power. Leisure is a normal good $\Rightarrow$ demand for leisure rises. $\Rightarrow$ L rises, h falls. **IE is always positive for leisure.**

Overall effect: SE and IE work in **opposite directions** for leisure. The net effect depends on which dominates:

- SE dominates $\Rightarrow$ h increases with w (upward-sloping supply)
- IE dominates $\Rightarrow$ h decreases with w (backward-bending supply)

The Backward-Bending Labour Supply Curve

- **Low wages:** marginal utility of consumption is high — **SE dominates**, hours *increase* with wage.
- **High wages:** extra income adds little utility — **IE dominates**, hours *decrease* with wage.



Socratic question: High-earning professionals such as surgeons often work very long hours. Does this contradict the backward-bending model?

Demographic Influences on Labour Supply

Beyond wages and non-labour income, preferences for leisure vary systematically with demographic characteristics.

Children:

- Increase household need for consumption goods ⇒ encourage *longer* working hours (income effect)
- Also increase the value of time at home ⇒ may reduce hours (preference for leisure)
- Net effect is empirically ambiguous; child-care costs matter

Health:

- Better health reduces disutility of work
- Encourages *longer* working hours

> Demographic controls Z_i are included in the labour supply regression to avoid OVB — omitting them would conflate demographic effects with wage and income effects.

Why a Quadratic Specification?

The backward-bending supply curve implies:

- Hours first *rise* with wage (upward-sloping region)
- Then *fall* with wage (backward-bending region)

A linear regression $h_i = \alpha + \beta w_i + \ldots$ cannot capture this non-monotonic relationship.

> **Solution:** Add a **quadratic** wage term.
> A quadratic function can have an interior maximum — exactly the shape of a backward-bending labour supply curve. At maximum working hours, the marginal effect of wage crosses zero.

Quadratic Labour Supply Function

Quadratic Labour Supply Specification

$$h_i = \alpha + \beta w_i + \gamma w_i^2 + \delta V_i + \phi Z_i + \varepsilon_i$$

- h_i — hours of work; w_i — real wage rate
- V_i — non-labour income; Z_i — demographic controls

Note: β and γ here are regression coefficients — not the IES parameter from Lecture 7.

Backward-bending conditions: $\beta > 0$ (upward slope at low w) **and** $\gamma < 0$ (diminishing returns, eventually turning negative) $\Rightarrow$ backward-bending supply curve.

$$\frac{\partial h_i}{\partial w_i} = \beta + 2\gamma w_i \qquad \Rightarrow \qquad w^* = -\frac{\hat{\beta}}{2\hat{\gamma}} \quad \text{(set to zero)}$$

Example

Example (peak hours wage): $\hat{\beta} = 4.2$, $\hat{\gamma} = -0.3 \Rightarrow w^* = -4.2 / (2 \times -0.3) = \$7.00/\text{hr}$.
Below \$7 SE dominates (hours rise); above \$7 IE dominates (hours fall).

Elasticity of labour supply (w.r.t. wage):

$$\varepsilon_{hw} = \frac{\partial h}{\partial w} \cdot \frac{w}{h} = (\beta + 2\gamma w) \cdot \frac{w}{h}$$

h in the denominator depends on w, V, and Z_i — all RHS variables influence the elasticity.

Tests for backward-bending supply:

Test	Hypothesis	Implication
Upward slope at low w	$H_0 : \beta = 0$, $H_1 : \beta > 0$	SE dominates at low w
Diminishing returns	$H_0 : \gamma = 0$, $H_1 : \gamma < 0$	IE strengthens with w
Backward-bending (joint)	$\beta > 0$ and $\gamma < 0$	Curve confirmed

Lecture 9 Summary

1. **Labour supply as consumer choice:** Workers trade off leisure and consumption. Budget constraint: $C + wL = V + wT$. Endowment point $E = (T, V)$. Optimum: $\text{MRS} = w$.
2. **Non-labour income (V):** Pure income effect — parallel shift. Leisure is normal $\Rightarrow L$ rises, h falls.
3. **Wage increase:** SE (leisure more expensive $\Rightarrow h$ rises) and IE (richer $\Rightarrow L$ rises, h falls) work in opposite directions.
4. **Backward-bending supply:** SE dominates at low wages (upward slope); IE dominates at high wages (backward bend). Peak at $w^* = -\hat{\beta}/(2\hat{\gamma})$.
5. **Quadratic specification:** $h_i = \alpha + \beta w_i + \gamma w_i^2 + \delta V_i + \phi Z_i + \varepsilon_i$. Backward-bending iff $\beta > 0$ and $\gamma < 0$. Elasticity: $\varepsilon_{hw} = (\beta + 2\gamma w) \cdot w/h$.