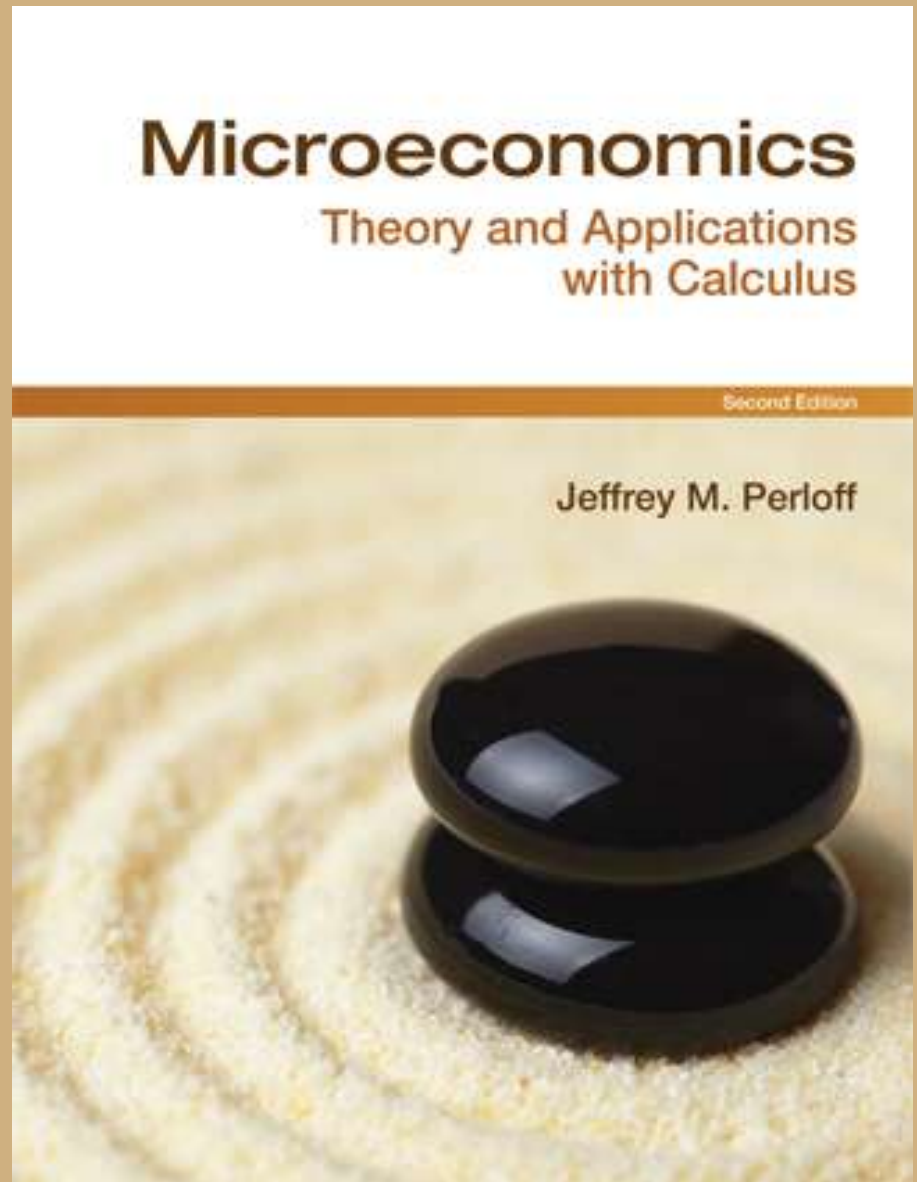


# Chapter 5

## Consumer Welfare and Policy Analysis

*The welfare of the people is the  
ultimate law.*

Cicero



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# Chapter 5 Outline

- 5.1 Consumer Welfare
- 5.2 Expenditure Function and Consumer Welfare
- 5.3 Market Consumer Surplus
- 5.4 Effects of Government Policies on Consumer Welfare
- 5.5 Deriving Labor Supply Curves

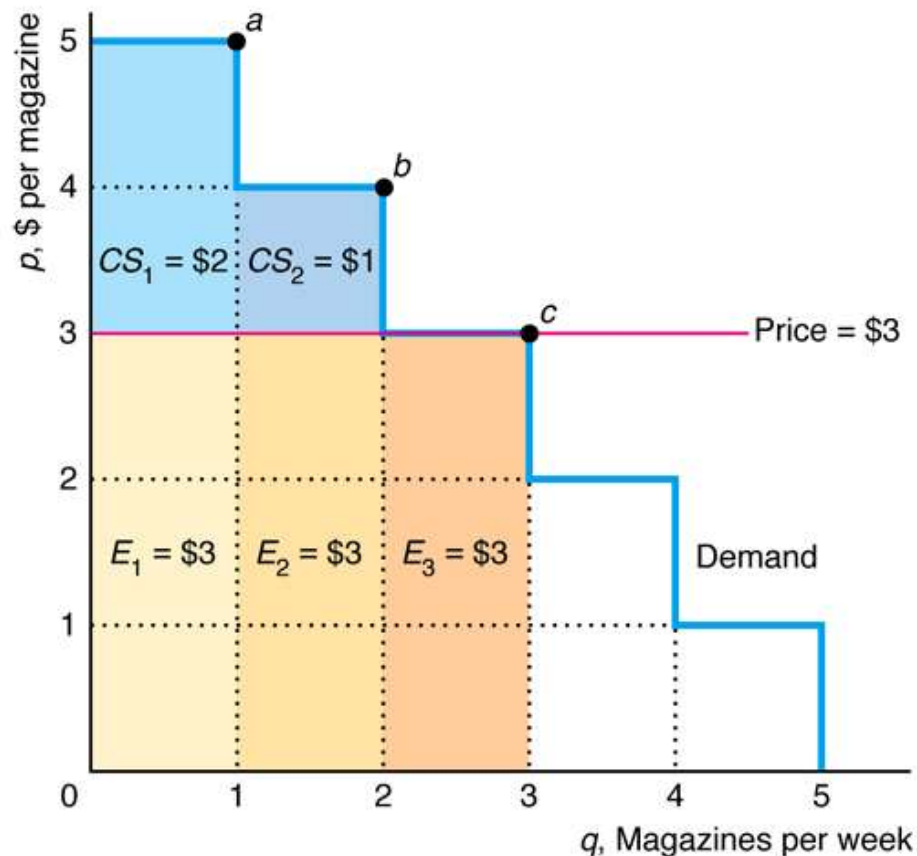
# 5.1 Consumer Welfare

- How much are consumers helped or harmed by shocks that affect the equilibrium price and quantity?
  - Shocks may come from new inventions that reduce firm costs, natural disasters, or government-imposed taxes, subsidies, or quotas.
- You might think utility is a natural measure of consumer welfare. Utility is problematic because:
  - we rarely know a consumer's utility function
  - utility doesn't allow for easy comparisons across consumers
- A better measure of consumer welfare is in terms of dollars.

# 5.1 Consumer Surplus

- **Consumer surplus** (CS) is the monetary difference between the maximum amount that a consumer is willing to pay for the quantity purchased and what the good actually costs.
  - Step function

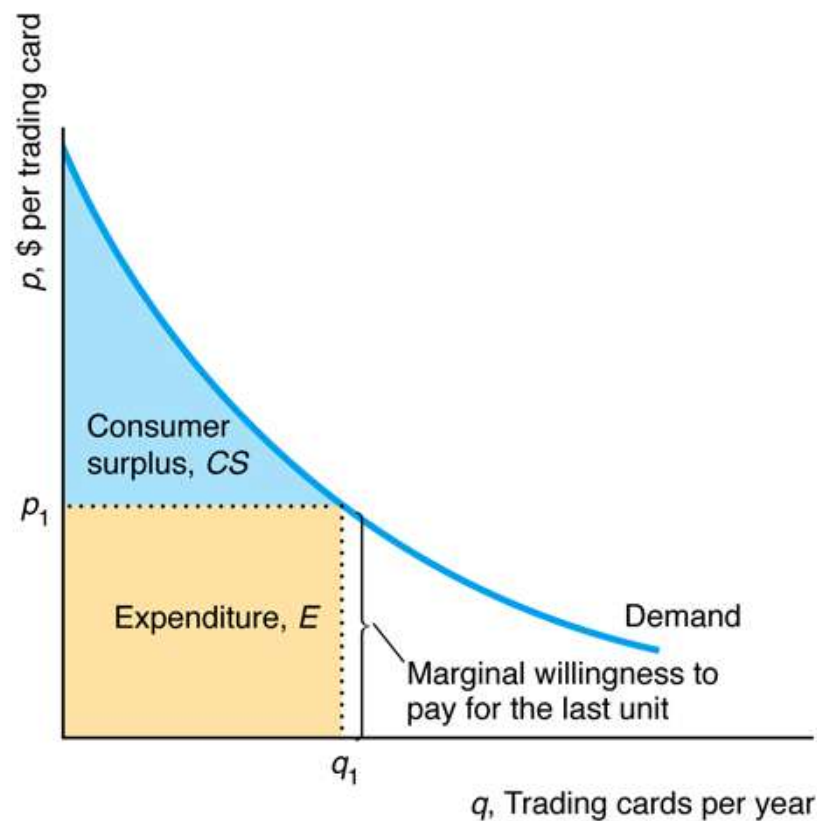
(a) David's Consumer Surplus



# 5.1 Consumer Surplus

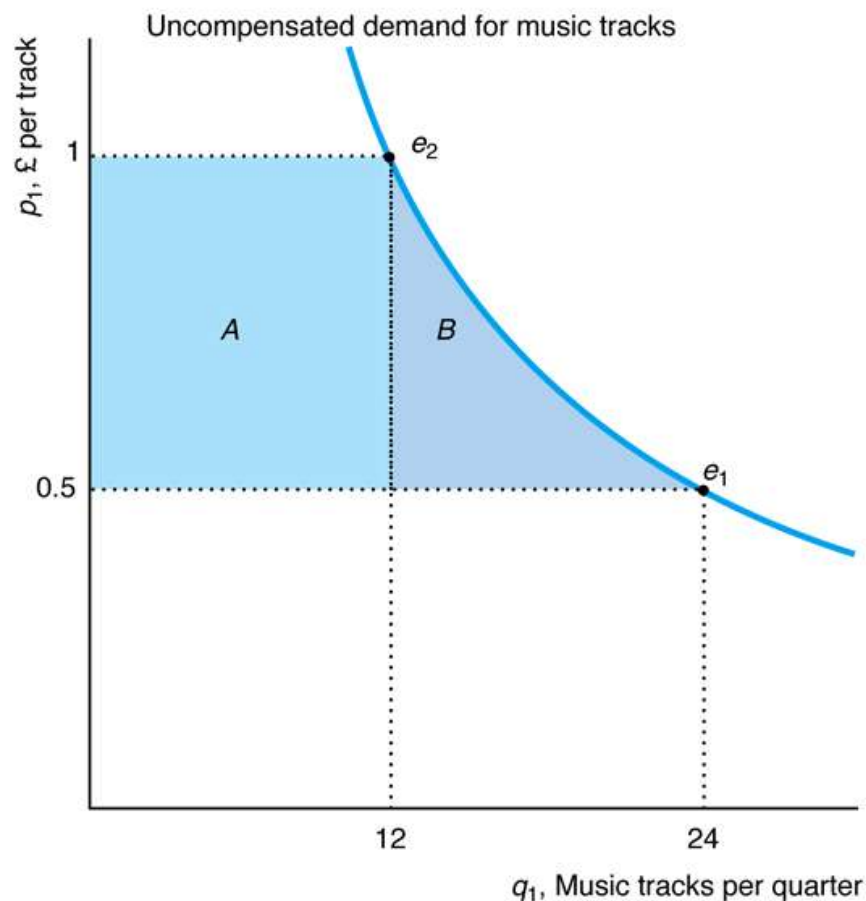
- **Consumer surplus** (CS) is the area under the inverse demand curve and above the market price up to the quantity purchased by the consumer.
  - Smooth inverse demand function

(b) Steven's Consumer Surplus



# 5.1 Effect of a Price Change on Consumer Surplus

- If the price of a good rises (e.g. £0.50 to £1), purchasers of that good lose consumer surplus (falls by  $A + B$ )
  - This is the amount of income we would have to give the consumer to offset the harm of an increase in price.



## 5.2 Expenditure Function and Consumer Welfare

- Offsetting the harm of a price increase means increasing income just enough to maintain the consumer's utility.
- Utility is not constant along an uncompensated demand curve.
  - More precise CS measure utilizes compensated demand and the expenditure function, which both do hold utility constant.
- Recall that the minimal expenditure necessary to achieve a specific utility level and given a set of prices is:

$$E = E(p_1, p_2, \bar{U})$$

- Welfare change associated with price increase to  $p_1^*$ :

$$\text{welfare change} = E(p_1, p_2, \bar{U}) - E(p_1^*, p_2, \bar{U})$$

## 5.2 Expenditure Function and Consumer Welfare

- Which level of utility should be used in this calculation?

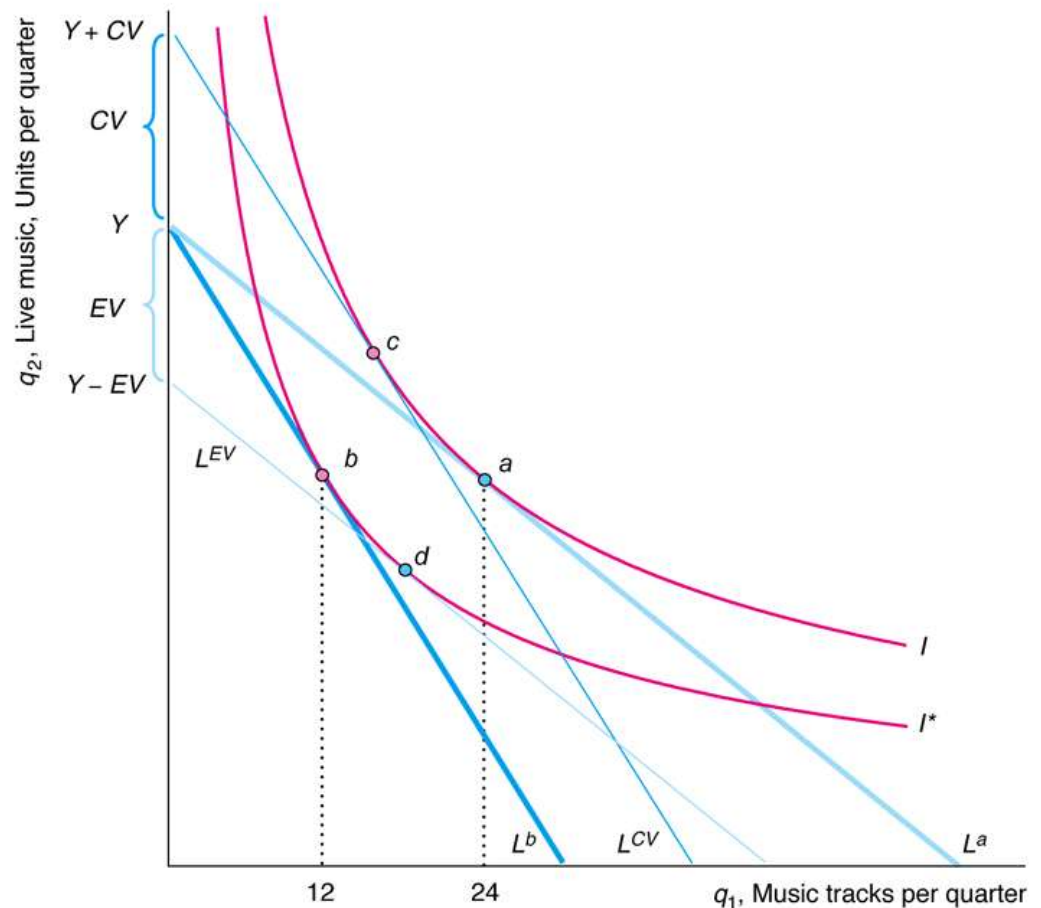
$$\text{welfare change} = E(p_1, p_2, \bar{U}) - E(p_1^*, p_2, \bar{U})$$

- Two options:
  - **Compensating variation** is the amount of money we would have to give a consumer after a price increase to keep the consumer on their original indifference curve.
  - **Equivalent variation** is the amount of money we would have to take away from a consumer to harm the consumer as much as the price increase did.



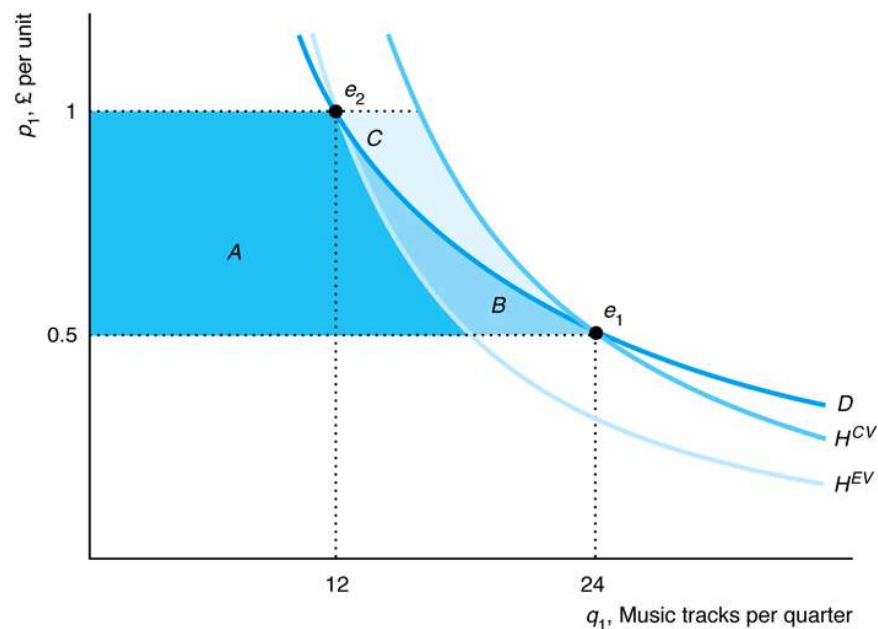
# 5.2 Compensating Variation and Equivalent Variation

- Indifference curves can be used to determine compensating variation (CV) and equivalent variation (EV).



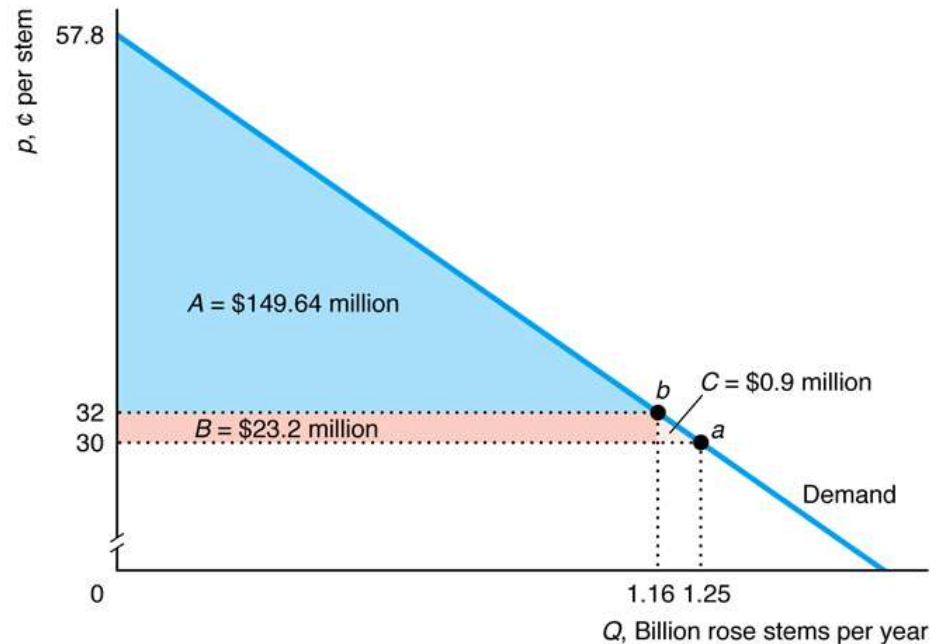
## 5.2 Three Measures: CS, CV, and EV

- Relationship between these measures for normal goods:
  - $|CV| > |\Delta CS| > |EV|$
- For small changes in price, all three measures are very similar for most goods.



# 5.3 Market Consumer Surplus

- Market demand is the (horizontal) sum of individual demand curves; market CS is the sum of each individual's consumer surplus.
- CS losses following a price increase are larger:
  - the greater the initial revenue ( $p \cdot Q$ ) spent on the good
  - the less elastic the demand curve at equilibrium

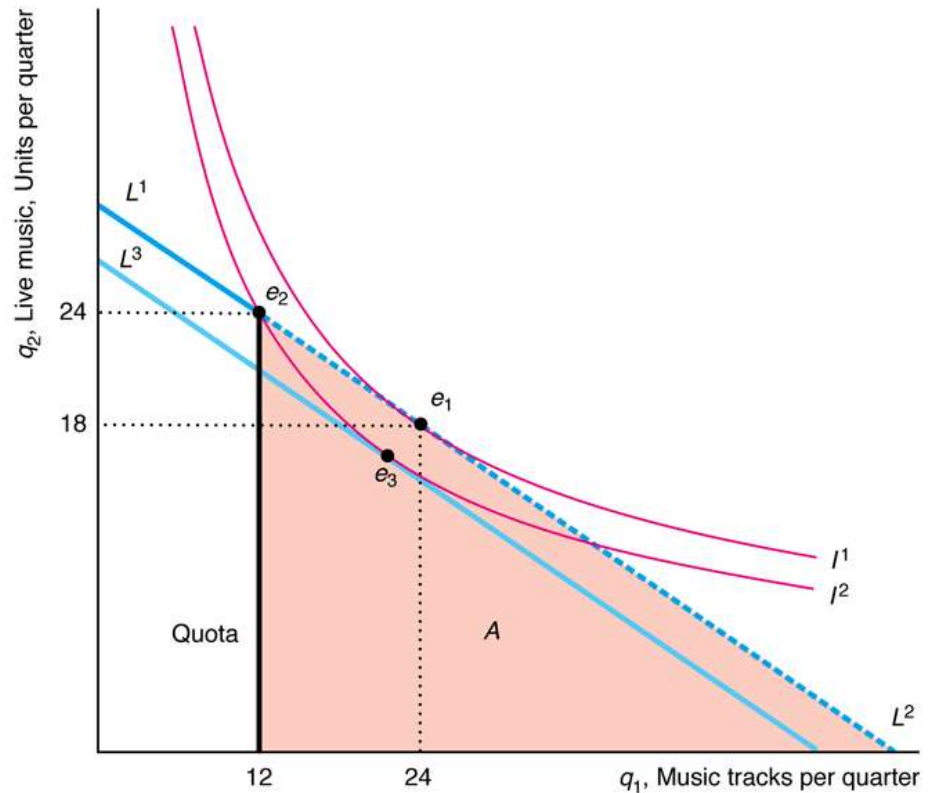


# 5.4 Effects of Government Policies on Consumer Welfare

- Government programs can alter consumers' budget constraints and thereby affect consumer welfare.
- Examples
  - **Quota**: reduces the number of units that a consumer buys
  - **Subsidy**: causes a rotation or parallel shift of the budget constraint
  - **Welfare programs**: may produce kinks in budget constraint

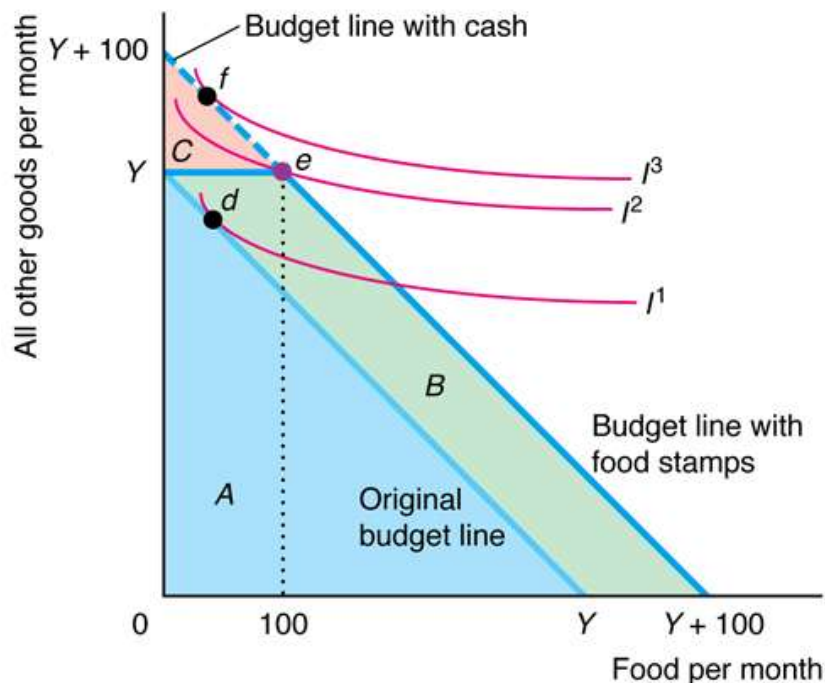
# 5.4 Effects of Government Policies

- **Quotas** limit how much of a good consumers can purchase.
  - Quota of 12 units generates kink in budget line and removes shaded triangle region from individual's choice set.
  - EV of this quota is the income reduction ( $L^2$  to  $L^3$ ) that would move her onto the lower indifference curve,  $I^2$ .



## 5.4 Effects of Government Policies

- **Welfare programs** provide either in-kind transfers or a comparable amount of cash to low-income individuals.
  - Example: food stamps
  - \$100 in food stamps (in-kind) generates kinked budget line.
  - \$100 cash transfer increases opportunity set further.

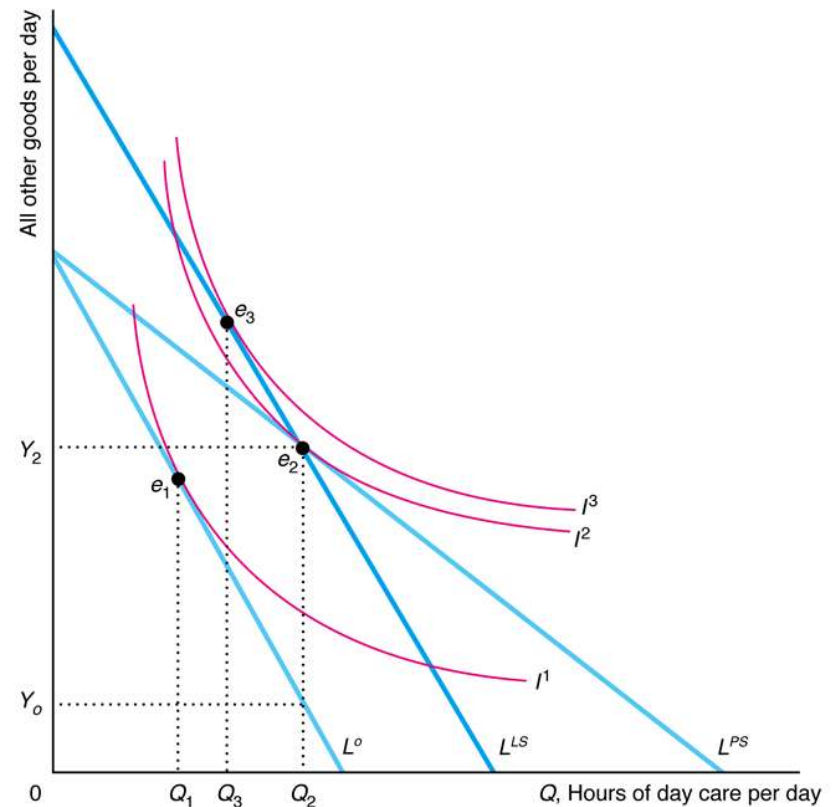


## 5.4 Effects of Government Policies

- Because food stamps can only be used on food, consumers are potentially worse off if they would find it optimal to consume less food and more other goods than allowed by the program.
- Despite this, food stamps are used rather than comparable cash transfers in order to:
  - reduce expenditures on drugs and alcohol
  - encourage appropriate expenditure on food from a nutrition standpoint
  - maintain program support from taxpayers, who feel more comfortable providing in-kind rather than cash benefits

# 5.4 Effects of Government Policies

- **Subsidies** either lower prices or provide lump-sum payments to low-income individuals.
  - Example: child care subsidy
  - Reducing price of child care rotates budget line out
  - Unrestricted lump-sum payment (equal to taxpayers' cost of the subsidy) shifts budget line out in a parallel fashion and increases opportunity set





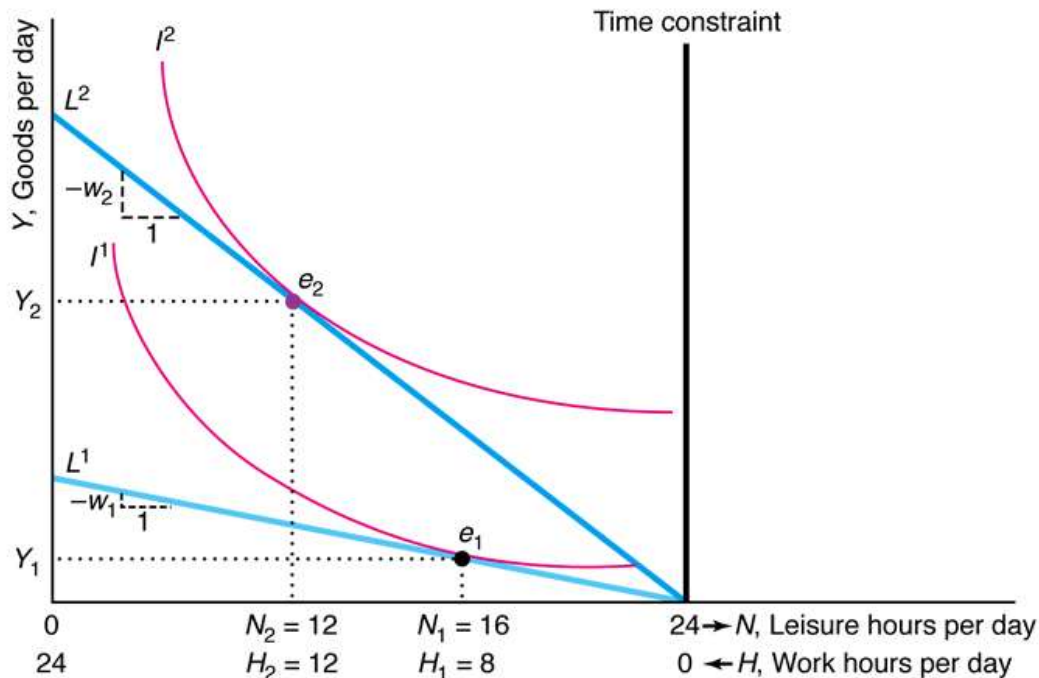
## 5.5 Deriving Labor Supply Curves

- Consumer theory is not only useful for determining consumer demand; it is useful for determining consumers' labor supply decisions.
- Labor – Leisure Choice
  - Work ( $H = \text{hours}$ ) to earn money ( $w = \text{wage}$ ) and buy goods
  - Don't work and consume leisure hours,  $N$ , and buy goods from unearned income sources,  $Y^*$
  - Utility:  $U = U(Y, N)$
  - Time constraint:  $H = 24 - N$
  - Total income:  $Y = wH + Y^*$
- Goal in determining labor and leisure choices is to maximize utility subject to constraints.

# 5.5 Deriving Labor Supply Curves

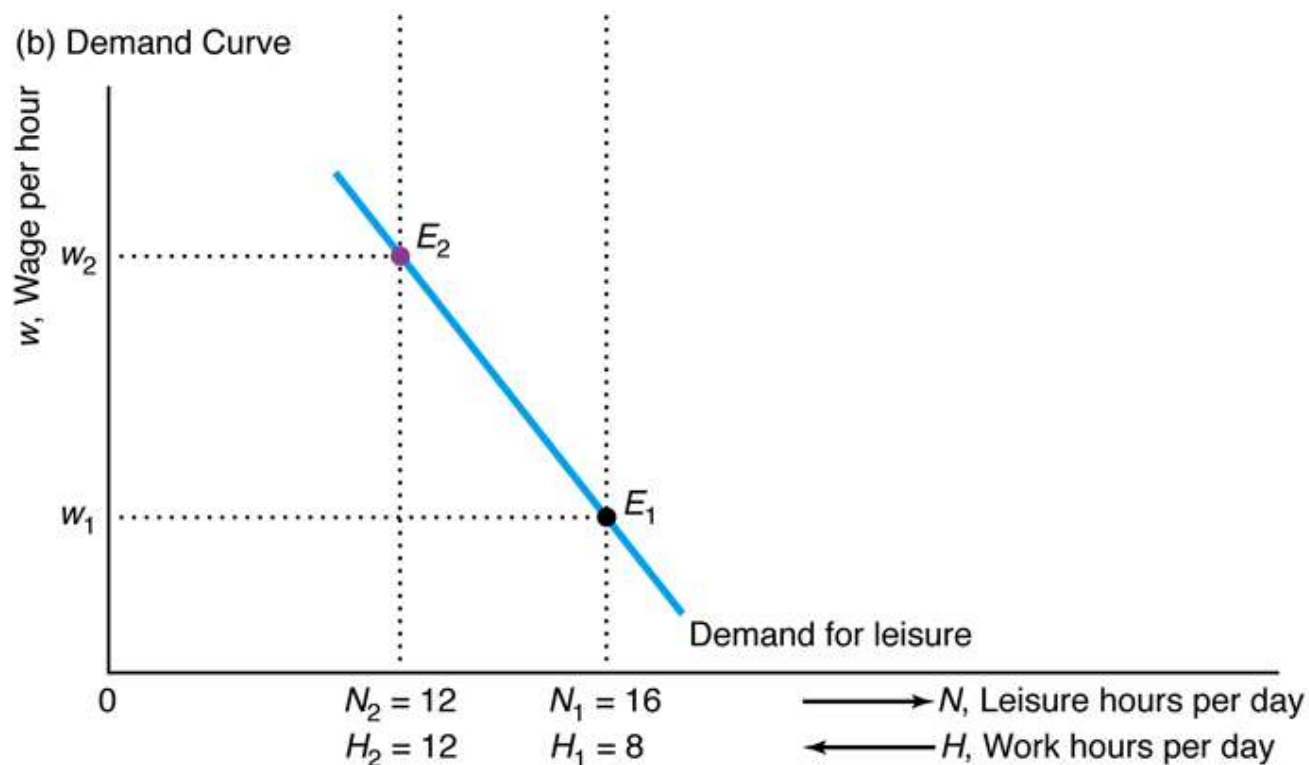
- Graphical analysis to determine optimal work hours and leisure hours per day:

(a) Indifference Curves and Constraints



## 5.5 Deriving Labor Supply Curves

- Graphically, when wage falls, it is optimal to work fewer hours and increase leisure:



## 5.5 Deriving Labor Supply Curves

- Mathematical analysis to determine optimal work hours and leisure hours per day uses calculus to find the tangency point between indifference curve and budget line.
- Maximize utility subject to constraints:

$$\max_H U = U(Y, N) = U(wH, 24 - H)$$

- First-order condition for an interior maximum is:

$$\frac{\partial U}{\partial Y} \frac{dY}{dH} + \frac{\partial U}{\partial N} \frac{dN}{dH} = U_Y w - U_N = 0$$

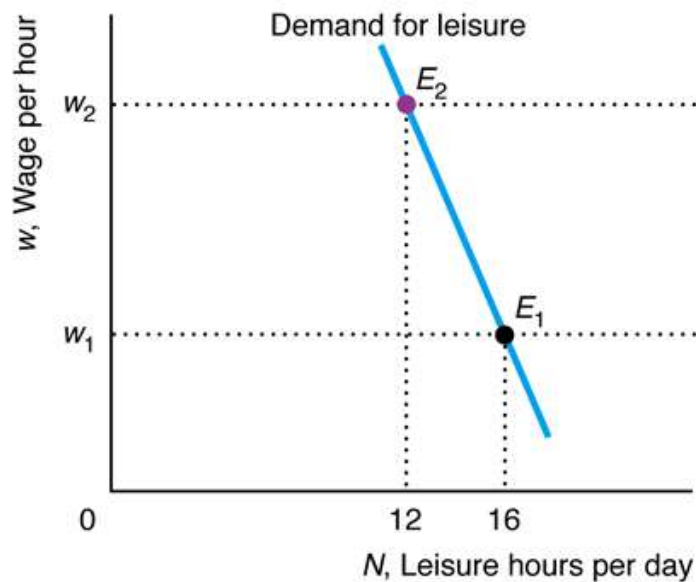
- Slope of indifference curve = Slope of budget line:

$$MRS = -\frac{U_N}{U_Y} = -w = MRT$$

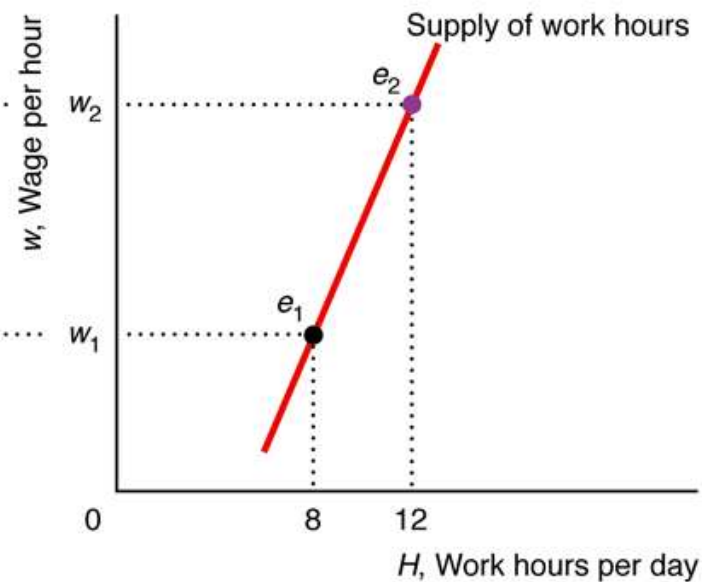
# 5.5 Deriving Labor Supply Curves

- The supply curve for hours worked is the mirror image of the demand curve for leisure hours.

(a) Leisure Demand

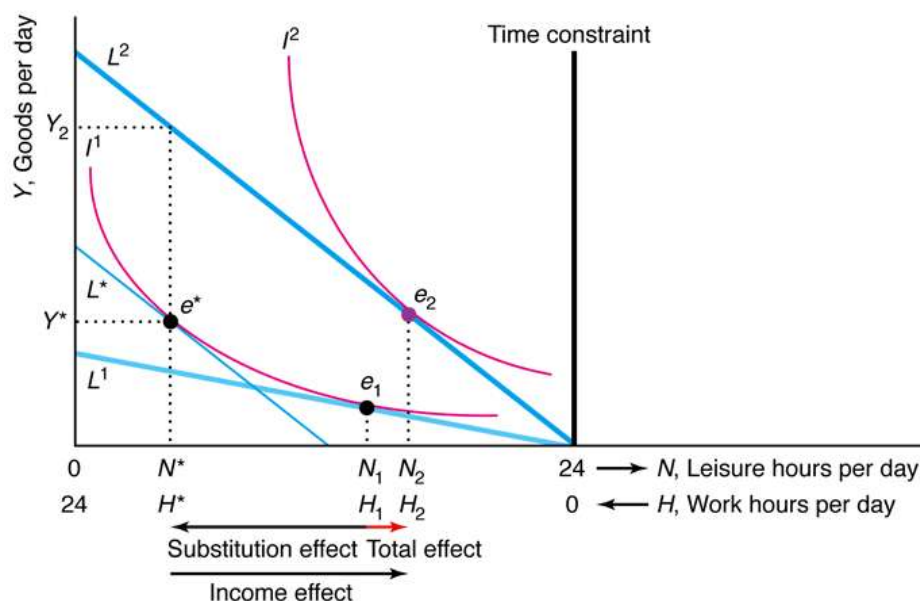


(b) Labor Supply



# 5.5 Income and Substitution Effects

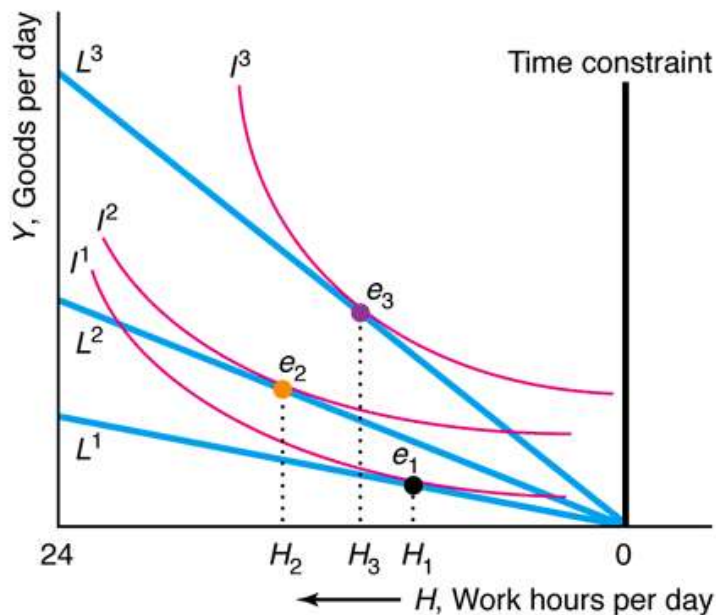
- An increase in the wage causes both income and substitution effects.
  - Total effect of a wage increase is move from  $e_1$  to  $e_2$  (work more).
  - Substitution effect is  $e_1$  to  $e^*$  (work more).
  - Income effect is  $e^*$  to  $e_2$  (work less).
  - Thus, substitution effect dominates in this case.



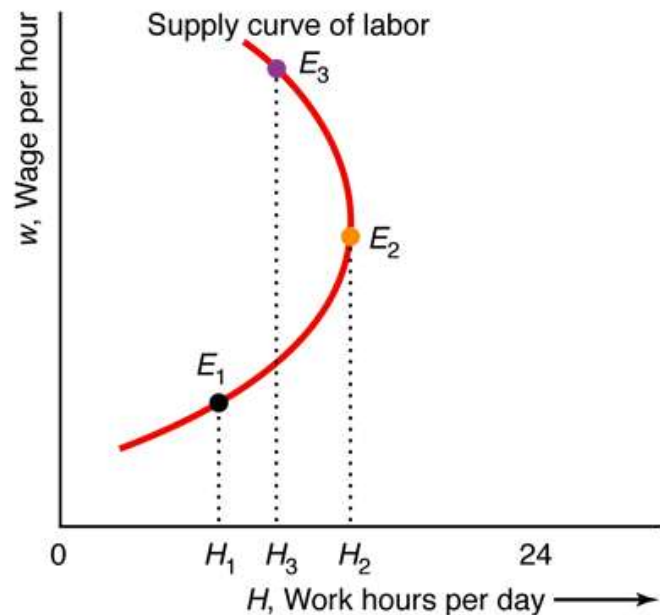
# 5.5 Shape of the Labor Supply Curve

- Different effects dominate along different portions of the labor supply curve.
  - Potentially backward-bending labor supply curve at higher wages

(a) Labor-Leisure Choice



(b) Supply Curve of Labor



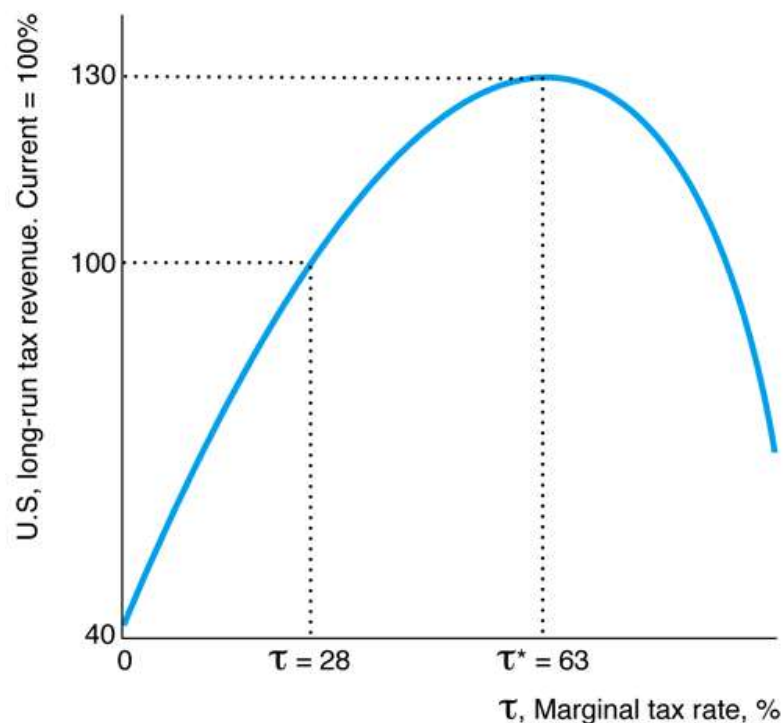
# 5.5 Income Tax Rates and Labor Supply

- An increase in the income tax rate – a percent of earnings – lowers workers' after-tax wages and may increase or decrease hours worked.
  - If labor supply is backward bending, lowering wages through higher income taxes will increase hours worked.
  - If labor supply is upward sloping, lowering wages through higher income taxes will decrease hours worked.
- The effect of imposing a marginal tax rate of  $\tau$  is to reduce the effective wage from  $w$  to  $(1 - \tau)w$ 
  - This rotates a worker's budget constraint in and downward.



# 5.5 Income Tax Revenue and Labor Supply

- Income tax revenue is  $\tau wH$ , which has a non-linear relationship to the marginal tax rate:



# 5.5 Income Tax Revenue and Labor Supply

- The government's tax revenue from an income tax is:

$$T = \tau w H [(1 - \tau)w] = \tau w H (\omega)$$

- Where  $H(\omega)$  is the hours of work supplied by an individual given the after tax wage,  $\omega = (1 - \tau)w$
- By differentiating the equation above, we can show how income tax revenue changes as the tax rate increases:

$$\frac{dT}{d\tau} = w H(\omega) - \tau w^2 \frac{dH}{d\omega}$$

- Two effects from a change in the marginal tax rate:
  1. Government collects more revenue from higher tax rate.
  2. Change in tax rate alters hours worked (and direction cannot be predicted by theory alone).