Microeconomics

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The Theory of Consumer Behavior: Individual and Market Demand

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The Effects of Changes in Price I

How to construct a demand curve from individual preferences?



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The Effects of Changes in Price I

How to construct a demand curve from individual preferences?



Definition

Price-consumption curve (PCC) – holding income and the price of Y constant, the PCC for a good X is the set of optimal bundles traced on an indifference map as the price of X varies.

The Effects of Changes in Price II

Individual Demand Curve:



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The Effects of Changes in Income I



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The Effects of Changes in Income I



Definition

Income-consumption curve (ICC) – holding the prices of X and Y constant, the ICC for a good X is the set of optimal bundles traced on an indifference map as income varies.

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The Effects of Changes in Income II

Engel Curve:



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The Effects of Changes in Income III

Normal Good: one whose quantity demanded rises as income rises:

$$\frac{dD(X,M)}{dM} > 0$$

Inferior Good: one whose quantity demanded falls as income rises:

$$\frac{dD(X,M)}{dM} < 0$$

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The Effects of Changes in Income III

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Price and Substitution Effects I

Definition

Substitution effect – a component of the total effect of a price change that results from the associated change in the relative attractiveness of other goods.

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Definition

Income effect – a component of the total effect of a price change that results from the associated change in real purchasing power.

• **The total effect** of the price increase is the sum of the substitution and income effects.

Price and Substitution Effects II



- The substitution effect always causes the quantity purchased to move in the opposite direction from the change in price
- The direction of the income effect depends on whether the good is normal or inferior.

Price and Substitution Effects III

For a normal good:



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Price and Substitution Effects IV

For an inferior good:



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Giffen Goods

- For Giffen goods the quantity demanded rises a its price rises
- An inferior good, for which the income effect offsets the substitution effect.
- Demand curve for a Giffen good would be upward sloping

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Aggregating Individual Demand Curves I

 To aggregate individual demand curves we need to add them horizontally.



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Algebraically: First solve for quantities!

Aggregating Individual Demand Curves II

With identical consumers:



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Algebraically:

• *n* consumers, each with $P = a - bQ_i$

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Aggregating Individual Demand Curves II

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• *n* consumers, each with $P = a - bQ_i$

Inverse:
$$Q_i = a/b - (1/b)P$$

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Aggregating Individual Demand Curves II

With identical consumers:



Algebraically:

• *n* consumers, each with $P = a - bQ_i$

• Inverse:
$$Q_i = a/b - (1/b)P$$

Sum:

$$Q = nQ_i = n\frac{a}{b} - n\frac{1}{b}P$$

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Price Elasticity of Demand I

Definition

Price elasticity of demand – the percentage change in the quantity of a good demanded that results from a 1 percent change in its price:

$$\varepsilon = \frac{\Delta Q/Q}{\Delta P/P} = \frac{\Delta Q}{\Delta P} \frac{P}{Q} = \frac{1}{\text{slope}} \frac{P}{Q}$$

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• When:
$$\Delta P \rightarrow 0$$
 and $\Delta Q \rightarrow 0$, we have $\varepsilon = \frac{dQ(P)}{dP} \frac{P}{Q}$

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Price Elasticity of Demand II



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Price Elasticity of Demand III

Important two cases:



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Price Elasticity of Demand IV

Some examples of elasticity estimates:

| Good or service | Price elasticity |
|--------------------------|------------------|
| Green peas | -2.8 |
| Air travel (vacation) | -1.9 |
| Frying chickens | -1.8 |
| Beer | -1.2 |
| Marijuana | -1.0 |
| Movies | -0.9 |
| Air travel (nonvacation) | -0.8 |
| Shoes | -0.7 |
| cigarettes | -0.3 |
| Theater, opera | -0.2 |
| Local telephone calls | -0.1 |

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Elasticity and Total Expenditure I

- If the price of a product changes, how will total spending on the product be affected?
- Total Expenditure:

$$R = PQ$$

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Elasticity and Total Expenditure II

Algebraically:

$$1 \max_{p} R = \max_{p} Q(P) \cdot P$$



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Elasticity and Total Expenditure II

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1
$$\max_{P} R = \max_{P} Q(P) \cdot P$$

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$$\frac{dQ(P)}{dP} \cdot P + Q(P) = 0 \quad | \quad : Q(P)$$

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Elasticity and Total Expenditure II

Algebraically:

$$1 \max_{P} R = \max_{P} Q(P) \cdot P$$

$$2 \text{ F.O.C.: } \frac{dQ(P)}{dP} \cdot P + Q(P) = 0 \quad | \quad : Q(P)$$

$$3 \underbrace{\frac{dQ(P)}{dP}}_{\varepsilon} \frac{P}{Q(P)} = -1$$

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Elasticity and Total Expenditure III

Graphically:



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1 **Substitution possibilities** – goods for which the substitution effect is small. E.g. drugs, salt



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- 2 **Budget share** the larger the share of total expenditures accounted for by the product, the more important will be the income effect of a price change. E.g. housing, education

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3 Direction of income effect – income effect reinforces the substitution effect for a normal good but offsets it for an inferior good, thus inferior goods less elastic

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- 3 Direction of income effect income effect reinforces the substitution effect for a normal good but offsets it for an inferior good, thus inferior goods less elastic
- 4 Time horizon generally more elastic in the long run. E.g. oil

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Income Elasticity of Demand I

Definition

Income elasticity of demand – the percentage change in the quantity of a good demanded that result from a 1 percent change in income.

 $\eta = \frac{\Delta Q/Q}{\Delta Y/Y}$

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Income elasticity of demand – the percentage change in the quantity of a good demanded that result from a 1 percent change in income.

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Types of goods:

- **•** $0 < \eta < 1$ **necessities** e.g. food
- $\eta > 1$ luxury goods e.g. travel
- $\eta < 0 \text{inferior goods}$

Income Elasticity of Demand II

Corresponding Engel Curves:



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Income Elasticity of Demand III

Some examples of elasticity estimates:

| TABLE 4.5 Income Elasticities of Demand for Selected Products* | | | |
|---|-----------------------|-------------------|--|
| | Good or service | Income elasticity | |
| | Automobiles | 2.46 | |
| | Furniture | 1.48 | |
| | Restaurant meals | 1.40 | |
| | Water | 1.02 | |
| | Tobacco | 0.64 | |
| | Gasoline and oil | 0.48 | |
| | Electricity | 0.20 | |
| | Margarine | -0.20 | |
| | Pork products | -0.20 | |
| | Public transportation | -0.36 | |

*These estimates come from H. S. Houthakker and Lester Taylor, Consumer Demand in the United States: Analyses and Projections, 2d ed., Cambridge, MA: Harvard University Press, 1970; L. Taylor and R. Halvorsen, "Energy Substitution in U.S. Manufacturing," Review of Economics and Statistics, November 1977; H. Wold and L. Jureen, Demand Analysis, New York: Wiley, 1953.

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Cross–Price Elasticity of Demand I

Definition

Cross-price elasticity of demand – the percentage change in the quantity of one good demanded that results from a 1 percent change in the price of the other good.

$$\varepsilon_{XZ} = \frac{\Delta Q_X / Q_X}{\Delta P_Z / P_Z}$$

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Cross–Price Elasticity of Demand I

Definition

Cross-price elasticity of demand – the percentage change in the quantity of one good demanded that results from a 1 percent change in the price of the other good.

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- **Complements:** $\varepsilon_{XZ} < 0$ e.g. whisky and cigars
- **Substitutes:** $\varepsilon_{XZ} > 0$ e.g. pizza and kebab

Cross–Price Elasticity of Demand II

Some examples of elasticity estimates:

TABLE 4.6 Cross-Price Elasticities for Selected Pairs of Products*

| Good or service | Good or service with price change | Cross-price elasticity |
|-----------------|-----------------------------------|------------------------|
| Butter | Margarine | +0.81 |
| Margarine | Butter | +0.67 |
| Natural gas | Fuel oil | +0.44 |
| Beef | Pork | +0.28 |
| Electricity | Natural gas | +0.20 |
| Entertainment | Food | -0.72 |
| Cereals | Fresh fish | -0.87 |

*From H. Wold and L. Jureen, Demand Analysis, New York: Wiley, 1953; L. Taylor and R. Halvorsen, "Energy Substitution in U.S. Manufacturing," Review of Economics and Statistics, November 1977; E. T. Fujii et al., "An Almost Ideal Demand System for Visitor Expenditures," Journal of Transport Economics and Policy, 19, May 1985, 161–171; and A. Deaton, "Estimation of Own- and Cross-Price Elasticities from Household Survey Data," Journal of Econometrics, 36, 1987. 7–30.

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