MICROECONOMICS I.
"B"

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week 9

Consumption and demand, part 3

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The course was prepaerd by Gergely Kőhegyi, using *Jack Hirshleifer, Amihai Glazer and David Hirshleifer (2009) Mikroökonómia. Budapest: Osiris Kiadó, ELTECON-books (henceforth HGH)*, and *Gábor Kertesi (ed.) (2004) Mikroökonómia előadásvázlatok. http://econ.core.hu/ kertesi/kertesimikro/ (henceforth KG).*

Applications and extensions of demand theory

Income elasticity of demand

How does the demanded quantity react to the change in income?

- For any good X the change in consumption ΔI due to a change in income Δx could be measured by the ratio $\frac{\Delta x}{\Delta I}$. (This ratio is the slope of the Engel curve over the relevant range)
- Problem: $\frac{\Delta x}{\Delta I}$ is sensitive to the units of measurement.
  - e.g.: income raises by 100 HUF, and then we consume 5 dkg=0,05 kg more butter.
  - Then $\frac{\Delta x}{\Delta I} = 0,05$, if we use $\left[\frac{dkg}{Ft}\right]$
  - and $\frac{\Delta x}{\Delta I} = 0,0005$, if we use $\left[\frac{kg}{Ft}\right]$
- This can cause trouble, especially if we want to compare the income sensitivity of different goods. (e.g. pieces of watermelon and apple, or grams of coffee and bags of tea)

Definition 1. *The income elasticity of demand (ε_x) is the proportionate change in the quantity purchased divided by the proportionate change in income. In other words, it shows how much (%) demanded quantity changes if income changes by 1%.*

- *with discrete quantity (*elasticity over a range or arc*):*

$$\varepsilon_x = \frac{\Delta x/x}{\Delta I/I} \equiv \frac{\Delta x}{\Delta I}\frac{I}{x}$$

Statement 1. *An Engel curve with positive slope has income elasticity greater than, equal to, or less than 1 depending upon whether the slope* along *the Engel curve is greater than, equal to, or less than the slope of a ray drawn from the origin* to *the curve.*

Statement 2. *If the income elasticity of a good is positive, it is a normal good, if it is negative, then it is an inferior good.*

- *Normal good:* $\varepsilon > 0$
- *Inferior good:* $\varepsilon < 0$

Definition 2.

- *Necessity good:* $1 > \varepsilon > 0$

- *Luxury good:* $\varepsilon > 1$

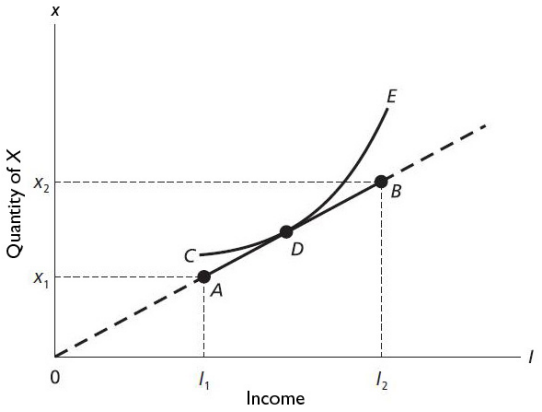
Statement 3. *The weighted average of an individual's income elasticities equals 1, where the weights are the proportions of the budget spent on each commodity. So if* $k_1 \equiv \frac{p_1 x_1}{I}, \ldots, k_i \equiv \frac{p_i x_i}{I}, \ldots, k_n \equiv \frac{p_n x_n}{I}$, *then*

$$k_1\varepsilon_1 + \ldots + k_i\varepsilon_i + \ldots + k_n\varepsilon_n = \sum_{i=1}^{n} k_i\varepsilon_i = 1$$

Income elasticity

Unitary income elasticity

The straight line Engel curve ADB has income elasticity 1, because the slope along the curve is the same as the slope of a ray from the origin to any point on the curve.



Effect of income on expenditures (income elasticities)

Category	Lowest income group	Highest income group
Food	0,63	0,84
Housing	1,22	1,80
Household operation	0,66	0,85
Clothing	1,29	0,98
Transportation	1,50	0,90
Tobacco and alcohol	2,00	0,85

Price elasticity of demand

How sensitive is the demanded quantity on the change in price? We can define the price elasticity similarly to income elasticity:

Definition 3. *The price elasticity of demand is the proportionate change in quantity purchased divided by the proportionate change in price. In other words, it shows how much (%) demanded quantity changes if price changes by 1%.*

- *with discrete quantities:*

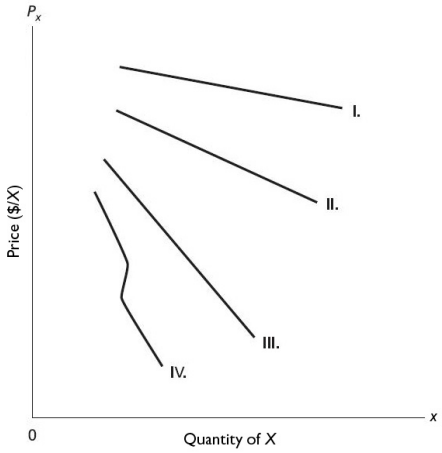
$$\eta_x = \frac{\Delta x/x}{\Delta P_x/P_x} \equiv \frac{\Delta x}{\Delta P_x}\frac{P_x}{x}$$

Statement 4. *The price elasticity of a Giffen good is positive, while it is negative for an ordinary good:*

- *Ordinary good:* $\eta_x < 0$
- *Giffen good:* $\eta_x > 0$

market price elasticity of demand

The four demand curves represent different responses of quantity purchased to changes in price. Since demand curves are conventionally drawn with price on the vertical axis, a greater response is represented by a flatter demand curve.



Statement 5. *If a consumer's demand for X is* elastic*, a reduction in price P_x will ead to increased spending $E \equiv P_x x$ on commodity X. If demand is* inelastic*, a price reduction decreases E_x. If the demand elasticity is* unitary *E_x remains the same.*

Cross elasticity of demand

- the demanded quantity of butter depends not only on the price of the butter, but also from the price of other related commodities such as e.g. bread or cheese.
- Now the fact that elasticity is not sensitive to unit measures comes very handy.

Definition 4. *The cross-price elasticity of demand is the proportionate change in quantity purchased divided by the proportionate change in price of another good. In other words, it shows how much (%) demanded quantity changes if price of another good changes by 1%.*

- *with discrete quantities:*

$$\eta_{xy} = \frac{\Delta x/x}{\Delta P_y/P_y} \equiv \frac{\Delta x}{\Delta P_y}\frac{P_y}{x}$$

Cross-price elasticity of demand

We can define the relationship between two commodities with the cross-price elasticity. If the are

- substitutes (butter-margarine), or
- complements (butter-bread) commodities.

Definition 5. *X and Y commodities are*

- substitutes, *if $\eta_{xy} > 0$*
- complements, *if $\eta_{xy} < 0$*

Note 1. *Cross-price elasticity can help in defining the relevant market*

Demand elasticities of two pharmaceuticals

	Brand 1	Generic 1	Brand 3	Generic 3
Brand 1	−0,38	1,01	−0,20	−0,21
Generic 1	0,79	−1,04	−0,09	−0,10
Brand 3	0,52	0,53	−1,93	1,12
Generic 3	0,21	0,23	2,00	−2,87

Price elasticity matrix and income elasticity vector

$$\begin{bmatrix} \eta_{11} & \cdots & \cdots & \cdots & \eta_{1n} \\ \vdots & \ddots & & & \vdots \\ \vdots & & \eta_{ij} & & \vdots \\ \vdots & & & \ddots & \vdots \\ \eta_{n1} & \cdots & \cdots & \cdots & \eta_{nn} \end{bmatrix}, \begin{bmatrix} \varepsilon_1 \\ \vdots \\ \varepsilon_i \\ \vdots \\ \varepsilon_n \end{bmatrix}$$

Relation of elasticities

Statement 6.

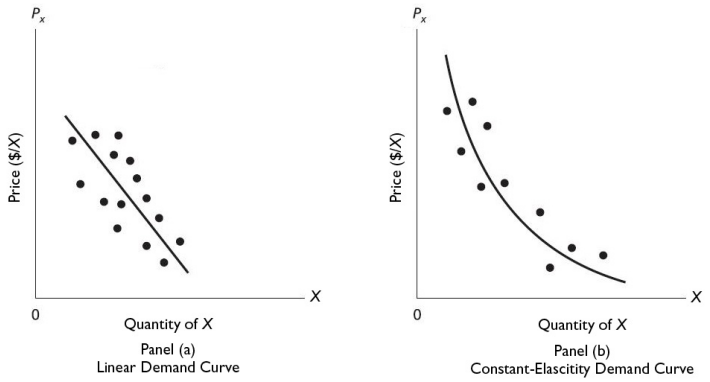
$$\sum_{j=1}^{n} \eta_{ij} + \varepsilon_i = 0; i = 1, \ldots, n$$

Note 2. *The demand for a (normal) good is more price elastic the more close substitutes it has and the higher its income elasticity is.*

Fitting demand curves

Elasticities of market demand:

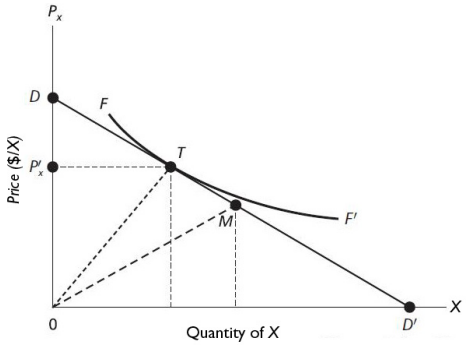
- $\varepsilon_X = \frac{\Delta X}{\Delta M}\frac{M}{X}$, or $\varepsilon_X = \frac{\partial X}{\partial M}\frac{M}{X}$, where M is the total income of the society $M = \sum_{i=1}^{n} I_i$, or the weighted average of their income.
- $\eta_X = \frac{\Delta X}{\Delta P_x}\frac{P_x}{X}$, or $\eta_X = \frac{\partial X}{\partial P_x}\frac{P_x}{X}$
- $\eta_{XY} = \frac{\Delta X}{\Delta P_Y}\frac{P_Y}{X}$, or $\eta_{XY} = \frac{\partial X}{\partial P_Y}\frac{P_Y}{X}$

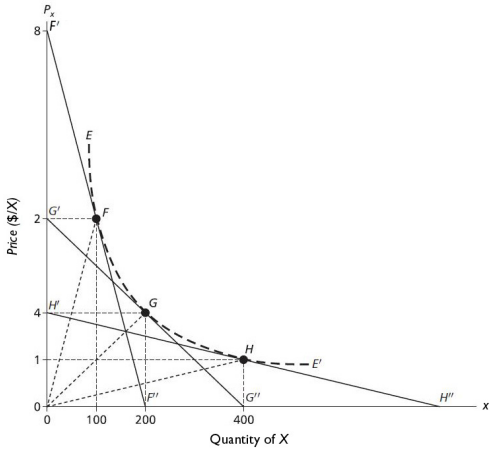


Interpreting elasticities graphically

Geometrical measure of elasticity

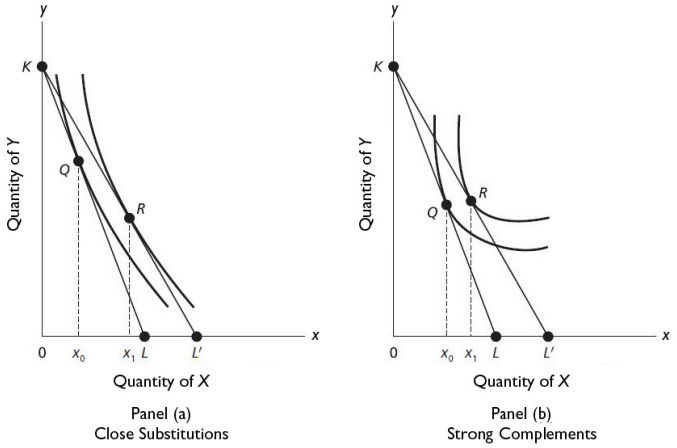
Elasticity at a point T along a linear demand curve DD' is the slope of a ray OT from the origin to point T divided by the slope of the demand curve. For a non-linear demand curve such as FF', the demand elasticity at point T is identical with the elasticity at T along the tangent straight-line demand curve DD' .



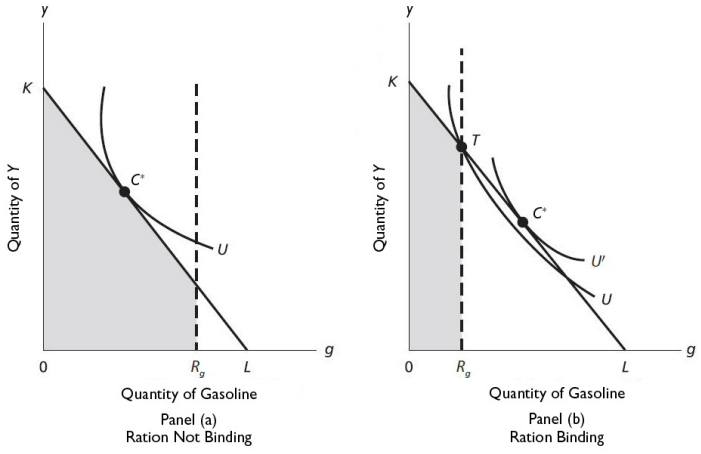


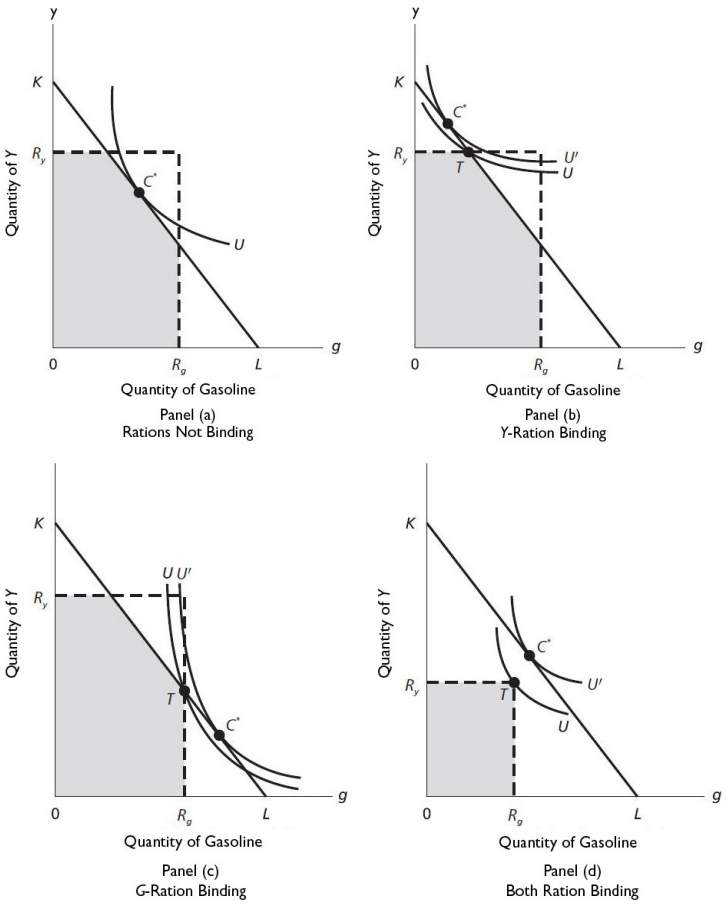
Determinants of responsiveness of demand to price

- Availability of substitutes. Demand for a commodity will be more elastic the more numerous and the closer the available substitutes.
- Luxuries versus necessities: Demand for a luxury tends to be more elastic than demand for a necessity.
- High-priced versus low-priced goods.

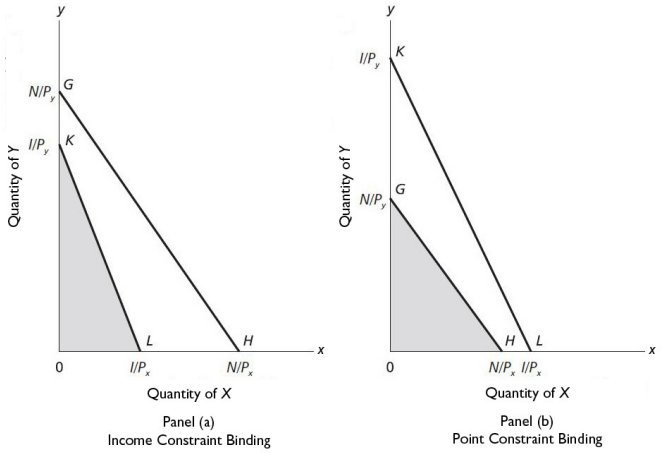


Coupon rationing

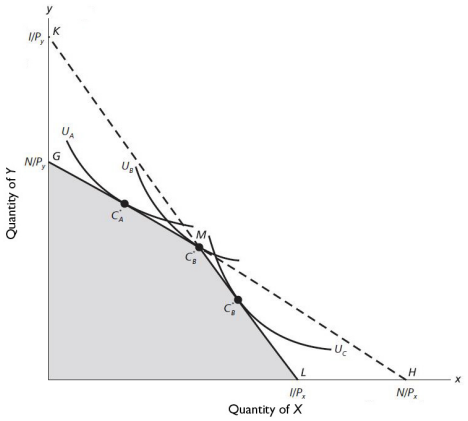




- $P_x x + P_y \leq I$ income constraint
- $p_x x + p_y y \leq N$ point constraint



Binding constraints
The point constraint limits consumption in the range GM (the solid portion of the line GH), and the income constraint in the range ML (the solid portion of KL).



Average weekly purchases by housekeeping families in cities (lb.)

Income	1000 dollars or less	1000–2000 dollars	2000–3000 dollars	3000–4000 dollars	Over 4000 dollars
1942					
Cheese	0,26	0,57	0,64	0,81	1,03
Canned fish	0,21	0,36	0,56	0,44	0,37
1944	0,24	0,33	0,44	0,49	0,52
Cheese					
Canned fish	0,06	0,12	0,17	0,22	0,28

Time as income constraint:

Average values of variables

	Chevron	Non-Chevron
Gallons purchased	11,6	8,8
% weekend customers	31,2	26,2
% with passengers	7,3	18,0
% employed full-time	67,9	83,6
% housewives	5,5	3,3