

Chapter 2. Income Elasticity of Demand

Given the demand function for flat screen televisions before and after a 5% increase in income

$$P = 1800 - 0.6Q_1 \text{ (before increase in income)} \quad (1)$$

$$P = 1872 - 0.6Q_2 \text{ (after increase in income)} \quad (2)$$

- a) Calculate the quantity demanded in both cases when the price of a television is £600.
Calculate the income elasticity of demand, and comment on the type of good.

- b) Given the demand function for bread before and after a 6% increase in income,

$$P = 3.00 - 0.007Q_1 \text{ (before increase in income)} \quad (3)$$

$$P = 2.95 - 0.007Q_2 \text{ (after increase in income)} \quad (4)$$

Calculate the quantity demanded in both cases when the price of bread is £1.50.

Calculate the income elasticity of demand and comment on the type of good.

Work correct to two decimal places and give all answers correct to two decimal places.

Solution a)

Changes in income affect quantity demanded by shifting (translating) the demand function horizontally.

Income elasticity of demand measures the responsiveness of demand for a good to changes in income.

Income elasticity of demand ε_Y is defined as the percentage change in quantity demanded divided by the percentage change in income (Y).

$$\varepsilon_Y = \frac{\% \text{ change in quantity demanded}}{\% \text{ change in income, } Y}$$

The numerator in ε_Y is the difference between the quantity demanded before and after the increase in income which is calculated from the demand functions (1) and (2). The denominator is 5: the percentage change in income, given in the question.

Before the increase in income, when the price is £600

$$600 = 1800 - 0.6Q_1 \quad (1)$$

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$$0.6Q_1 = 1200$$

$$Q_1 = 2000$$

After the increase in income, when price is £600

$$600 = 1872 - 0.6Q_2 \quad (2)$$

$$0.6Q_2 = 1272$$

$$Q_2 = 2120$$

The increase in quantity demanded is $2120 - 2000 = 120$.

The percentage increase in quantity demanded is $\frac{120}{2000} \times 100 = 6\%$.

A 5% increase in income causes a 6% increase in demand.

Income elasticity of demand, the percentage change in quantity demanded divided by the percentage change in income

$$\varepsilon_Y = \frac{\% \text{ change in quantity demanded}}{\% \text{ change in income}} = \frac{6}{5} = 1.20.$$

The income elasticity of demand is positive (an increase in income leads to an increase in demand), so the good is a *normal* good. Also, the value of income elasticity is greater than +1, so the good is a *luxury* good.

	$Q = 0$	$Q = 3000$	$Q = 3120$
$P_1 = 1800 - 0.6Q$	1800	0	-72
$P_2 = 1872 - 0.6Q$	1872	72	0

Table 2.1C. Points for plotting demand curves.

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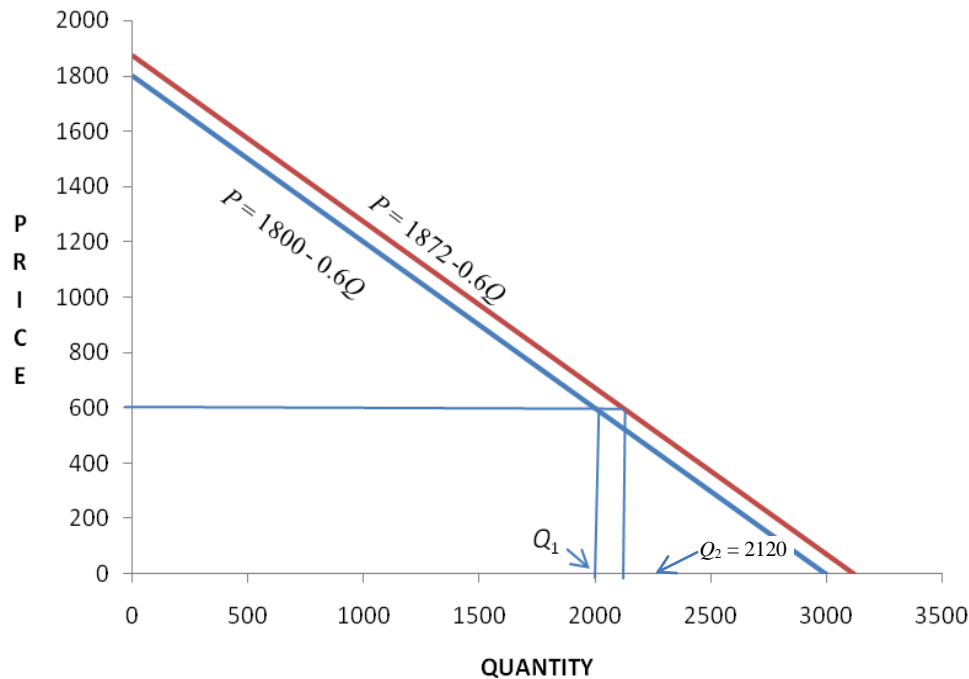


Figure 2.1C. Demand Curves before and after increase in income – normal good.

Solution b)

Before the increase in income, when the price is £1.50

$$1.50 = 3.00 - 0.007Q_1$$

$$0.007Q_1 = 1.50$$

$$Q_1 = 214.29$$

After increase in income, when price is £1.50

$$1.50 = 2.95 - 0.007Q_2$$

$$0.007Q_2 = 1.45$$

$$Q_2 = 207.14$$

The reduction in quantity demanded is $214.29 - 207.14 = 7.15$.

The percentage decrease in quantity demanded is

$$\frac{7.15}{214.29} \times 100 = 3.34\%.$$

A 6% increase in income causes a 3.34% decrease in demand.

Note: a decrease of 3.34% is written as a change of -3.34%

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Income elasticity of demand is

$$\varepsilon_Y = \frac{\% \text{ change in quantity demanded}}{\% \text{ change in income}} = \frac{-3.34}{6} = -0.56$$

The income elasticity of demand is negative (an increase in income leads to a reduction in demand), so the good is an *inferior* good.

Table 2.2C. Points for plotting demand curves.

	$Q = 0$	$Q = 428.6$	$Q = 421.4$
$P_1 = 3 - 0.007Q$	3	0	0.05
$P_2 = 2.95 - 0.007Q$	2.95	-0.05	0

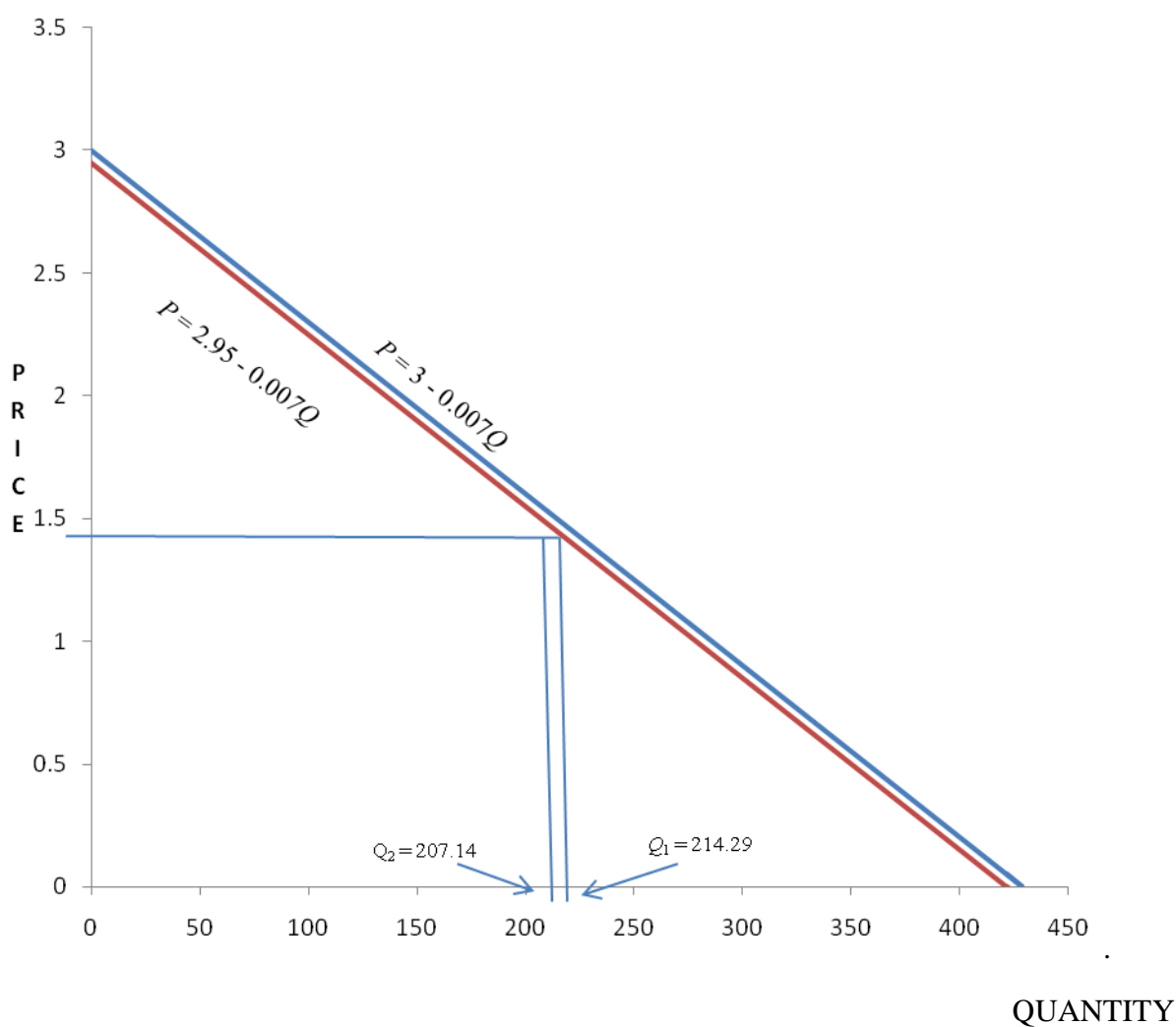


Figure 2.2C. Demand Curves before and after increase in income – inferior good

Cross Price Elasticity of Demand

- a) Given the demand function for tea before and after a 10% decrease in the price of coffee,

$$P = 14 - 0.002Q_1 \text{ (before decrease in price of coffee)} \quad (5)$$

$$P = 13.5 - 0.002Q_2 \text{ (after decrease in price of coffee)} \quad (6)$$

Calculate the quantity demanded in both cases when the price of tea is £8.00 per kg.

Calculate the cross price elasticity of demand, and comment on the relationship between tea and coffee.

- b) Given the demand function for tonic before and after a 5% increase in the price of gin,

$$P = 6 - 0.005Q_1 \text{ (before increase in price of gin)} \quad (7)$$

$$P = 5.8 - 0.005Q_2 \text{ (after increase in price of gin)} \quad (8)$$

Calculate the quantity demanded in both cases when the price of tonic is £1.50.

Calculate the cross price elasticity of demand and comment on the relationship between gin and tonic.

Solution a)

Cross price elasticity of demand measures the responsiveness of demand for a good to a change in the price of a related good.

Cross price elasticity is defined as the percentage change in the quantity of good X demanded divided by the percentage change in the price of good Y.

Changes in the price of a related good affect quantity demanded by shifting (translating) the demand function horizontally.

Before decrease in price of coffee, when price of tea is £8.00 the quantity of tea demanded is calculated from (5)

$$8 = 14 - 0.002Q_1$$

$$0.002Q_1 = 6$$

$$Q_1 = 3000$$

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After decrease in the price of coffee, when the price of tea is £8.00 the quantity of tea demanded is calculated from (6)

$$8 = 13.5 - 0.002Q_2$$

$$0.002Q_2 = 5.5$$

$$Q_2 = 2750$$

The reduction in the quantity of tea demanded is $3000 - 2750 = 250$.

The percentage reduction in the quantity of tea demanded is

$$\frac{250}{3000} \times 100 = 8.3\%.$$

A 10% decrease in the price of coffee results in an 8.3% reduction in the demand for tea.

Cross price elasticity of demand for tea with respect to coffee is

$$\varepsilon_{T,C} = \frac{\% \text{ change in quantity of Tea demanded}}{\% \text{ change in price of Coffee}} = \frac{-8.3}{-10} = 0.83.$$

The cross price elasticity is a positive number (a reduction in price of one good leads to a reduction in demand of the other good), so the goods are *substitutes*.

Consumers have substituted some tea consumption for coffee consumption, because coffee has become relatively cheaper.

Table 2.3C. Points for plotting demand curves.

	$Q=0$	$Q=7000$	$Q=6750$
$P_1=14.0-0.002Q$	14	0	0.5
$P_2=13.5-0.002Q$	13.5	-0.5	0

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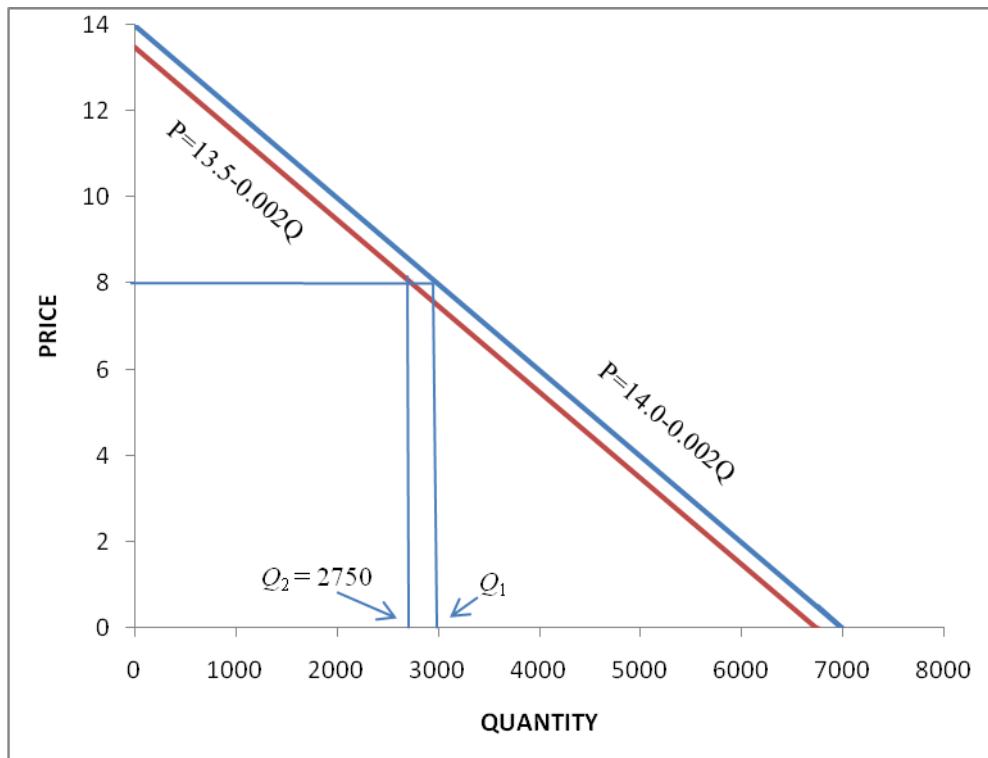


Figure 2.3C. Demand Curves for tea before and after increase in price of coffee (substitute good).

Solution b)

Before the increase in the price of gin, when the price of tonic is £1.50 the quantity of tonic demanded is calculated from (7)

$$P = 6 - 0.005Q_1$$

$$1.50 = 6 - 0.005Q_1$$

$$0.005Q_1 = 4.5$$

$$Q_1 = 900$$

After the increase in the price of gin, when the price of tonic is £1.50 the quantity of tonic demanded is calculated from (8)

$$P = 5.8 - 0.005Q_2$$

$$1.50 = 5.8 - 0.005Q_2$$

$$0.005Q_2 = 4.3$$

$$Q_2 = 860$$

The reduction in the quantity of tonic demanded is $900 - 860 = 40$.

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The percentage reduction in the quantity of tonic demanded is

$$\frac{40}{900} \times 100 = 4.44\%.$$

A 5% increase in the price of gin results in a 4.44% reduction in the demand for tonic.

Cross price elasticity of demand for tonic with respect to gin is

$$\varepsilon_{t,G} = \frac{\% \text{ change in quantity of tonic demanded}}{\% \text{ change in price of Gin}} = \frac{-4.44}{5} = -0.89$$

The cross price elasticity is a negative number (an increase in price of one good leads to a reduction in demand for the other good), so the goods are *complements*.

Complements are consumed together, so an increase in the price of one good leads to a reduction in the quantity demanded of both goods.

Table 2.4C. Points for plotting demand curves.

Q	0	1200	1160
$P=6.0-0.005Q$	6	0	0.2
$P=5.8-0.005Q$	5.8	-0.2	0

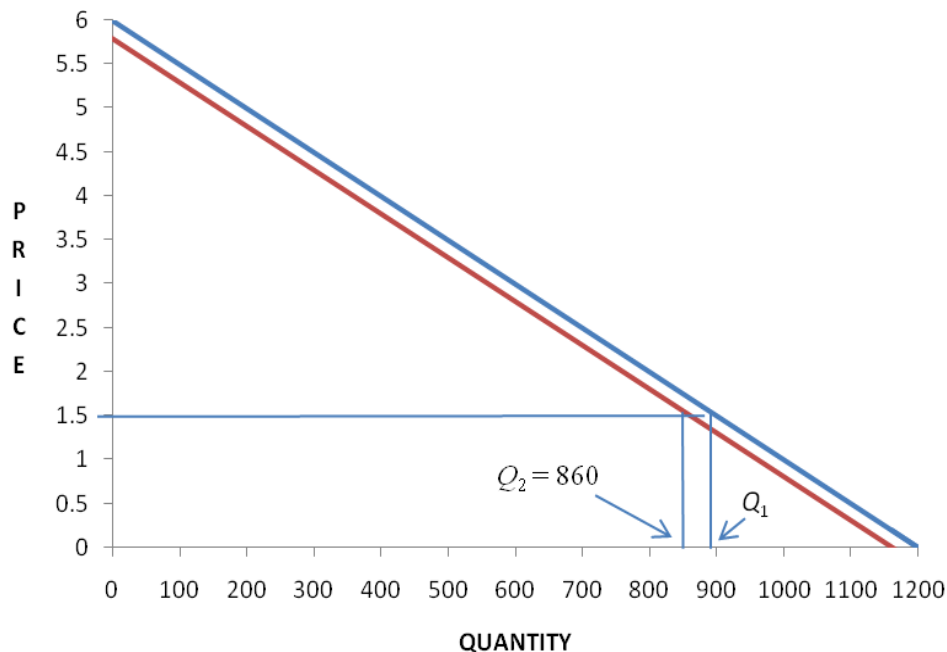


Figure 2.4C. Demand Curves for tonic before and after increase in price of gin (complement).