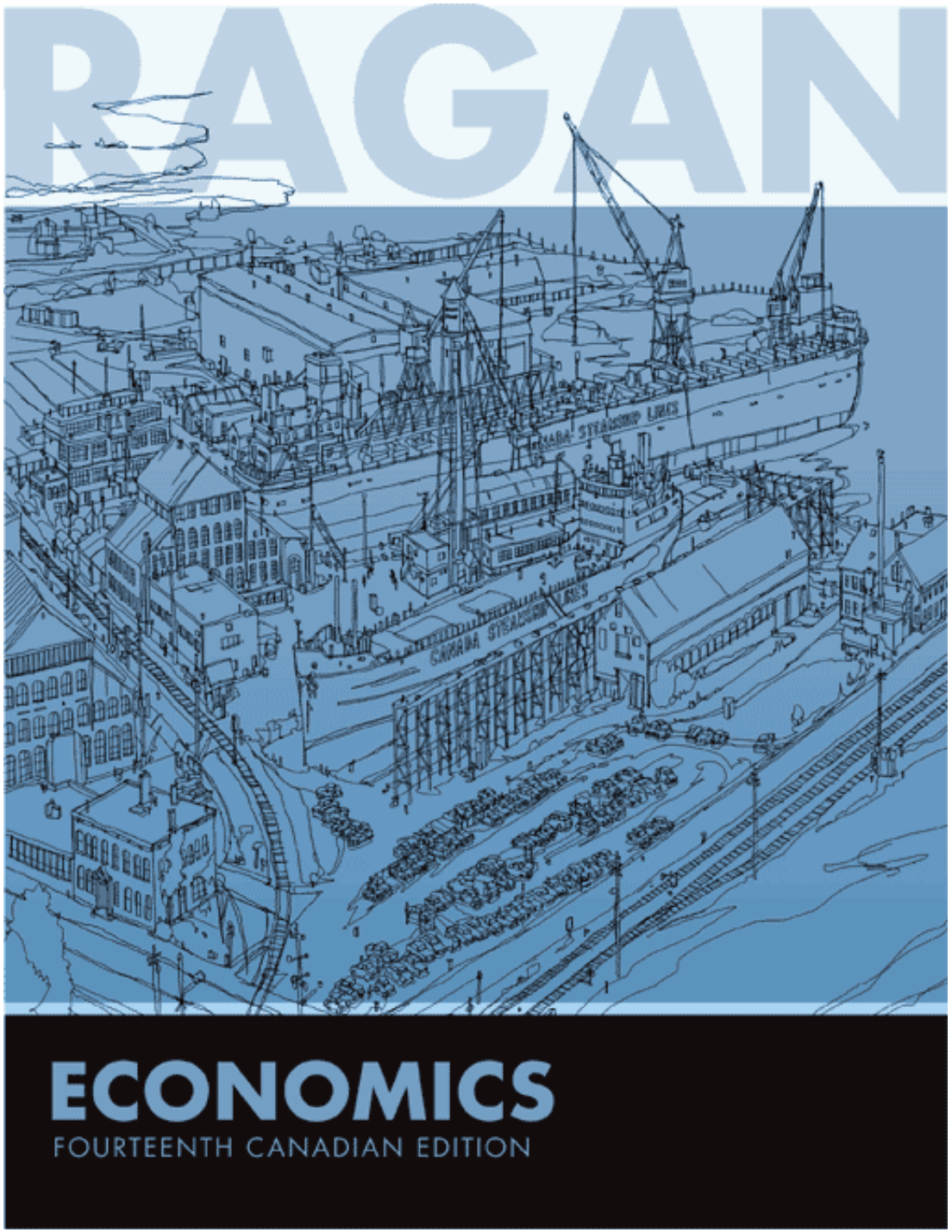


Chapter 4:
Elasticity

Chapter Outline/Learning Objectives

Section	Learning Objectives After studying this chapter, you will be able to
4.1 Price Elasticity of Demand	1. explain what price elasticity of demand is and how it is measured. 2. explain the relationship between total expenditure and price elasticity of demand.
4.2 Price Elasticity of Supply	3. explain what price elasticity of supply is and how it is measured.
4.3 An Important Example Where Elasticity Matters	4. see how elasticity of demand and supply determine the effects of an excise tax.
4.4 Other Demand Elasticities	5. measure the income elasticity of demand and be able to distinguish between normal and inferior goods. 6. measure cross elasticity of demand and be able to distinguish between substitute and complement goods.

4.1 Price Elasticity of Demand

Demand is said to be **elastic** when quantity demanded is very responsive to a change in the products own price.

Demand is **inelastic** if quantity demanded is very unresponsive to changes in its price.

Elasticity is related to the slope of the demand curve, but it is **not** exactly the same.

Fig. 4-1(i) **Elastic Demand**

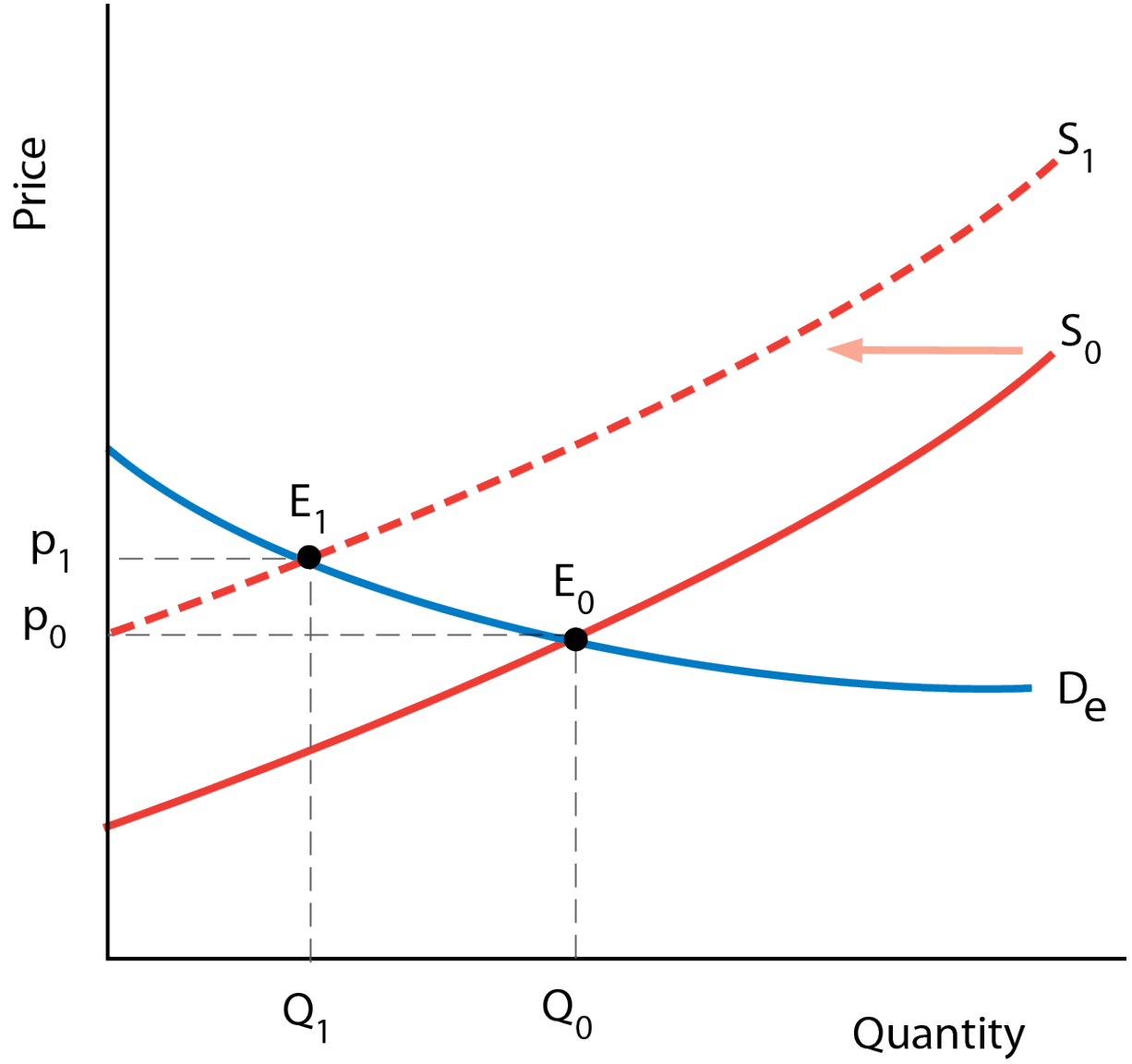
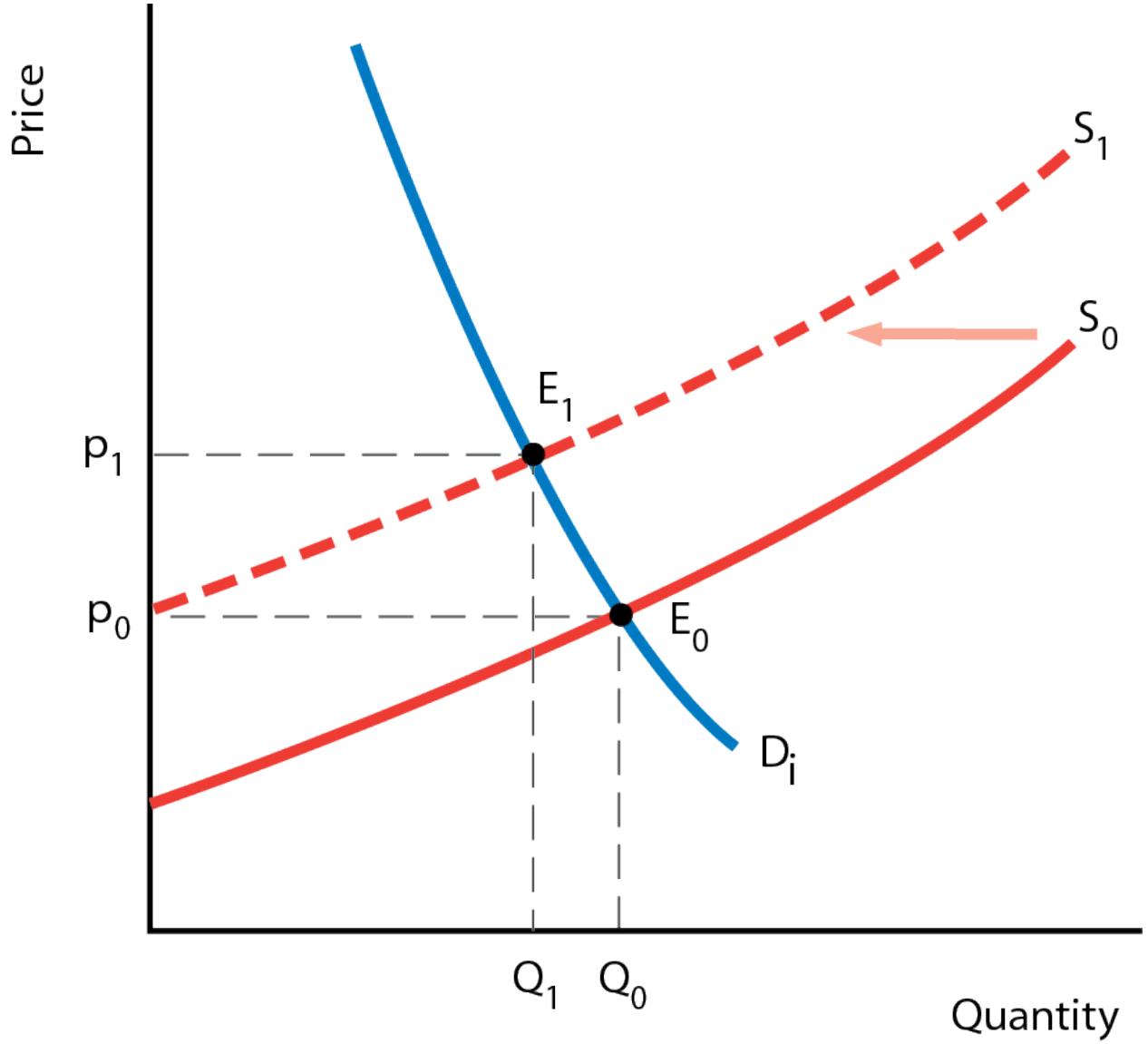


Fig. 4-1(ii) **Inelastic Demand**



Note!

We can only do the visual comparison (comparing the slope of the demand curves) if:

- Both figures are drawn on the same scale
- We start from the same price-quantity equilibrium

Otherwise, what? we need to know the percentage change in the prices and quantities of the various products.

Price reductions and quantity demanded

Commodity	Reduction in price	Increase in quantity demanded (per month)
Cheese	$2 per kilogram	7.500 kilograms
T-shirts	$2 per shirt	25.000 shirts
iPhones	$2 per iPhone	500 iPhones

The Measurement of Price Elasticity

Elasticity (Greek letter eta: η) is defined as:

$$\eta = \frac{\textit{percentage change in quantity demanded}}{\textit{percentage change in price}}$$

$$\eta = \frac{\Delta\ Q^D / \overline{Q}^D}{\Delta\ p / \overline{p}}$$

Demand elasticity is **negative**, but economists usually emphasize the **absolute value**.

Elasticity usually measures the change in *p* and *Q* relative to some "base" values of *p* and *Q*.

Demand elasticity between point "0" and point "1" on some demand curve is:

$$\eta = \frac{(Q_1 - Q_0)/\overline{Q}}{(p_1 - p_0)/\overline{p}}$$

where p and Q are the average price and average quantity, respectively.

Thus $\overline{p} = (p_1+p_0)/2$ and $\overline{Q} = (Q_1+Q_0)/2$. After a little simplifying, we get:

$$\eta = \frac{(Q_1 - Q_0)/(Q_1 + Q_0)}{(p_1 - p_0)/(p_1 + p_0)}$$

A Numerical Example of Price Elasticity

Product	Original Price	New Price	Average Price	Original Quantity	New Quantity	Average Quantity
Corona Beer (6-pack)	$9.00	$8.00	$8.50	2000	3000	2500

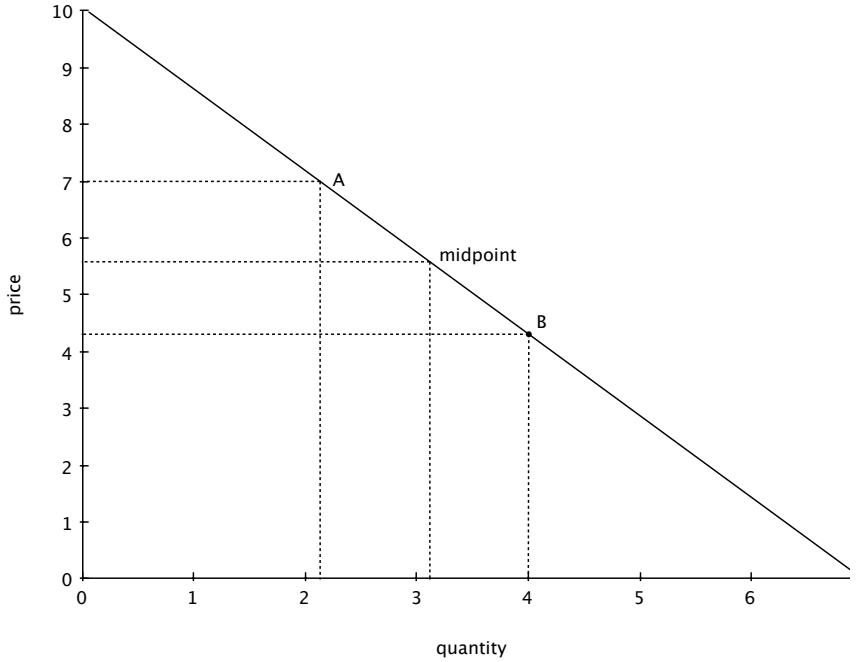
$$\eta = \frac{(3000 - 2000)/(3000 + 2000)/2}{(8 - 9)/(8 + 9)/2}$$

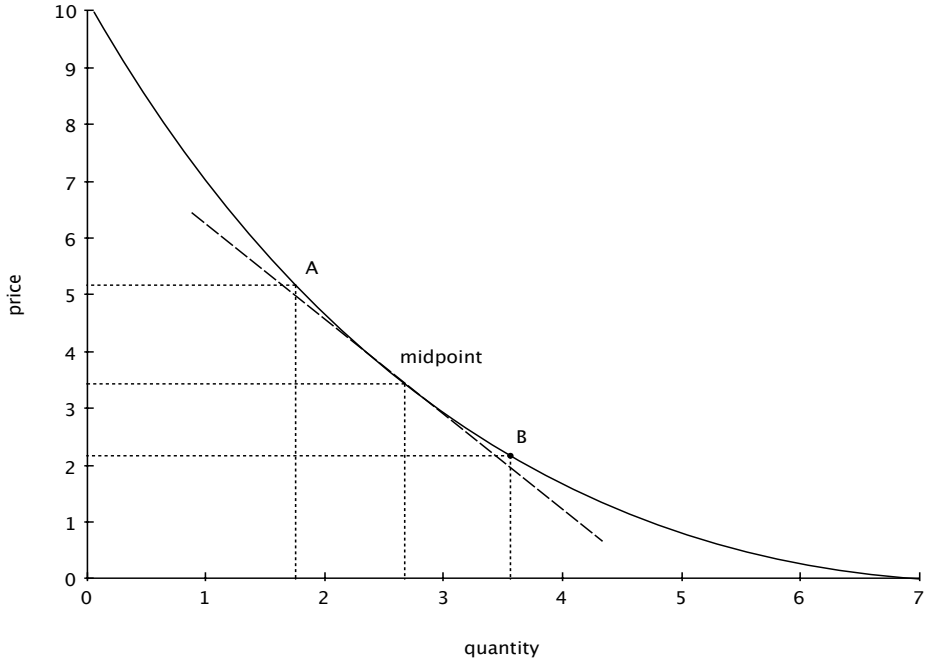
$$\eta = \frac{(1000)/(2500)}{(-1)/(8.5)}$$

$$\eta = \frac{0.4}{-0.1176} = -3.40$$

But we use the absolute value: 3.40!

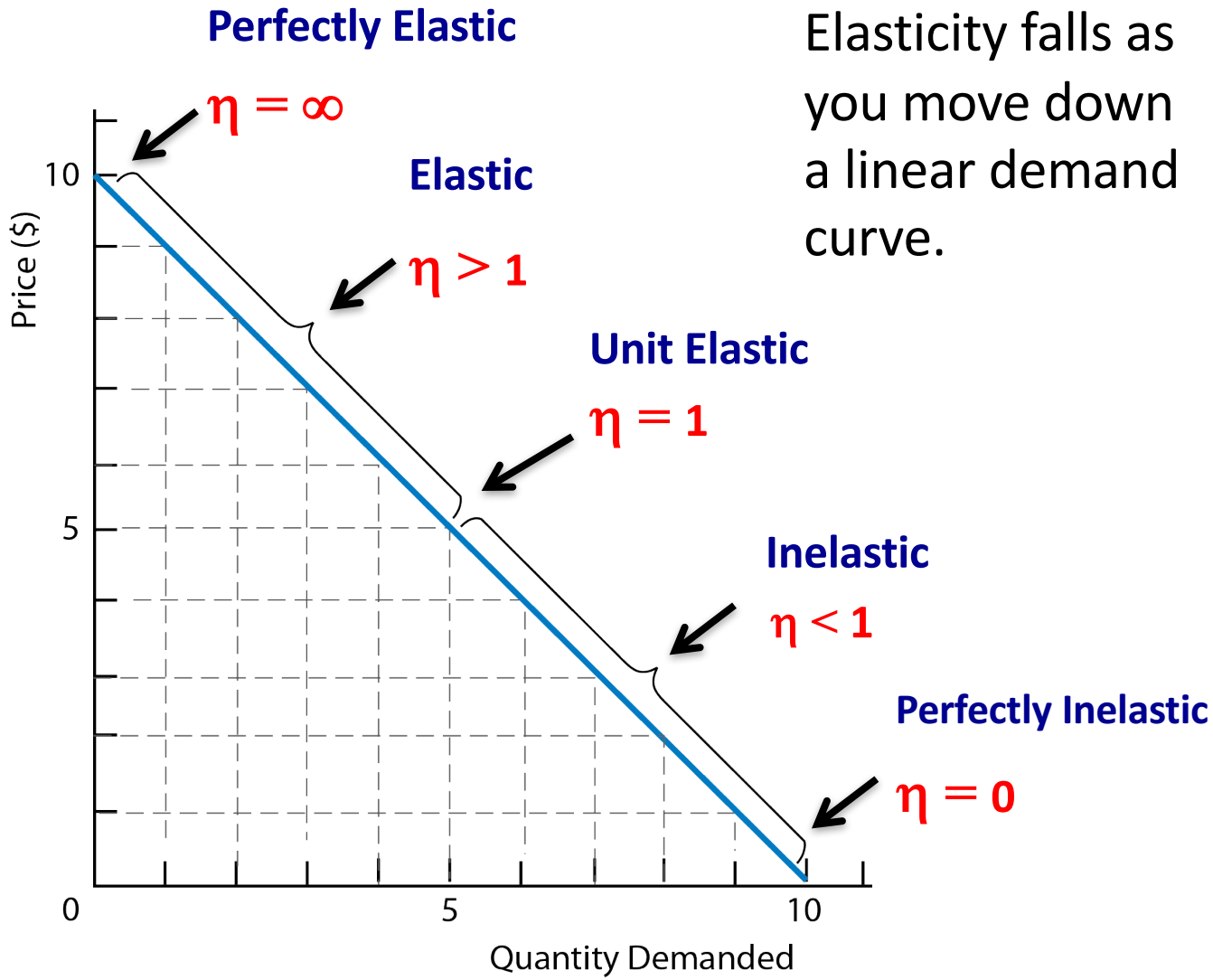
Why to use average price and average quantity





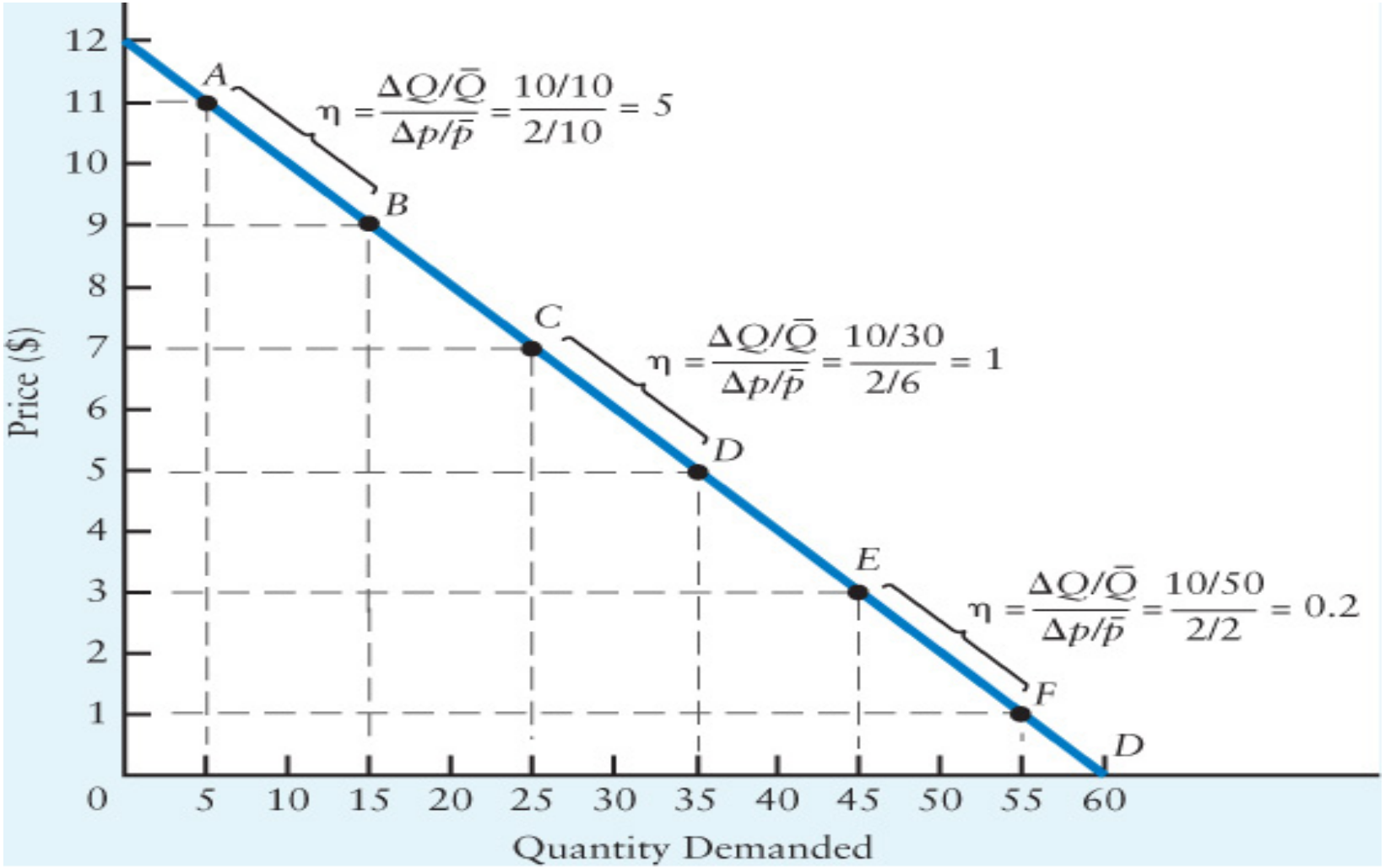
$$\eta = \frac{\Delta Q^D / \overline{Q^D}}{\Delta p / \overline{p}} = \frac{\Delta Q^D}{\Delta p} \times \frac{\overline{p}}{\overline{Q^D}}$$

Fig. 4-2 **Elasticity Along a Linear Demand Curve**



Elasticity falls as you move down a linear demand curve.

Fig. 4-2 **Elasticity Along a Linear Demand Curve**

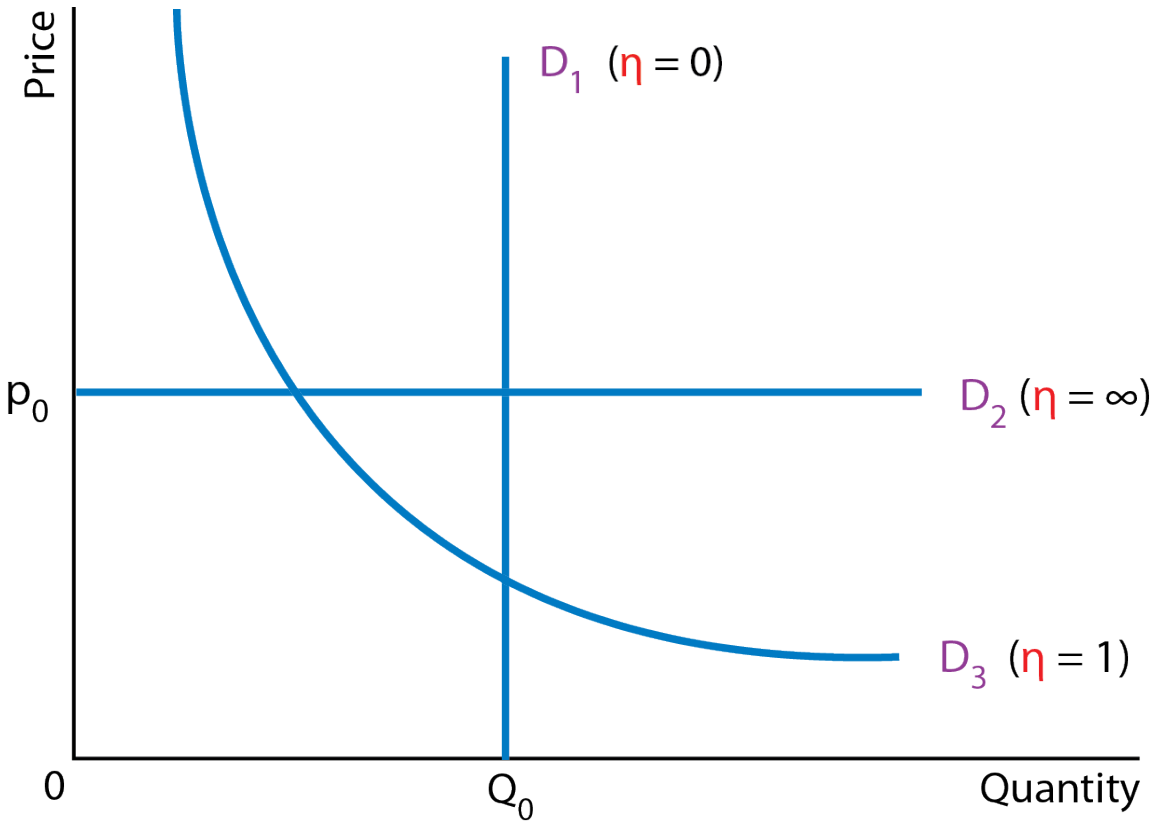


MyEconLab

www.myeconlab.com

For more details about demand elasticity, including the use of calculus to measure elasticity along a non-linear demand curve, look for **Some Further Details About Demand Elasticity** in the *Additional Topics* section of this book's MyEconLab.

Fig. 4-3 Three Demand Curves with Constant Elasticity

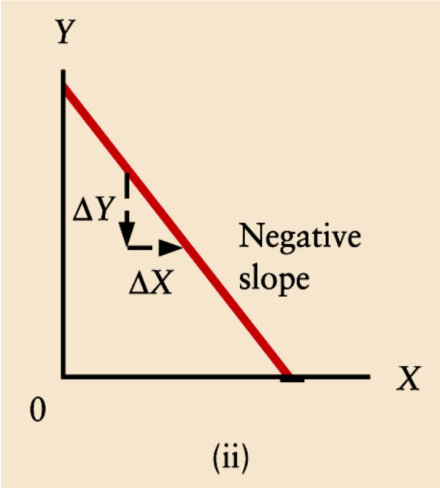


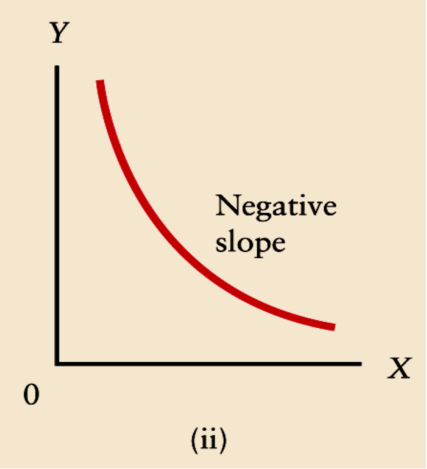
D_1 is perfectly inelastic

D_2 is perfectly elastic at p_0

D_3 is unit elastic: a given % increase in p induces an equal % decrease in q at all points on the curve

Remember





Slopes in absolute changes

Slope is constant: constant relation of changes in Q and P along the curve

Slope is not constant: relation of changes in Q and P changes

Elasticities in % changes

Different elasticities along the curve

May have different elasticities along the curve

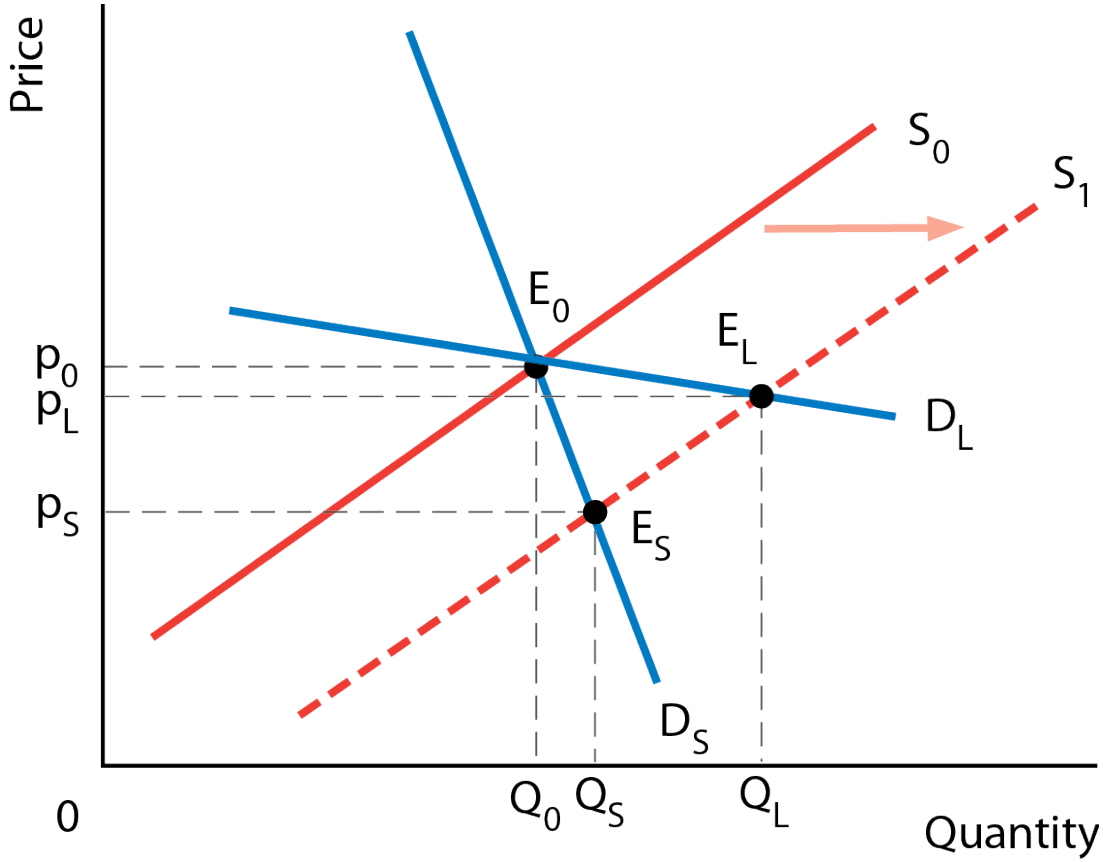
What Determines Elasticity of Demand?

Demand elasticity tends to be high when there are many **close substitutes**.

The availability of substitutes is determined by:

- the length of the time interval considered
- whether the good is a necessity or a luxury
- how specifically the product is defined

Fig. 4-4 **Short-Run and Long-Run Equilibrium Following an Increase in Supply**



The changes depend on the time that consumers have to respond.

In the long run, demand is more elastic.

Predict the relative price elasticity of demand for:

- Food
- Vegetables
- Leafy vegetables
- Leafy vegetables sold at your local supermarket
- Leafy vegetables sold at your local supermarket on Wednesdays

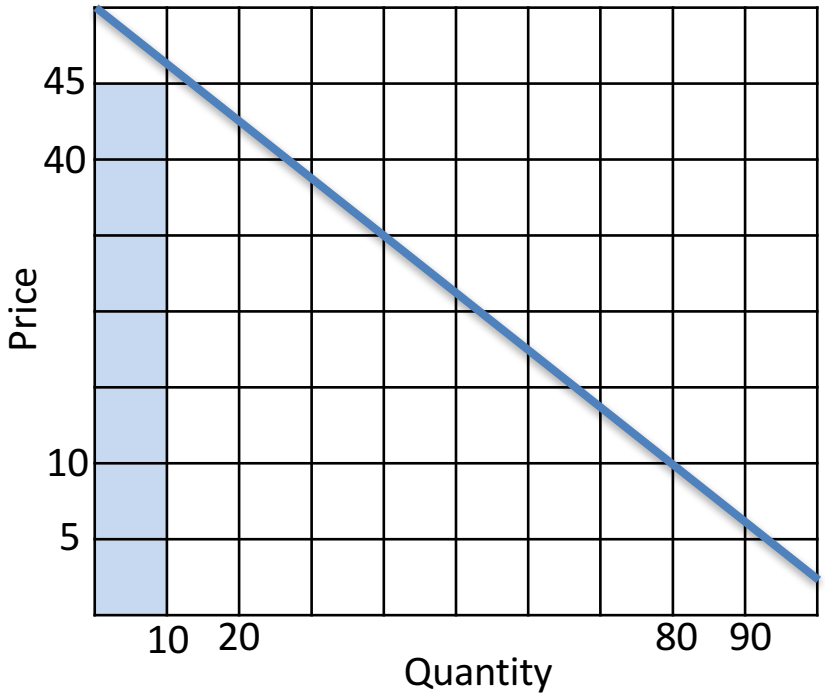
Narrowly defined products have more elastic demands

Total Expenditure

The change in total expenditure depends on the *relative* changes in price and quantity.

Total Expenditure = Price x Quantity

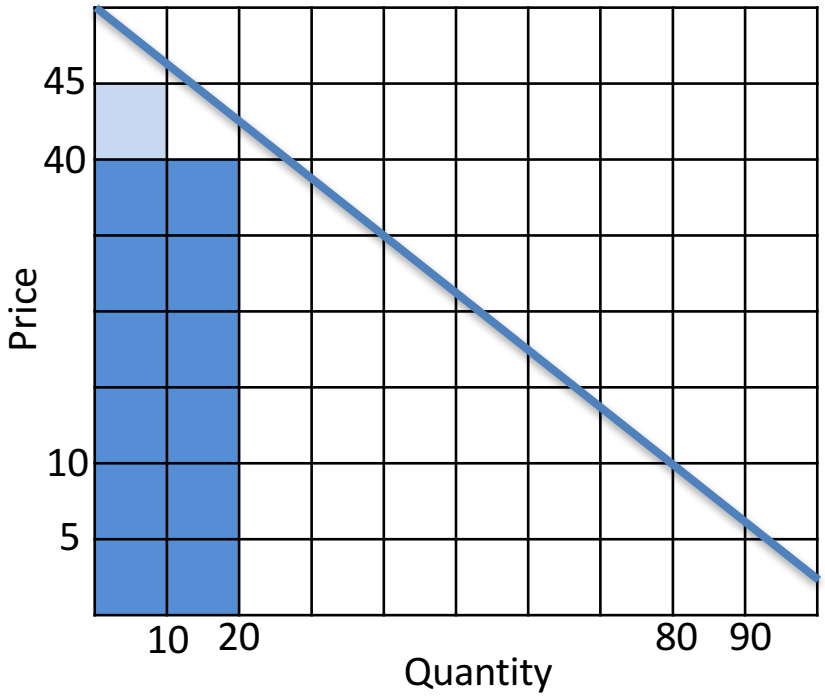
Total Expenditure



When the elasticity is greater than 1, TE increases when price falls

TE = 45 x 10 = 450

Total Expenditure

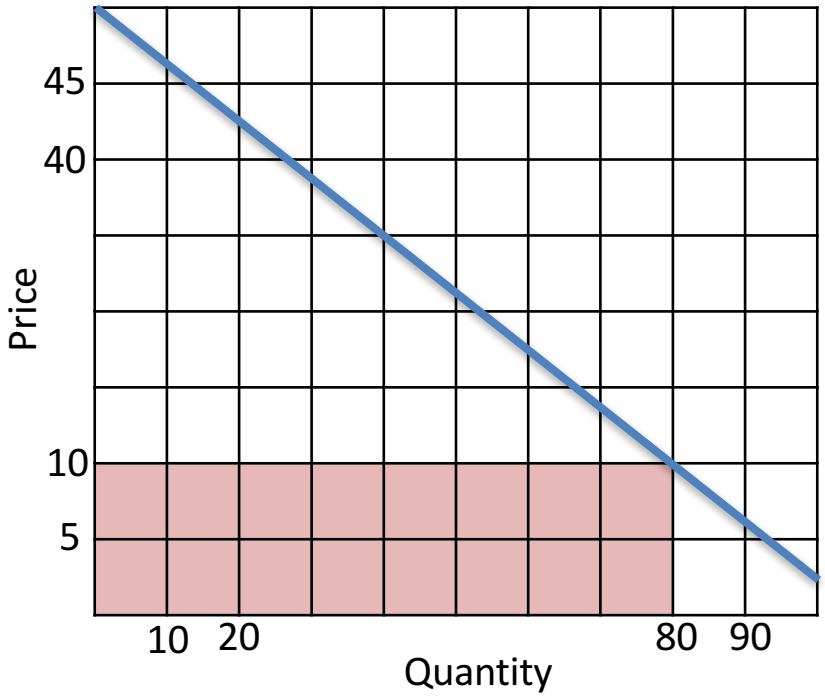


When the elasticity is greater than 1, TE increases when price falls

TE = 45 x 10 = 450

TE = 40 x 20 = 800

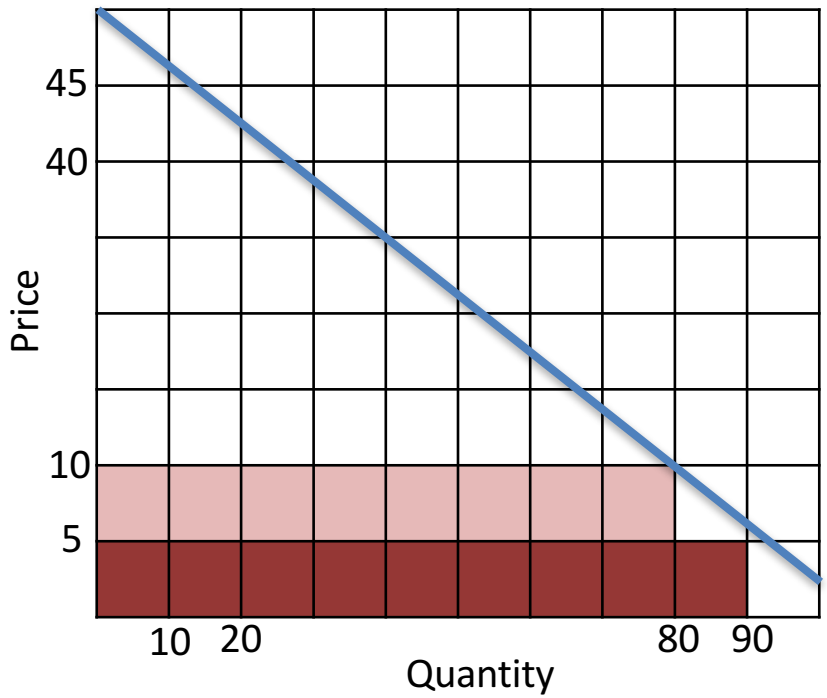
Total Expenditure



When the elasticity is smaller than 1, TE decreases when price falls

TE = 10 x 80 = 800

Total Expenditure

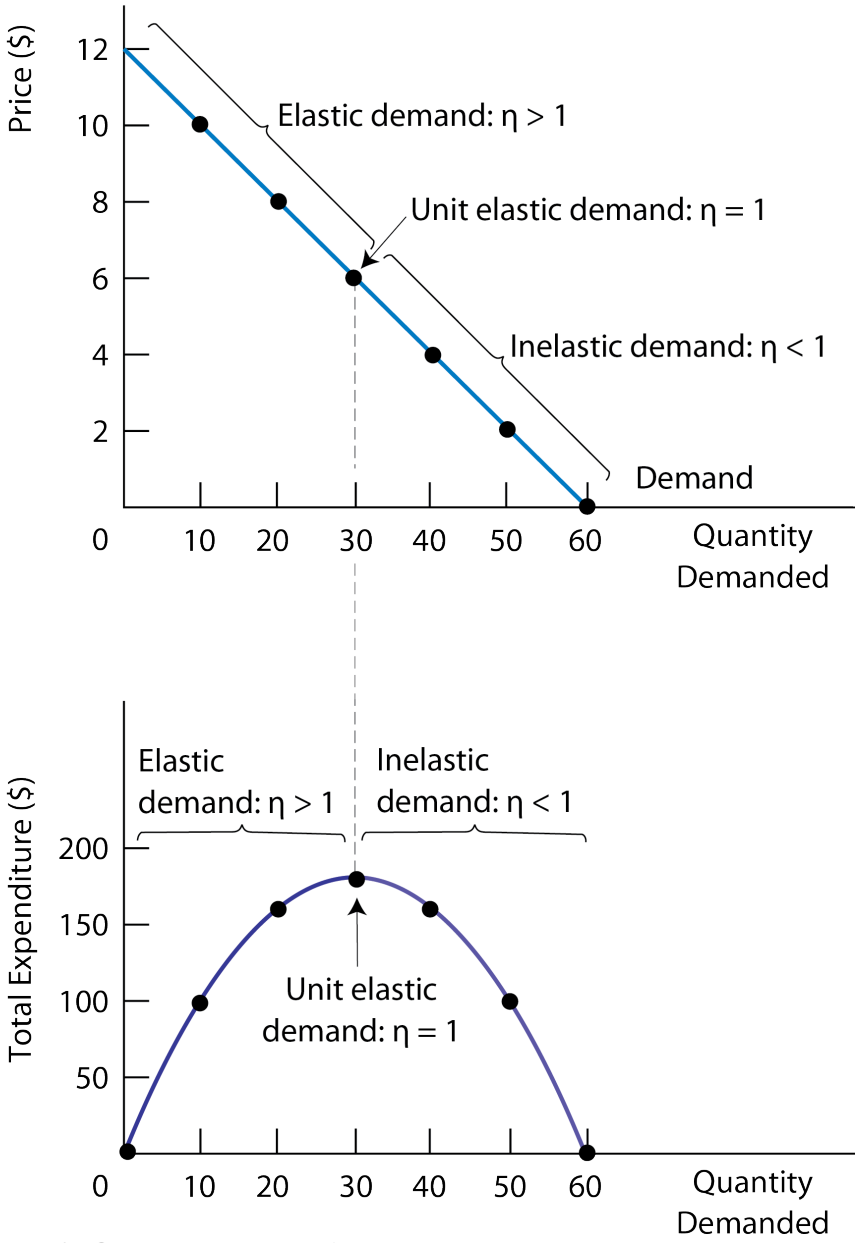


When the elasticity is smaller than 1, TE decreases when price falls

TE = 10 x 80 = 800

TE= 5 x 90 = 450

Fig. 4-5 Total Expenditure and Quantity Demanded



When demand is **elastic**,
TE increases when price falls.

When demand is **inelastic**,
TE decreases when price falls.

TE reaches a maximum
when demand is **unit elastic**.

Example: What happens when OPEC's output restrictions raise the world price of oil?

Example

The Economist | World politics | Business & finance | Economics | Science & technology | Culture

Primark

Faster, cheaper fashion

A rapidly rising, super-cheap Irish clothes retailer prepares to conquer America. Rivals should be fearful

Sep 5th 2015 | NEW YORK | From the print edition

John Bason, ABF's finance director, says Primark achieves its low prices thanks to sleek logistics, a meagre marketing budget and its scale, which helps win bargains from suppliers. The company withstands tiny margins, making its money on volume. It has bet successfully that demand for clothes is as elastic as the waistband in a pair of plus-size sweatpants: the cheaper they are, the more shoppers buy of them. It is also benefiting from the "Instagram effect", in which fashion-conscious young consumers post snaps of themselves wearing another new outfit on social media.

Example: low cost airlines

The business school experience

Example

The New York Times

Drug Goes From $13.50 a Tablet to $750, Overnight

By ANDREW POLLACK SEPT. 20, 2015

The drug, called Daraprim, was acquired in August by Turing Pharmaceuticals, a start-up run by a former hedge fund manager. Turing immediately raised the price to $750 a tablet from $13.50, bringing the annual cost of treatment for some patients to hundreds of thousands of dollars.

Although some price increases have been caused by shortages, others have resulted from a business strategy of buying old neglected drugs and turning them into high-priced "specialty drugs."

Exercise

If a 10 percent increase in the price of ski lift tickets causes a 5 percent decrease in total expenditure on lift tickets, then demand is

a) elastic.

b) inelastic.

c) perfectly inelastic.

d) normal.

e) inferior.

Exercise

If the demand for some commodity has an elasticity of unity, a decrease in price

a) causes a 1 percent decrease in quantity demanded.

b) induces no change in quantity demanded.

c) results in no change in total expenditure.

d) is matched by a unit increase in quantity demanded

e) both (a) and (b) are correct.

4.2 Price Elasticity of Supply

Price elasticity of supply measures the responsiveness of the quantity supplied to a change in the product's own price.

It is denoted by η_s and is defined as:

$$\eta_s = \frac{\textit{percentage change in quantity supplied}}{\textit{percentage change in price}}$$

$$\eta_s = \frac{\Delta\ Q^S / \overline{Q}^S}{\Delta\ p / \overline{p}}$$

Determinants of Supply Elasticity

The elasticity of supply depends on how easily firms can increase output in response to an increase in the product's price.

This depends on:

- the technical ease of substitution in production
- the nature of production costs
- the time span under consideration

Determinants of Supply Elasticity

Are resource inputs readily *available*?

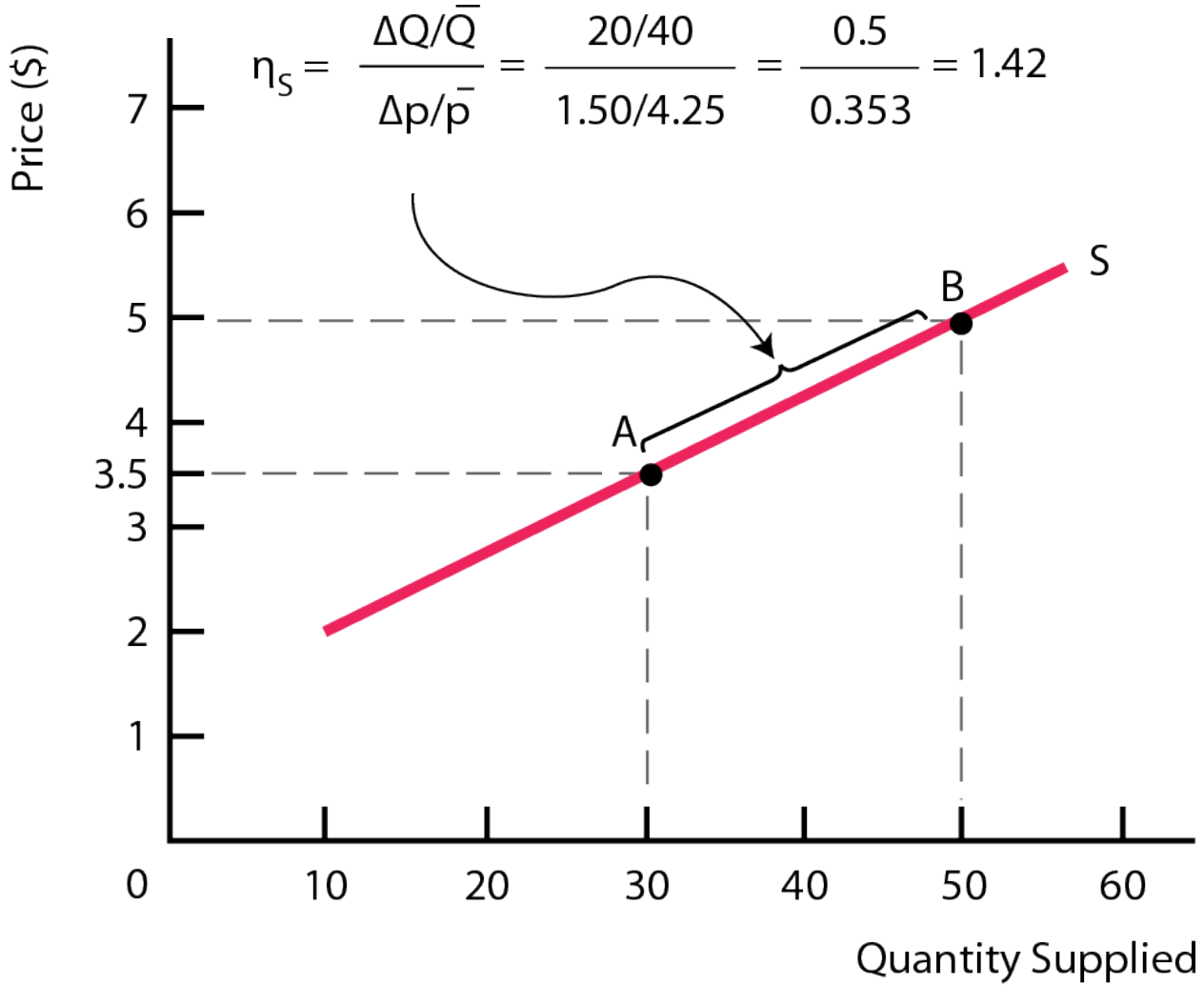
Are factors *mobile* - are workers prepared to move to where they are needed?

Can finished products be easily *stored*, and are there existing stocks?

Is production running at *full capacity*?

How long and complex is the *production cycle* or production process?

Fig. 4-6 Computing Price Elasticity of Supply



4.3 An Important Example Where Elasticity Matters

Why measuring price elasticity? Tax Incidence

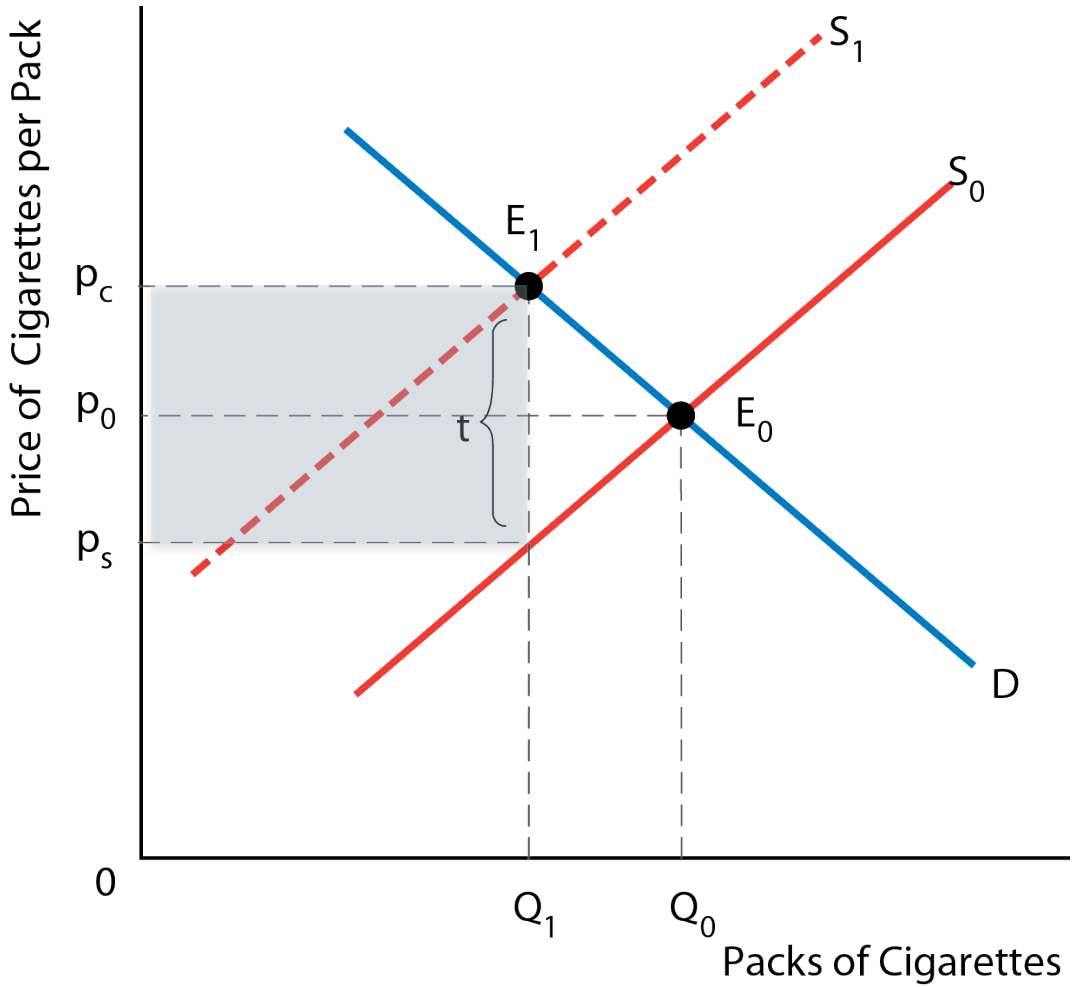
Excise Tax: a tax on the sale of a particular commodity

(e.g. Cigarettes, alcohol or gasoline)

Tax Incidence: who bears the burden of the tax?

To answer this question we need to know the relative elasticities of supply and demand.

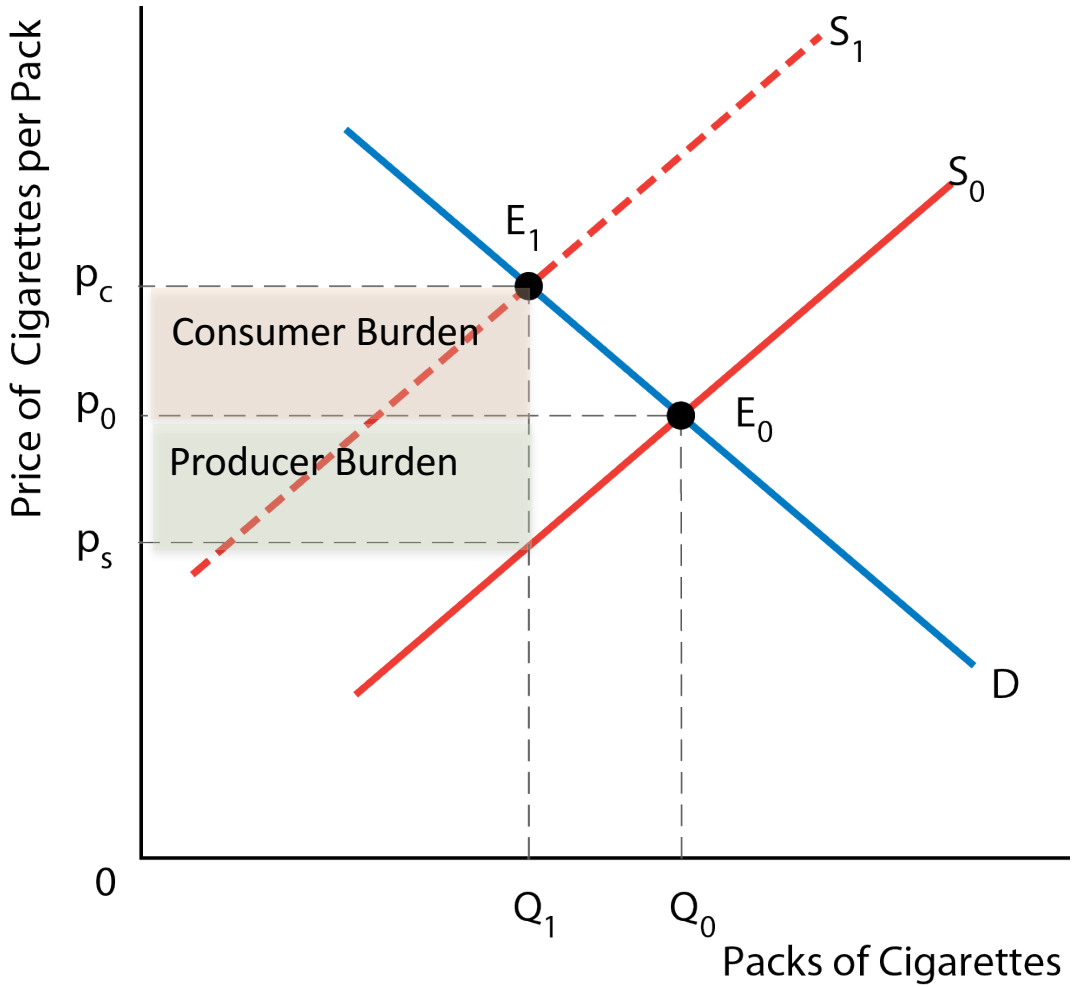
Fig. 4-8 **The Effect of a Cigarette Excise Tax**



Revenue raised by the tax (government):

TR = q x tax

Fig. 4-8 **The Effect of a Cigarette Excise Tax**

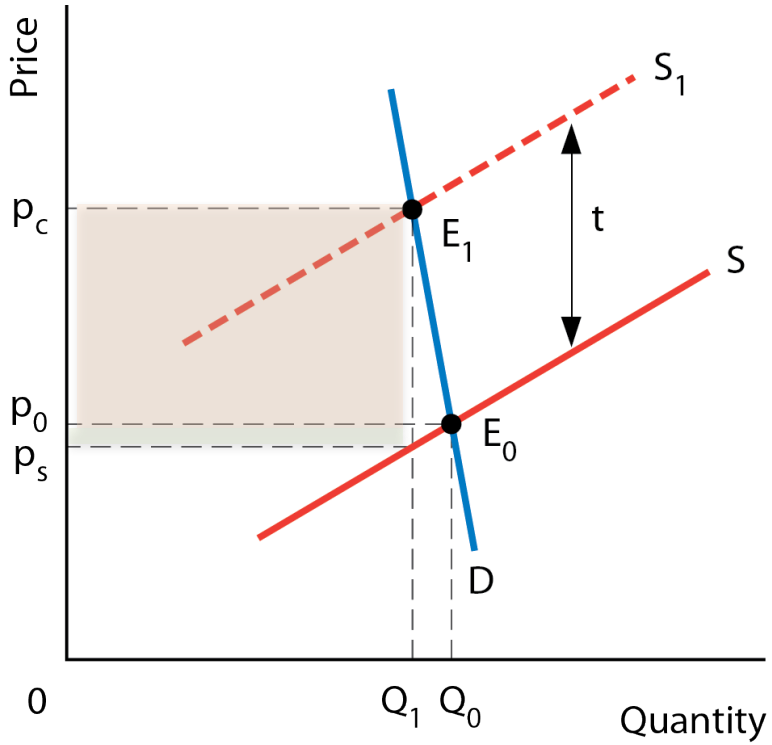


The burden of an excise tax is independent of who actually remits the tax to the government – it depends only on the relative **elasticities** of demand and supply.

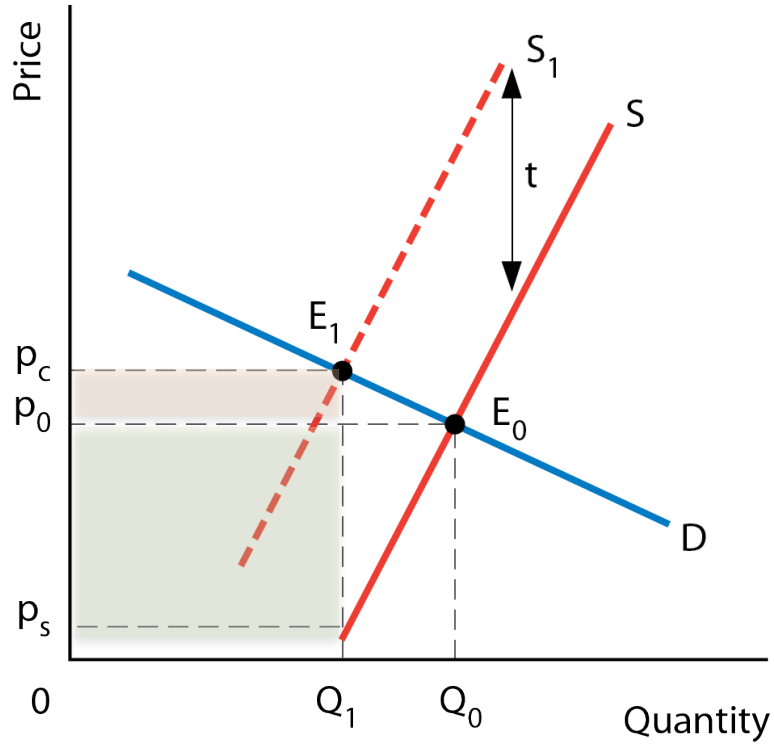
More inelastic is demand more burden for consumers.

The **burden** of an excise tax is independent of who actually remits the tax to the government—it depends only on the relative elasticities of demand and supply.

Fig. 4-9 **Elasticity and the Incidence of an Excise Tax**



(i) Inelastic demand, elastic supply



(ii) Inelastic supply, elastic demand

EXTENSIONS IN THEORY 4-1

The Algebra of Tax Incidence

Demand: $p_c = 80 - 5q_d$

Supply: $p_s = 24 + 2q_s$

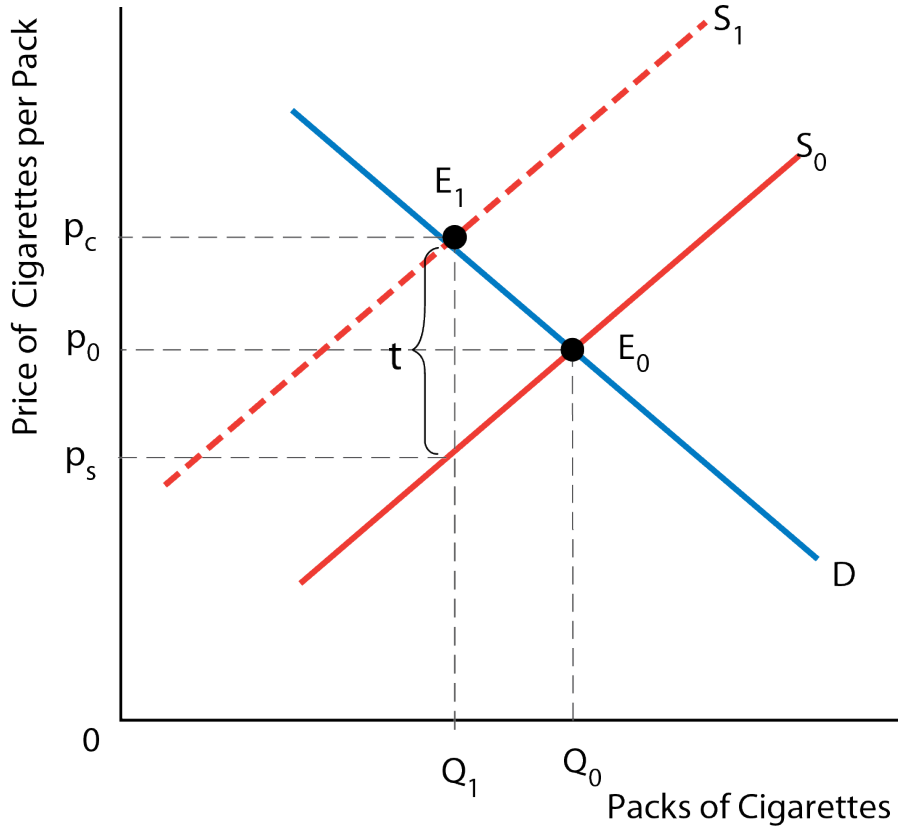
$t = 14$

The price received by the seller p_s must be t less than the price paid by the consumer p_c

$$p_s = p_c - t$$

When the market is in equilibrium

$$q_d = q_s$$



EXTENSIONS IN THEORY 4-1

The Algebra of Tax Incidence

Demand: $p_c = 80 - 5q_d$

Supply: $p_s = 24 + 2q_s$

$$p_s = p_c - 14$$

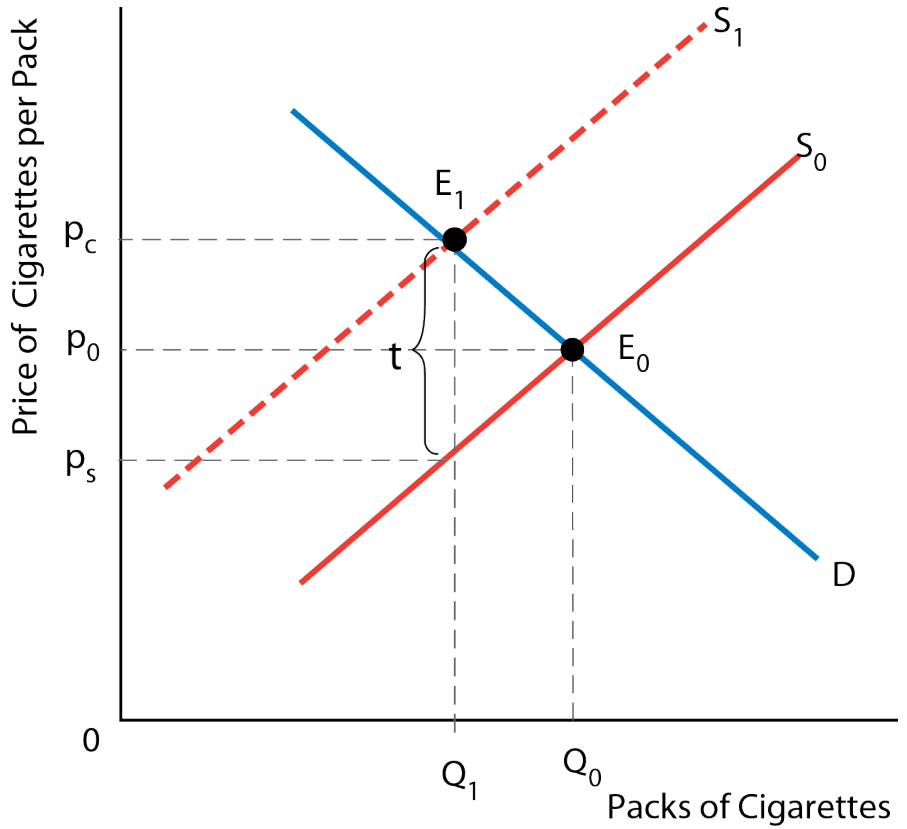
$$24 + 2q = 80 - 5q - 14$$

$$7q = 42$$

$$q_1 = 6$$

$$p_c = 80 - 5(6) = 50$$

$$P_s = 24 + 2(6) = 36$$



EXTENSIONS IN THEORY 4-1

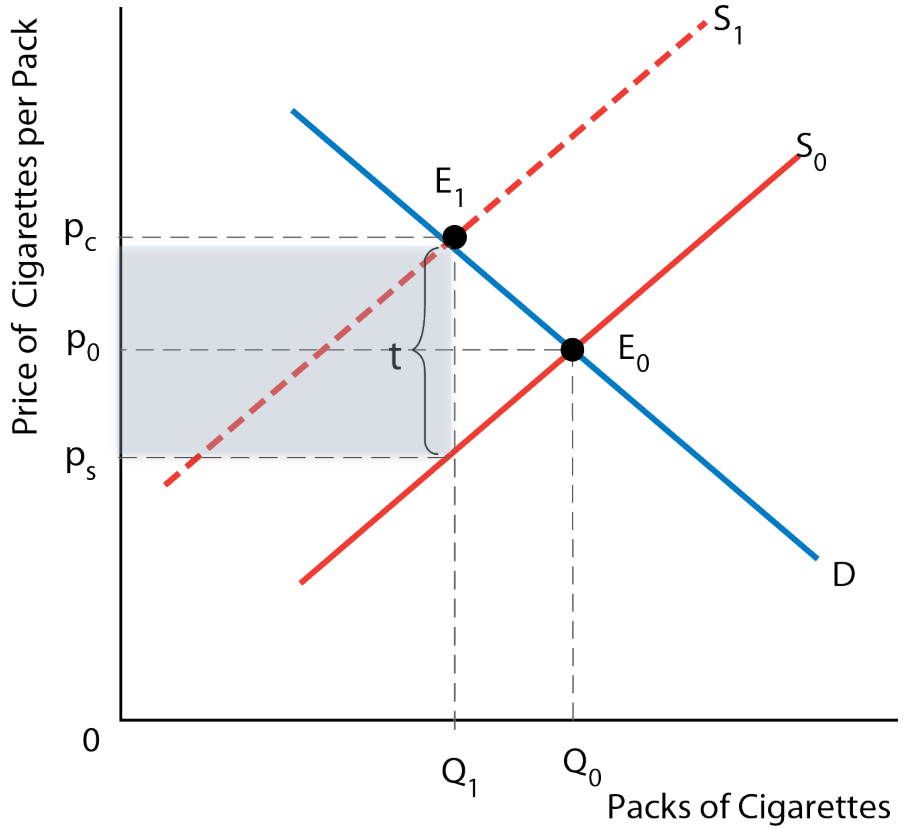
The Algebra of Tax Incidence

$p_0 = 40$ $q_0 = 8$

$p_c = 50$ $p_s = 36$ $q_1 = 6$

Government revenue = Q_1 x *tax*

GR = 6 x 14 = 84



EXTENSIONS IN THEORY 4-1

The Algebra of Tax Incidence

$p_0 = 40$ $q_0 = 8$

$p_c = 50$ $p_s = 36$

Government revenue = $Q \times tax$

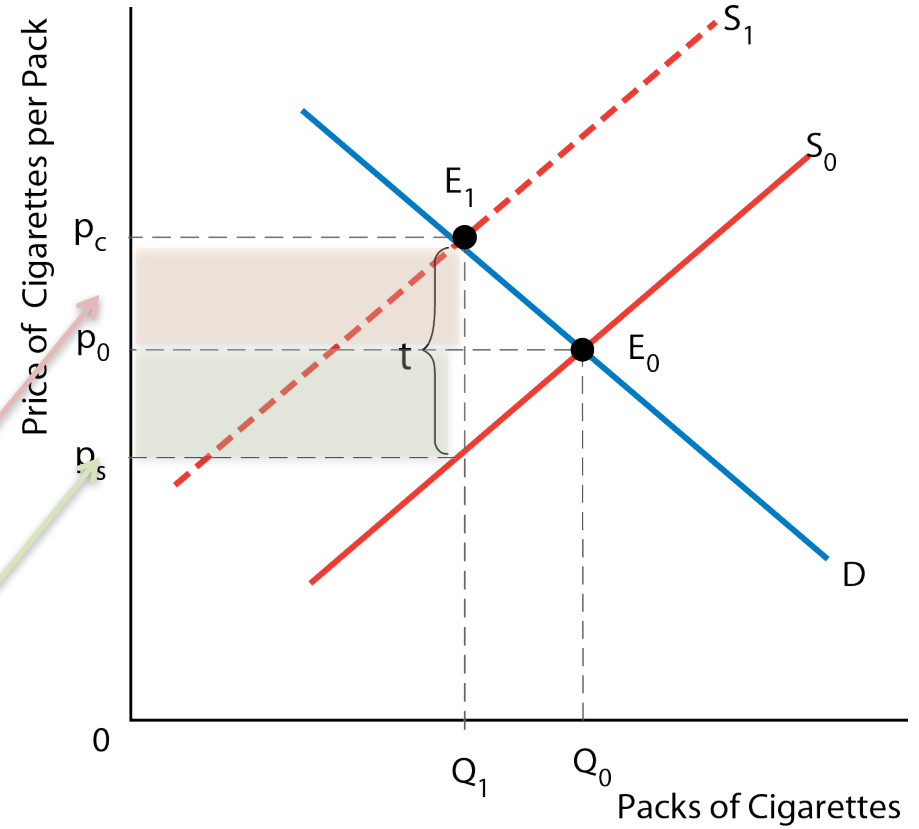
$GR = 6 \times 14 = 84$

Part paid by the consumers:

$(p_c - p_0) \times q_1 = (50 - 40) \times 6 = 60$

Part paid by the producers:

$(p_0 - p_c) \times q_1 = (40 - 36) \times 6 = 24$



MyEconLab
www.myeconlab.com

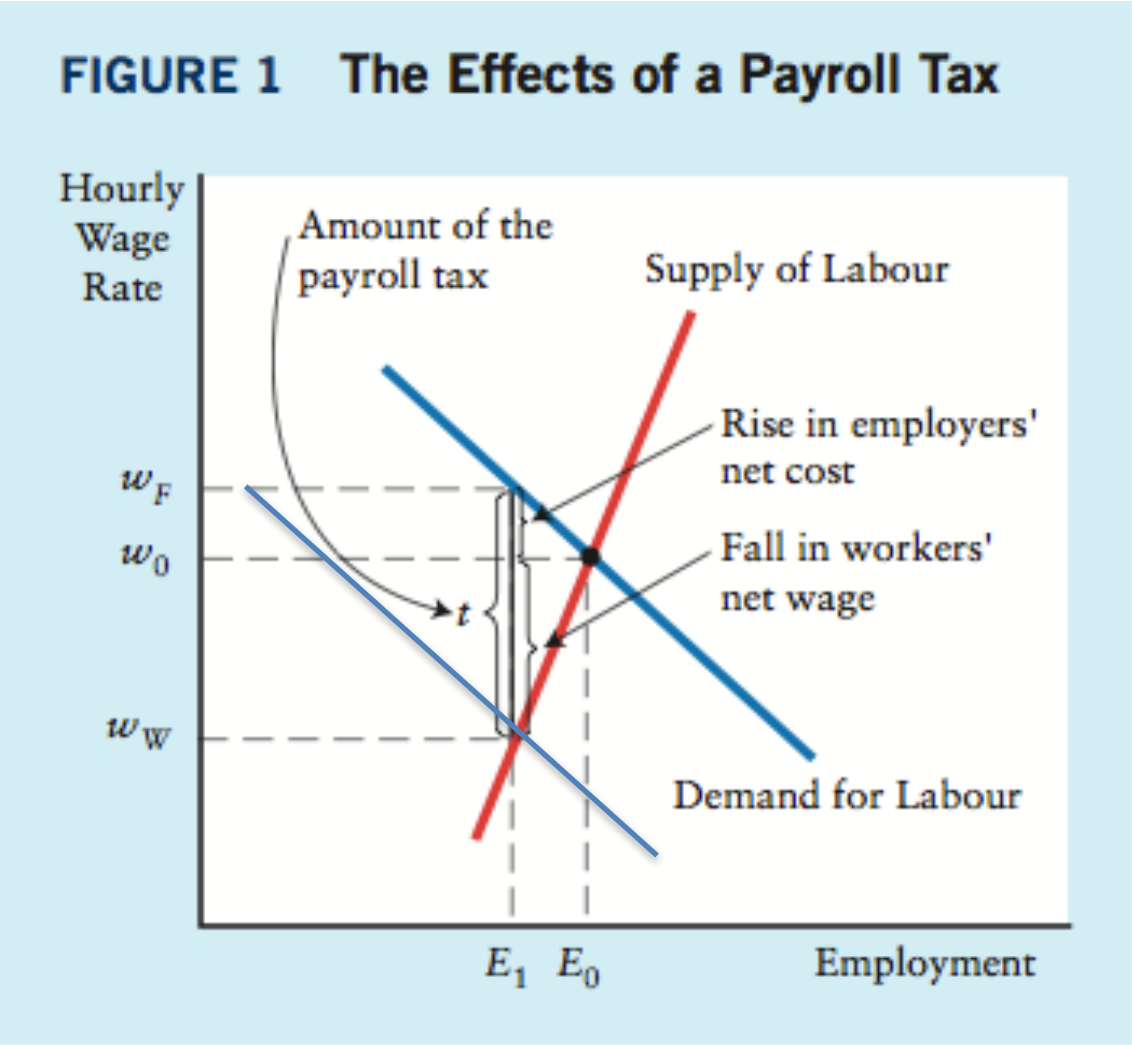
Another application of the concept of tax incidence relates to payroll taxes such as premiums that workers and firms pay for employment insurance and the Canada Pension Plan. For more information on this application of tax incidence, look for **Who Really Pays for Payroll Taxes?** in the *Additional Topics* section of this book's MyEconLab.

Similar to the excise taxes discussed before.

But notice that now:

- Workers supply labor
- Firms demand labor
- Instead of price and quantity we have wages and employment

Fig. 1. Additional Topics: **Who Really Pays for Payroll Taxes?**



- Payroll taxes seen as "job killers"
- Different types of labor can have different curves
- Presence of unions may change the competitive character of the market

4.4 Other Demand Elasticities

Income Elasticity of Demand

$$\eta_Y = \frac{\textit{percentage change in quantity demanded}}{\textit{percentage change in income}}$$

If $\eta_Y > 0$, the good is said to be **normal**

If $\eta_Y < 0$, the good is said to be **inferior**

Luxuries Versus Necessities

The more necessary an item is in the consumption pattern of consumers, the lower its income elasticity.

Income elasticities for any one product also vary with the level of a consumer's income.

The distinction between luxuries and necessities also helps to explain differences in income elasticities between countries.

Important economic effects of an increase in income

1st part XX century: increase demand durable goods.

Increase employment in manufacturing, decrease employment in agriculture.

2nd part XX century: increase demand services.

Increase employment in services, decrease employment in manufacturing and agriculture.

Cross Elasticity of Demand

$$\eta_{XY} = \frac{\textit{percentage change in quantity demanded of good } \boldsymbol{X}}{\textit{percentage change in price of good } \boldsymbol{Y}}$$

If $\eta_{XY} > 0$, then ***X*** and ***Y*** are **substitutes**

If $\eta_{XY} < 0$, then ***X*** and ***Y*** are **complements**

EXTENSIONS IN THEORY 4-2

The Terminology of Elasticity

Price elasticity of demand (supply)		Income elasticity of demand		Cross elasticity of demand	
perfectly inelastic	0	inferior good	(-)	substitute	(+)
inelastic	0-1	normal good	(+)	complement	(-)
unit elastic	1	income - inelastic	<1		
elastic	>1 & < infinite	income-elastic	>1		
perfectly elastic	infinite				