LECTURE 4: ELASTICITY

Today's Topics

1. The Price Elasticity of Demand: total revenue, determinants, formulæ, a bestiary, total revenue, estimation of price elasticity of demand.
2. The Income Elasticity of Demand, and the Cross-Price Elasticity of Demand.
3. The Elasticity of Supply: determinants, formula.
4. Two Applications: the OPEC cartel tries to keep the price of oil up, farmers' adoptions lower their profits.

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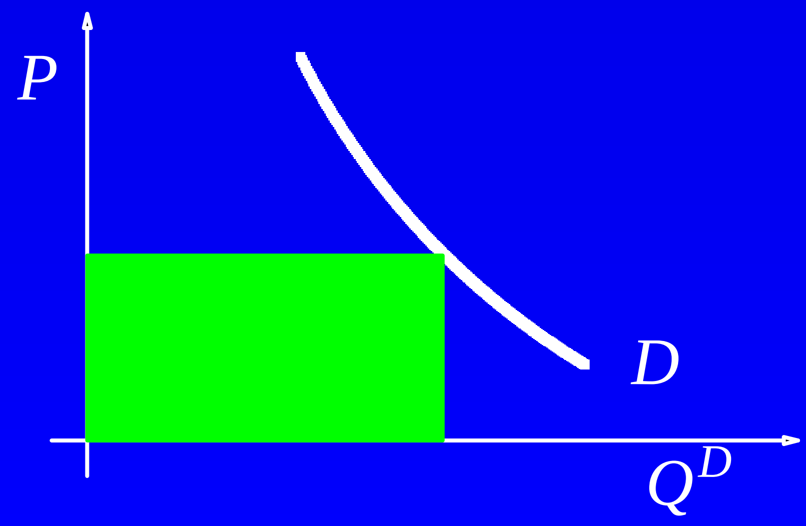

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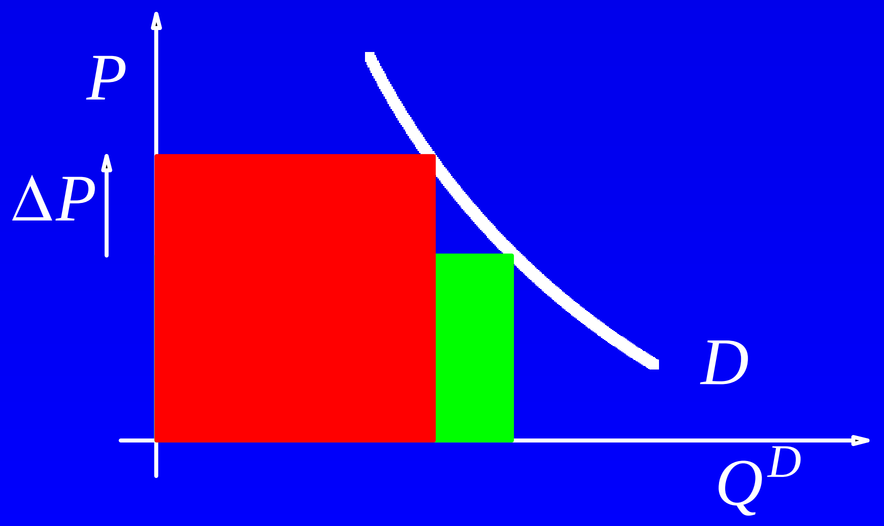

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Is $\eta = \frac{P}{Q} \frac{\Delta Q}{\Delta P}$ **greater than, equal to, or less than −1?**

INTUITION OF THE REVENUE CHANGE

$\eta \equiv \dfrac{\Delta Q / Q}{\Delta P / P}$ **is the *price elasticity of demand.***

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$\therefore$ **Taxes on what?**

To summarize:

	$\lvert\eta\rvert$	Price	Total Expenditure (Revenue)
Elastic demand	> 1	Up	Down
		Down	Up
Unitary elasticity	= 1	Up	Constant
		Down	Constant
Inelastic demand	< 1	Up	Up
		Down	Down

Price Elasticity of Demand and Revenue Changes

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Since the price elasticity of demand is never positive, we usually ignore its sign (or use its absolute value $|\eta|$).

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Four determinants of a good's *own-price elasticity of demand* η:

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(These properties do not follow from the axioms and definitions; they have been observed in the market.)

ARC OR POINT MEASUREMENTS

The arc elasticity: $\eta = \dfrac{\Delta Q / \bar{Q}}{\Delta P / \bar{P}} = \dfrac{\bar{P}}{\bar{Q}} \dfrac{\Delta Q}{\Delta P} \le \mathbf{0}$

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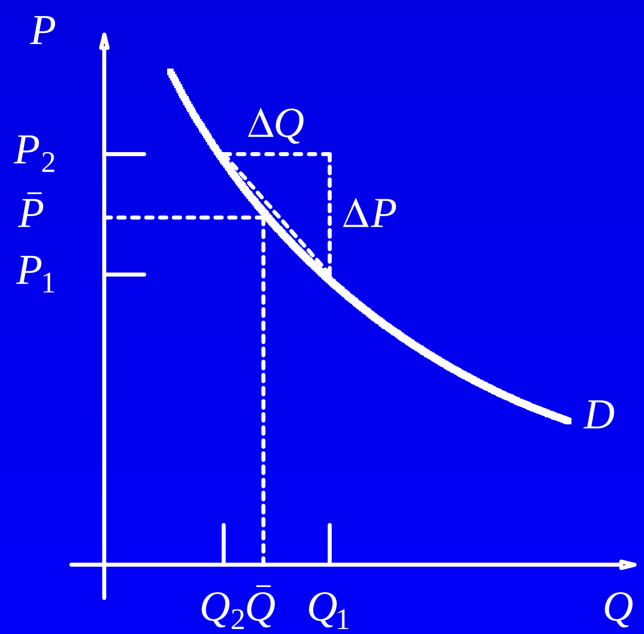

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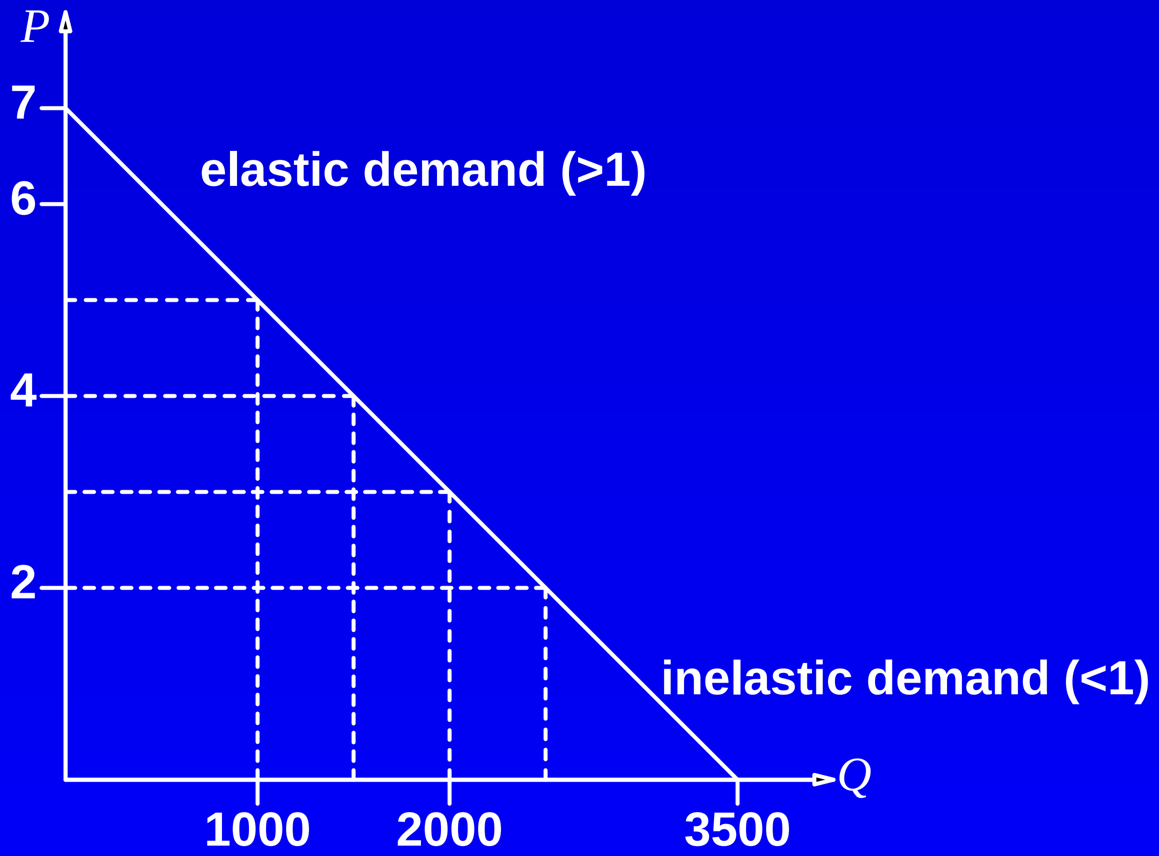
Price ($/t)	Purchase (tonnes)	Value of Sales ($)	$\lvert\eta\rvert$ Elasticity
2 3 4 5	2500 2000 1500 1000	5000 6000 6000 5000	5/9 = 0.556 1 9/5 = 1.8

$$\text{eg. } \frac{5}{9} = \frac{(2,500 - 2,000)/2,250}{(3-2)/2.5} = \frac{\Delta Q/\bar{Q}}{\Delta P/\bar{P}}$$

A LINEAR DEMAND CURVE



$$Q^D = 3500 - 500P$$

elasticity ≠ slope

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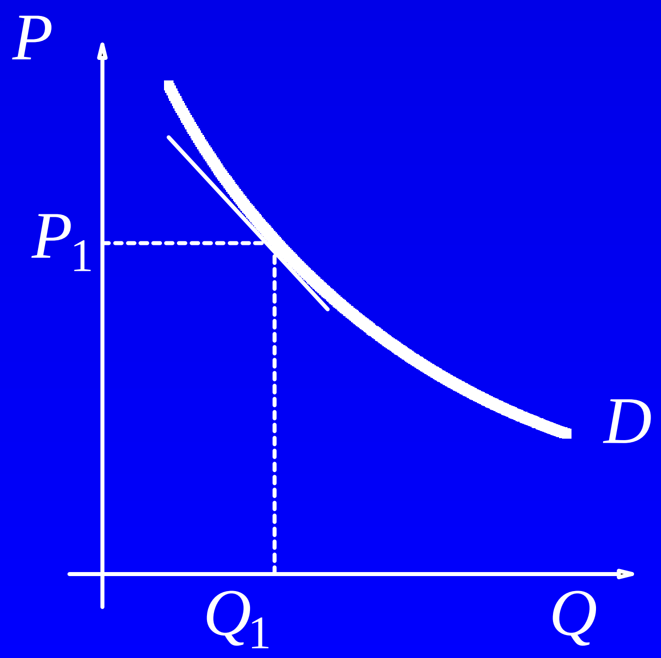

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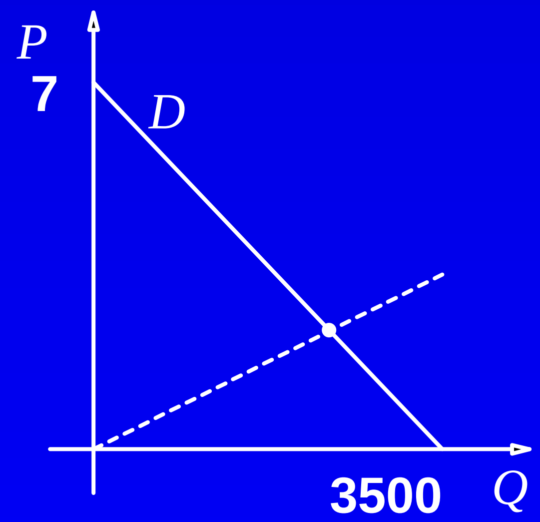

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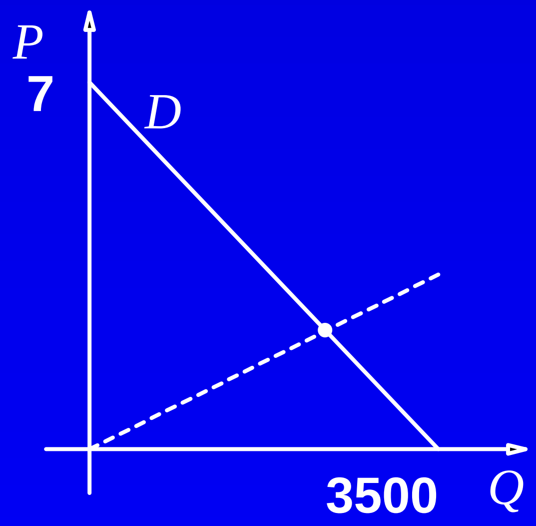

$$\text{Elasticity at point} = \frac{\text{the slope of the ray through the origin}}{\text{the slope of the demand curve}}$$

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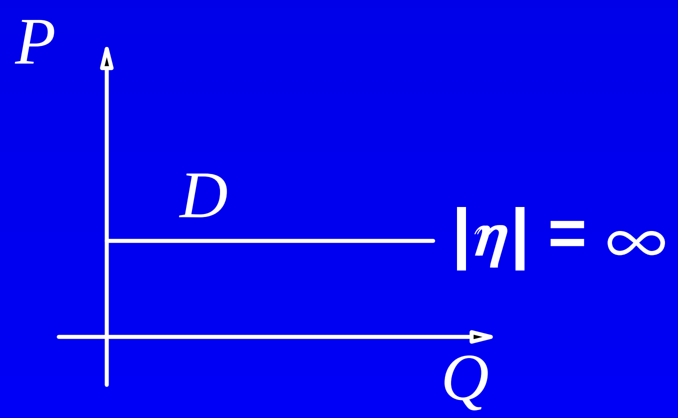

Horizontal demand: perfectly elastic.

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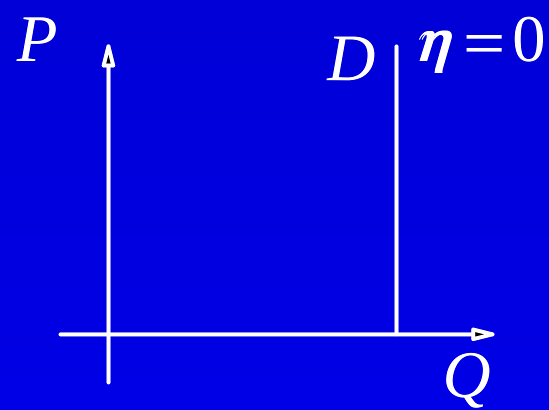

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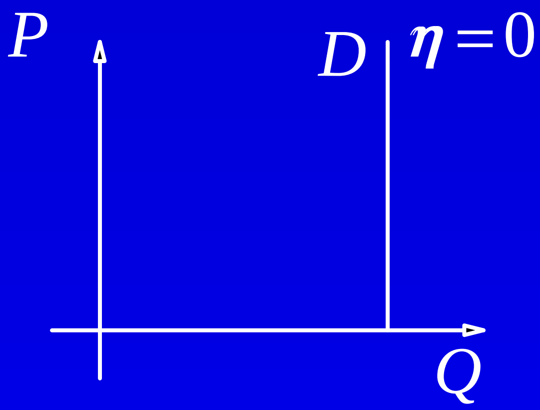

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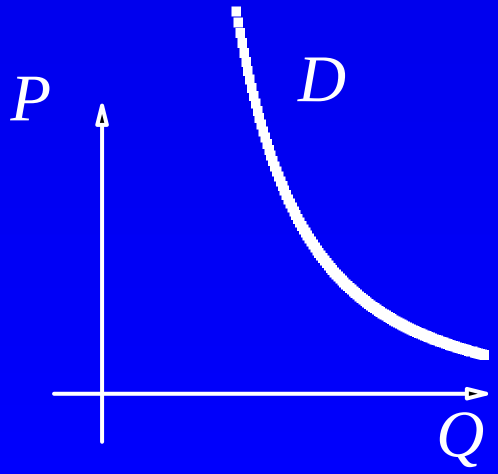
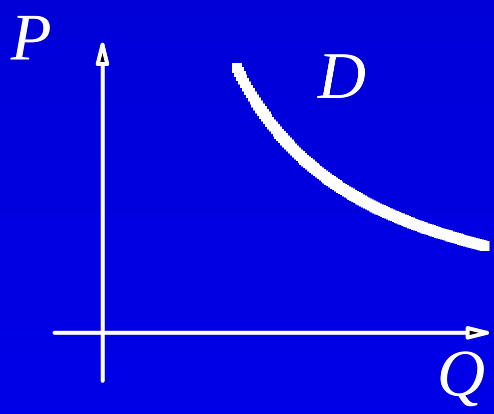


$|\eta|$ = ½: inelastic demand

A BESTIARY 3



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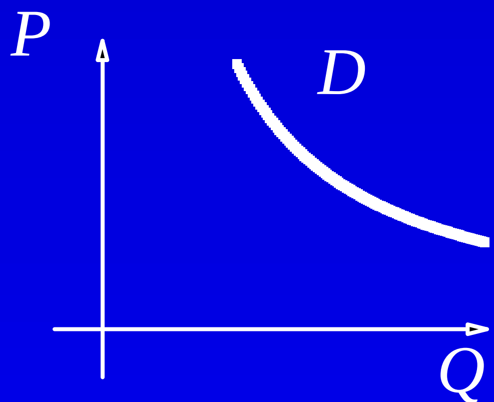

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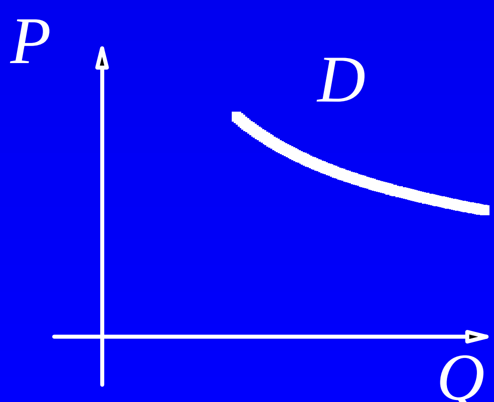

|η| = 2: elastic demand

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Note: in general $\eta_{X,Y} \neq \eta_{Y,X}$ (see Coke and Pepsi below) because of *income effects* (GKSM p.472).

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or

$$y = a + \eta x$$

which means that we can use linear regression to estimate the elasticity η (assuming our data come from an unshifting demand curve).

MARKET DATA

Price, Cross-Price, and Income Elasticities of Demand for Coca-Cola and Pepsi

Elasticity	Coca-Cola	Pepsi
Own Price elasticity η	−1.47	−1.55

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(Perhaps estimated using $X^D = A \bullet P_X^{\eta} \bullet I^{\varepsilon} \bullet P_Y^{\eta_{X,Y}}$).

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Depends mainly on the time horizon: the longer, the more elastic, in general, because firms have more time to adjust their production processes in order to increase their profits.

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In the short run, both supply and demand for oil are relatively inelastic:

- **changing capacity and proving up more reserves is relatively slow;**
- **old guzzlers and old habits of use are slow to change: demand adjusts only slowly.**

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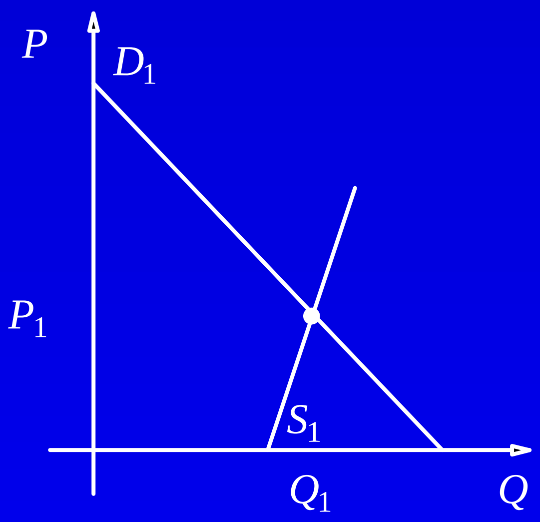
The initial high price fell, although only slowly, and not (at first) back to the pre-squeeze price.

GRAPHICALLY



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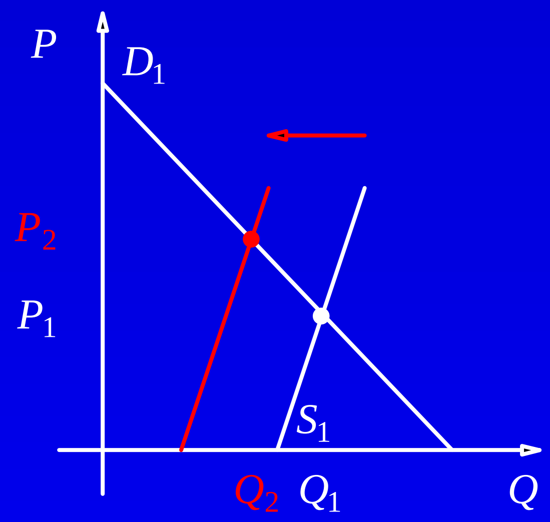

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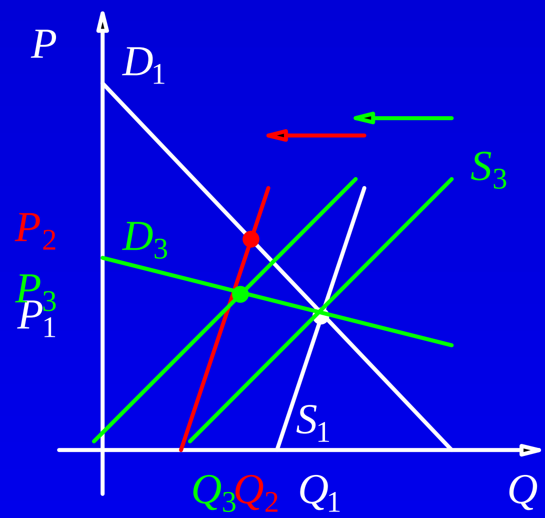

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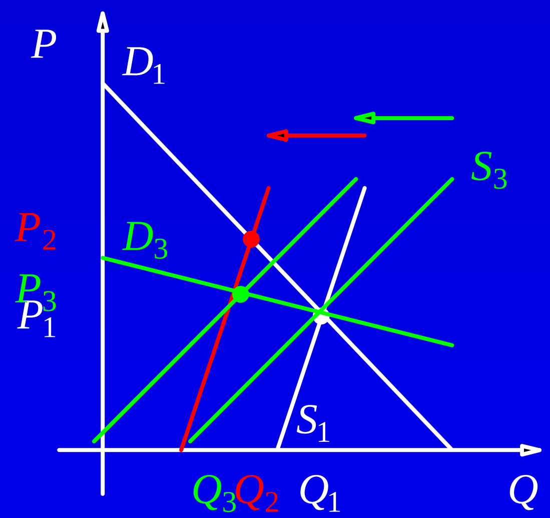

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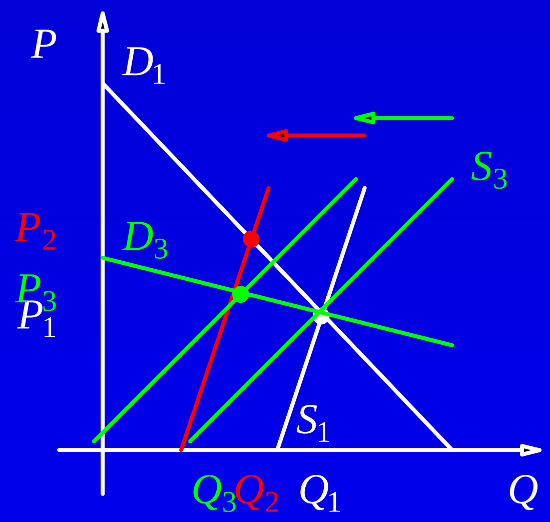

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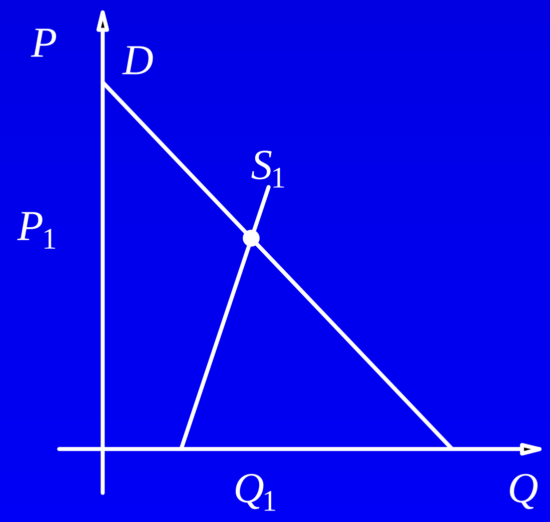

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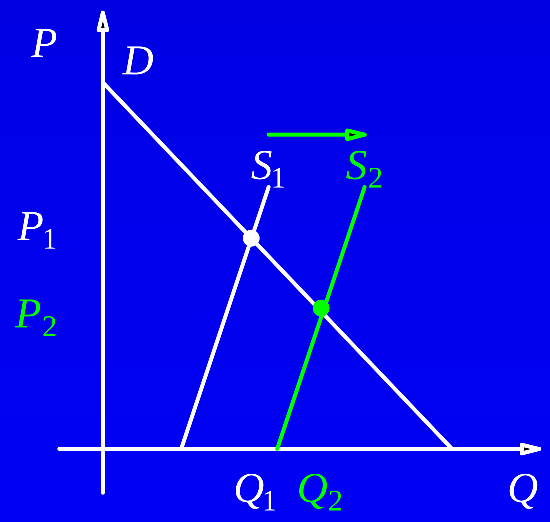
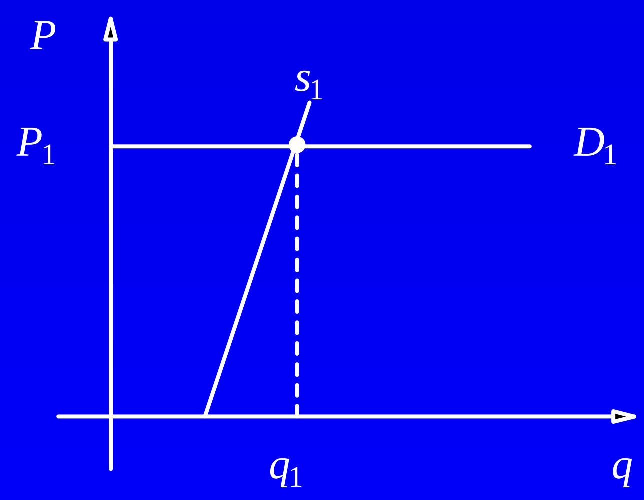


The industry view: downwards-sloping demand. With inelastic demand, revenues fall with price.

THE PRICE-TAKING FARMER

From the small (price-taking) farmer's view, the market price is a given: she faces an infinitely elastic (horizontal) demand curve, the going price. She adopts the new technology to improve her net returns or profits, by reducing her costs. Her supply curve expands.



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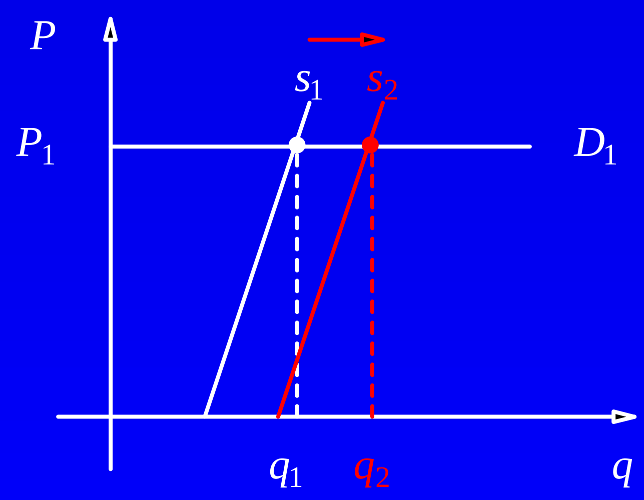

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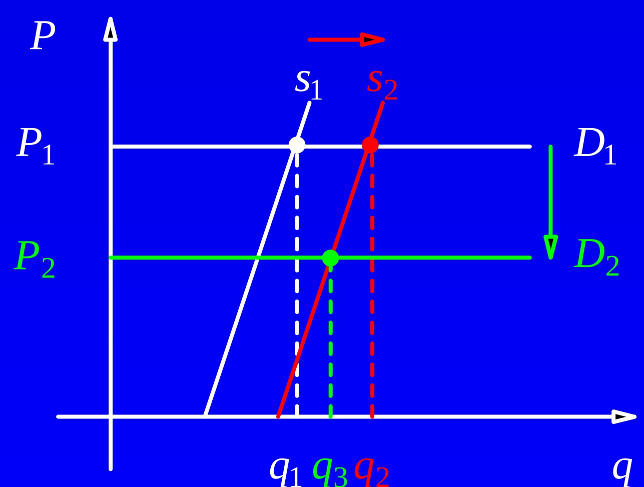

As all farmers adopt the technology, price will fall. No single farmer, however, can prevent this.