# Price Elasticity of Demand

AP Microeconomics | Unit 2 | the coefficient, its determinants, and the total revenue test

*Running example.* Two coffee shops raise the price of a latte from \$4 to \$5. Shop A's sales fall from 100 cups a day to 90, and its revenue *rises* from \$400 to \$450. Shop B's sales fall from 100 to 60, and its revenue *falls* from \$400 to \$300.

## 1. What elasticity measures

**Price elasticity of demand**

$$E_d = \left| \frac{\%\,\Delta Q_d}{\%\,\Delta P} \right|$$

How strongly buyers react to a change in price. Price and quantity demanded move in opposite directions, so the ratio is negative; we report its size.

Both shops: $\%\,\Delta P = \dfrac{5-4}{4} = +25\%$.

| | $\%\,\Delta Q_d$ | $E_d$ | demand is |
|---|---|---|---|
| Shop A | $\dfrac{90-100}{100} = -10\%$ | $\dfrac{10}{25} = 0.4$ | inelastic |
| Shop B | $\dfrac{60-100}{100} = -40\%$ | $\dfrac{40}{25} = 1.6$ | elastic |

## 2. Elastic or inelastic?

| | | |
|---|---|---|
| $E_d < 1$ | **inelastic** | quantity changes by a smaller % than price |
| $E_d = 1$ | **unit elastic** | quantity and price change by the same % |
| $E_d > 1$ | **elastic** | quantity changes by a larger % than price |
| $E_d = 0$ | perfectly inelastic | vertical demand curve |
| $E_d = \infty$ | perfectly elastic | horizontal demand curve |

**Demand is more elastic when** the good has many close substitutes, is a luxury rather than a necessity, takes a large share of the buyer's income, and when buyers have more time to adjust.

*Supply* has an elasticity built the same way: $E_s = \dfrac{\%\,\Delta Q_s}{\%\,\Delta P}$.

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## 3. The total revenue test

**Total revenue** $= P \times Q$

| | |
|---|---|
| **Inelastic** demand: | $P$ and $TR$ move *together* ($P \uparrow \Rightarrow TR \uparrow$). |
| **Elastic** demand: | $P$ and $TR$ move in *opposite* directions ($P \uparrow \Rightarrow TR \downarrow$). |
| **Unit elastic**: | $TR$ does not change. |

Shop A (0.4): price +25%, quantity only −10%, so revenue rises. Shop B (1.6): price +25%, quantity −40%, so revenue falls. The test runs both ways: told what happened to revenue, you can name the elasticity.

## 4. One demand curve, three elasticities

Take the straight demand curve $P = 10 - Q$. Its slope is the same everywhere; its elasticity is not.

| $P$ | $Q$ | $TR = P \times Q$ | |
|---|---|---|---|
| \$8 | 2 | \$16 | top half: **elastic** (lower the price, revenue rises) |
| \$5 | 5 | \$25 | midpoint: **unit elastic**, total revenue is at its maximum |
| \$2 | 8 | \$16 | bottom half: **inelastic** (lower the price, revenue falls) |

So a demand curve is not "elastic" or "inelastic" as a whole: it is elastic or inelastic *over a range of prices*. Slope is not elasticity.

## 5. Midpoint method, supply, and the extremes

**Midpoint method**: divide each change by the *average* of the two values. Price \$10 → \$14, quantity 50 → 30: $\%\Delta Q = \frac{-20}{40} = -50\%$, $\%\Delta P = \frac{4}{12} \approx 33\%$, $E_d = 1.5$ (elastic). From the starting values instead: $-40\% \div 40\% = 1.0$. The midpoint method gives the same answer whether the price rises or falls; use the method the question names.

- **Elasticity of supply** $E_s = \%\Delta Q_s \div \%\Delta P$. With more **time** to adjust, supply (and demand) become more elastic.
- **Perfectly elastic demand** (horizontal): a supply shift changes only the quantity; the price stays the same.
- **Perfectly inelastic supply** (vertical): a demand shift changes only the price.
- Under a binding **price floor**, sellers sell only what buyers demand at the floor: revenue = floor × $Q_d$, which rises only if demand is inelastic.

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**Where students lose points**

1. Putting price on top: it is % change in quantity over % change in price.
2. Using the changes in dollars and units instead of the percent changes.
3. Saying a steep curve is inelastic: slope is not elasticity.
4. Getting the revenue test backwards: inelastic means $P$ and $TR$ move together.
5. Answering "elastic" with no reason: give the coefficient compared with 1, or the change in total revenue.

**Now practise it**

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