

Principles of Economics

Discussion Session 2: Elasticity

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Slope vs Elasticity

We want to describe the effect of a change in price on quantity.

Two options:

① Slope:

- Ratio of the *absolute* change in $f(x)$ to the *absolute* change in x .
- Interpretation: "If x increases by 1, then $f(x)$ increases by m ."
"If x increases by 2, then $f(x)$ increases by $2m$."
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$$m = \frac{f(x_2) - f(x_1)}{x_2 - x_1}$$

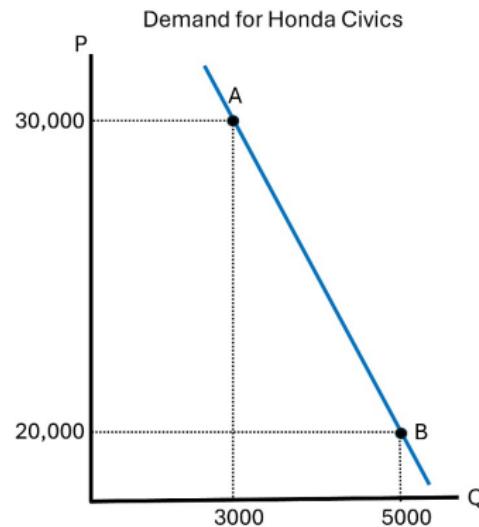
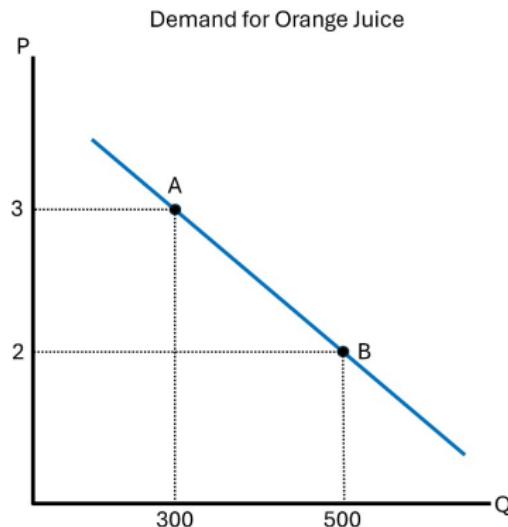
② Elasticity:

- Ratio of the *proportional* change in $f(x)$ to the *proportional* change in x .
- Interpretation: "If x increases by 1%, then $f(x)$ increases by $\varepsilon\%$."
"If x is multiplied by 2, then $f(x)$ is multiplied by 2ε ."
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$$\varepsilon = \frac{\left(\frac{f(x_2) - f(x_1)}{\text{midpoint}(f(x_1), f(x_2))} \right)}{\left(\frac{x_2 - x_1}{\text{midpoint}(x_1, x_2)} \right)}$$

So why use elasticity?

Elasticity allows us to compare markets where prices/quantities are quite different:



- Slopes: $m_{OJ} = -200$, $m_{HC} = -0.2$
- Elasticities: $\epsilon_{OJ} = 1.25$, $\epsilon_{HC} = 1.25$
- How do we interpret these numbers? ("If P increases by 1, then...")

More interpretation

- If demand is elastic ($\varepsilon > 1$), then a change in P causes a proportionately **large** change in Q .
- If demand is inelastic ($\varepsilon < 1$), then a change in P causes a proportionately **small** change in Q .
- If demand is unit-elastic ($\varepsilon = 1$), then a change in P causes a proportionately **equal** change in Q .

Exercise 1: Price Elasticity of Demand

Suppose the current price of coffee sold at Hillside Cafe is \$5 per cup. However, the cafe announced this Friday that the price of coffee per cup will be \$3. The cafe expects that after reducing the price, the number of cups sold will increase from 200 to 400.

- ① Using the midpoint formula, calculate the price elasticity of demand for coffee between \$5 and \$3. Is the demand elastic, inelastic, or unit elastic?
- ② What will happen to the total revenue of Hillside Cafe? Please answer by calculating the change in total revenue and explain why.
- ③ In which direction do you expect the total revenue will change if Hillside Cafe cuts the price during the final week? Why?
- ④ *Bonus:* What is the elasticity of demand at the revenue-maximizing price?

Exercise 1: Price Elasticity of Demand

Solution:

- ① $\frac{4}{3}$. Elastic.
- ② Total revenue changes from \$1000 to \$1200. Lowering the price will increase revenue if demand is relatively elastic.
- ③ Total revenue will decrease as the seller lowers the price when the demand is inelastic.
- ④ *Bonus:* Revenue is maximized when $\varepsilon = 1$!
If $\varepsilon < 1$, the seller can increase revenue by increasing the price, which increases ε .
If $\varepsilon > 1$, the seller can increase revenue by decreasing the price, which decreases ε .
Thus, revenue is maximized when $\varepsilon = 1$.

Exercise 2: Price Elasticity of Supply

Suppose Catherine and Jae work at Hillside Cafe with an hourly wage of \$15. Both of them work 4 hours per day. Now the manager wants to extend the operating hours and announces to increase the wage to \$20. Catherine is willing to work 6 hours with the new wage offered, but Jae only wants to work 5 hours.

- ① Using the midpoint formula, calculate the price elasticity of supply for Catherine and Jae between \$15 and \$20.
- ② What should Catherine's supply curve look like? What about Jae's?

Exercise 2: Price Elasticity of Supply

Solution:

- ① Catherine: $\frac{7}{5}$; Jae: $\frac{7}{9}$
- ② Since Catherine's supply is elastic while Jae's supply is inelastic, Catherine's supply curve should be flatter than Jae's.