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."
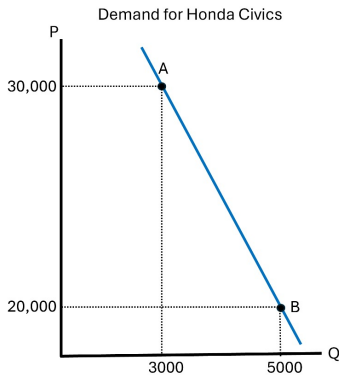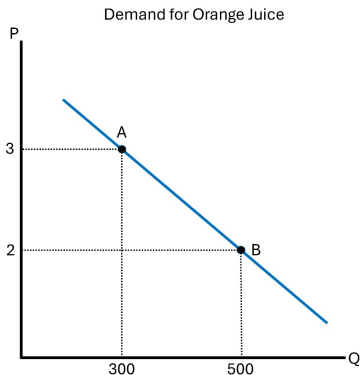   -
   $$m = \frac{f(x_2) - f(x_1)}{x_2 - x_1}$$

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 $\varepsilon\%$."
   -
   $$\varepsilon = \frac{\left(\frac{f(x_2) - f(x_1)}{midpoint(f(x_1), f(x_2))} \right)}{\left(\frac{x_2 - x_1}{midpoint(x_1, x_2)} \right)}$$

So why use elasticity?

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

Demand for Orange Juice

Demand for Honda Civics

- Slopes: $m_{OJ} = -200$, $m_{HC} = -0.2$
- Elasticities: $\varepsilon_{OJ} = 1.25$, $\varepsilon_{HC} = 1.25$
- 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 Anirudh 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. Anirudh 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 Anirudh and Jae between $15 and $20.

2. What should Anirudh's supply curve look like? What about Jae's?

Exercise 2: Price Elasticity of Supply

Solution:

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