

Lecture 2: Demand

FOR 4684

Natural Resource Economics and
Management



School of Forest Resources



Demand

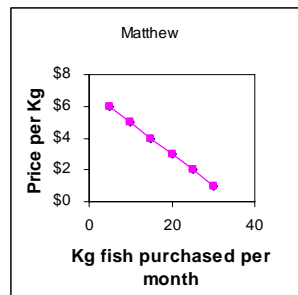
- A functional relationship between quantities of a good or service that buyers are willing and able to buy at DIFFERENT prices in a given time period
- Different from *consumption* – the quantity of a good or service consumed at a given price

Expressing demand

- Equation
 - $Q = f(p)$
 - Graph
 - Table or schedule
- Attributes of Demand curves:
 - have negative slope because of diminishing marginal utility
 - Expressed for some time period and often for some region

A demand table, graph, and equation

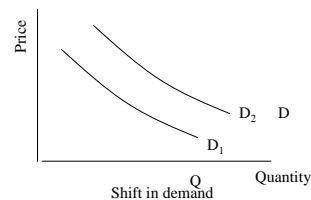
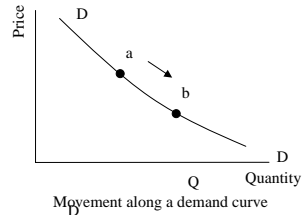
Price	Matthew
\$6	5
\$5	10
\$4	15
\$3	20
\$2	25
\$1	30



$$Q = 35 - 5P$$

Movement along vs. shifts in demand curves

- Movement along a demand curve
 - Factors of consumption/demand unchanged
- Shift in demand curve
 - Factors in market consumption change
 - Needs, wants, preferences of buyers change
 - Addition of more buyers in a market



Assumptions about demand

- Relationship holds true as long as other factors remain equal
- If price changes, quantity exchanged in the market will change according to the schedule
- If the quantity offered changes, the price will change according to the schedule
- Demand describe the relationship between average revenue to quantity exchanged
 - Price in the demand curve is the average revenue for the quantity sold

Price Elasticity of Demand

$$E_p = \frac{\% \Delta Q}{\% \Delta P}$$
$$E_p = \frac{\frac{\Delta Q}{Q}}{\frac{\Delta P}{P}} = \frac{\Delta Q}{Q} \times \frac{P}{\Delta P} = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q}$$

As the change in Q and change in P approach zero, we have...

$$E_p = \frac{\partial Q}{\partial P} \times \frac{P}{Q}$$

Normally, E_p is negative, since demand curves are negatively sloped. We often ignore the sign.

Elasticity

- If we ignore the sign of E_p , then:
 - If $E_p = 0$, perfectly inelastic
 - If $E_p > 1$, prices are elastic
 - If $E_p < 1$, prices are inelastic.
 - If E_p approaches infinity, prices are perfectly elastic
- For Matthew's demand curve, calculate E_p for prices of \$1, \$3.50, and \$5.00. Characterize the elasticity.

Matthew's demand curve

$$Q = 35 - 5P$$

Price elasticity of demand

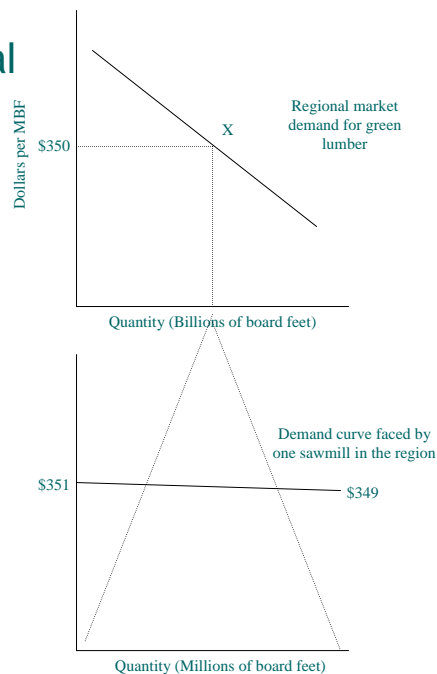
$$E_p = \frac{\partial Q}{\partial P} \times \frac{P}{Q}$$

Demand from a producer's view

- A producer asks, "if I produce a quantity, Q , of a good, what will the price be?"
- Market structure has impact on prices
 - Competition, monopoly, oligopoly
 - Assume we are working in a competitive market
 - Producers are price takers, no matter how much or how little they produce, they cannot influence prices

Market and individual demand curve

- Typical market demand downward sloping
- Each individual producer has such small portion of market that they face a nearly horizontal demand curve.
- Therefore, they cannot change their price by decreasing the quantity they produce.
- Gross revenue is maximized by maximizing quantity
- Net revenue is maximized by maximizing the difference between gross revenue and total costs of production.
- *Exception: in a monopoly or oligopoly, an individual firm produces enough quantity to actually have it's own downward sloping demand curve!*



Working with demand equation to find optimal total revenue

1. Demand equation $Q = 6,500,000 - 10000P$

where: Q = board feet produced per year
P = price \$/MBF for green lumber

2. Can rewrite demand equation to: $P = 650 - 0.0001Q$

3. We know that total revenue is: $TR = P \times Q$

4. Since $TR = P \times Q$, we can write: $TR = (650 - 0.0001Q)Q$
 $TR = 650Q - 0.0001Q^2$

5. Taking the first derivative and setting equal to zero and solving for Q we find the point where TR is maximized (and minimized if Q has two values)

$$\frac{\partial TR}{\partial Q} = 650 - 0.0002Q = 0$$

$$Q = 3,250,000 \leftarrow \text{Optimal bf/yr production}$$

Elasticity and revenue

Demand equation is:

$$Q = 6,500,000 - 10,000P$$

- or -

$$P = 650 - 0.0001Q$$

- Where demand is unit elastic ($E_p = -1$), revenue is maximized!

- Let's calculate E_p at three levels of production

- $Q = 3,250,000$

$$E_p = -10,000 \times \frac{325}{3,250,000} = -1$$

- $Q = 2,000,000$

$$E_p = -10,000 \times \frac{450}{2,000,000} = -2.25$$

- $Q = 5,500,000$

$$E_p = -10,000 \times \frac{100}{5,500,000} = -0.18$$

Elasticity and revenue

Unit elasticity:

Any percent change in price is met by an equal percent change in quantity, resulting in no revenue change.

$$E_p = -10,000 \times \frac{325}{3,250,000} = -1$$

Price elasticity:

Any percent change in price is cause a greater percent change in quantity. Thus, lowering price will increase total revenue

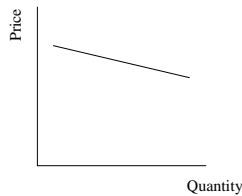
$$E_p = -10,000 \times \frac{450}{2,000,000} = -2.25$$

Price inelasticity:

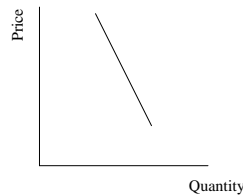
Any percent change in price is met by a lesser percent change in quantity. Thus, increasing price will result in greater total revenue.

$$E_p = -10,000 \times \frac{100}{5,500,000} = -0.18$$

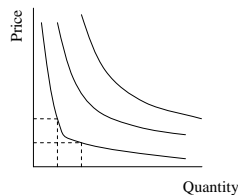
Graphs of elasticity



Elastic demand (Price elasticity).
higher prices lower total revenue.



Inelastic demand (Price inelasticity).
higher prices increase total revenue.



Demand curves of unit elasticity.

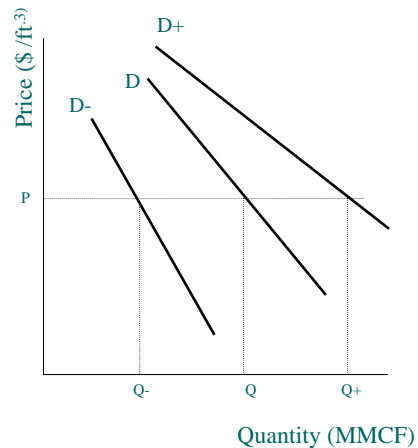
Cross-price elasticity of demand

- If the price of wood 2x4s increases, the price for plywood, osb, and other structural members will fall as they are goods used together.
- In general, the cross-price elasticity of demand for good X with respect to the price of good Y is given in the equation.
- Substitutes have positive cross-price elasticities.
 - Wood 2x4s and steel studs
- Complements (used together) have negative cross price elasticities (as above).

$$E_{xy} = \frac{\frac{\Delta Q_x}{Q_x}}{\frac{\Delta P_y}{P_y}}$$

Demand shifters

- Growth in consumers (population)
- Income, tastes, and preferences change
- If the original demand curve is D, then Q units are consumed at price P
- If demand shifts:
 - If more units are demanded at the same price, P, then demand has increased.
 - If fewer units are demanded at the same price, P, then demand has decreased.



Next lecture...

Supply and production
economics