탄력성

5. Elasticity and Its Application

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What this chapter is about

- What is elasticity? What kinds of issues can elasticity help us understand?
- What is the price elasticity of demand?
  - How is it related to the demand curve?
  - How is it related to revenue & expenditure?
- What is the price elasticity of supply?
  - How is it related to the supply curve?
- What are the income and cross-price elasticities of demand?

Elasticity

- Elasticity
  - Measure of the responsiveness of Q^D or Q^s
  - To a change in one of its determinants
- Price elasticity of demand
  - How much the quantity demanded of a good responds to a change in the price of that good

Price elasticity of demand

- Definition:

수요의 가격 탄력성

$$\text{Price elasticity of demand} = \frac{\text{Percentage change in } Q^D}{\text{Percentage change in } P}$$

- Loosely speaking, it measures the price sensitivity of buyers' demand.
- Along demand curve, P and Q move in opposite direction.
  - P (\$200 $\rightarrow$ \$250) and $Q^D(12 \rightarrow 8)$
  - Make price elasticity negative

  (4/12)/(50/200)
- Drop the minus sign and report all price elasticities as non-negative numbers

Calculating Percentage Changes

- Standard method

$$\frac{\text{end value - start value}}{\text{start value}} \times 100\%$$

- Percentage change in price in the previous example?
- Problem
  - The standard method gives different elasticities depending on where you start.
  - What are the price elasticities in the example?

그러나 이렇게 할 경우 start -> end, end -> start 가 다르게 된다.

Calculating Percentage Changes

그래서 midpoint = (start + end)/2로 정의하여 분모에 넣는다!

- So, we instead use the **midpoint method**:

$$\frac{\text{end value - start value}}{\text{midpoint}} \times 100\%$$

- The midpoint is the number halfway between the start and end values, the average of those values.
- It doesn't matter which value you use as the start and which as the end—you get the same answer either way!
- What is the price elasticity of demand in the example?

Calculating Percentage Changes

- Use the following information to calculate the price elasticity of demand.
- If $P = \$70, \quad Q^D = 5000$
- If $P = \$90, \quad Q^D = 3000$

(2000/4000) / (20/80) = 2

What determines price elasticity?

- We look at a series of examples.
- Each compares two common goods.

Example 1: Breakfast Cereal vs. Sunscreen

- The prices of both of these goods rise by 20%.
- For which good does Q^D drop the most? Why?
- Breakfast cereal has close substitutes
  - e.g. pancakes, Egg waffles, leftover pizza
  - So buyers can easily switch if the price rises.
- Sunscreen has no close substitutes,
  - So consumers would probably not buy much less if its price rises.
- Lesson: Price elasticity is higher when close substitutes are available.

Example 2: "Blue Jeans" vs. "Clothing"

- The prices of both of these goods rise by 20%.
- For which good does Q^D drop the most? Why?
- For a narrowly defined good such as blue jeans, there are many substitutes
  - Khakis, Shorts.
- There are fewer substitutes available for broadly defined goods.
  - There aren't too many substitutes for clothing other than living in a nudist colony.)
- Lesson: Price elasticity is higher for narrowly defined goods than broadly defined ones.

Example 3: "Insulin" vs. "Caribbean Cruises"

- The prices of both of these goods rise by 20%.
- For which good does Q^D drop the most? Why?
- To millions of diabetics, insulin is a necessity.
  - A rise in its price would cause little or no decrease in demand.
- A cruise is a luxury.
  - If the price rises, some people will forego it.
- Lesson: Price elasticity is higher for luxuries than for necessities.

Example 4: "Gasoline in the Short Run" vs. "Gasoline in the Long Run"

짧은 시간동안에는 반응하지 못하지만 긴 시간으로 보면 탄력적이게 된다.

- The prices of both of these goods rise by 20%.
- Does Q^D drop more in the SR or the LR? Why?
- There's not much people can do in the short run, other than ride the bus or carpool.
- In the long run, people can buy smaller cars or live closer to where they work.
- Lesson: Price elasticity is higher in the LR than the SR.

The Determinants of Price Elasticity: A Summary

The price elasticity of demand depends on:

- the extent to which close substitutes are available
- whether the good is a necessity or a luxury
- how broadly or narrowly the good is defined
- the time horizon—elasticity is higher in the long run than the short run

The Variety of Demand Curves

- The price elasticity of demand is closely related to the slope of the demand curve.
- Rule of thumb:
  - The flatter the curve, the bigger the elasticity.
  - The steeper the curve, the smaller the elasticity.
- Five different classifications of demand curves...

The Variety of Demand Curves

- Perfectly inelastic demand 0
- Inelastic demand 비탄력적
- Unit elastic demand (the case where price changes have no effect on revenue) 1
- Elastic demand 탄력적
- Perfectly elastic demand infinity

A few elasticities from the real world

Might think it's easy to estimate price elasticities of demand from real-world data
- But, it's not that simple.
- Must use careful statistical analysis to separate the influence of different factors

- Eggs: 0.1
- Healthcare: 0.2
- Rice: 0.5
- Housing: 0.7
- Beef: 1.6
- Restaurant meals: 2.3
- Foreign travel: 4.1
- Mountain Dew: 4.4

파워에이드 같은 다른 음료수를 먹으면 된다!

Elasticity of a Linear Demand Curve

선형 수요 곡선에서 고정된 탄력성 값을 갖는 것이 아니다!

- Constant elasticity?
  - The slope of a linear demand curve is constant, but its elasticity is not.
- Elasticity falls as you move downward & rightward along a linear demand curve.

Price Elasticity and Total Revenue

$$\text{Price elasticity of demand} = \frac{\text{Percentage change in } Q^D}{\text{Percentage change in } P}$$

$$\text{Revenue} = Q \times P$$

- If demand is elastic, 탄력적이면 가격을 내려서 수요량을 올리는게 더 이득!
  - Price elasticity of demand > 1
  - % change in $Q >$ % change in P
  - The fall in revenue from lower Q is greater than the increase in revenue from higher P, so revenue falls.
- If demand is inelastic, opposite result.
- The knife-edge case is unit-elastic demand.
- Should a firm reduce P when demand is elastic?

APPLICATION: Does Drug Interdiction Increase or Decrease Drug-Related Crime?

- One side effect of illegal drug use is crime:
  - Users often turn to crime to finance their habit.
- We examine two policies designed to reduce illegal drug use and see what effects they have on drug-related crime.
- For simplicity, we assume the total dollar value of drug-related crime equals total expenditure on drugs.
- Demand for illegal drugs is inelastic, due to addiction issues.

Policy 1: Interdiction

- Lower supply
  - Supply curve shifts.
- Demand is inelastic.
- P rises, Q falls (yet, by a small amount)
- Result: an increase in total spending on drugs and in drug-related crime

Policy 2: Education

- Lower demand
  - Demand curve shifts.
- P and Q fall.
- Result: A decrease in total spending on drugs and in drug-related crime.

Other elasticities

수요의 소득 탄력성

- Income elasticity of demand

$$\text{Income elasticity of demand} = \frac{\%\text{ change in } Q^D}{\%\text{ change in income}}$$

- Normal goods 정상제(양수인 경우)
  - Necessities $0 <$ 필수재 < 1
  - Luxuries $1 <$ 사치재
- Inferior goods 열등재(음수인 경우)

Other elasticities

- Cross-price elasticity of demand

$$\text{Cross-price elasticity of demand} = \frac{\%\text{ change in } Q^D \text{ for good 1}}{\%\text{ change in price of good 2}}$$

- Substitutes 대체재(양수인 경우)
- Complements 보완재(음수인 경우)

Price elasticity of supply

공급의 가격 탄력성

- Definition:

$$\text{Price elasticity of supply} = \frac{\%\text{ change in } Q^S}{\%\text{ change in } P}$$

- Loosely speaking, it measures sellers' price-sensitivity.
- Again, use the midpoint method to compute the percentage changes.

The Variety of Supply Curves

- The price elasticity of supply is closely related to the slope of the supply curve.
- Rule of thumb:
  - The flatter the curve, the bigger the elasticity.
  - The steeper the curve, the smaller the elasticity.
- Five different classifications of supply curves. . .

The Variety of Supply Curves

비슷하게 정의된다.

- Perfectly inelastic supply
- Inelastic supply
- Unit elastic supply
- Elastic supply
- Perfectly elastic supply

The Determinants of Price Elasticity of Supply

- The more easily sellers can change the quantity they produce, the greater the price elasticity of supply.
  - eg: Supply of beachfront property is harder to vary and thus less elastic than supply of new cars.
- Time period: LR vs. SR

- The Price Elasticity of Supply Along a Supply Curve
  - Typical case: as Q increases, less elastic

공급 곡선의 끝으로 갈때(공급이 증가하는 곳) 비탄력적으로 간다.

Applications

Can Good News for Farming Be Bad News for Farmers?

기술이 증가해서 공급곡선이 오른쪽으로 가게 되면 가격이 줄어든게 된다. 하지만 수요가 비탄력적이기 때문에 가격이 줄어들게 되면 오히려 수익이 줄어들게 된다. ㄷㄷ;

- New hybrid of wheat – increase production per acre 20%
  - Supply curve shifts to the right
  - Higher Q and lower P
  - Demand is **inelastic**: total revenue falls
- Paradox of public policy
  - Induce farmers not to plant crops
- Where have all the farmers gone?
  - low price elasticity of demand
  - low income elasticity of demand

Applications

Why Did OPEC Fail to Keep the Price of Oil High?

석유 공급을 줄이면 단기간에는 석유의 수요가 비탄력적이기 때문에 석유가격이 폭등하게 되지만 장기간으로 보면 차의 사용을 줄이는 등으로 인하여 수요가 탄력적으로 변하기 때문에 가격변동이 적어지게 되어 수익이 줄어들게 된다.

- Increase in prices 1973-1974, 1971-1981
- Short-run: supply and demand are inelastic
  - Decrease in supply: large increase in P
- Long-run: supply and demand are elastic
  - Decrease in supply: small increase in P