Calculus 2

MATH 128

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Contents

Chapter 1

Supply and Demand

1.1 Demand

Demand is the quantity of something we want, and the ability to procure.
What impacts our demand?

1. Price
    - Higher price → lower demand
2. Utility and preference
    - Higher utility → higher demand
3. Price of alternatives
    - Higher demand of complementary goods → higher demand
    - Higher demand of substitute goods → lower demand
4. Income
    - Higher income → higher demand
5. Expected future price
    - Higher expected future price ↔ higher demand
    - Price doesn't actually need to change for demand to be affected
6. Information
    - What people know affects demand
    - Creates self-fulfilling prophecies
7. Government interventions
    - Restrictions → lower demand

(The "law" of demand) If prices go up, demand goes down, and vice versa.
Luxury goods violate this.
How can we represent demand?

1. Graph
    - Price on y-axis
    - Quantity on x-axis
    - Generally downwards sloping
    - Best for presentation
2. Function

- A function that maps independent variables (price, income, etc.) to quantity demanded
- More precise, good for prediction
- Can use more than one factor at once

$$D(p) = (-)p$$

1.1.1 Supply

What impacts supply?

1. Costs of inputs
   - Higher costs → lower Supply
2. Price
   - Higher prices → higher supply
3. Government interventions

How can we represent supply?

$$S(p, c) = (+)p + (-)c$$

1.1.2 Summing supply & demand

- Add horizontally

When can we use the supply & demand model?

1. Minimal to no frictions
2. Full information
3. Everyone is a price taker
4. Identical products

1.1.3 Solving the supply & demand model

Find the quantity and price where $Q_D = Q_S$, or quantity supplied equals quantity demanded.
For graphs, find where supply & demand interesects.
For functions, set $Q_D = Q_S$ and solve for p.

1.1.4 Competitive model

[Market structure]

- Number of firms in the market
- Ease with which firms can enter/exit
- Ease with which firms can differentiate their products

[Perfectly competitive market] A market in perfect competition has the following properties:

- Numerous small firms
- Easy entry and exit
- Difficult to differentiate
- Everyone is a price taker
- Everyone is profit maximizing (a legal responsibility)
- Firms are competitive in the short run and in the long run

In a perfectly competitive market, the market has normal supply and demand curves. For firms, the demand is perfectly elastic at the market price (residual demand) because they are price takers.

1.1.5 Profit

$$\text{Profit} = R(q) - C(q) = \pi$$

Economic profit also considers opportunity cost, the value of the best foregone alternative.

Firm profit vs quantity graphs look like a parabola. There is an optimal quantity that maximizes firm profit.

Options to maximize profit:

1. Choose q that maximizes profit
2. Find q for which marginal profit is 0
3. Find q for which marginal cost is equal to price

The term **marginal** represents the value of a 1 unit increase.

1.1.6 Costs

1.2 Taxes, Tariffs, Surplus

1.2.1 Surplus

Surplus is the value gained from buying/selling something for less/more than its worth to you.

Supplier surplus refers to the area above S but below p.

Consumer surplus refers to the area below D but above p.

There are two types of tax:

- Per unit (fixed tax rate)
- Ad Valorem (percent tax rate)