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SEEP Bridging Course

Lecture 2: Microeconomics

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Economy is made up sectors

- Households
- Firms
- Banks
- Central Bank
- Government

Micro

Financial

Macro

Environment

Microeconomics (N)

- Households (Demand side)
  - Budget constraint
  - Utility function
- Firms (Supply side)
  - Cost structure
  - Revenue structure
- Markets (Exchange)
  - Demand = Supply

Some Mathematics

Total

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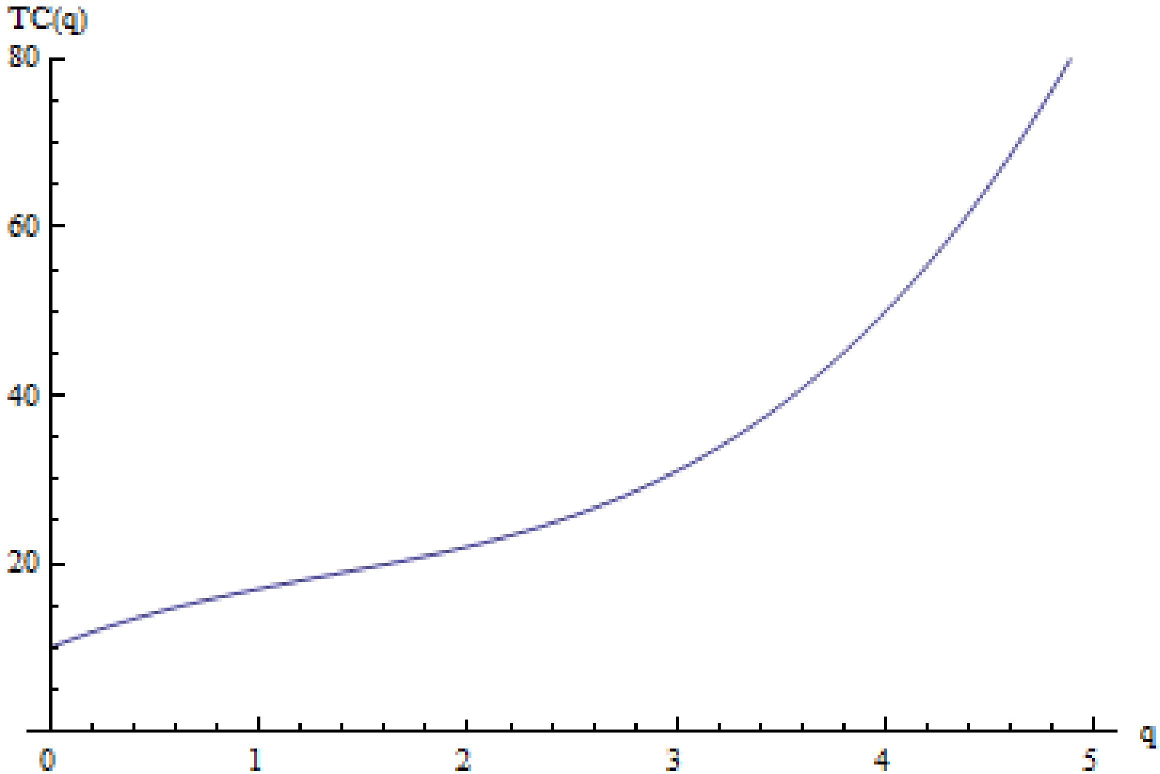
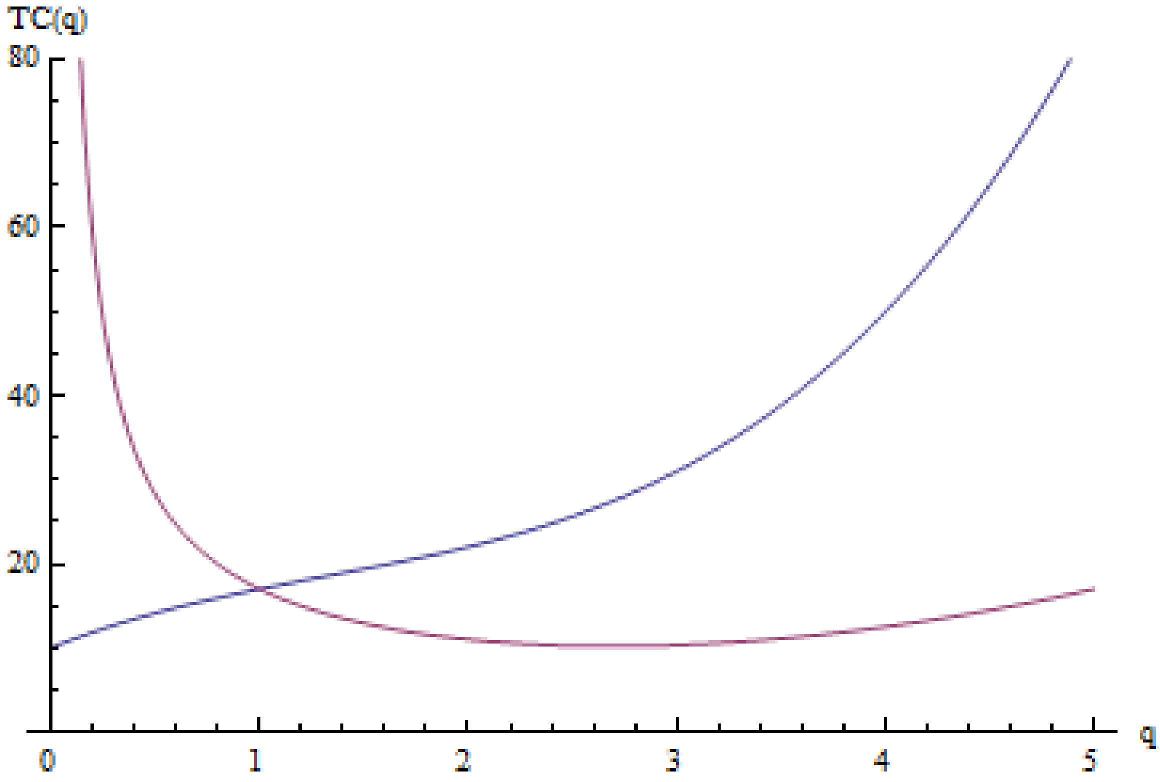
- Lets take a cost function which depends on one input q.
  - $TC(q) = q^3 - 4q^2 + 10q + 10$



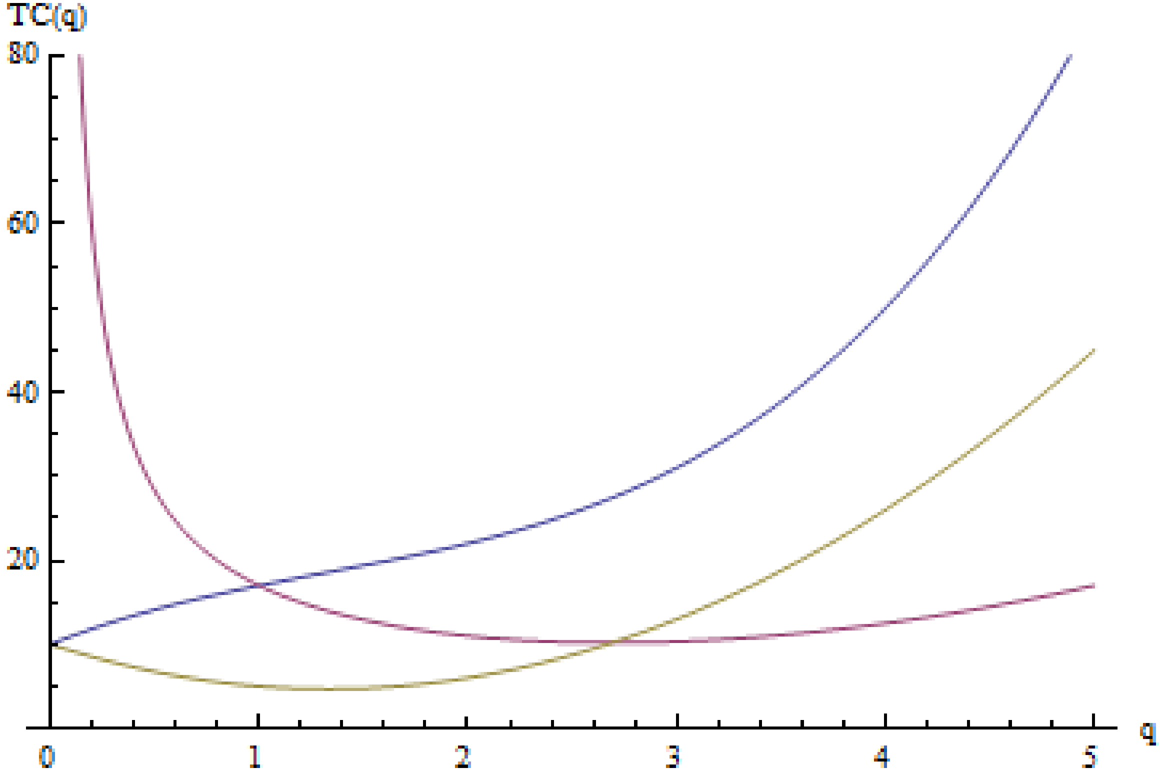
Average

- Average cost is the cost of producing one unit of output
  - $AC = \frac{TC}{q} = \frac{q^3 - 4q^2 + 10q + 10}{q} = q^2 - 4q + 10 + \frac{10}{q}$



Marginal

- Marginal cost is the cost of producing an additional unit of output
  - $MC = \frac{\partial TC}{\partial q} = 3q^2 - 8q + 10$



Total, Average, Marginal

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$$TC(q) = q^3 - 4q^2 + 10q + 10$$

$$AC(q) = q^2 - 4q + 10 + \frac{10}{q}$$

$$MC(q) = 3q^2 - 8q + 10$$

q	TC	AC	MC
0	10	∞	
1	17	17	5
2	22	11	6
3	31	10.33	13
4	50	12.5	26
5	85	17	45

Minimum of a function?

- What is the minimum of the AC?

$$AC(q) = q^2 - 4q + 10 + \frac{10}{q}$$

- Min/Max is where slope = 0
- Slope = First derivative
- Optimum of AC = $\frac{\partial AC}{\partial q} = 2q - 4 - \frac{10}{q^2} = 0 \rightarrow q = 2.69$

Min or max?

- To check whether it is min or max, differentiate twice and add the optimal value
- $\frac{\partial^2 AC}{\partial q^2} = 2 + \frac{20}{q^3}$ evaluated at $q = 2.69$ it equals 3.02

- Second derivative > 0 = Minimum point
- Second derivative < 0 = Maximum point

- Marginal functions always cut average functions at the minimum point!

Households

Core assumptions

- All households are identical (representative agent)
  - Can have different endowment points
- Households have full information
  - Past and future
  - Other agents
- Households are fully rational
  - Always know what they want
  - Will always make the "optimal choice"
- A household is faced with a simple problem
  - Maximize "utility" subject to a "budget constraint"

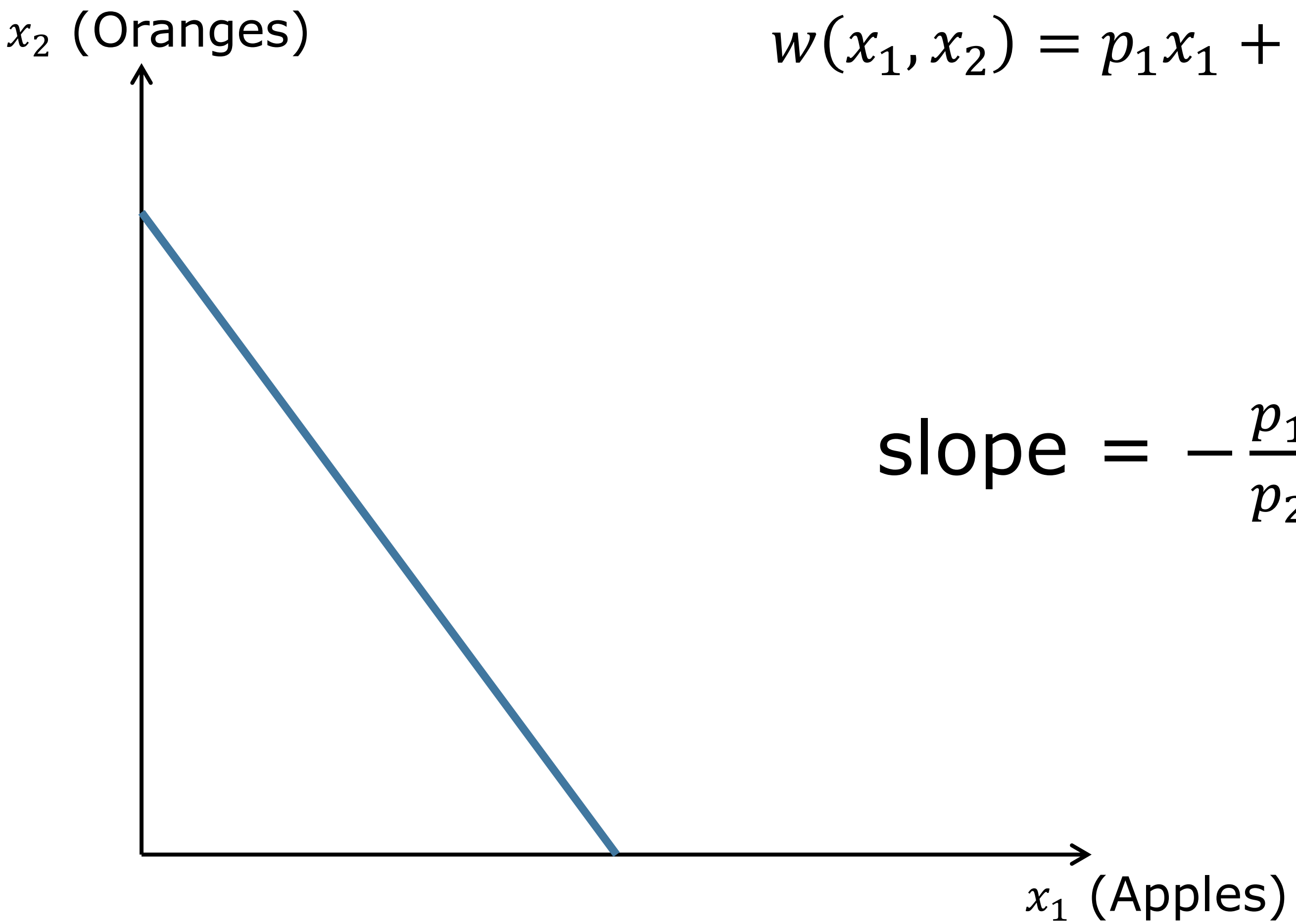
Defining a household

- What is a budget constraint?
  - Income is w
  - HH wants to buy two goods:
    - Apples (x_1) price of apples p_1= $1
    - Oranges (x_2) price of orange p_2= $2
  - Budget constraint

$$p_1 x_1 + p_2 x_2 \leq w$$

  - You cannot spend more than what you earn

Household budget constraint



$$w(x_1, x_2) = p_1 x_1 + p_2 x_2$$

$$\text{slope} = -\frac{p_1}{p_2}$$

But which combination to buy?

Utility function

- Households have a utility function
  - Mostly of the Cobb-Douglas form:

$$U(x_1, x_2) = {x_1}^{\alpha} {x_2}^{\beta}$$

    - Continuous
    - Differentiable
    - Implies both goods are perfectly substitutable

Utility function

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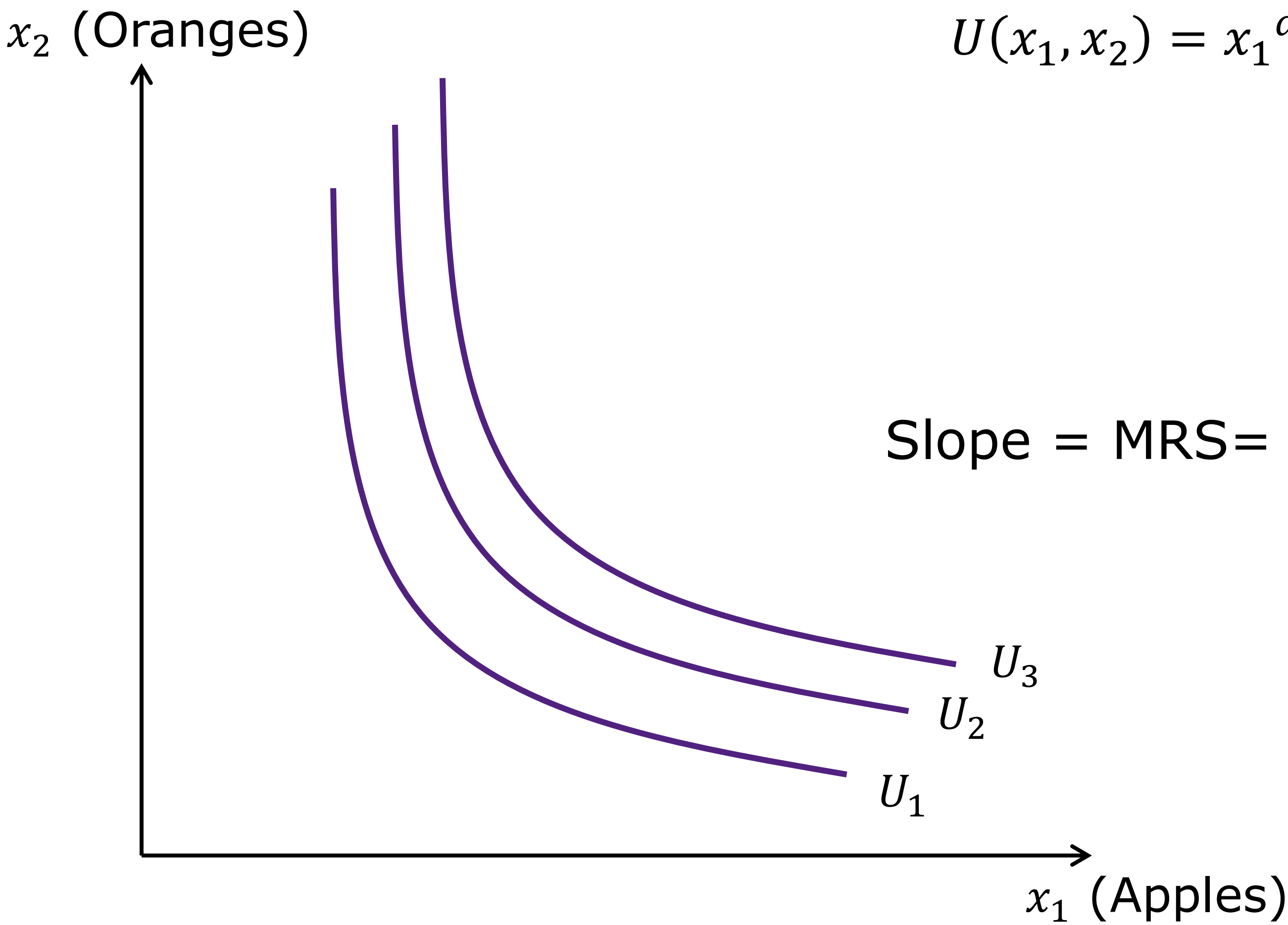
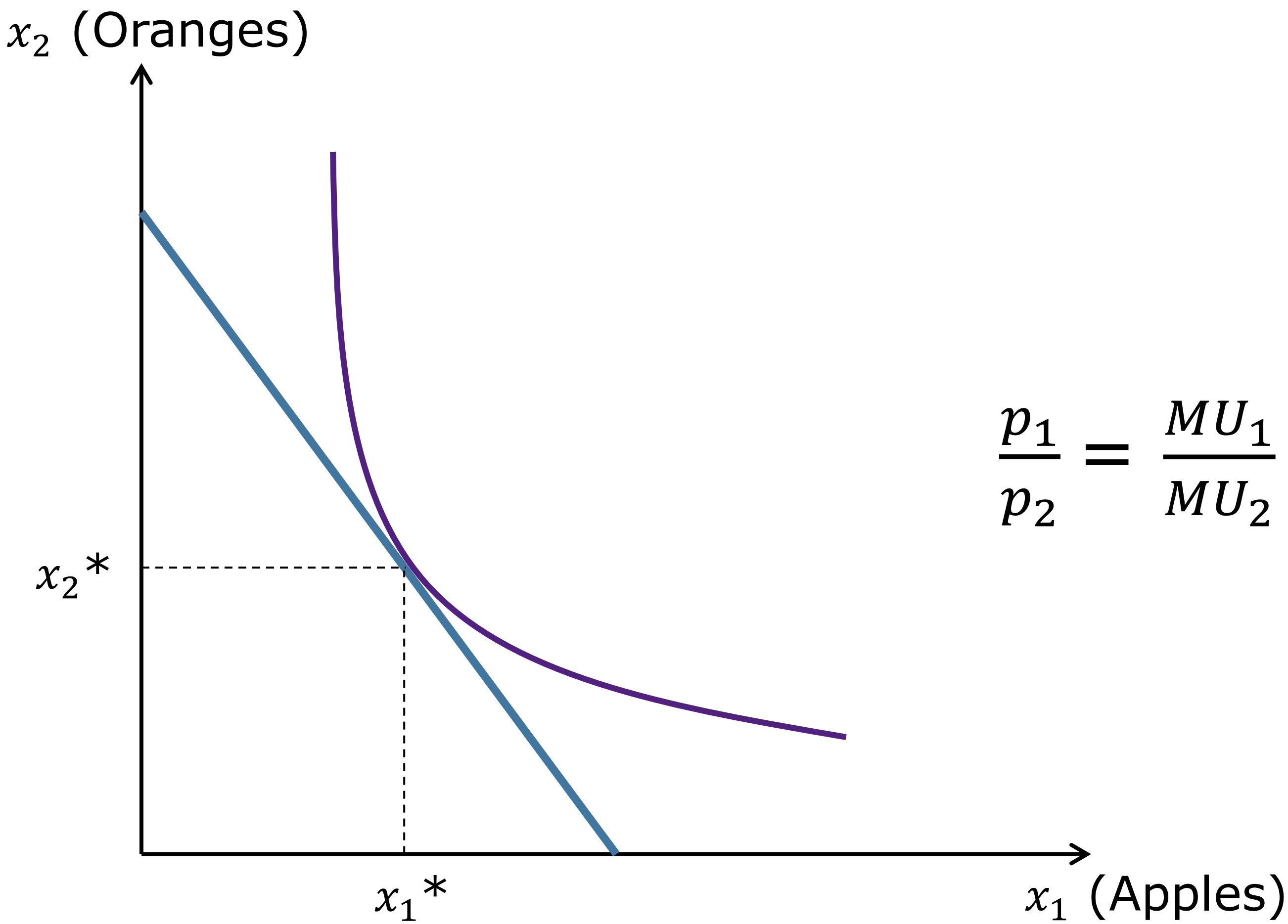
$U(x_1, x_2) = {x_1}^{\alpha} {x_2}^{\beta}$



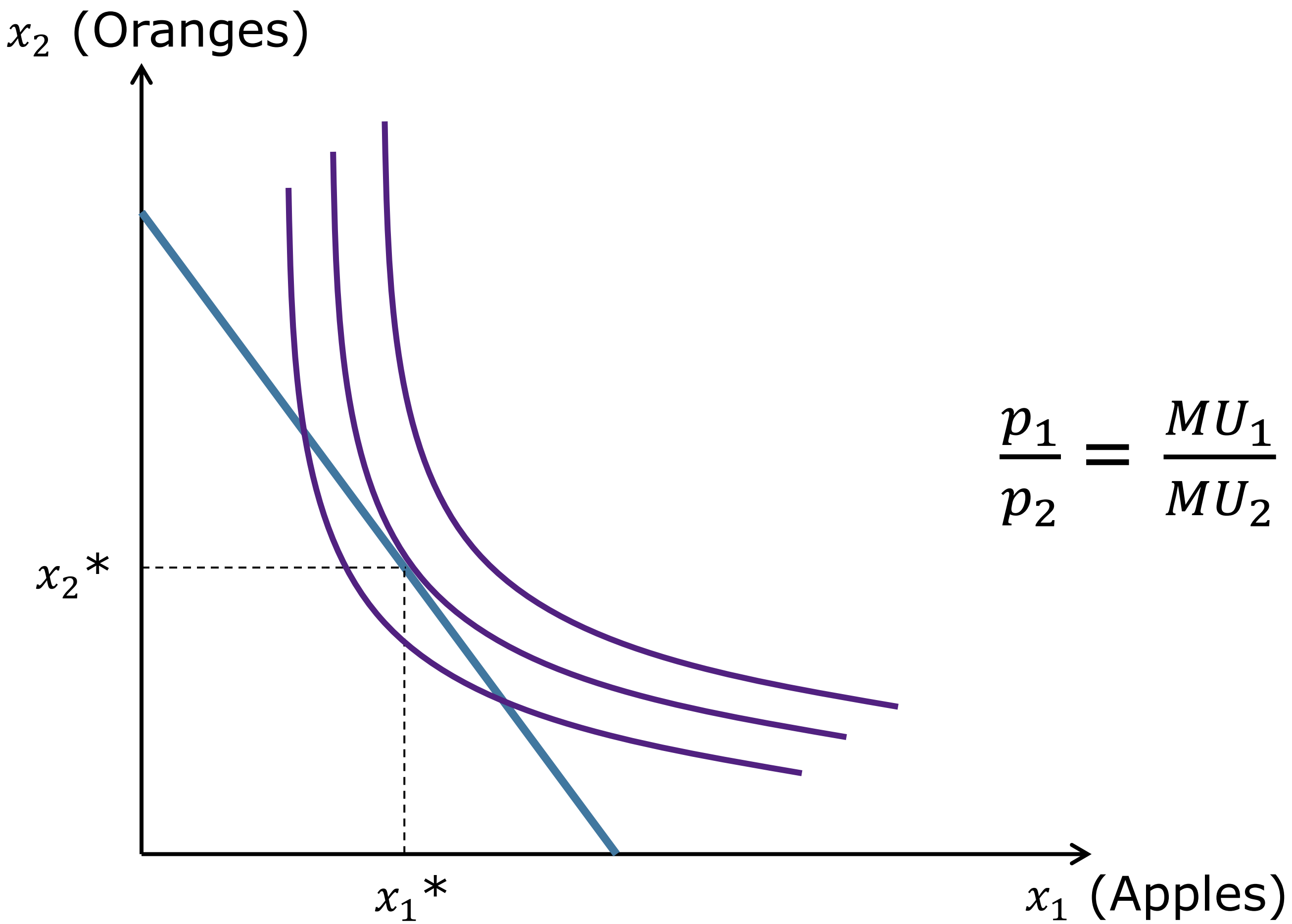
Slope = MRS= $-\frac{MU_1}{MU_2}$

Utility function



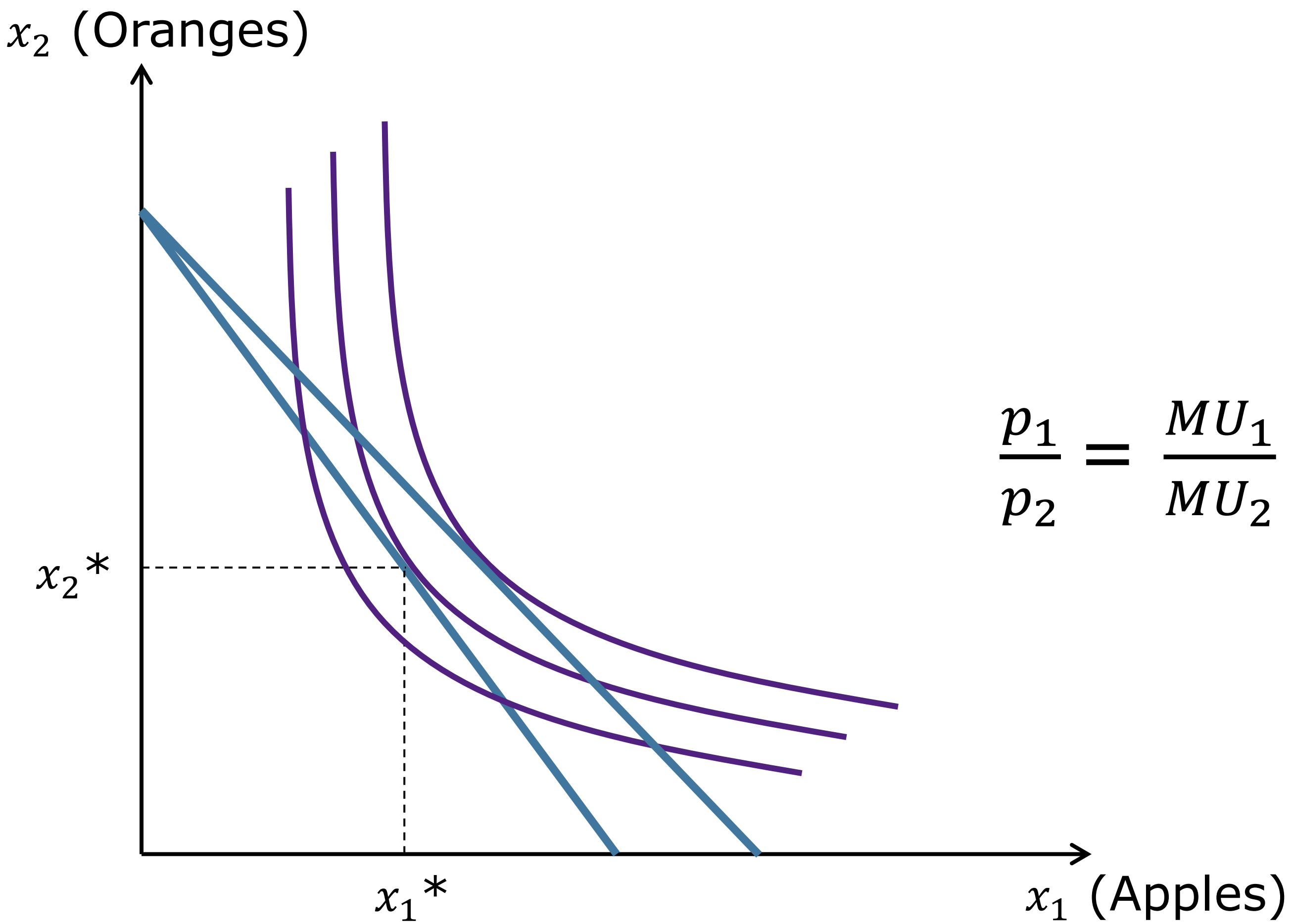
$$\frac{p_1}{p_2} = \frac{MU_1}{MU_2}$$

Utility function



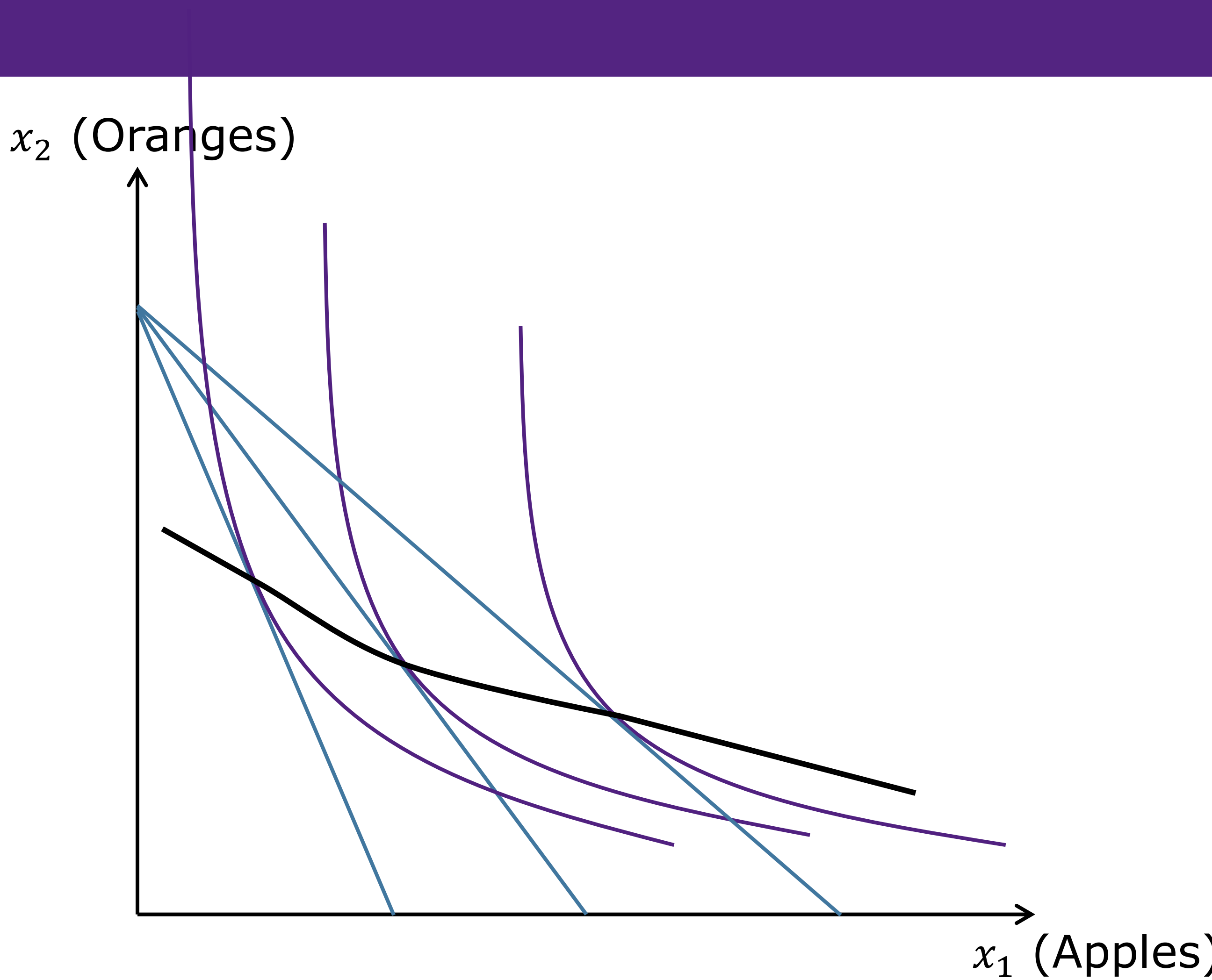
$$\frac{p_1}{p_2} = \frac{MU_1}{MU_2}$$

Utility function



$$\frac{p_1}{p_2} = \frac{MU_1}{MU_2}$$

The demand curve



Firms

Core assumptions

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All firms are identical (representative)

- Can have different endowment points

Firms have full information

- Past and future
- Other agents

Firms are fully rational

- Always know what they want
- Will always make the "optimal choice"

A firm is faced with a simple problem

- Maximize "revenue" subject to a "cost constraint"

Defining a Firm

- Firms face multiple costs
  - Fixed costs: Cost of maintaining machinery, capital (K)
  - Variable costs: Input costs: labor (L)

  - The cost structure of the firm is defined as:

$$C = wL + rK$$

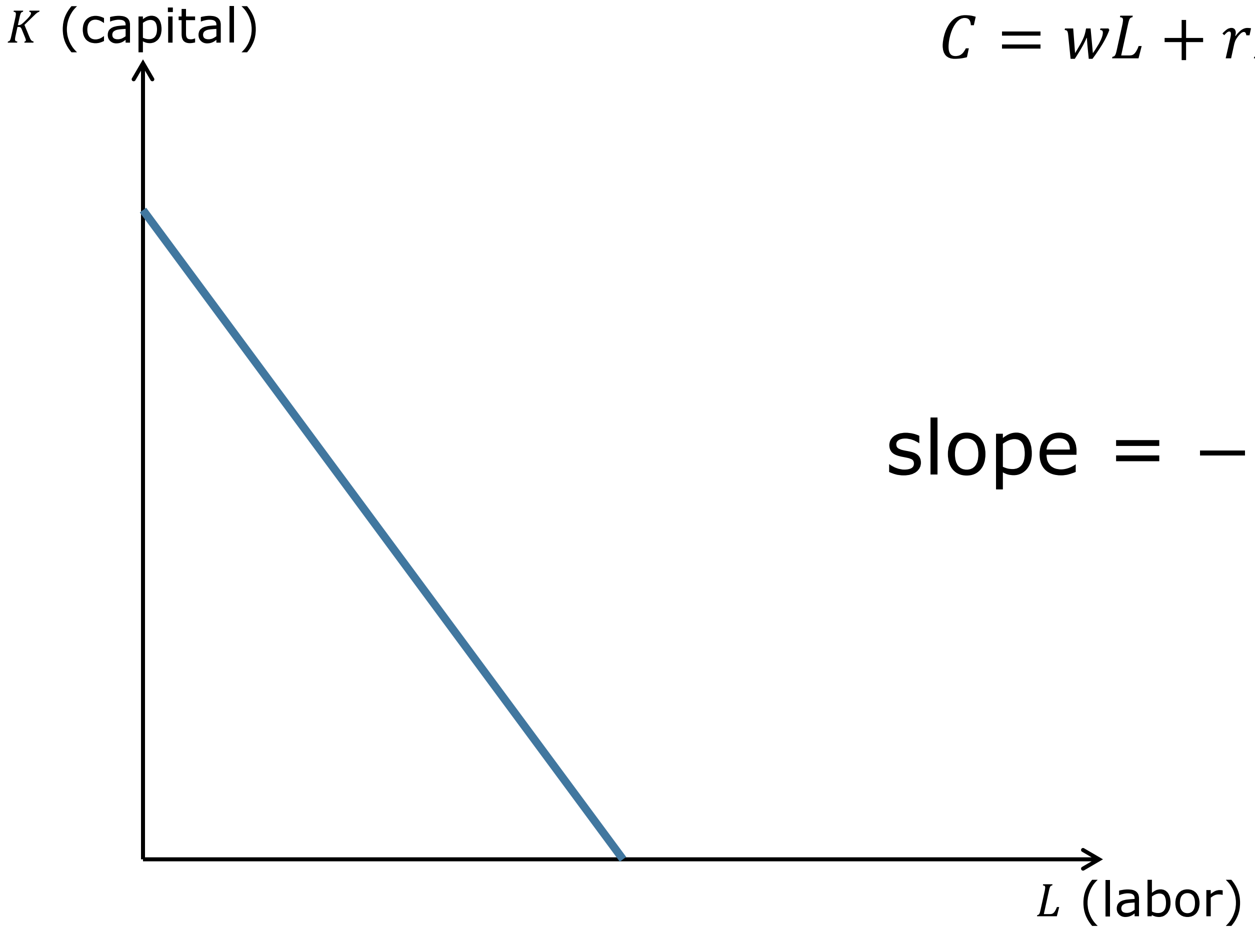
where

w = wage rate or price of labor

r = rental cost or price of capital

- Firms cost structure mimics households cost structure

Household budget constraint



$$C = wL + rK$$

$$\text{slope} = -\frac{w}{r}$$

But which combination to buy?

Utility function

- Firms have a production function
  - Cobb-Douglas form:

$$y(K, L) = K^{\alpha} L^{\beta}$$

    - Implies both goods are substitutes

  - Leontief form

$$y(K, L) = \min[\alpha K, \beta L]$$

    - Implies both goods are compliments

Utility function

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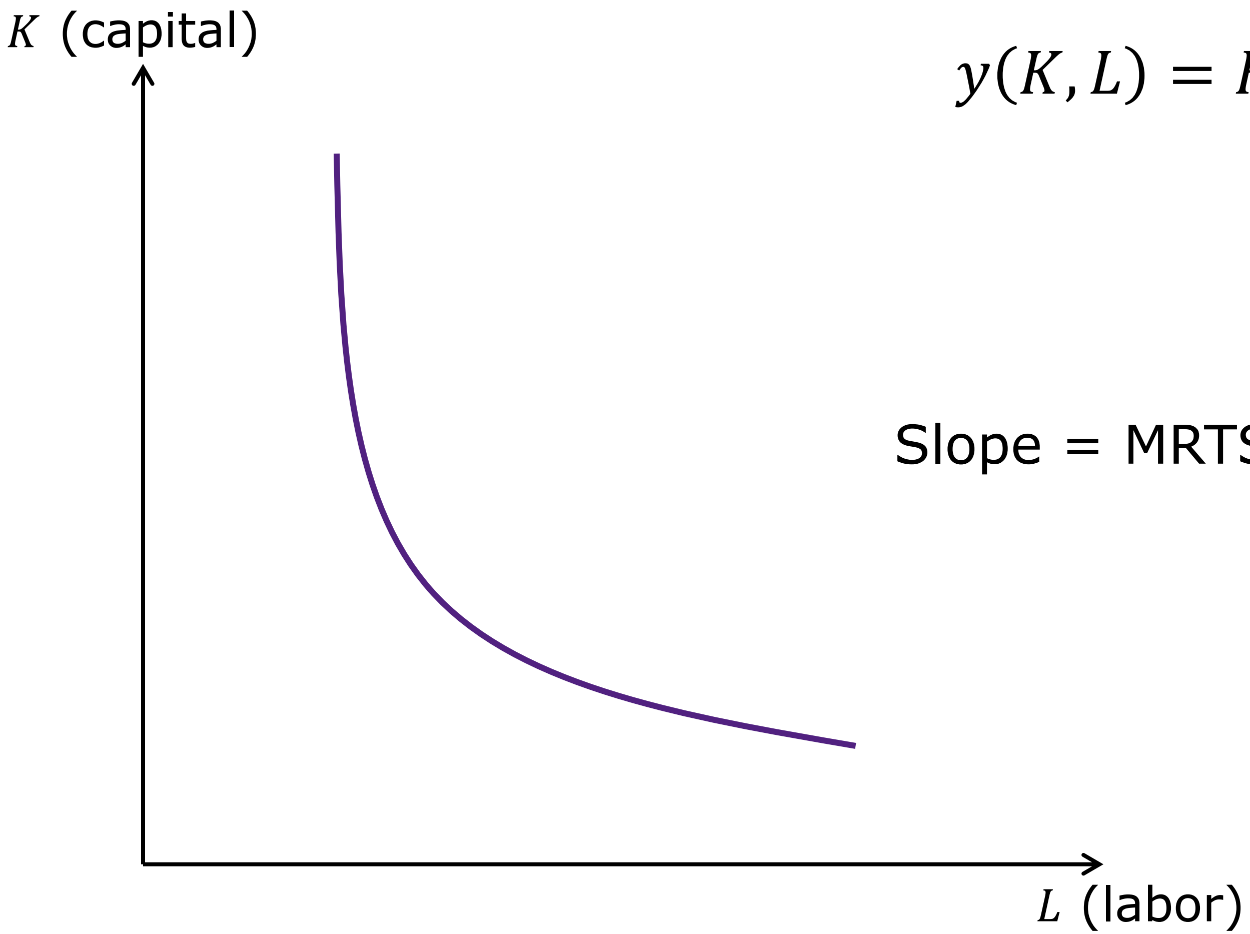
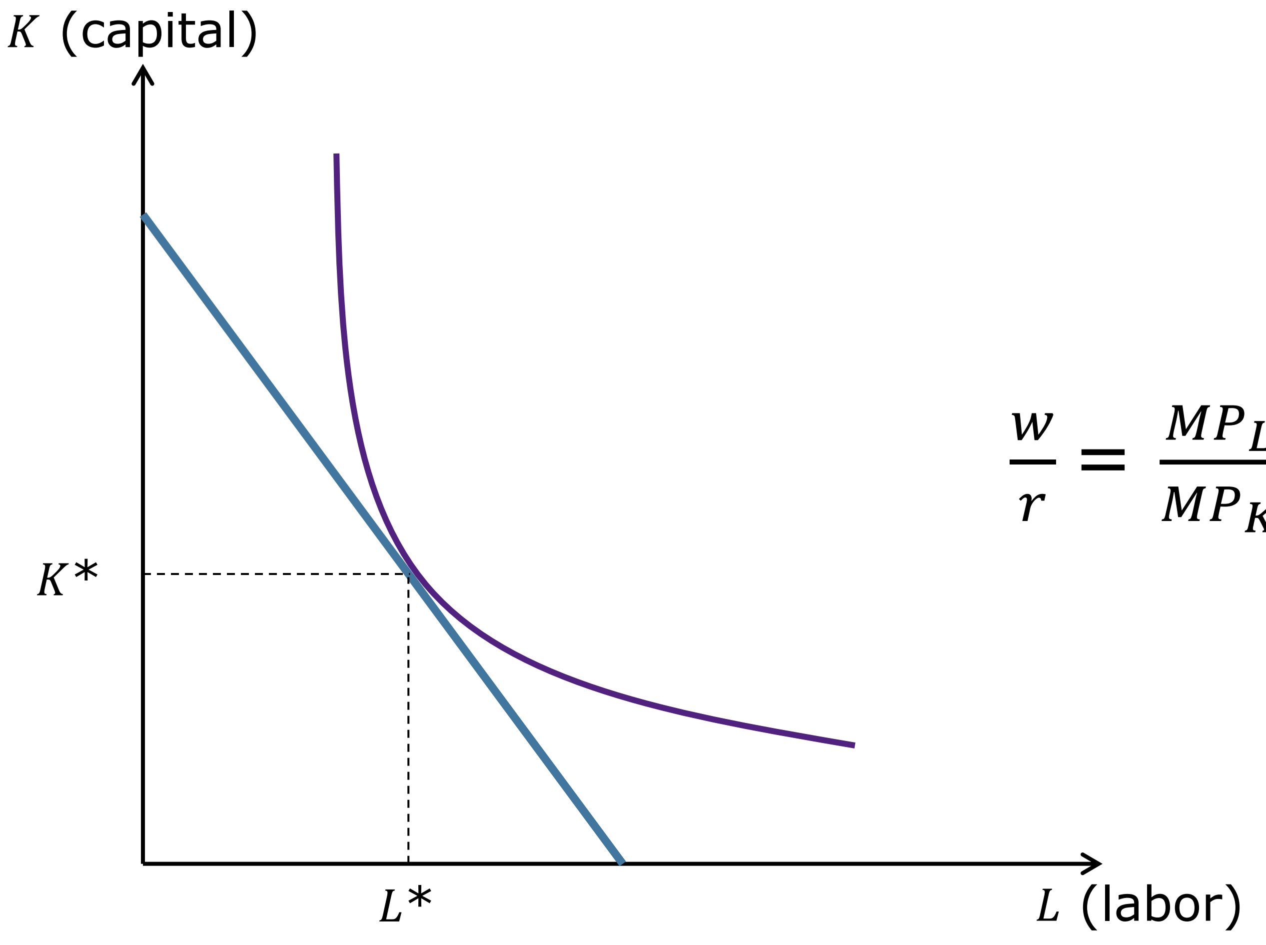


$$y(K, L) = K^{\alpha} L^{\beta}$$

Slope = MRTS= $-\frac{MP_L}{MP_K}$

Utility function



$$\frac{w}{r} = \frac{MP_L}{MP_K}$$

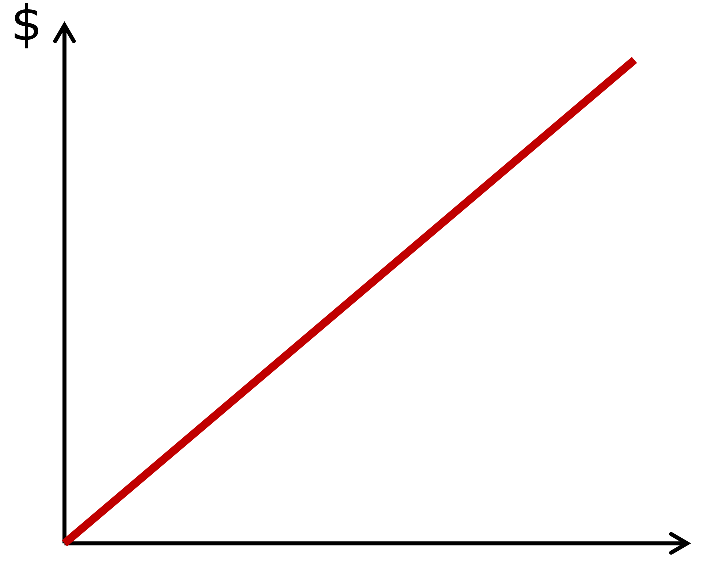
Profit maximization

- Profits = Revenue – costs:

$$\pi = R - C$$

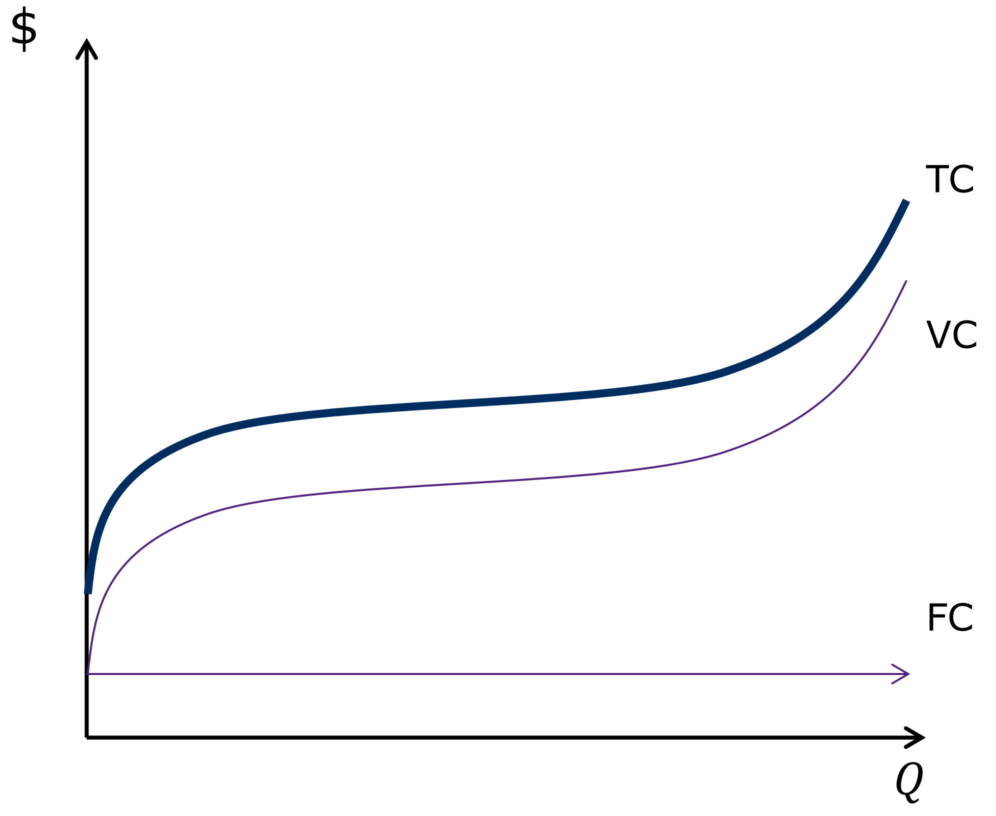
  - Revenue equals = price times the amount sold

$$R = pQ$$

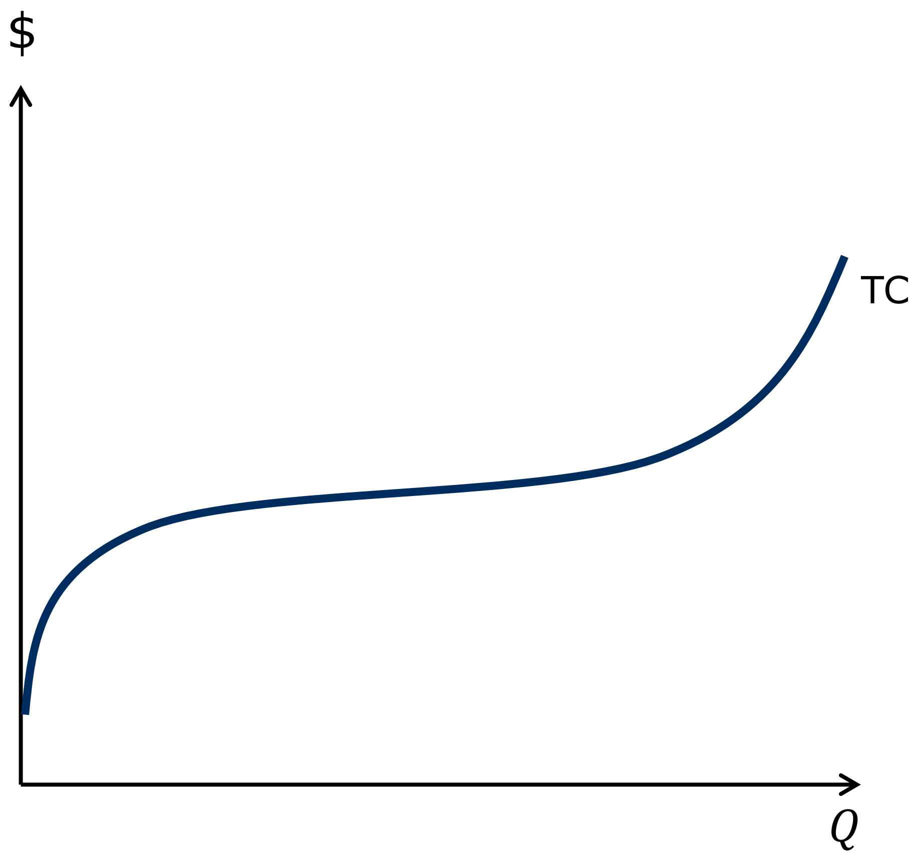


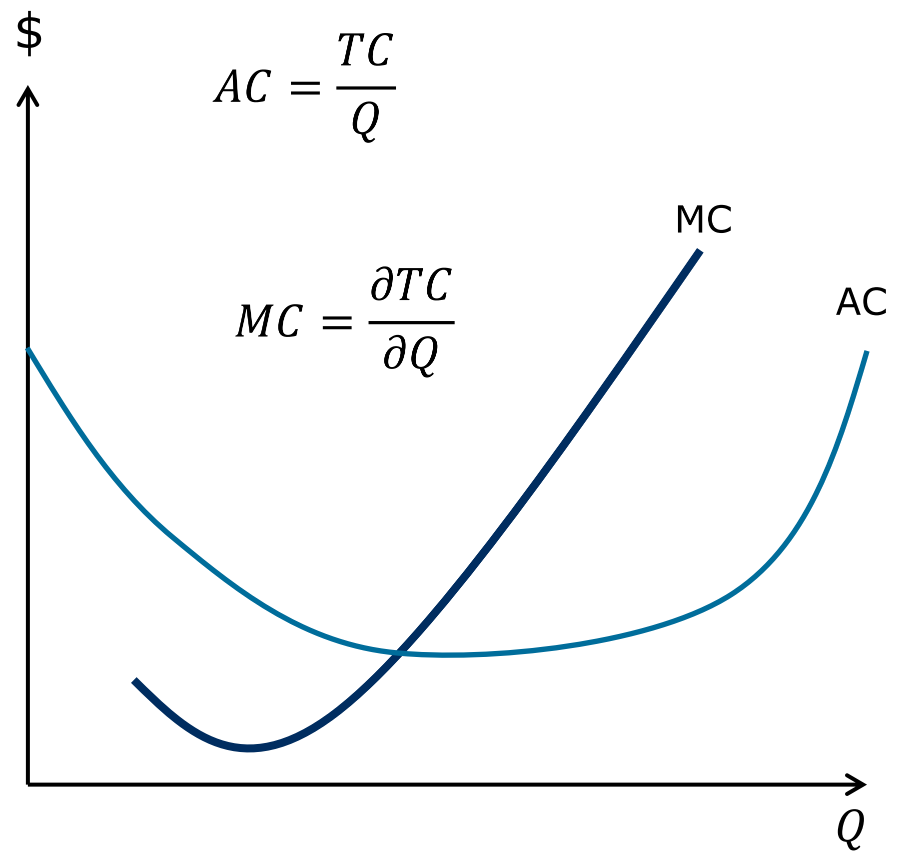
Profit maximization

- Total costs (TC) = Fixed costs (FC) + Variable costs (VC)



Profit maximization

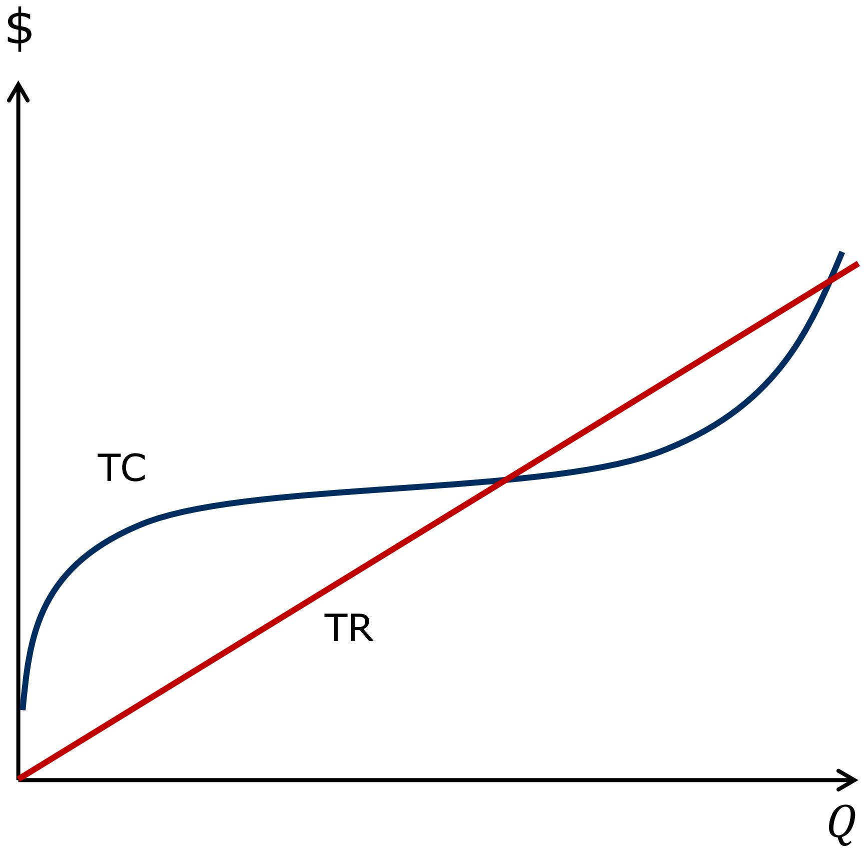


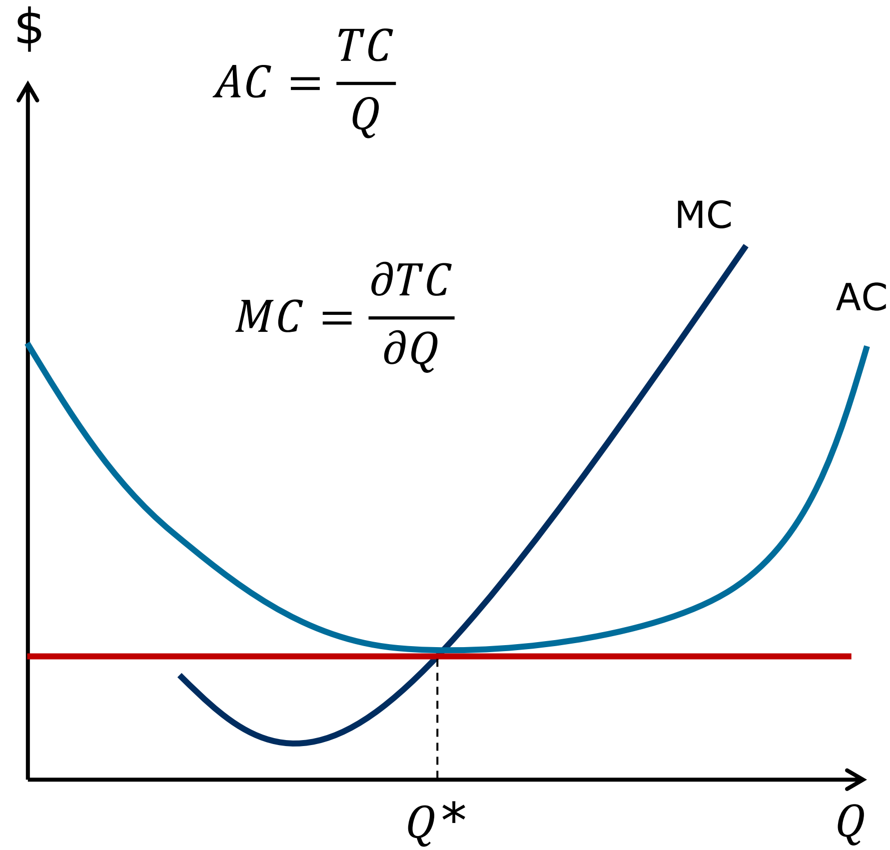


$$AC = \frac{TC}{Q}$$

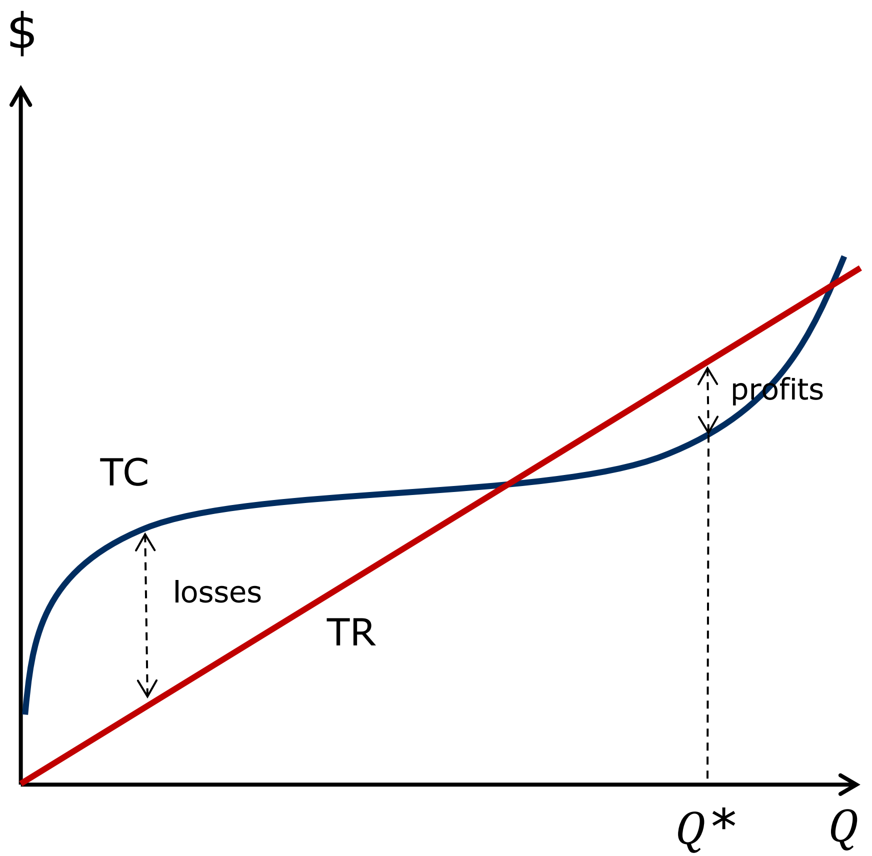
$$MC = \frac{\partial TC}{\partial Q}$$

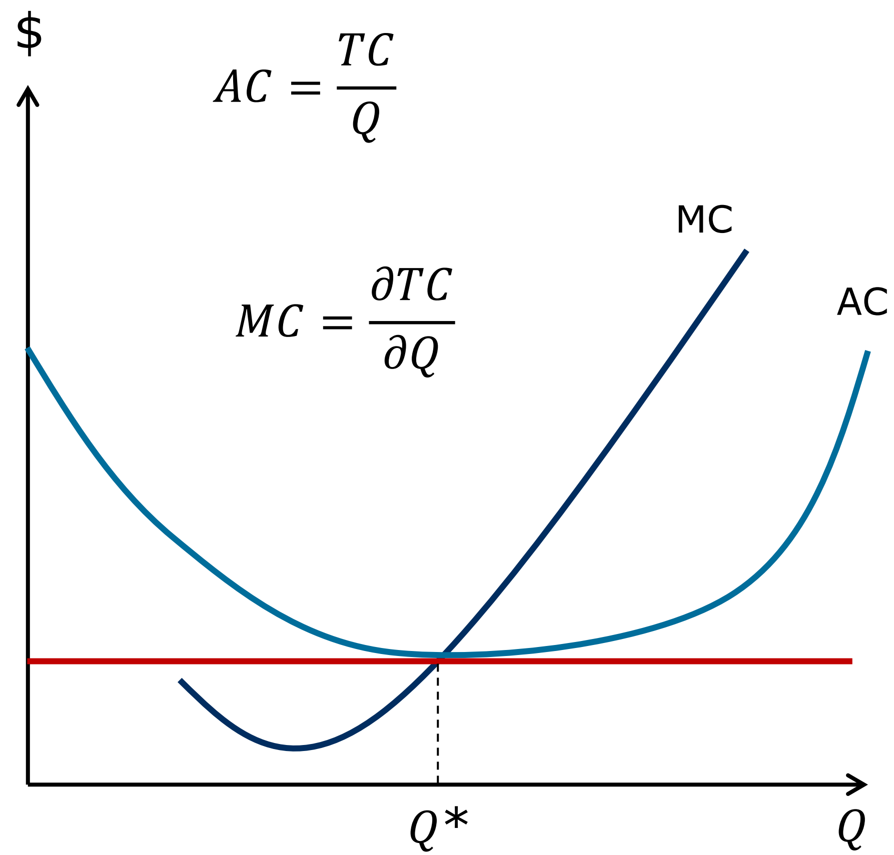
Profit maximization





Profit maximization





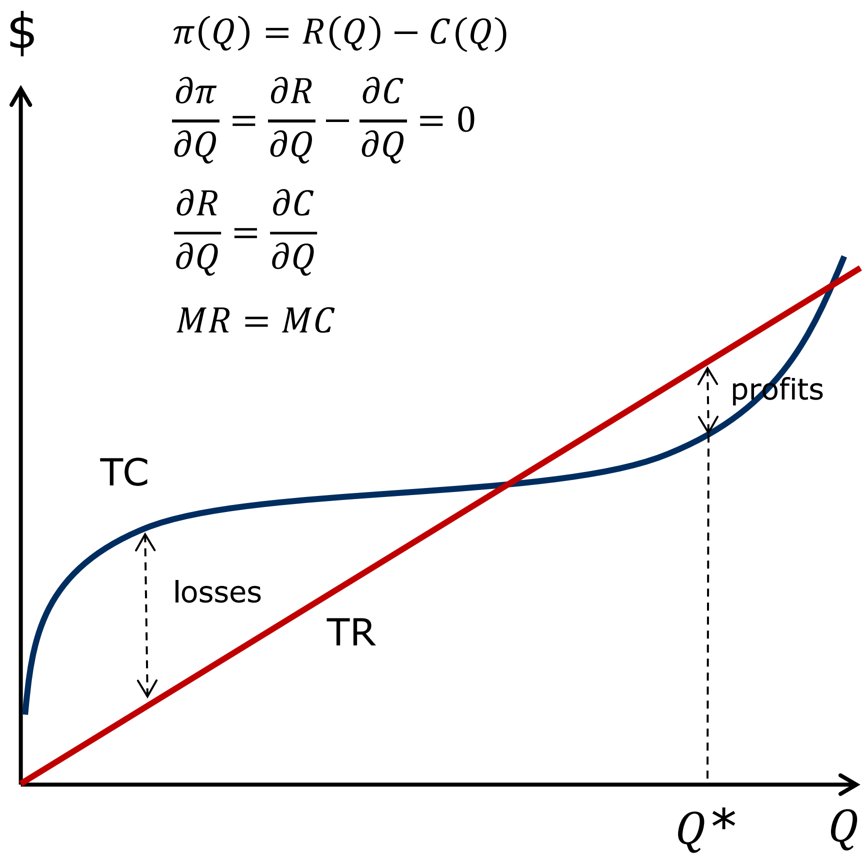
Profit maximization

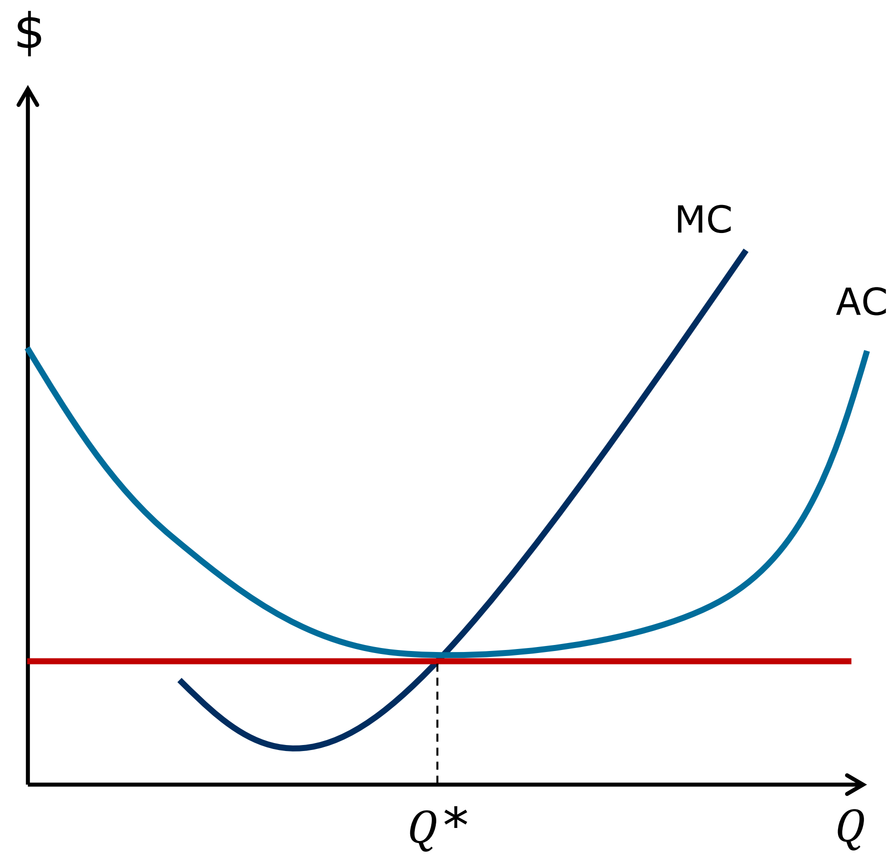
$$\pi(Q) = R(Q) - C(Q)$$

$$\frac{\partial \pi}{\partial Q} = \frac{\partial R}{\partial Q} - \frac{\partial C}{\partial Q} = 0$$

$$\frac{\partial R}{\partial Q} = \frac{\partial C}{\partial Q}$$

$$MR = MC$$





Firms sell only when MR = MC

Equilibrium

Putting it all together

- We now know how
  - Households take decisions – maximize utility
  - Firms take decisions – maximize profits

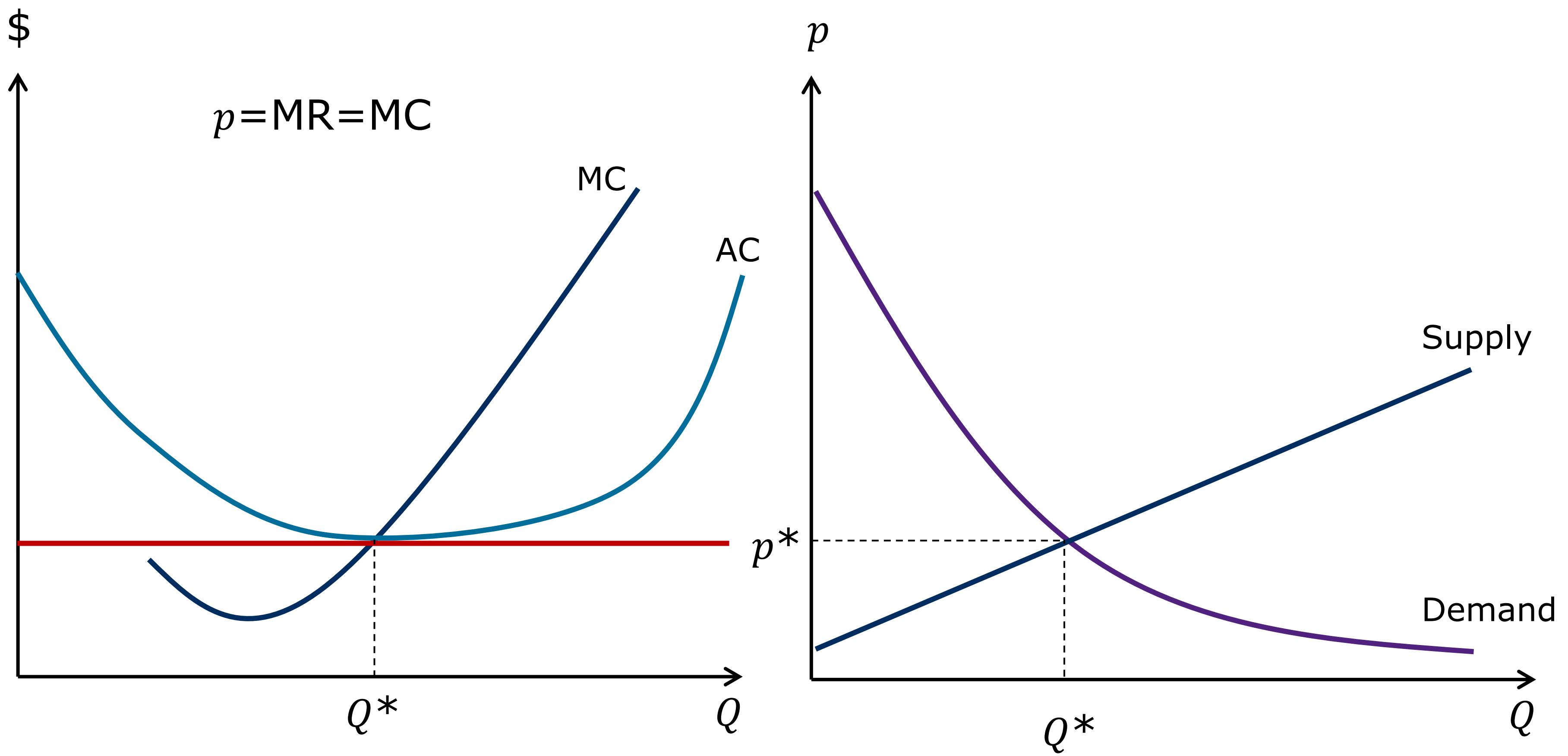
- But we still don’t know
  - How much households demand
  - At what price firms sell

- In neo-classical theory this problem is solved by a “central planner” or the “invisible hand” (Adam Smith)

Putting it all together

- We know that all households and firms are identical
- Households give us the demand curve
  - If price goes up, less will be demanded
- Firms give us the supply curve
  - Supply will always be on the MC curve (profit maximization condition
- From this we can determine the market equilibrium condition for a good

Equilibrium



Market structures

Market structures

- This condition holds only in one type of market structure
  - Perfect competition

- As competition goes down, market conditions change
  - Producers get more power to determine prices
  - Make more profits

- Causes inefficiency in markets
  - Dead-weight loss

	Perfect Competition	Pure Monopoly	Monopolistic Competition	Oligopoly
Number of Sellers in the Market	many	one	many	few
Type of Item(s) Sold	identical	unique	differentiated	varies
Market Power of an Individual Seller	none	very high	some	substantial
Entry Barriers	none	very high	none	some
Long-Run Economic Profit	zero	positive	zero	varies
Profit-Maximizing Condition	MC = P	MC = MR	MC = MR	varies

Pareto efficiency

Endowment exchange economy

- Lets assume 10 agents own different quantities of a good (lets say money)
  - Agent 1 has $9.01
  - All the rest have 10 cents each

- To make the 9 better off, money will have to be taken from Agent 1 and given to the rest.
  - Agent 1 will be make worse off

- Is it fair?
- Is it efficient?

Endowment exchange economy

- There are $10 and 10 agents
- All agents have 99 cents each (or $9.9 in total)
  - 1 cent is lying on the table

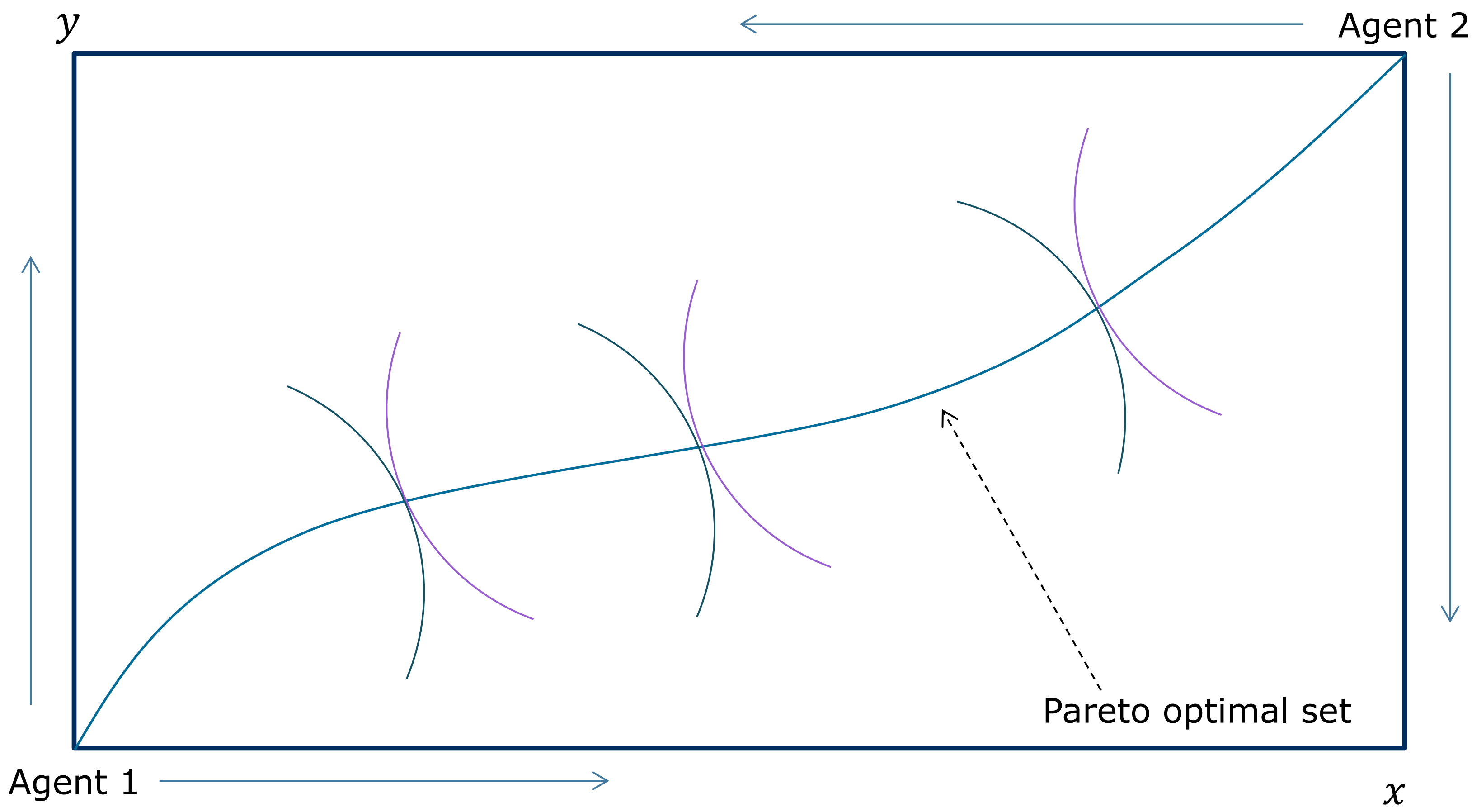
- Is this fair?
- Is this efficient?

- *Pareto efficiency is the allocation of resources in which it is impossible to make any one individual better off without making anyone else worse off.*

- In neo-classical economics, a lot of focus is on efficiency

Edgeworth box

- 2 agents x 2 goods



General Equilibrium

- General equilibrium (GE) analysis:
  - looks at the impact of ALL markets
- Partial equilibrium analysis:
  - looks at the impact of one market, assuming all other markets are not changing
- A lot of theory and hypotheses have been developed in GE analysis

Walras' Law

- Walras' Law:
  - At a given set of prices, excess demand is always 0.
  - Excess demand in one market is offset by negative demand in another
- If $n-1$ markets are in equilibrium, then the n market will be in equilibrium
- Has huge implications in Labor Economics:
  - If all good markets are in equilibrium, then the labor market must be in equilibrium

Fundamental theorems of Welfare Economics

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- First fundamental theorem (Pareto optimal allocation)
  - Markets will result in an efficient and optimal distribution of resources.
  - If you cannot increase your utility without making anyone worse off, you are at a Pareto optimal solution.
  - Efficiency

- Second fundamental theorem (Invisible hand theorem)
  - Given initial endowments of agents, markets will result in an efficient distribution of endowments (wealth).
  - Allocation

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Some issues

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- One agent holding all wealth is also a Pareto optimal solution
  - Internalizing inequality as a market efficiency argument

- No discussion how to transition between one Pareto efficient point to another
  - Equilibriums are stable, stationary, and unique

- Can result in low wages and high inequality(key area of debate between different schools)

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Other concepts

Game theory

- John Nash’s Prisoner’s Dilemma
  - Nash equilibrium: Solution of a non-cooperative game can result in a zero-sum outcome and is Pareto optimal
  - Generalized the von Neumann theorem

- Assumptions
  - Agents will maximize their pay-offs
  - Agents have “common knowledge” of own/other players, current and future outcomes
  - Agents know how others will behave and know their strategies
  - Agents will always make the right move

Game Theory

- Extensions
  - Repeated Prisoner’s Dilemma
  - Iterative games
  - Mixed strategies
  - Hotelling’s Law
  - Mexican standoff, etc. etc.

- Applications:
  - Market interactions
  - Industrial Organization (IO)
  - Wars, arms races
  - Experimental economics

Intertemporal optimization

- Suppose an agent lives for two periods
  - Now (p1) and future (p2)

- Agent earns income only in period 1 (p1)
  - Agent consumes part of his income now and saves part of it for consumption in period 2 (p2)

- What is the optimal level of consumption between two time periods, given current income?

- Fischer, Modigliani (life-cycle hypothesis), Friedman (Permanent Income hypothesis)

- Assumptions:
  - Full information
  - Time preference
  - Rational decision making (utility maximization)

Intertemporal optimization

- General equilibrium outcomes imply:
  - All markets, at all time periods much be in equilibrium
  - All agents must be fully rational
  - All agents must have full information:
    - time preferences, income, wealth, consumption, utility functions of all agents
  - All agents must know the strategies of all other agents
- Hence at time 0, the solution of the problem should be know.

Intertemporal Optimization

- Has strong policy implications and one of the most widely used theories:
  - Borrowing against future income (credit cards in the USA)
  - Investment decisions against future profits
  - Polluting now for cleaner environment later
  - Taxes has two model:
    - Pay-as-you-go: Pay for your own retirement benefits
    - Overlapping Generation Model: One generation pays for the next
    - Has implication on demographic, labor, wages debates

- 99% of modeling is General Equilibrium modelling using CGE and DSGE models
  - Very large, complex, computationally intensive models