Econ 1 Midterm 2 Review

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Introduction

- What chapters does midterm 2 cover?
  - Chapters 9-14
    - Including the chapter 10 appendix
- What is the format of the exam?
  - Only 15 multiple choice questions
  - 4 short answer questions
- What do I need to bring?
  - Full page, pink Scantron
  - A pencil/writing utensil
  - A non-graphing calculator

Ch. 9: Decision Making By Individuals and Firms

- What are the most important concepts from this chapter?
  - Explicit versus implicit costs
    - Relation to opportunity costs
  - Accounting versus economic profits
  - Principle of “either-or” decision making
  - Principle of “how much” decision making
  - Sunk costs
  - Irrationality
    - Causes of seemingly irrational behavior (that is actually rational)
    - Causes of truly irrational behavior

Ch. 9: Costs and Profits

- Types of costs
  - Explicit cost: cost that requires an outlay of money
    - Ex: tuition for going to college, cost of books/school supplies
  - Implicit cost: value of foregone benefits
    - Ex: wages you would have earned if you hadn't gone to school
  - Total opportunity cost = explicit costs + implicit costs
- Types of profits
  - Accounting profit = revenue – explicit costs
    - This is the type of profit businesses tend to report
  - Economic profit = revenue – explicit costs – implicit costs
    - Takes the total opportunity cost (i.e., both implicit and explicit costs) into account

Ch. 9: Either-or Decision Making

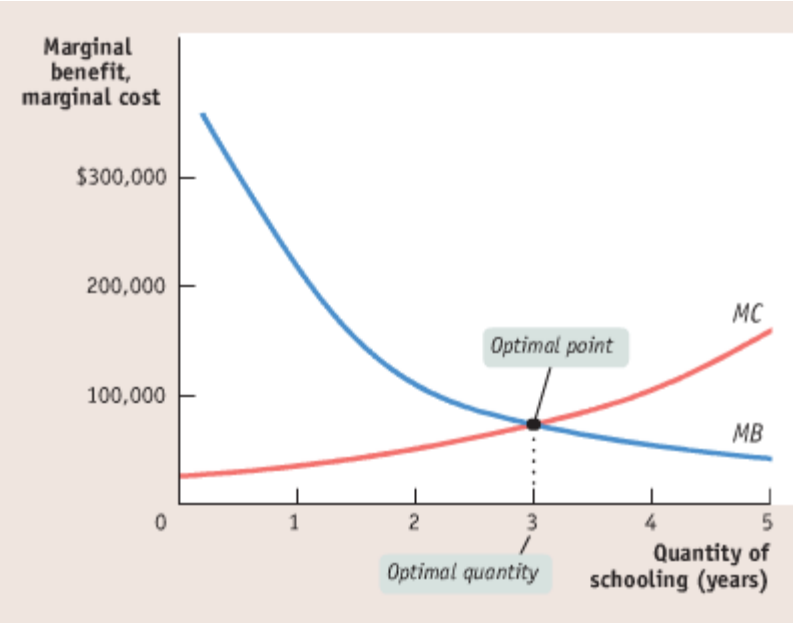
- What is an “either-or” decision?
  - When one must choose one activity/action when faced with potential two options
- Either-or decision making principle
  - It is optimal to choose the activity/action with positive economic profit
- Example: should Mary run her own restaurant or work as an accountant?
  - If she becomes an accountant
    - Annual salary as accountant = $100,000
  - If she runs her own restaurant
    - Annual revenue = $200,000
    - Annual explicit cost of running restaurant (materials, wages, etc.) = $50,000
  - Economic profit of running restaurant
    - = revenue – explicit costs – implicit costs = $200K – $50K – 100K = $50K
  - Economic profit of being an accountant
    - = $100K – $0 – $150 = -$50K
      - Mary should run the restaurant!

Ch. 9: How Much Decision Making

- How much decisions require the use of marginal analysis
  - Marginal cost: additional cost incurred by producing/consuming one more unit of a good or service
    - MC = change in total cost/change in Q
  - Marginal benefit: additional benefit reaped by producing/consuming one more unit of a good or service
    - MB = change in total benefit/change in Q
- What do the MC and MB curves look like?
  - In principle, both curves could be increasing (upward sloping), decreasing (downward sloping) or constant (flat)
    - Generally, we think of MC as being increasing
      - As I increase production, the MC of each additional unit rises
    - Generally, we think of MB as being decreasing
      - As I eat more and more pizza, each additional slice gives me lower MB

Ch. 9: How Much Decision Making

- Principle of "how much" decision making: the optimal quantity of production/consumption is the quantity at which MC = MB for the last unit produced/consumed
  - If there is no quantity for which MC = MB exactly, choose the largest quantity where MC <MB



Ch. 9: Sunk Costs

- What is a sunk cost?
  - A cost that has already been incurred and is non-recoverable.
- Should we consider sunk costs in the decision making process?
  - NO! Sunk costs should be ignored when making decisions about future actions.
    - You've already paid the sunk cost whether or not you undertake some action, so it should not be factored into the current costs of a decision
- Ex: You recently replaced your transmission fluid at a cost of $250. Soon after, you find out that your whole transmission needs to be replaced at a cost of $1500.
  - Alternatively, you could sell your car and buy another at a cost of $1600
    - Cost of transmission fluid is a sunk cost and should be ignored the decision to repair your car or sell it
    - In this case, you should repair your car

Ch. 9: Irrationality

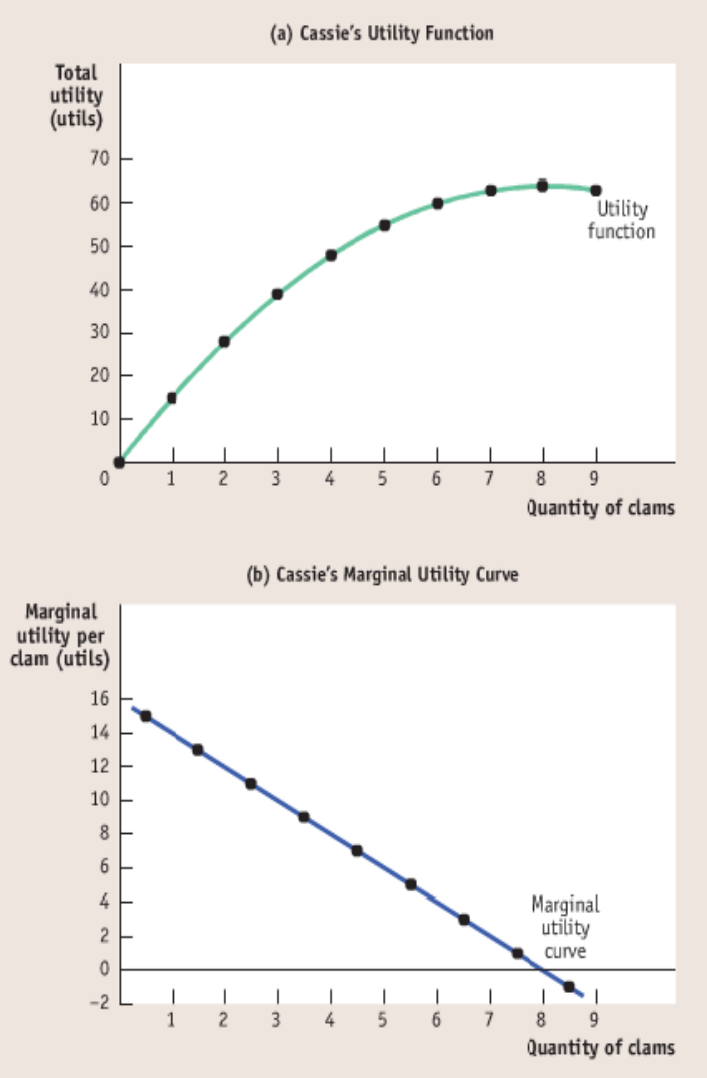
- Causes of seemingly irrational behavior that is actually rational
  - Concerns about fairness
  - Bounded rationality: making a choice that is close to (but is not exactly) the best choice
    - It can take a bit of mental effort to figure out the best choice…sometimes "close enough" is okay
  - Risk aversion: willingness to avoid some economic payoff in order to avoid a potential loss
- Causes of truly irrational behavior
  - Misperceptions of opportunity costs
  - Overconfidence
  - Unrealistic expectations about the future
  - Counting dollars unequally
    - Ex: splurging after receiving your tax return, buying something because it's on sale
  - Loss aversion: oversensitivity to loss
    - Can lead to an unwillingness to recognize a loss and move on
  - Status quo bias: tendency to avoid making a decision altogether

Ch. 10: The Rational Consumer

- What are the most important concepts from this chapter?
  - The utility function
    - Principle of diminishing marginal utility
  - Graphing the budget line
  - The optimal consumption bundle
    - Marginal utility per dollar rule
  - Decomposing the effects of a price change
    - The income and substitution effects
  - Graphical analysis of the optimal bundle
    - Indifference curves
      - Properties of
      - Slope of (marginal rate of substitution)
    - Tangency condition
    - Effect of a shift/pivot of the budget line

Ch. 10: Utility

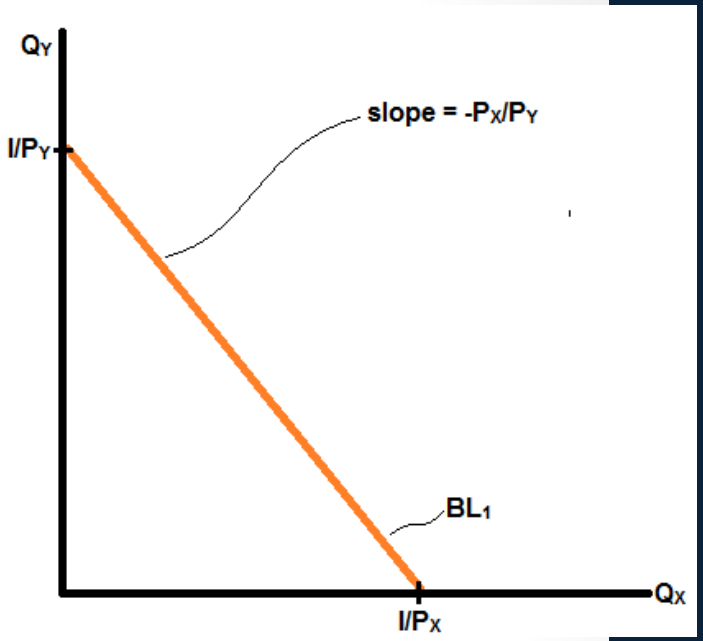
- What is utility?
  - Measure of satisfaction from consumption
  - The utility function shows the relationship between the consumption bundle and the total utility it generates
    - Consumption bundle: combination of goods/services one consumes
- What is marginal utility?
  - Marginal utility (MU): the change in total utility from consuming one more unit of a good or service
    - Mathematically: $MU=\Delta TU/\Delta Q$
- Principle of diminishing marginal utility
  - Each additional unit consumed adds less to total utility than the previous unit
    - That is, marginal utility decreases as the quantity consumed increases



Ch. 10: The Budget Line

- Budget constraint
  - The total cost of a consumer's consumption bundle must be less than or equal the consumer's income
    - We assume no borrowing or savings
      - Implies we always spend all of our income
  - Mathematically, we can express the budget constraint as follows:

    $P_X*Q_X+P_Y*Q_Y = I$ (income)



- Budget line
  - Graphical representation of the budget constraint in Q_X-Q_Y space
    - Putting the budget constraint in slope-intercept form (i.e., y = mx+b)

      $Q_Y = -(P_X/P_Y)*Q_X+(I/P_Y)$
  - Shows all the possible consumption bundles that exhaust all of the consumer's income
    - When graphing the budget line, make sure to label the intercepts!

Ch. 10: Optimal Bundle

- What is the optimal consumption bundle?
  - Bundle that maximizes utility while satisfying the consumer's budget constraint
- Marginal utility per dollar rule
  - What is marginal utility per dollar?
    - MU/P
      - "bang for your buck"
  - The marginal utility per dollar spent must be equal across all goods in the optimal consumption bundle

    $MU_X/P_X = MU_Y/P_Y$
    - Why is this optimal?
      - If the above doesn't hold, we can increase total utility by shifting spending to the good with the higher MU/P

Ch. 10: Sub and Income Effects

- We know (from the law of demand) that as the price of a good falls, that quantity demanded rises
  - We can decompose the effect of this price change into two components
    - Substitution and income effects
- Substitution effect
  - Change in quantity consumed that results after a price change because consumers shift consumption to the relatively cheaper good
    - We substitute the relative more expensive good for the relatively cheaper good
- Income effect
  - Change in quantity consumed that results from a change in consumer purchasing power that is caused by a price change
    - When price goes up, purchasing power falls ➔ "poorer" in terms of what we can buy
  - When real income falls after a price increase, demand will change
    - Inferior good: increase in demand caused by income effect
    - Normal good: decrease in demand caused by income effect

Ch. 10: Indifference Curves

- What is an indifference curve (IC)?
  - Curve that shows all the possible consumption bundles that yield the same amount of utility
    - Utility is constant along a given IC
- Properties of indifference curves
  - ICs never cross
    - Why? If two ICs did cross, this would imply that the consumption bundle at the intersection of the two ICs yields two different levels of utility
  - The further an IC is from the origin, the higher level of utility associated with that curve
    - Utility increases as we move northeast from the origin
  - ICs are downward sloping
    - To keep utility constant along a given IC, as I decrease consumption of good X (which lowers utility) I must increase consumption of good Y to counteract the effect on utility of consuming less of good X
  - ICs are convex (bowed in towards the origin)
    - Consequence of the principle of diminishing marginal utility

Ch. 10: Marginal Rate of Substitution

- What is the slope of the indifference curve?
  - The marginal rate of substitution (MRS)
    - Conceptually, the MRS is the rate at which I am willing to exchange one good for another
      - i.e., how much of good Y I am willing to give up to get one more unit of good X
    - Mathematically, the MRS = $-(MU_X/MU_Y)$
  - Derivation
    - Change in utility as I move along a given IC is given by

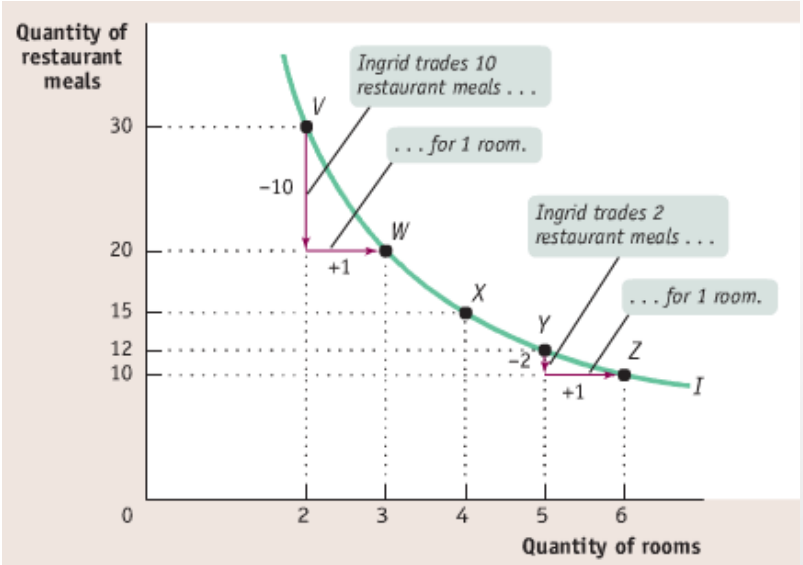
$$\Delta Q_X * MU_X + \Delta Q_Y * MU_Y = 0$$

      - This is equal to 0 because the level of utility is CONSTANT along a given IC
    - Slope is "rise/run", or $\Delta Q_Y/\Delta Q_X$ ➔ solving the above equation for this

$$\frac{\Delta Q_Y}{\Delta Q_X} = -\frac{MU_X}{MU_Y}$$

Ch. 10: Marginal Rate of Substitution

- The principle of diminishing MRS
  - The marginal rate of substitution (of good X for good Y) falls as I consume more and more of good X (and less and less of good Y)
    - That is, the IC curve gets flatter as I increase consumption of good X and decrease consumption of good Y
  - Why? ➔ diminishing marginal utility
    - When I consume very little of good X, I am willing to give up a lot of good Y to get another unit of X
      - High Y consumption ➔ low MU_Y
      - Low X consumption ➔ high MU_X
        - Together ➔ high MRS (MU_X/MU_Y)
    - When I consume a lot of X (and not much Y), I am not willing to give up much of Y to get another unit of X



Ch. 10: The Tangency Condition

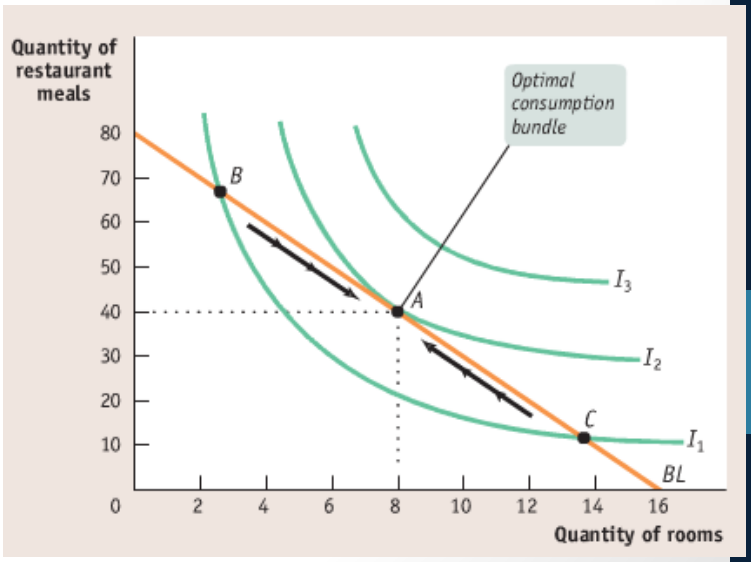
- How can we graphically illustrate the optimal consumption bundle?
  - The optimal consumption bundle is given by the point where the budget line is tangent to the highest-utility IC curve
  - What does it mean to be "tangent"?
    - Tangency implies that the budget line is just touching (but not intersecting) the IC at the optimal bundle
      - Ex: point A
    - Mathematically, it means that the slope of the budget line is just equal to the slope of the IC at the optimal bundle
      - Slope of budget line = $-(P_X/P_Y)$
      - Slope of IC = MRS = $-(MU_X/MU_Y)$
      - At the optimal bundle

$$-\frac{P_X}{P_Y} = -\frac{MU_X}{MU_Y}$$

        - We can rearrange this a bit…

$$\frac{MU_Y}{P_Y} = \frac{MU_X}{P_X}$$

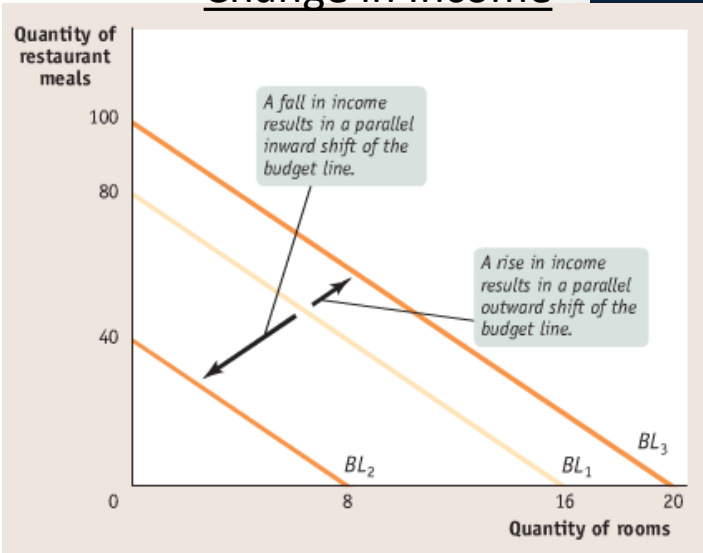
        - …to get the marginal utility per dollar rule!



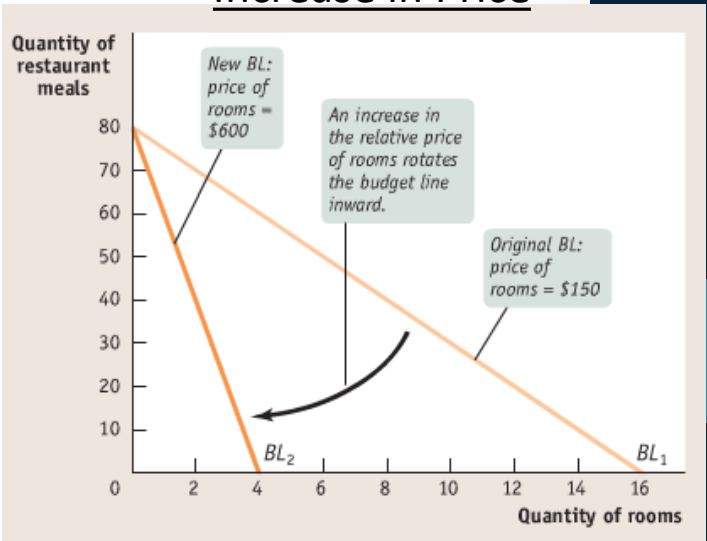
Ch. 10: Changes in the Budget Line

- What are the intercepts of the budget line?
  - X-axis intercept = income/P_X
  - Y-axis intercept = income/P_Y
    - If income or price(s) change, the budget line will move
- Change in income ➔ parallel shift
  - Both intercepts change by the same proportion
    - Increase in income ➔ shift out
    - Decrease in income ➔ shift in
- Change in price ➔ pivot
  - Change in the intercept of the good whose price changed
    - Increase in price ➔ pivot in
    - Decrease in price ➔ pivot out
- The optimal bundle will change after a change in income or prices

Change in Income



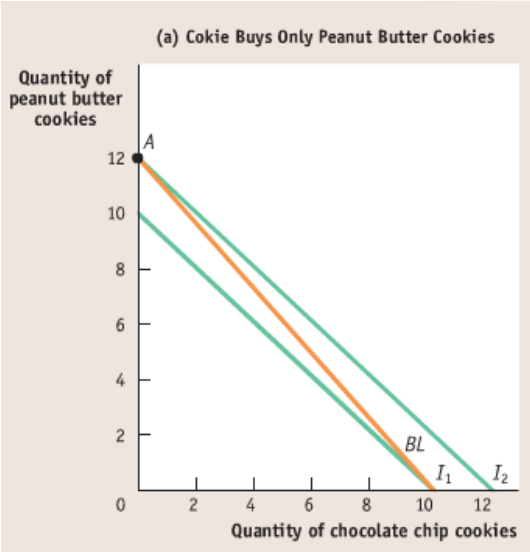
Increase in Price



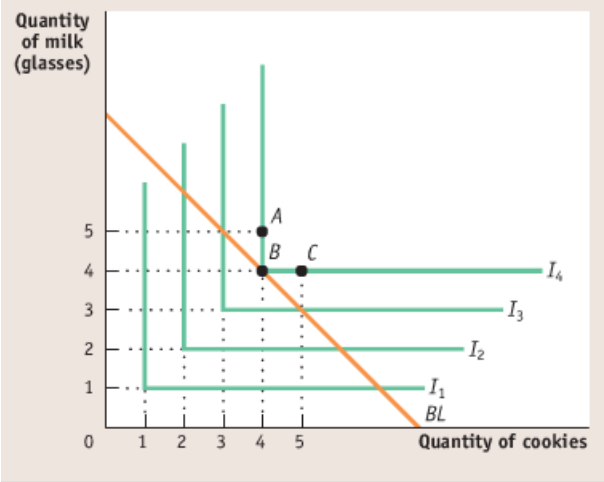
Ch. 10: Special Indifference Curves

- Perfect Substitutes
  - Two goods are perfect substitutes when the MRS between the two goods is constant
    - Will always be willing to exchange one good for the other at a constant rate
  - Constant MRS ➔ linear (straight-line) ICs
    - This will yield a corner solution
      - Consume only one good, none of the other
        - Specifically, one will consume the good with the higher MU/P
- Perfect complements
  - Two goods are perfect complements when one always want to consume the goods in the same ratio regardless of price
  - "L"-shaped ICs

Perfect Substitutes



Perfect Complements



Ch. 11: Behind the Supply Curve

- What are the most important concepts from this chapter?
  - The production function and inputs
    - Variable versus fixed inputs/ short-run versus long-run
    - Total product, marginal product
      - Diminishing returns to inputs
  - The cost curves
    - Total cost, total variable cost, total fixed cost
    - Average total cost, average variable cost, average fixed cost
    - Marginal cost
  - Graphing the cost curves
  - Long-run average total cost
    - Graphing the LRATC
    - Returns to scale

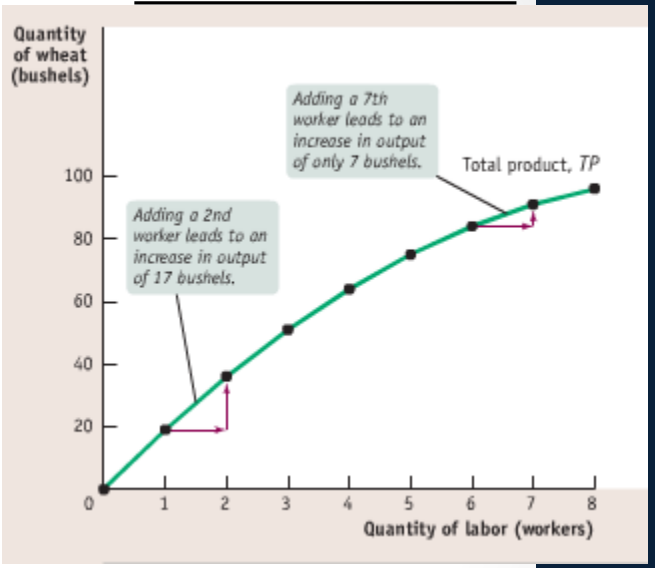
Ch. 11: The Production Function

- What is the production function?
  - Relationship between the quantity of inputs a firm uses and the quantity of output it produces
- Types of inputs
  - Variable inputs: input whose quantity can vary at any time
    - Ex: labor, materials
  - Fixed inputs: input whose quantity is fixed in the short run and cannot be changed
    - Ex: land, capital
- Short-run versus long-run
  - Short-run: period of time in which at least one input is fixed
  - Long-run: period of time in which all inputs are variable

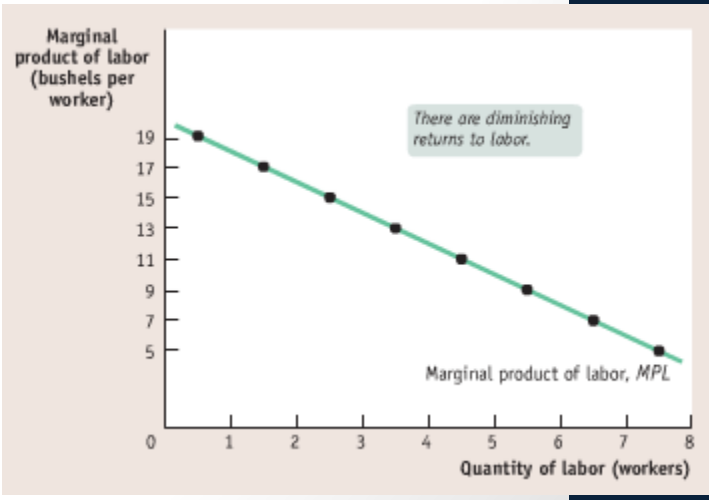
Ch. 11: Total/Marginal Product

- Total product curve
  - Shows how the quantity of output depends on the quantity of the variable input used, for a given amount of the fixed input
- Marginal product
  - Additional output generate by using one more unit of the variable input, for a given amount of the fixed input
  - Mathematically, MP = Δoutput/Δinput
- Diminishing returns to inputs
  - This occurs when the MP of an input declines at the quantity of the input used increases, holding all other inputs constant
- But what happens if we allow the amount of the fixed input to change?
  - Increase in fixed input ➔ shifts TP and MP curves up

Total Product Curve



Marginal Product Curve

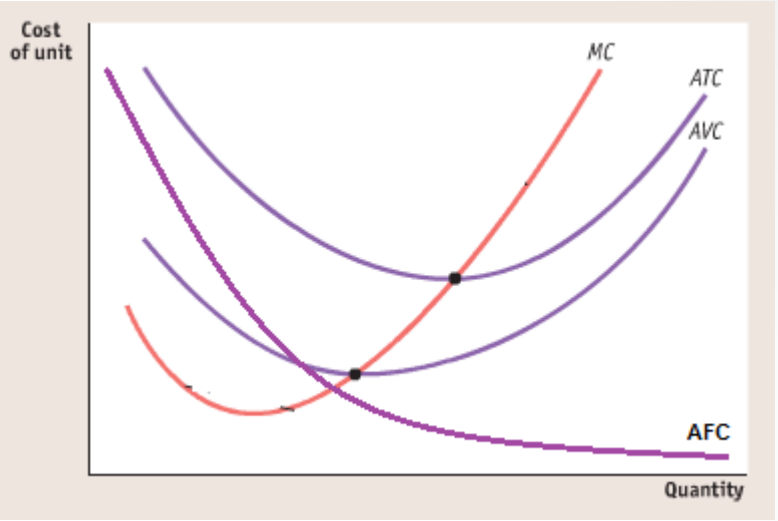


Ch. 11: The Cost Curves

- Types of costs
  - Total fixed cost (TFC): total cost of the fixed input
    - In the short-run, TFC are constant since the amount of the fixed input is constant
  - Total variable cost (TVC): total cost of the variable input
    - TVC is increasing with the amount of the variable input used
  - Total cost (TC): sum of fixed costs and variable costs
    - TC = TVC + TFC
- Average costs
  - Average variable cost (AVC): total variable cost divided by output
    - AVC = TVC/Q
  - Average fixed cost (AFC): total fixed cost divided by output
    - AFC = TFC/Q
  - Average total cost (ATC): total cost divided by output
    - ATC = TC/Q = (TVC+TFC)/Q = AVC + AFC
- Marginal cost
  - The increase in total cost generated by one additional unit of output
    - MC = ΔTC/ΔQ

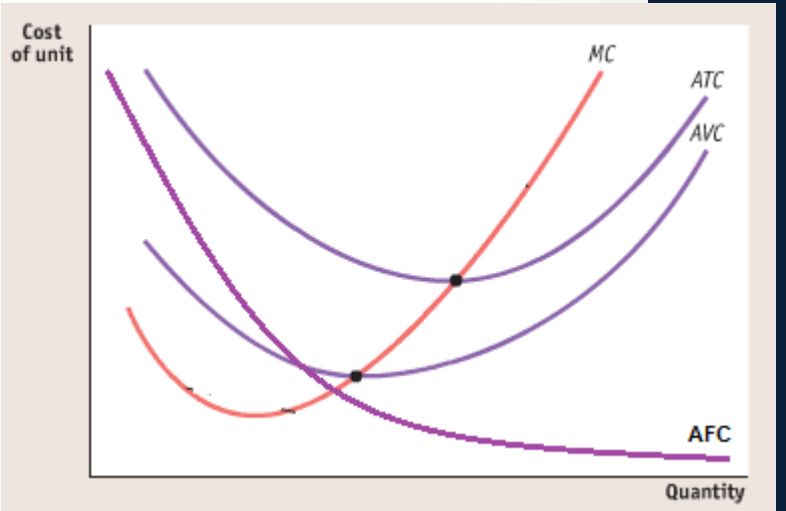
Ch. 11: The Cost Curves

- Graphing the curves
  - "Swoosh" shaped MC curve
    - At low levels of output, MC falls with output due to returns to specialization
      - As I increase output (and thus increase the amount of the variable input), the variable inputs can focus on one part of the production process and become specialized
        - Specialization increases efficiency ➔ lowers marginal cost
    - At some point, the gains from specialization are exhausted and MC rises with output due to diminishing returns to inputs
  - Downward sloping AFC (don't worry about graphing this curve on the exam)
    - Recall, that AFC = TFC/Q
    - In the short-run, TFC is constant
      - As we increase Q, TFC/Q falls
        - This is call the "spreading" effect (i.e., we're spreading out the fixed cost over more units, thus AFC falls)



Ch. 11: The Cost Curves

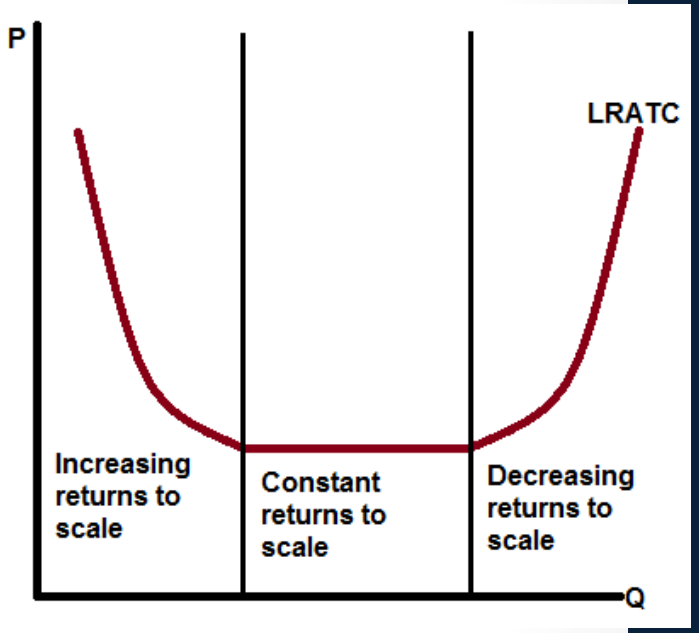
- U-shaped ATC and AVC
  - Recall, ATC = AFC + AVC
    - At low levels of output, the "spreading" effect associated with the AFC causes ATC to fall
    - At some point though, the increase in TC caused by diminishing returns to the variable input causes ATC to rise
  - AVC is U-shaped due to initial gains from specialization and then the eventual diminishing returns to inputs



- MC intersects ATC and AVC at their minimum
  - Think of GPA's…
    - If you have a 3.5 GPA (average) and you receive a 4.0 this quarter (marginal contribution), your GPA will rise
    - If instead you receive a 3.0, your GPA will fall
      - In other words, when MC < ATC (or AVC), the average cost is falling (i.e., the curve is downward sloping)
      - When MC > ATC (or AVC), the average cost is rising (i.e., upward sloping)
  - If your graphs on the exam do not reflect this, you will be docked points!!
- The gap between ATC and AVC falls as output increases
  - This is because AFC (which is the difference between ATC and AVC) falls with output

Ch. 11: Long-Run Costs

- What is the long-run average total cost curve (LRATC)?
  - Shows the relationship between average total costs and output when the amount of the fixed cost has been chosen to minimize short-run ATC for each level of output
- Returns to scale
  - Increasing returns to scale: when LRATC falls as output increases
    - Downward sloping portion of the LRATC
  - Decreasing returns to scale: when LRATC increases as output increases
    - Upward sloping portion of the LRATC
  - Constant returns to scale: when LRATC is constant as output increase



Ch. 12: Perfect Competition

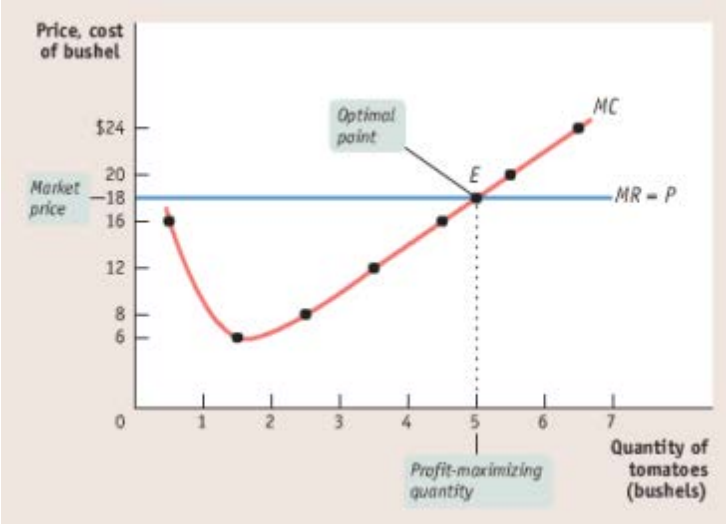
- What are the most important concepts in this chapter?
  - Characteristics of a perfectly competitive market
  - Profit maximization in perfect competition
    - The marginal revenue curve
    - Profit maximizing rule
    - Graphical analysis
      - Identifying profits and losses
  - The shut-down decision in the short-run
  - The short-run supply curve
  - Long-run market equilibrium
    - Zero profits condition
    - Adjustment from the short-run to the long-run

Ch. 12: Perfectly Competitive Market

- What are the characteristics of a perfectly competitive (PC) market?
  - All producers and consumers are price takers
    - Take the market price as given; output/consumption decisions do not affect the market price
    - A producer in a PC can sell as much or as little output as he/she wants at the given market price
  - Output is standardized
    - All products in a given market look exactly the same regardless of who produced them
  - Free entry and exit in the long-run
    - Firms can easily enter the market or leave
      - Firms will enter if incumbent firms are earning profits
      - Firms will exit if they are losing money in the long-run
        - …more on this soon…

Ch. 12: The PC Firm's Output Decision

- We've already discussed the cost curves for a firm in chapter 11…
  - But what about the revenue side?
  - Marginal revenue: increase in total revenue generated by selling an additional unit of output
    - MR = $\Delta TR/\Delta Q$, where TR = Q*P
    - For a price-taking, PC producer MR = P
      - MR is a horizontal line at the market price
- How much should the PC firm produce?
  - Optimal output rule: a firm should produce until MC = MR
    - For the PC firm, this implies that they should produce until MC = P

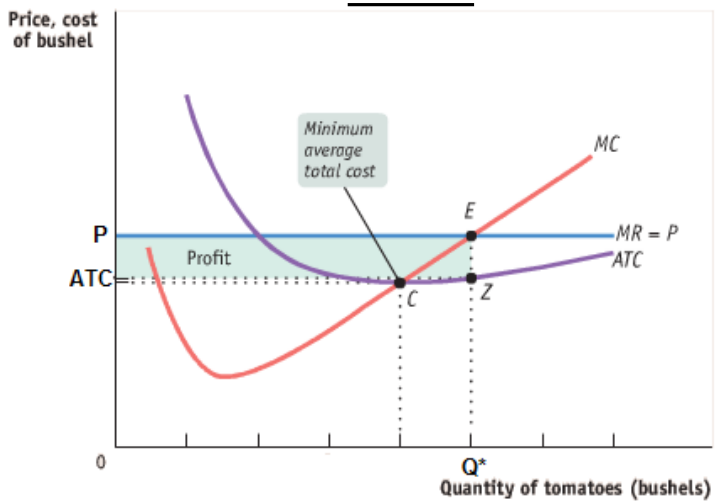


Ch. 12: Identifying Profits/Losses

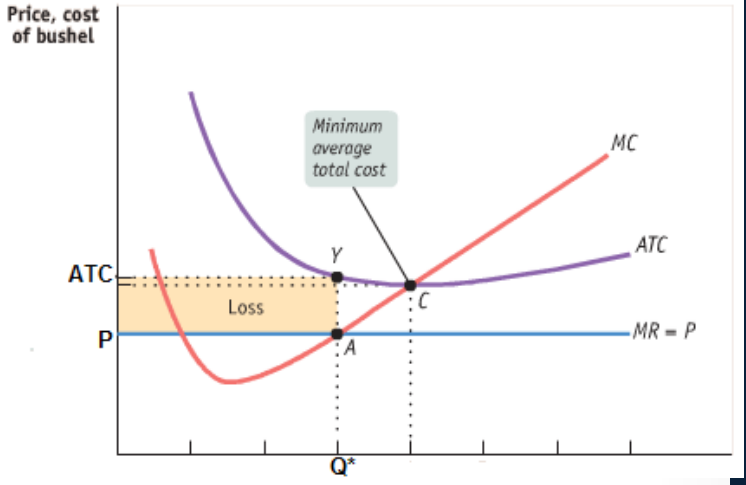
- What are profits?
  - Profits = TR-TC = P*Q – ATC*Q = (P – ATC)*Q
    - If P > ATC, profits are positive
    - If P < ATC, profits are negative
    - If P = ATC, the firm just breaks even
- To identify profits on our graph, we need to draw in the ATC curve
  - Step 1: set up the graph and draw in the MC and ATC curves
  - Step 2: draw in the (horizontal) MR curve
    - If you want to show a firm earning positive profits, draw MR above the minimum of the ATC
    - If you want to show a firm earning negative profits, draw MR below the minimum of the ATC
    - If you want to show a firm just breaking even, draw MR exactly at the minimum of the ATC
  - Step 3: find the optimal quantity where MR = MC
  - Step 4: find the ATC at the optimal quantity
    - Go straight up from the opt. qty. until you hit the ATC curve
  - Step 5: Identify profits/losses
    - This will be the rectangle whose length is equal to the optimal quantity, and whose height is the segment between ATC and P

Ch. 12: Identifying Profits/Losses

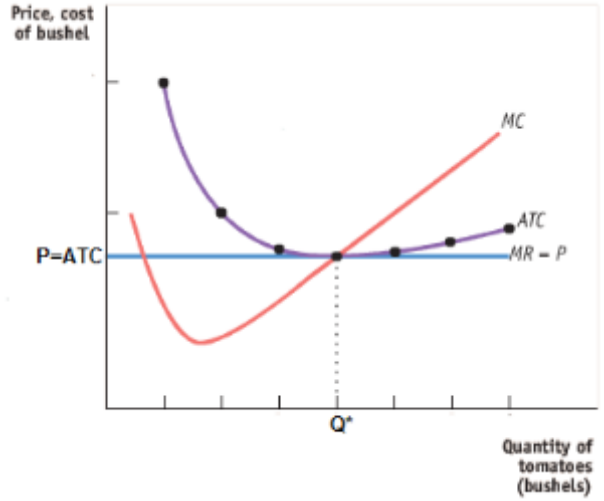
Profits



Losses



Break Even



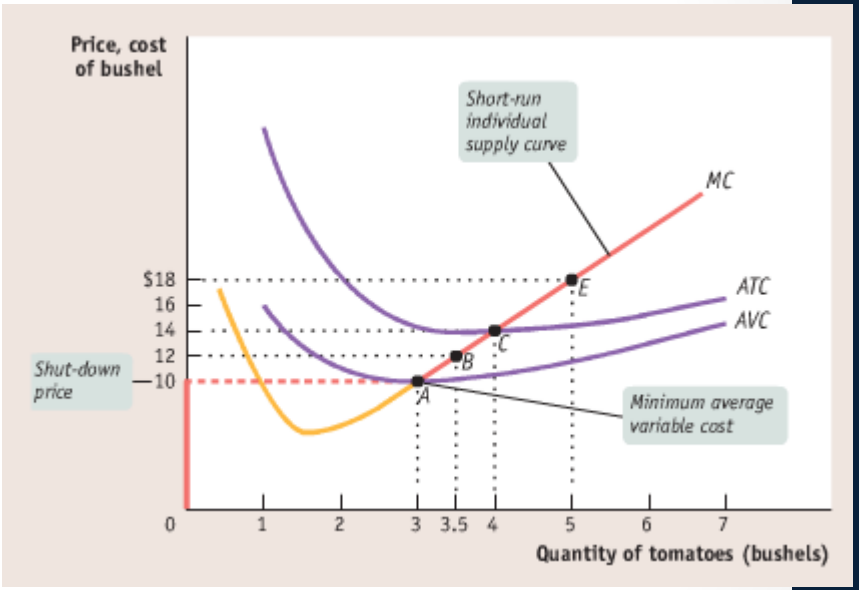
Ch. 12: The Shut-Down Rule

- When should a firm shut-down (i.e., set Q = 0) in the short-run?
  - It is not necessarily optimal for a firm to shut-down in the short-run if it is losing money
    - Why? ➔ fixed costs
    - A firm must pay its fixed cost regardless of whether it produces or not, but it can avoid its variable costs by shutting down
      - If they can make enough revenue to pay their (potentially avoidable) variable costs they can use whatever is left over to help pay some of their (unavoidable) fixed cost
      - If they just shut-down, they would have to pay all of their fixed cost
  - Short-run shut-down rule: a PC firm should shut down in the short-run if price is below the minimum AVC
    - Minimum of the AVC is called the shut-down price
      - No shut-down profits (NSDP) = P*Q-ATC*Q = P*Q-AVC*Q-FC
      - Shut-down profits (SDP) = -FC
        - When will SDP > NSDP?

$$-FC > P * Q - AVC * Q - FC$$
$$0 > P * Q - AVC * Q$$
$$AVC > P \Rightarrow shutdown!$$

Ch. 12: The SR Firm Supply Curve

- What is the supply curve for an individual perfectly competitive firm?
  - If P < minimum ATC, the firm shuts down and produces zero
    - SR supply is vertical at zero up until the shut-down price
  - If P > minimum ATC, the firm produces where P = MC
    - At all prices above the shut-down price, the MC tells us what quantity the firm will produce at various prices
      - That is, the portion of the MC curve that is above the shut-down price is the individual firm's short-run supply curve

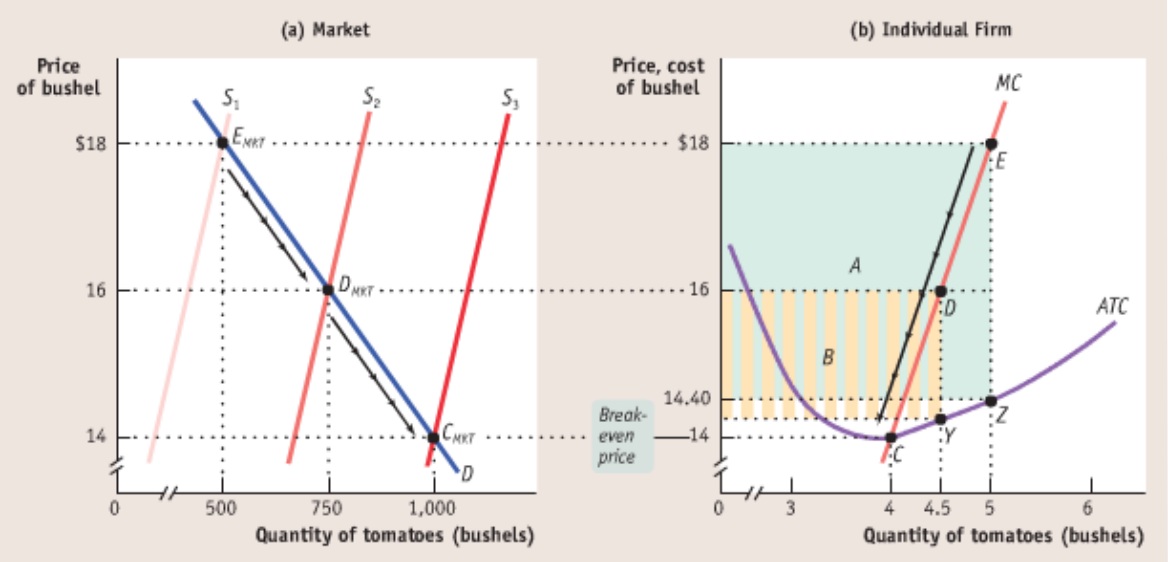


Ch. 12: Long-Run Market Eq.

- What does it mean for a perfectly competitive market to be in a long-run equilibrium?
  - Quantity supplied = quantity demanded
  - No producer has the incentive to enter or exit the industry
- When does a producer exit or enter an industry?
  - In the LR (when entry and exit occurs), there are no fixed costs, thus AVC=ATC
    - If a firm is consistently earning negative profits, they will exit
    - If firms are consistently earning positive profits, other firms will be attracted to the market (by the prospect of profits) and enter
  - It must be the case that profits are zero in the LR if no firm wishes to enter or exit the industry

Ch. 12: Long-Run Market Eq.

- How do we get from a SR equilibrium where firms are earning negative/positive profits to a zero profit LR equilibrium?
  - If firms are earning profits in the SR…
    - In the LR the prospect of profits attracts entrants into the industry…
    - …this increases the number of producers in the market…
    - …which increases the industry supply…
    - …which pushes the market price down
      - Entry will continue/the price will keep falling until P = min ATC and profits are zero



Ch. 13: Monopoly

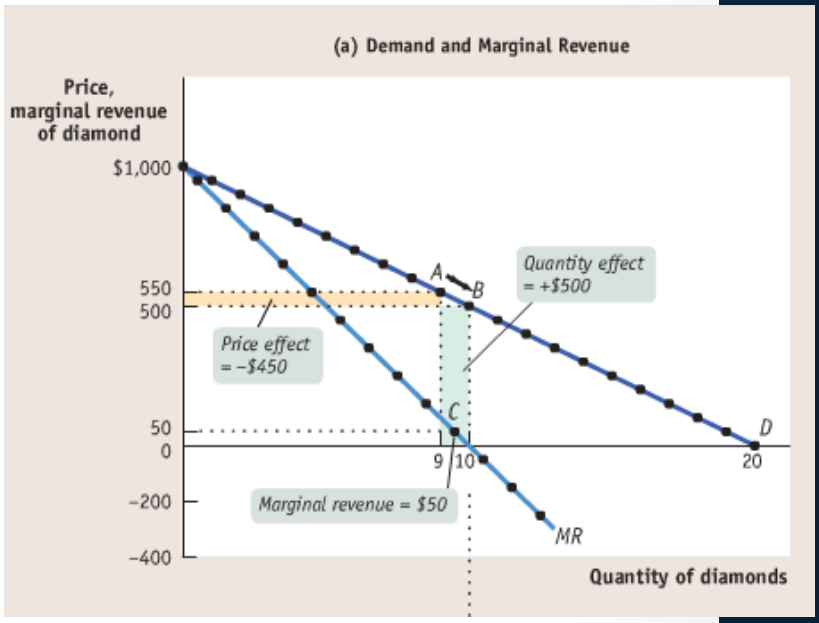
- Characteristics of a monopolist market
  - Barriers of entry
- The profit maximizing monopolist
  - Marginal revenue for a monopolist
  - Graphical analysis
    - The monopolist price and quantity
    - Deadweight loss generated by monopoly
- Natural monopoly
  - What is it?
  - Graphical analysis
    - Unregulated versus regulated
- Price discrimination

Ch. 13: Characteristic of Monopoly

- What is a monopoly?
  - It is when an industry is controlled by only one producer, called a monopolist
    - The monopolist has complete power over setting the price of the good by choosing the quantity they produce
- How do monopolies arise? ➔ barriers to entry
  - Control of a scarce input or resource
  - Increasing returns to scale
    - Higher output ➔ lower ATC ➔ more profitable
      - Big firms push smaller firm out by exploiting increasing returns to scale
        - We call this a "natural monopoly"
  - Technological superiority
  - Network externality
    - Exists when the value of a good or service increases when more people use the good or service
      - Ex: Facebook and Google+
  - Government created barriers
    - Patents and copyrights

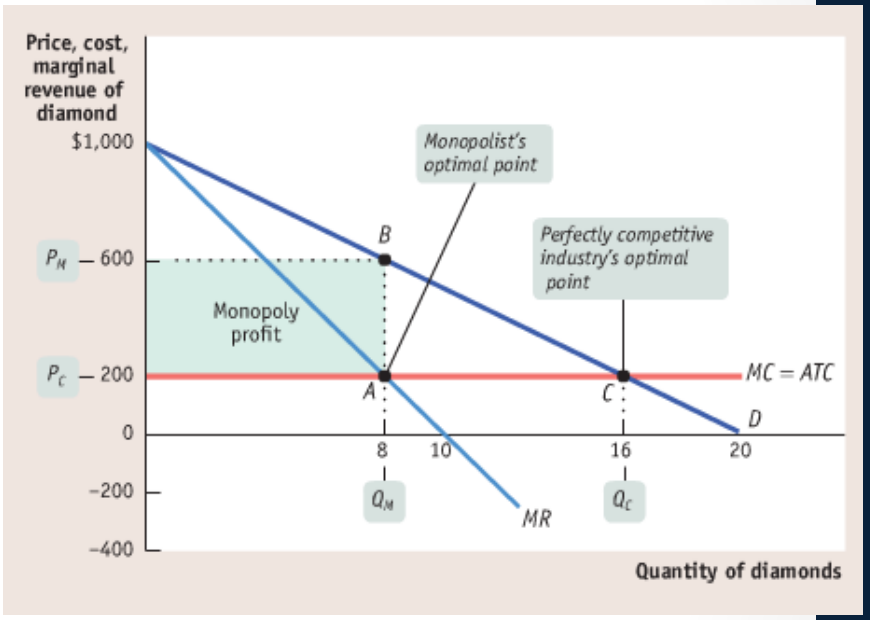
Ch. 13: MR and Demand

- The monopolist faces a downward-sloping demand curve
  - Since the monopolist is the sole producer, the demand curve he faces is the market demand curve
    - Law of demand states that for the market, an ↑ P ➔ ↓ Q_D
    - In order to sell an additional unit of output, the monopolist must lower his price
- The monopolist's MR curve is downward-sloping AND lies below the demand curve
  - Why? Two effects on total revenue (TR=P*Q) when a monopolist sells one more unit of output
    - Quantity effect: selling one more unit ➔ increases TR
    - Price effect: to sell one more unit the monopolist must lower the price on ALL units sold ➔ decreases TR
      - The price effect is what causes MR to lie below the demand curve



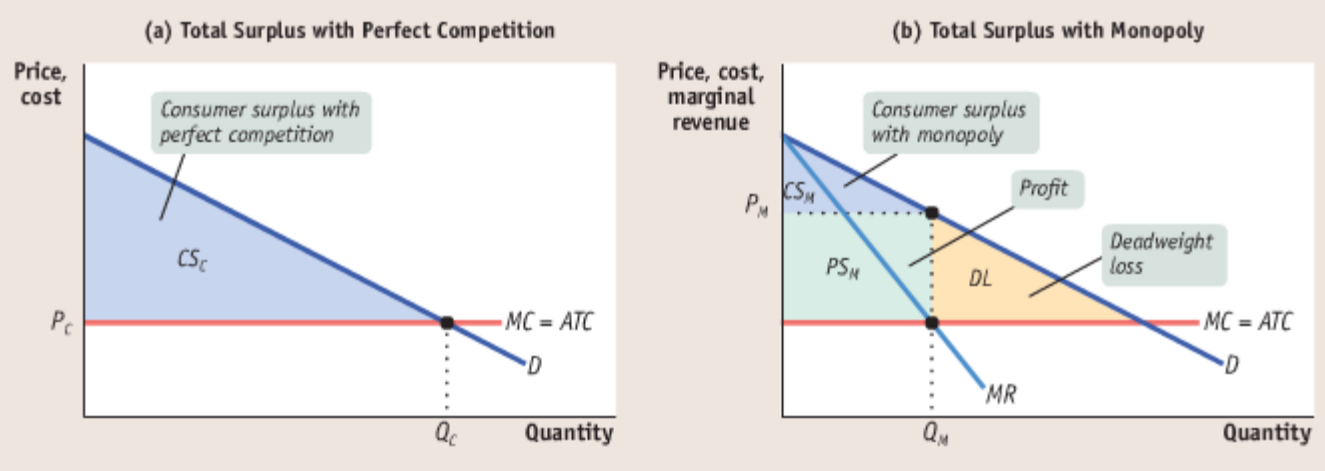
Ch. 13: Profit Max for Monopolists

- The profit maximizing monopolist produces where MR = MC
  - This is the same rule as for the perfectly competitive firm…
    - …but MR is not the same for the PC firm and the monopolist!
- Simple case: no fixed costs, constant MC (implies that MC=ATC)
  - After setting up the graph…
    - Find monopolist Q where MC = MR
    - To find price, go up from the monopolist quantity until you hit the demand curve
      - This is the monopolist price



Ch. 13: Monopolist vs. PC

- Price
  - Monopolist charges a higher price than the PC market price
    - For PC firm, P=MC
    - For monopolist, P>MC, and P>MR
- Quantity
  - Monopolist sells less output than the PC market output
    - This is how the monopolist is able to charge a higher price!
- Welfare
  - In a monopoly, consumer surplus is lower…
  - …and total surplus is lower
    - Monopoly causes deadweight loss

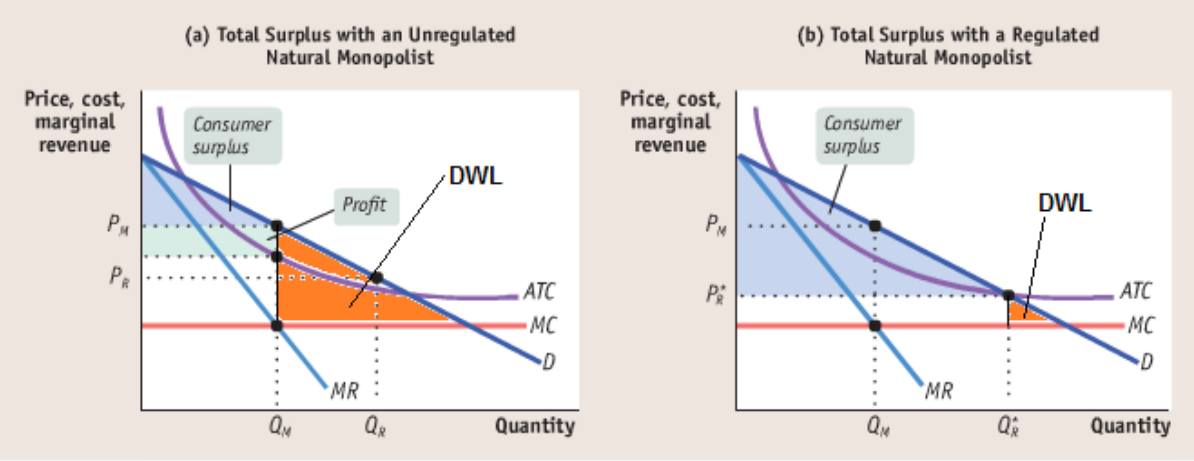


Ch. 13: Natural Monopoly

- What is a natural monopoly?
  - Industry where monopoly power is caused by increasing returns to scale
    - Lower average cost to have one producer versus many
    - Often, these industries are characterized by very high fixed costs of production
      - Ex: railroads (must lay all of the track before selling any output), utilities
  - It's desirable to have one producer (because of the lower ATC), but a natural monopolist will still result in inefficiency by charging $P > MC$
    - Two options to get around this inefficiency:
      - Public ownership: good is provided by the government or a government-owned firm
        - Ex: SMUD (publically owned utilities)
      - Price regulation: limit the price that a natural monopolist can charge

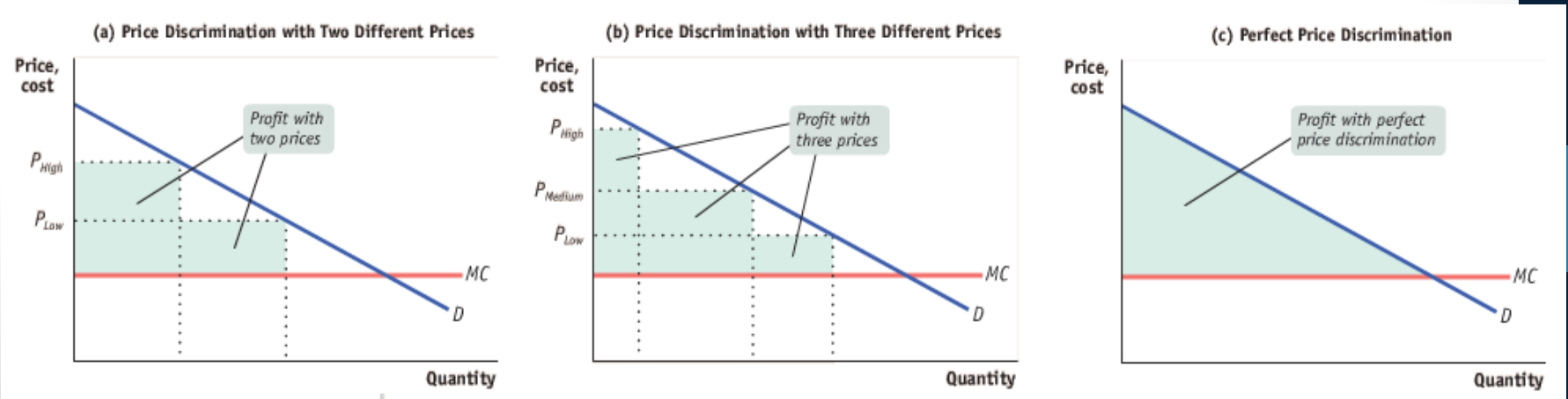
Ch. 13: Natural Monopoly

- Regulated versus unregulated natural monopolist
  - Assumption: MC is fixed, but production is characterized by very high costs of production
    - This implies that ATC is downward sloping and is asymptotic to the MC curve (i.e., gets very close to MC but stays above it)
  - Unregulated ➔ monopolists choose quantity where MR=MC
    - Price is given by the point on the demand curve (NOT MR curve) at that Q
    - Monopolist earns positive profits; CS is small; DWL is large
  - Regulated ➔ monopolist must set P = ATC
    - Price and quantity is given by the intersection of the ATC and demand curves
    - Monopolist earns no profits; CS is large, DWL is small
      - We cannot completely eliminate the DWL because forcing the natural monopolist to produce where MC=D would result in negative profits and drive them out of business



Ch. 13: Price Discrimination

- What is price discrimination?
  - When a seller charges different prices to different customers (or types of customers)
    - Charging multiple prices raises monopolist profits and reduces DWL
- Perfect price discrimination
  - When a seller charges each customer their exact willingness to pay
    - There is no DWL under perfect price discrimination
- Methods of price discrimination
  - Advance purchase restrictions: charge a lower/higher price depending on when the good is purchased
  - Volume discounts: charge a lower cost when larger quantities are purchased
  - Two-part tariffs: flat upfront fee and per-unit fee on each item purchased



Ch. 14: Oligopoly

- What are the most important concepts in this chapter?
  - Characteristics of a oligopolistic market
    - Herfindahl-Hirschman index
  - The case of duopoly
    - Non-cooperative behavior versus collusion
    - Prisoner's Dilemma
    - Overcoming the Prisoner's Dilemma
      - Tit-for-tat and tacit collusion
      - When is tacit collusion hard to acheive?

Ch. 14: Characteristic of Oligopoly

- What are the characteristics of oligopoly?
  - Industry in which there are only a few major producers
    - Products may or may not be standardized
    - Weaker form of monopoly
- Determining if an industry is oligopolistic
  - We use the Herfindahl-Hirschman Index (HHI)
    - Measure of how concentrated an industry is

$$HHI = \sum_{n=1}^{N} (market\ share\ of\ firm\ n)^2$$

      - Sum of all N firms' squared market shares
- Interpreting the HHI
  - HHI < 1500 ➔ competitive industry
  - 1500 < HHI < 2500 ➔somewhat competitive industry
  - HHI > 2500 ➔ oligopolistic industry
- Example
  - HHI = $82^2+7^2+5^2+4^2+2^2$ = 6724+49+25+16+4=6818
    - This is an oligopolistic industry

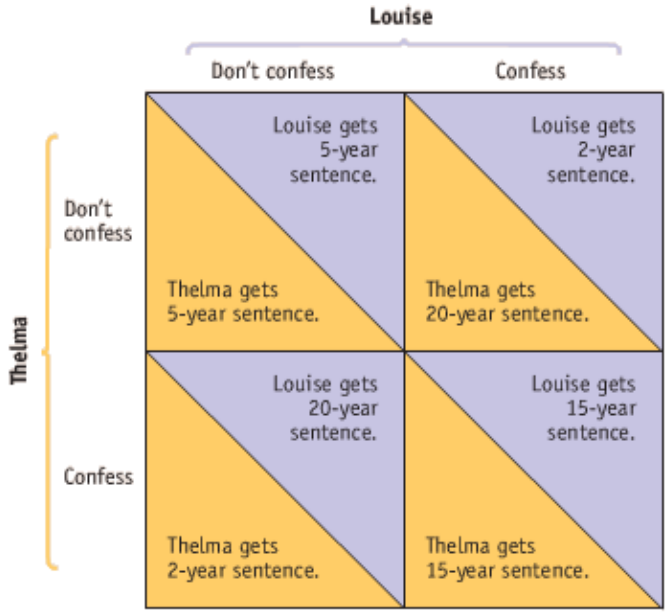
Search engine	Market share
Google	82%
Yahoo!	7
Baidu	5
Bing	4
Other	2

Ch. 14: Duopoly, Cartels, Collusion

- What is a duopoly?
  - An industry with two producers
- Duopoly and strategic interdependence
  - For a given demand curve, the price of a good is determined by the total production of both producers
    - If one producer increases production ➔ price falls for both producers
  - In this simple case, the two firms have two options
    - Engage in non-cooperative behavior
      - Ignore the impact of the other producer's actions on their own profits
        - When each firm acts in its own self-interest (while ignoring the other firm), output goes up, price goes down and profits for BOTH firms fall
    - Collusion
      - Two firms agree to restrict their output to keep price (and profits) high
      - This is better for both firms than non-cooperative behavior…
        - …but there is always the incentive to cheat and increase production to raise profits
        - If both firms cheat, the collusion is likely to break down
      - Collusion is illegal in the US

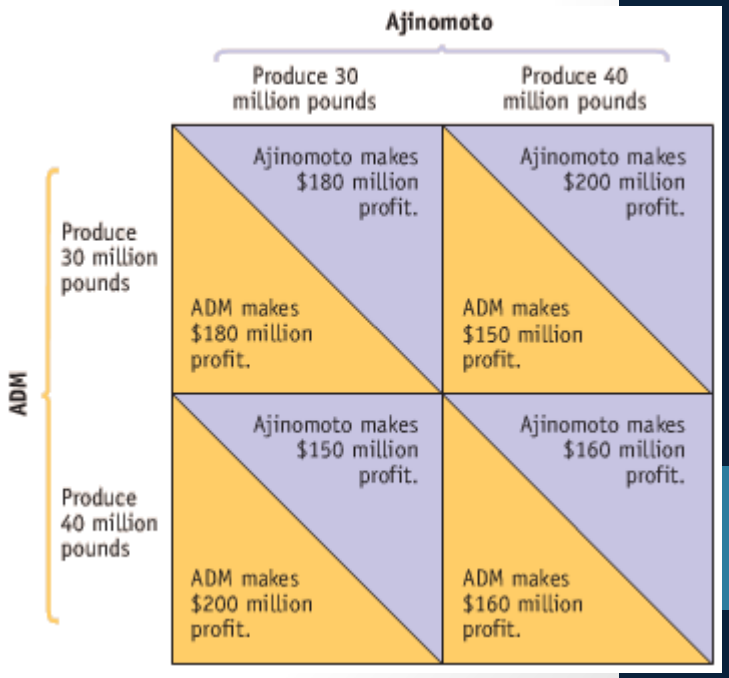
Ch. 14: Prisoner's Dilemma

- The classic example of the prisoner's dilemma
  - We want to know what the Nash eq. will be given the payoffs in the payoff matrix
    - Nash equilibrium: outcome when each player choose the action that makes them best off given what the other player does
  - How to determine the Nash equilibrium
    - For Thelma, ask ourselves what action (confess or don't confess) makes Thelma best off ASSUMING that Louise doesn't confess
      - Assuming Louise does not confess, Thelma gets 5 years if she doesn't confess or 2 years if she does confess
        - So, assuming Louise does not confess, Thelma should confess
    - Assuming Louise does confess, what action makes Thelma best off?
      - Assuming Louise does confess, Thelma gets 20 years if she doesn't confess or 15 years if she does confess
        - So, assuming Louise does confess, Thelma should also confess
    - In this case, Thelma's dominant strategy is to confess
      - Dominant strategy: when an action is a player's best option regardless of the action taken by the other player
    - To find the Nash eq., we would repeat this analysis for Louise
      - Louise will also choose to confess since it is also a dominant strategy for her



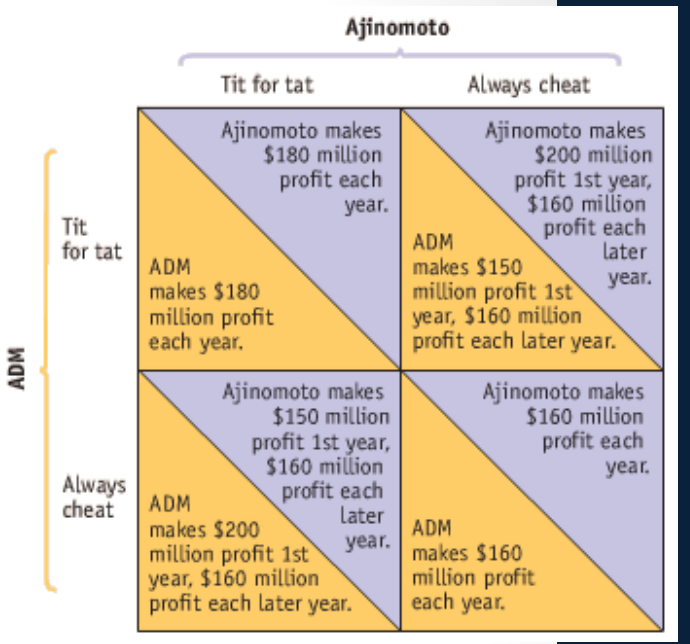
Ch. 14: Prisoner's Dilemma

- Since both players will always choose to confess, the Nash eq. is therefore Confess-Confess
  - Both players each get 15 years in prison
    - Each player has the incentive to cheat…
    - …but doing make both worse off than if they had not cheated
- Prisoner's dilemma applied to an duopoly
  - Will each producer restrict output (cooperate) to raise profits, or raise output (cheat)?
    - For ADM, if we assume that
      - Ajinomoto cooperates ➔ ADM should cheat
      - Ajinomoto cheats ➔ ADM should cheat
        - Dominant strategy for ADM is to cheat
    - Likewise, for Ajinomoto, the dominant strategy is to cheat
  - Both firms will cheat, and the Nash eq. is cheat-cheat
    - Each firms makes only $160m in profits
    - If they had cooperated, they would have made $180m each



Ch. 14: Overcoming Prisoner's Dil.

- The previous examples were one-shot games (only play the game once)
  - What happens if duopolists play the game repeatedly?
- One strategy they could adopt is tit-for-tat
  - Tit-for-tat: play cooperatively first and then do whatever the other player did in the previous period
    - In this case, the two actions the firm could pursue are playing tit-for-tat or always cheating
      - What they end up doing depends on what action they think the other firm will pursue and how long they will play the game for
      - If you think your opponent will always cheat
        - You should always cheat
      - If you think your opponent will play tit-for-tat
        - You should play tit-for-tat if you expect to play the game for a long time
        - You should cheat if you expect the game to end soon



Ch. 14: Tacit Collusion

- What is tacit collusion?
  - When firm limit production and raise prices/profits even though they have not made a formal agreement to do so
    - In the previous example, if both firms think the other will play tit-for-tat AND expect to play the game for a long time…
      - …both will limit production and thus raise prices and the profits of both firms
- When is tacit collusion harder to achieve?
  - Less market concentration
    - When firms have smaller market shares they are less impacted if their rivals choose to raise output
  - Complex products and pricing schemes
    - Makes it harder to determine if another firm is cheating
  - Differences in interests
    - Disagreement over relative market shares, differences in marginal costs
  - When buyers have strong bargaining power over producers
    - Buyers can bargain for lower prices (ex: Walmart)