

*Profit Maximization and  
Competitive Supply*

# Key topics

1. competitive firm is a price taker
2. profit maximization
3. competition in short run (SR)
4. competition in long run (LR)
5. competitive firms earn zero LR profit

# Applications & Problems

- Do competitive firms pass through 100% of cost increases to customers?
- Why are there mini-banks in grocery stores?
- Why do unprofitable steel firms continue to operate for years?
- Which way do manufacturing market supply curves slope?

# Major question facing a firm

"How much output should we produce?"



# Optimal output

to pick profit-maximizing level of output, firm must consider

- its cost function
- how much it can sell at a given price (demand)
- market structure
  - number of firms in the market
  - ease of enter and exit
  - firm's ability to differentiate its product from its rivals'

# Why start with competition

- frequently observed market structure
- has desirable properties, so it is useful to compare other market structure to competition

# Competition

- consumers believe that all firms sell *identical products*
- firms *freely enter and exit* market
- *buyers and sellers know the prices* charged by firms
- *transaction costs are low*

# Price taking

- if all 4 conditions hold each firm is a price taker: firm cannot affect market prices
- even if some of conditions don't hold, firms may be price takers
- for example, if entry of new firms is limited but there are many firms, no firm can successfully raise its price

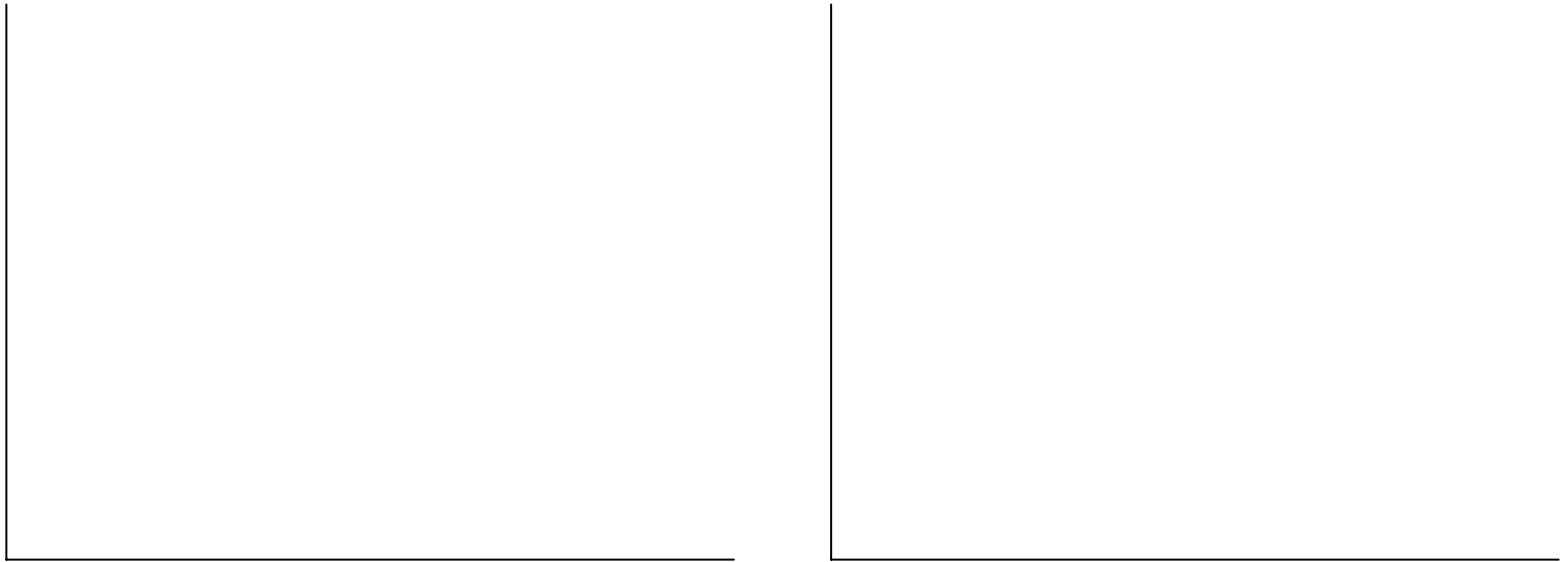
# Meaning of “competitive firms”

- to most people: firms that are rivals for the same customers
- to economists:
  - firm is a price taker
  - competitive firm ignores individual rival's behavior in deciding how much to produce

# Why would a competitive firm be a price taker?

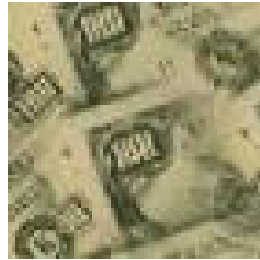
- *answer*: it has no choice
- competitive firm faces a demand curve that is horizontal at the market price

# Residual Demand Curve



# Profit maximization

- economists assume that a firm maximizes its profit



- competitive firm that did not profit maximize would lose money and be driven out of business



# NON SEQUITUR *Wiley Miller*

ESTER'S  
DISAPPOINTMENT  
IN DISCOVERING  
THE SECRET OF  
STONEMAN'S LIFE...

Illustration by Wiley Miller

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# Profit



# Business vs. economic profit

- business profit: revenue minus business cost (only explicit cost)
- economic profit: revenue minus economic cost (explicit + implicit cost: opportunity cost)
- because explicit cost  $\leq$  economic cost, business profit  $\geq$  economic profit
- we always use economic profit

# Example: Own your own firm

- you pay explicit costs (wages, materials,...)
- you do not pay yourself a salary
- you receive a business profit of \$20,000 per year
- your opportunity cost is \$25,000,
- so you have an economic loss of \$5,000

# Profit function

# Two steps to maximizing profit

to maximize its profit, any firm (not just competitive firms) must answer two questions:

- *output decision*: if the firm produces, what output level,  $q^*$ , maximizes its profit or minimizes its loss?
- *shut-down decision*: is it more profitable to produce  $q^*$  or to shut down and produce no output?

# Maximizing Profit



3 equivalent output rules

Why output rules are equivalent

# Interpreting output rules

# Calculus

# Shut-down rules

- apply to all firms in SR and LR
- firm produces if it can make a profit
- should it shut down if it makes a loss?  
answer: “it depends”



# Equivalent shut-down rules

- *Rule 1*: firm shuts down only if it can reduce its loss by doing so
- *Rule 2*: firm shuts down only if its revenue is less than its avoidable cost
- by shutting down, firm eliminates *avoidable costs*:
  - variable costs
  - fixed costs that are not sunk

# Example 1

# Example 2

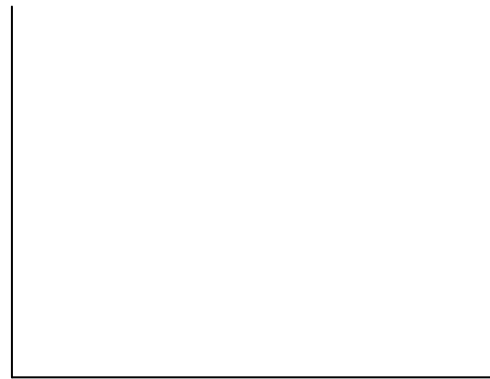
# Short run vs. long run

- SR: firm compares its revenue to only its avoidable (variable) cost — ignores sunk fixed costs
- LR: all costs are avoidable
  - firm can eliminate them by shutting down
  - therefore, firm shuts down if LR profit is negative:  $\pi < 0$

# SR competitive output decision

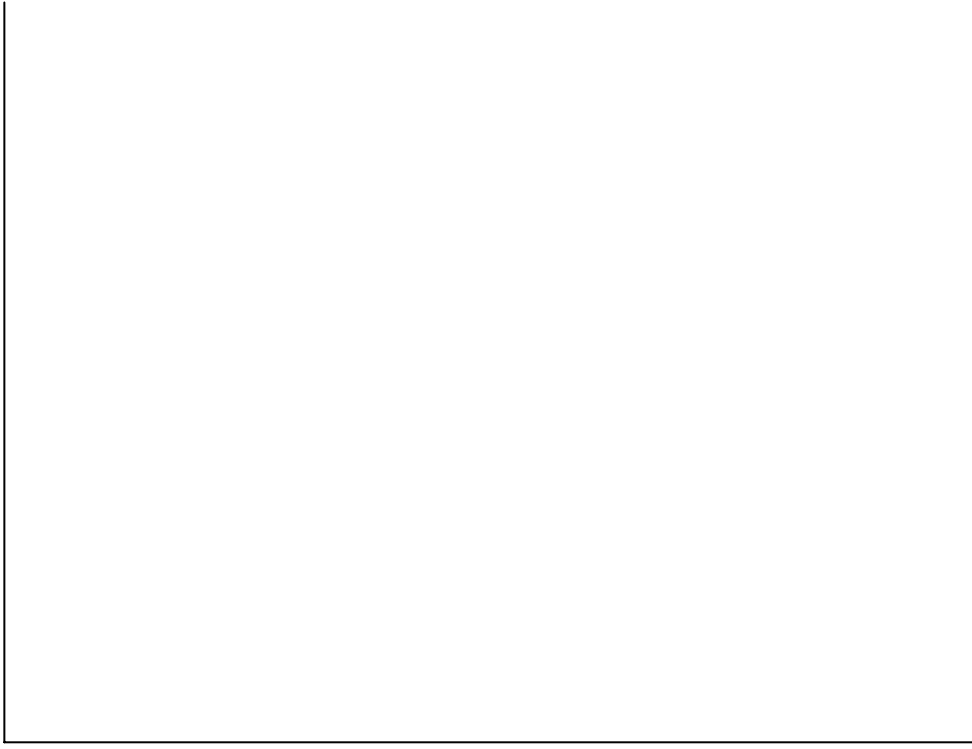
- because competitive firm is a price taker,
- market price,  $p$ , does not change if firm increases output
- because competitive firm's revenue,  $R = pq$ ,
- $MR = p$
- competitive firm maximizes profit by setting output where  $MC = p$

# How a Competitive Firm Maximizes Profit



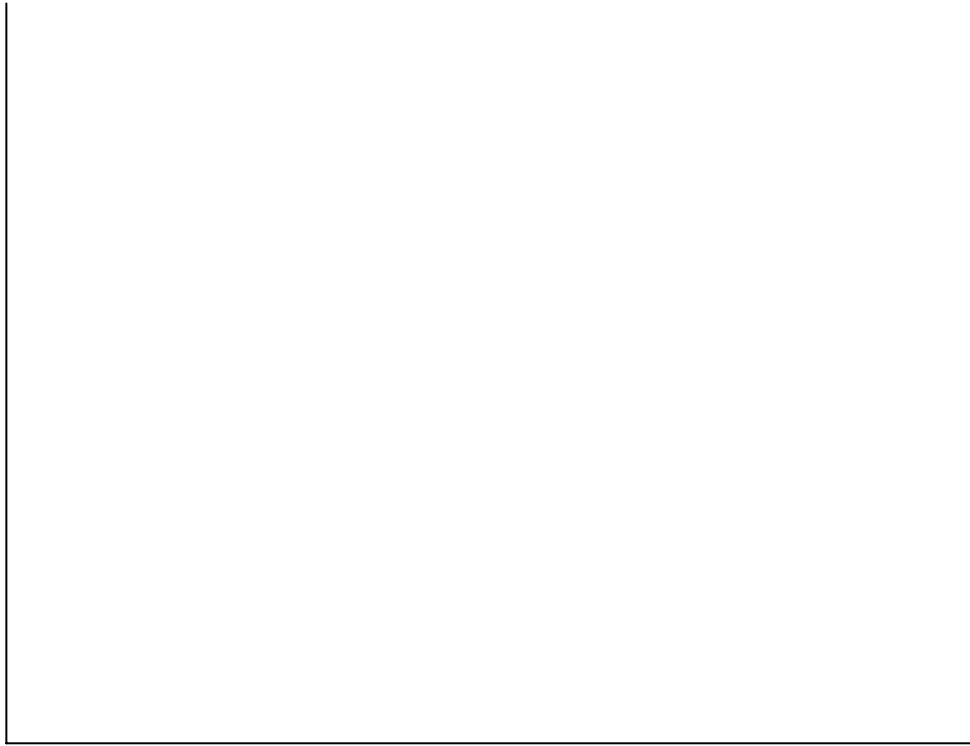
# Solved problem

- specific tax of  $\tau$  is collected from only one competitive firm
- how should that firm change its output level to maximize its profit
- how does its maximum profit change?



# SR shut-down decision

# The Short-Run Shutdown Decision



# SR competitive firm supply curve

- shift in market price traces out firm's supply curve
- SR supply curve is  $MC$  above the minimum of  $AVC$  curve

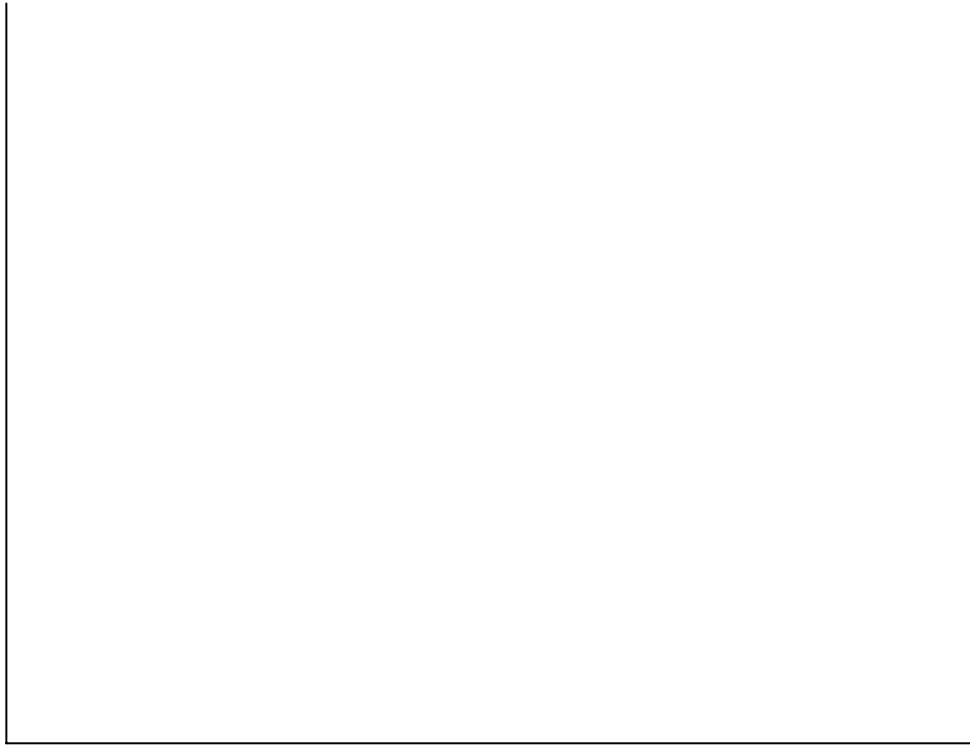
# How the Profit-Maximizing Quantity Varies with Price



# Factor prices and SR firm supply curve

- increase in factor prices causes the production costs of a firm to rise, shifting the firm's supply curve to the left
- if all factor prices double, costs double
- if only one factor price rises, costs rise less than in proportion

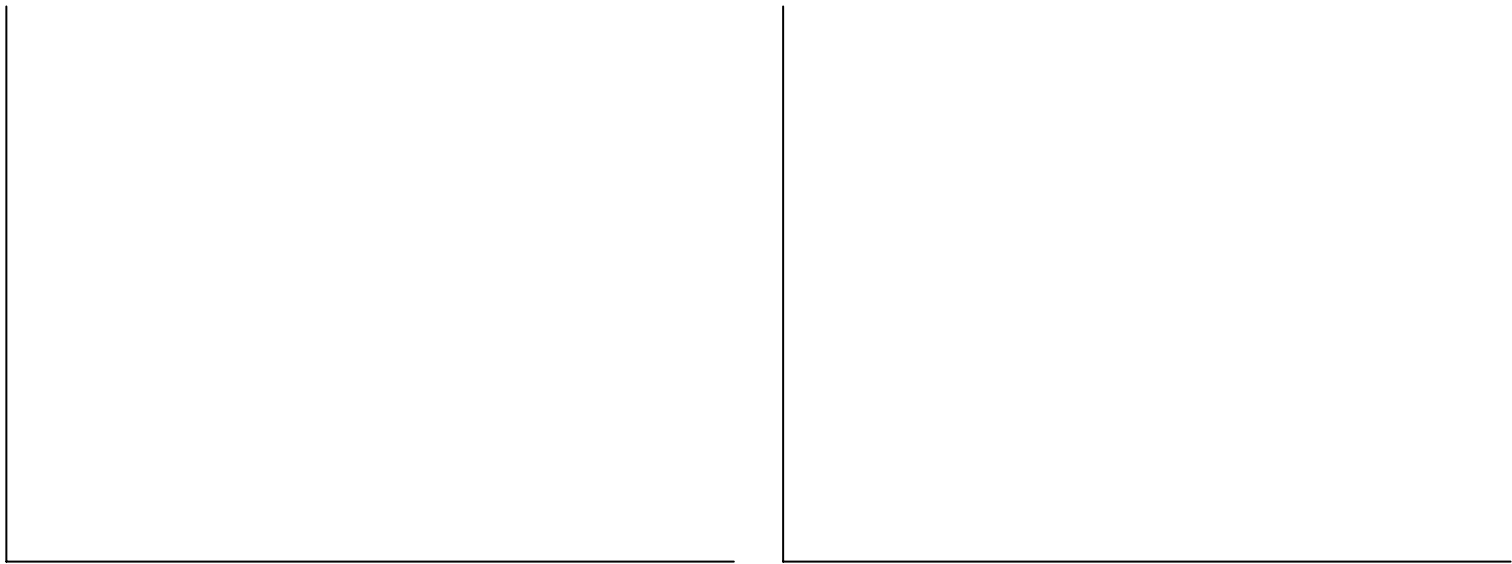
# Effects of an Increase in the Cost of Materials on the Vegetable Oil Supply Curve



# SR market supply; identical firms

- market supply curve is horizontal sum of the supply curves of all the individual firms
- maximum number of firms in a market,  $n$ , is fixed in SR
- market supply curve at any price is  $n$  times the supply of an individual firm
- larger  $n$  (more identical firms), the flatter (more elastic) the SR market supply curve at each price

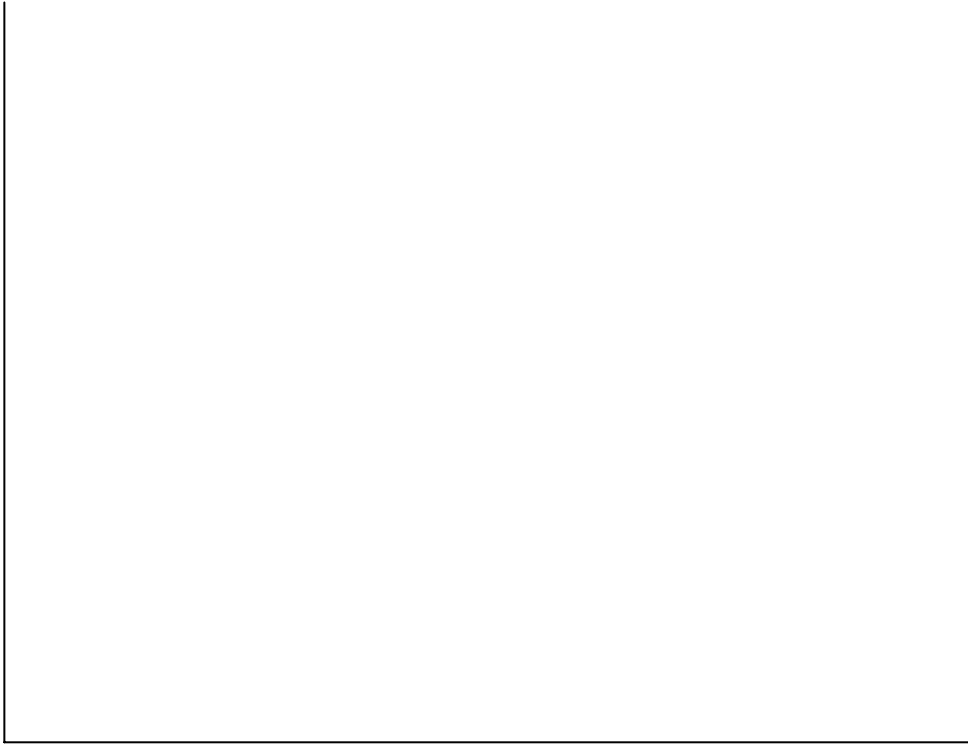
# Short-Run Market Supply with Five Identical Lime Firms



# SR market supply; firms differ

- relatively low-cost firms enter first
- more (differing) firms, more kinks in supply curve

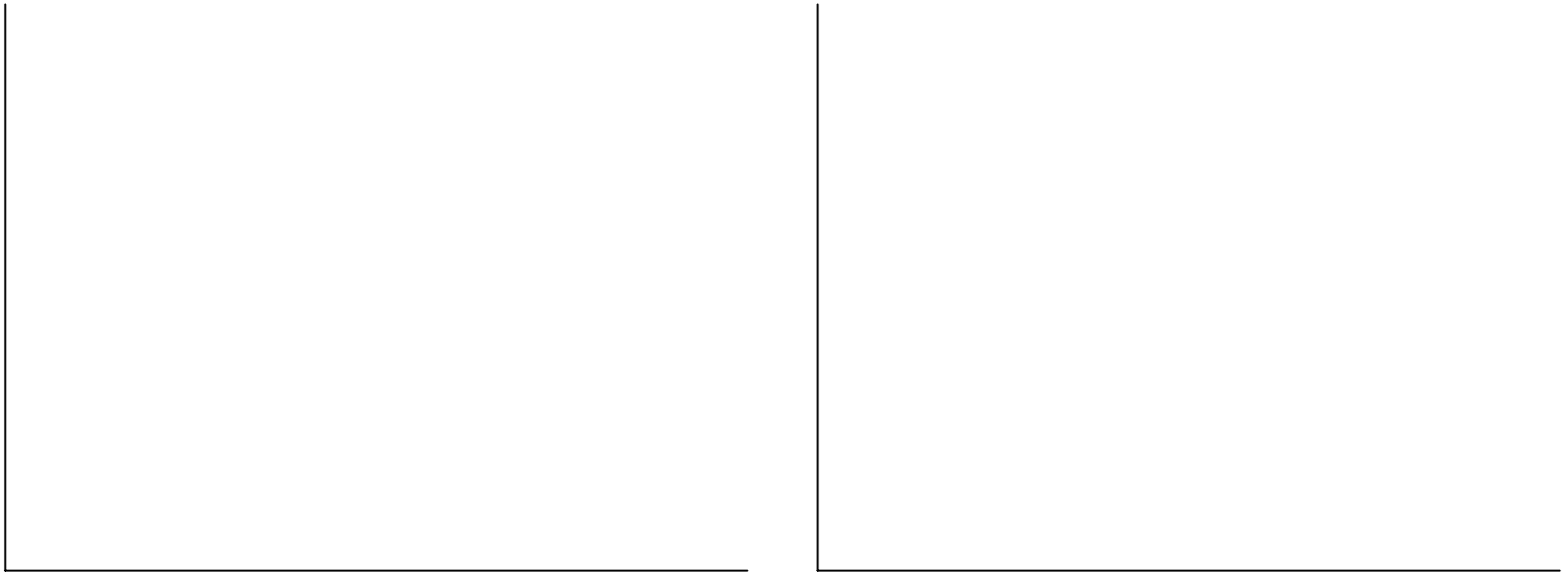
# Short-Run Market Supply with Two Different Lime Firms



# SR competitive equilibrium

intersection of SR market supply curve and market demand curve determines the SR competitive equilibrium

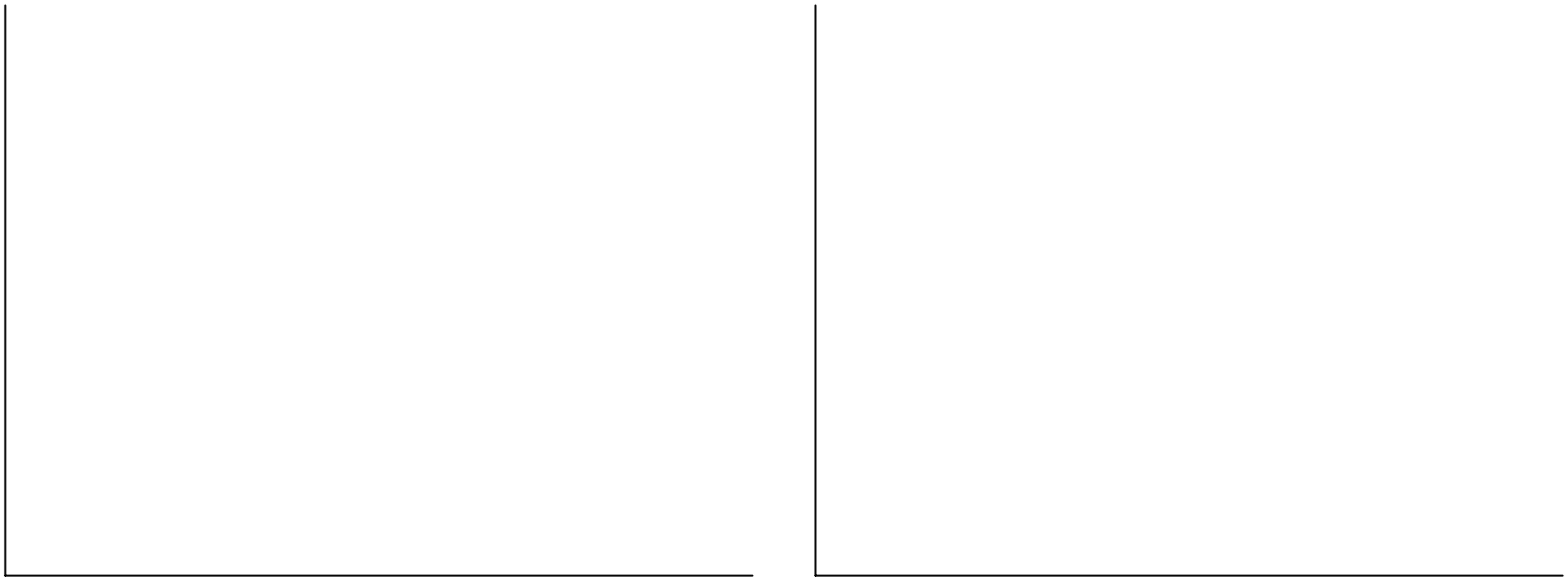
# Short-Run Competitive Equilibrium in the Lime Market



# Effect of a specific tax on SR equilibrium

- specific tax  $\tau$  applied to all firms in market
- shifts the market supply curve up by  $\tau$
- alters the SR equilibrium:
  - lower equilibrium quantity
  - higher equilibrium price

# Short-Run Effect of a Specific Tax in the Lime Market



# Changes in Banking

- Patrick Flinn took over as chairman and chief executive of Bank South Corporation in Atlanta in 1991
- business profit increased
  - \$55 million in 1991
  - \$71 million in 1993
- reason: new strategy of opening branches in Kroger supermarkets in Atlanta area (44 out of 143 of Georgia branches by 1994)



# Why did this policy help?

- fixed cost of creating a supermarket branch
  - \$250,000 grocery
  - \$1.5 to \$2 million traditional branch
- revenue per square-foot is four to six times greater for a grocery facility than a traditional branch
- by reducing fixed costs, Bank South Corporation increased its profit



# Nontraditional banking

- > 70% of all Wells Fargo retail transactions are conducted outside of a bank lobby automated teller machines
  - banking by phone
  - banking by personal computer
  - supermarket outlets
- Wells Fargo banks in Safeway, Raley's, Von's, and Ralph's supermarkets
- policies lower fixed cost and make banking easier for customers



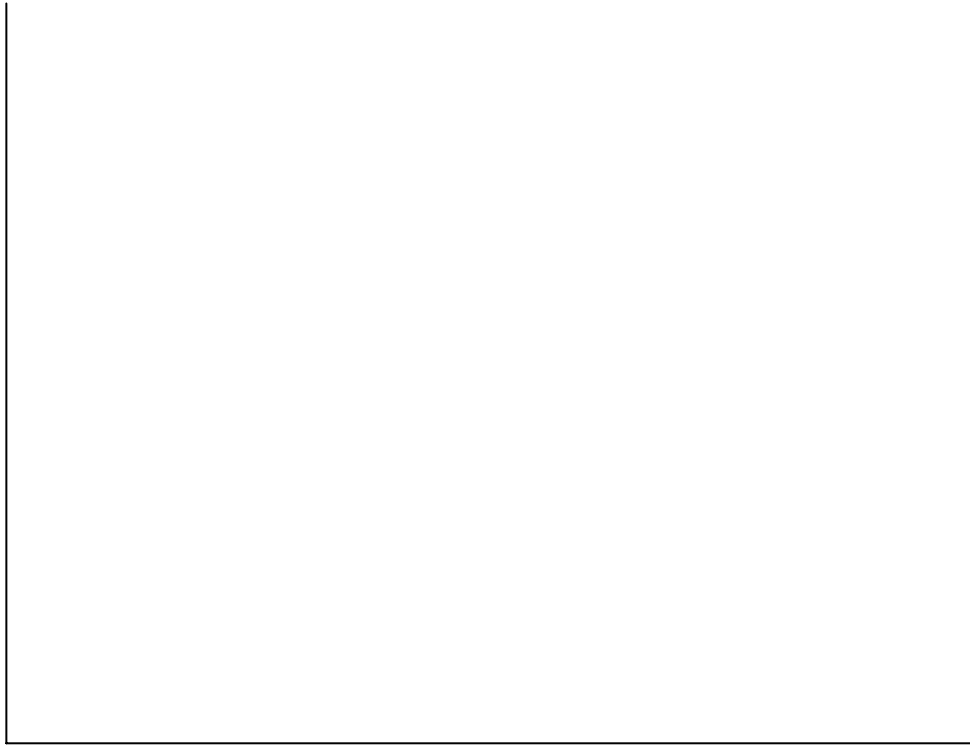
# LR competitive profit maximization

# LR shut-down decision

# LR firm supply curve

- LR  $MC$  above the minimum of LR  $AC$  curve (all costs are variable in LR)
- firm chooses its capital in LR, so LR supply curve may differ from SR supply curve

# The Short-Run and Long-Run Supply Curves



# LR market supply curve

- market supply curve = horizontal sum of firms' supply curves in both SR and LR to get more market output
- LR market supply differs from SR because of differences in number of firms and input prices

# Number of firms

- in SR, each firm must produce more because the number of firms,  $n$ , is fixed
- in LR, firms can produce more and/or more firms can produce

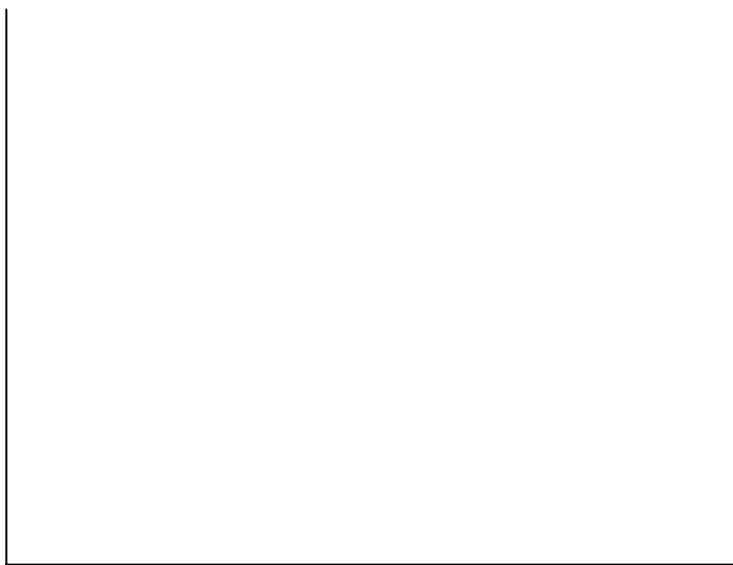
# Input prices

- to construct LR market supply curve, we need to know how input prices vary with output
- as market expands or contracts, changes in factor prices may shift firms' cost and supply curves
- LR effect of changes in input prices  $>$  SR effect because market output can change more dramatically in LR

# LR market supply



- LR market supply curve is flat at the minimum long-run average cost if
  - free entry and exit
  - an unlimited number of firms have identical costs
  - input prices are constant
- “many firms” = 10 firms in the vegetable oil market



# Role of entry and exit

- firm enters if it can make LR profit:  $\pi > 0$
- firm exits to avoid a LR loss:  $\pi < 0$
- entry and exit of firms determines number of firms in a market in LR
  - higher barriers to entry reduce number of firms
  - in markets with free entry (no barriers or fixed costs to entry): can have hit-and-run entry and exit

# Exit cost and shut-down decision

- if firms incur a cost to exit a market they may not shut down in SR even if  $R < VC$
- stay in operation for a while, to delay incurring exit costs



# Steel trap



- for decades, many U.S integrated steel mills (produce steel from iron ore) operated at losses – why?
- U.S firms stopped being competitive in 1950s and 1960s: foreign firms
  - had lower labor costs
  - had modern plants
  - found new sources of rich iron ore

# U.S. firms slow to leave the market

- not until late 1970s did Youngstown Sheet & Tube and U.S. Steel Corporation at Youngstown close
- next closing not until 1982
- firms continued to operate aging, inefficient, and unprofitable plants

# Big shut-down costs

- pay to dismantle mill and terminate contracts
- union contracts:
  - workers severance pay
  - supplemental unemployment benefits
  - make payments to cover additional future pensions and insurance benefits
  - generally, union members eligible for pensions when age + years of service = 75
  - workers laid off due to plant closings are eligible for a pension when age + years of service = 70

# U.S. Steel Corp's closing costs

- in 1979 were \$650 million (\$415 million labor related, or \$37,000 per laid-off worker)
- rose at least 45% since then



# Pricing

# Why LR market supply curve slopes

- limited entry
- firms have different costs
- input prices vary with output

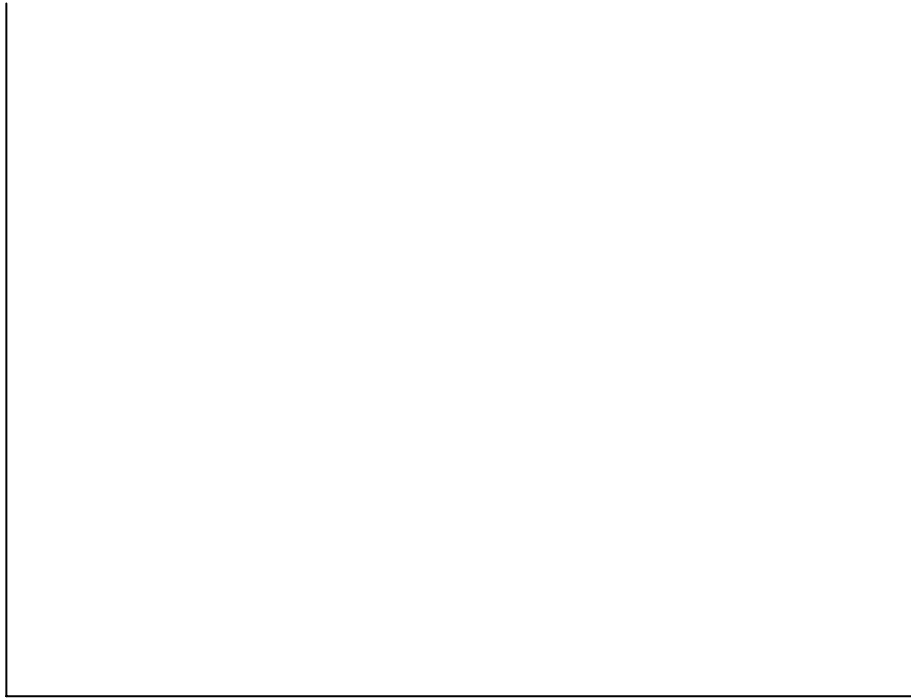
# LR market supply; entry limited

- number of firms in a market is limited in LR if
  - government restricts
  - scarce resource
- only way to get more output is for existing firms to produce more
- because individual firms' supply curves slope up, the market supply curve slopes up

# LR market supply; firms differ

- if firms differ:
  - firms with relatively low minimum LR  $AC$  enter the market at lower prices than others, so
  - LR market supply curves slope up if firms differ
- LR supply curve slopes up only if amount that lower-cost firms can produce is limited

# Application Upward-Sloping Long-Run Supply Curve for Cotton



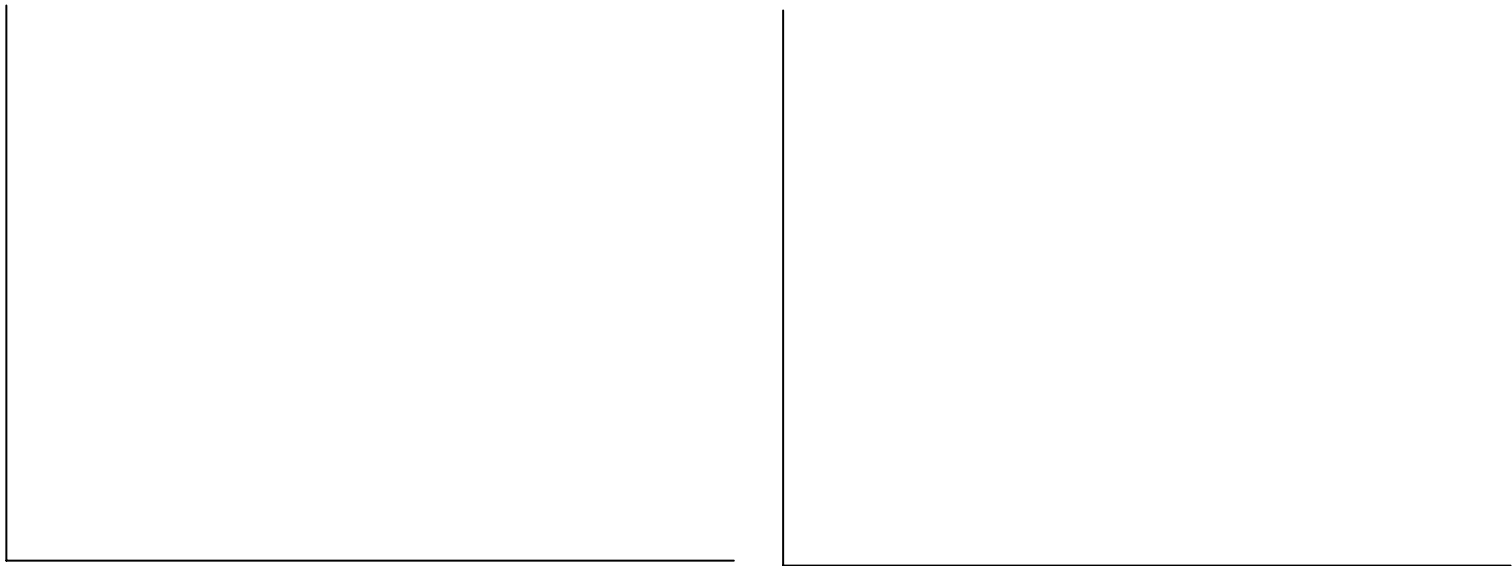
# LR market supply if input prices vary with output

- nonconstant input prices:
- if market buys most of total sales of a factor, factor price may vary with market output
- if price of an input rises when more is purchased, the cost of producing the final good also rises:
  - increasing-cost market
  - LR supply curve slopes up
- in a decreasing-cost market, LR market supply curve is slopes down

# Long-Run Market Supply in an Increasing-Cost Market



# Long-Run Market Supply in an Decreasing-Cost Market



# Slope of manufacturing supply curves

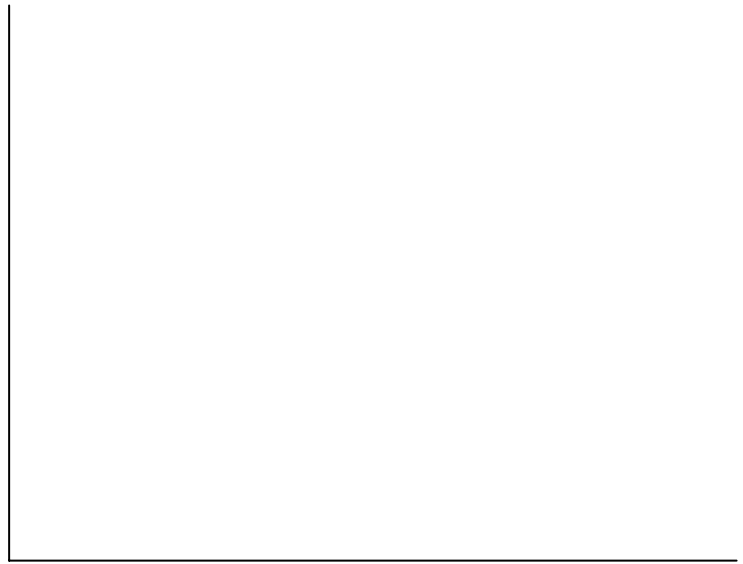
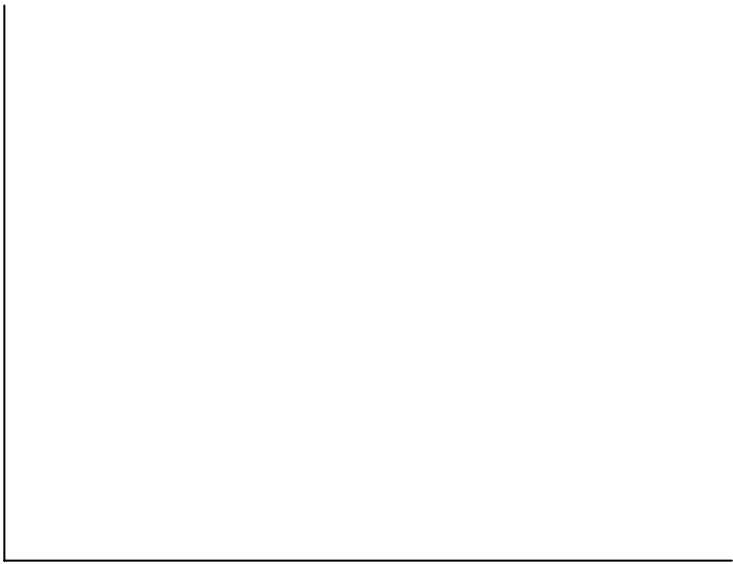
- downward-sloping LR supply curves (3): prepared feeds, aircraft, construction equipment
- upward-sloping LR supply curves (16), including: tires, drugs, paints, electronic components, glass
- flat LR supply curves (7), including: plumbing and heating products, floor coverings, fats, oils
- on average across all industries: LR supply curves have only slight upward slope
- supply elasticity is 5.5  $\Rightarrow$  1% increase in price leads to a 5.5% increase in quantity

# LR competitive equilibrium

- intersection of LR market supply and demand curves determines LR competitive equilibrium
- with identical firms, constant input prices, and free entry and exit,
- LR market supply is horizontal at minimum LR  $AC$
- so equilibrium price = LR  $AC$
- shift in demand curve affects only equilibrium quantity and not equilibrium price

# Solved problem

- If government starts collecting a lump-sum franchise tax of  $\mathcal{L}$  each year
- all firms are identical
- free entry and exit
- how do the long-run market and firm equilibria change?



# LR competitive profit is zero with free entry

- LR supply curve is horizontal if
  - firms are free to enter the market
  - firms have identical cost
  - input prices are constant
- all firms in market operate at minimum LRAC
- profit-maximizing firm stays in business if it earns zero LR profit

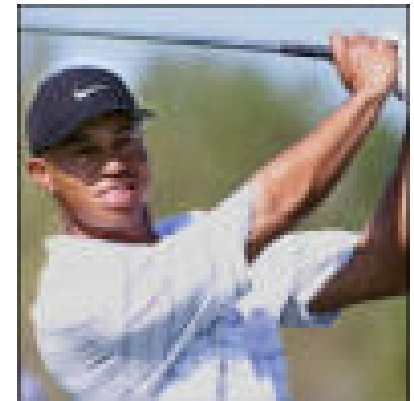
# LR profit = zero when entry is limited

- if some firms in a market make SR  $\pi > 0$  due to a scarce input,
- other firms bid for scarce input (factor receives rents),
- which drives up the price of the factor until all firms earn  $\pi = 0$  in LR



# Rent

- extra, opportunity value of a scarce input
- payment to the owner of an input beyond the minimum necessary for the factor to be supplied
- people, such as Tiger Wood, with unusual abilities earn staggering rents



# Rolling Stones

Rolling Stones earned \$121.2 million, from their 1994 concert tour; compare 1993 gross national product of

- Grenada (100,000 people): \$215 million
- Kiribati: \$51.1 million
- Bhutan: \$234 million



# Competitive firms must maximize profits

- competitive market with free entry:
- profits are driven to zero in LR
- any firm that did not profit maximize would make losses
- thus, firms that survive in a competitive market must profit maximize

# 1 Competition

- competitive firms are price takers
- markets are likely to be competitive if
  - firms sell identical products
  - firms can enter and exit freely
  - buyers and sellers know the prices charged by firms
  - transaction costs are low
- competitive firm faces a horizontal demand curve at the market price

## 2 Profit maximization

- firms maximize economic profit = revenue minus economic (opportunity) cost
- business profit  $\geq$  economic profit
- quantity where profit is highest:
  - marginal profit is zero
  - $MR = MC$
- To maximize profit, all firms make two decisions:
  - determine the quantity where its profit is highest
  - decide whether to produce or shut down

# 3 Competition in SR

# 4 Competition in LR

# Competition in LR (cont.)

- LR market supply curve is horizontal if
  - all firms are identical
  - entry and exit is easy
  - input prices are constant
- LR market supply curve is flat at minimum  $AC$
- LR supply curve slopes if
  - firms differ
  - entry is difficult or costly, or
  - input prices vary with output,

# 5 Competitive firms earn zero profits in LR

- competitive firms may make profits or losses in SR
- in LR, economic profit = 0
- prices of scarce inputs adjust to ensure competitive firms make zero long-run profits
- only competitive firms that maximize profit can survive