



Economic Cost

Instructional Goals: You will understand:

- The difference between opportunity costs and accounting costs.
- The importance of sensitivity and break-even analysis.
- How to derive long run cost curves from production functions by minimizing long run costs using both marginal and incremental analysis.
- How to perform a shut down analysis.

And the relevance of these concepts to operational decision making.

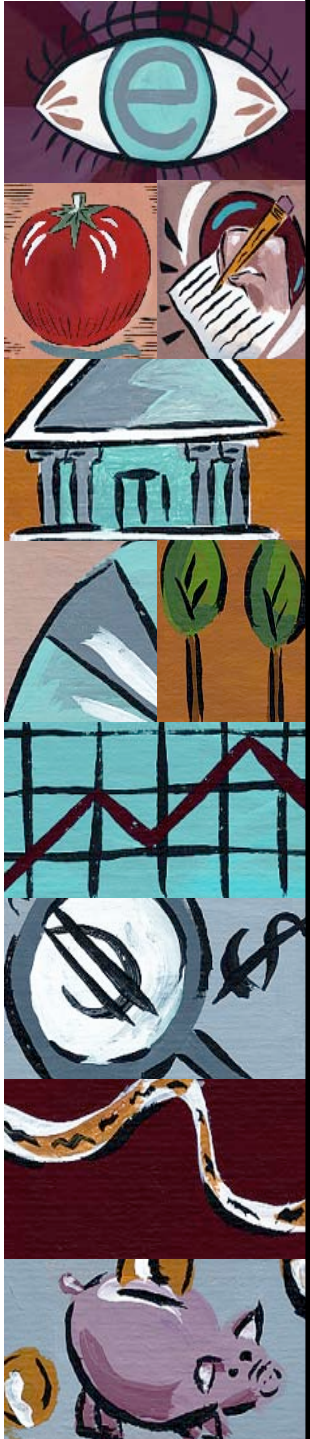


Economic costs vs. accounting costs I

Economists define cost in terms of opportunities that are sacrificed when a choice is made.

- Hence, economic costs are simply benefits lost (and, in some cases, benefits are merely costs avoided).
- Economic costs are subjective -- seen from the perspective of a decision maker not a detached observer.
- Economic costs are prospective.
- Economic cost is a stock concept -- economic costs are incurred when decisions are made.

Economic cost estimates are used for making decisions about pricing, output levels, buying or making, alternative marketing tactics/strategies, product introductions and withdrawals, etc.



Economic costs vs. accounting costs II

Accountants define cost in terms of resources consumed.

- Hence, from an accountant's standpoint, costs are objective -- seen from the perspective of a detached observer.
- Accounting costs are retrospective.
- Accountants usually define costs as flows. Accounting costs reflect changes in stocks (reductions in good things, increases in bad things) over a fixed period of time.

Accounting cost measures are used in the evaluation of managerial performance (usually together with information on income) and as a basis for economic cost estimation.



Economic costs vs. accounting costs III

There are two kinds of mistakes you can make when you use accounting costs to estimate economic costs:

- Include cost measures that should be ignored;
- Ignore costs that should be included.

You should ignore costs that will not vary as a result of your decision

*You should include all **RELEVANT** costs that will vary as a result of your decision.*



Examples of costs that should be ignored in decision making: *sunk costs, imaginary costs*

The DOE developed a cyclotron to enrich uranium. It spent billions on research and development, and almost had a fully operational machine but they never brought it on-line because Congress required them to charge a high enough price for enriched uranium to recover the cost of capital.

Had they brought it on-line, they would have priced themselves out of the market.

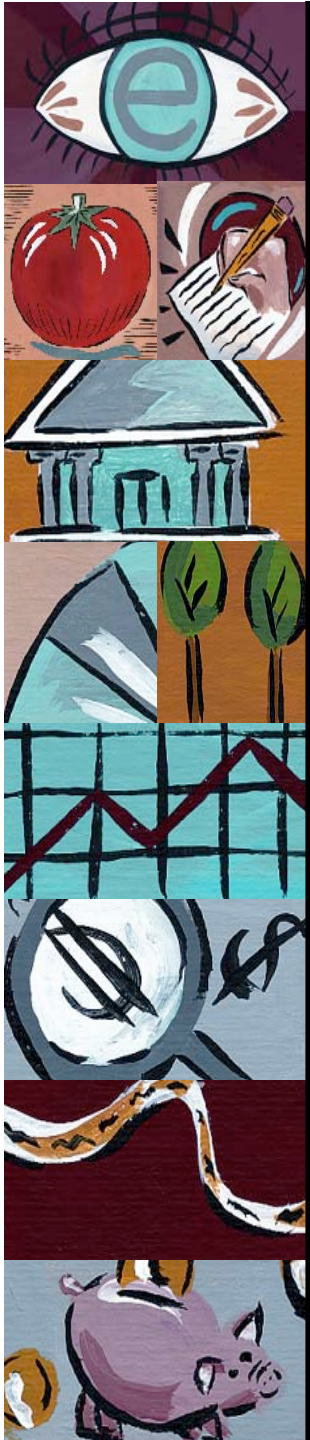
God Committee looked at annualized cost of completing TVA's Tennessee-Tom Bigbee dam project, using the same discount plus depreciation rate to estimate both the incremental construction cost and the loss of land rents.



Examples of ignoring costs that should be considered in decision making: *hidden costs, spillovers*

- Opportunity costs of capital (like all costs, opportunity costs depend on the question being asked)
- Opportunity cost of office space
- Opportunity cost of top-management attention
- Cost of investments that increase period costs

AFRL high-energy research unit at WPAFB ignored energy costs, when it scheduled test runs, because it wasn't accountable for them



Accounting and Economic Profit are both retrospective measures

Economic profit or economic value added is total revenues minus total costs (including all opportunity costs).

Economic profit occurs only when the rate of return is above the normal market rate of return (the opportunity cost of capital).

businesses earning *zero economic profit* are earning exactly the *risk-adjusted market* (normal) *rate of return*.

In a sense all organizations are in the same business: they borrow cash (implicitly or explicitly), invest it in capacity (fixed) and working capital to do things that create value for their customers, which they convert into cash. Both price and timing(turnover) are relevant to the success of this process ex post.

Accounting profit or cash flow is total revenue minus the expenses of the business over a time period.

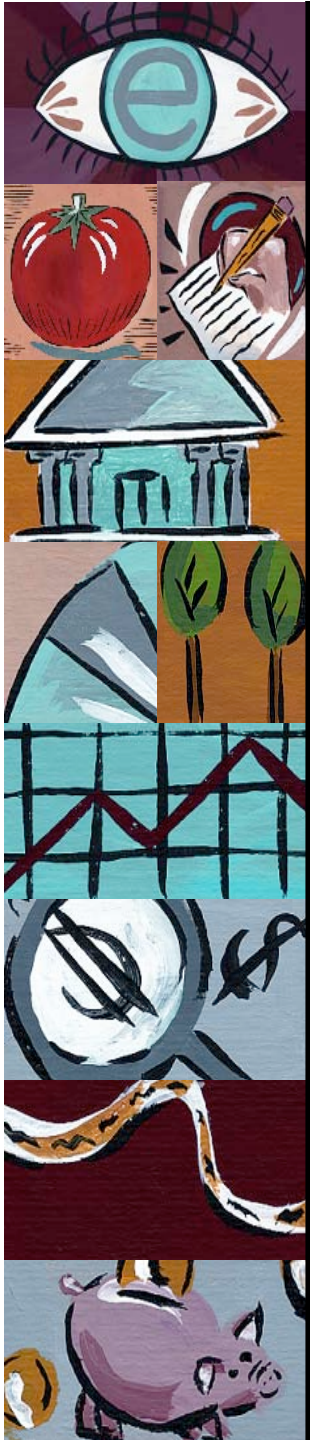
Often excludes implicit costs such the opportunity cost of equity capital or PE, the consumption of assets like employee commitment or customer good will or natural resources, and misallocates consumption of PE.

Accounting profit is usually greater than *economic profit*.



Questions for Thought:

1. “When an economist says a business is earning zero economic profit, this implies that the business will be forced out of business in the near future unless market conditions change.”
-- Is this statement *true or false*?
2. Which of the following is true?
 - a. Business owners have a strong incentive to promote the public interest and they recognize that operational efficiency will help them achieve this goal.
 - b. Since business owners are *residual income claimants*, they have a strong incentive to produce efficiently because lower costs will enhance their personal income.



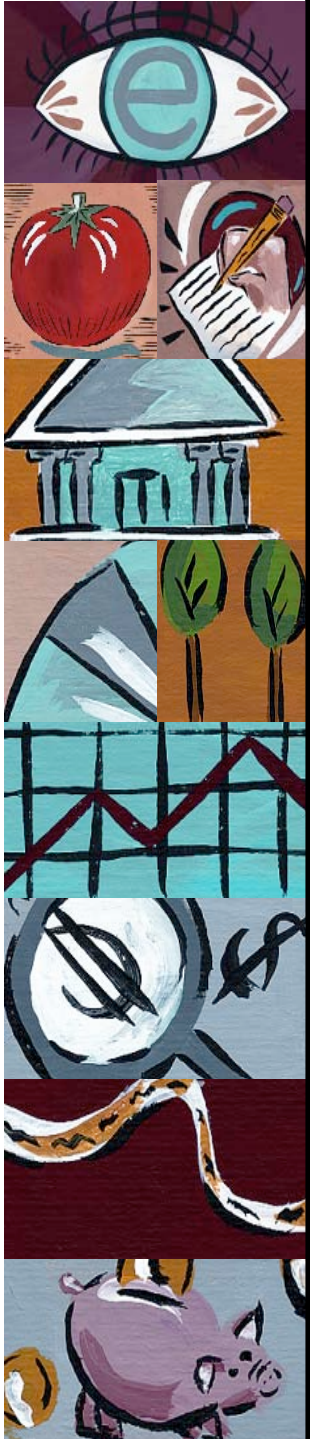
The Short and Long Run



The Short Run

The *short run* is a period of time so short that the business's capacity (product designs, operating systems and routines, qualified suppliers, level of plant and heavy equipment [PE], capital) and location are fixed.

In the *short run*, output cannot be altered, except by changing the mix and quantity of variable resources such as unskilled labor (or, where there is an unemployed pool of skilled journeymen, journeymen), components, and materials used.



The Long Run

The *long run* is a period of time sufficient for the business to alter all factors of production.

In the *long run*, businesses can freely enter and exit a line of business.

The actual *short run* and *long run* differs by industry. There is a lot of room in most lines of work between the economic short run and the long run)

The distinction between *short run* and *long run* is not as important as the distinction between *ex ante (prospective)* and *ex post (retrospective)*

Economic costs are always *ex ante*, success (profit) or failure (loss) are always *ex post*.



Example

You are trying to determine whether it makes sense to buy a house or to continue renting for \$1100. You start looking at houses but decide that you will not purchase a house unless it is more profitable than renting. What price house is equivalent to \$1100 in rent? Make several assumptions:

- 1. Assume that property taxes plus any transactions costs incurred in buying and selling the house will exactly be offset by the capital gains on the house. There will be no inflation. Your nominal rent will not increase.
- 2. Assume that you can borrow the purchase price at 5%. This is both a real and a nominal rate. Your investments also earn 5%.
- 3. Assume that you do not pay any principle on the mortgage, only interest.
- You think that you will make enough money to put yourself in a 33 percent tax bracket and mortgage interest is wholly deductible.
- HINT: the annual rent equivalent for a \$350,000 house is \$17,500.



Doing the Breakeven Analysis

- **Step one: annualize your current rent**

$$\$1100 * 12 = \$13,200$$

- **Step two: calculate your breakeven rent**

$$\$13,200 / .05 = \$264,000$$

- **Step three: Calculate your tax shield**

$$\$264,000 / .67 = \$394,000$$



Sensitivity Analysis

Suppose that you think there is a 75% chance that you will make enough to put yourself in a 33% tax bracket, and a 25% chance that you will stay in the 0% tax bracket.

$$P(.33 \text{ bracket}) = .75 | \$394,000 = \$295,000$$

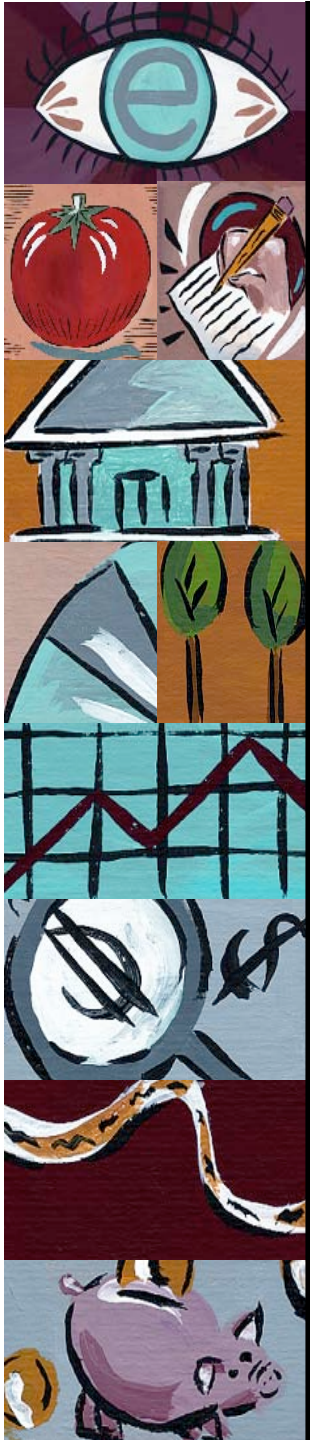
$$P(0 \text{ bracket}) = .25 | \$264,000 = \$66,000$$

$$\text{Sum} = \$361,500$$

Note this is a version of what is known as sensitivity analysis. When you are uncertain about the future, it is important to redo your forecasts, computations, or spreadsheets, using a variety of scenarios: a best case, middling, and worse case scenario.



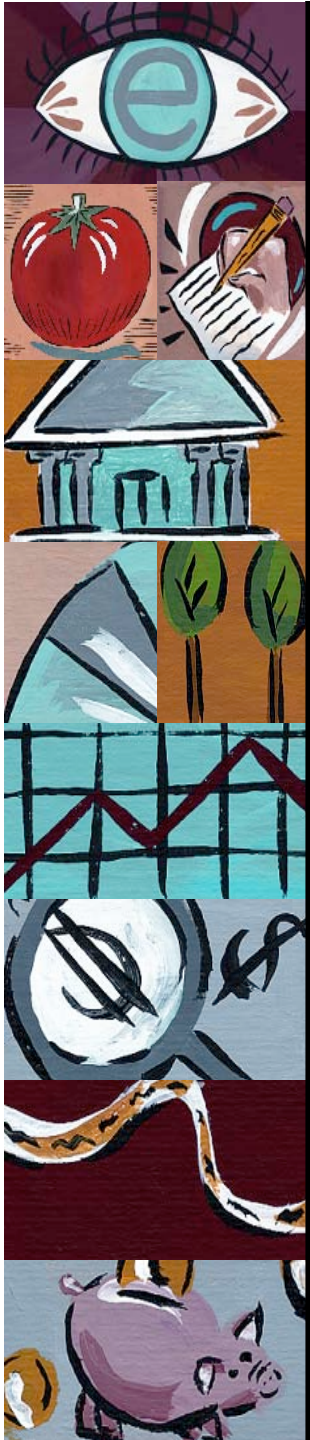
Output and Costs In the Long Run



Long run production functions and cost functions I

$Q = f(K, L)$. Quantity is a function of the inputs used to produce it: in this example capital and labor. Quantity is measured as a rate of production (flow) as are capital and labor, e.g. the amount of cars washed per day is a function of the amount of labor and capital used each day.

- The production function specifies a technically efficient use of labor and capital necessary to produce output, i.e. no resources are wasted.
- The cost function specifies an economically efficient use of resources, i.e. the firm chooses the least cost combination of inputs, to produce a given output.
- This yields the long run cost function: total costs (C) = $g(Q)$, which depends on the prices of inputs. This function can be a pretty good proxy for the opportunity cost of delivering Q , at least where we measure costs in units of present value: i.e., the change in present value or owner's equity caused by some specified action (and where for purposes of measurement the attendant increase in wealth is excluded from the computation of equity).



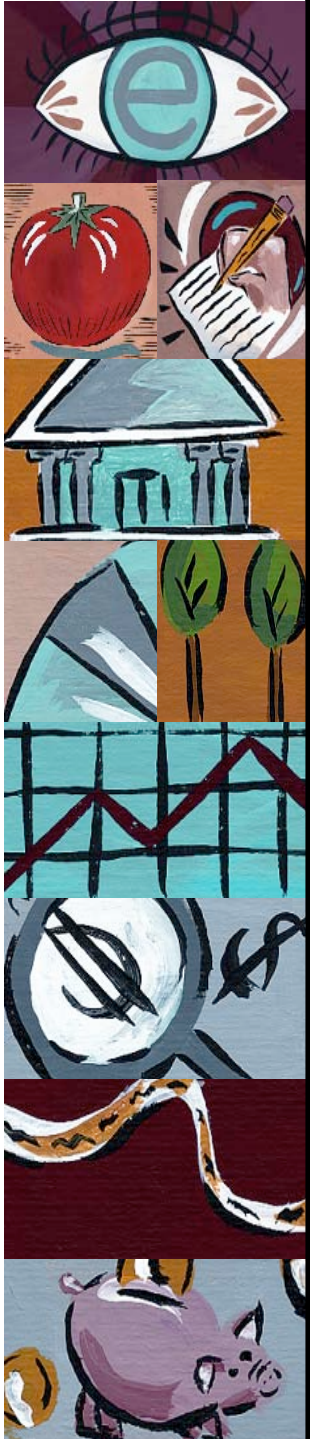
Long run production functions and cost functions II

The following long-run functional relationships traditionally obtain in the single product case: Cost varies as a function of total production volume (V), the rate of output (x), the date of first delivery (T), and the date of completion of the full production run (m), where $x(t)$ denotes the rate of output at moment t . Moreover, as the total quantity of units produced increases, the cost of future output tends to decline because production-knowledge increases as a result of production experience (this proposition is known as the learning or progress curve). That is: $dC / dT | x = x_0, V = V_0, < 0$.

This relationship probably holds for most products produced in large batches using traditional mass-production methods. Moreover it is usually assumed that:

1. $dC / dx(t) | T = T_0, V = V_0 > 0$
2. $d^2C / dx(t)^2 | T = T_0, V = V_0 > 0$
3. $dC / dV | x = x_0, T = T_0 > 0$
4. $d^2C / dV^2 | x = x_0, T = T_0 < 0$

Many of these functional relationships have been attenuated by the rise of computer assisted design and manufacturing technology and modern information.



Economies of Scale and Scope

As output is increased, per-unit costs will follow one of three possibilities:

Economies of Scale and Scope:

Reductions in per unit costs as output/product volume expands. This can occur for three reasons:

Mass production (spreading overheads)

Specialization

Improvements in production as a result of experience

Diseconomies of Scale and Scope:

Increases in per unit costs as rate increases.

Constant Returns to Scale and Scope:

Unit costs are constant as output expands.



Cost minimization: marginal analysis

Here we will assume that the firm can choose any level of capital and labor to produce output, Q . More capital leads to more output; less capital to less output. More labor leads to more output; less labor to less output. This is known as a variable proportions production technology because labor can substitute for capital, and vice-versa, in production.

- The marginal product of labor is the additional output from one extra unit of labor.
- The marginal product of capital is the additional output from one more unit of capital.

The cost minimization rule for producing a given quantity: choose labor and capital such that $(MP \text{ of labor}) / (\text{Price of labor}) = (MP \text{ of capital}) / (\text{price of capital})$.

Proof: dividing the marginal products of each input by the price of the input tells you how much output you can produce for a dollar. If it costs more to produce output using labor than it does using capital, then sell labor and buy capital. This allows you to produce the same amount at lower cost. Only when the costs of production using each input are the same are no further cost savings possible.



Shut down analysis

Ex Ante don't produce if economic profits are negative. In the long run, stop producing if economic profits are negative.

In the short run or *ex post*, stop producing if revenue is less than total variable cost. In the short run, you don't have to cover your fixed costs, but you must make enough to cover your variable costs. If not, then you can shut down. You will still have to pay your fixed costs, but at least you can avoid paying your variable costs (which are greater than revenue). **(Looking ahead, time of sale is a basis for price discrimination)**

MC is always relevant to pricing, but to know what your MC is you have to understand what you are selling (what provides value to customers) and how your activities provide that value.

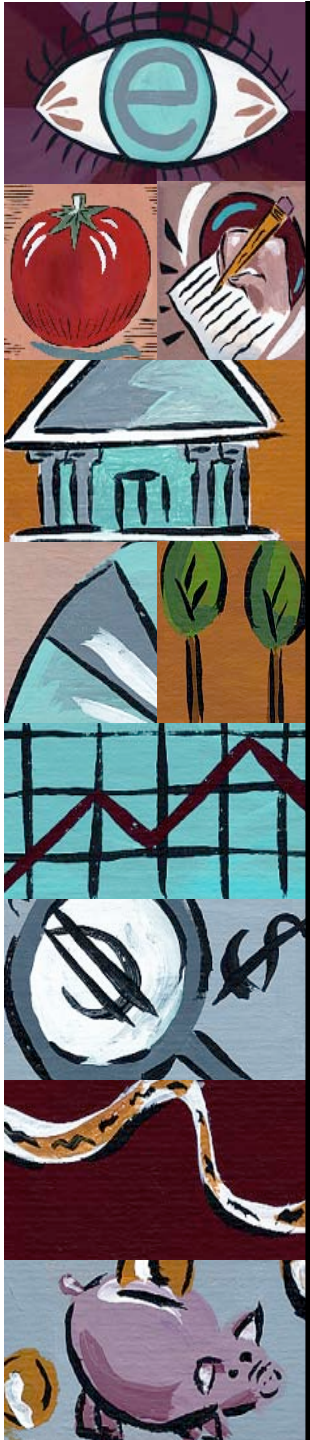


Price Takers and Price Searchers

Instructional Goals: You will understand:

- The difference between price taking markets and price searching markets.
- How to identify and avoid price-taking markets if you are not a speculator, arbitrageur, or farmer.

And the relevance of these concepts to operational decision making.



Price Takers

- *Price Takers* sell identical products and each seller is small relative to the market.
 - Each seller has little or no effect on the market price.
 - Each seller can sell as much as it wants at the market price
 - It is unable to sell any output at a price greater than the market price
 - *Example:* agriculture (wheat, corn, soybeans), raw materials and standardized components, foreign exchange, treasury bonds
 - Also called a *purely or perfectly competitive* market.
 - We call the demand curve for a specific product from an individual organization its *residual demand curve.*



Price Searchers

- *Price Searchers* face downward sloping residual demand curves for their products.
 - The amount that the business is able to sell is inversely related to the price it charges.
 - *Examples:*
 - Nike,
 - General Motors,
 - Exxon,

Any business line that has an individual name or a brand



Why Study Price Takers?

- **Model applies to all financial markets and all commodities with forward or futures markets.**
- **Model may help us understand the relationship between individual businesses and market supply.**
- **Increases our appreciation of competition as a dynamic process.**

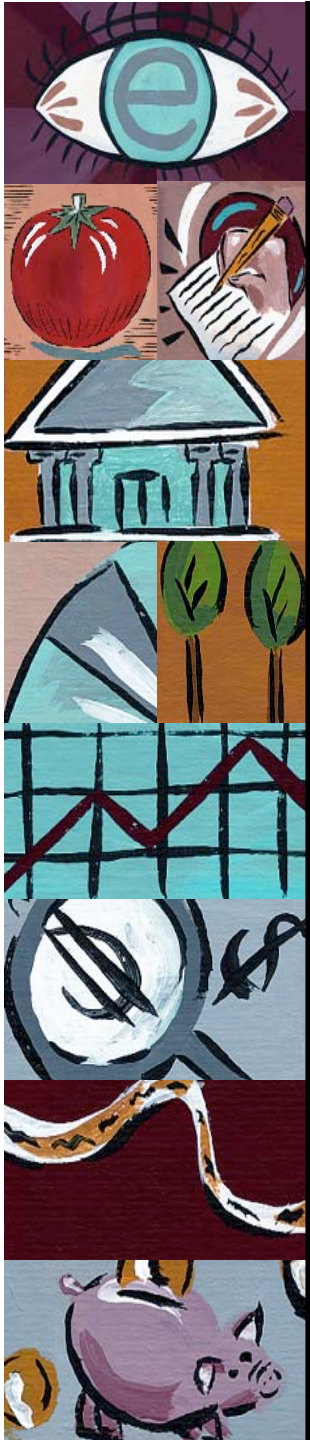


Markets When Organizations are Price Takers



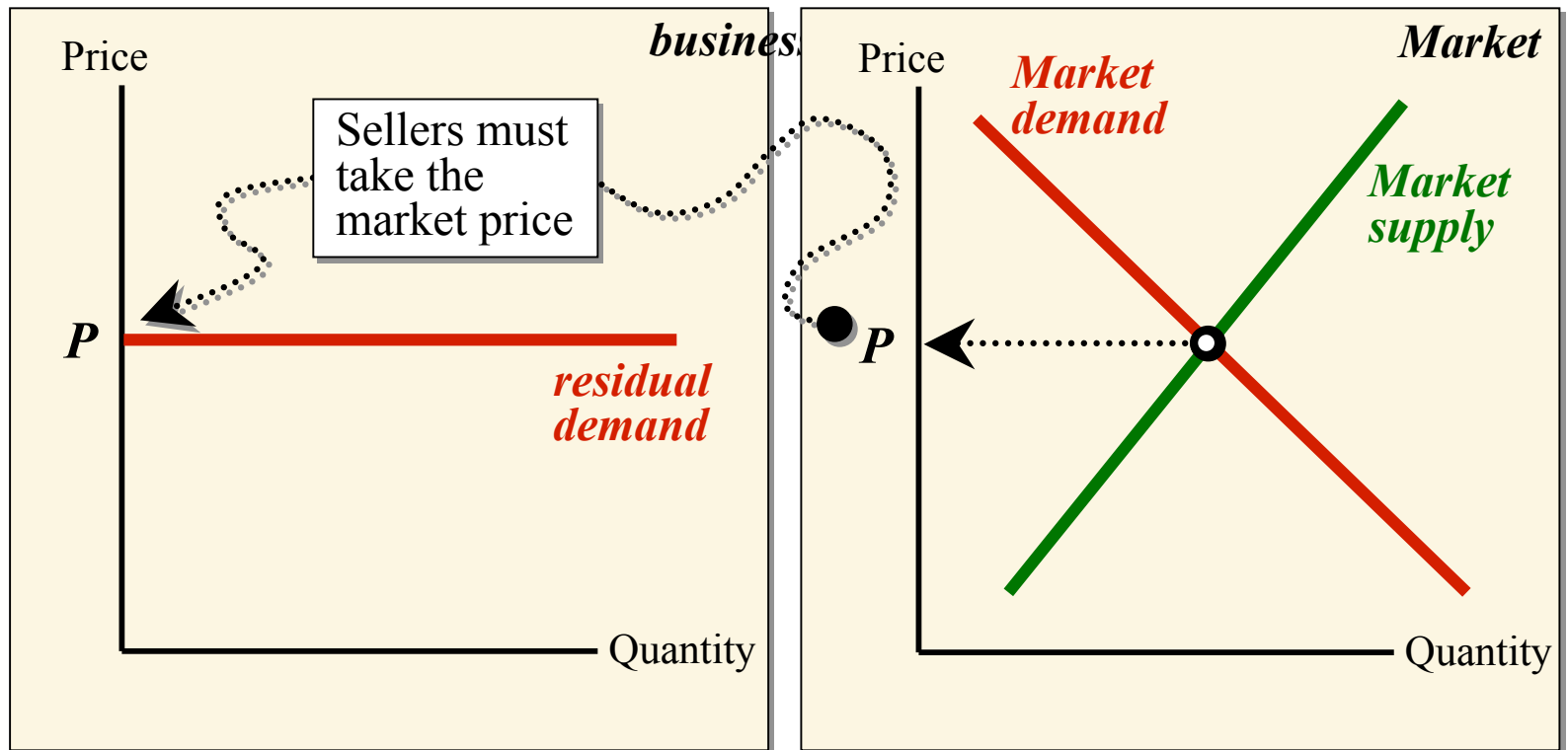
Conditions for a Market of Price Takers

- All sellers sell an identical good (so they're perfect substitutes) .
- A large number of sellers are in the market.
- Each seller supplies only a small portion of the total supplied to the market.
- No barriers to entry or exit exist.



Price Taker's Demand Curve

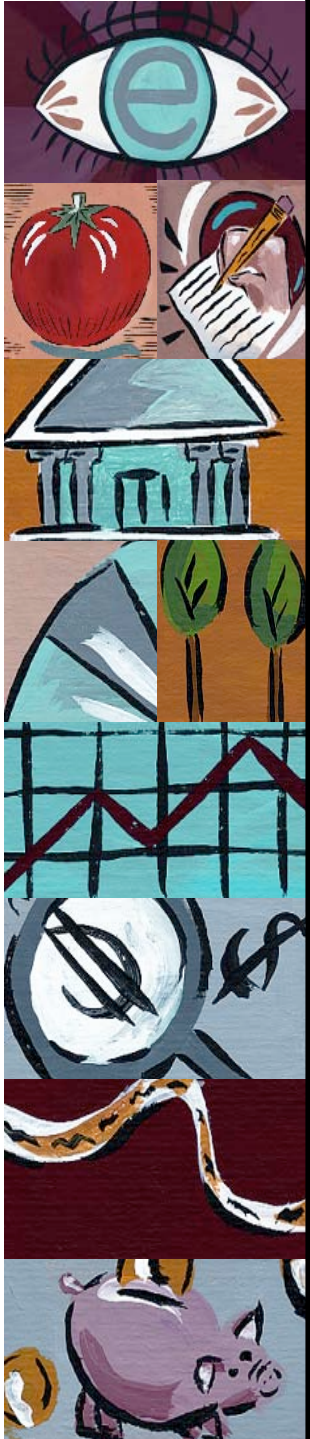
- Market forces (*supply & demand*) determine price.
- *Price takers* have no control over the price that they may charge in the market. If such a seller were to charge a *price* above that *established by the market*, buyers would simply buy elsewhere.
- So, the price taker's *residual demand* will be *perfectly elastic*. Only at the market price will there be any demand.





Questions for Thought:

- 1. How do organizations that are price takers differ from those that are price searchers? What are the distinguishing characteristics of a price taker market?**
- 2. Why is market competition important? Is there a positive or negative impact on the economy when strong competitive pressures drive organizations out of business? Why or why not?**



Questions for Thought:

3. Which of the following is a competitive price taker?
 - a. McDonald's, a restaurant chain that competes in numerous locations
 - b. A bookstore located a few blocks from a major university
 - c. A Texas rancher that raises beef cattle

4. "A restaurant in a summer tourist area that is highly profitable during the summer but unable to cover even its variable costs during the winter months should operate during all months of the year as long as its profits during the summer exceed its losses during the winter." Is this statement true?



Output Adjustments in the Long Run



Economic Profits and Entry

- If price exceeds *average total cost*, businesses will earn an *economic profit*.
- *Economic profit* induces both:
 - the *entry* of new businesses, and,
 - expansion in the scale of operation of existing businesses.
- Capital moves into the industry, shifting the market supply to the right. This will continue until price falls to *ATC*.
- In the long-run, competition drives economic profit to *zero*.



Economic Losses and Exit

- If *average total cost* exceeds price, businesses will suffer an *economic loss*.
- *Economic losses* induce:
 - the *exit* of businesses from the market, and,
 - a reduction in the scale of operation of remaining businesses or consolidation.
- As market supply decreases, price will rise to *average total cost*.
- Thus, profits and losses move price toward the zero-profit long-run equilibrium.



Long Run Supply

- ***Constant-Cost Industry:***
Industry where per-unit costs remain unchanged as market output is expanded.
 - Occurs when the industry's demand for resource inputs is small relative to the total demand for the resources.
 - The long-run market supply curve in a ***constant-cost industry*** is horizontal.



Long Run Supply

- ***Increasing-Cost Industry:***
Industry where per-unit cost rises as market output is expanded.
 - Results because an increase in industry output generally leads to stronger demand and higher prices for the inputs.
 - The long-run market supply curve in a ***increasing-cost industry*** is upward-sloping.
 - Most common type of industry.



Long Run Supply

- ***Decreasing-Cost Industry:***
Industry where per-unit costs decline as market output expands.
 - Implies either economies of scale exist in the industry or that an increase in demand for inputs leads to lower input prices.
 - The long-run market supply curve in a ***decreasing-cost industry*** is downward-sloping.
 - ***Decreasing-cost industries*** are uncommon.



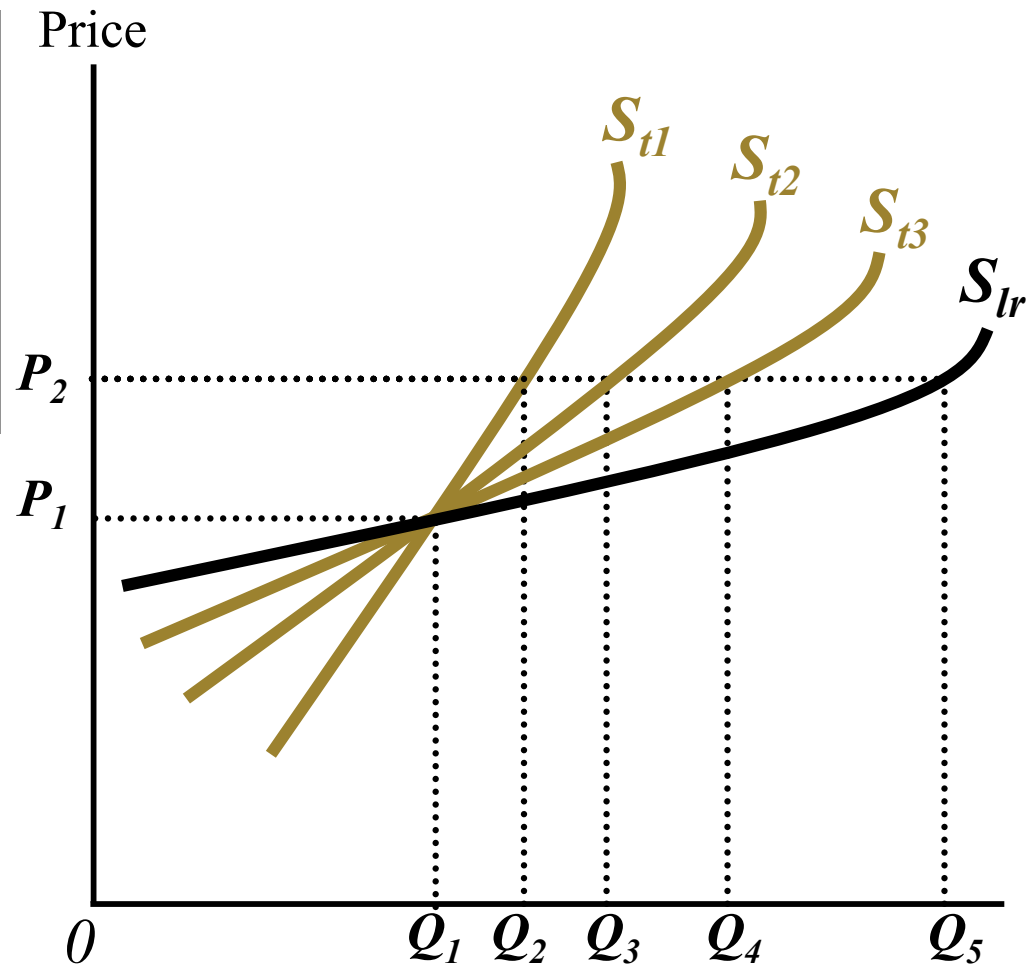
Supply Elasticity and the Role of Time

- In the short run, fixed factors of production such as plant size limit the ability of businesses to expand output quickly.
- In the long run, businesses can alter plant size and other fixed factors of production.
- Therefore, the market supply curve will be more elastic in the long-run than in the short run.



Time and the Elasticity of Supply

- The elasticity of the market *supply* curve usually increases as time allows for adjustment to a change in price.



$t_1 = 1$ week	$t_3 = 3$ months
$t_2 = 1$ month	$t_{lr} = 6$ months



Role of Profits and Losses



Profits and Losses

- Businesses earn an *economic profit* by producing goods that can be sold for more than the cost of the resources required for their production.
- *Profit* is usually a reward for production of a product that has greater value than the value of the resources required for its production.
- *Losses* are a penalty for the production of a good that consumers value less highly than the value of the resources required for its production.