
ECONOMICS

Study Sessions 4 & 5

Weight on Exam	10%
SchweserNotes™ Reference	Book 2, Pages 1–174

STUDY SESSION 4: ECONOMICS—MICROECONOMICS AND MACROECONOMICS

TOPICS IN DEMAND AND SUPPLY ANALYSIS

Cross-Reference to CFA Institute Assigned Reading #14

Elasticity

Price elasticity of demand is the ratio of the percent change in quantity demanded to the percent change in price.

Income elasticity of demand is the ratio of the percent change in quantity demanded to the percent change in income. For a normal good, income elasticity is positive so that an increase in income increases demand for the good. For an inferior good, income elasticity is negative so that an increase in income decreases demand for the good (e.g., bus travel).

Cross price elasticity of demand is the ratio of the percent change in quantity demanded to the percent change in the price of a related good. It is positive for a good that is a substitute in consumption (e.g., cars and bus travel) and negative for a good that is a complement in consumption (e.g., cars and gasoline).

For a demand function of the general form: $Q_D = 100 - A \times P_{\text{good}} + B \times \text{Income} + C \times P_{\text{other good}}$, at price and quantity P^* and Q^* :

- **The price elasticity of demand is $A \times (P^*/Q^*)$.** If $A < 1$, an increase (decrease) in price will increase (decrease) total revenue; if $A > 1$, an increase (decrease) in price will decrease (increase) total revenue.
- **The income elasticity of demand is $B \times (\text{Income}/Q^*)$** and is positive ($B > 0$) for normal goods and negative ($B < 0$) for inferior goods (an increase in income decreases quantity demanded of the good).
- **The cross price elasticity of demand is $C \times P_{\text{other good}}/Q^*$.** When C is negative the goods are complements and when C is positive the goods are substitutes.

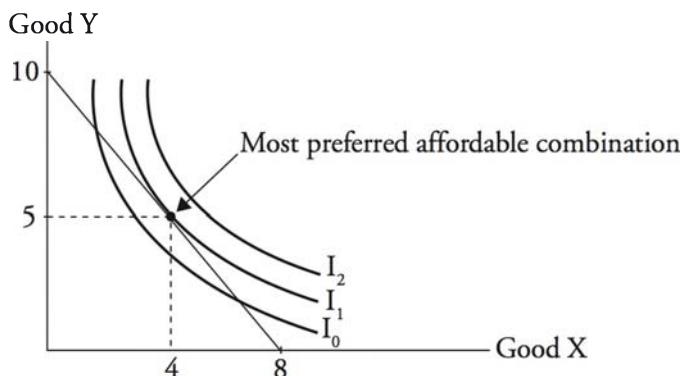
Income and Substitution Effects

A budget line represents all the combinations of two goods that will just exhaust a consumer's income. A budget line bounds an area representing all affordable combinations of two goods at current prices. The y-intercept of a budget line is income/price of Good Y, and the x-intercept is income/price of Good X.

An indifference curve for an individual that is higher than (to the north-east of) another represents a set of more preferred bundles of goods. By combining an individual's indifference curves with that individual's budget constraint, we can illustrate the choice of the most preferred affordable bundle as the combination of goods along the budget line that lies on the highest attainable indifference curve. Graphically, this is the point where one of an individual's indifference curves is just tangent to his budget constraint.

We illustrate this result in the following figure, which is consistent with an individual with an income of 200 when the price of Good Y is 20 and the price of Good X is 25.

Figure 1: A Consumer's Equilibrium Bundle of Goods



The effect of a decrease in the price of Good X is to move the x-intercept to the right (flattening the budget line), which will result in a different optimal bundle of goods. We can decompose this change into a **substitution effect**, substitution of X for Y because the relative price of Good X has decreased, and an **income effect**, approximately the effect of the income left over from consuming the original bundle of goods after the price decrease.

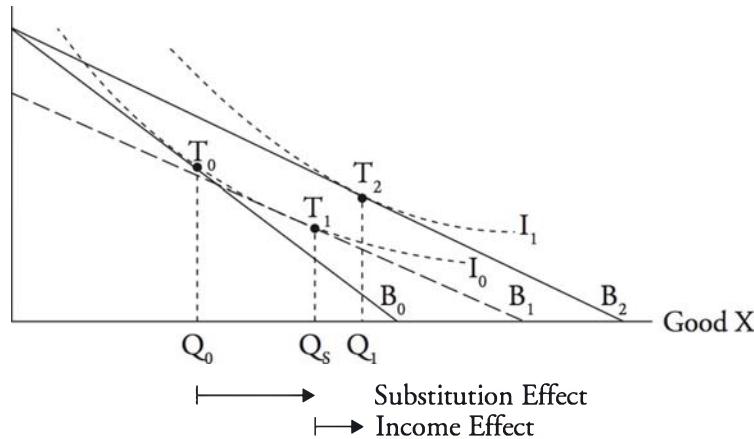
The income effect of the price decrease on consumption of Good X can theoretically be either positive or negative, depending on whether the good is normal or inferior over the relevant range of income.

The substitution effect is the change in consumption due to the change in relative prices and is always positive (i.e., results in increased consumption of the good that decreased in price). Graphically we show this effect as a change in consumption to a point on the consumer's original tangent indifference curve, but at the point where the slope of the curve (MRS) is equal to the slope of the new budget line after the price decrease. The three possible combinations of income and substitution effects are shown graphically in Figure 2. The three combinations, different because of the income effect, are:

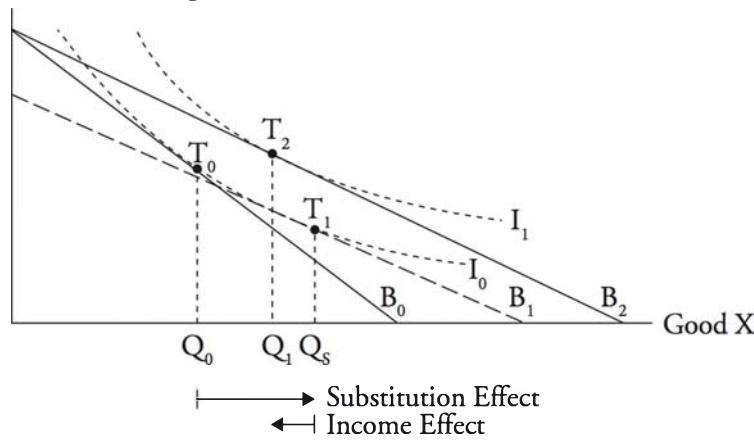
1. Income effect is positive so consumption of Good X increases.
2. Income effect is negative but smaller than the positive substitution effect so that consumption of Good X increases.
3. The income effect is negative and larger than the substitution effect so that consumption of Good X decreases as a result of the decrease in its price.

Figure 2: Income and Substitution Effects

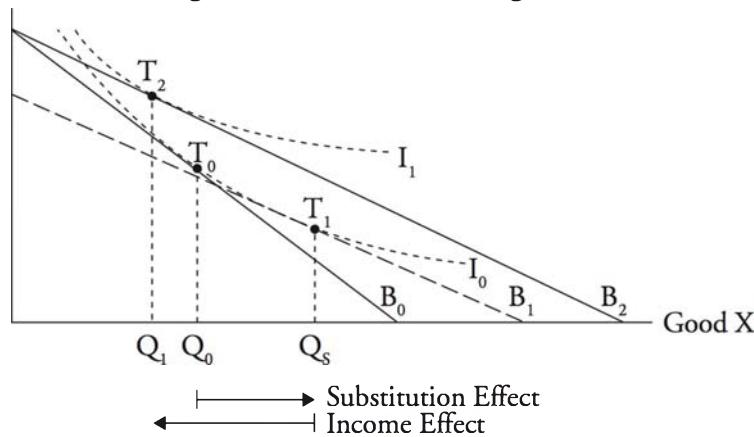
Good Y A: Positive Income Effect



Good Y B: Negative Income Effect, Smaller Than Substitution Effect



Good Y C: Negative Income Effect, Larger Than Substitution Effect



In the third panel of Figure 2, a decrease in the price of the good results in a decrease in the quantity demanded. Such a good is referred to as a **Giffen good** and is consistent with utility theory and theoretically possible.

A **Veblen good** is defined as a good for which an increase in price increases its value to some consumers, so that their quantity demanded actually increases (e.g., Gucci bag). Since such goods, if they exist, are clearly not inferior, their existence is at odds with utility theory as rational decision makers are assumed to prefer lower prices and increased consumption opportunities.

Diminishing Marginal Returns

Factors of production are the resources a firm uses to generate output. Factors of production include:

- *Land*—where the business facilities are located.
- *Labor*—includes all workers from unskilled laborers to top management.
- *Capital*—sometimes called *physical capital* or *plant and equipment* to distinguish it from financial capital. Refers to manufacturing facilities, equipment, and machinery.
- *Materials*—refers to inputs into the productive process, including raw materials and intermediate goods.

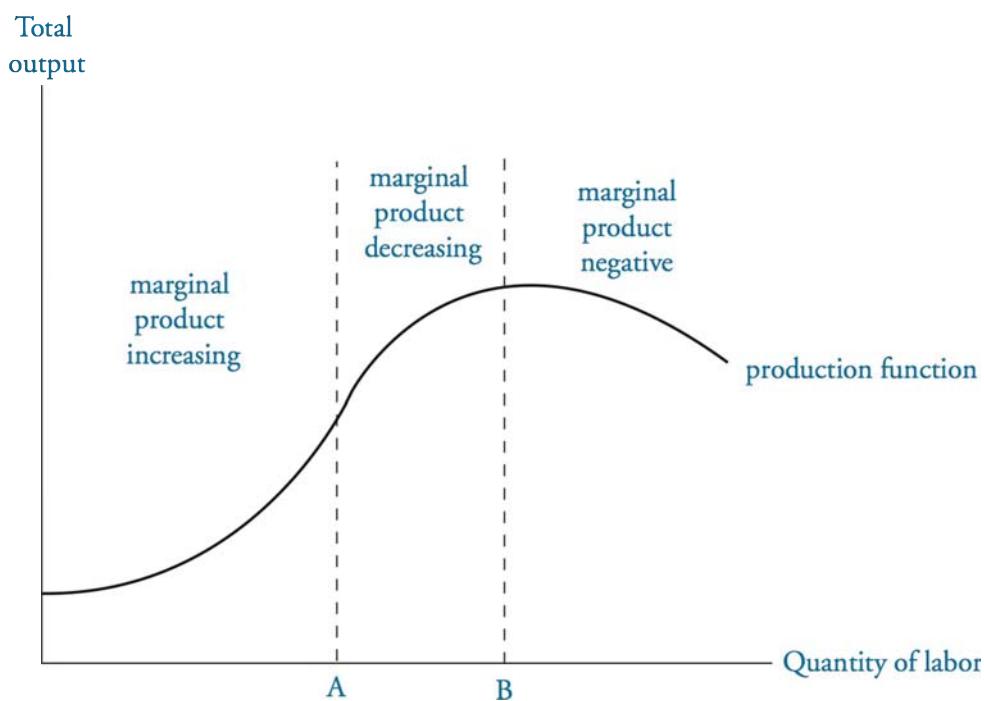
For economic analysis, we often consider only two inputs: capital and labor. The quantity of output that a firm can produce can be thought of as a function of the amounts of capital and labor employed. Such a function is called a **production function**. For a given amount of capital (a firm's plant and equipment), we can examine the increase in production (the total product of labor) that will result as we increase the amount of labor employed.

The output with only one worker is considered the **marginal product** of the first unit of labor. The addition of a second worker will increase total product by the marginal product of the second worker. The typical total product curve will at first increase at increasing rates, as additional workers increase total product by greater amounts, and marginal product is increasing with additional workers. At some point, since we are holding capital constant, each additional worker adds less and less to total product, total product increases at a decreasing rate, and the marginal product of labor decreases with additional workers. At some level of labor, additional workers may actually decrease total product (think of a very crowded factory) and the marginal product of labor is negative.

When we reach the quantity of labor for which the marginal product of labor begins to decline, we have reached the point of **diminishing marginal productivity** of labor, or that labor has reached the point of **diminishing marginal returns**.

Beyond this quantity of labor, the additional output from each additional worker continues to decline. This typical assumption about the nature of labor productivity (in the short run when capital is fixed) is illustrated in Figure 3.

Figure 3: Production Function—Capital Fixed, Labor Variable

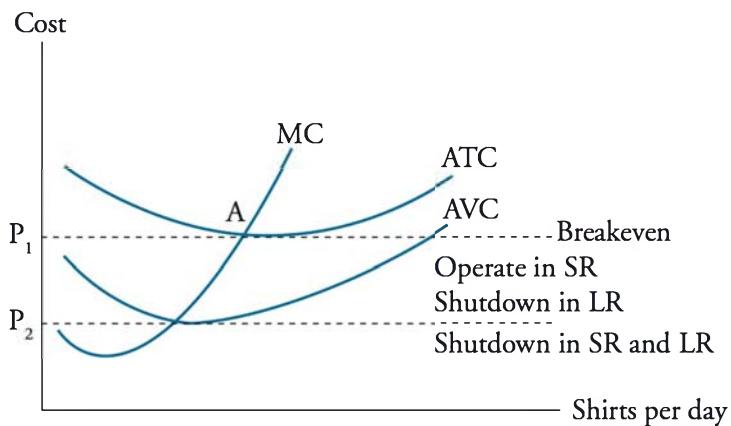


Breakeven and Shutdown

In the short run, a firm may be selling at less than average total cost (ATC), generating an economic loss. Such a firm should continue to operate in the short run as long as price is greater than average variable cost (AVC). In this case, the losses from shutting down (producing zero output) in the short run would be greater (equal to total fixed costs [TFC]) than the losses from continued operation. If selling price is less than average variable cost, the firm will minimize its losses in the short run by ceasing operations.

In the long run, a firm should shut down if price is expected to remain less than average total cost. These cases are illustrated in Figure 4. At prices below P_1 but above P_2 , a profit maximizing (loss minimizing) firm should continue to operate in the short run but shut down in the long run. At prices below P_2 , the firm should shut down in the short run as well. We refer to this price (minimum average variable cost) as the **shutdown point**.

Figure 4: Shutdown and Breakeven

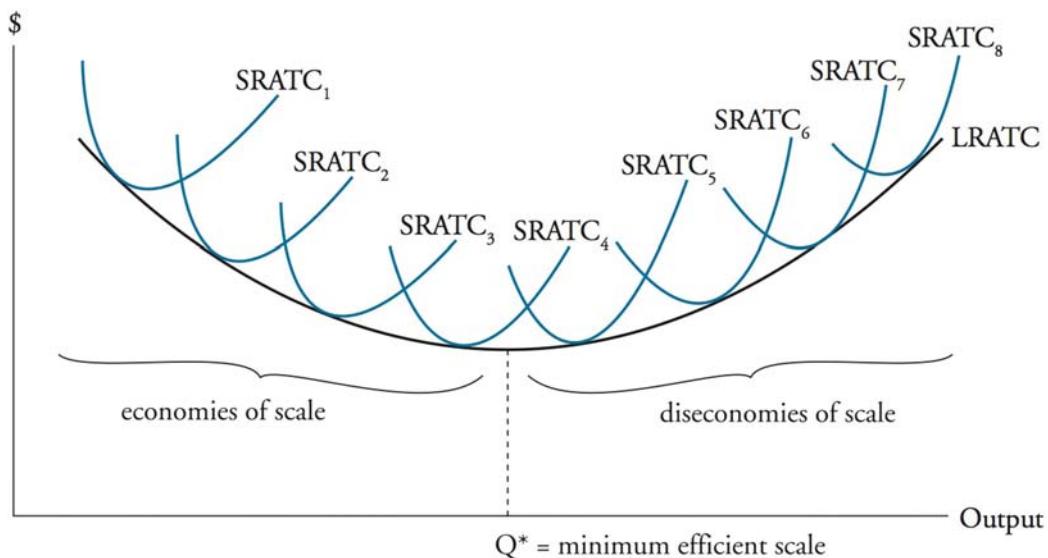


Economies and Diseconomies of Scale

In the long run, firms can adjust their scale of operations (i.e., capital is variable). The minimum average total cost at each possible scale of operations is shown on the **long-run average total cost (LRATC)** curve.

The downward sloping segment of the long-run average total cost curve presented in Figure 5 indicates that **economies of scale** (or *increasing returns to scale*) are present. Economies of scale result from factors such as labor specialization, mass production, and investment in more efficient equipment and technology. In addition, the firm may be able to negotiate lower input prices with suppliers as firm size increases and more resources are purchased. The lowest point on the LRATC curve corresponds to the scale or plant size at which the average total cost of production is at a minimum. This scale is sometimes called the **minimum efficient scale**. At larger firm sizes, minimum average total costs begin to increase, indicating that there are **diseconomies of scale** beyond the minimum efficient scale.

Figure 5: Economies and Diseconomies of Scale



THE FIRM AND MARKET STRUCTURES

Cross-Reference to CFA Institute Assigned Reading #15

We can differentiate among four types of markets based on the following characteristics:

- Number of firms and their relative sizes.
- Elasticity of the demand curves they face.
- Ways that they compete with other firms for sales.
- Ease or difficulty with which firms can enter or exit the market.

At one end of the spectrum is **perfect competition**, in which many firms produce identical products and competition forces them all to sell at the market price.

At the other extreme, we have **monopoly**, where only one firm is producing the product. In between are **monopolistic competition** (many sellers and differentiated products) and **oligopoly** (few firms that compete in a variety of ways).

Characteristics of Market Structures

Markets can be differentiated by several characteristics, including number of seller firms, their market shares/industry concentration, the degree of product differentiation, the nature of competition, and barriers to entry into and exit from the industry. We can identify four primary types of market structures. An analyst, however, may be most concerned with the pricing power a particular firm has.

Perfect competition is characterized by:

- Many firms, each small relative to the market.
- Very low barriers to entry into or exit from the industry.
- Homogeneous products that are perfect substitutes.
- No advertising or branding.
- No pricing power.

Monopolistic competition is characterized by:

- Many firms.
- Low barriers to entry into or exit from the industry.
- Differentiated products, heavy advertising, and high marketing expenditure.
- Firms that have some pricing power.

Oligopoly markets are characterized by:

- Few sellers.
- High barriers to entry into or exit from the industry.
- Products that may be homogeneous or differentiated by branding and advertising.
- Firms that may have significant pricing power.

Monopoly is characterized by:

- A single firm that comprises the whole market.
- Very high barriers to enter or exit the industry.
- Advertising used to compete with substitute products.
- Significant pricing power.

Demand Characteristics

Perfect competition: Price = marginal revenue = marginal cost (in equilibrium)
Perfectly elastic firm demand curve
Zero economic profit in equilibrium

Monopolistic competition: Price > marginal revenue = marginal cost (in equilibrium)
Downward sloping firm demand curve
Zero economic profit in long-run equilibrium

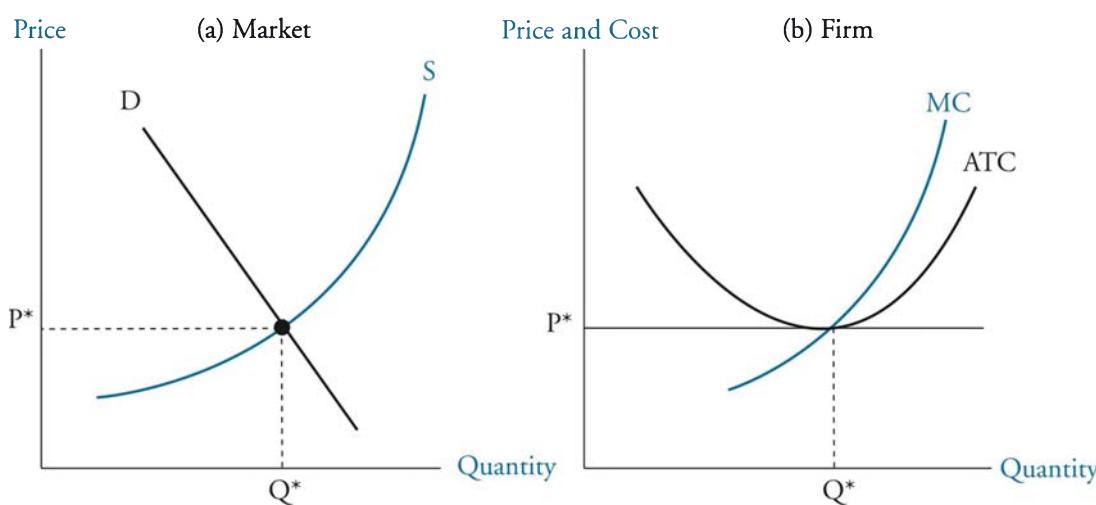
Oligopoly: Price > marginal revenue = marginal cost (in equilibrium)
Downward sloping firm demand curve
May have positive economic profit in long-run equilibrium
Tends towards zero economic profit over time

Study Sessions 4 & 5
Economics

Monopoly: Price > marginal revenue = marginal cost (in equilibrium)
Downward sloping firm demand curve
May have positive economic profit in long-run equilibrium
Profits may be zero because of expenditures to preserve monopoly

All firms maximize profits by producing the quantity of output for which marginal cost equals marginal revenue. Under perfect competition (perfectly elastic demand), marginal revenue also equals price. Equilibrium under perfect competition is illustrated in Figure 6.

Figure 6: Equilibrium in a Perfectly Competitive Market



The market price, P^* , is determined by the intersection of market supply and demand (Panel a). To maximize profits, each individual firm will produce the quantity for which marginal cost equals marginal revenue. This is the price when firm demand is perfectly elastic (Panel b). In long-run equilibrium, this is also the quantity for which average total cost is minimized.

An increase in market demand will result in an increase in market price, and each firm will increase output and earn economic profits in the short run. In the long run, these economic profits will attract new firms into the industry, increasing market supply and decreasing the market price until the equilibrium situation illustrated in Figure 6 is restored.

Firms in monopolistic competition or that operate in oligopoly or monopoly markets all face downward sloping demand curves. Selling price is determined from the price on the demand curve for the profit maximizing quantity of output.

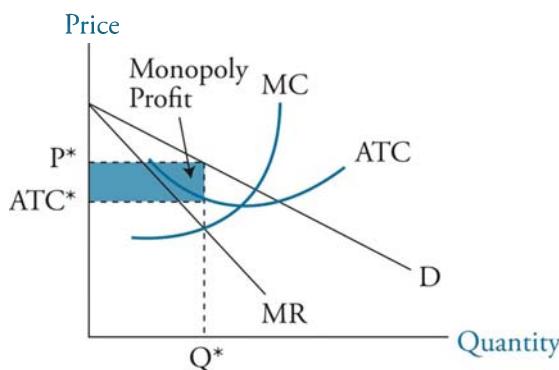
An increase (decrease) in demand will increase (decrease) economic profits in the short run under all market structures. Positive economic profits result in entry of

firms into the industry unless barriers to entry are high. Negative economic profits result in exit of firms from the industry unless barriers to exit are high. When firms enter (exit) an industry, market supply increases (decreases), resulting in a decrease (increase) in market price and an increase (decrease) in the equilibrium quantity traded in the market.

A **natural monopoly** refers to a situation where the average cost of production is falling over the relevant range of consumer demand. In this case, having two (or more) producers would result in a significantly higher cost of production and be detrimental to consumers.

Left unregulated, a single-price monopolist will maximize profits by producing the quantity for which $MR = MC$, charge the price indicated on the demand curve for that quantity, and maximize their producers' surplus. This situation is illustrated in Figure 7.

Figure 7: Monopoly Short-Run Costs and Revenues



Government regulation may attempt to improve resource allocation by requiring a monopolist to institute **average cost pricing** or **marginal cost pricing** (with a subsidy to the firm if $MC < ATC$). Additionally, regulators often attempt to increase competition and efficiency through efforts to reduce artificial barriers to trade, such as licensing requirements, quotas, and tariffs.

Rather than estimate elasticity of demand, **concentration measures** for a market or industry are often used as an indicator of market power. One concentration measure is the **N-firm concentration ratio**, which is calculated as the sum of the percentage market shares of the largest N firms in a market. While this measure is simple to calculate and understand, it does not directly measure market power or elasticity of demand.

Study Sessions 4 & 5 Economics

One limitation of the N-firm concentration ratio is that it may be relatively insensitive to mergers of two firms with large market shares. This problem is reduced by using an alternative measure of market concentration, the **Herfindahl-Hirschman Index (HHI)**. The HHI is calculated as the sum of the squares of the market shares of the largest firms in the market.

A second limitation that applies to both concentration measures is that barriers to entry are not considered. Even a firm with high market share may not have much pricing power if barriers to entry are low and there is *potential competition* in that a competitor may enter the market if the price is high enough to produce economic profits.

There are alternative assumptions made about the nature of competition in oligopoly markets. At one extreme, competition within an oligopoly market is strong, the product undifferentiated, and the result is very much like perfect competition in the long run. At the other extreme, if oligopolistic firms successfully collude (mostly illegally), they will charge the price a monopolist would and agree to share the economic profits. Between these extremes we have the following models:

The **kinked demand curve model** is based on an assumption that a firm's competitors will not follow a price increase but will cut their prices in response to a price decrease by a competitor. Under this model, each firm faces a demand curve with a kink at the current market price – more elastic above the current price and less elastic below the current price.

The **Cournot model** assumes that the firms in a two-firm oligopoly have identical cost structures and react only to the price charged by the other firm in the prior period. Each firm will produce half the industry output and charge the same price in equilibrium. This is a special case of a **Nash equilibrium**, defined as a situation in which no firm can increase profits by changing its price/output choice. The incentive for firms to cheat on a collusive agreement that is not a Nash equilibrium is one reason that collusive agreements are difficult to maintain.

In the **dominant firm model**, one firm is assumed to have the lowest cost structure and a significant proportion of the market. In this case, the dominant firm essentially sets the price for the industry, and competitors set their output quantities taking this price as given.

Supply Curves and Market Structure

Under perfect competition, a firm's short-run supply curve is the portion of the firm's short-run marginal cost curve above average variable cost. A firm's long-run

supply curve is the portion of the firm's long-run marginal cost curve above average total cost.

Firms operating under monopolistic competition, oligopoly, and monopoly do not have well-defined supply functions, so neither marginal cost curves nor average cost curves are supply curves in these cases.

To identify the type of market in which a firm operates, an analyst should focus on the number of firms in the market, their market shares, the nature of competition, the availability of substitute goods, and barriers to entry into and exit from the industry.

AGGREGATE OUTPUT, PRICES, AND ECONOMIC GROWTH

Cross-Reference to CFA Institute Assigned Reading #16

There are alternative methods of calculating gross domestic product (GDP), the market value of all final goods and services produced within a country over a specific time period, usually one year.

Using the **income approach**, GDP is calculated as the total income earned by households and businesses in the country during a time period.

Using the **expenditure approach**, GDP is calculated as the total amount spent on goods and services produced in the country during a time period.

The expenditure approach to measuring GDP can use the **sum-of-value-added method** or the **value-of-final-output method**.

- *Sum-of-value-added:* GDP is calculated by summing the additions to value created at each stage of production and distribution.
- *Value-of-final-output:* GDP is calculated by summing the values of all final goods and services produced during the period.

GDP under all these methods is the same, and estimates using different methods will differ only due to statistical discrepancies.

Nominal GDP values goods and services at their current prices. **Real GDP** measures current-year output using prices from a base year.

The **GDP deflator** is a price index that can be used to convert nominal GDP into real GDP by removing the effects of changes in prices. Price change estimates are based on the ratio of current-year nominal GDP to the value of the current-year output mix using base-year prices.

Study Sessions 4 & 5
Economics

The four components of gross domestic product are consumption spending, business investment, government spending, and net exports. The relationship among them is:

$$GDP = C + I + G + (X - M)$$

National income is the income received by all factors of production used in the creation of final output.

Personal income is the pretax income received by households.

Personal disposable income is personal income after taxes.

Private saving and investment are related to the fiscal balance and the trade balance. A fiscal deficit must be financed by some combination of a trade deficit or an excess of private saving over private investment. We write this relation as:

$$(G - T) = (S - I) - (X - M)$$

From this relation, we can see that a government budget deficit can be offset by a trade deficit or an excess of domestic savings over domestic investment. A government budget deficit combined with a trade surplus ($X - M > 0$) must be offset by a surplus of domestic savings over domestic investment.

The **IS curve** shows the negative relationship between the real interest rate (y-axis) and equilibrium value of aggregate income (which must equal planned expenditures) consistent with each real interest rate.

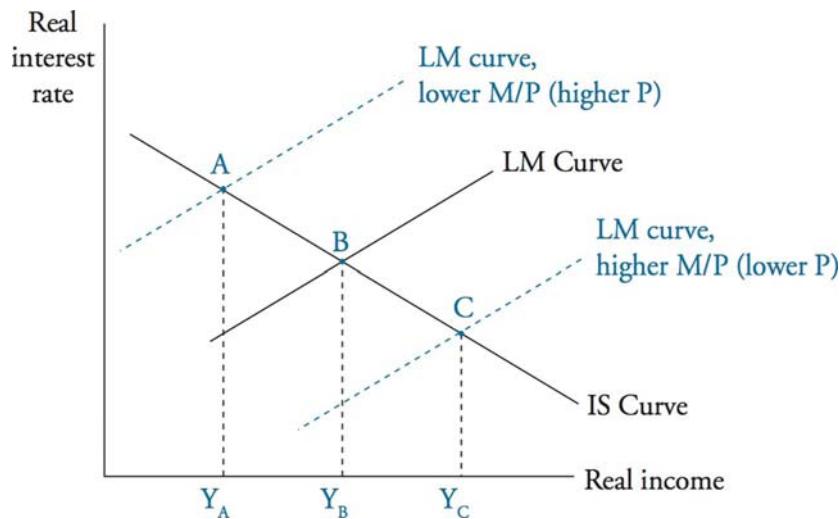
For a given level of the real money supply, the **LM curve** shows the positive relationship between the real interest rate (y-axis) and the level of aggregate income at which demand for and supply of real money balances are equal.

The points at which the IS curve intersects the LM curves for different levels of the real money supply (i.e., for different price levels, holding the nominal money supply constant) form the **aggregate demand curve**. The aggregate demand curve shows the negative relationship between GDP (real output demanded) and the price level (y-axis) when other factors are held constant.

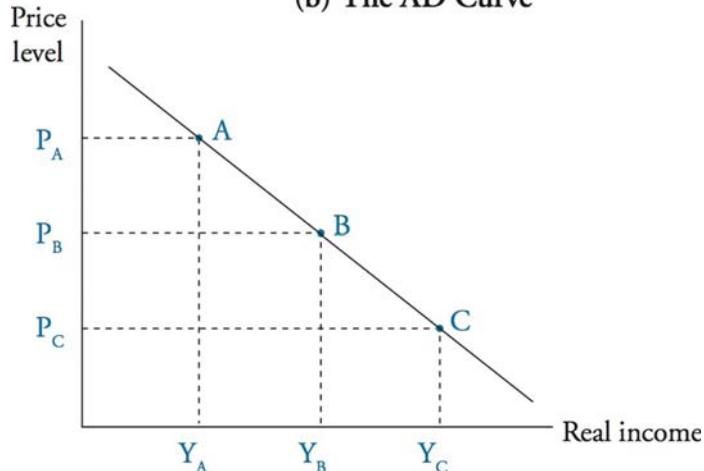
In Panel (a) of Figure 8, we illustrate the IS curve and LM curves for different levels of the money supply (and the price level). These intersections allow us to create the aggregate demand curve in Panel (b), which shows the relation between the price level (for various levels of the money supply) and real income (real GDP).

Figure 8: Deriving the Aggregate Demand Curve

(a) The IS and LM Curves



(b) The AD Curve



The **short-run aggregate supply curve** shows the positive relationship between real GDP supplied and the price level when other factors are held constant. Because we hold some input costs fixed in the short run (e.g., wages), the SRAS curve slopes upward because higher output prices result in greater output (real wages fall).

Because all input prices are assumed to be flexible in the long run, the **long-run aggregate supply curve** is perfectly inelastic (vertical). Long-run aggregate supply represents potential GDP, the full-employment level of economic output.

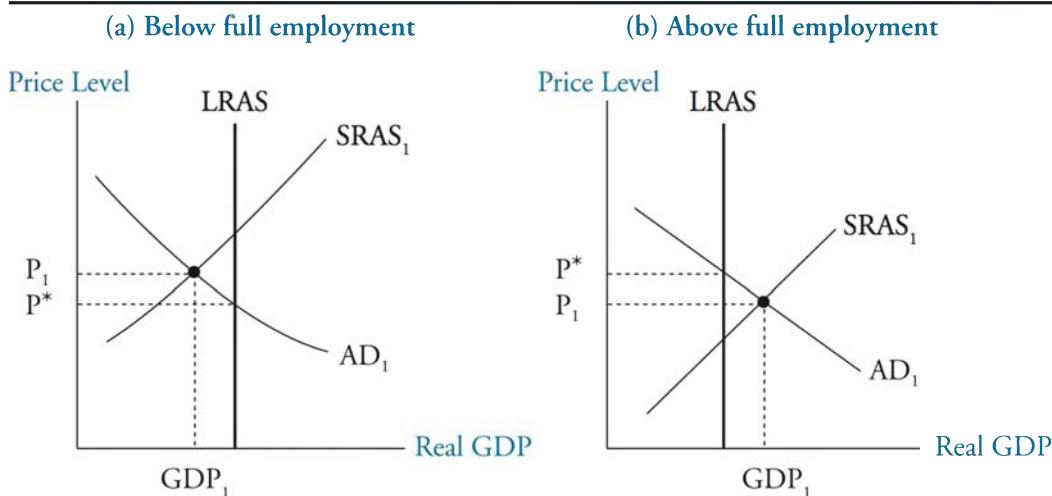
Shifts in the aggregate demand curve are caused by changes in household wealth, business and consumer expectations, capacity utilization, fiscal policy, monetary policy, currency exchange rates, and global economic growth rates.

Shifts in the short-run aggregate supply curve are caused by changes in nominal wages or other input prices, expectations of future prices, business taxes, business subsidies, and currency exchange rates, as well as by the factors that affect long-run aggregate supply.

Shifts in the long-run aggregate supply curve are caused by changes in labor supply and quality, the supply of physical capital, the availability of natural resources, and the level of technology.

In Figure 9, we illustrate the situation in the short run when aggregate demand decreases (Panel a) and increases (Panel b). The situation in Panel a when aggregate demand has decreased is referred to as a **recessionary gap** because real GDP is less than potential real GDP (LRAS). The resulting downward pressure on input prices will result in an increase in SRAS. The SRAS curve will shift to the right as input prices fall until aggregate demand once again equals LRAS.

Figure 9: Long-Run Disequilibrium



In Panel b we illustrate an increase in aggregate demand that results in an **inflationary gap**. Here real GDP is greater than potential real GDP in the short run, causing upward pressure on input prices. As input prices increase, SRAS decreases and long-run equilibrium is restored as we move along the aggregate demand curve to its intersection with LRAS.

Stagflation is simultaneous high inflation and weak economic growth, which can result from a sudden decrease in short-run aggregate supply.

Sources of economic growth include:

- Increases in the supply of labor.
- Increases in human capital.

- Increases in the supply of physical capital.
- Increases in the availability of natural resources.
- Advances in technology.

The **sustainable rate of economic growth** is determined by the rate of increase in the labor force and the rate of increase in labor productivity.

A **production function** relates economic output to the supply of labor, the supply of capital, and total factor productivity. Total factor productivity is a residual factor, which represents that part of economic growth not accounted for by increases in the supply of either labor or capital. Increases in total factor productivity can be attributed to advances in technology.

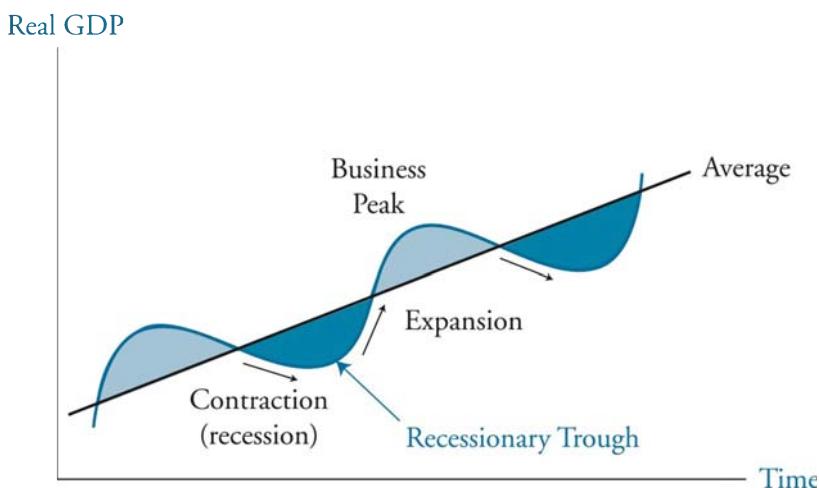
In developed countries, where a high level of capital per worker is available and capital inputs experience diminishing marginal productivity, technological advances that increase total factor productivity are the main source of sustainable economic growth.

UNDERSTANDING BUSINESS CYCLES

Cross-Reference to CFA Institute Assigned Reading #17

The business cycle has four phases: **expansion** (real GDP is increasing), **peak** (real GDP stops increasing and begins decreasing), **contraction or recession** (real GDP is decreasing), and **trough** (real GDP stops decreasing and begins increasing).

Figure 10: Business Cycle



Inventory-to-sales ratios typically increase late in expansions, when sales slow unexpectedly, and decrease near the end of contractions, when sales unexpectedly begin to accelerate. As firm expectations change, firms decrease or increase production to restore their inventory-to-sales ratios to their desired levels.

Study Sessions 4 & 5

Economics

Because hiring and laying off employees have high costs, firms prefer to adjust their utilization of current employees. As a result, firms are slow to lay off employees early in contractions and slow to add employees early in expansions.

Firms use their physical capital more intensively during expansions, investing in new capacity only if they believe the expansion is likely to continue. They use physical capital less intensively during contractions, but they are more likely to reduce capacity by deferring maintenance and not replacing equipment than by selling their physical capital.

Business Cycle Theories

Neoclassical economists: Business cycles are temporary and driven by changes in technology. Rapid adjustments of wages and other input prices cause the economy to move to full-employment equilibrium.

Keynesian economists: Excessive optimism or pessimism among business managers causes business cycles. Contractions can persist because wages are slow to move downward.

New Keynesians: Input prices other than wages are also slow to move downward.

Monetarists: Inappropriate changes in the rate of money supply growth cause business cycles. Money supply growth should be maintained at a moderate and predictable rate to support the growth of real GDP.

Austrian-school economists: Business cycles are initiated by government intervention that drives interest rates to artificially low levels.

Real business cycle theory: Business cycles result from utility-maximizing actions in response to real economic changes, such as external shocks and changes in technology. Policymakers should not intervene in business cycles.

Unemployment

Frictional unemployment results from the time lag necessary to match employees seeking work with employers seeking their skills and is always present as employers expand or contract their businesses and as workers move, are fired, or quit to seek other opportunities.

Structural unemployment is caused by long-run changes in the economy that eliminate some jobs while generating other jobs for which unemployed workers are not qualified, so these workers must learn new skills.

Cyclical unemployment is caused by changes in the general level of economic activity. It is positive when the economy is operating at less than full capacity and negative when an expansion leads to employment temporarily above the full employment level.

A person is considered to be **unemployed** if he is not working *and* actively searching for work. The **labor force** includes all people who are either employed or unemployed. The **unemployment rate** is the percentage of people in the labor force who are unemployed. A person who is employed part time but would prefer to work full time, or is employed at a low-paying job despite being qualified for a significantly higher-paying one, is said to be **underemployed**.

The **participation ratio** (also referred to as the *activity ratio* or *labor force participation rate*) is the percentage of the working-age population who are either employed or actively seeking employment.

Short-term fluctuations in the participation ratio can occur because of changes in the number of **discouraged workers**, those who are available for work but are neither employed nor actively seeking employment. The participation rate tends to increase when the economy expands and decrease during recessions.

The movement of discouraged workers out of and back into the labor force causes the unemployment rate to be a lagging indicator of the business cycle. Early in an expansion when hiring prospects begin to improve, the number of discouraged workers who re-enter the labor force is greater than the number hired immediately. This causes the unemployment rate to increase even though employment is expanding. To gauge the current state of the labor market, analysts should also observe other widely available indicators such as the number of employees on payrolls.

Firms' tendency to be slow to hire or lay off workers at business cycle turning points also causes the unemployment rate to lag the business cycle. The effect can also be seen in data on **productivity**, or output per hour worked. Productivity declines early in contractions as firms are slow to reduce employment and increases early in expansions as firms produce more output but are slow to hire new employees.

Inflation

Inflation is a persistent increase in the price level over time. Inflation erodes the purchasing power of a currency. Inflation favors borrowers at the expense of lenders because when the borrower returns the principal to the lender, it is worth less in terms of goods and services (in real terms) than it was worth when it was borrowed.

Inflation that accelerates out of control is referred to as **hyperinflation**, which can destroy a country's monetary system and bring about social and political upheavals.

The **inflation rate** is the percentage increase in the price level, typically compared to the prior year.

Disinflation refers to an inflation rate that is decreasing over time but remains greater than zero.

A persistently decreasing price level (i.e., a negative inflation rate) is called **deflation**. Deflation is commonly associated with deep recessions.

A **price index** measures the total cost of a specific basket of goods and services relative to its cost in a prior (base) period. The inflation rate is most often calculated as the annual percentage change in a price index. **Core inflation** is calculated by excluding food and energy prices from a price index because of their high short-term volatility.

The most widely followed price index is the **consumer price index (CPI)**, which is based on the purchasing patterns of a typical household. The **GDP deflator** (described earlier) and the **producer or wholesale price index** are used as measures of price inflation of goods in process and may give early indications of changes in consumer prices. Analysts can observe sub-indexes of the producer price index for different stages of processing (raw materials, intermediate goods, and finished goods) or for specific industries for indications of emerging price pressure.

A **Laspeyres price index** is based on the cost of a specific basket of goods and services that represents actual consumption in a base period. New goods, quality improvements, and consumers' substitution of lower-priced goods for higher-priced goods over time cause a Laspeyres index to be biased upward.

A **Paasche price index** uses current consumption weights for the basket of goods and services for both periods, thereby reducing substitution bias. A **Fisher price index** is the geometric mean of a Laspeyres index and a Paasche index and is termed a *chained index*.

Cost-push inflation results from a decrease in aggregate supply caused by an increase in the real price of an important factor of production, such as labor or energy. Because wages are the largest cost to businesses, analysts look to the unemployment rate as an indicator of future inflationary pressure. The **non-accelerating inflation rate of unemployment** (NAIRU) represents the unemployment rate below which upward pressure on wages is likely to develop.

Demand-pull inflation results from persistent increases in aggregate demand that increase the price level and temporarily increase economic output above its potential or full-employment level. This could result from expansionary fiscal policy when the economy is already near full employment. Monetarists focus on growth in the money supply in excess of the growth rate of real GDP as a cause of demand-pull inflation. Excessive money supply growth will create excess liquidity, reduce interest rates, and increase aggregate demand, resulting in demand-pull inflation.

Because recent inflation levels affect inflation expectations, which are reflected in input prices (commodity prices and especially wages), inflation can persist even after an economy has fallen into recession. Slow or negative economic growth together with high inflation is termed *stagflation*.

Leading, Coincident, and Lagging Indicators

Economic indicators are used by analysts to assess the current state of the economy and to provide information about future economic activity. Indicators are classified by how they rise and fall relative to the phases of the business cycle.

- *Leading indicators* have turning points that tend to precede those of the business cycle. Weekly hours in manufacturing, the S&P 500 return, private building permits, initial unemployment claims, and the real M2 money supply are examples of leading indicators.
- *Coincident indicators* have turning points that tend to coincide with those of the business cycle and are used to indicate the current phase of the business cycle. Examples are manufacturing activity, personal income, and number of non-agricultural employees.
- *Lagging indicators* have turning points that tend to occur after those of the business cycle. The bank prime lending rate, inventory-to-sales ratio, average duration of unemployment, and the change in unit labor costs are examples of lagging indicators.

A limitation of using economic indicators to predict business cycles is that their relationships with the business cycle are inexact and can vary over time.