and programs affect prices, producers, and consumers. A huge number of diverse and interesting issues can be usefully analyzed using supply and demand.

1.2.1 Supply

The **Supply** of a good represents the behavior of firms, or producers. Supply refers to how much of a good will be produced at a given price.

> **Supply** = The relationship between the price of a good and quantity supplied, *ceteris paribus*.

Notice the important term, "*ceteris paribus*" at the end of the definition of supply. Recall the complexity of the real world, and how economists must simplify the world to understand it. Use of the concept, *ceteris paribus*, allows us to understand the supply of a good. In the real world, there are numerous forces affecting the supply of a good: weather, prices, input prices, just to name a few.

> ***Ceteris Paribus*** = Holding all else constant (Latin).

When studying supply, we seek to isolate the relationship between the price and quantity supplied of a good. We must hold everything else constant (*ceteris paribus*) to make sure that the other supply determinants are not causing changes in supply. An example is the supply of organic cotton. Patagonia spearheaded the movement into using organic cotton in the production of clothing. Nike and other clothing manufacturers are increasing organic clothing production to meet the growing demand for this good. Interestingly, conventional (non-organic) cotton is the most chemical-intensive field crop, and can result in agricultural chemical runoff in the soil and groundwater. A small but convicted group of consumers are willing to pay high premiums for clothing made with organic cotton, to reduce the potential environmental damage from agricultural chemicals used in cotton production. Notice that this graph has two items on each axis: (1) a label, and (2) units. Every graph drawn must have both labels and units on each axis to effectively communicate what the graph is about.

Point E is the only equilibrium in the wheat market shown in Figure 1.6. At any other price, market forces would come into play, and bring the price back to the equilibrium market price, P*. At any price higher than P*, such as P' in Figure 1.7, producers would increase the quantity supplied to Q_1 million metric tons of wheat, and consumers would decrease the quantity demanded to Q_0 million metric tons of wheat. A surplus would result, since quantity supplied is greater than quantity demanded ($Q_1 > Q_0$).

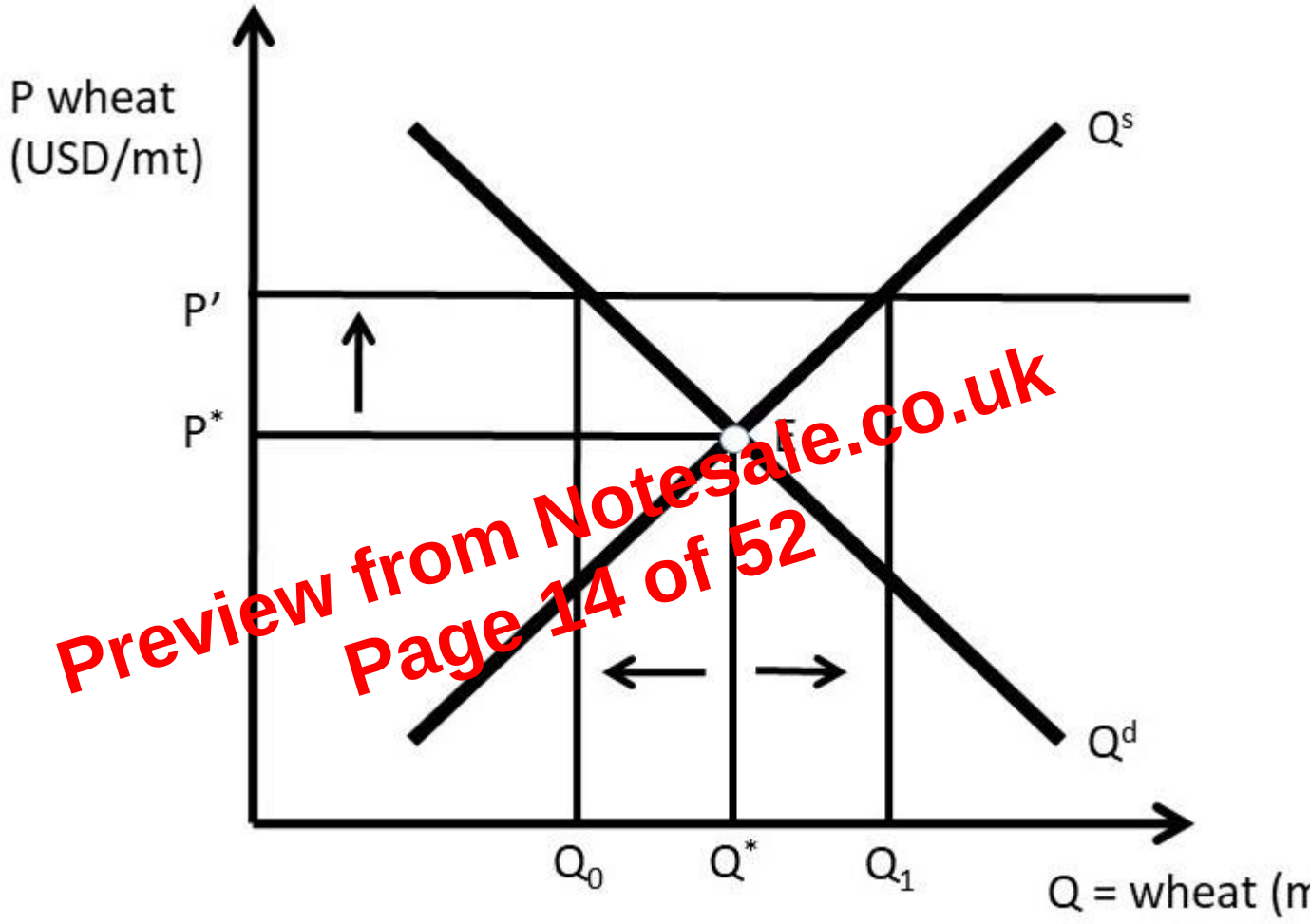

Figure 1.7 Wheat Market Surplus

A wheat surplus such as the one shown in Figure 1.7 would bring market forces into play since $Q^s \neq Q^d$. Wheat producers would lower the price of wheat in order to sell it. It would be preferable to earn a lower price than to let the surplus go unsold. Consumers would increase the quantity demanded along Q^d and producers decrease the quantity supplied along Q^s until the equilibrium point E was reached.

3. freedom of entry and exit, and

4. perfect information.

The first property of perfect competition is a homogeneous product. This means that the consumer can not distinguish any differences in the good, no matter which firm produced it. Wheat is an example, as it is not possible to determine which farmer produced the wheat. A John Deere tractor is an example of a nonhomogeneous good, since the brand is displayed on the machine, not to mention the company's well known green paint and deer logo.

The assumption of numerous buyers and sellers means something specific. The word, "numerous" refers to an industry so large that each individual firm can not affect the price. Each firm is so small relative to the industry that it is a price taker.

Freedom of entry and exit means that there are no legal, financial, or regulatory barriers to entering the market. A wheat market allows anyone to produce and sell wheat. Attorneys and physicians, however, do not have freedom of entry. To practice law or medicine, a license is required.

Perfect information is an assumption about industries where all firms have access to information about all input and output prices, and all technologies. There are no trade secrets or patented technologies in a perfectly competitive industry. These four properties of perfect competition are stringent and do not reflect real-world industries and markets. Our study of market structures in this course will examine each of these properties, and use them to define industries where these properties do not hold. Competitive markets have a number of attractive properties.

1.3.2 Outcomes of Competitive Markets

Competitive markets result in desirable outcomes for economies. A competitive market maximizes social welfare, or the total amount of well-being in a market. Competitive markets use voluntary exchange, or mutually beneficial trades, to achieve this result. In a market-based economy, no one is forced, or coerced, to do anything that they do not want to do. In this way, all trades are mutually beneficial: a producer or consumer would never make a trade unless it made him or her better off. This idea will be a theme throughout this course: free markets and free trade lead to superior economic outcomes.

It should be emphasized that free markets and free trade are not perfect, since there are negative features associated with markets and capitalism. Income inequality is an example. Markets do not solve all of society's problems, but they do create conditions for higher levels of income and wealth than other economic organizations, such as a command economy (as found in a communist or fascist nation). There are winners and losers to market changes. An example is free trade.

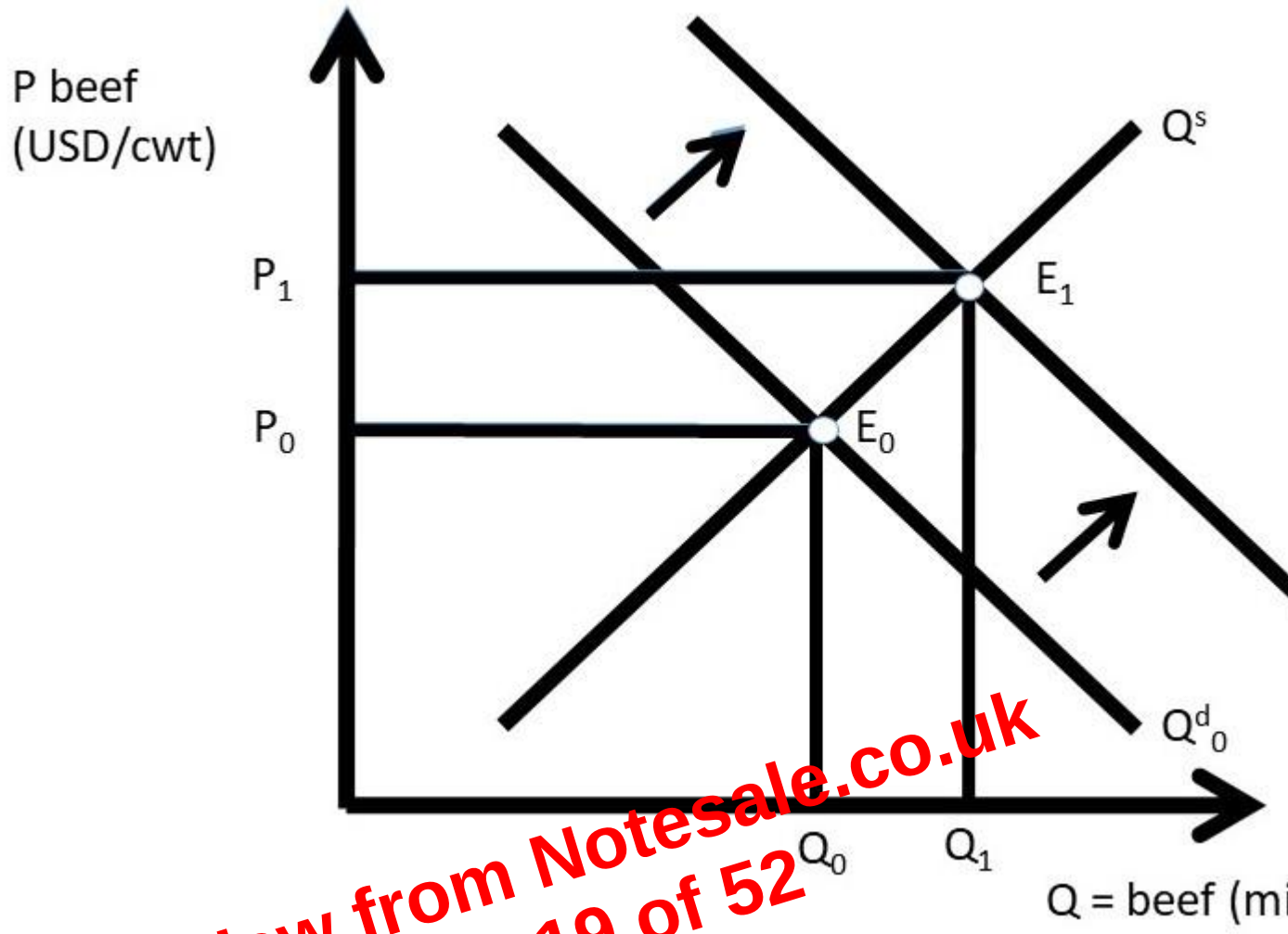

Figure 1.9 Increase in China Income Impact on US Beef Market

Interestingly, income growth in China is beneficial to not only US beef producers, who face an increased demand for beef, but also for grain farmers in the USA. The major input into the production of beef is corn, sorghum (also called milo), and soybeans. These grains are fed to cattle in feedlots. Seven pounds of grain are required to produce one pound of beef. Therefore, any increase in the global demand for beef will result in an increase in demand for beef, and a large increase in the demand for feed grains.

1.3.3.2 Demand Decrease

In the United States, the demand for beef offals (tripe, tongue, heart, liver, etc.) has decreased in the past few decades. As incomes increase, consumers shift out of these goods and into more expensive meat products such as hamburger and steaks. The demand for offals has decreased as a result, as in Figure 1.10. This is a

A luxury good is one that has increasing demand as income increases, as shown in the right panel of Figure 1.17. Good such as boats, golf club memberships, and expensive clothing are examples of luxury goods. Inferior goods (Figure 1.18) are characterized by lower levels of consumption as income increases: ramen noodles and used clothes are examples.

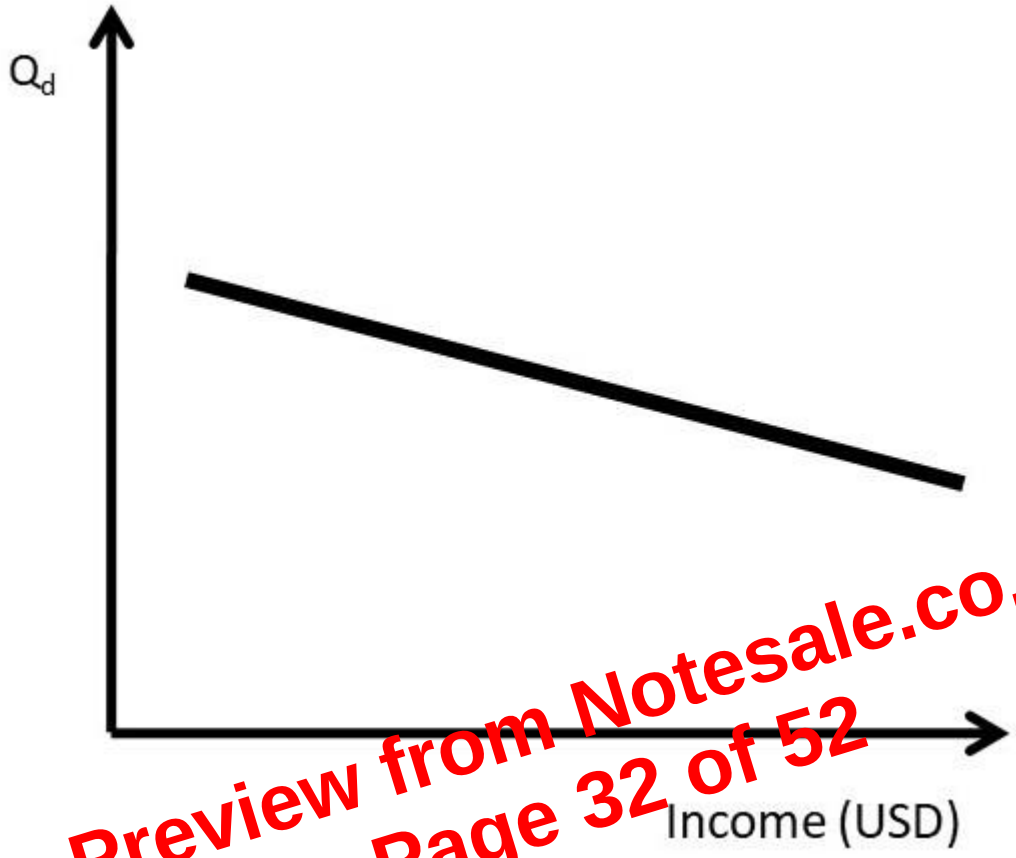

Figure 1.18 Engel Curve for an Inferior Good

It is important to point out that a good can be a normal good at low income levels, and an inferior good at higher income levels. Hamburger (ground beef) is an example. At low levels of income, hamburger consumption might increase when income rises (Figure 1.19). However, at higher levels of income, consumers might shift out of ground beef and into more expensive meats such as steak. Figure 1.19 shows that the same good can be both a normal good and an inferior good, at different levels of income.

lower-price strategy led to Walmart becoming the most successful retailer in the history of the world.

1.4.10 Calculation of Market Supply and Demand Elasticities

In Section 1.3.4 above, inverse supply and demand curves were used to calculate the equilibrium price and quantity of phones.

The inverse demand and supply functions were:

(1.18) $P = 100 - 2Q^d$

(1.19) $P = 20 + 2Q^s$

Where P is the price of phones in USD/unit, and Q is the quantity of phones in millions. By setting the two equations equal to each other, the intersection of the inverse supply and demand curves was found, yielding the equilibrium market price and quantity:

P^e = USD 60/phones, and

Q^e = 20 million phones.

The graph of the phone market is replicated in Figure 1.22.

To calculate the own price elasticities of supply and demand, simple calculus provides an easy solution. Recall the definition of the own price elasticity of demand:

(1.20) $E_d = \%\Delta Q^d/\%\Delta P = (\Delta Q^d/\Delta P)(P/Q^d) = (\partial Q^d/\partial P)(P/Q^d)$

The delta sign (Δ) refers to a small change in a variable. This is the same as the derivative sign, "∂." The difference is that the derivative indicates in infinitesimally small change, whereas the delta sign is a discrete change, which is the same idea, just larger. Therefore, the delta signs can be replaced with the derivative signs in the equation that defines the price elasticity of demand. For example, the slope of a function is $\Delta y/\Delta x$. The slope of the function at a given point on the function is $\partial y/\partial x$.

The last expression in the equation shows that to calculate E_d, use the derivative of quantity with respect to price, and the levels of P and Q. At the equilibrium point, the equilibrium levels of P and Q are known. To find the derivative, begin by taking the derivative of the inverse demand equation (Equation 1.18).

(1.21) $\partial P/\partial Q^d = -2$

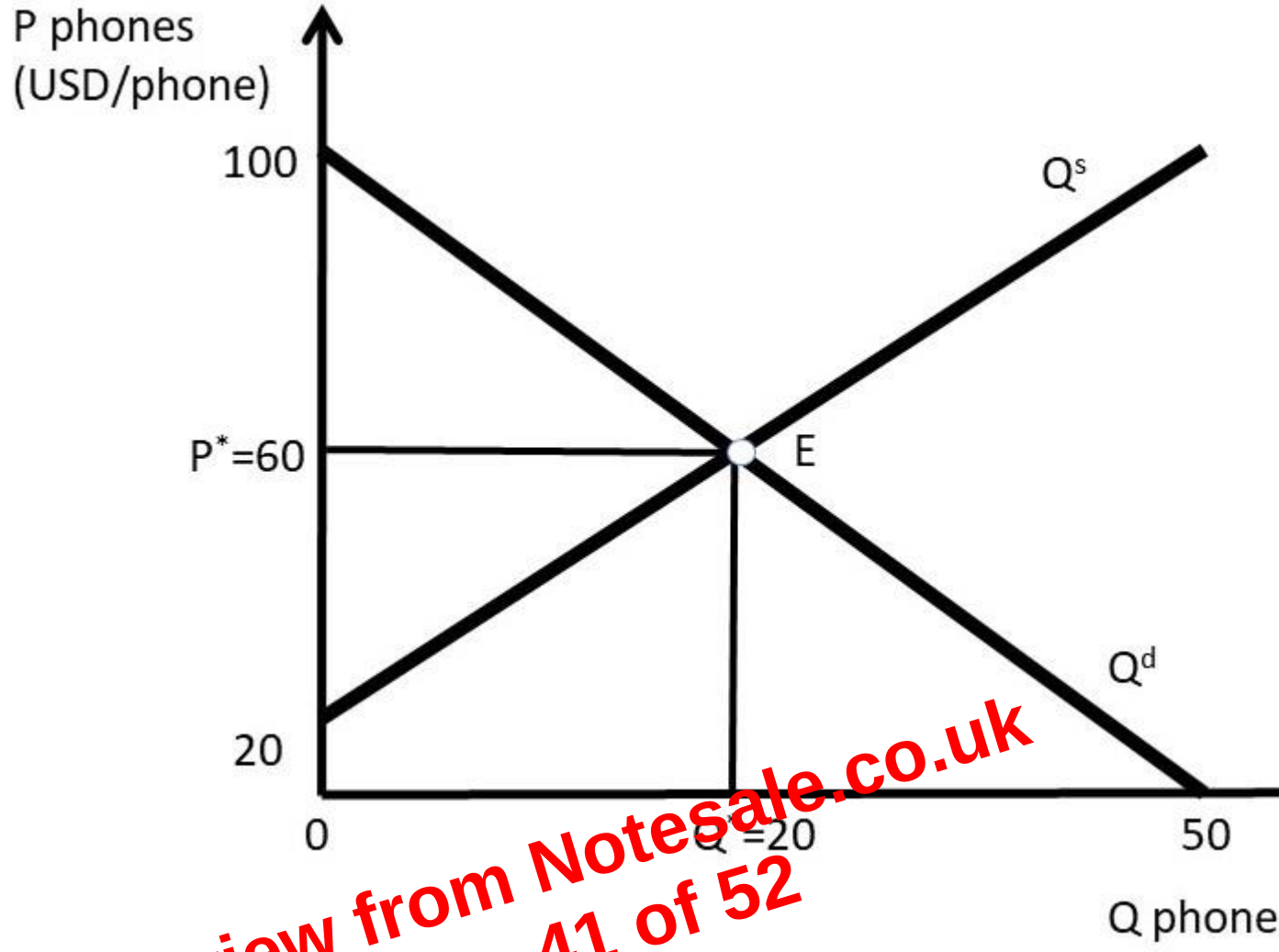

Figure 1.22 Phone Market Equilibrium

This is simply the power function rule from calculus [if $y = ax^b$, then $\partial y/\partial x = abx^{(b-1)}$]. Notice something important: the derivative of the inverse demand equation is the inverse of what is needed to calculate the price elasticity. This is due to the inverse demand function being, "price-dependent," with P on the left hand side. To find the derivative $\partial Q^d/\partial P$, invert the derivative by dividing one by the derivative.

(1.22) $\partial Q^d/\partial P = -(1/2)$

(1.23) $E_d = \%\Delta Q^d/\%\Delta P = (\Delta Q^d/\Delta P)(P/Q^d) = (\partial Q^d/\partial P)(P/Q^d) = (-1/2)(60/20) = -1.5$

The absolute value of the own price elasticity of demand at the equilibrium point is:

$|E_d| = 1.5$. The demand for phones is elastic: if the price were increased one percent, the decrease in phone purchases would be 1.5 percent.

Globalization and free trade result in enormous economic benefits to nations that trade. These benefits have led to high incomes in many nations throughout the world, particularly since 1950. As with all national policies, there are benefits and costs to international trade: there are winners and losers to globalization. When trade is voluntary, the gains are mutually beneficial, and the overall benefits are greater than the costs. There is a strong motivation to trade, and the nations of the world continue to become more globalized over time.

A nation's consumption possibilities are vastly increased with trade. In nations North of the equator such as the USA, Japan, EU, and China, fresh fruit and vegetables can be purchased during the winter from nations in the Southern hemisphere. In the United States, tropical products including coffee, sugar, bananas, cocoa, and pineapple are imported, since the costs of producing these goods are much lower in tropical climates than in the USA.

The principle of comparative advantage provides large benefits to individuals, nations, and firms that specialize in what they do best, and trade for other goods. This process greatly expands the consumption possibilities of all nations, due to efficiency gains that arise from specialization and gains from trade. For example, if Canada specializes in wheat production, and Costa Rica produces bananas, both nations could be better off through specialization and trade.

A nation that does not trade with other nations is called a closed economy.

> **Closed Economy** = A nation that does not trade. All goods and services consumed must be produced within the nation. There are no imports or exports.
>
> **Open Economy** = A nation that allows trade. Imports and exports exist.

If a nation does not trade, then consumers in the closed economy must only consume what it produces. In this case, quantity supplied must equal quantity demanded ($Q^s = Q^d$). Trade allows this equality to be broken, providing the opportunity for imports ($Q^s < Q^d$) or exports ($Q^s > Q^d$). The concepts of **Excess Supply** and **Excess Demand** will be introduced in the next section to aid in understanding the motivation and consequences of free trade.

1.6.2 Excess Supply and Excess Demand

We will use wheat as an example to see how and why trade occurs. We will investigate wheat trade between the USA and Japan. Japan is one of the largest international buyers of wheat from the United States. The USA is a wheat exporter. The left panel of Figure 1.25 show the USA wheat market. Define P_e to be the price of wheat in the exporting nation. At price P_e, domestic consumption (Q_d) is equal to domestic production (Q_s).