Chapter 4

Excess Demand, Excess Supply, Changes in Equilibrium, and Price Controls

Introduction

In Chapter 3 we learned about demand, supply, and equilibrium price and quantity. Building on our knowledge of the Law of Demand and the Law of Supply, we learn how we reach the equilibrium price and equilibrium quantity should we happen to be away to the equilibrium. In this chapter, we also learn how shifts in the demand curve and/or supply curve affect the equilibrium price and quantity. We will also learn what happens when government imposes price controls and prices are not able to adjust.

Market Equilibrium, Again

We learned in Chapter 3 that market is in equilibrium when quantity demanded is equal to quantity supplied. Let us revisit the example in Chapter 3. I reproduce Table 3.5 here.

Table 3.5: Market Equilibrium

[1]	[2]	[3]
Price (in Dollars)	Market Quantity Demanded (Q_d)	Market Quantity Supplied (Q_s)
0	85	0
1	70	10
2	55	25
3	40	40
4	25	55
5	15	70

Source: M. Ashraf

Table 3.5 has three columns—Columns [1], [2], and [3]. Column [1] lists the price of gas per gallon, and Columns [2] and [3] list the market quantity demanded (Q_d) and the market quantity supplied (Q_s).

We know from Chapter 3, that at price $3.00 per gallon, market quantity demanded is equal to market quantity supplied. That is, $Q_d = Q_s = 40$. In Figure 3.12, this condition is represented by point *e*.

Excess Demand

Suppose, now, that price is below the market equilibrium price, say, at $2.00. In this case quantity demanded will exceed quantity supplied. Using data in Table 3.5, a price of $2.00 will represent such a situation. Note that at price $2.00, quantity demanded is 55 gallons, and quantity supplied is 25 gallons. There is an excess demand of 30 gallons. Figure 4.1 presents this situation graphically. In Figure 4.1, we abstract from some details.

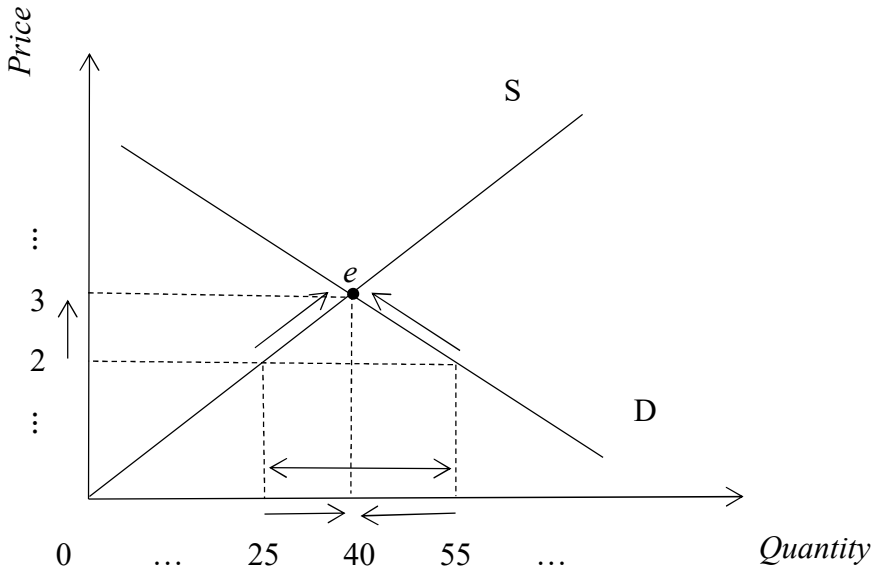

Figure 4.1: Excess Demand

Source: M. Ashraf

Figure 4.1: Gallons of gas produced in the market, *Quantity*, is on the horizontal axis and the price of gas per gallon, *Price*, is on the vertical axis. The curve, D, is the market demand curve, and the curve, S, is the market supply curve. The point *e* represents the equilibrium. At a price of $2.00 per gallon, there is excess demand of 30 gallons.

In Figure 4.1, gallons of gas produced in the market, *Quantity*, is on the horizontal axis and the price of gas per gallon, *Price*, is on the vertical axis. The curve, D, is the market demand curve, and the curve, S, is the market supply curve. The point *e* represents the equilibrium. At a price of $2.00 per gallon, quantity demanded is 55 gallons, and quantity supplied is 25 gallons; there is excess demand of 30 gallons.

Because there is excess demand of gas at this price, assuming that there are not any restrictions on the price, i.e., price is flexible, the price of gas will increase. See the direction of arrow along the vertical axis. Recall that the law of demand tells us that as the price of the product increases, its quantity demanded decreases, and vice versa. As a result, we move along the demand curve. The direction of the arrow in Figure 4.1 shows this movement.

As the price of gas increases, quantity supplied of gas also increases. This is what we learned when we learned the law of supply. As a result, we move along the supply curve, as shown by the direction of the arrow in Figure 4.1.

We assume that these movements take place simultaneously until we reach the equilibrium price, $3.00, and equilibrium quantity, 40 gallons. See the direction of arrows along the horizontal axis.

Excess Supply or Surplus

When the price is above the market equilibrium price, there is excess supply or surplus. Using the data in Table 3.5, a price of $4.00 is one such example. At price $4.00, the quantity demanded is 25 gallons, and quantity supplied is 55 gallons. There is an excess supply of 30 gallons. Figure 4.2 shows this graphically. We, again, abstract from details.

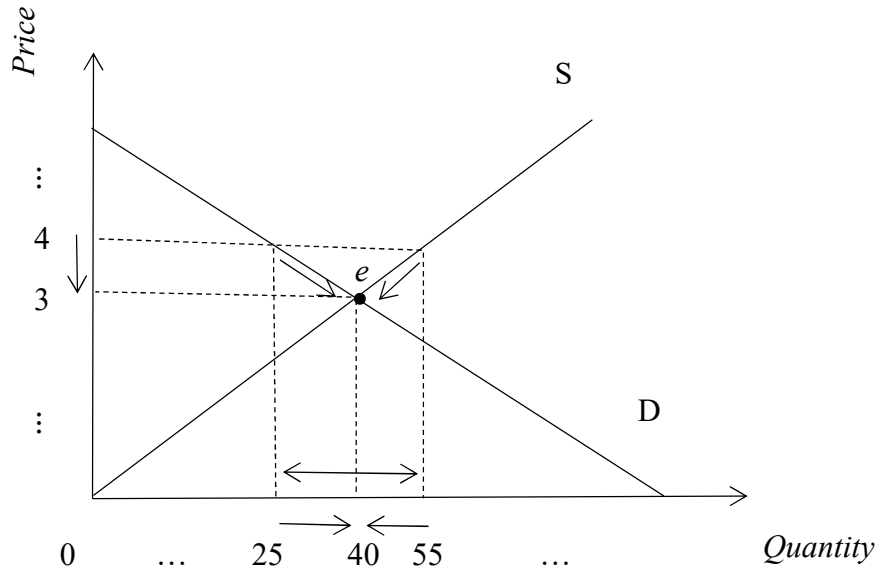

Figure 4.2: Excess Supply or Surplus

Source: M. Ashraf

Figure 4.2: Gallons of gas produced in the market, *Quantity*, is on the horizontal axis and the price of gas per gallon, *Price*, is on the vertical axis. The curve, D, is the market demand curve, and the curve, S, is the market supply curve. The point *e* represents the equilibrium. At a price of $4.00 per gallon, there is excess supply of 30 gallons.

In Figure 3.14, gallons of gas produced in the market, *Quantity*, is on the horizontal axis and the price of gas per gallon, *Price*, is on the vertical axis. The curve, D, is the market demand curve, and the curve, S, is the market supply curve. The point *e* represents the equilibrium. At a price of $4.00 per gallon, there is excess supply of 30 gallons.

Because at price $4.00, there is excess supply of gas, assuming that there is not any restriction on price movement, i.e., price is flexible, price will decline. See the direction of the arrow along the

vertical axis. As the law of demand indicates, with a decline in the price of gas, the quantity demanded of gas will increase and we move along the demand curve. This is shown by the direction of the arrow next of the market demand curve, D.

As the price of gas declines, the quantity supplied of gas declines as well, and we move along the supply curve, S. This is what we learned when we studied the law of supply. In Figure 4.2, this is shown by the direction of the arrow next to the supply curve.

We assume that these changes take place simultaneously until we reach the equilibrium price, $3.00, and equilibrium quantity, 40 gallons. See the direction of arrows along the horizontal axis.

Changes in Equilibrium Price and/or Equilibrium Quantity

Suppose that either the demand curve shifts, or the supply curve shifts, or both demand and supply curves shift. How will these changes affect the equilibrium price and/or equilibrium quantity? Let us start with a shift in the demand curve.

Shifts in the Demand Curve and the Impact on Equilibrium Price and Equilibrium Quantity

Suppose that due to an increased awareness of the impact of burning fossil fuels on climate, people start driving less or purchase cars that are more fuel efficient. In both cases, the demand for gasoline will decline, holding all else constant. This will shift the market demand curve of gasoline to the left. This is shown in Figure 4.1 graphically.

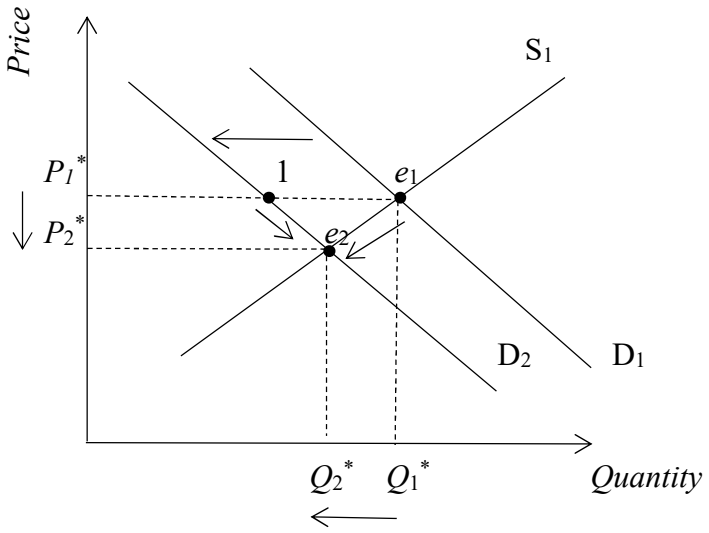

Figure 4.1: The Impact of a Shift in Demand Curve

Source: M. Ashraf

Figure 4.1: Gallons of gas produced in the market, *Quantity*, is on the horizontal axis and the price of gas per gallon, *Price*, is on the vertical axis. The curve, S_1, is the market supply curve, and the curve, D_1, is the market demand curve. The market is in equilibrium at point e_1; P_1^* and

Q_1^* are equilibrium price and quantity, respectively. As people buy less gas, the market demand curve shifts to the left, from D_1 to D_2. After the leftward shift of the market demand curve, there is excess supply P_1^*. The amount of excess supply is represented by distance between point 1 and e_1. This leads to a decrease in price, from P_1^* to P_2^*. As price decreases, quantity demanded increases (we move along the demand curve, D_2), and quantity supplied decreases (we move along the supply curve S). See the direction of arrows. We reach the new equilibrium, e_2.

In Figure 4.1, initially the market demand curve D_1, and the market supply curve, S_1. The equilibrium takes place at point e_1, where quantity demanded is equal to quantity supplied. When the demand for gas decreases, the market demand curve shift left from D_1 to D_2. When demand curve shifted to the left, the equilibrium quantity and equilibrium price, both declined.

It is important to note the sequence of events. Before the leftward shift in the demand curve from D_1 to D_2, the market is equilibrium at point e_1; P_1^* and Q_1^* are equilibrium price and quantity, respectively. When the demand curve shifts to the left from D_1 to D_2, demand decreases, and there is an excess supply at P_1^*. The amount of excess supply is represented by the horizontal distance between point 1 and e_1. This leads to a decline in price from P_1^* to P_2^*. Due to the decline in price, quantity demanded increases (law of demand), and we move along the new demand curve, D_2. Due to a decline in the price, quantity supplied decreases (law of supply), and we move along the supply curve, S_1. We reach the new equilibrium, e_2.

Note again, that first there is a decrease in demand due to people purchasing fewer gallons of gasoline (the demand curve shifts to the left). Then there is an increase in quantity demanded as price of gasoline declines (we move along the new demand curve, D_2.) The process is completed when we reach the new equilibrium price, P_2^*, and new equilibrium quantity, Q_2^*. We reach the new equilibrium, represented by point e_2.

Shift in the Supply Curve and the Impact on Equilibrium Price and Equilibrium Quantity

Suppose now that due to improvement in oil exploration, the cost of producing gasoline declines. As a result, the market supply curve shifts to the right. All else constant, this will lead to a lower equilibrium price and a higher equilibrium quantity. Figure 4.2 shows this graphically.

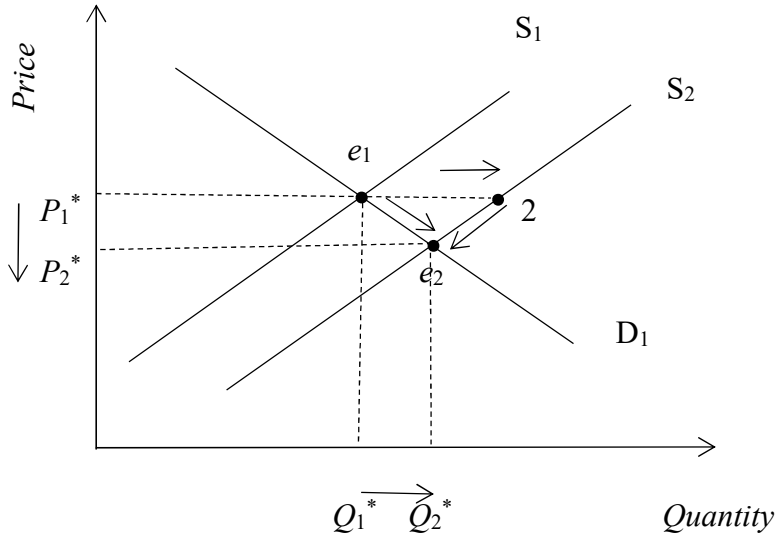

Figure 4.2: The Impact of a Shift in Supply Curve

Source: M. Ashraf

Figure 4.2: Gallons of gas produced in the market, *Quantity*, is on the horizontal axis and the price of gas per gallon, *Price*, is on the vertical axis. The curve, S_1, is the market supply curve, and the curve, D_1, is the market supply curve. The market is in equilibrium at point e_1; P_1^* and Q_1^* are equilibrium price and quantity, respectively. As the gas production increases, the supply curve shifts to the right, from S_1 to S_2. After the rightward shift of the market supply curve, there is excess supply P_1^*. The amount of excess supply is represented by the horizontal distance between point e_1 point 2. This leads to a decrease in price, from P_1^* to P_2^*. As price decreases, quantity demanded increases (we move along the demand curve, D_1), and quantity supplied decreases (we move along the supply curve S_2). See the direction of arrows. We reach the new equilibrium, e_2.

In Figure 4.2, gallons of gas produced in the market, *Quantity*, is on the horizontal axis and the price of gas per gallon, *Price*, is on the vertical axis. The curve, S_1, is the market supply curve, and the curve, D_1, is the market supply curve. The market is in equilibrium at point e_1; P_1^* and Q_1^* are equilibrium price and quantity, respectively. As the gas production increases, the supply curve shifts to the right, from S_1 to S_2. After the rightward shift of the market supply curve, there is excess supply P_1^*. The amount of excess supply is represented by the horizontal distance between point e_1 point 2. This leads to a decrease in price, from P_1^* to P_2^*. As price decreases, quantity demanded increases (we move along the demand curve, D_1), and quantity supplied decreases (we move along the supply curve S_2). See the direction of arrows. We reach the new equilibrium, e_2. At this point the new equilibrium price is lower than before and the new equilibrium quantity is higher than before.

Shifts in the Demand Curve and Supply Curve and the Impact on Equilibrium Price and Equilibrium Quantity

When both the demand curve and the supply curve shift, the impact on the equilibrium quantity and equilibrium price will depend upon the directions of the shifts of the demand curve and the supply curve and the relative magnitudes of these shifts.

To see this, let us combine the two cases discussed above. Suppose that with a decrease in demand for gasoline due to increased fuel efficiency, the demand curve shifts to the left, and an increase in supply due to technological advances the supply curve shifts to the right. How will these changes affect the equilibrium price and equilibrium quantity? The figures below—Figure 4.3 (a)-Figure 4.3 (c)—show these scenarios graphically.

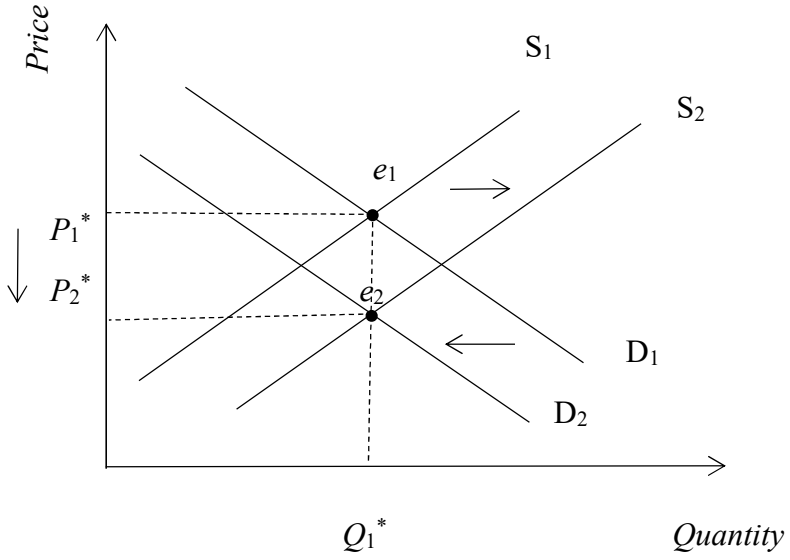

Figure 4.3 (a): Supply and Demand Curves Shift by Equal Magnitude

Source: M. Ashraf

Figure 4.3(a): Gallons of gas produced in the market, *Quantity*, is on the horizontal axis and the price of gas per gallon, *Price*, is on the vertical axis. The curve, S_1, is the market supply curve, and the curve, D_1, is the market supply curve. The market is in equilibrium at point e_1; P_1^* and Q_1^* are equilibrium price and quantity, respectively. As people buy less gas, the market demand curve shifts to the left, from D_1 to D_2. As the gas production increases, the supply curve shifts to the right, from S_1 to S_2. The equilibrium price decreases from P_1^* to P_2^*. Since the magnitudes of shifts in the demand curve and the supply curve are the same, the equilibrium quantity remains the same.

In Figure 4.3(a), gallons of gas produced in the market, *Quantity*, is on the horizontal axis and the price of gas per gallon, *Price*, is on the vertical axis. The curve, S_1, is the market supply curve, and the curve, D_1, is the market supply curve. The market is in equilibrium at point e_1; P_1^* and Q_1^* are equilibrium price and quantity, respectively. As people buy less gas, the market

demand curve shifts to the left, from D_1 to D_2. As the gas production increases, the supply curve shifts to the right, from S_1 to S_2. The equilibrium price decreases from P_1^* to P_2^*. Since the magnitudes of shifts in the demand curve and the supply curve are the same, the equilibrium quantity remains the same.

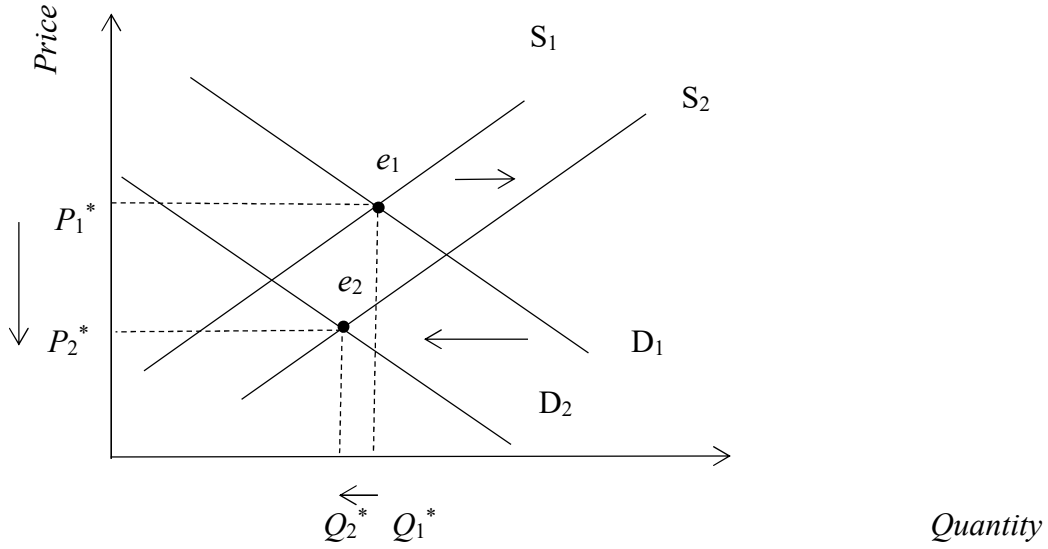

Figure 4.3 (b): Demand Curve Shifts More Than Supply Curve

Source: M. Ashraf

Figure 4.3(b): Gallons of gas produced in the market, *Quantity*, is on the horizontal axis and the price of gas per gallon, *Price*, is on the vertical axis. The curve, S_1, is the market supply curve, and the curve, D_1, is the market supply curve. The market is in equilibrium at point e_1; P_1^* and Q_1^* are equilibrium price and quantity, respectively. As people buy less gas, the market demand curve shifts to the left, from D_1 to D_2. As the gas production increases, the supply curve shifts to the right, from S_1 to S_2. The new equilibrium is at point e_2. The equilibrium price decreases from P_1^* to P_2^*. Since the leftward shift in the demand curve is larger than the rightward shift in the supply curve, the equilibrium quantity decreases from Q_1^* to Q_2^*.

In Figure 4.3(b), gallons of gas produced in the market, *Quantity*, is on the horizontal axis and the price of gas per gallon, *Price*, is on the vertical axis. The curve, S_1, is the market supply curve, and the curve, D_1, is the market supply curve. The market is in equilibrium at point e_1; P_1^* and Q_1^* are equilibrium price and quantity, respectively. As people buy less gas, the market demand curve shifts to the left, from D_1 to D_2. As the gas production increases, the supply curve shifts to the right, from S_1 to S_2. The new equilibrium is at point e_2. The equilibrium price decreases from P_1^* to P_2^*. Since the leftward shift in the demand curve is larger than the rightward shift in the supply curve, the equilibrium quantity decreases from Q_1^* to Q_2^*.

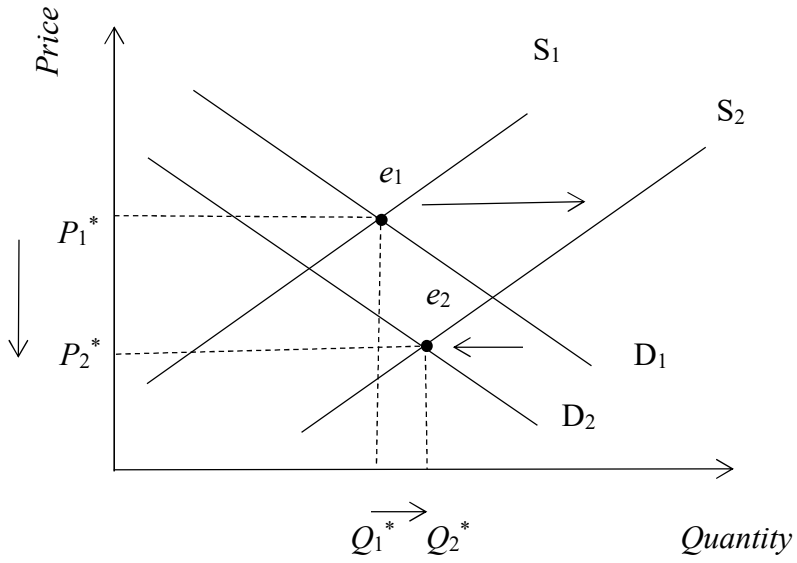

Figure 4.3 (c): Supply Curve Shifts More Than the Demand Curve

Source: M. Ashraf

Figure 4.3(c): Gallons of gas produced in the market, *Quantity*, is on the horizontal axis and the price of gas per gallon, *Price*, is on the vertical axis. The curve, S_1, is the market supply curve, and the curve, D_1, is the market supply curve. The market is in equilibrium at point e_1; P_1^* and Q_1^* are equilibrium price and quantity, respectively. As people buy less gas, the market demand curve shifts to the left, from D_1 to D_2. As the gas production increases, the supply curve shifts to the right, from S_1 to S_2. The new equilibrium is at point e_2. The equilibrium price decreases from P_1^* to P_2^*. Since the leftward shift in the demand curve is smaller than the rightward shift in the supply curve, the equilibrium quantity increases from Q_1^* to Q_2^*.

Note that in these three situations—Figures 4.3(a)-4.3(b)—the equilibrium price decreases, but the change in equilibrium quantity depends upon the relative magnitudes of the shifts in the supply curve and the demand curve.

I will leave other scenarios for exercises. It is important that you draw diagrams and see how these shifts affect the equilibrium quantity and equilibrium price.

Price Controls

Sometimes the market-clearing price of a good or service, i.e., the equilibrium price, is considered an "unfair" price. That is, it is either too low or it is too high. Some segments of the society may deem price of a good or service to be too high, arguing that not many people can afford the said good or service. In other cases, some segments of the society may deem the price of a good or service too low, arguing that the producers of that good or service cannot make their ends meet. In such situations governments may step in and impose price controls. We will discuss here two types of price controls; one is price ceiling and the other is price floor.

Price Ceiling

Price ceiling is the maximum price that the sellers may legally charge. The government may place this legal limit on the price of a good or service if it deems that the price of the product is too high, and not everyone can afford it. If this limit is below the market-clearing price, it will lead to an excess demand.

Look at the data provided in Table 3.5 in Chapter 3, reproduced in the beginning of this chapter. Recall that the equilibrium price is $3, and the equilibrium quantity is 15 gallons. Suppose that the government deems a price of $3 to be too high, and it puts an upper price limit at $2. That is, it sets the price ceiling at $2. Since the price has now decreased, the quantity demanded increases to 20 gallons, and the quantity supplied decreases to 10 gallons—the laws of demand and supply take effect. This leads to an excess demand of 10 gallons. This is show graphically in Figure 4.4.

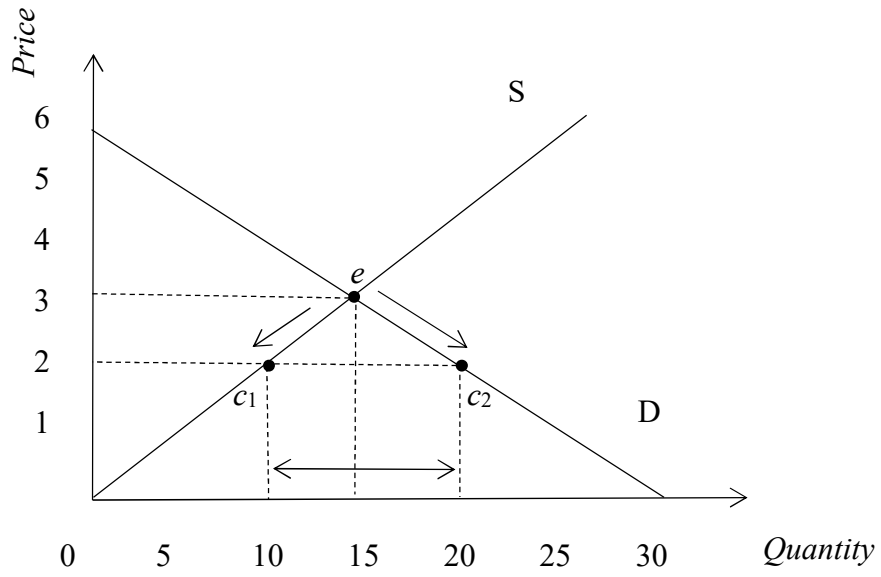

Figure 4.4: Price Ceiling

Source: M. Ashraf

Figure 4.4: Gallons of gas produced in the market, *Quantity*, is on the horizontal axis and the price of gas per gallon, *Price*, is on the vertical axis. The curve, S, is the market supply curve, and the curve, D, is the market supply curve. Quantity demanded and quantity supplied are equal at point *e*, the equilibrium price is $3, and the equilibrium quantity is 15 gallons. After the price ceiling is set at $2, quantity supplied decreases to 10 gallons, we move along the supply curve to point c_1, quantity demanded increases to 20 gallons, we move along the demand curve to point c_2. At price $2, there is excess demand of 10 gallons, the horizontal distance between point c_1 and point c_2.

Figure 4.4 shows the impact of price ceiling. Gallons of gas produced in the market, *Quantity*, is on the horizontal axis and the price of gas per gallon, *Price*, is on the vertical axis. The curve, S,

is the market supply curve, and the curve, D, is the market supply curve. Quantity demanded and quantity supplied are equal at point *e*, the equilibrium price is $3, and the equilibrium quantity is 15 gallons. After the price ceiling is set at $2, quantity supplied decreases to 10 gallons, we move along the supply curve to point c_1, quantity demanded increases to 20 gallons, we move along the demand curve to point c_2. At price $2, there is excess demand of 10 gallons, the horizontal distance between point c_1 and point c_2.

Binding and Non-Binding Price Ceiling

Recall that a price ceiling is the maximum price that buyers can legally pay, and sellers can legally charge. Suppose that the government sets the price ceiling at a price above the market-clearing price, say, at $4 in our example. In this case, the price ceiling will not be binding—it will not have any impact on quantity demanded or quantity supplied. The reason is that buyers and sellers are already buying and selling gas, respectively, at $3 dollars per gallon, which is below the price ceiling of $4 dollars per gallon. Such a price ceiling will not be binding. For price ceiling to be binding, it must be below the market-clearing price.

Price Floor

Price floor is a price below which buyers cannot legally purchase a good or service. The intuition behind setting a price floor is that the market-clearing price of the good or service is too low, and the sellers cannot make their ends meet.

Look at the data in Table 3.5, again. Suppose that the government deems the market-clearing price of $3 to be too low; it sets a price floor at $5. Since the price has increased, quantity supplied increases to 25 gallons and quantity demanded decreases to 5 gallons. This leads to an excess supply of 20 gallons. Laws of demand and supply are in action again. Figure 4.5 shows this graphically.

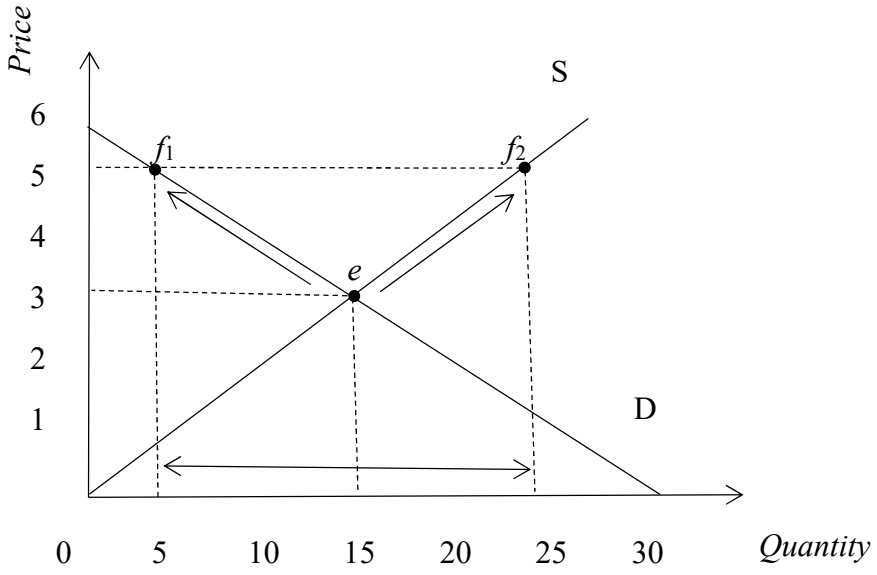

Figure 4.5: Price Floor

Source: M. Ashraf

Figure 4.5: Gallons of gas produced in the market, *Quantity*, is on the horizontal axis and the price of gas per gallon, *Price*, is on the vertical axis. The curve, S, is the market supply curve, and the curve, D, is the market supply curve. Quantity demanded and quantity supplied are equal at point *e*, the equilibrium price is $3, and the equilibrium quantity is 15 gallons. After the price floor is set at $5, quantity demanded decreases to 5 gallons, we move along the demand curve to point f_1, quantity supplied increases to 25 gallons, we move along the supply curve to point f_2. At price $5, there is excess supply of 20 gallons, the horizontal distance between point f_1 and point f_2.

Figure 4.5 shows the impact of price floor. Gallons of gas produced in the market, *Quantity*, is on the horizontal axis and the price of gas per gallon, *Price*, is on the vertical axis. The curve, S, is the market supply curve, and the curve, D, is the market supply curve. Quantity demanded and quantity supplied are equal at point *e*, the equilibrium price is $3, and the equilibrium quantity is 15 gallons. After the price floor is set at $5, quantity demanded decreases to 5 gallons, we move along the demand curve to point f_1, quantity supplied increases to 25 gallons, we move along the supply curve to point f_2. See the directions of arrows. At price $5, there is excess supply of 20 gallons, the horizontal distance between point f_1 and point f_2.

Binding and Non-Binding Price Floor

Recall that a price floor is the minimum price that buyers can legally pay, and sellers can legally charge. Suppose that the government sets the price ceiling at a price below the market-clearing price, say, at $2 in our example. In this case, the price floor will not be binding—it will not have any impact on quantity demanded or quantity supplied. The reason is that buyers and sellers are

already buying and selling gas, respectively, at $3 dollars per gallon, which is above the price floor of $2 dollars per gallon. Such a price floor will not be binding. For price floor to be binding, it must be above the market-clearing price.

It is important to note that while the intentions in setting both price ceiling and price floor may be noble, the result is that the gallons of gas bought and sold are lower than they were before the setting of price ceiling and price floor.

Chapter Conclusion

In this chapter we learned how do we get to the equilibrium price and equilibrium quantity should the market happen to be away from the equilibrium. We learned about the impact of shift in the demand curve and/or the supply curve on the equilibrium quantity and equilibrium price. We also learned the impact of price controls—price ceiling and price floor—on equilibrium price and equilibrium quantity.

Review of Terms

Excess Demand or Shortage: A situation when quantity demanded is greater than quantity supplied at a given price.

Excess Supply or Surplus: A situation when quantity supplied is greater than quantity demanded at a given price.

Price Ceiling: The maximum price that sellers can legally charge, and buyers can legally pay.

Binding Price Ceiling: A price ceiling that is set below the market-clearing price.

Non-Binding Price Ceiling: A price ceiling that is set above the market-clearing price.

Price Floor: The minimum price that buyers can legally pay, and sellers can legally charge.

Binding Price Floor: A price floor that is set above the market-clearing price.

Non-Binding Price Floor: A price floor that is set below the market-clearing price.