Multiple Choice Quiz (10 questions) covering main points:

1. The federal gasoline tax is a specific tax because
a. it is a fixed dollar amount (e.g. 18.4 cents) per gallon of gas.
b. the federal government specifically prohibits taxing gas.
c. the federal government specifically prohibits states from taxing gas.
d. none of the above

2. Consumers pay a larger share of a specific tax when demand for the good is:
a. less elastic.
b. more elastic.
c. perfectly inelastic.
d. none of the above

3. True or false: Federal law states that employers and employees must pay equal shares of the tax that funds Social Security and Medicare, but – in reality – for full time employees, almost all of the tax is paid by the employees.
a. True
b. False

4. True or False: A milk price floor would definitely help all dairy farmers.
a. True
b. False

5. The requirement that each must taxi driver must purchase a medallion
a. increases the price of taxi services by almost 20%.
b. creates a deadweight loss of approximately $30,000 per year.
c. creates a deadweight loss of approximately $19 million per year.
d. Both a and c

6. Some government policies create net losses. They are enacted because:
a. the policies create benefits for a small group that lobbies for the policies.
b. the policies generate costs that are spread over such a large group, that individual members of that large group are not motivated to lobby against the policies.
c. Both a and b
d. None of the above

7. An effective price ceiling (that actually impacts the market) would be set
a. below the equilibrium price.
b. above the equilibrium price.

8. An effective price floor (that actually impacts the market) would be set
a. below the equilibrium price.
b. above the equilibrium price.

9. A tariff
a. helps domestic producers, but harms foreign producers.
b. helps domestic producers, but harms domestic consumers.
c. helps domestic producers and doesn't hurt anyone.
d. none of the above

10. Assume US consumers can initially purchase any quantity of a foreign-produced good at the going international price. Compared with the initial situation, imposition of a tariff will definitely cause aggregate surplus to:
a. decrease, compared with the pre-tariff level.
b. increase, compared with the pre-tariff level.
c. remain the same as it would have been without the tariff.

Answers to Multiple Choice Quiz

1. a
2. **a**
3. a
4. b
5. d
6. c
7. a
8. b
9. b
10. a

Answers to In-Text Questions

15.1
The first step is to set supply and demand equal and to solve for equilibrium price:

$Q^s = Q^d$
$5P - 2.5 = 15 - 2P$
$7P = 17.5$
$P = \$2.50$

At a price of \$2.50, we can see from either supply or demand that quantity will be 10 billion bushels per year. The other two numbers that will be helpful to us are: the highest price at which quantity supplied equals zero and the lowest price at which quantity demanded equals zero. We find these two numbers by plugging in 0 for Q^d and Q^s and solving for the prices that result.

$Q^d = 15 - 2P$
$0 = 15 - 2P$
$2P = 15$
$P = \$7.50$

$Q^s = 5P - 2.5$
$0 = 5P - 2.5$
$2.5 = 5P$
$P = \$0.50$

Now we can compute the areas of the triangles.

$CS = ½(Q)(\$7.50 - P)$
$CS = ½(10)(\$7.50 - \$2.50)$
$CS = \$25$

$PS = ½(Q)(P - \$0.50)$
$PS = ½(10)(\$2.50 - \$0.50)$
$PS = \$10$

Aggregate surplus is the sum of consumer and producer surplus:

$AS = CS + PS$
$AS = \$25 + \$10$
$AS = \$35$

Next, we need to find the equilibrium after the tax by putting P_b into the demand function and $(P_b - T)$ into the supply function, and set Q^d equal to Q^s. (The market still clears.)

$Q^s = Q^d$
$5(P_b - T) - 2.5 = 15 - 2P_b$
$5(P_b - 1.40) - 2.5 = 15 - 2P_b$
$5P_b - 7 - 2.5 = 15 - 2P_b$
$7P_b = 24.5$
$P_b = \$3.50$

At a buyer price of \$3.50, we can see from demand that quantity will be 8 billion bushels per year. If the buyer price is \$3.50, then the seller price is that price less the amount of the tax, or \$2.10. Plugging \$2.10 into the supply function also gives 8.

Now we can compute the areas of the *CS* and *PS* triangles.

$CS = ½(Q)(\$7.50 – P)$	$PS = ½(Q)(P – \$0.50)$
$CS = ½(8)(\$7.50 – \$3.50)$	$PS = ½(8)(\$2.10 – \$0.50)$
$CS = \$16$	$PS = \$6.40$

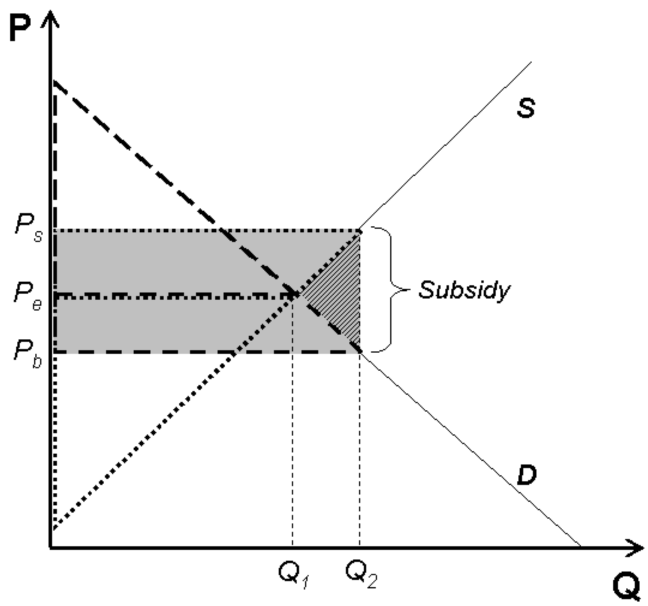
Government collects tax revenues equal to the amount of the per-unit tax multiplied by the number of units that are taxed: $Q×T$, which is (8)(\$1.40) = \$11.20.

Aggregate surplus is the sum of consumer surplus, producer surplus and government revenue:

$AS = CS + PS + GR$
$AS = \$16 + \$6.40 + \$11.20$
$AS = \$33.60$

Since aggregate surplus has decreased by \$35 – \$33.60 = \$1.40, the size of the deadweight loss caused by this tax is \$1.40.

15.2 (page 553)
In the drawing to the right, the before-subsidy price is P_e and the before-subsidy quantity is Q_1. Consumer surplus is the small dashed triangle and producer surplus is the small dotted triangle.

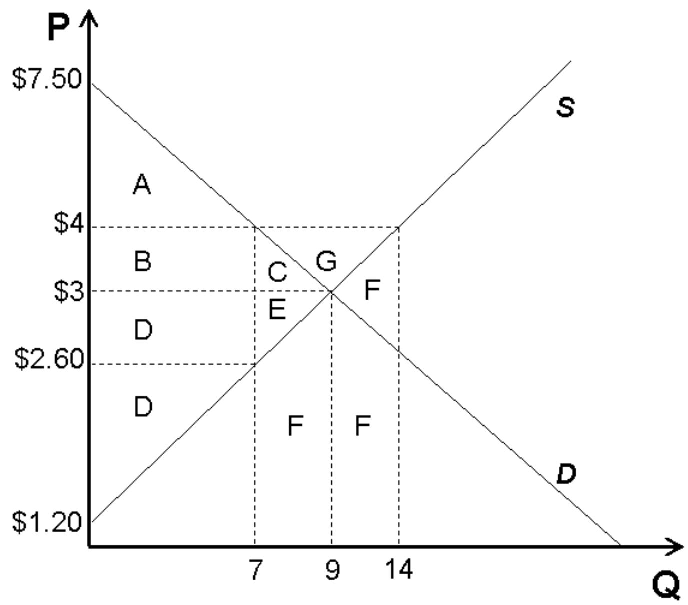


After the subsidy is imposed, buyers pay price P_b and sellers receive price P_s; Q_2 units are bought and sold. Consumer surplus grows to the large dashed triangle and producer surplus grows to the large dotted triangle. The shaded rectangle shows government expenditures on the subsidy, or the decrease in government revenue caused by the subsidy. The triangular portion of that rectangle that is darker shows the deadweight loss caused by the subsidy.

Students should be encouraged to use care when presenting this graphically, as consumer surplus, producer surplus, and government spending all overlap after the subsidy.

15.2 (page 563)
From In-Text Exercise 14.5, we remember that the equilibrium without intervention is a price of $3.00 per bushel and a quantity of 9 billion bushels. At the target price of $4.00 per bushel, consumers demand 15 – 2(4) = 7 billion bushels and suppliers want to sell 5(4) – 6 = 14 billion bushels.

The price ceiling policy would state that the corn cannot be sold for less than $4.00 per bushel. The price support program would make the government purchase 7 billion bushels (the difference between quantities supplied and demanded at the price of $4.00). The quota would distribute 7 billion bushels of quotas to farmers (hopefully, in a manner that minimizes the cost of producing those bushels). In the voluntary production reduction program, the government would pay farmers to reduce their productions from 14 billion to 7 billion bushels per year. The required payment would have to equal 4.9 billion (area *C* + *G* + *E*). Using a drawing like Figure 15.3 on page 558 (but with the numbers relevant to this problem) is helpful.



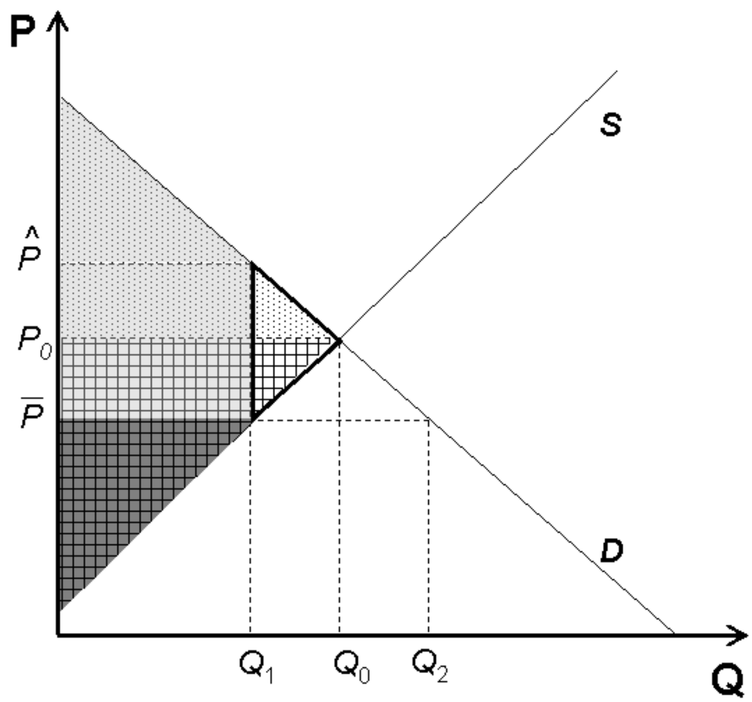
The values of each of these areas are:

A: (½)(3.5)(7) = 12.25
B: (1)(7) = 7
C: (½)(1)(2) = 1
D: (½)(1.4)(7) + (.4)(7) = 7.7
E: (½)(.4)(2) = .4
F: (½)(2.6 + 4)(7) = 23.1
G: (½)(7)(1) = 3.5

Using Figure 15.3 as a guide, the welfare effects of each policy are shown in the table below:

	No intervention	Price floor	Price support	Production quota	Voluntary production reduction
Aggregate Surplus	28.35	26.95	3.85	26.95	26.95
Deadweight loss	0	1.4	24.5	1.4	1.4
Consumer surplus	20.25	12.25	12.25	12.25	12.25
Producer surplus	8.1	14.7	19.6	14.7	19.6
Government Revenue	0	0	–28	0	–4.9

15.3



In the drawing to the right, the price before the price ceiling is P_0. Consumer surplus is the dotted area between the demand curve and price P_0. Producer surplus is the area with the vertical and horizontal stripes below P_0 and above the supply curve. After the government imposes the price ceiling of $\overline{P}$, producer surplus falls to the dark shaded triangle. Consumer surplus changes to the lightly-shaded trapezoid bounded by the price axis, price $\overline{P}$, Q_1 and the demand curve. Deadweight loss caused by the price ceiling is the bordered unshaded triangle formed by the supply and demand curves and Q_1.

Answers to End-of-Chapter Questions

15.1

In In-Text Exercise 15.1, we calculated that the equilibrium price and quantity in this market were \$2.50 and 10 billion bushels per year. We further calculated that *CS* was \$25 and *PS* was \$10, making *AS* \$35.

We need to find the equilibrium after the tax by putting P_b into the demand function and $(P_b - T)$ into the supply function, and set Q^d equal to Q^s. (The market still clears.)

$Q^s = Q^d$
$5(P_b - T) - 2.5 = 15 - 2P_b$
$5(P_b - 2.10) - 2.5 = 15 - 2P_b$
$5P_b - 10.50 - 2.5 = 15 - 2P_b$
$7P_b = 28$
$P_b = \$4.00$

At a buyer price of \$4.00, we can see from demand that quantity will be 7 billion bushels per year. If the buyer price is \$4.00, then the seller price is that price less the amount of the tax, or \$1.90. Plugging \$1.90 into the supply function also gives 7.

Now we can compute the areas of the *CS* and *PS* triangles (other needed prices calculated in In-Text Exercise 15.1).

$CS = ½(Q)(\$7.50 - P)$
$CS = ½(7)(\$7.50 - \$4.00)$
$CS = \$12.25$

$PS = ½(Q)(P - \$0.50)$
$PS = ½(7)(\$1.90 - \$0.50)$
$PS = \$4.90$

Government collects tax revenues equal to the amount of the per-unit tax multiplied by the number of units that are taxed: $Q \times T$, which is (7)(\$2.10) = \$14.70.

Aggregate surplus is the sum of consumer surplus, producer surplus and government revenue:

$AS = CS + PS + GR$
$AS = \$12.25 + \$4.90 + \$14.70$
$AS = \$31.85$

Since aggregate surplus has decreased by \$35 – \$31.85 = \$3.15, the size of the deadweight loss caused by this tax is \$3.15.

15.2
In Exercise 15.1, we calculated a deadweight loss (*DWL*) of $3.15 with government revenue (*GR*) from the tax of $14.70. The *DWL*:*GR* ratio here is $3.15/$14.70 = 0.214. This means that for every $1 of government revenue, 21.4 cents of aggregate surplus is forgone.

In In-Text Exercise 15.1, we calculated a deadweight loss of $1.40 with government collecting tax revenue of $11.20. The *DWL*:*GR* ratio here is $1.40/$11.20 = 0.125. This means that for every $1 of government revenue, 12.5 cents of aggregate surplus is forgone.

The tax in Exercise 15.1 was 50% larger than the tax in In-Text Exercise 15.1, and the *DWL*:*GR* ratio was over 70% larger in Exercise 15.1 than the same ratio in In-Text Exercise 15.1. It appears that as the size of the tax increases, the *DWL* generated by each dollar of government revenue collected through taxes increases—in other words, bigger per-unit taxes are less efficient.

15.3
From the section "Which Goods Should the Government Tax?" on page 550, students learn that the deadweight loss created by taxation is smaller when demand (and supply) is less elastic. Demand for *all* car purchases is less elastic than demand for the luxury cars. This would be due to the fact that luxury cars, by definition, are not a necessity; cars in general, might be more of a necessity. Also, someone buying a car for its luxury might as well buy a boat or motorcycle—or some other toy—if the car's price changes too much. Since luxury cars have more elastic demand, a tax on luxury cars would be less efficient.

15.4
In a market with a free entry and exit, the supply curve is horizontal in the long run, this means that supply is perfectly elastic. Demand is also likely to be more elastic in the long-run as consumers adapt to the price change (for non-durable goods), but it will still be downward-sloping. The reason that supply becomes perfectly elastic in the long run is that the same technology is available to everyone who produces the good, so that they all have the same minimum average cost. Demand is based on willingness-to-pay, and we have no reason to believe that buyer's preferences will converge in the long run.

Regardless of the distribution of the tax burden in the short run (which will be determined by the elasticities of short-run demand and supply), tax burden in the long run will be completely born by buyers. A tax does not change a seller's minimum average cost, and the seller must (and will) receive a price equal to this minimum to be motivated to produce; seller price cannot fall in the long run due to a tax.

15.5
The initial long-run equilibrium has 100 active firms each producing 260 pizzas and selling them at a price of \$11.50. If, in the short run, sellers have to pay a tax of \$11.50, then we have to substitute $P_b - 11.50$ into the short-run supply function. The short-run supply function from this problem was:

$$Q^s = \begin{Bmatrix} 4{,}000P - 20{,}000 & \text{when } P \geq \$5.00 \\ 0 & \text{when } P < \$5.00 \end{Bmatrix}$$

After including the tax, we can rewrite this supply function as:

$$Q^s = \begin{Bmatrix} 4{,}000(P_b - 11.50) - 20{,}000 = 4{,}000P_b - 66{,}000 & \text{when } P_b \geq \$16.50 \\ 0 & \text{when } P_b < \$16.50 \end{Bmatrix}$$

Then we can set this supply function equal to the demand function:

$Q_s = Q_d$
$4{,}000P_b - 66{,}000 = 32{,}900 - 600P_b$
$4{,}600P_b = 98{,}900$
$P_b = \$21.50$

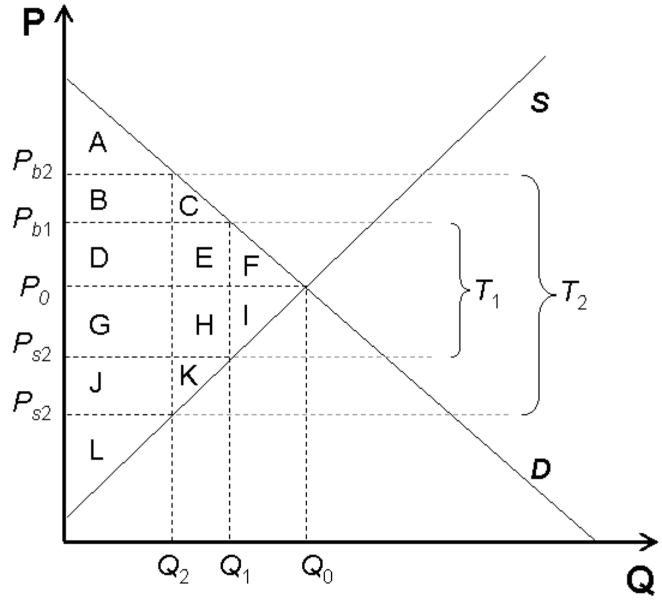
At the new buyer price of \$21.50, buyers will demand 32,900 – 600(21.5) = 20,000 pizzas. Since there are 100 firms in this market, each firm reduces production to 200 pizzas. We can calculate the deadweight loss as the area of the triangle it forms: (½)(6,000)(11.50) = \$34,500. Government revenue from the tax is just the amount of the tax multiplied by the number of units that are taxed: $Q \times T$ = (\$11.50)(20,000) = \$230,000.

To summarize the short-run effect of the tax: P_b increases by \$10.00; P_s decreases by \$1.50; total output decreases by 6,000; deadweight loss is \$34,500; government revenue is \$230,000.

In the long-run, the supply curve will be horizontal at the minimum of average variable cost, which is still \$11.50. Therefore, P_s will equal \$11.50 and P_b will equal \$11.50 + \$11.50 = \$23. At a price of \$23, buyers will demand 32,900 – 600(23) = 19,100 pizzas. Since each firm produces 260 pizzas at the efficient scale, there will be 73.46 firms producing pizza in the long run. We can calculate the deadweight loss as the area of the triangle it forms: (½)(6,900)(11.50) = \$39,675. Government revenue from the tax is just the amount of the tax multiplied by the number of units that are taxed: $Q \times T$ = (\$11.50)(19,100) = \$219,650.

To summarize the long-run effect of the tax: P_b increases by \$11.50; P_s does not change; total output decreases by 6,900; deadweight loss is \$39,675; government revenue is \$219,650.

15.6
In the drawing to the right, the equilibrium price and quantity without intervention are P_0 and Q_0. With a small tax, T_1, the quantity decreases to Q_1, buyer price increases to P_{b1} and seller price decreases to P_{s1}. With a large tax, T_2, the quantity decreases to Q_2, buyer price increases to P_{b2} and seller price decreases to P_{s2}. The table below summarizes the results under the three situations:



	No intervention	**Tax T_1**	**Tax T_2**	**Change, from T_1 to T_2**
Consumer surplus	ABCDEF	ABC	A	–BC
Producer surplus	GHIJKL	JKL	L	–JK
Government revenue	*none*	DEGH	BDGJ	BJ – EH
Aggregate surplus	ABCDEFGHIJKL	ABCDEGHJKL	ABDGJL	–CEHK
Deadweight loss	*none*	FI	CEFHIK	CEHK

The claim was that, when going from a smaller tax to a larger one, the change in deadweight loss equals the sum of the changes in consumer surplus, producer surplus and government revenue. Given the graph above, these changes sum to:

$\Delta CS + \Delta PS + \Delta GR$
(–BC) + (–JK) + (BJ – EH)
–C + –K + –EH
–(CEHK)

This is the same as the result derived above for the change in deadweight loss. This is very common sense, however, since the sum of consumer surplus, producer surplus and government revenue equals aggregate surplus and any decrease in aggregate surplus is necessarily an increase in deadweight loss—in fact, that's what deadweight loss is: unrealized potential aggregate surplus.

In Worked-Out Problem 15.1, before the tax, *CS* was \$25, *PS* was \$10 and *AS* was \$35. There was no government revenue or deadweight loss. After the tax, *CS* was \$20.25, *PS* was \$8.1, *GR* was \$6.3, *AS* was \$34.65 and *DWL* was \$0.35. Adding up the changes gives:

$(\Delta CS + \Delta PS + \Delta GR)$
$= (\$20.25 - \$25) + (\$8.10 - \$10) + (\$6.3 - \$0)$
$= (-\$4.75) + (-\$1.90) + (\$6.3)$
$= -\$0.35$

This is the same as the change in *DWL* calculated in this exercise.

In In-Text Exercise 15.1, before the tax, everything was the same as in Worked-Out Problem 15.1 (see above). After the tax, *CS* was \$16, *PS* was \$6.40, *GR* was \$11.20, *AS* was \$33.60 and *DWL* was \$1.40. Adding up the changes gives:

$(\Delta CS + \Delta PS + \Delta GR)$
$= (\$16 - \$25) + (\$6.40 - \$10) + (\$11.20 - \$0)$
$= (-\$9) + (-\$3.60) + (\$11.20)$
$= -\$1.40$

This is the same as the change in *DWL* calculated in this exercise.

15.7
In In-Text Exercise 15.1, we calculated that the equilibrium price and quantity in this market were \$2.50 and 10 billion bushels per year. We further calculated that *CS* was \$25 and *PS* was \$10, making *AS* \$35.

We need to find the equilibrium after the subsidy by putting P_b into the demand function and $(P_b + S)$ into the supply function, and set Q^d equal to Q^s. (The market still clears.)

$Q^s = Q^d$
$5(P_b + S) - 2.5 = 15 - 2P_b$
$5(P_b + 0.70) - 2.5 = 15 - 2P_b$
$5P_b + 3.50 - 2.5 = 15 - 2P_b$
$7P_b = 14$
$P_b = \$2.00$

At a buyer price of \$2.00, we can see from demand that quantity will be 11 billion bushels per year. If the buyer price is \$2.00, then the seller price is that price plus the amount of the subsidy, or \$2.70. Plugging \$2.70 into the supply function also gives 11.

Now we can compute the areas of the *CS* and *PS* triangles (other needed prices calculated in In-Text Exercise 15.1).

$CS = ½(Q)(\$7.50 – P)$	$PS = ½(Q)(P – \$0.50)$
$CS = ½(11)(\$7.50 – \$2.00)$	$PS = ½(11)(\$2.70 – \$0.50)$
$CS = \$30.25$	$PS = \$12.10$

Government spends money equal to the amount of the per-unit subsidy multiplied by the number of units that are subsidized: $Q \times S$, which is (11)(\$0.70) = \$7.70.

Aggregate surplus in this case is the sum of consumer surplus and producer surplus less government spending:

$AS = CS + PS – GS$
$AS = \$30.25 + \$12.10 – \$7.70$
$AS = \$34.65$

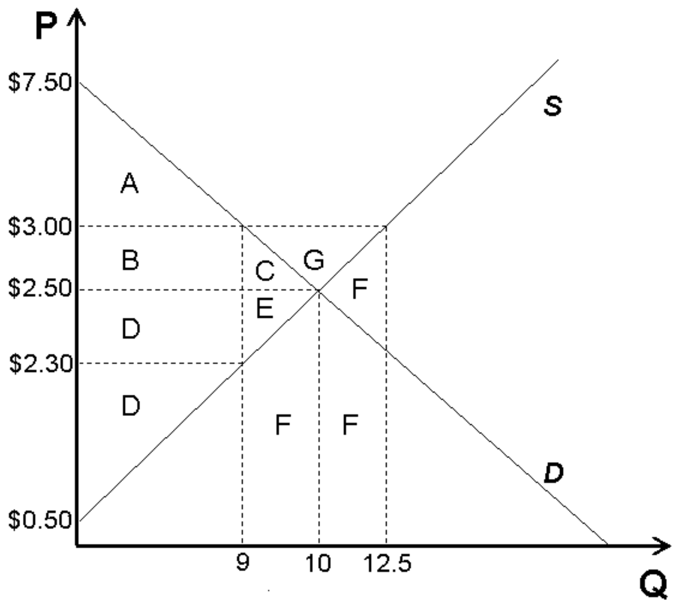
Since aggregate surplus has decreased by \$35 – \$34.65 = \$0.35, the size of the deadweight loss caused by this subsidy is \$0.35.

15.8
An operating fee of this sort would essentially be an increase in the fixed costs of production. In the short run, this would have no impact on output or price, since the number of firms is fixed and a change in fixed costs does not affect marginal cost. The only thing that would change in the short run is that firms would be earning less profit (or, rather, incurring losses).

In the long-run, however, this increase in fixed costs would cause price to go up by $\$F/Q$ (because an $\$F$ increase in total cost increases average cost by $\$F/Q$ and long run price is equal to the minimum of average total cost). The number of firms would decrease (some would exit due to the losses) and the output at each firm would increase slightly. Total output would decrease.

15.9

From Exercise 15.1, we remember that the equilibrium without intervention is a price of \$2.50 per bushel and a quantity of 10 billion bushels. At the target price of \$3.00 per bushel, consumers demand 15 – 2(3) = 9 billion bushels and suppliers want to sell 5(3) – 2.5 = 12.5 billion bushels. Using a drawing like Figure 15.3 on page 558 (but with the numbers relevant to this problem) is helpful in determining the welfare effects of the various policies.



The values of each of these areas are:

A: (½)(4.5)(9) = 20.25
B: (0.5)(9) = 4.5
C: (½)(0.5)(1) = 0.25
D: (½)(1.8)(9) + (.2)(9) = 9.9
E: (½)(.2)(1) = .1
F: (½)(2.3 + 3)(3.5) = 9.275
G: (½)(3.5)(0.5) = 0.875

Using Figure 15.3 as a guide, the welfare effects of each policy are shown in the table below:

	No intervention	**Price floor**	**Price support**	**Production quota**	**Voluntary production reduction**
Aggregate Surplus	35	34.65	25.375	34.65	34.65
Deadweight loss	0	0.35	9.625	0.35	0.35
Consumer surplus	25	20.25	20.25	20.25	20.25
Producer surplus	10	14.4	15.625	14.4	15.625
Government Revenue	0	0	–10.5	0	–1.225

15.10

Let's first solve for the initial equilibrium price with no interventions. We equate market demand and market supply to accomplish that:

$Q^s = Q^d$
$4{,}000P - 20{,}000 = 65{,}800 - 1{,}200P$
$5{,}200P = 85{,}800$
$P = \$16.50$

When we plug this price back into supply and demand we get 4,000(16.5) – 20,000 = 65,800 – 1,200(16.5) = 46,000.

In this case then the price floor of $15 is set up below the equilibrium price of $16.5. The price floor is not binding and has no effect on consumer surplus, producer surplus, or aggregate surplus. By mandating a minimum price lower than the market price, no market participant has to adjust and the market outcome does not change.

Regarding the price support policy, government would probably take no action. At the desired price of $15, buyers want 47,800 pizzas and sellers only want to make 40,000. The price support policy would involve government *selling* 7,800 pizzas. But this lowers price to $15; it does not raise price, so it is not actually a price support policy.

Only if the price fell below $15 would either of these policies come into effect.

15.11
The demand function for milk is $31.6 - 9.4P_b$ and the supply function, if the subsidy is in effect, at prices below $1.46, is $13.4 + 5.7P_b$. Equating supply and demand gives:

$Q_s = Q_d$
$13.4 + 5.7P_b = 31.6 - 9.4P_b$
$15.1P_b = 18.2$
$P_b = \$1.21$

From this buyer price of $1.21 per gallon, we see that quantity will be 31.6 – 9.4(1.21) = 13.4 + 5.7(1.21) = 20.27 billion. We see that sellers are receiving $1.21 + (0.45)($1.46 – $1.21) = $1.21 + (0.45)($0.25) = $1.32 per gallon.

If government wanted to raise the retail price (buyer price) of milk to $1.40 per gallon under a price support program, it would need quantity supplied to be 13.4 + 5.7(1.40) = 21.38 billion. At a price of $1.40, buyers only want 31.6 – 9.4(1.40) = 18.44 billion. So government would have to buy the difference, 21.38 – 18.44 = 2.94 billion. In this case, P_b is $1.40, so sellers would be receiving $1.40 + (0.45)($1.46 – $1.40) = $1.40 + $0.03 = $1.43 per gallon.

Consumer surplus has decreased by (18.44)($1.40 – $1.21) + (½)(20.27 – 18.44)($1.40 – $1.21) = $3.68 billion. Producer surplus has increased by (20.27)($1.43 – $1.32) + (½)(21.38 – 20.27)(($1.43 – $1.40) + ($1.43 - **$1.21))** = **2.37** billion. Government spending on the MILC program has decreased by ($0.11)(20.27) – ($0.03)(21.38) = $1.59 billion, but government spending has increased due to the purchasing of milk by ($1.40)(2.94) = $4.12 billion. The net increase in government spending is $2.53 billion.

We know that the change in *AS* is equal to the sum of the changes in *CS*, *PS* and *GR*.

$\Delta AS = \Delta CS + \Delta PS + \Delta GR$

ΔAS = (–\$3.68) + (\$2.37) + (–\$2.53) = –\$3.96 billion

The price support has decreased *AS* (or increased deadweight loss) by \$3.96 billion.

15.12
In Exercise 15.10, we solved for the initial equilibrium price of \$16.50 and found that at this price 46,000 pizzas were bought and sold.

With a price ceiling of \$10 we compute that buyers would like to purchase 65,800 – 1,200(10) = 53,800 pizzas, and sellers would like to sell 4,000(10) – 20,000 = 20,000 pizzas. Thus, with this binding price ceiling, quantity supplied will be smaller than the quantity demanded. Only 20,000 pizzas will be sold (and therefore bought) at the price ceiling of \$10.

To calculate the areas of surplus, we need to figure out the price at which buyers would have chosen to purchase only 20,000 pizzas. We do this by setting Q^d equal to 20,000.

$20{,}000 = Q^d$
$20{,}000 = 65{,}800 - 1{,}200P$
$1{,}200P = 45{,}800$
$P = \$38.17$

Now we can calculate the changes in surplus. Consumer surplus has changed in two ways: first, the 20,000 pizzas that are still purchased are cheaper than they used to be, so consumer surplus increases by (\$16.50 – \$10)(20,000) = \$130,000; secondly, consumers are consuming less pizza, so the consumer surplus from the no-longer-consumed pizzas is lost, and consumer surplus decreases by (½)(46,000 – 20,000)(\$38.17 – \$16.50) = \$281,710. So the net change in consumer surplus is a decrease of \$151,710.

Producer surplus likewise has two changes. Those producers producing pizza after the price ceiling get paid less for their pizzas, so producer surplus decreases by ($16.50 – $10.00)(20,000) = $130,000; secondly, some pizzas no longer get produced, so the producer surplus from those pizzas is lost for good, and producer surplus decreases by (½)($16.50 – $10.00)(46,000 – 20,000) = $84,500. So the total decrease in producer surplus is $214,500.

Since consumer surplus fell by $151,710 and producer surplus fell by $214,500, we know that aggregate surplus fell by $151,710 + $214,500 = $366,210. This is the deadweight loss of this policy.

15.13
In problem 15.1 we calculated that the equilibrium price is $2.50 per bushel and the equilibrium quantity is 10 billion bushels. With a price ceiling of $2, we see that buyers want to purchase 15 – 2(2) = 11 billion bushels while sellers are only willing to produce 5(2) – 2.5 = 7.5 billion bushels. Thus, the quantity bought and sold will be 7.5 billion bushels. In order to properly calculate the changes in surplus, we need to know at what price consumers would have chosen to purchase 7.5 billion bushels. We find this price by setting Q^d equal to 7.5 and solving for P:

$7.5 = Q^d$
$7.5 = 15 - 2P$
$2P = 7.5$
$P = \$3.75$

Now we can calculate the changes in surplus. Consumer surplus has changed in two ways: first, the 7.5 billion bushels that are still purchased are cheaper than they used to be, so consumer surplus increases by ($2.50 – $2)(7.5) = $3.75 billion; secondly, consumers are consuming less corn, so the consumer surplus from the no-longer-consumed corn is lost, and consumer surplus decreases by (½)(10 – 7.5)($3.75 – $2.50) = $1.56 billion. So the net change in consumer surplus is an increase of $2.19 billion. (This assumes that corn goes to the consumers who value it the most highly.)

Producer surplus likewise has two changes. Those producers producing corn after the price ceiling get paid less for their corn, so producer surplus decreases by ($2.50 – $2)(7.5) = $3.75 billion; secondly, some corn no longer get produced, so the producer surplus from that corn is lost for good, and producer surplus decreases by (½)($2.50 – $2)(10 – 7.5) = $0.63 billion. So the total decrease in producer surplus is $4.38 billion.

Since consumer surplus increased by $2.19 billion and producer surplus fell by $4.38 billion, we know that aggregate surplus changed by (2.19) – (4.38) = –$2.19 billion. Aggregate surplus has fallen. $2.19 billion is the deadweight loss of this policy.

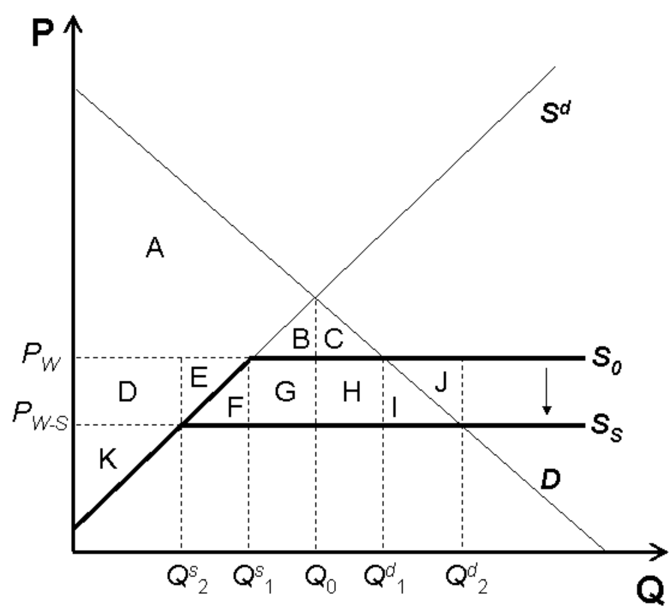
15.14
Initially, without the tariff, the price is at P_W = \$1.50. At this price, the quantity bought and sold in the market is 15 – 2(1.5) = 12 billion bushels. The quantity supplied by domestic firms is 5(1.5) – 2.5 = 5 billion bushels. This means that 7 billion bushels are imported.
With a \$0.50 tariff, the price increases to \$2.00. At this price, the quantity bought and sold in the market is 15 – 2(2) = 11 billion bushels. The quantity supplied by domestic firms is 5(2) – 2.5 = 7.5 billion bushels. This means that 3.5 billion bushels are imported.

Using the "choke" prices derived in In-Text Exercise 15.1, we can calculate consumer surplus, which is (½)(Q^d)(\$7.50 – P), and producer surplus, which is (½)(Q^s)(P – \$0.50) with and without the tariff, keeping in mind that Q^d and Q^s differ. Government revenue is simply the size of the tariff, T, multiplied by the number of imports, $T \times Q$.

	No tariff	**Tariff of \$0.50**
Consumer surplus	(½)(12)(\$7.50 – \$1.50) = \$36 billion	(½)(11)(\$7.50 – \$2.00) = \$30.25 billion
Producer surplus	(½)(5)(\$1.50 – \$0.50) = \$2.50 billion	(½)(7.5)(\$2.00 – \$0.50) = \$5.63 billion
Government revenue	(\$0)(7) = \$0	(\$0.50)(3.5) = \$1.75 billion
Aggregate surplus	\$36 + \$2.50 + \$0 = \$38.50 billion	\$30.25 + \$5.63 + \$1.75 = \$37.63 billion

The tariff causes 38.50 – 37.63 = \$0.87 billion in deadweight loss.

15.15
In the graph to the right, the world price is P_W. Before the import subsidy, domestic producers sell $Q^s{}_1$ units of the good and domestic buyers consume $Q^d{}_1$ units, importing the difference. When the subsidy goes into effect, the price falls to $P_{W\text{–}S}$. Domestic producers sell only $Q^s{}_2$ units; domestic buyers consume $Q^d{}_2$ units.

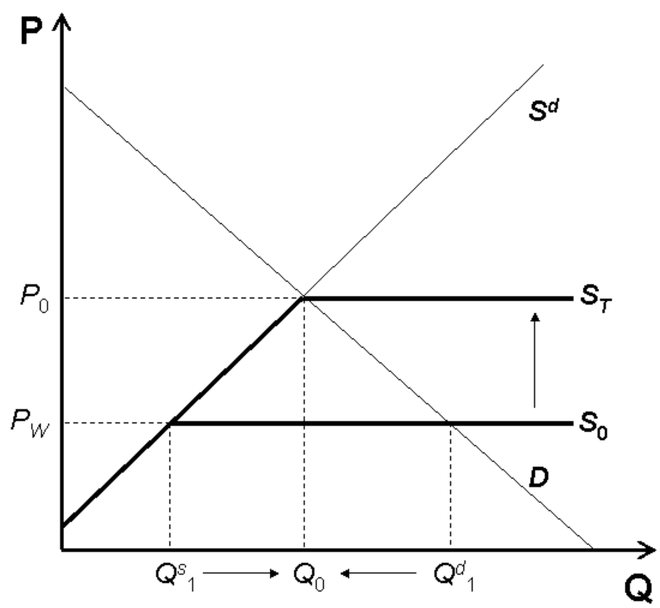


The changes in surplus are summarized in the table below:

	No import subsidy	Import subsidy of $S	Change
Consumer surplus	ABC	ABCDEFGHI	+DEFGHI
Producer surplus	DEK	K	–DE
Government spending	*none*	EFGHIJ	+EFGHIJ
Aggregate surplus	ABCDEK	ABCDK – J	–EJ

The deadweight loss of the import subsidy is $E + J$.

15.16
To completely prevent imports from coming into the country, a tariff must be set so high that the price of an import is more than (or equal to if indifferent consumers consume domestically produced goods) the domestic price. Therefore, the right size of this tariff is the difference between the domestic market equilibrium price and the world price.



In the graph to the right, the world price is P_W. Without a tariff, domestic suppliers produce $Q^s{}_1$ units and domestic buyers consume $Q^d{}_1$ units, importing the difference. As a tariff is added, the S_0 curve shifts upward toward S_T. As this happens, domestic quantity supplied increases and domestic quantity demand decreases, which decreases the need for imports. Once S_T is such that it produces a price exactly equal to the domestic market equilibrium price, P_0, there is no need for any imports, because quantity demanded and quantity supplied domestically are equal at Q_0. The size of the tariff is $P_0 - P_W$.

15.17

No, subsidizing exports to another country where markets are perfectly competitive produces no benefit to the exporting country. When the government offers export subsidy, domestic producers will export the good up to the point where domestic price exceeds the price in the importing country by the amount of the subsidy. In other words, the domestic price of the good might increase by as much as the amount of the subsidy. With this price increase, producers gain but consumers are hurt. Additionally, government loses by spending money on the subsidy. Consumption and production distortions will be created (by stimulating artificially high exports), so aggregate surplus will decrease. If the domestic price does not go up, it is because the domestic price already exceeds the foreign price by more than the amount of the subsidy, so nothing will be exported and nothing will change.