Intermediate Microeconomics  
ECNS 301  
Fall 2015  

Homework #: 3  

Due by the beginning of class on: Thursday September 17, 2015  

Name:  

Instructions:  
There are 8 questions worth a total of 100 points. Answer each question clearly and concisely. You must show your work to receive credit. You are allowed to work with others, but all work must be your own.  

Clearly print your name above and in the space provided on the next page. You must turn in both sides of this cover sheet along with your responses. You do not need to turn in the questions, only your responses with the cover sheet. All pages must be stapled to be graded.
Comparative Statics

1. Think about the domestic market for coffee. For each part, is there a change in demand, supply or both? Does demand and/or supply increase or decrease? How does the equilibrium quantity and equilibrium price change? (12)

(a) There is a new study announcing health problems associated with coffee.

Solution: This causes a change in demand. Demand decreases due to a change in tastes. The equilibrium price decreases and the equilibrium quantity decreases.

(b) The US experiences a hot summer (temperatures are average in coffee producing countries).

Solution: If we don’t consider iced coffee, this causes a change in demand. Demand decreases due to a change in tastes. The equilibrium price decreases and the equilibrium quantity decreases.

(c) There is a new technique in the rain-forest which makes coffee production cheaper.

Solution: This causes a change in supply. Supply increases due to an improvement in technology. The equilibrium price decreases and the equilibrium quantity increases.

(d) You win the lottery and have more disposable income.

Solution: This causes a change in demand. Demand increases because coffee is a normal good. The equilibrium price increases and the equilibrium quantity increases.

(e) The price of tea decreases.

Solution: This causes a change in demand. Demand decreases because coffee and tea are substitutes. The equilibrium price decreases and the equilibrium quantity decreases.

(f) The price of cream and sugar increases and you don’t like drinking it black.

Solution: This causes a change in demand. Demand decreases because cream and sugar are complements. The equilibrium price decreases and the equilibrium quantity decreases.

(g) Workers in the coffee industry unionize and the union negotiates higher wages.
Solution: This causes a change in supply. Supply decreases due to an increase in input costs. The equilibrium price increases and the equilibrium quantity decreases.

(h) The price of fertilizer used to grow coffee decreases.

Solution: This causes a change in supply. Supply increases due to a decrease in input costs. The equilibrium price decreases and the equilibrium quantity increases.

2. What is wrong with each of the following statements?

(a) When the price of feed rises, farmers raise fewer pigs. This means there are fewer pork chops in supermarkets. Consumers therefore bid up the price of pork-chops. This means that farmers raise more pigs. These effects net each other out and the price of pork-chops is unchanged.

Solution: Farmers don’t raise more pigs because the price of feed is still higher.

(b) If the price of art works increases, we know that supply has increased.

Solution: An increase in supply would cause the price of art works to decrease. An increase in the equilibrium price can be explained by either an increase in demand or a decrease in supply.

(c) Though sales of homes are down in San Jose, the price continues to rise. This is a violation of the supply and demand.

Solution: If we say that sales of homes are down, we mean that the equilibrium quantity has decreased. The equilibrium quantity can decrease and the price can increase when there is a decrease in supply.

(d) When demand for parrots exceeds the supply, price for parrots remains high.

Solution: If the quantity demanded is greater than the quantity supplied, then the price is too low.
(e) When the baby-boomers retire, there will be a shortage of workers in many occupations. Perhaps as many as 25% of jobs will go unfilled.

**Solution:** Consider the labor market where workers supply labor and firms demand labor. When baby-boomers retire, the supply of labor decreases. This causes an increase in the equilibrium wage rate and a decrease in the equilibrium number of jobs. Jobs don’t go unfilled because firms hire less workers when the wage rate is higher.

3. If the price of hot dogs rises,

(a) What happens to the market for ketchup?

**Solution:** Demand for ketchup decreases because ketchup and hot dogs are complements. This causes the equilibrium price of ketchup to decrease and the equilibrium quantity of ketchup to decrease.

(b) For tomatoes?

**Solution:** Ketchup producers demand fewer tomatoes and the demand for tomatoes decreases. This causes the equilibrium price of tomatoes to decrease and the equilibrium quantity of tomatoes to decrease.

(c) For tomato juice?

**Solution:** The supply of tomato juice increases due to the decrease in input price (tomatoes). This causes the equilibrium price of tomato juice to decrease and the equilibrium quantity to increase.

(d) For orange juice?

**Solution:** The demand for orange juice decreases because orange juice and tomato juice are substitutes and the price of tomato juice decreased. Most people might not think of tomato juice and orange juice as substitutes, but if you have some vodka you can either make screwdrivers or bloody mary’s. This causes the equilibrium price of orange juice to decrease and the equilibrium quantity of orange juice to decrease.

It’s also preposterous to think that a change in the price of a hot dog impacts the market for orange juice. The reason we got to this point is because our simple model of demand and supply says nothing about the magnitude of the changes, only the direction of the change.
4. In 1973, the U.S. Supreme Court ruled that any woman has a right to an abortion. What effect do you think this ruling had on the price and quantity of abortions? Use a diagram to illustrate your answer.

**Solution:** The quantity of abortions increased, but the effect on the price is more ambiguous.

The supply of abortions increased (shifted to the right) since the costs of providing abortions decreased. The costs to medical providers decreased because now they didn’t face the additional costs associated with prosecution.

It’s likely that demand also increased (shifted to the right). This could be due to improvements in information and the quality of the procedure or due to the decreased risk of prosecution.

If demand increases from $D$ to $D'$ and there’s an increase in supply from $S$ to either $S'$ or $S''$, then we move from an equilibrium at $A$ to an equilibrium at $B$ or $C$. Both $B$ and $C$ result in a higher equilibrium quantity, but the effect on price is ambiguous.
5. A virus killed more than half the oysters used to produce pearls in the world’s busiest undersea factory. Use a diagram to indicate why the price of pearls used in earrings rose 18%. Can you infer anything about the elasticities of demand or supply from this information? According to Lynn Ramsey, former executive director of the Jewelry Information Center in New York, “Price is not an object in this market.” What do you think she means by this statement? Is this statement consistent with the evidence?

**Solution:** There was a large decrease in supply, which lead to a lower equilibrium quantity and a higher equilibrium price. Since the price only rose 18% for such a large decrease in supply, demand must be relatively elastic.

Notice that when there is a decrease in supply, the equilibrium moves from $A$ to $B$. This move gives you information about the price elasticity of demand, but no information about the price elasticity of supply.

Presumably price not being an “object” implies that demand is inelastic which is inconsistent with the evidence.
6. Assume that individuals will only buy computers if they already have a web browser installed. Computer companies must purchase browsers from software companies and install them. The government embarks on a campaign to increase the number of computers that Americans buy and imposes a price ceiling on browsers. However, after this campaign, the price of computers increases! Why? (Assume all markets are competitive, with upward sloping supply curves and downward sloping demand curves.)

**Solution:** The price ceiling on browsers leads to a shortage of browsers and decreases the quantity of browsers being produced. If the quantity of browsers being produced decreases and if browsers are an input to producing computers, then the supply of computers decreases. A decrease in the supply of computers leads to an increase in the price.

With the price ceiling, the shortage is $q_D - q_S$. Computer firms are only able to get $q_S$ browsers. This causes a decrease in the supply of computers.
The decrease in supply of computers increases the price since the equilibrium moves from $A$ to $B$. 
Taxes

7. What is the effect of a 10% ad valorem tax (a tax that is not a straight dollar amount but a sales tax of 10% of the price) on equilibrium price and quantity if the supply curve is upwards sloping and the demand curve is as follows. Illustrate these graphically and describe what incidence of the tax falls on consumers?

(a) Vertical?

Solution: Since consumers are perfectly inelastic, they incur the entire burden of the tax. The equilibrium quantity does not change. Firms still receive the same price, but consumers pay the price of the good plus the tax.

Before the tax, the equilibrium was at $A$ where the equilibrium price was $p_A$ and the equilibrium quantity was $q_A$. Now with the tax, the quantity is $q_T$, $p_S$ is the price sellers get, and $p_B$ is the price buyers pay. Since $p_S = p_A$, sellers get the same price they did before the tax and buyers incur the entire incidence of the tax.
(b) Downward sloping?

**Solution:** The tax burden is shared among consumers and producers. The equilibrium quantity decreases, the price buyers pay increases and the price sellers get decreases. The incidence for consumers depends on the price elasticity of demand relative to the price elasticity of supply.

Before the tax, the equilibrium was at $A$ where the equilibrium price was $p_A$ and the equilibrium quantity was $q_A$. Now with the tax, the quantity is $q_T$, $p_S$ is the price sellers get, and $p_B$ is the price buyers pay. The tax incidence of the buyers is $p_B - p_A$ and the tax incidence of the sellers is $p_A - p_S$. 
(c) Horizontal?

**Solution:** Since consumers are perfectly elastic, producers incur the entire burden of the tax. The equilibrium quantity decreases. The price buyers pay does not change, but the price sellers get decreases.

Before the tax, the equilibrium was at $A$ where the equilibrium price was $p_A$ and the equilibrium quantity was $q_A$. Now with the tax, the quantity is $q_T$, $p_S$ is the price sellers get, and $p_B$ is the price buyers pay. Since $p_B = p_A$, buyers pay the same amount before the tax as they do with the tax and sellers incur the entire incidence of the tax, $p_A - p_S$. 
8. California taxes cigarettes to fund preschools. It recognizes that a secondary benefit of the tax would be to reduce teen smoking. Suppose taxes are $15 per carton. Demand and supply of cigarettes are as follows.

\[ Q_S = 2P + 20 \]
\[ Q_D = 200 - P \]

(a) Write out the equations for the inverse demand and inverse supply curves. What is the market equilibrium price and quantity without the tax?

**Solution:** Inverse demand and supply are as follows:

\[ P = \frac{1}{2} Q_S - 10 \]
\[ P = 200 - Q_D \]

The market equilibrium is determined as follows.

\[ D(P) = S(P) \]
\[ 200 - P = 2P + 20 \]
\[ 3P = 180 \]
\[ P^* = 60 \]
\[ Q^* = 200 - (60) = 140 \]

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\(^1\)These number are made up, although the policy in California is a real one (Proposition 10 passed November 1998). The actual tax is 50 cents per pack, resulting in tax revenues of $700 million for 2000.
(b) By how much does the tax increase the price consumers pay? By how much does it decrease the price producers receive?

**Solution:** Let’s impose the tax on the buyers (although it doesn’t matter with a per unit tax). If the price is $P_S = P$, buyers now have to pay $P_B = P + \tau$, where $\tau = 15$ and sellers get $P$. Note that the equilibrium price, $P^*(\tau)$, is a function of the tax rate because as we increase or decrease the tax rate, $\tau$, this will change the equilibrium price.

At this point you solve the problem by setting up the following equation.

\[
D(P + 15) = S(P) \quad \text{Market equilibrium price has } Q_S = Q_D.
\]

\[
200 - (P + 15) = 2P + 20 \quad \text{By substitution}
\]

\[
3P = 165 \quad \text{By rearranging}
\]

\[
P^* = 55
\]

\[
P_B = 55 + 15 = 70
\]

\[
P_S = 55
\]

\[
Q^*_T = 2(55) + 20 = 130
\]

Before the tax, consumers paid $60 and producers received $60. After the tax, consumers pay $70 and producers receive $55. The tax increases the price consumers pay by $10 and decreases the price producers receive by $5.

(c) How much revenue does the tax raise? By how much does it reduce smoking?

**Solution:** The quantity with the per unit tax of $15 is $Q_T = 130$. The tax revenue is $\tau Q_T = (15)(130) = 1950$. The quantity before the tax was 140 so the tax reduces smoking by $140 - 130 = 10$. 
(d) Suppose instead of a $15 tax per unit, former Governor Gray Davis decides that every consumer who buys cigarettes must pay the government a tax of $0.25 for every dollar they pay to the cigarette producer. (This is the same as a sales tax of 25%.) Would this be any different from the $15 tax? Justify your answer.

**Solution:** Right away we know that a sales tax of 25% would be different from the $15 per unit tax since the price with the $15 per unit tax is $55 and 
\[(1.25)(55) = 68.75\] rather than the $70 found above. Comparing the sales tax of 25% to the $15 per unit tax, the quantity will be greater with the 25% sales tax and the price will be higher.

The 25% sales tax is imposed on the buyers. If the price is \(P_s = P\), buyers now have to pay \(P_B = P + \tau P = (1 + \tau)P\), where \(\tau = 0.25\) and sellers get \(P\). Note that the equilibrium price, \(P^*(\tau)\), is a function of the tax rate because as we increase or decrease the tax rate, \(\tau\), this will change the equilibrium price.

At this point you solve the problem by setting up the following equation.

\[
D(1.25P) = S(P) \quad \text{Market equilibrium price has } Q_S = Q_D.
\]

\[
200 - 1.25P = 2P + 20 \quad \text{By substitution}
\]

\[
\frac{13}{4}P = 180 \quad \text{By rearranging}
\]

\[
P^* = \frac{720}{13}
\]

\[
P_B = (1.25)\frac{720}{13} = \frac{900}{13} = 69.24
\]

\[
P_S = \frac{720}{13} = 55.39
\]

\[
Q_T^* = 2\left(\frac{720}{13}\right) + 20 = \frac{1700}{13} = 130.77
\]

With the $15 per unit tax, consumers pay $70, producers receive $55 and the quantity is 130. With the 25% sales tax, consumers pay a lower price of \(\frac{900}{13}\), producers receive a higher price of \(\frac{720}{13}\) and the quantity of \(\frac{1700}{13}\) is higher.
(e) Voters argue that it is unfair for poor and addicted cigarette consumers to pay the tax. They argue that instead the wealthy tobacco companies should pay the government $\frac{1}{3}$ of every dollar they receive from cigarette buyers (a tax on producers of 33.3%). Would this be any different from the tax in part d? Explain.

Solution:
The $\frac{1}{3}$ sales tax is imposed on the producers. If the price is $P_B = P$, producers now receive $P_S = P - \tau P = (1 - \tau)P$, where $\tau = \frac{1}{3}$. Note that the equilibrium price, $P^*(\tau)$, is a function of the tax rate because as we increase or decrease the tax rate, $\tau$, this will change the equilibrium price.

At this point you solve the problem by setting up the following equation.

$$D(P) = S\left(\frac{2}{3}P\right)$$

Market equilibrium price has $Q_S = Q_D$.

200 - $P = \frac{4}{3}P + 20$  By substitution

$\frac{7}{3}P = 180$  By rearranging

$P^* = \frac{540}{7}$

$P_B = \frac{540}{7} = 77.15$

$P_S = \left(\frac{2}{3}\right)\frac{540}{7} = \frac{360}{7} = 51.43$

$Q^*_T = 200 - \frac{540}{7} = \frac{860}{7} = 122.86$

With the 25% sales tax, consumers pay a price of $\frac{900}{13}$, producers receive a price of $\frac{720}{13}$ and the quantity is $\frac{1700}{13}$. With the $\frac{1}{3}$ ad valorem tax on producers, consumers pay a higher price of $\frac{540}{7}$, producers receive a lower price of $\frac{360}{7}$ and the quantity of $\frac{860}{7}$ is lower.
(f) Arnold Schwarzenegger argues that cigarette-smoking movie stars are key to the financial health of the state. Instead of being taxed, cigarettes receive a subsidy of $15 per carton. Calculate the price consumers pay, the price producers receive and the quantity exchanged with the subsidy.

Solution: The subsidy can be thought of as a per unit negative tax. Let’s impose the subsidy on the buyers (although it doesn’t matter with a per unit subsidy). If the price is $P_S = P$, buyers now have to pay $P_B = P - \tau$, where $\tau = 15$ and sellers get $P$. The reason that buyers pay less than what the sellers receive is because the government subsidy covers the difference. Note that the equilibrium price, $P^*(\tau)$, is a function of the subsidy rate because as we increase or decrease the subsidy rate, $\tau$, this will change the equilibrium price.

At this point you solve the problem by setting up the following equation.

$$D(P - 15) = S(P)$$

Market equilibrium price has $Q_S = Q_D$.

$$200 - (P - 15) = 2P + 20$$

By substitution

$$3P = 195$$

By rearranging

$$P^* = 65$$

$$P_B = 65 - 15 = 50$$

$$P_S = 65$$

$$Q^*_T = 200 - 50 = 150$$

(g) Suppose that instead of any taxes or subsidies, the government imposes a $55 price ceiling on cartons of cigarettes. What are the effects of the price ceiling?

Solution: Without any taxes, the equilibrium price is $60. A price ceiling of $55 will create a shortage in the market where $Q_D > Q_S$.

With a price ceiling of $55, $Q_D = 200 - 55 = 145$ and $Q_S = 2(55) + 20 = 130$. The price ceiling creates a shortage of $145 - 130 = 15$. 