**ECON 2100 – Principles of Microeconomics (Summer 2016)**

“Consumers’ Surplus, Producers’ Surplus, Social Surplus, and Deadweight-Loss”

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**Relevant readings from the textbook:**
- Mankiw, Ch. 7 – “Consumers, Producers, and the Efficiency of Markets”

**Suggested problems from the textbook:**
- Chapter 7 “Questions for Review” (Page 151): 1, 2, 3, and 4
- Chapter 7 “Quick Check Multiple Choice” (Pages 151-152): 1, 2, 4, 5, and 6
- Chapter 7 “Problems and Applications” (Pages 152-153): 1, 4, 5, 7, 8, 10, and 11

**Definitions and Concepts:**

- **Consumer’s Surplus** – a measure of the benefit realized by a buyer from making a purchase, defined as the difference between the buyer’s reservation price for the item and price paid for the item.
  - Example: suppose a consumer with a buyer’s reservation price of \( r_b = 22 \) for an item purchases the item for \( p = 14 \) \( \Rightarrow \) his Consumer’s Surplus from making this purchase at this price is \( CS = r_b - p = 22 - 14 = 8 \).

- **Producer’s Surplus** – a measure of the benefit realized by a seller from making a sale, defined as the difference between price received for the item and the seller’s reservation price for the item.
  - Example: suppose a producer with a seller’s reservation price of \( r_s = 10 \) for an item sells the item for \( p = 14 \) \( \Rightarrow \) her Producer’s Surplus from making this sale at this price is \( PS = p - r_s = 14 - 10 = 4 \).

- **Social Surplus** – a measure of the benefits of a transaction on society as a whole, defined as the sum of the gains (and potentially losses) from the transaction over every person in society.
  - Note: if “no third parties impacted by a trade,” then Social Surplus will simply be equal to the sum of Consumer’s Surplus and Producer’s Surplus \( \Rightarrow SS = CS + PS \). In this case the expression for Social Surplus can be further simplified as: \( SS = (r_b - p) + (p - r_s) = r_b - r_s \).
  - Observe that “price” completely drops out of this expression for Social Surplus. However, “price” is critical for determining how the “gains from trade are split between the trading partners.”

- **Total Consumers’ Surplus** – a measure of the total gains from trade realized by all consumers in a market, defined as the difference between buyer’s reservation price and actual price paid added over all units purchased.
- **Total Producers’ Surplus** – a measure of the total gains from trade realized by all sellers in a market, defined as the difference between actual price received and seller’s reservation price added over all units sold.

- **Total Social Surplus** – a measure of the total gains from trade in a market, defined as the sum of Total Consumers’ Surplus and Total Producers’ Surplus in the market. *(Again, this definition assumes that “no third parties are impacted by the transactions in the market.”)*

- To maximize “Total Social Surplus”: (i) **Do trade all units** for which \((r_b - r_s) > 0\) (or equivalently \(r_b > r_s\)) and (ii) **Do NOT trade any units** for which \((r_b - r_s) < 0\) (or equivalently \(r_b < r_s\)). That is, Total Social Surplus is maximized by trading all units and only those units for which buyer’s reservation price exceeds seller’s reservation price.

- Comparison of “equilibrium level of trade” to “efficient level of trade” (i.e., “Total Social Surplus maximizing level of trade”):
  - The **“Equilibrium Quantity of Trade” is “Efficient”** in the sense that it maximizes Total Social Surplus (i.e., total gains from trade).
  - **Any other level of trade is “Inefficient”** in the sense that Total Social Surplus is not as large as possible => Any other level of trade (either higher or lower) leads to a smaller realized value of Total Social Surplus.

- **Deadweight Loss (DWL)** – the difference between the “maximum possible level of Total Social Surplus” and the “realized level of Total Social Surplus.”
  - DWL is **zero** at the efficient level of trade
  - DWL is **positive** at all other levels of trade

- **Inefficiency from “too little trade”** – Deadweight Loss will be positive if the actual level of trade is less than the efficient level of trade, as a result of not trading all units for which buyer’s reservation price is greater than seller’s reservation price. *(i.e., society does not trade all of the units that should be traded => the “loss” in this case results from “not trading some units which would give society a positive surplus.”)*

- **Inefficiency from “too much trade”** – Deadweight Loss will be positive if the actual level of trade is greater than the efficient level of trade, as a result of trading some units for which buyer’s reservation price is less than seller’s reservation price. *(i.e., society trades some units that should not be traded => the “loss” in this case results from “trading some units which give society a negative surplus.”)*
• **Change in Total Consumers’ Surplus resulting from a change in price.** A decrease in price increases Total Consumers’ Surplus in two ways: (i) CS increases “directly” since consumers now pay a lower price on all units purchased at the initial high price and (ii) CS increases “indirectly” since consumers choose to purchase additional units of the good at the new low price. If price were to instead increase, each of these effects would work in the “opposite direction,” causing CS to decrease.

• **Change in Total Producers’ Surplus resulting from a change in price.** An increase in price increases Total Producers’ Surplus in two ways: (i) PS increases “directly” since sellers now receive a higher price on all units sold at the initial low price and (ii) PS increases “indirectly” since sellers choose to sell additional units of the good at the new high price. If price were to instead decrease, each of these effects would work in the “opposite direction,” causing PS to decrease.

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**Graphical illustration of Social Surplus on one unit of trade** – on any arbitrary unit traded, Social Surplus is illustrated as the “vertical distance between the demand curve and the supply curve” at the unit being traded…

Again, note that “price” is irrelevant for this illustration of “Social Surplus”…
“Maximum Total Social Surplus” and “Inefficiency of too much or too little trade”:

To maximize

- Do trade all units for which \((r_b - r_s) > 0\) (or equivalently \(r_b > r_s\))
- Do not trade any units for which \((r_b - r_s) < 0\) (or equivalently \(r_b < r_s\))

Any other level of trade (either higher or lower) leads to a smaller realized value of Total Social Surplus.

Inefficiency from “too little trade”:

- Realized Social Surplus equal to “orange area”
- DWL equal to “black area”

Level of Trade below “Efficient Level”

Inefficiency from “too much trade”:

- Realized Social Surplus equal to “orange area minus black area”
- DWL equal to “black area”

Level of Trade above “Efficient Level”
“Equilibrium Price” serves to define the “split” of “total gains from trade” between buyers and sellers under the market equilibrium outcome:

- **Efficient** Level of Trade, as well as “Equilibrium” Level of Trade

- **Total Social Surplus** ("green area” plus “purple area”)

![Diagram showing supply and demand curves, equilibrium price, and areas representing total consumers’ surplus and total producers’ surplus.](image-url)
**Impact of price change on Total Consumers’ Surplus:**

When there is a decrease in price, there are two distinct factors which increase Consumers’ Surplus. Consider price decrease from $4 to $3 below:

(i) Consumers made better off “directly” by paying a lower price on “all initial units purchased” (i.e., paying $1 less on each of the 140 units purchased before the price decrease) => increase in CS illustrated by “green area” above

(ii) Consumers made better off “indirectly” since they now “purchase more units” (i.e., there are now 110 more units which give them a “positive surplus”) => increase in CS illustrated by “pink area” above

**Total increase in CS:** “green area plus pink area”
**Impact of price change on Total Producers’ Surplus:**

When there is an increase in price, there are two distinct factors which increase Producers’ Surplus. Consider price increase from $8 to $10 below:

(i) Sellers made better off “directly” by receiving a higher price on “all initial units sold” (i.e., receiving $2 more on each of the 820 units purchased before the price increase) => increase in PS illustrated by “brown area” above

(ii) Sellers made better off “indirectly” since they now “sell more units” (i.e., there are now 80 more units which give them a “positive surplus”) => increase in PS illustrated by “lime green area” above

**Total increase in PS: “brown area plus lime green area”**
Problem:

1. Consider a market in which demand is given by the linear demand function 
   \[ D(p) = 24,000 - 3,000p \].
   
   1A. Determine the numerical value of Total Consumers’ Surplus at a price of 
       \( p = 6 \).
   
   1B. Suppose price in this market were to decrease from \( p = 6 \) to \( p = 5 \). 
       Determine the change in the numerical value of Total Consumers’ Surplus 
       resulting from this decrease in price.

Multiple Choice Questions:

1. ______________ refers to a measure of the benefit realized by a buyer from 
   making a purchase, defined as the difference between the buyer’s reservation 
   price for the item and price paid for the item.
   
   A. Consumer’s Surplus 
   B. Producer’s Surplus 
   C. Social Surplus 
   D. Deadweight Loss 

2. Consider a market in which quantity demanded is 50,000 units when price is 
   $12.50 per unit. Suppose that an increase in supply causes price in this market to 
   decrease to $12.00. As a result of this change in equilibrium price, Total 
   Consumers’ Surplus would:
   
   A. not change. 
   B. increase by less than $25,000. 
   C. increase by exactly $25,000. 
   D. increase by more than $25,000. 

3. John has a ticket to an upcoming Atlanta Braves game at Turner Field. His 
   reservation price as a seller of this item is \( r_s = 25 \). Both Mary and Alice are 
   interested in purchasing the ticket from John. Mary’s reservation price as a buyer 
   is \( r_{brMary} = 35 \); Alice’s reservation price as a buyer is \( r_{brAlice} = 50 \). In order to 
   maximize Total Social Surplus 
   
   A. John must keep the ticket. 
   B. Mary must end up with the ticket. 
   C. Alice must end up with the ticket. 
   D. the ticket must be destroyed, without any of them attending the game. 

4. Consider a market in which the efficient level of trade is 29,000 units. If only 
   24,500 are traded, then Deadweight Loss 
   
   A. will be positive. 
   B. will be equal to zero. 
   C. will be negative. 
   D. may be positive or negative (it depends upon “how elastic” demand is).
5. Albert is considering purchasing a new basketball. His reservation price as a buyer of this item is \( r_b = 24 \). Walmart is selling basketballs for \( p = 16 \). If Albert buys a basketball from Walmart he would realize a Consumer’s Surplus of:
A. \((-16)\).
B. \((24/16) = (1.5)\).
C. \((24-16) = (8)\).
D. \((24)\).

6. If there is an increase in the price of a good, then Total Producers’ Surplus will
A. increase.
B. decrease.
C. become negative.
D. More than one of the above answers is correct.

7. Consider the market for bananas. The Social Surplus from trading the 10\(^{th}\) banana is illustrated by:
A. the height of the demand curve at the 10\(^{th}\) unit.
B. the height of the supply curve at the 10\(^{th}\) unit.
C. the vertical distance between the demand curve and the supply curve at the 10\(^{th}\) unit.
D. the area below the demand curve but above price for every unit up to the 10\(^{th}\) unit.

8. Consider a market in which there is currently “inefficiency from too much trade.” Which of the following statements is a correct observation about the current outcome in this market?
A. Deadweight Loss is equal to zero.
B. Total Social Surplus could be increased by increasing the level of trade.
C. some units are being traded for which buyer’s reservation price is less than seller’s reservation price.
D. the efficient level of trade must be zero units.

9. At the market equilibrium outcome
A. Total Producers’ Surplus is typically positive, while Total Consumers’ Surplus is typically equal to zero.
B. Total Consumers’ Surplus is typically positive, while Total Producers’ Surplus is typically equal to zero.
C. Deadweight Loss is typically positive.
D. equilibrium price “splits” the “total gains from trade” between buyers and sellers (i.e., price divides the Total Social Surplus into Total Consumers’ Surplus and Total Producers’ Surplus).
For questions 10 through 12, consider a market with demand and supply as illustrated below:

10. The level of trade which maximizes Total Social Surplus in this market is:
   A. 160 units.
   B. 200 units.
   C. 240 units.
   D. 400 units.

11. At the market equilibrium outcome,
   A. Total Consumers’ Surplus is equal to “areas (d)+(e)+(f).”
   B. Deadweight Loss is equal to “areas (c)+(e).”
   C. there is “inefficiency from too much trade.”
   D. None of the above answers are correct.

12. If supply were to decrease so that the new equilibrium quantity of trade becomes 160 units, then Total Consumers’ Surplus will
   A. become zero.
   B. decrease by “areas (b)+(c).”
   C. decrease by “area (c).”
   D. increase by “areas (d)+(f).”
**Answer to Problem:**

1A. Demand in this market is as illustrated below:

![Diagram of demand curve](image)

At a price of $6 Total Consumers’ Surplus is equal to “area (a).” Since the demand function is a linear function, “area (a)” is a triangle. In general, the area of any triangle is equal to “one half of base times height.” This triangle has a base of 6,000-0=6,000 and a height of 8-6=2. Therefore, its area (and the value of Total Consumers’ Surplus) is $6,000.

1B. As price decreases from $6 to $5, Total Consumers’ Surplus increases by “area (b) plus area (c).” “Area (b)” is a rectangle (with base of 6,000 and height of 1), while “area (c)” is a triangle (since demand is given by a linear function – with base of 3,000 and height of 1). Thus, “area (b)” has an area of 6,000, while “area (c)” has an area of 1,500. It follows that the resulting increase in Total Consumers’ Surplus is equal to $7,500.

**Answers to Multiple Choice Questions:**

1. A  
2. D  
3. C  
4. A  
5. C  
6. A  
7. C  
8. C  
9. D  
10. B  
11. D  
12. B