International Trade

1. Assume Saudi Arabia and the United States face the production possibilities for oil and cars shown in the accompanying table.

<table>
<thead>
<tr>
<th>Quantity of oil (millions of barrels)</th>
<th>Quantity of cars (millions)</th>
<th>United States</th>
<th>Quantity of oil (millions of barrels)</th>
<th>Quantity of cars (millions)</th>
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</thead>
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<tr>
<td>0</td>
<td>4</td>
<td>0</td>
<td>10.0</td>
<td>7.5</td>
</tr>
<tr>
<td>200</td>
<td>3</td>
<td>100</td>
<td>5.0</td>
<td>2.5</td>
</tr>
<tr>
<td>400</td>
<td>2</td>
<td>200</td>
<td>5.0</td>
<td>2.5</td>
</tr>
<tr>
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<td>1</td>
<td>300</td>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>800</td>
<td>0</td>
<td>400</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

a. What is the opportunity cost of producing a car in Saudi Arabia? In the United States? What is the opportunity cost of producing a barrel of oil in Saudi Arabia? In the United States?

b. Which country has the comparative advantage in producing oil? In producing cars?

c. Suppose that in autarky, Saudi Arabia produces 200 million barrels of oil and 3 million cars; similarly, that the United States produces 300 million barrels of oil and 2.5 million cars. Without trade, can Saudi Arabia produce more oil and more cars? Without trade, can the United States produce more oil and more cars?

1. a. In Saudi Arabia, 1 million cars can be produced by giving up production of 200 million barrels of oil. So the opportunity cost of 1 car in Saudi Arabia is 200 barrels of oil. The opportunity cost of 2.5 million cars in the United States is 100 million barrels of oil, making the opportunity cost of 1 car equal to 100 million/2.5 million = 40 barrels of oil. The opportunity cost of 1 barrel of oil in Saudi Arabia is 0.005 of a car. The opportunity cost of 1 barrel of oil in the United States is 0.025 of a car.

b. Since the opportunity cost of producing oil is lower in Saudi Arabia, it has the comparative advantage in oil production. And since the opportunity cost of producing cars is lower in the United States, it has the comparative advantage in car production.

c. In autarky, Saudi Arabia cannot produce both more oil and more cars. If Saudi Arabia produces 200 million barrels of oil and 3 million cars, it is on its production possibility frontier. This means that it can produce more oil only if it produces fewer cars. The same is true for the United States.
2. The production possibilities for the United States and Saudi Arabia are given in Problem 1. Suppose now that each country specializes in the good in which it has the comparative advantage, and the two countries trade. Also assume that for each country the value of imports must equal the value of exports.

a. What is the total quantity of oil produced? What is the total quantity of cars produced?

b. Is it possible for Saudi Arabia to consume 400 million barrels of oil and 5 million cars and for the United States to consume 400 million barrels of oil and 5 million cars?

c. Suppose that, in fact, Saudi Arabia consumes 300 million barrels of oil and 4 million cars and the United States consumes 500 million barrels of oil and 6 million cars. How many barrels of oil does the United States import? How many cars does the United States export? Suppose a car costs $10,000 on the world market. How much, then, does a barrel of oil cost on the world market?

Solution

2. a. If each country specializes, Saudi Arabia will produce 800 million barrels of oil and the United States will produce 10 million cars.

b. It is possible for Saudi Arabia to consume 400 million barrels of oil and for the United States to consume 400 million barrels of oil (for a total of 800 million barrels). And it is possible for Saudi Arabia to consume 5 million cars and for the United States to consume 5 million cars (for a total of 10 million cars).

c. The United States imports 500 million barrels of oil and exports 4 million cars. That is, each car trades for 125 barrels of oil. If a car costs $10,000 on the world market, then a barrel of oil costs $10,000/125 = $80.

3. Both Canada and the United States produce lumber and music CDs with constant opportunity costs. The United States can produce either 10 tons of lumber and no CDs, or 1,000 CDs and no lumber, or any combination in between. Canada can produce either 8 tons of lumber and no CDs, or 400 CDs and no lumber, or any combination in between.

a. Draw the U.S. and Canadian production possibility frontiers in two separate diagrams, with CDs on the horizontal axis and lumber on the vertical axis.

b. In autarky, if the United States wants to consume 500 CDs, how much lumber can it consume at most? Label this point A in your diagram. Similarly, if Canada wants to consume 1 ton of lumber, how many CDs can it consume in autarky? Label this point C in your diagram.

c. Which country has the absolute advantage in lumber production?

d. Which country has the comparative advantage in lumber production?

Suppose each country specializes in the good in which it has the comparative advantage, and there is trade.

e. How many CDs does the United States produce? How much lumber does Canada produce?

f. Is it possible for the United States to consume 500 CDs and 7 tons of lumber? Label this point B in your diagram. Is it possible for Canada at the same time to consume 500 CDs and 1 ton of lumber? Label this point D in your diagram.
3. a. The two accompanying diagrams illustrate the U.S. and Canadian production possibility frontiers.

b. If the United States wants to consume 500 CDs, in autarky it can at most consume 5 tons of lumber, as indicated by point A in panel (a) of the diagram. And if Canada wants to consume 1 ton of lumber, it can at most consume 350 CDs in autarky, as shown by point C in panel (b).

c. The United States can produce at most 10 tons of lumber, and Canada can produce at most 8 tons. So the United States has the absolute advantage in lumber production.

d. In the United States, producing 1 additional ton of lumber means forgoing production of 100 CDs: the opportunity cost of 1 ton of lumber is 100 CDs. In Canada, the opportunity cost of 1 ton of lumber is 50 CDs. Since the opportunity cost of lumber production in Canada is lower, Canada has the comparative advantage in lumber production.

e. If there is trade, the United States will specialize in the production of CDs and produce 1,000 CDs. Canada will specialize in lumber production and produce 8 tons of lumber.

f. With trade, it is possible for the United States to consume 500 CDs and 7 tons of lumber. This is shown by point B in the diagram. That leaves exactly 500 CDs and 1 ton of lumber to be consumed by Canada, shown by point D.

4. For each of the following trade relationships, explain the likely source of the comparative advantage of each of the exporting countries.

a. The United States exports software to Venezuela, and Venezuela exports oil to the United States.

b. The United States exports airplanes to China, and China exports clothing to the United States.

c. The United States exports wheat to Colombia, and Colombia exports coffee to the United States.

4. a. The United States has the comparative advantage in software production because of a factor endowment: a relatively large supply of human capital. Venezuela has the comparative advantage in oil production because of a factor endowment: large oil reserves.
b. The United States has the comparative advantage in airplane production because of a factor endowment: it has a relatively large supply of the human capital needed to produce airplanes. China has the comparative advantage in clothing production because of a factor endowment: it has a relatively large supply of unskilled labor.

c. The United States has the comparative advantage in wheat production because of an advantage in climate: it has a climate suitable for growing wheat. Colombia has the comparative advantage in coffee production because of an advantage in climate: it has a climate suitable for growing coffee.

5. The U.S. Census Bureau keeps statistics on U.S. imports and exports on its website. The following steps will take you to the foreign trade statistics. Use them to answer the questions below.

(i) Go to the U.S. Census Bureau’s website at www.census.gov
(ii) Under the heading “Business & Industry,” select “Foreign Trade”
(iii) At the top of the page, select “Data”
(iv) Then select “Country/Product Trade”
(v) Under the heading “North American Industry Classification System (NAICS)-Based,” select “NAICS web application”
(vi) In the drop-down menu “3-digit and 6-digit NAICS by country,” select the product category you are interested in, and hit “Go”
(vii) In the drop-down menu “Select 6-digit NAICS,” select the good or service you are interested in, and hit “Go”
(viii) In the drop-down menus that allow you to select a month and year, select “December” and “2010,” and hit “Go”
(ix) The right side of the table now shows the import and export statistics for the entire year 2010. For the questions below on U.S. imports, use the column for “Consumption Imports, Customs Value Basis.”

a. Look up data for U.S. imports of hats and caps: in step (vi), select “(315) Apparel & Accessories” and in step (vii), select “(315991) Hats and Caps.” From which country do we import the most hats and caps? Which of the three sources of comparative advantage (climate, factor endowments, and technology) accounts for that country’s comparative advantage in hat and cap production?

b. Look up data for U.S. imports of grapes: in step (vi), select “(111) Agricultural Products” and in step (vii), select “(111332) Grapes.” From which country do we import the most grapes? Which of the three sources of comparative advantage (climate, factor endowments, and technology) accounts for that country’s comparative advantage in grape production?

c. Look up data for U.S. imports of food product machinery: in step (vi), select “(333) Machinery, Except Electrical” and in step (vii), select “(333294) Food Product Machinery.” From which country do we import the most food product machinery? Which of the three sources of comparative advantage (climate, factor endowments, and technology) accounts for that country’s comparative advantage in food product machinery?

5. a. In 2010, the United States imported the most hats and caps from China: U.S. imports of hats and caps from China totaled $846 million. (The runner-up was Vietnam, at $100 million, followed by Bangladesh, at $83 million.) China’s comparative advantage comes from a difference in factor endowments: China has an abundance of labor, used to make hats and caps. (If you’re wearing a hat, check where it was made!)
b. In 2010, the United States imported the most grapes from Chile: U.S. imports of grapes from Chile totaled $740 million. (The distant runner-up was Mexico, at $464 million.) Chile's comparative advantage comes from a difference in climate: when it is impossible to grow grapes in the United States during the cold winter months, it is summer in Chile and easy to grow grapes.

c. In 2010, the United States imported the most food product machinery from Germany: U.S. imports of food product machinery from Germany totaled $174 million. (The runner-up was Italy, at $129 million.) Germany's comparative advantage comes from a difference in technology: over a long period of producing machinery, German manufacturers have developed superior production techniques. (Much of the world's beer is bottled by German beer-bottling machinery.)

6. Compare the data for U.S. imports of hats and caps from China in 2010 that you found in Problem 5 with the same data for the year 2000. Repeat the steps outlined in Problem 5, but in step (viii) select “December” and “2000.”

a. What happened to the value of U.S. imports of hats and caps from China between 2000 and 2010?

b. What prediction does the Heckscher–Ohlin model make about the wages received by labor in China?


b. As trade increases, the Heckscher–Ohlin model predicts that prices of factors that are abundantly available in a country will rise. In other words, the model predicts that the wages received by labor in China would have risen between 2000 and 2010. (Is this really true? According to China's National Bureau of Statistics, the average Chinese worker's wage rose from 9,371 yuan in 2000 to 32,736 yuan in 2000, the latest year for which data were available at the time of writing. Almost none of this increase in wages was due to inflation: between 2000 and 2010, China experienced almost no inflation.)

7. Shoes are labor-intensive and satellites are capital-intensive to produce. The United States has abundant capital. China has abundant labor. According to the Heckscher–Ohlin model, which good will China export? Which good will the United States export? In the United States, what will happen to the price of labor (the wage) and to the price of capital?

7. The Heckscher–Ohlin model predicts that a country will have a comparative advantage in the good whose production is intensive in the factor the country has abundantly available: the United States has the comparative advantage in satellite production, and China has the comparative advantage in shoe production. So the United States will export satellites, and China will export shoes. In the United States, demand for capital increases, raising the price of capital, but the demand for labor decreases, lowering the wage.

8. Before the North American Free Trade Agreement (NAFTA) gradually eliminated import tariffs on goods, the autarky price of tomatoes in Mexico was below the world price and in the United States was above the world price. Similarly, the autarky price of poultry in Mexico was above the world price and in the United States was below the world price. Draw diagrams with domestic supply and demand curves for each country and each of the two goods. As a result of NAFTA, the United States now imports tomatoes from Mexico and the United States now exports poultry to Mexico. How would you expect the following groups to be affected?
a. Mexican and U.S. consumers of tomatoes. Illustrate the effect on consumer surplus in your diagram.

b. Mexican and U.S. producers of tomatoes. Illustrate the effect on producer surplus in your diagram.

c. Mexican and U.S. tomato workers.

d. Mexican and U.S. consumers of poultry. Illustrate the effect on consumer surplus in your diagram.

e. Mexican and U.S. producers of poultry. Illustrate the effect on producer surplus in your diagram.


8. The four accompanying diagrams illustrate the U.S. and Mexican domestic demand and supply curves.

a. As shown in panel (b), consumer surplus decreases in Mexico by the size of area \( W \) as the price rises from \( P_M \) to \( P_W \). As shown in panel (a), consumer surplus increases in the United States by the size of the area \( A + B \) as the price falls from \( P_{US} \) to \( P_W \).
b. As shown in panel (a), production of tomatoes decreases in the United States from $Q_{US}$ to $Q_1$; producer surplus decreases by area $A$. As shown in panel (b), production of tomatoes increases in Mexico from $Q_M$ to $Q_2$, so producer surplus increases by areas $W + X$.

c. As production of tomatoes decreases in the United States, the demand for U.S. tomato workers falls and so the wages of U.S. tomato workers fall. In Mexico, as the production of tomatoes increases, the wages of Mexican tomato workers rise.

d. As shown in panel (d), consumer surplus increases in Mexico by the size of areas $Y + Z$ as the price falls from $P_M$ to $P_W$. As shown in panel (c), consumer surplus decreases in the United States by the size of area $C$ as the price rises from $P_{US}$ to $P_W$.

e. As shown in panel (d), production of poultry decreases in Mexico, from $Q_M$ to $Q_4$; so producer surplus in Mexico decreases by area $Y$. As shown in panel (c), U.S. production of poultry increases from $Q_{US}$ to $Q_3$, so producer surplus in the United States increases by areas $C + D$.

f. As production of poultry increases in the United States, the demand for poultry workers rises and so the wages of poultry workers rise. In Mexico, as the production of poultry decreases, the wages of poultry workers fall.

9. The accompanying table indicates the U.S. domestic demand schedule and domestic supply schedule for commercial jet airplanes. Suppose that the world price of a commercial jet airplane is $100 million.

<table>
<thead>
<tr>
<th>Price of jet (millions)</th>
<th>Quantity of jets demanded</th>
<th>Quantity of jets supplied</th>
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<tbody>
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<td>100</td>
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<td>900</td>
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<tr>
<td>40</td>
<td>500</td>
<td>200</td>
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</tbody>
</table>

a. In autarky, how many commercial jet airplanes does the United States produce, and at what price are they bought and sold?

b. With trade, what will the price for commercial jet airplanes be? Will the United States import or export airplanes? How many?

Solution

9. a. In autarky, the equilibrium price will be $60 million, and 400 airplanes will be bought and sold at that price.

b. When there is trade, the price rises to the world price of $100 million. At that price, the domestic quantity supplied is 800, and the domestic quantity demanded is 200. So 600 airplanes are exported.
10. The accompanying table shows the U.S. domestic demand schedule and domestic supply schedule for oranges. Suppose that the world price of oranges is $0.30 per orange.

<table>
<thead>
<tr>
<th>Price of orange</th>
<th>Quantity of oranges demanded (thousands)</th>
<th>Quantity of oranges supplied (thousands)</th>
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</thead>
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<tr>
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<td>4</td>
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<tr>
<td>0.20</td>
<td>18</td>
<td>3</td>
</tr>
</tbody>
</table>

a. Draw the U.S. domestic supply curve and domestic demand curve.

b. With free trade, how many oranges will the United States import or export? Suppose that the U.S. government imposes a tariff on oranges of $0.20 per orange.

c. How many oranges will the United States import or export after introduction of the tariff?

d. In your diagram, shade the gain or loss to the economy as a whole from the introduction of this tariff.

Solution: 

10. a. The U.S. domestic supply and demand curves are illustrated in the accompanying diagram.

b. With free trade, the price will be the world price, $0.30, the domestic quantity demanded will be 16,000 oranges, and the domestic quantity supplied will be 4,000 oranges. So the United States will import 12,000 oranges.

c. With the tariff, the domestic price will rise to $0.50. At that price, the domestic quantity demanded will exceed the domestic quantity supplied by 6,000. So the United States will import 6,000 oranges.

d. The shaded areas indicate the deadweight loss to the economy as a whole due to the tariff.
11. The U.S. domestic demand schedule and domestic supply schedule for oranges was given in Problem 10. Suppose that the world price of oranges is $0.30. The United States introduces an import quota of 3,000 oranges and assigns the quota rents to foreign orange exporters.

a. Draw the domestic demand and supply curves.

b. What will the domestic price of oranges be after introduction of the quota?

c. What is the value of the quota rents that foreign exporters of oranges receive?

Solution

11. a. The domestic demand and domestic supply curves are shown in the accompanying diagram.

![Diagram showing domestic demand and supply curves for oranges]

b. After introduction of the quota, instead of importing $16,000 - 4,000 = 12,000$ oranges, the United States will import only 3,000 oranges. The price will rise to $0.60$, the price at which the domestic quantity demanded exceeds the domestic quantity supplied by exactly 3,000 oranges.

c. The foreign exporters of oranges receive quota rent of $0.30 \times 3,000 = $900.

12. The accompanying diagram illustrates the U.S. domestic demand curve and domestic supply curve for beef.

![Diagram showing domestic demand and supply curves for beef]

The world price of beef is $P_w$. The United States currently imposes an import tariff on beef, so the price of beef is $P_T$. Congress decides to eliminate the tariff. In terms of the areas marked in the diagram, answer the following questions.
12. a. As the price falls from $P_T$ to $P_W$, consumer surplus increases by areas $A + B + C + D$.
   b. As the price falls, producer surplus decreases by area $A$.
   c. As the tariff is eliminated, the government loses revenue of area $C$, which is the amount of imports under the tariff $(Q_{DT} - Q_{ST})$ times the tariff.
   d. The gain to the economy as a whole is the gain to consumers minus the loss to producers minus the loss to the government: $A + B + C + D - A - C = B + D$.

13. As the United States has opened up to trade, it has lost many of its low-skill manufacturing jobs, but it has gained jobs in high-skill industries, such as the software industry. Explain whether the United States as a whole has been made better off by trade.

14. The United States is highly protective of its agricultural industry, imposing import tariffs, and sometimes quotas, on imports of agricultural goods. This chapter presented three arguments for trade protection. For each argument, discuss whether it is a valid justification for trade protection of U.S. agricultural products.

15. In World Trade Organization (WTO) negotiations, if a country agrees to reduce trade barriers (tariffs or quotas), it usually refers to this as a *concession* to other countries. Do you think that this terminology is appropriate?
15. The word *concession* implies that when a country lowers its trade barriers, it is giving up something to other countries. As discussed in this chapter, free trade is beneficial to all countries, including the country that lowers its trade barriers. In fact, even if no other country does so, the country that does lower its trade barriers still benefits from trade. By allowing more international trade, each country’s economy simply gains overall.

16. Producers in import-competing industries often make the following argument: “Other countries have an advantage in production of certain goods purely because workers abroad are paid lower wages. In fact, American workers are much more productive than foreign workers. So import-competing industries need to be protected.” Is this a valid argument? Explain your answer.

16. Even if American workers were better at producing everything than are foreign workers (that is, even if America has the absolute advantage in everything), this does not mean that the United States should restrict trade. What matters for trade is who has the comparative advantage. In fact, other countries will have a comparative advantage in some good or service, and specialization and trade will mean improvements in the welfare of both countries. Claiming that other countries have an advantage only because labor is so cheap relies on the pauper labor fallacy.
Consumer and Producer Surplus

1. Determine the amount of consumer surplus generated in each of the following situations.

   a. Leon goes to the clothing store to buy a new T-shirt, for which he is willing to pay up to $10. He picks out one he likes with a price tag of exactly $10. When he is paying for it, he learns that the T-shirt has been discounted by 50%.

   b. Alberto goes to the CD store hoping to find a used copy of Nirvana’s Greatest Hits for up to $10. The store has one copy selling for $10, which he purchases.

   c. After soccer practice, Stacey is willing to pay $2 for a bottle of mineral water. The 7-Eleven sells mineral water for $2.25 per bottle, so she declines to purchase it.

Solution

1. a. Leon’s consumer surplus is $5. This is the difference between how much he is willing to pay ($10) and how much he does pay ($5).

   b. Since Alberto’s willingness to pay is $10 and the price of the CD is $10, he gets zero consumer surplus.

   c. No trade takes place because Stacey’s willingness to pay is less than the price. So no consumer surplus is created.

2. Determine the amount of producer surplus generated in each of the following situations.

   a. Gordon lists his old Lionel electric trains on eBay. He sets a minimum acceptable price, known as his reserve price, of $75. After five days of bidding, the final high bid is exactly $75. He accepts the bid.

   b. So-Hee advertises her car for sale in the used-car section of the student newspaper for $2,000, but she is willing to sell the car for any price higher than $1,500. The best offer she gets is $1,200, which she declines.

   c. Sanjay likes his job so much that he would be willing to do it for free. However, his annual salary is $80,000.

Solution

2. a. Gordon will receive no producer surplus since the price received for the trains is equal to his cost.

   b. No trade takes place because So-Hee’s cost is $1,500, which is higher than the price of $1,200 she is offered. So no producer surplus is created.

   c. Sanjay’s cost is zero. The price he is paid for his time is $80,000, so his producer surplus is $80,000.
3. You are the manager of Fun World, a small amusement park. The accompanying diagram shows the demand curve of a typical customer at Fun World.

![Demand Curve Diagram](image)

a. Suppose that the price of each ride is $5. At that price, how much consumer surplus does an individual consumer get? (Recall that the area of a right triangle is $\frac{1}{2} \times \text{height} \times \text{base}$.)

b. Suppose that Fun World considers charging an admission fee, even though it maintains the price of each ride at $5. What is the maximum admission fee it could charge? (Assume that all potential customers have enough money to pay the fee.)

c. Suppose that Fun World lowered the price of each ride to zero. How much consumer surplus does an individual consumer get? What is the maximum admission fee Fun World could charge?

**Solution**

3. a. From the demand curve, you can see that with a price per ride of $5, the customer takes 10 rides. At this point her consumer surplus is $\frac{1}{2} \times (10 - 5) \times 10 = 25$.

b. Since a consumer obtains consumer surplus of $25 from going to Fun World when each ride costs $5, that is the most that she would be willing to pay to go there. And it is therefore the maximum admission fee that Fun World could charge. (Charging consumers both an entrance fee and a price for each unit of a good bought is called a two-part tariff.)

c. If Fun World charged nothing for each ride, a typical consumer would consume 20 rides, and this would give her a consumer surplus of $\frac{1}{2} \times 10 \times 20 = 100$. This is the maximum admission fee that Fun World can charge with a price per ride of zero.

4. The accompanying diagram illustrates a taxi driver’s individual supply curve (assume that each taxi ride is the same distance).

![Supply Curve Diagram](image)

a. Suppose the city sets the price of taxi rides at $4 per ride, and at $4 the taxi driver is able to sell as many taxi rides as he desires. What is this taxi driver’s producer surplus? (Recall that the area of a right triangle is $\frac{1}{2} \times \text{height} \times \text{base}$.)
b. Suppose that the city keeps the price of a taxi ride set at $4, but it decides to charge taxi drivers a “licensing fee.” What is the maximum licensing fee the city could extract from this taxi driver?

c. Suppose that the city allowed the price of taxi rides to increase to $8 per ride. Again assume that, at this price, the taxi driver sells as many rides as he is willing to offer. How much producer surplus does an individual taxi driver now get? What is the maximum licensing fee the city could charge this taxi driver?

Solution

4. a. At a price of $4, the taxi driver supplies 40 rides. His producer surplus is therefore \( \frac{1}{2} \times 4 \times 40 = 80 \).

b. Since the taxi driver’s producer surplus is $80, this is the most he is willing to pay to supply 40 rides at $4. So it is the most the city can charge him as a licensing fee.

   c. At a price of $8, the taxi driver supplies 80 rides, making his producer surplus \( \frac{1}{2} \times 8 \times 80 = 320 \). So $320 is the most the city can charge as a licensing fee when the price per ride is $8.