**Economics 101**
Homework #3
Fall 2009
Answer Key

1. International Trade

Consider the market for books. Domestic demand for books in a small country is given by the equation $P= -3Q_d+ 100$. Domestic supply is given by the equation $P=Q_s$. The world price of books is $10.

a. Assume that this economy is closed to world trade. Calculate the equilibrium quantity, price, consumer surplus, and producer surplus in the market for books.

Answer:
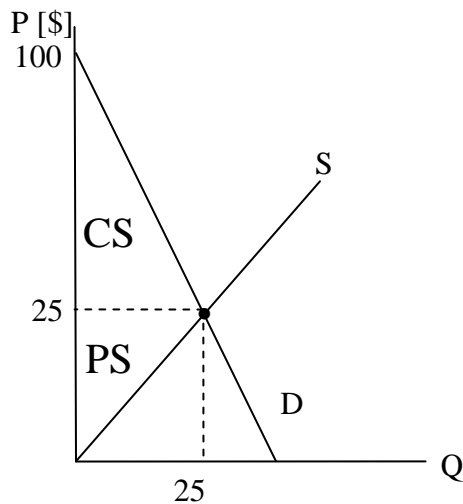
If this economy is closed to world trade, the equilibrium quantity is 25 and the price is $25. The consumer surplus is $(1/2)*25*(100-25)= \$937.5$. The producer surplus is $(1/2)*25*25= \$312.5$.

b. Now assume that this economy opens to world trade. How many units of books will this economy import or export? Calculate the equilibrium quantity, price, consumer surplus, producer surplus, and total surplus in the market for books if this economy opens to trade. Is there a deadweight loss when this economy opens to trade?

Answer:
The world price is lower than the equilibrium price in the domestic market, so we know that this country will import books. At a price of $\underline{\$10}$, consumers want to buy 30 units and domestic suppliers want to sell 10 units. Thus, the country will import 20 units. The total quantity supplied will be $\underline{30 \text{ units}}$, which is equal to the total quantity demanded. Consumer surplus equals $(1/2)*30*(100-10)= \underline{\$1350}$. Producer surplus equals $(1/2)*10*10= \$50$. Deadweight loss is $0. The total surplus is equal to $\underline{\$1400}$.

100

D

S

25

10

10 25 30

Q
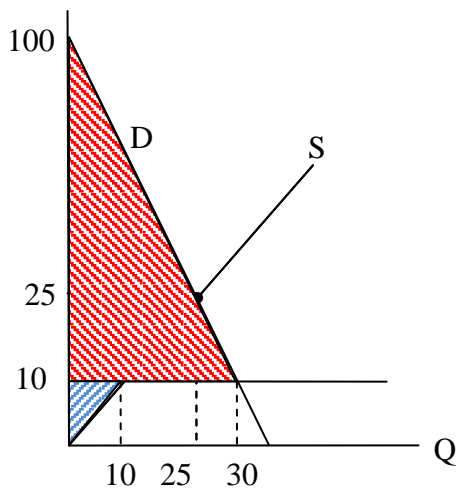
c. Continue to assume that this economy is open to world trade, but now the government has imposed a tariff of $9 per book. Calculate the new equilibrium quantity, price, consumer surplus, producer surplus, and the deadweight loss in the market for books when this economy imposes this tariff.

Answer:

100

D

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25

19

10

10 25 30
19 27

Q
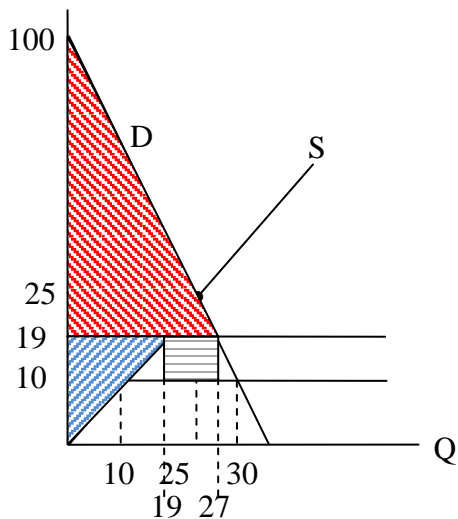
This tariff raises the effective world price to $19. At this price, consumers demand 27 books, and domestic suppliers are willing to sell 19 books. Thus, 8 books are imported. Consumer surplus equals (1/2)*27*(100-19) = $1093.5, and producer surplus equals (1/2)*19*19= $180.5. Government's tariff revenue is 8*9=$72. Thus, total welfare, which is consumer surplus plus producer surplus plus government revenue, equals $1,346. In part (b), total surplus equaled consumer surplus plus producer surplus, which is equal to $1400. Thus the deadweight loss, which is the lost welfare, equals 1400-1346= $54.

d. Instead of the tariff, suppose that the government implements a quota of 12 books. Calculate the new equilibrium quantity, price, consumer surplus, producer surplus, and the deadweight loss in the market for books when this country imposes the quota.

Answer:
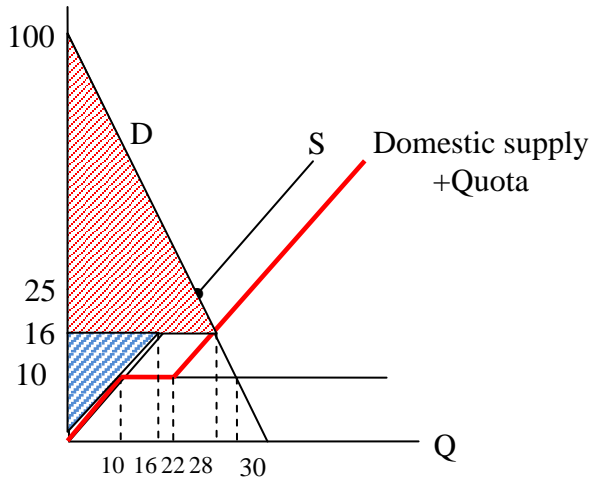
A quota means that they can only import 12 units. After imposing a quota of 12, the new supply curve (domestic supply + quota) will be the red line. The equation is follows:

$$P = Q_s \quad \text{if } Q_s < 10$$
$$P = 10 \quad \text{if } 10 \leq Q_s \leq 22$$
$$P = Q_s - 12, \text{ if } Q_s > 22$$

For getting the new equilibrium, we need to solve $-3Q_d + 100 = Q_s - 12$. Therefore the equilibrium quantity is Q=28, and the equilibrium price is P=16. At this price, the quantity demanded by domestic consumers is 28, and the quantity supplied by domestic suppliers is 16, implying that 12 books (the amount of the quota) are imported.
  Consumer surplus equals $(1/2)*28*(100-16) = \$1176$, and producer surplus equals $(1/2)*16*16 = \$128$. There is no government revenue in this case, because there is no tax. However, in part (b), foreign producers earned $10 for each import. Now, they are earning $16 per import. In this case, the license holder revenue equals $(16-10)*(28-16) = \$72$. Thus, total welfare, which is consumer surplus plus producer surplus plus license holder revenue, equals $1,376. In part (b), total surplus equaled consumer surplus plus producer surplus, which is equal to $1400. Thus, the deadweight loss, which is the lost welfare, equals 1400-1376= $24.

e. Instead of the quota of 12 books, suppose that the government implements a quota of 25 books. Compare the deadweight loss in the market to that of part (d).

Answer:
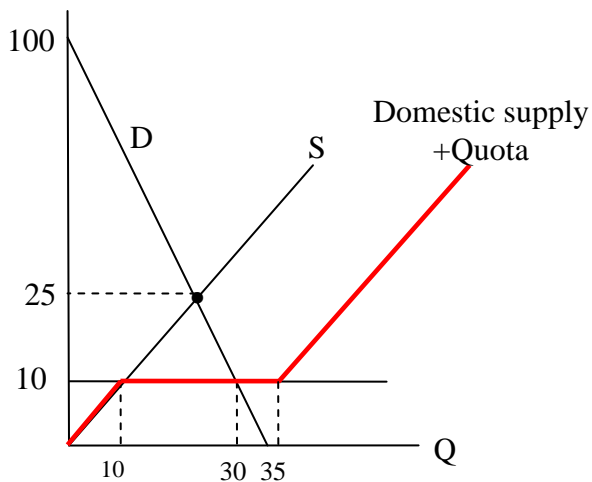
When there are no restrictions such as a tariff or a quota, the 20 books are imported (part (b)). If the quota is 25 books, 20 books can be imported. Thus, in this quota example we get the same results as we found with the open economy without any restrictions (part (b)). As we calculated in part (b), the deadweight loss is $0. Therefore, the deadweight loss of (e) is less than the deadweight loss of (d).

f. If the world price of books equaled $31 instead of $10, how many units would this country import or export? Calculate the new equilibrium quantity, price, consumer surplus, and producer surplus.

Answer:
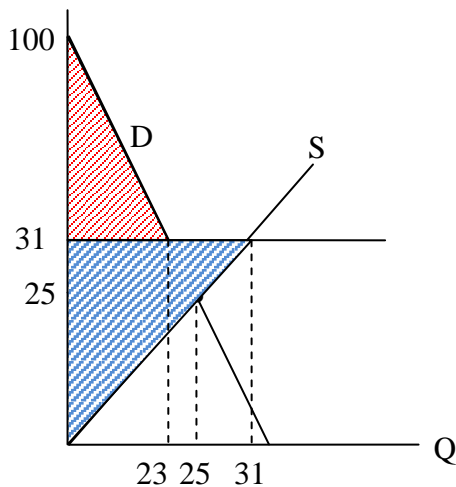
Since the world price ($31) is higher than the domestic equilibrium price ($25), the domestic sellers in the economy will export books. At a price of $31, consumers want to buy 23 units and domestic suppliers want to sell 31 units. Thus, the country will export 8 units. Consumer surplus equals (1/2)*23*(100-31)= $793.5. Producer surplus equals (1/2)*31*31= $480.5.

2. Elasticity
Consider the market for bicycles. The demand is given by P= -1.5Q_d+ 60.

a. Suppose that the price changes from $15 to $30. Using the standard percentage change formula (not the midpoint method), what is the price elasticity of demand?

Answer:
Using the demand equation, we can get Q_d =30 when P=15, and Q_d =20 when P=30

$$e_p = \left| \dfrac{\dfrac{20-30}{30}}{\dfrac{30-15}{15}} \right| = \left| \dfrac{\dfrac{-10}{30}}{\dfrac{15}{15}} \right| = \left| \dfrac{\dfrac{-1}{3}}{\dfrac{1}{1}} \right| = \dfrac{1}{3}$$

b. Suppose that the price changes from $30 to $15. Using the midpoint method, what is the price elasticity of demand?

Answer:

$$e_p = \left| \dfrac{\dfrac{30-20}{30+20}}{\dfrac{15-30}{15+30}} \right| = \left| \dfrac{\dfrac{10}{50}}{\dfrac{-15}{45}} \right| = \left| \dfrac{\dfrac{1}{5}}{\dfrac{-1}{3}} \right| = \dfrac{3}{5}$$

c. When P=15, what is the price elasticity of demand, using the point elasticity of demand? Is it elastic or inelastic? At P=15, if the price goes up, does the total revenue increase, decrease, or stay the same?

Answer:

$$e_p = \dfrac{(\Delta Q)/Q}{(\Delta P)/P} = \dfrac{1}{|slope|} * \dfrac{P}{Q}$$

Using the demand equation, we can get Q_d =30, when P=15.

$$e_p = \dfrac{1}{\left|\dfrac{-3}{2}\right|} * \dfrac{15}{30} = \dfrac{1}{3}$$

Since e_p = 1/3 <1, the demand is inelastic. Therefore, when the price goes up, the total revenue increases.

d. When Q_d =10, what is the price elasticity of demand, using the point elasticity of demand? Is it elastic or inelastic? At Q_d =10, if the price goes up, does the total revenue increase, decrease, or stay the same?

Answer:
Using the demand equation, we can get P=45, when Q_d =10.

$$e_p = 1 = \dfrac{1}{\left|\dfrac{-3}{2}\right|} * \dfrac{45}{10} = \dfrac{2}{3} * \dfrac{9}{2} = 3$$

Since e_p = 3 >1, the demand is elastic. Therefore, when the price goes up, the total revenue decreases.

*e. At what price is the price elasticity of demand equal to 1?*

Answer:
The unit elastic point occurs at the midpoint of the demand curve if the demand curve is linear and intersects both the y-axis and x-axis.
When we draw the demand curve, the y-intercept is 60, and the x-intercept is 40.
Therefore, the midpoint of the demand curve is (20, 30), which is the unit-elastic point.
The answer is P=30.
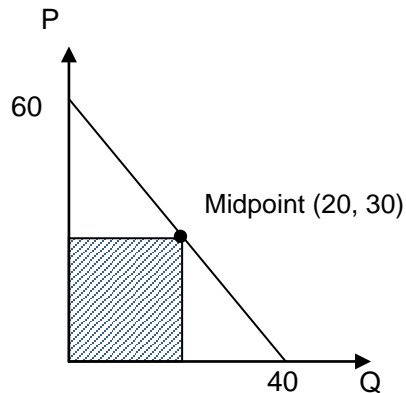
f. Suppose you are a producer of bicycles. To maximize total revenue, at what price should you sell bicycles? How much is the maximized total revenue?

Answer:
At the midpoint which is the unit elastic point, the total revenue will be maximized.
Therefore, P=30, and Total Revenue= 30*20=600 (the rectangle shaded in the above graph).

3. Real vs. Nominal Price
You are given the following information about production in Wonderland.

Item	Price in 2007	Quantity in 2007	Price in 2008	Quantity in 2008	Prince in 2009	Quantity in 2009
Bagel	2	5	2	5	2	5
Pizza	15	4	18	3	20	2
Ears of Corn	5	3	4	5	4	7
Banana	1	10	2	10	1	12

For purposes of computing the CPI you are told that the market basket consists of 5 bagels, 3 pizzas, 5 ears of corn, and 10 bananas.

a. Calculate the CPI for 2007, 2008, and 2009 using 2008 as the base year. Use a 100 point scale for your CPI measure. Show your work.

Answer:
Cost of market basket in 2007 = 2*5 + 15*3 + 5*5 + 1*10 = 90
Cost of market basket in 2008 = 2*5 + 18*3 + 4*5 + 2*10 = 104
Cost of market basket in 2009 = 2*5 + 20*3 + 4*5 + 1*10 = 100

CPI in 2007 = [Cost of market basket in 2007/Cost of market basket in base year]*100
CPI in 2007 = (90/104)*100 = 86.54
CPI in 2008 = [Cost of market basket in 2008/Cost of market basket in base year]*100
CPI in 2008 = (104/104)*100 = 100
CPI in 2009 = [Cost of market basket in 2009/Cost of market basket in base year]*100
CPI in 2009 = (100/104)*100 = 96.15

b. Calculate the rate of inflation between 2007 and 2008, and the rate of inflation between 2008 and 2009, based upon the above information and using the CPI as your measure of the price level.

Answer:
Rate of inflation between 2007 and 2008= [(100– 86.54)/86.54] * 100 = 15.56% (or 15.55%)
Rate of inflation between 2008 and 2009= [(96.15– 100)/100] * 100 = -3.85%

c. Holding everything else constant, recalculate the CPI using 2009 as the base year.

Answer:
CPI in 2007 = [Cost of market basket in 2007/Cost of market basket in base year]*100
CPI in 2007 = (90/100)*100 = 90
CPI in 2008 = [Cost of market basket in 2008/Cost of market basket in base year]*100
CPI in 2008 = (104/100)*100 = 104
CPI in 2009 = [Cost of market basket in 2009/Cost of market basket in base year]*100
CPI in 2009 = (100/100)*100 = 100

d. Based on your calculation in part (c), what is the rate of inflation between 2007 and 2008? What is the rate of inflation between 2008 and 2009?

Answer:
Rate of inflation between 2007 and 2008= [(104 – 90)/90] * 100 = 15.56%
Rate of inflation between 2008 and 2009= [(100 – 104)/104] * 100 = -3.85%

e. Suppose you live in the economy depicted in the above information and your nominal salary in 2007 is $18,000 a year. Your boss tells you she is going to increase your nominal salary to $20,000 in 2008. Based on your calculation in part (c) and (d), will this nominal increase in salary increase your purchasing power or decrease your purchasing power? Show your work.

Answer:
CPI in 2007 = 90, CPI in 2008 = 104

Using 2007 as a base year, the real salary in 2007 is $18,000 (same with the nominal salary in 2007). Using 2007 as a base year, the real salary in 2008 can be calculated as follows:

$$\text{Real salary in } 2008 = 20000 * \frac{CPI\ in\ 2007}{CPI\ in\ 2008} = 20000 * \frac{90}{104}$$

$$= 20000 * \frac{1}{(1 + 0.1556)} = 17{,}307.03$$

The real salary in 2008 is lower than the real salary in 2007. Therefore, the purchasing power (real salary) decreases, even if the nominal salary increases.

f. Suppose your nominal salary was $20,000 in 2008. Based on your calculation in part (c) and (d), what's the minimum nominal salary you should ask for 2009 in order to maintain the same real salary/purchasing power you had in 2008?

Answer:
CPI in 2008 = 104, CPI in 2009 = 100
Using 2008 as a base year, the Real salary in 2008 is $20,000. Nominal salary in 2009 for maintaining the real salary of $20,000 can be calculated as follows:

$$\text{Nominal salary in } 2009 = 20000 * \frac{CPI\ in\ 2009}{CPI\ in\ 2008} = 20000 * \frac{100}{104}$$

$$= 20000 * (1 - 0.0385) = 19{,}230.77$$

Therefore, I should ask $19,230.77 for 2009 to maintain the same purchasing power I had in 2008.
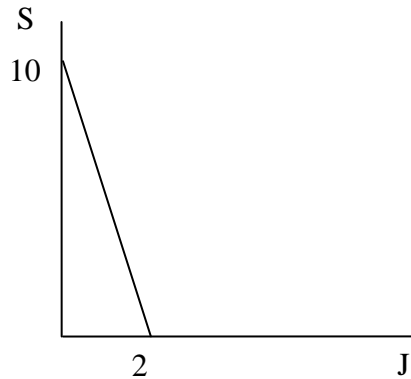
4. Budget set
Suppose Noah's available income to spend on jeans and shirts is $100. Furthermore, suppose the price of jeans is $50 per pair of jeans and the price of shirts is $10 per shirt.

a. Draw Noah's budget line on a graph. Measure jeans on the x-axis and shirts on the y-axis. Label your graph carefully and include the numerical values of the y-intercept and x-intercept.

Answer:
10*Shirts + 50*Jeans = 100
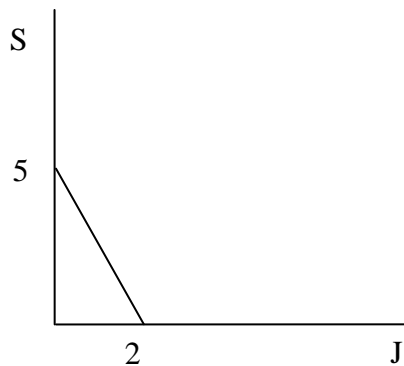   ⇨ S = -5 J + 10

S

10

2   J

b. Suppose the price of shirts doubles while the price of Shirts and Noah's income are unchanged. Provide an equation in slope-intercept form for the budget line, and draw Noah's budget line on a graph.

Answer:
The new price of Shirts is 10*2=$20.
20*Shirts + 50*Jeans = 100
⇨ S = -2.5 J + 5

S

5

2   J

c. Now, Noah gets a raise in his salary. So, Noah's available income to spend on jeans and shirts becomes $200. Prices are same <u>as in part (b).</u> Provide an equation in slope-intercept form for the budget line, and draw Noah's budget line on a graph.

Answers:
The price of shirts is $20, and the price of jeans is $50. The new income is $200.
20*Shirts + 50*Jeans = 200
⇨ S = -2.5 J + 10

S

10

4   J
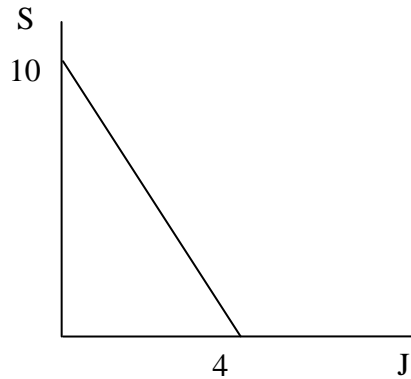
d. Prices and Income are same <u>as in part (c).</u> Which of the following combinations of jeans and shirts can Noah afford? (Put a check in the appropriate column for each of the given combinations.)

Combination	Afford	Not Afford
5 shirts, 2 jeans		
2 shirts, 3 jeans		
8 shirts, 1 jeans		
1 shirts, 5 jeans		

Answer:

The budget constraint is 20*Shirts + 50*Jeans ≤200.

1) 5 shirts, 2 jeans: 20*5 + 50*2 = 200 ➔ Afford
2) 2 shirts, 3 jeans: 20*2 + 50*3 = 190 ➔Afford
3) 8 shirts, 1 jeans: 20*8 + 50*1 = 210 ➔ Not Afford
4) 1 shirts, 5 jeans: 20*1 + 50*5 = 270 ➔ Not Afford