Problem set 1

answers, corrected 9/14/2009, 3:40pm

Use the following information for problems 1-3

Green et al. (2005) estimate the supply and demand curves for California processed tomatoes. The supply function is $\ln(Q) = .2 + .55\ln(p)$, where Q is the quantity of processing tomatoes in millions of tons per year and p is the price in dollars per ton. The demand function is $\ln(Q) = 2.6 - .2\ln(p) + .15\ln(p_t)$, where p_t is the price of tomato paste (which is what processing tomatoes are used to produce) in dollars per ton. Suppose that in 2002, $p_t = 110$.

Problem 1 (Supply and demand)

a. What is the demand function for processing tomatoes, where the quantity is solely a function of the price of processing tomatoes?

$\ln(Q) = 3.31 - .2\ln(p)$.

b. Solve for the equilibrium price and quantity of processing tomatoes (explain your calculations, and round to two digits after the decimal point).

$p^8 = \$63.22/ton$, $q^* = 11.95$ million tons/year.

c. Sketch the supply and demand curves, and label the equilibrium and axes appropriately.

Supply is upward sloping and demand is downward sloping. They are both curvy. Use a computer or calculator to get an idea of what the picture looks like.

Problem 2 (Supply and demand II) Determine how the equilibrium price and quantity of processing tomatoes change if the price of tomato paste falls by 10%.

The new price would be $p^* = \$61.59$ and $q^* = 11.76$.

Problem 3 (Price controls) Suppose the government imposes a price floor on processing tomatoes at \$65 per ton. The government will buy as much as farmers want to sell at that price. Therefore, processing firms pay \$65. Determine how many tons firms buy and how many tons the government buys. What is the cost of this price support program to the government?

First, the price floor is above the equilibrium price from 1, so it is binding. At a price of \$65, quantity supplied is 12.18 million tons, while quantity demanded is 11.82 million tons. Thus the government must purchase .36 million tons at a cost of \$23.4M.

Problem 4 (Price gouging) After a major earthquake struck Los Angeles in January 1994, several stores raised the price of milk to over \$6 a gallon. The local authorities announced that they would investigate and that they would enforce a law prohibiting price increases of more than 10% during an emergency period. What is the likely effect of such a law?

The law would create a price ceiling (at 110% of the pre-emergency price). Because the supply curve shifts substantially to the left during the emergency, the price control will create a shortage: At the ceiling price, the quantity supplied will be less than the quantity demanded.

Problem 5 (Elasticity and tax incidence)

Green et. al. estimate that the demand elasticity is -0.47 and the long-run supply elasticity is 12.0 for almonds. The corresponding elasticities are -0.68 and 0.73 for cotton, and -0.26 and 0.64 for processing tomatoes. If the government were to apply a per-unit tax to each of these commodities, what incidence would fall on consumers?

Tax incidence for almonds is

$$\frac{12}{12+.47} = .96$$

for cotton

$$\frac{.73}{.73+.68} = .52$$

and for processing tomatoes is

$$\frac{.64}{.64+.26} = .71$$

Problem 6 (per-unit taxes and elasticity)

Suppose the supply and demand curves for cigarettes, in millions of packs sold per month, are given by

$$Q^d = 11 - \frac{1}{5}p$$
$$Q^s = 2p$$

a. Solve for equilibrium price and quantity. $p^* = 5$, $q^* = 10$

b. Solve for price elasticity of demand and supply at the equilibrium. $\epsilon = -\frac{1}{10}$, $\eta = 1$

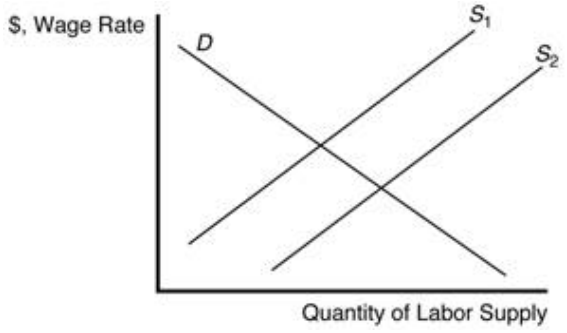
c. Suppose the government imposes a \$1/pack tax on cigarettes, paid by buyers. Solve for the new equilibrium, making sure to note both the before-tax and after-tax prices. What portion of the tax is paid by consumers, and what portion by sellers? After the tax, the quantity is 9.82, while the price including the tax (paid by buyers) is \$5.91 and the after-tax price (received by sellers) is \$4.91.

d. Would your answer to c. change were the taxed paid by the sellers instead of the buyers? No.

Problem 7 (Supply, demand, and elasticity I)

According to Borjas (2003), immigration into the US increased the labor supply of working men by 11% between 1980 and 2000 and reduced the wage rate by 3.2%. From these data, can we make any inferences about the elasticity of supply or demand? Which of the two curves is likely to be relatively more elastic?

The increase in immigration shifts the supply curve to the right by 11%. The relatively large percentage change in supply, which resulted in a relatively small decrease in the wage, would suggest that demand is elastic relative to supply. The situation is depicted below.



Problem 8 (Constant elasticity supply and demand curves)

a. Prove that a demand curve given by $Q = Ap^{\epsilon}$ has elasticity ϵ at all points along the curve (hints: the curve Ap^{ϵ} has slope $\epsilon Ap^{\epsilon-1}$, and ϵ is probably a negative number).

The slope is $\epsilon Ap^{\epsilon-1}$, so price elasticity of demand is given by $slope * \frac{p}{Q}$, or $\epsilon Ap^{\epsilon-1}\frac{p}{Q}$. Substitute in $Q = Ap^{\epsilon}$ and we have the answer.

b. Prove that a supply curve of the form $Q = Bp^{\eta}$ has elasticity η at all points along the curve.

The calculation is the same as in part a.