1. (5 pts.) From your position of casual mini-economist, you notice that sales of potatoes rise when the economy is in recession. You also note that protracted strikes by workers in the milk-processing industry tend to precede declines in the national sales of cookies. Those strikes also precede declines in the purchase of ice cream. What conclusion might you draw about potatoes? About the relationship between milk and cookies? Between milk and ice cream?

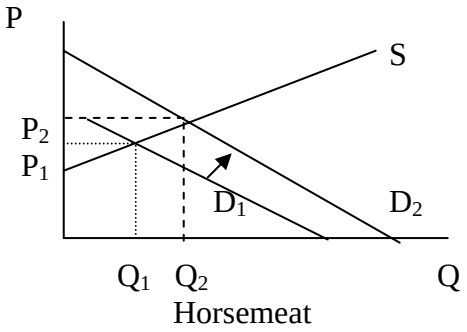
When the economy goes into recession, incomes fall. If the demand for a good rises when incomes fall, that good (here potatoes) is an *inferior* good. If the demand for potatoes had fallen as income fell, we would say that potatoes are a *normal* good.

If there are strikes in the milk-processing industry, one would expect to see a decrease in supply of milk (shift up and to the left). Given the same demand, this leads to a higher price of milk. When a rise in the price of one good (here milk) causes the demand for another good (here cookies) to fall, the two goods are *complements*. If the demand for cookies had risen as the price of milk rises, we would say the two goods are *substitutes*.

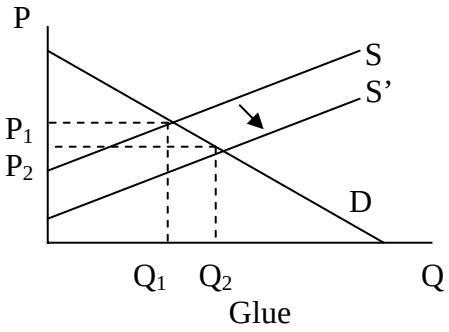
Those same strikes led to the price of milk being higher and somehow affecting the equilibrium quantity of ice cream. While it is possible that milk and ice cream are either complements or substitutes in demand, it is likelier that the observed relationship comes from milk being an input in the production of ice cream. Such an increase in a factor price causes supply to shift up and to the left, leading to a higher price.

2. (25 pts.) During the mad-cow scare in Europe, *The Wall Street Journal* ran an article detailing an increased interest in horse-meat, especially in France. (I do not make this stuff up.) For what follows, you should assume that all horse parts are used once a horse is killed.

A. Use a graph to show what happens to the equilibrium price and quantity of horse-meat before and after the mad-cow scare. What is your intuition as to what happens to the total number of horses slaughtered? Draw a separate graph to show how mad-cow disease (probably) affected the market for glue made from horse hooves.



Horsemeat



Glue

The two graphs (one describing the market for horsemeat, the other describing the market for hoof-based glue) should look like those drawn above. In the first, demand increases (shifts up and to the right), which in equilibrium leads to a higher quantity of horsemeat bought and sold and a higher price. While horses are undoubtedly killed for other reasons, the increase in this

price will make horse-slaughtering more attractive and more horses will be killed. Since more horses are killed, there are more horse hooves available, hooves cost less, and the supply of glue increases. This leads to a greater quantity of glue bought and sold, and a lower price of that glue.

B. Now suppose that the annual demand for glue is $Q^D = 80 – 2P$. The annual supply of glue is $Q^S = 20 – 4w + 2P$, where w is the price of horse hooves. All quantities are in thousands, and prices are in dollars. The rise in horse slaughtering eventually causes the price of horse hooves to fall from \$10 to \$5. Find the actual changes in glue's equilibrium quantity and price.

To find the original equilibrium quantity and price, first substitute the price of horse hooves (w = 10) into the supply equation. This yields $Q^S = -20 + 2P$, and demand is $Q^D = 80 – 2P$. In equilibrium, $Q^S = Q^D = Q^*$, so the market-clearing price is \$25 and 30 thousand (bottles of) glue are bought and sold. Solving for the new, post-mad-cow equilibrium requires that the lower price of horse hooves (w = 5) be substituted into the general supply equation. This yields $Q^S = 2P$, and demand is still $Q^D = 80 – 2P$. Again imposing market-clearing, the new equilibrium price is \$20 and the new equilibrium quantity is 40 thousand (bottles of) glue. This means that the change in price ($P^*_{NEW} – P^*_{OLD}$) is -\$5 and the change in quantity ($Q^*_{NEW} – Q^*_{OLD}$) is 10 thousand (bottles of) glue.

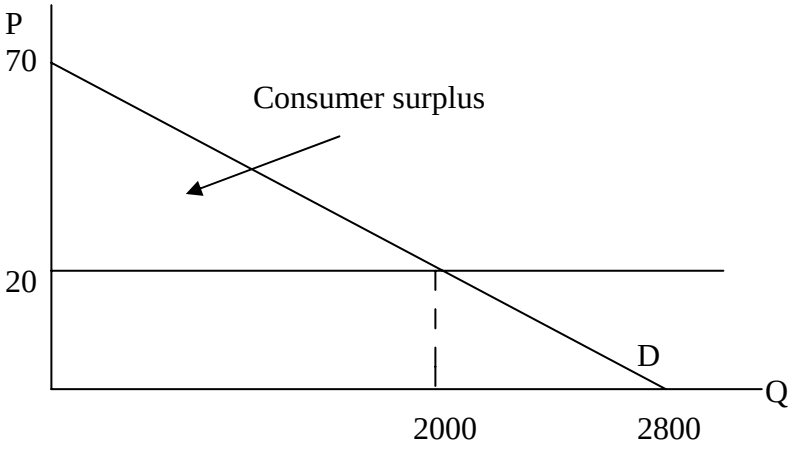
3. (10 pts) Suppose that the demand for electricity is approximately $Q^D = 2800 – 40P$.

A. Transform this demand into a willingness-to-pay expression.

Demand expresses quantity demanded as a function of price. Willingness-to-pay (a.k.a. inverse demand) expresses price as a function of quantity demanded. In this case, this inverse demand is $P = 70 – (1/40)Q^D$. The individual who values the good the most would be willing to pay up to \$70 (=70 – (1/40)*0).

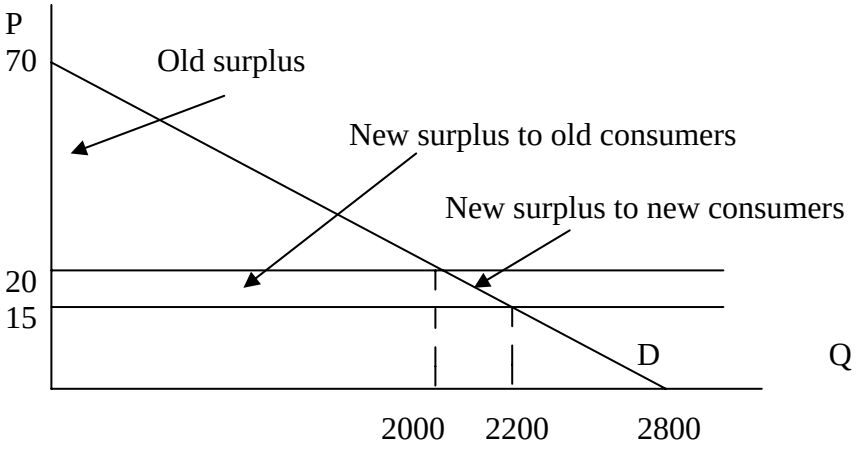
B. Let P = 20. What quantity is demanded? What is the valuation of the marginal consumer? What is the surplus of the consumer with the highest valuation of electricity? What is the value of total consumer surplus?

If P = 20, then Q = 2000 (= 2800 – 40*20). The price is exactly the valuation of the marginal consumer. From above, it is apparent that the surplus of the consumer with the highest valuation of electricity is \$50 (= 70 – 20). The total value of consumer surplus at this price/quantity combination is the area of the triangle above P = 20 and beneath the demand (or inverse demand) curve. This area is one-half the product of the surplus of the consumer with the highest valuation and the quantity demanded. In this case, that surplus is \$50,000 (= ½*base*height = ½*2000*50). Graphically,




C. Suppose that the price of electricity falls, so that P = 15. What is consumer surplus now? How is the new surplus divided among existing and new consumers?

Consumer surplus is now \$60,500 (= ½*2200*55). Of the new surplus (\$10,500), \$10,000 (= 2000*5) goes to pre-existing consumers in that they are each paying \$5 less than they would have had to pay before. The remaining \$500 in surplus goes to new consumers who would not have otherwise made the purchase. Graphically,




4. (25 pts) Suppose that Congress cares only for the welfare of the working poor and is considering raising the hourly minimum wage from \$3 to \$6. You have been called as an economic expert to study that market and testify about your findings.

A. You estimate the demand for labor by businesses to be $Q^D = 100 – 5W$. You also estimate the supply of labor by workers to be $Q^S = 20W$. W is the hourly wage rate, and both quantities are measured each week in thousands of hours. Find the market equilibrium quantity and wage. What effect does the existing minimum wage have?

The market wage can be found by solving for the price that sets the quantity of labor demanded equal to the quantity of labor supplied: 100 – 5W = 20W, so W= 4. At \$4 an hour, 80,000 hours of labor will be traded each week (80 = 100 – 5(4) = 20(4)). Because the market wage is higher than the minimum wage (which is a price floor), the existing minimum wage is not binding and has no effect.

B. The Senator who is advocating the higher minimum wage argues that the welfare of the working poor can be best measured by their total earnings (i.e., the product of the wage rate and the number of hours worked). Given this premise, should Congress raise the minimum wage to $6?

The market outcome yields weekly earnings to the working poor of (80000 hours*$4/hour=) $320,000. If the $6 minimum wage is enacted, the traded amount of labor will fall to what is demanded at $6/hour ($Q^D = 100 – 5(6) = 70$). The weekly earnings under the new minimum wage will be (70000 hours*$6/hour=) $420,000. Because the working poor earn $100,000 more each week under the new minimum wage than they did under the old, Congress should raise the minimum if they believe that the welfare of the working poor is best measured by their earnings as a group.

C. Another Senator is more concerned with unemployment among the working poor. Given this premise, should Congress raise the minimum wage?

Because the minimum wage is a price floor, it will always cause a surplus in the form of unemployment if it is binding. In this case, 10,000 fewer hours each week (i.e., 250 full-time workers) are demanded under the new minimum wage law. These 250 workers are laid off. Additionally, workers respond to the higher wage by trying to supply 40,000 more hours each week ($\Delta Q^S = 20(6) – 20(4) = 40$). These workers are frustrated by their inability to find work. The new minimum wage causes a surplus of 50,000 hours or 1250 full-time workers. If Congress believes that unemployment among the working poor is the best way to measure the welfare of the working poor, Congress should not raise the minimum wage.

D. The bill passes in the House and Senate and goes on for the President's signature. You realize only then that the estimates you gave to the Senate were based upon the *short-run* demand for labor. You go back to work, estimating the *long-run* demand for labor. You calculate that, without the raise in the minimum wage, labor demand in the long run will be the same as in the short-run. If the new minimum wage bill becomes law, though, the long-run demand for labor will be $Q^D = 160 – 20W$. The President calls you and asks you for your advice. He is confused as to why the long-run demand for labor is different from the short-run if the minimum wage rises. Give an explanation for the difference.

Low-skill labor is relatively easy to replace with equipment and machines. If the market wage is $4/hour, it is not profitable for firms to make this investment: it's cheaper to use people. However, if the wage is $6/hour, those same investments may make more sense than paying the higher wage. In such cases, one might expect to see demand for low-skill labor decrease and become more responsive.

E. The President is impressed and asks for your long-term opinion on the bill, specifically inquiring about the two viewpoints of the aforementioned Senators. What do you say?

In the short-run, the new minimum wage increased the weekly earnings of the working poor and increased unemployment. In the long run, the $6 minimum wage will cause the quantity of labor demanded to be 40,000 ($Q^D = 160 – 20(6) = 40$) hours each week. This will yield weekly earnings of (40000 hours*$6/hour =) $240,000, which is $80,000 less than under the market outcome. The labor surplus is 80,000 weekly hours, 40,000 of which come in the form of layoffs and 40,000 of which are in the form of the higher quantity supplied. Therefore, in the long run, you should recommend that the President should veto the bill based upon either Senator's premise.