

ECON 110, Prof. Hogendorn

Problem Set 2 Answers

1. SUVs_a.

(a) The derivatives are:

$$\frac{dQ}{dp} = -6040.5p^{-2.5} < 0 \quad \frac{d^2Q}{dp^2} = 15101.25p^{-3.5} > 0$$

The first derivative is negative (for any value of p), thus the function must slope down. The second derivative is positive, thus the slope must be getting less steep as price increases.

The graph looks is like in part (d).

(b) Setting demand equal to supply gives:

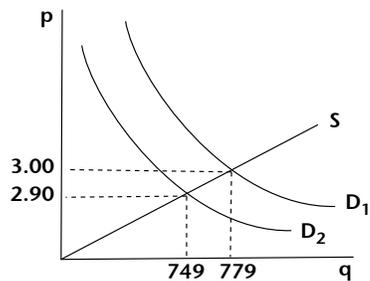
$$\begin{aligned} 4027p^{-1.5} &= 258.3p \\ 15.59 &= p^{2.5} \\ p &= 3 \quad Q = 775 \end{aligned}$$

(c) Gas is a *complement* to SUVs. If the price of a complement rises, it produces a negative demand shift. Therefore, we would expect to see a lower demand for SUVs at *any* price of SUVs, and the demand curve $Q = 3700p^{-1.5}$ is the more likely result.

(d) Setting demand equal to supply gives:

$$\begin{aligned} 3700p^{-1.5} &= 258.3p \\ 14.32 &= p^{2.5} \\ p &= 2.90 \quad Q = 749 \end{aligned}$$

The graph of what happened is:



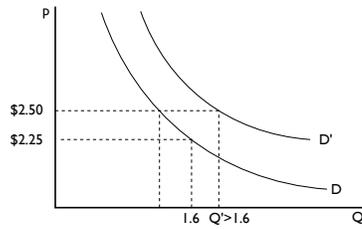
2. *Shifters_a.*

- (a) Technology affects only supply. An improvement means a greater quantity supplied at any given price, hence a right shift of the supply curve. Market equilibrium price falls and quantity rises.
- (b) “Desire” reflects tastes, which affect the demand curve. Increased desire means a higher quantity demanded at any given price, hence a right shift of the demand curve. Market equilibrium price rises and quantity rises.
- (c) Since wages of *all* workers fall, we can expect two effects. First, for any particular good, demand will shift to the left because of lower incomes (assuming the good is a normal good). Second, the lower wage is a lower cost to firms, so supply will shift to the right. The market equilibrium price will definitely fall, but the effect on quantity exchanged is indeterminate.

This type of problem is important in macroeconomics, and we will model it more completely later in the course.

3. *MTA_a.*

- (a) This function is convex (also called “concave up”) since the second derivative is positive.



- (b) This demand curve is called a constant-elasticity demand curve, and it has the property that the exponent of -0.4 is the price elasticity everywhere along the curve. To prove it, use the definition of elasticity:

$$\begin{aligned}
 \epsilon_p &= \frac{dQ}{dp} \frac{p}{Q(p)} = -0.884p^{-1.4} \frac{p}{2.21p^{-0.4}} \\
 &= -0.4 \frac{p^{-1.4} \times p}{p^{-0.4}} \\
 &= -0.4
 \end{aligned}$$

- (c) From (b) we know that demand is inelastic since elasticity is less than 1. That means that the 11% increase in fare will cause a less-than-11% decrease in quantity demanded. Revenue will therefore go up. This makes sense because the substitutes for subway rides are quite poor in a congested city.
- (d) This is not surprising, because the fare increase is only one change affecting the market. Another important change is demand, which is likely to shift right because the economic recovery means more people commuting to work than before. As shown in the graph to part (a), a new demand curve D' could easily result in a new quantity Q' that is greater than 1.6, even at the higher fare.
- (e) This means that consumer demand operates as if it were

$$Q(p - 0.05) = 2.21(p - 0.05)^{-0.4}$$

This demand curve including the subsidy is shifted up 5¢ from the original demand curve. The new quantity demanded

will be

$$Q(2.50 - 0.05) = 2.21(2.50 - 0.05)^{-0.4} = 1.54$$

The graph looks like:

