ECON 111: Fall 2021
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Problem Set 2

Please complete these problems to the best of your ability and submit your solutions on Gradescope by 11:59pm on Friday, September 17. When drawing any graphs, please use the appropriate labels on axes and specialization points.

1. Consider the following supply and demand curves in the market for wristwatches. Prices are expressed in U.S. dollars, and quantities are in thousands of wristwatches.

   - Demand: $Q_d = 40 - \frac{4P}{5}$
   - Supply: $Q_s = 2P - 20$

   (a) Sketch the supply and demand curves, and label the market equilibrium.

   (b) Compute the price elasticity of demand and price elasticity of supply at the equilibrium point.

   (c) Consider a case in which existing firms in the market collude and set a price of 30. What would the result of this (non-equilibrium) price be? Would the outcome be Pareto efficient? Why or why not?

   (d) Suppose that, due to a reduction in the price of mobile devices, the demand for wristwatches shifts to: $Q_d = 24 - \frac{4P}{5}$. What can you conclude about the relationship between wristwatches and mobile devices? How does this shift affect the price and quantity demanded at the new equilibrium?

   (e) Suppose that, due to the widespread distribution of mobile devices, many wristwatch producers leave the market, resulting in an inward shift of the supply curve (so that at every price, the quantity supplied is lower). You're not able to estimate the exact shift in the supply curve. What can you say about how this change, alongside the change in prices of mobile devices from part (d), would affect the equilibrium price and quantity demanded as compared to the original equilibrium from part (a)?

2. You observe the consumption patterns of a single individual over the course of a year in order to study how they respond to changes in economic conditions.[1] Over the course of your year of observation, several changes occur.

   (a) First, you find that after this person is promoted at their job and receives a raise from $60,000 to $63,000, their consumption of bottled water rises from 72 bottles per month to 90 bottles per month. Over this period, you observe no change in the price of bottled water or products you believe to be related to it. Compute the income elasticity of demand for bottled water for this person. Do they consider bottled water a normal or an inferior good?

   (b) Much later in the year, you find out that this person regularly takes anxiety medication to better their mental health. In response to an increase in the price of the medication that this person takes from $200 per bottle to $280 per bottle, their quantity demanded changes, according to your calculations, from 13 bottles per year to 11 bottles per year. What is their price elasticity of demand for this medication? Is it elastic, or inelastic?

   (c) Finally, toward the end of your study you notice that in response to a decrease in the price of winter jackets from $120 to $90 this person increases their demand for ski trips from 4 to 5 times per year. Compute their cross-price elasticity of demand for ski trips with regard to the price of winter jackets. What do you conclude about the relationshp between these goods for this person?

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[1]You have informed them of your intention to research their behavior, and they have agreed to take part.
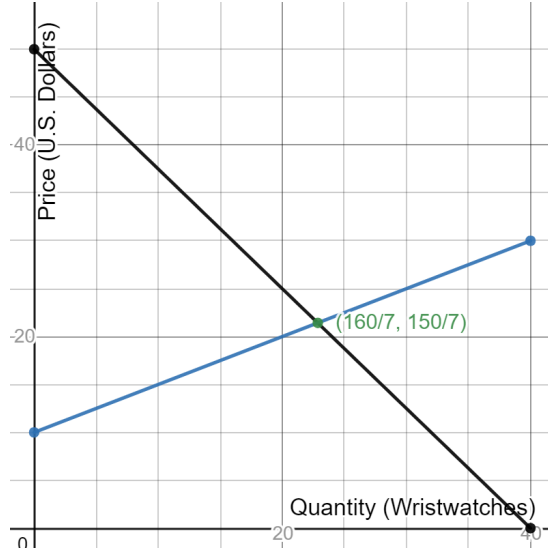
1. (a) A sketch is given in the following figure:



Figure 1: Market supply and demand sketch

(b) Using the formula for a point elasticity, the price elasticity of demand at the equilibrium point is given by:

$$\frac{\Delta Q_d}{\Delta P}\frac{P}{Q} = -\frac{4}{5}\frac{\frac{150}{7}}{\frac{160}{7}} = -\frac{3}{4}$$

Similarly, the price elasticity of supply is given by:

$$\frac{\Delta Q_s}{\Delta P}\frac{P}{Q} = 2\frac{\frac{150}{7}}{\frac{160}{7}} = \frac{15}{8}$$

(c) A price of 30 leads to an excess supply (surplus) of 24 units (no need to give the amount of excess supply in the answer). This outcome is not Pareto efficient. To see why, consider the following figure: We see
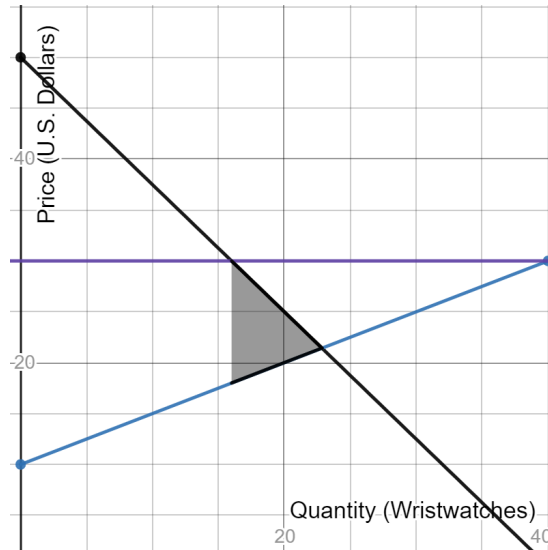


Figure 2: Lost transactions due to a price above that which would arise in equilibrium.

that the grey region represents the loss in surplus due to the high price. To demonstrate that this is not Pareto efficient, one can make the following allocation. For all transactions that took place at the price of 30, maintain the price (make no change). The agents participating in these transactions are not worse off

2

as a result of this. For all transactions that could have taken place at the equilibrium price, but did not at a price of 30, charge the equilibrium price of $\frac{150}{7}$ for these transactions. All agents participating in these new trades are necessarily better off. And so we have found a way to make some collection of individuals better off without hurting anybody.

(d) Consider the following figure demonstrating the change in demand for wristwatches as a result of the change in the price of mobile devices. Given that the demand for wristwatches decreased as a result of a decrease
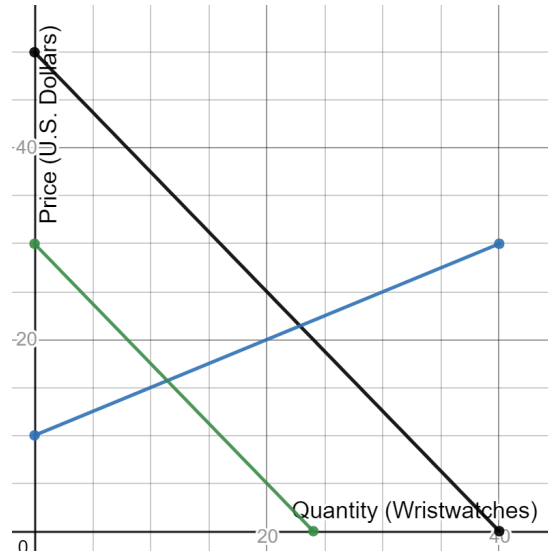


Figure 3: Old demand (black) and new demand (green)

in the price of mobile devices, we see that these two goods are substitutes. The change lead to a lower equilibrium price and quantity as compared to the original equilibrium from part (a).

(e) The equilibrium quantity must fall as a result of these changes. The change in price is ambiguous, and will depend on the relative magnitude of the changes in supply and demand. The following figure demonstrates two possible shifts in the supply curve, one in which the new equilibrium has a higher price than the original, and one in which the new equilibrium has a lower price than the original.
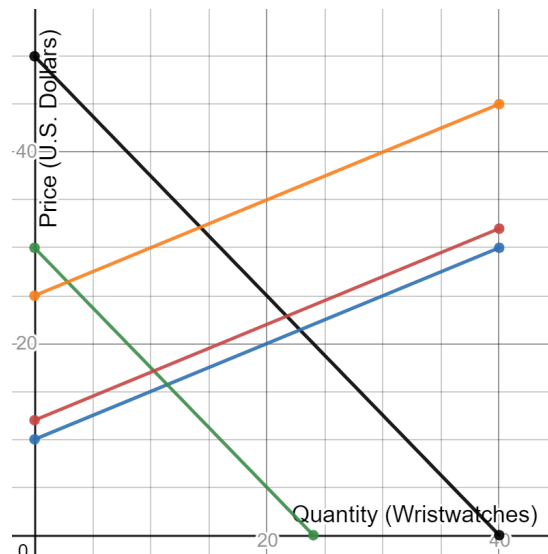


Figure 4: The equilibrium when the new supply is red results in a lower price, while the equilibrium when the new supply is yellow results in a higher price.

2. (a) Using the midpoint formula, we see that the income elasticity is computed as:

$$\frac{90 - 72}{81} \frac{61,500}{63,000 - 60,000} = \frac{2}{9} \cdot \frac{41}{2} = \frac{41}{9}$$

Given that the computed income elasticity of demand is positive, this individual considers bottled water to be a normal good.

(b) Using the midpoint formula, we see that the price elasticity of demand is computed as:

$$\frac{11 - 13}{12} \frac{240}{280 - 200} = -\frac{1}{6} \cdot 3 = -\frac{1}{2}$$

We see that the price elasticity is less than 1 in absolute value, and thus demand for this medication is inelastic along this portion of the demand curve.

(c) Using the midpoint formula, we see that the cross-price elasticity of demand for ski trips with regard to the price of winter jackets is computed as:

$$\frac{5 - 4}{\frac{9}{2}} \frac{105}{90 - 120} = -\frac{210}{270} = -\frac{7}{9}$$

Given that the cross-price elasticity is negative, we can conclude that winter jackets and ski trips are complements for this individual.