Department of Economics

Carleton University

ECON 2030B – Intermediate Microeconomics II: Consumers and General Equilibrium

ASSIGNMENT 1 - Due Jan 27 at the beginning of the tutorial at 11:35AM

1. (12 points) In class we discussed factors that might cause shifts in supply and demand curves. In each case below, identify the effect on the supply and/or demand in the market for steak. Discuss also effects on equilibrium prices and quantities.

   (a) (2 points) An increase in the price of lamb

   (b) (2 points) A decrease in the population

   (c) (2 points) An increase in the price of cattle

   (d) (2 points) An increase in consumer income

   (e) (2 points) A decrease in the price of steak sauce

   (f) (2 points) An increase in advertising by chicken producers

   (a) An increase in the price of lamb: The demand curve for steak shifts to the right because an increase in the price of a substitute good raises the demand for steak. Therefore, the equilibrium price for steak increases and quantity increases.

   (b) A decrease in the population: The demand curve for steak shifts to the left, because total demand falls with population. The equilibrium price for steak decreases and quantity decreases.

   (c) An increase in the price of cattle: The supply curve shifts to the left due to the increase in the price of an input into producing steaks. The equilibrium price for steak increases and quantity decreases.

   (d) An increase in consumer income: The demand curve shifts to the right because consumers now have more disposable income and steak is a normal good. The equilibrium price for steak increases and quantity increases.

   (e) A decrease in the price of steak sauce: The demand curve shifts to the right because the price of a complement falls. The equilibrium price for steak increases and quantity increases.

   (f) An increase in advertising by chicken producers: If the advertising is successful, it will raise the demand for chicken (a substitute for steak) and the demand curve for steak shifts to the left because now consumers are switching towards chicke. The equilibrium price for steak decreases and quantity decreases.

2. (20 points) Suppose demand for inkjet printers is estimated to be $Q = 1000 - 5p + 10p_X - 2p_Z + 0.1Y$, where p is the price of inkjet printers, p_X and p_Z are prices of other products, and Y is the level of income. If $p = 80$, $p_X = 50$, $p_Z = 150$, and $Y = 20,000$; answer the following:

   (a) (4 points) What is the price elasticity of the demand for inkjet printers?

   (b) (6 points) What is the cross-price elasticity with respect to commodity X? Give an example of what commodity X might be in this context, i.e. that its price has the impact you just calculated on the demand for inkjet printers.

   (c) (6 points) What is the cross-price elasticity with respect to commodity Z? Give an example of what commodity Z might be in this context, i.e. that its price has the impact you just calculated on the demand for inkjet printers.

   (d) (4 points) What is the income elasticity?

   (a) With the data provided, $q = 1000 - 5 \times 80 + 10 \times 50 - 2 \times 150 + 0.1 \times 20,000 = 2,800$

$$\epsilon = \frac{dq}{dp}\frac{p}{q} = -5 \times \frac{80}{2,800} = \frac{-400}{2,800} = -0.143$$

   (b) What is the cross-price elasticity with respect to commodity X?

$$\epsilon_{PX} = \frac{dq}{dp_X}\frac{p_X}{q} = 10 \times \frac{50}{2,800} = 0.179$$

   The cross-price elasticity is positive, so commodity X is a substitute product of inkjet printers, e.g. laser printers.

   (c) What is the cross-price elasticity with respect to commodity Z?

$$\epsilon_{PZ} = \frac{dq}{dp_Z}\frac{p_Z}{q} = -2 \times \frac{50}{2,800} = -0.107$$

   The cross-price elasticity is negative, so commodity Z is a complementary product of inkjet printers, e.g. paper.

   (d) What is the income elasticity?

$$\xi = \frac{dq}{dY}\frac{Y}{q} = 0.1 \times \frac{20,000}{2,800} = 0.714$$

3. (20 points) Suppose a tax on beans of \$0.05 per can is levied on firms. As a result of the tax, the equilibrium price increases from \$0.20 to \$0.22. What fraction of the incidence falls on consumers? On firms? (10 points) Suppose the supply elasticity is 0.6. What must the demand elasticity be? (10 points)

As we have seen in class, the incidence on consumers is the change in price paid by consumers divided by the change in the tax:

$$\frac{dp}{d\tau} = \frac{0.22 - 0.20}{0.05 - 0} = \frac{0.02}{0.05} = 0.4$$

Therefore, the incidence on firms is $1 - 0.4 = 0.6$ If the supply elasticity is 0.6 we can infer the demand elasticity by using the formula we derived for the incidence of a tax. In class we showed that in equilibrium supply must equal demand and we can derive the consumer's tax incidence by derivating the equilibrium condition with respect to the tax.

$$D(p(\tau)) = S(p(\tau) - \tau) \tag{1}$$

Differentiating with respect to τ:

$$\frac{dD}{dp}\frac{dp}{d\tau} = \frac{dS}{dp}\frac{d(p(\tau) - \tau)}{d\tau} = \frac{dS}{dp}\left(\frac{dp}{d\tau} - 1\right) \tag{2}$$

Rearranging we find how the tax changes the price consumers pay:

$$\frac{dp}{d\tau} = \frac{\frac{dS}{dp}}{\frac{dS}{dp} - \frac{dD}{dp}} \text{ Multiplying by } p/Q \rightarrow \frac{dp}{d\tau} = \frac{\frac{dS}{dp}\frac{p}{Q}}{\frac{dS}{dp}\frac{p}{Q} - \frac{dD}{dp}\frac{p}{Q}} = \frac{\eta}{\eta - \epsilon} \tag{3}$$

$$\text{If } \eta = 0.6 \text{ and using } \frac{dp}{d\tau} = 0.4 \text{ then } \rightarrow 0.4 = \frac{0.6}{0.6 - \epsilon} \rightarrow \boxed{\epsilon = -0.9} \tag{4}$$

4. (8 points) The automobile makers Mercedes-Benz and Kia were considering entering a developing country. Prior to entering, a survey of consumers in this developing country indicated that consumers prefer Mercedes-Benz automobiles over Kia automobiles. However, after the two automobile makers entered the country and began sales of their vehicles, consumers flocked to Kia dealerships. How can you explain this apparent paradox? (Hint: think about the data needed to infer a consumer's optimal bundle choice and the data provided here.)

   There is no paradox. Preferences do not involve prices, and consumers in the developing country preferred Mercedes vehicles based solely on product characteristics. However, Mercedes prices are considerably higher than Kia prices. So, even though consumers preferred a Mercedes to a Kia, they either could not afford a Mercedes or they preferred a bundle of other goods plus a Kia to a Mercedes alone. While the marginal utility of consuming a Mercedes exceeded the marginal utility of consuming a Kia, consumers considered the marginal utility per dollar for each good and, for most of them, the marginal utility per dollar was higher for Kia vehicles. As a result, they flocked to Kia dealerships.

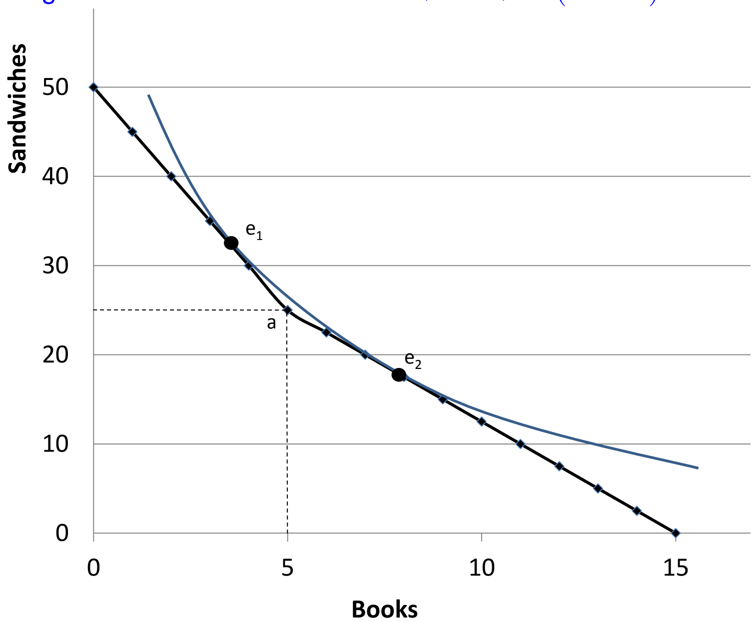
5. (20 points) Suppose Carmela's income is \$100 per week, which she allocates between sandwiches

and books. Sandwiches cost \$2 each. Books cost \$10 each if she purchases between 1 and 5 books. If she purchases more than 5 books in a week, the price falls to \$5 for the 6th book and all subsequent books. Draw the budget constraint.(15 points) Is it possible that Carmela might have more than one utility-maximizing solution? (5 points)

Because the price of books falls when Carmela purchases more than 5 books in one week, the budget constraint is nonlinear, i.e. it does not have a constant slope. As the figure shows, the budget line is kinked at a.

Carmela's budget constraint up to 5 books does not change. $\$100 = \$2S + \$10B$. Or rewriting to solve for Sandwiches which we will draw on the y-axis: $S = 50 - 5B$.

If Carmela buys more than 5 books, then she spends \$50 on the first five and and has the rest of her budget to spend on sandwiches and books at prices \$2 for sandwiches and \$5 for books. Her budget constraint is: $\$100 = \$50 + 2S + \$5(B - 5)$ or solving for S: $S = 25 - 5/2(B - 5)$.

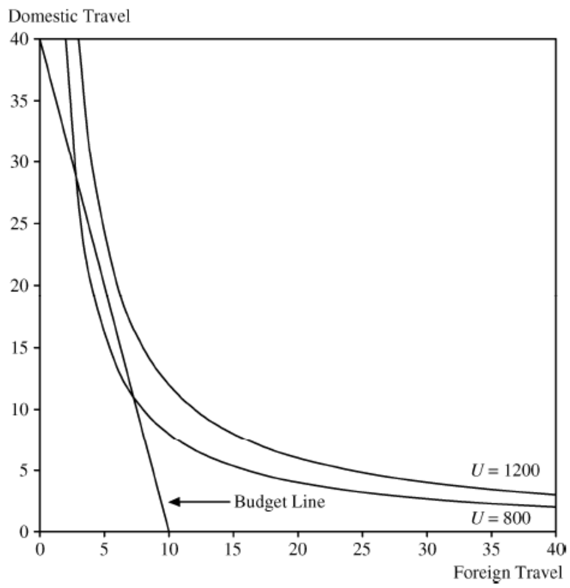


This nonlinearity makes it possible that a single indifference curve could be tangent to the constraint in two places. In this figure, the red indifference curve is tangent to the budget constraint at e_1 and e_2.

6. (20 points) Steven receives utility from days spent traveling on vacation domestically (D) and days spent traveling on vacation in a foreign country (F), as given by the utility function $U(D, F) = 10DF$. In addition, the price of a day spent traveling domestically is \$100, the price of a day spent traveling in a foreign country is \$400, and Steven's annual travel budget is \$4000.

   (a) (4 points) Illustrate the indifference curve associated with a utility of 800 and the indifference curve associated with a utility of 1200.

   The indifference curve with a utility of 800 has the equation $10DF = 800$, or $D = 80/F$. Find combinations of D and F that satisfy this equation (such as $D = 8$ and $F = 10$) and plot the indifference curve, which is the lower of the two on the graph below. The indifference curve with a utility of 1200 has the equation $10DF = 1200$, or $D = 120/F$. Find combinations of D and F that satisfy this equation and plot the indifference curve, which is the upper curve on the graph.



(b) (2 points) Graph Steven's budget line on the same graph.

If Steven spends all of his budget on domestic travel he can afford 40 days. If he spends all of his budget on foreign travel he can afford 10 days. His budget line is $100D + 400F = 4000$, or $D = 40 - 4F$. This straight line is plotted in the graph above.

(c) (4 points) Can Steven afford any of the bundles that give him a utility of 800? What about a utility of 1200?

Steven can afford some of the bundles that give him a utility of 800 because part of the $U = 800$ indifference curve lies below the budget line. He cannot afford any of the bundles that give him utility of 1200 as this indifference curve lies entirely above the budget line.

(d) (10 points) Find Steven's utility maximizing choice of days spent traveling domestically and days spent in a foreign country.

The optimal bundle is where the ratio of prices is equal to the MRS, and Steven is spending his entire income. Setting these two equal and solving for D, we get:

$$\begin{aligned} MRS &= MRT \\ -\frac{U_D}{U_F} &= -\frac{p_D}{p_F} \\ \frac{10F}{10D} &= -\frac{100}{400} \\ F &= D/4 \end{aligned} \tag{5}$$

Substitute this into the budget constraint, $100D + 400F = 4000$, and solve for D.

$$\begin{aligned} 100D + 400(D/4) &= 4000 \\ 200D &= 4000 \rightarrow \boxed{D = 20} \end{aligned} \tag{6}$$

Replacing this solution back into equation (5) gives us the optimal solution is $F = 5$ and $D = 20$. Utility is 1000 at the optimal bundle, which is on an indifference curve between the two drawn in the graph above.