EC387 Problem Set 5 Ellis

1. a) Imagine that there are only two countries in the world, Canada and the US, and that the demand for drug XYZ prescriptions in each country are as follows

$Q^{US} = 10{,}000{,}000 - 1000\ P^{US}$ $\quad$ $Q^{CAN} = 1{,}000{,}000 - 1000\ P^{CAN}$

Assume that the marginal cost is constant at $100 per prescription.

b) Suppose that you are a profit maximizing drug manufacturer able to choose prices separately in the US and Canada. What prices P^{US} and P^{CAN} do you choose in each country if there is no resale between countries? What profits are earned in each of the two countries?

c) Suppose now that you are told that you must charge the same price in both countries. How does this change your optimal pricing strategy?

d) Should Canada favor a single price policy? Explain.

d) Should the US favor a single price policy? Explain.

2. Suppose that there is one brand-name type of aspirin (Bayer, the first to market it in 1899) selling X and a large number of competing generic aspirin manufacturers collectively selling Y containers of aspirin. Think of X and Y as measured in standardized pill containers of 100 pills each.

Assume the marginal cost throughout is $1 per pill container.

For historic reasons, Bayer is the most popular form of aspirin, and hence has half of the market.

Assume that the ordinary demand curves for X and Y can be written as

$X = 499 - 2Px + Py$

$Y = 499 + Px - 2\ Py$

a) Assume initially that the market for all aspirin is perfectly competitive, and that Bayer is a price taker, just like all of the generic sellers. What must the prices Px and Py be? How much aspirin is sold as X and Y?

b) Now assume that the generic producers remain competitive and continue to sell at the price Py just determined. Assume Bayer takes this price as given when choosing Px. What is the profit maximizing price Px and quantity X sold for Bayer? Show your solution method.

c) Is this a signaling equilibrium in which price is taken as a signal of quality? Explain.

3. Continue to assume MC=1 and the same market structure as shown in problem 2. But assume Bayer has an advantage over other producers in that demand is less elastic for Bayer than for the generics.

Bayer: $X = 499 - 1Px + Py$

Generic: $Y = 499 + Px - 2Py$

a) If Bayer and the generics all act as price takers and price at marginal cost, what is the market equilibrium price and quantities of X and Y? Calculate the ordinary demand elasticities for X and Y at these prices.

b) Now assume that the generic producers remain competitive and continue to sell at the price Py just determined. Assume Bayer takes this price as given when choosing Px. Write down an expression for profits. What is the profit maximizing price Px and quantity X sold for Bayer? What are Bayer's profits?

c) Is this a signaling equilibrium in which price is taken as a signal of quality? Explain.

4. **Extra credit problem.** I could not figure out constant terms that made this model both solvable and feasible prices for Px and Pc. You are welcome to try it, but when I solve it using *Mathematica*, (analytical software that is available for free from BU), it comes up with X=0, and Px-Pc=1. The reward to attracting people with a high price has to be concave (have diminishing returns) or an infinite amount of signaling happens. This one tries it with the log function.

This question introduces a Hotelling type competition between Bayer and generics. Assume there are 1000 consumers to be divided up between the competing firms. One side is Bayer with its preferred brand X, the other side has a large number of competing generic firms offering Y at its marginal cost. Consumers choose X or Y according to which gives them the most perceived utility. The assumption is that there are heterogeneous consumers distributed uniformly over t from 0 to 1, and the distance from their preferred optimum costs δ per unit distance from their origin. Bayer is located at 0, generics at 1. Bayer has the option of giving out free coupons that lower the price of its aspirin, which has a price effect but no effect on perceived quality of its brand.

Using this notation we have:

Utility of Bayer $= U^X = 2 + \log_e(Px) - (Px-Pc) - \delta t$ (4.1)

Utility from generics $= U^Y = 2 - Py - \delta(1-t)$ (4.2)

Note from this that Bayer differs from the generics in two ways. Its higher prices are perceived as a sign of quality, giving utility to its consumers, but at a diminishing rate since the log function is concave. Bayer also has the option of a coupon that lowers its price but not its perceived quality.

a) If Bayer and the generics all set Px=Py=MC=1 and Pc=0, what is the share t of consumers that will choose Bayer? Assuming 1000 consumers in total, how many will choose Bayer? What are profits to Bayer and the generic firms?

b) Continuing to assume Px=Py=MC=1, does it make sense for X to offer coupons?

The next steps solve for Bayer's optimal pricing of Px and Pc given that the generic will always price competitively.

c) Consider the marginal consumer at location t who is just indifferent between buying X and Y.

This happens when $U^X - U^Y = 0$. Solve this expression for t

d) This expression for t is the fraction of consumers who will choose X ,and hence 1000t is the demand curve for X. Bayer's profits can be written as (Px – Pc – 1) 1000t.

e) Assume that the generics always price at Py=1. What is U^Y? What is the demand for Y at this assumed price?

Using Py=1, take the derivative of profits with respect to Px and Pc to find the optimum prices for Bayer. What is Bayer's profit at these prices? What is X?

c) Is this a signaling equilibrium in which price is taken as a signal of quality? Explain.