ECO410H: Practice Questions 6 – SOLUTIONS

1. (a) i. 5880 observations (30 cities * 196 weeks = 5880)

   ii. 6. Once for each of 6 existing brands: Cottonelle, Charmin, Northern, Angel Soft, Scot Tissue, Private Label

   iii. 30 dummy variables (omitted category not specified, since no constant term included in equation possible to include all 30).

   iv. 196 dummy variables (omitted category not specified, since no constant term included in equation possible to include all 196).

   v. 1 dummy variable (omitted category is that KBT has not yet been introduced).

   vi. $\hat{\delta_1} * 100$ is an estimate of the percent price decrease the introduction of KBT caused for a particular existing bath tissue brand.

   vii. -0.035 and it is statistically significant: see Table II on page 246.

   viii. -0.006 and it is not statistically significant: see Table II on page 246.

   ix. The authors have. The idea is that they have controlled for differences over time and for differences across cities. Any remaining price differences that coincide with the KBT introduction are assumed to be caused by the KBT introduction.

   x. No. They included a dummy variable for every week, which controls for any national trend in prices.

   xi. No. They include a dummy variable for each city, which controls for any demand differences across cities (that are constant over time).

   xii. See article: specifically p. 243 (the parameter would not be identified because the equation includes a full set of week-specific dummies).

   xiii. It would be close to zero as it measures the average post-introduction price effect.

   xiv. 1 dummy variable (omitted category first and second wave cities and third wave cities outside the 7/93 - 5/94 time period).

   xv. Roughly 390: 10 third wave cities over about 9 months (39 weeks) is 390.

   xvi. $\hat{\delta_2} * 100$ is an estimate of the percent price decrease the introduction of KBT caused for a particular existing bath tissue brand in the third wave cities in the 9 months preceeding KBT's actual introduction into the city.

   xvii. -0.005 and it is not statistically significant: see Table II on page 246.

   xviii. -0.012 and it is statistically significant: see Table II on page 246.

   xix. It does not make sense: see Table II on page 246 and note that delta1 is the post-introduction effect and delta2 is the interim effect. These are effects in two mutually exclusive time periods.

   xx. See article. (Direct effect: observed price impact controlling for other factors through use of dummies.)

   (b) 63%: see Table II on page 246: 1 - 0.37 = 0.63. Scot Tissue and private label tissues. For these there must be less variation over time WITHIN the same city: prices are more stable. This makes sense because these are the "discount" (economical) bath tissue alternatives. Prices are less variable over time within a particular supermarket. More expensive brands are more likely to go on sale or have other price promotions and exhibit greater variation.

(c) i. 41,160 observations is an upper bound estimate because KBT was not available in all cities for all weeks: 30 cities * 196 weeks * 7 brands = 41,160

ii. 23,324 observations: 17 cities * 196 weeks * 7 brands = 23,324

iii. See article: specifically, page 250, Section 3.

iv. 1.

v. See Appendix Table 1. (private label)

vi. 96 (note one of the cities is omitted as in Appendix Table 1 they do include a constant term): 16 cities * 6 brands = 96

vii. 72 (note one of the months is omitted as in Appendix Table 1 they do include a constant term). No they are not all dummy variables: the time trend is an integer that counts out the weeks: (11 months * 6 brands) + (1 time trend * 6 brands) = 72

viii. Negative and positive respectively. The estimation results given in Appendix Table I do mostly have the expected signs, but there are a few exceptions.

(d) There is evidence that without these controls the price effect on quantity demanded is biased towards zero as expected in demand estimation with unobserved demand shifters. Demand is found to be more elastic (elasticities are more negative) when the controls are included. Demand is found to be less elastic (elasticities are less negative) when the controls are excluded. More elastic demand corresponds to a bigger percent decrease in quantity demanded with a percent change in price. If we fail to control for demand shifters that explain both the higher prices and the higher market shares (quantities) observed in some markets in some weeks, the estimated price effect is biased towards zero. In an extreme case of endogeneity bias we may even find an upward sloping demand. Note: as the elasticity is biased towards zero the bias is towards estimating a demand elasticity that is too inelastic. Remember a perfectly inelastic demand is vertical and has an own-price elasticity of 0 (which is only a hair away from an upward sloping demand and a positive elasticity). Another way to look at this is that the parameter estimate of γ_{ii} for $i = 1, 2, ..., 7$ in Equation 5 will be biased towards zero (expected sign is negative). This is because price and unobserved demand shifters will be positively correlated as manufacturers charge higher prices in markets where demand is stronger. As we can see from Equation 9 if the estimate of γ_{ii} is biased towards zero then e_{ii} (own-price elasticity of Good i) will also be biased towards zero.

(e) -3.47 ($= \frac{1}{0.10}[-0.2438 - 0.0325 * 0.10] - 1 + (1 + \frac{0.0325}{0.10})(1 - 0.8390) * 0.10$)

(f) 0.5297 ($= \frac{1}{0.10}[0.0546 - 0.0325 * 0.10] - 0 + (1 + \frac{0.0325}{0.10})(1 - 0.8390) * 0.10$)

(g) The virtual price is like a choke price: the maximum amount a consumer is willing to pay. The difference between the virtual price and the actual (lower) price is a measure of consumer benefit from the introduction of the good.

(h) The total benefit of consumers from increased variety due to the introduction of KBT is 3.5% of total bath tissue expenditures. This seems large. (Check out size of total expenditures in Table I).

(i) See article. (The total benefit of the introduction of KBT to consumers is 7.3% of total bath tissue expenditures (includes both the variety effect and the price effect).)

(j) They allow for differences across firms in the level of constant marginal costs. We know that Bertrand NE implies $\frac{p-c_j}{p_j} = \frac{1}{\varepsilon_j}$ and since they estimate a flexible functional form for demand that allows demand elasticities to freely vary across products, they do not impose that costs must be the same across firms.

i. If measure in terms of 28,000 sheets as authors do, it is not reasonable to assume that 28,000 "quilted" two-ply premium bath tissue cost the same as discount one-ply tissue. Clearly the pulp costs per sheet would be higher the thicker the tissue.

2. (a) Some subset of the following: (1) They have panel data at the weekly level for a cross-section of U.S. cities (2) The variables include the prices and quantities of 7 brands of bath tissue (such as Kleenex) for each week in each city (3) One of the 7 "brands" is private label, which is an aggregate of all of the generic versions of bath tissue offered (4) They aggregate to the level of a brand (i.e. Kleenex) by figuring out the price per a specified number of sheets and the quantity as measured by sheets: this allows them to measure how much "Kleenex bath tissue" is sold even though there are many different packages and versions of Kleenex bath tissue available to consumers (5) The new product, Kleenex bath tissue, is rolled out in waves during their sample period such that they observe some of the same cities before and after Kleenex bath tissue has entered (6) the source of the data is supermarket scanners.

(b) They indirectly obtain the cost estimates (i.e. they do not have data on marginal costs). Specifically they use the first order conditions of their assumed oligopoly model and their estimates of the elasticity of demand obtained from their empirical model and data to deduce the marginal costs. We found the Lerner index is inversely related to the elasticity of demand. They obtain estimates of the elasticity of demand for each brand of bath tissue including the Kleenex brand. Combining this with information on current prices they can figure out the level of marginal costs. (Specifically we have $L = (p - c)/p = 1/elasticity$ that we can solve for c.)

(c) They use a simple static Bertrand model with differentiated goods. They assume the only endogenous (choice) variable is price. They assume the market is in a NE in prices.

(d) No. They can estimate it directly as they did using Equation 3.

(e) The first two equations are the demand model, which uses the AIDS (Almost Ideal Demand System) function form. The purpose of estimating these is to estimate the system of demand equations for bath tissue, which is a differentiated good. It is a system because there are seven different products. These along with a model of oligopoly (Bertrand NE) is used to provide the "indirect estimates."

(f) In contrast the overall purpose of estimating this equation is to see what effect the introduction of KBT had on the prices of the six existing brands. This is used to provide the "direct estimates" of the effect that the introduction of KBT had on lowering prices of competitors.

(g) The γ parameters reflect the responsiveness of demand to changes in the price of a good and the prices of its substitutes. Hence the γ parameter estimates should affect the own and cross-price elasticity estimates. [In fact Hausman and Leonard show the mathematical connection on page 250 in Equation (9).]

(h) c_j represents the constant marginal cost of production of product j. The cost function is of the form: $C_j(q_j) = F_j + c_j q_j$. s_i represents the revenue-based market share (as opposed to quantity based). p_j is the price of the bath tissue (\$s per 28,000 sheets). e_{jt} is the own and cross-price elasticity estimates. The market shares and prices are in Hausman and Leonard's data but not marginal costs. The elasticities are estimated used the data and the demand system. Hausman and Leonard back-out marginal costs using s_i, p_j, e_{jt}, and the equation above.

(i) The introduction of KBT causes the positive total consumer welfare effects: this would increase competition thus lowering consumer prices (price effect) and provide consumers with greater selection (variety effect). To conduct the test of statistical significance.
H_0: Welfare effect is 0
H_1: Welfare effect is not 0
Calculate the t test statistic: $t = (196, 9260)/9,843 = 20$. It is highly statistically significant. (Recall the rule of thumb that if the t test statistic is either < -2 or > 2 the result is statistically significant.) Hence we easily reject the null hypothesis that there was no effect in the city with the smallest effect.

3. (a) This industry is moderately concentrated. The six firm concentration ratio is 75.26 in the most recent year of data (1998) and it shows concentration increasing over the three years reported. We can get a lower bound for the HHI:

$$HHI = \sum_{j=1}^{15} s_j^2$$

$$HHI = 4.37^2 + 9.16^2 + 16.43^2 + 2.57^2 + 16.43^2 + 10.05^2 + 6.85^2 + 1.68^2 + 16.33^2 = 1066.9$$

This is a lower-bound for the HHI because it does not include all firms but rather the largest firms (which together account for 84.87% of the market).

(b) (i) There are many dummy variables: male, white, 30 to 50, married, employed, inclow, inchigh, own PC, PCnew, cable, magazine, weekend newspaper, weekday newspaper; (ii) 44.3 percent of the sample is between 30 and 50 years old; (iii) It is the sample standard deviation of years of education. It shows that years of education varies a fair bit.

(c) i. Instrumental variables (IV).

ii. If we test the statistical significance of the price coefficient in the first column we obtain $t = (-0.05 - 0)/0.04 = -1.25$. According to the rule-of-thumb ($t > 2$ or $t < -2$) this test statistic is not sufficient for a statistically significant result. Hence we cannot reject the hypothesis that consumers do not care about price other things equal! In contrast if we look at the IV results our price coefficient is statistically negative, which is what we would expect. $t = (-0.71 - 0)/0.13 = -5.46$, which means that we have strong evidence to support the inference that other things equal a higher price makes consumers less likely to choose that computer.

Why should Goeree expect price to be endogenous? Surely consumers consider more than just price, CPU speed, whether a computer is a Pentium, and whether a computer is a laptop when making a decision about which computer to buy. That means

that there are other characteristics that consumers consider that Goeree does not observe. These unobserved characteristics would include characteristics such as brand, reliability, pre-installed software, battery life, and weight. These unobserved characteristics will affect the prices that firm sets. Hence price will be correlated with the error term.

(d) This is a measure of the own-price elasticity of demand. Specifically it means that as the price of the IBM Thinkpad goes up by 1 percent the quantity demanded decreases by about 7 percent. Demand is very elastic. This elasticity estimate does seem plausible because we are talking about a very specific product: an IBM Thinkpad. There are many good substitutes: other brands and other IBM laptops. While we would expect the demand for computers (an aggregate good) to be inelastic because there are not good substitutes for computers, the demand for a very specific model is likely to be quite elastic because there are many good substitutes.

(e) She is explaining how many empirical IO papers figure out firms' marginal costs even when these data are not directly available. The idea is that you estimate demand (in Goeree's case a logit model), assume a model of competition (in Goerees case differentiated Bertrand), observe the equilibrium prices and then back-out (figure out) what marginal costs must have been such that Bertrand competitors facing that demand would have picked the prices we have observed. Hausman and Leonard (2002) did do the same thing to figure out the marginal costs of each brand of bath tissue.