Group HW 1

Demand Analysis: Supermarket

Using the orange juice data in "oj_data.csv," the goal is for you to provide visualizations to assist your retailer client in understanding your price recommendations. Using a log-log demand model, you want to estimate demand using all the data, but allowing for (i) a product-specific price elasticity, (ii) separate intercepts by product, (iii) separate intercepts by store, and (iv) controls for holiday weeks and display promotion weeks. In other words, you should include the following terms in your regression: intercept (included by default in R), product and store specific dummies (to allow for level of demand to vary by store and product), two different price terms to allow for product-specific price elasticities (i.e. a log(price) term with no interaction and another one interacted with a product dummy) and separate dummies for holiday and display. Do not drop any terms from the regression even if the estimates are not statistically significant.

1) Write down the regression equation you will use.
2) In a table, report your regression results (coefficients with statistical significance, standard errors, R-squared, and adjusted R-squared) and any other diagnostics you think will be useful.
3) In a well-labeled graph, plot the estimated demand curve for product 1 in store 2 during a non-Holiday and non-Promotion week. Put Price on the horizontal axis (ranging from \$0.1 to \$0.5) and the corresponding unit sales on the vertical axis. On the graph, indicate where store 2 has been pricing product 1 during the sample period (i.e. average non-holiday, non-promoted price) with a vertical line (use the abline() command for this). Also plot the raw data points corresponding to product 1, store 2, non-holiday and non-display weeks on the same graph (use the points() command for this).
4) Assume the unit cost for product 1 is currently \$0.1.
    a. Determine the profit-maximizing price for product 1 by hand, using the optimal price formula. Show your calculations.
    b. Use the brute force method (i.e. compute the profit function at all points ranging from 0.1 to 0.5 in increments of 0.001) to get the profit maximizing price for product 1 at store 2.
    c. In a well-labeled graph, plot the profit function for product 1 in store 2 during a non-holiday and non-promotion week. Put Price on the horizontal axis (ranging from \$0.1 to \$0.5) and the corresponding

profit levels on the vertical axis. On the graph, indicate store 2's average non-holiday non- display price for product 1 during the sample period. Also indicate the optimal (profit-maximizing) price for product 1. How much incremental profit do you predict the firm would generate by changing from this average price to the recommended price. How would this analysis change if the firm incurred a fixed cost of $25 to manage the category, regardless of the total volume sold? In your graph, plot both the profit function with the $25 fixed cost and the profit function without.

5) Re-do the analysis in (4) (i.e. redo all the parts) when the unit cost rises to $0.2. Explain how and why your results change. How would you respond if your retailer client insisted on keeping the price set at the optimal price point you computed in (4)?

Submit on Canvas as PDF: Questions 1-5.