Industrial Organization and Data Science

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Course Assignments & Reading

Course assignments should be printed (code, output and descriptive answers) and turned in at the start of class unless otherwise noted. Feel free to work in groups but everyone is required to turn in their own work with answers written in your own words. In both calculations and complex ideas, write down each step of logic used in reaching your conclusion. Keep in mind that in most cases a good answer is one precise sentence; quality is heavily favored over quantity. This will be graded on a full credit, half credit and no credit basis. All work must be typed

Discussion questions do not need be written out ahead of time. At the beginning of each class the professors will lead a discussion around these questions. Students will be called on, potentially at random, to add their insight. This part of class will contribute heavily to your course participation grade.

Week 5, due March 4

This homework will also serve as a useful study guide for the midterm.

Assignment to be turned in. Please turn in your R output and answers to the questions.

1) Let's return to the orange juice assignment and investigate how store demographics are related to demand.
   a. Take the final model from HW2 (logmove ~ log(price)*brand*feat) and add in the store demographics as linear features (e.g. + demo1 + demo2). Report your output (past into your answer document).
   b. What demographics are significantly (t>2) related to demand?
   c. How much did the adjusted R-squared improve with the addition of these variables?
2) Let's focus on two variables HHLARGE ("fraction of households that are large") and EDUC ("fraction of shoppers with advanced education").
   a. What are the means and percentiles of each of these variables?
   b. Using your coefficient estimates from the regression in 1b:
      i. If we move from the median value of HHLARGE to the 75th percentile (3rd quartile), how much does log(quantity) change each week on average?
      ii. If we move from the median value of EDUC to the 75th percentile (3rd quartile), how much does log(quantity) change each week on average?
      iii. Base on this analysis, which is the more important predictor of demand?
   c. Now let's see if these variables impact price sensitivity. Add two interaction terms (with logprice) to the model to test this.
      i. What are the coefficients on the interaction terms?

        ii. Recall, positive values indicate lower price sensitivity and negative values indicate greater price sensitivity. Do your estimates make sense based on your intuition?

       iii. What are the coefficient estimates on the constants EDUC and HHLARGE? How do they compare to your regression from 1b?

       iv. Similar to 2b, if we move from the median value of each variable to the 3rd quartile, how much does elasticity change? Based on this, which is more important to price sensitivity?

    d. You should notice that the coefficients on EDUC and HHLARGE have flipped sign once we include interaction terms with price. HHLARGE now appears to be a positive demand shifter and increases price sensitivity. Explain in words or pictures what is going on.

3) Conceptual Exercise: Assume that in addition to orange juice, you also observe demand for bananas.

    a. What regression would you run to determine if bananas and orange juice are compliments or substitutes? What is the coefficient of interest (i.e. on what variable) that would inform you?

    b. Assume you find they are substitutes. What would the sign of the coefficient be? Would you be more or less likely to bundle these products if they are substitutes?

       i. Explain why with an equation, figure or a sentence or two.

       ii. Would the price of the bundle be less than or more than the sum of the two independent prices? (Not a trick question; verifying you understand bundles.)

    c. During a sale for orange juice, should you continue to offer the bundle at the same price? Why or why not? HINT: who is price sensitive for orange juice? Who comes into market?

Study guide: You don't need to turn in any answers to these questions. This is a study guide to help you, but it may not cover every concept on the midterm.

Optimal pricing basics

- Setting up the monopolist's profit maximization problem and deriving the optimal pricing formula for 1-good.
- Lerner index and optimal markup formula for one good.
- Different types of elasticities (own price, cross-price, income)
- Definition of extensive and intensive margin.
- How does optimal quantity vary with MC for monopolist?
  - o More or less quickly than with perfect competition.
- Intuition on the markup formula and the role of price sensitivity and available substitutes in determining markups.
- You do not need to memorize the N-good optimal pricing formula, but you do need to know the intuition for how the optimal prices change when goods are complements vs. substitutes.

Optimal pricing with many prices

- What is the Myerson-Satterthwaite Theorem and how does it relate to pricing?
- Why does one price leave "trades on the table"? Understand this graphically and in words.
- Direct price discrimination, definition and examples.
- Indirect price discrimination, definition and examples.
- Definition of two-part tariff, examples of two-part tariff in the market.

- How does bundling work? What "valuation profiles" make bundling attractive? What are some examples of bundles in the marketplace.
- Related to the OJ HW, if the supermarket chain learned that different shoppers at different stores have different price sensitivity, how should it respond?

Game theory and firms

- What are the elements of a game?
- What is a best response function and Nash Equilibrium?
- Key insight of Cournot: when firms compete, their outputs are strategic substitutes.
    - If they're not doing this, its collusion to be monopolistic
    - Cournot embeds perfect competition as a special case.
- Key insight of Bertrand: competing on price is brutal. Best to differentiate.
- Hotelling Line: simplest why to introduce heterogeneity in a model.
    - Costs are costs (prices/time/any distance in product space etc…)
- Quality differentiation: Bang for the buck versus level costs.
- Degrade quality to induce high types to good quality product.
- Fixed costs imply rents can exist & market structure as a function of fixed cost changes.

Empirical methods

- What is conjoint analysis and how is it used to price products?
- When pricing new products, what is the most popular method firms rely on?
- In the conjoint assignment, how did the number of variables create issues for our estimation?
    - What is a "for loop"?
- What are some issues with hypothetical surveys that can create potential bias?
    - How can these be overcome?
- In the demand curve modeling, what functions in R were we using?
- Why is plotting histograms or looking at the variable summary (i.e. percentiles/mean/median) considered a best practice?
- What are interaction terms? What can they tell us? What are some examples of how we have used these in assignments?
- What is a predicted value?
- Why can matching be useful for gaining insight?

Midterm format
- 90 minutes in length.
- Multiple Choice, T/F plus explanation, short answer, some calculation.
- Type of questions you should expect:

    - Conceptual: similar to discussion questions on HW and conversations we've had in class.
    - R Output interpretation: we provide you R output and you interpret this based on your understanding of the core concepts we have learned so far.
    - Pen/paper math: we give you key parameters and you use/derive formulas to produce the answers, similar to HW1.
    - Graphical: we show you figures and ask you to interpret what's going on.

- o Methodological: we ask how you would test a certain hypothesis using the statistical methods we have used. Similar to the written questions in HW2-4.
- o R commands (<10%): straightforward questions on the main commands we have been using so far.
- Tips
  - o Know and understand the key formulas we have highlighted above
  - o Some questions will come almost directly from the HW assignments.
  - o Word your answers concisely
  - o Ask questions if anything is unclear
  - o Justify your answers with core economic logic