14.271 Glenn Ellison
Fall 2022 Tobias Salz

Problem Set #4

October 19, 2022

1. Consider a slight variant of Stahl's model of consumer search and price dispersion. As in Stahl assume that there are a continuum of consumers with unit mass: a fraction μ always visit all firms and a fraction $1-\mu$ are costly searchers who must pay a cost of s to visit a firm and learn its price. The costly searchers know the equilibrium prices (but don't know which firm offers which price) and search optimally.

Specialize the model in three ways: assume that cost of production is $c = 0$; assume that there are just two firms; and that each consumer buys $D(p) = 1 - p$ units if the lowest price he finds is p.

And change the model in one way: assume that the firms can only choose prices from the set $\{0, \frac{1}{4}, \frac{1}{2}, \frac{3}{4}, 1\}$ rather than assuming that they can choose any real number as a price.

(a) For some parameter values this model has a pure strategy Nash equilibrium. (In fact for some values it has multiple pure strategy Nash equilibria.) In class I proved that Stahl's model had no pure strategy Nash equilibrium. Why does that proof not work here?

(b) Give as complete a description as you can of the set of values of μ and s for which $p_1^* = p_2^* = \frac{1}{4}$ is a pure strategy Nash equilibrium.

(c) For other parameter values this model does have a symmetric mixed Nash equilibrium in which the firms mix over two or more prices, playing p with probability $\sigma^*(p)$. Which prices do you think would be played with positive probability in such an equlibrium? Write down the set of equalities and inequalities that are necessary and sufficient for such a σ^* to be a an equilibrium of the model.

2. Consider a model of search for differentiated products wtih an infinite number of firms. Assume that the firms are ex ante identical and each has a constant marginal cost c of production. If a consumer visits firm j they learn both its price p_j and their idiosyncratic preference ϵ_{ij} for firm j's product. Assume that the consumer's utility is $u_{ij} = v - p_j + \epsilon_{ij} - Ns$ if they purchase from firm j and visit a total of N firms. Assume that their utility is $-Ns$ if they visit N firms and do not purchase.

Suppose that the ϵ_{ij} are independent draws from uniform distributions on $[0, 1]$.

(a) Suppose all firms set price p^*. Suppose that the best option a consumer has found so far is a firm j with $p_j = p^*$ and $\epsilon_{ij} = x$. Find an expression for the expected benefit that the consumer gets from conducting one additonal search (and then buying the best product they've found) relative to buying immediately from firm j.

(b) A standard result in search theory implies that if all firms set a common price p^* and s is not too large, then the optimal search strategy will involve a simple cutoff rule: for some constant $\underline{u}$ they continue to search until they first find a firm j for which $u_{ij} \geq \underline{u}$ and then buy from this

firm. Note that when all firms do indeed charge price p^* this is equivalent to buying from the first firm with $\epsilon_{ij} \geq \underline{x}$ where $\underline{x} \equiv \underline{u} - (v - p^*)$.

Note that for such a strategy to be optimal it must be that consumers prefer buying a product that provides utility at least $\underline{u}$ to doing one additonal search and prefer doing one additonal search to purchasing if they find a product that provides utility less than $\underline{u}$.

Use this fact to find an expression for the optimal $\underline{x}$ as a function of the search cost s.

(c) Suppose firm j deviates from an equilibrium in which all firms charge p^* and sets a price of p_j. Find an expression for the fraction of the consumers who visit the firm that decide to buy from it.

(d) Find the equilibrium price that firms will charge in this model assuming that the parameters are such that all consumers do eventually purchase from some firm in equiliibrium.

(e) In class I discussed a related search model with just two firms. How does the equilibrium price you found in part (d) compare with the price in that model (assuming then same distribution for ϵ_{ij}) when s is small? Provide as clear intuition for why the comparison comes out as it does. If you were unable to find the equilibrium describe how you think the two will compare and describe your intuition.

3. Read as much of Galenianos and Gavazza's paper "Regulatory Intervention in Consumer Search Markets: The Case of Credit Cards" as you have time to read.

(a) One of the motivations for their counterfactual is that some papers, e.g. Armstrong, Vickers, and Zhou's 2009 paper in the *Journal of the European Economic Association*, have shown that an exogenously imposed price cap can increase the average prices consumers pay in a search model. Give some intuition for why this might occur.

(b) The emprical work in the Galenianos and Gavazza paper is quite different from that in most of the empirical papers we cover in this course. I think of it as resembling more the kinds of calibrations one often sees in macroeconomics paper. Are there features of the dataset that you think contributed to their decision to use such an approach?

(c) Suppose you had access to the data from Alan Sorensen's paper on pharmaceutical prices and wanted to take a similar approach to see if a calibrated search model could account for features of the data. What type of search model might you use? What moments might you try to calibrate it to? Why do you think Galenianos and Gavazza chose to do an analysis building on Stango and Zinman's paper rather than on Sorensen's?

MIT OpenCourseWare
https://ocw.mit.edu/

14.271 Industrial Organization I

Fall 2022

For information about citing these materials or our Terms of Use, visit: https://ocw.mit.edu/terms.