

Quantitative Marketing and Economics
2003 Conference Schedule
October 24 – 25, 2003

Sponsored by

James M. Kilts Center for Marketing, GSB, University of Chicago

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Friday, October 24, 2003

12 noon – 12:50 pm	Box Lunch
12:55 pm – 1:00 pm	Welcome and Introduction
1:00 pm – 3:00 pm	Session 1

Predicting Online Purchase Conversion Using Web Path Analysis

Alan Montgomery (CMU), Shibo Li (CMU), Kannan Srinivasan (CMU)
and John Liechty (Penn State)

Click stream data provides information about the sequence of pages viewed by a visitor as they move through a web site. A valuable facet of this data is the navigation or web path the user has chosen to traverse the web site. This path reflects a user's goals, which we use to predict a user's potential to purchase. One application of path analysis is to predict which users are likely to make a purchase as they browse through the web site. An online retailer could use path analysis to improve the design of their web site and better target customers. In our research we propose a dynamic multinomial probit model to predict the path that a user will take through a web site. Our model is formulated with a hierarchical Bayesian framework to account for consumer's observed and unobserved heterogeneity. Additionally, our model incorporates a mixture process whose multiple states are governed by a hidden Markov switching model to capture within user heterogeneity. Results show that more promotional messages on a page, removing the presence of price information on a page, and reducing the number of hypertext links can positively affect the purchase conversion rate of users who are surfing but these changes can negatively impact visitors who are purchase oriented. Therefore, online retailers should use different marketing mix tools, web design, and navigation paths to target the right customers at the right time to bolster their purchase conversion rates.

Discussant: Hai Che (Berkeley)

Demand Estimation with Heterogeneous Consumers and Unobserved Product Characteristics: A Hedonic Approach

Patrick Bajari (Duke) and C. Lanier Benkard (Stanford)

We study the identification and estimation of Gorman-Lancaster style hedonic models of demand for differentiated products for the case when one product characteristic is not observed. Our identification and estimation strategy is a twostep approach in the spirit of Rosen (1974). Relative to Rosen's approach, we generalize the first stage estimation to allow for a single dimensional unobserved product characteristic, and also allow the hedonic pricing function to have a general, non-additive structure. In the second stage, if the product space is continuous and the functional form of utility is known then there exists an inversion between the consumer's choices and her preference parameters. This inversion can be used to recover the distribution of random coefficients nonparametrically.

For the more common case when the set of products is finite, we use the revealed preference conditions from the hedonic model to develop a Gibbs sampling estimator for the distribution of random coefficients. We apply our methods to estimating personal computer demand.

Discussant: Ron Goettler (CMU)

3:00 pm – 3:30 pm Break

3:30 – 5:30 pm Session 2

The Effect of Entry and Market Structure on Cellular Pricing Tactics

Katja Seim (Stanford) and Brian Viard (Stanford)

We test the effect of entry on the tariff choices of incumbent cellular firms. We relate the change in the breadth of calling plans between 1996, when incumbents enjoyed a duopoly market, and 1998, when incumbents faced increased competition from personal communications services (PCS) firms. Entry by PCS competitors differed across geographic markets due to the number of licenses left undeveloped as a result of the bankruptcy of some of the auctions' winning bidders and due to variation across markets in the time required to build a sufficiently large network of wireless infrastructure. We find that incumbents increased the number of calling plans more in markets with more entrants and that this effect is not explained by demographic characteristics of these markets or the geographic scope of the incumbents' services.

Discussant: Pradeep Chintagunta (Chicago)

Learning and the Value of Information: The Case of Health Plan Report Cards
Michael Chernew (Michigan), Gautam Gowrisankaran (Harvard) and
Dennis P. Scanlon (Penn State)

We estimate a Bayesian learning model in order to assess the value of health plan performance information and the extent to which the explicit provision of information about product quality alters consumer behavior. We make use of a source of variation in which health plan performance information for HMOs was released to employees of a Fortune 50 company for the first time. Our empirical work indicates that the release of information had a small but statistically significant effect on health plan choices, causing 3.1% of employees to switch health plans. Although consumers were willing to pay an extra \$267 per year per below average rating avoided, the average value of the information per employee was only \$10 per year. The relatively small impact of the ratings arises because the ratings were estimated to be very imprecise measures of quality. More precise measures of quality could have been more valuable.

Discussant: Marta Wosinska (Harvard)

6:00 pm Reception/Dinner, 6th Floor Gleacher Center

Saturday, October 25, 2003

7:00 am – 8:00 am Continental Breakfast

8:00 am – 10:00 am Session 3

Bayesian Analysis of Simultaneous Demand and Supply
Sha Yang (NYU), Yuxin Chen (NYU) and Greg Allenby (Ohio State)

In models of demand and supply, consumer price sensitivity affects both the sales of a good through price, and the price that is set by producers and retailers. The relationship between the dependent variables (e.g., demand and price) and the common parameters (e.g., price sensitivity) is typically non-linear, especially when heterogeneity is present. In this paper, we develop a Bayesian method to address the computational challenge of estimating simultaneous demand and supply models that can be applied to both the analysis of household panel data and aggregated demand data. The method is developed within the context of a heterogeneous discrete choice model coupled with pricing equations derived from either specific competitive structures, or linear equations of the kind used in instrumental variable estimation, and applied to a scanner panel dataset of light beer purchases. Our analysis indicates that incorporating heterogeneity into the demand model all but eliminates the bias in the price parameter due to the endogeneity of price. The analysis also supports the use of a full information analysis.

Discussant: J.P. Dube (Chicago)

A Theoretical and Empirical Investigation of Slotting Allowances in the Grocery Industry
Adam Rennhoff (Virginia)

This research examines the behavior of manufacturers and retailers in the presence of slotting allowances. Slotting allowances are fees manufacturers pay retailers to encourage them to carry a new product or allocate premium shelf space to a product. According to estimates, retailers collect billions of dollars in allowance payments annually. Using a four-stage game, I formulate a vertical structural model that endogenously models manufacturer, retailer, and consumer behavior. Manufacturers compete with each other, using slotting allowance payments, in order to obtain premium shelf space at retailer outlets. Retailers, given allowance offers, choose display configurations and then set retail prices. Consumers observe the display and retail prices and determine whether to purchase one or no units of the good. I estimate the model with a method of moments technique using IRI scanner data from the ketchup industry. In addition to estimating consumer taste parameters, the model yields predictions of the underlying wholesale prices and slotting allowances each manufacturer offers the retailer. I use the parameter estimates to conduct counterfactual simulations of how agents might respond to different economic environments. Of the potential scenarios, one of the most informative predicts the effects (including welfare) when the use of slotting allowances is not longer permissible.

Discussant: Bart Bronnenberg (UCLA)

10:00 am – 10:30 am **Break**
10:30 am – 12:30 pm **Session 4**

The Effect of Information and Institutions on Price Negotiations: Evidence from Matched Survey and Auto Transaction Data

Fiona Scott Morton (Yale), Florian Zettelmeyer (Berkeley) and Jorge Silva-Risso (UCLA)

Using matched survey and transaction data on 1,500 buyers, we investigate how different types of search and purchasing behavior affect transaction prices in auto retailing. Our results are consistent with the predictions of information economics and bargaining theory. Buyers pay less if they obtain an offer from a competing dealer (0.6% of purchase price), if they are informed about the specific car they eventually purchase (0.8%), and if they are patient (0.6%). The combined savings of these effects equal 1/3 of the average dealer margin. We find that the Internet lowers prices because it informs consumers (0.9%), and because the referral process of online buying services helps consumer (0.7%). We also find that buyers who perceive themselves as vulnerable in negotiations are more likely to use and benefit from the Internet. Such buyers pay 1.5% less when they use the Internet to inform themselves, while buyers who like the bargaining process do not benefit from being informed. These results suggest that tactical decisions consumer make to improve their price negotiation outcomes have surplus redistributing effects. The results speak both to the significance of the Internet in making information more easily

available, and also on the potential of Internet institutions to affect the distribution of surplus even in established offline industries like auto retailing.

Discussant: Greg Crawford (Arizona)

Long-Run Effects of Promotion Depth On New Versus Established Customers: Three Field Studies

Eric Anderson (Northwestern) and Duncan Simester (MIT)

We use the results of three large-scale field experiments to investigate how the depth of a current price promotion affects future purchasing of first-time and established customers. While most previous studies have focused on packaged goods sold in grocery stores, we consider durable goods sold through a direct mail catalog. The findings reveal different effects for first-time and established customers. Deeper price discounts in the current period *increased* future purchases by first-time customers (a positive long-run effect) but *reduced* future purchases by established customers (a negative long-run effect). We investigate alternative explanations for these findings including purchase acceleration, selection, customer learning and increased deal sensitivity.

Discussant: Ram Rao (Dallas)

12:30 – 1:00 pm Box Lunch

1:00 pm – 3:00 pm Session 5

Learning about Computers: An Analysis of Information Search and Technology Choice

Tulin Erdem (Berkeley), Michael Keane (Yale) and Judi Strebel (San Francisco State)

This paper examines consumer search for high-tech durable goods, in markets characterized by two or more technological alternatives and a rapid pace of technological change. Special emphasis is on how consumers learn about and choose between the Apple/Macintosh and IBM/Compatible technologies. However, the modeling framework we develop can be easily generalized to any product category with more than one competing technology, such as Internet access (cable model line versus a digital subscriber line), satellite access (cable service versus satellite dish), etc.

For most consumers, making a high-tech purchasing decisions involves searching many different types of information channels. In our model, consumers decide in each period whether to obtain information from several sources. After obtaining information, the consumer decided whether (and what) to buy at that time. If the consumer decides to wait, then in the next period he/she again has the option of obtaining information from several different sources, and so on. Waiting has the advantage that more information can be gathered and prices may fall. But it has the drawback of delaying the stream of consumption of a new computer.

To estimate the model we use a unique panel data set collected in collaboration with a major U.S. personal computer manufacturer. This data set contains a wealth of information about the search behavior of a set of consumers who were in the market for a personal computer, and who were interviewed at two-month intervals over a one-year period, including the information sources visited each period, search durations, brand purchased and price paid. It also contains measures of price expectations and stated attitudes toward the alternatives during the search process. A major innovation in our work is the incorporation of these expectations and attitudinal measures into the estimation of a dynamic structural model. This allows us to relax some of the assumptions that are typically required to estimate such models.

Our estimated model fits the data very well. Our results imply that consumers have substantial uncertainty about qualities of different computer technologies and information sources differ in regard to the costs associated with obtaining information and accuracy of information these information sources provide. We find preliminary evidence for duration dependence in information search, that is, as time passes by, consumers tend to search less. Given the estimated model, we also run policy experiments to investigate how altering accuracy and cost of various information sources would alter information acquisition and technology choice behavior of consumers.

Discussant: Tat Chan (Washington University)

Leveraging Information Across Categories

Raghuram Iyengar (Columbia), Asim Ansari (Columbia) and Sunil Gupta (Columbia)

Companies are collecting increasing amounts of information about their customers. This effort is based on the assumption that more information is better and that this information can be leveraged to predict customers' behavior in a variety of situations and product categories. For example, information about a customer's purchase behavior in one category can be helpful in predicting his potential behavior in a related category, which in turn could help a firm in its cross-selling efforts.

In this paper, we present a model to better understand and predict a consumer's purchases and preferences when we may have limited or no information about him in one or more product categories. Conceptually this involves leveraging information from purchases of other consumers in multiple categories as well as partial information (e.g., purchase in one of the categories) of the target consumer. Our approach builds on the pioneering work of Rossi, McCulloch and Allenby (1996) who demonstrate that value of purchase information in the context of a single product category. We present results from an extensive simulation as well as an application on scanner panel data.

Our simulation shows many interesting and somewhat surprising results. Specifically we find that compared to a single category analysis, a cross-category analysis improves parameter recovery in many situations. However, it does not lead to any significant improvement in predictions or hit-rates in most cases. We also show the conditions under

which information transfer across categories is likely to be the greatest. Many of these conditions are unlikely to be met in real marketing applications. Therefore, the single category analysis of Rossi et al. is even more powerful than previously thought.

We demonstrate the transfer of information across categories in an application of two grocery products – Breakfast Foods and Table Syrups. In spite of a reasonable correlation (0.21) in the price parameter across these two categories, our simulation guidelines predict very little benefit of cross-category analysis over single category analysis. Our empirical results confirm this prediction.

Discussant: Seethu Seetharaman (Washington University)

3:00 pm – 3:30 pm **Break**
3:30 pm – 5:30 pm **Session 6**

A Structural Estimable Model of Forgetting in Memory-Based Choice Decisions

Nitin Mehta (Toronto), Surendra Rajiv (Singapore) and Kannan Srinivasan (CMU)

We propose a structural model to investigate the impact of forgetting on consumers' brand choice decisions in frequently purchased products. Forgetting results in consumers imperfectly recalling their prior brand evaluations when making a purchase decision in the category. We conceptualize the imperfect recall by positing that the consumers recall their prior evaluations with an added noise. Based on the results of experimental work done on forgetting, we characterize the extent of forgetting as an increasing and concave function of time. Our framework generates interesting analytical results on the impact of forgetting on consumers' brand evaluations and their consequent purchase behavior. We calibrate our model using scanner panel data for liquid detergents. Furthermore, we obtain interesting insights into the consumers' extent of forgetting in the category, the extent of learning, the predicted price elasticities and implications for state dependence and habit persistence.

Discussant: Michaela Dragnanska (Stanford)

Search Under Product Differentiation at an Internet Shopbot

Astrid Dick (Federal Reserve Board), Michael Smith (CMU) and Erik Brynjolfsson (MIT)

Price dispersion among commodity goods is typically attributed to consumer search costs. We explore the importance of search costs using a unique data set obtained from a major Internet shopbot (online comparison-shopping service). We use a flexible demand model and a compensating variations framework to estimate consumer benefits and costs for search. We find that the benefits to searching lower screens are \$1.65 for the median consumer, while the cost of carrying an exhaustive search of the offers is a maximum of

\$1.40 for the median consumer that chooses to search lower screens. The observed search costs amount to 13% of the price dispersion in this market. Interestingly, in our setting, consumers who search more intensively are less price sensitive than other consumers, reflecting increased weight on non-price retailer attributes such as delivery time and reliability. Our results demonstrate that even in this nearly perfect market, substantial price dispersion can exist in equilibrium.

Discussant: K. Sudhir (Yale)