

# DISSERTATION DEFENSE

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Wednesday, December 8, 2010

10:00 am

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## **“Essays on Multi-product Pricing”**

Managers often make price decisions for several products simultaneously. By doing so, decision makers can control for substitution effects or take advantage of potential synergies between products. My dissertation consists of three essays that investigate novel aspects of this multi-product pricing approach.

My first essay, analyzes the implications in optimal prices and profits of using the information contained in the definition of the feasible set in the estimation of the demand parameters. Traditional approaches to price optimization take a two step approach to setting prices. First the parameters of the demand system are estimated given an observed dataset, and second a profit maximization problem is formulated to decide upon the optimal prices. Often the profit function derived from the estimated demand model is either ill-formed or the answers are non-sensical. Hence, the manager imposes a set of constraints on the prices of all products to identify a more appropriate solution. This process is not consistent with a Bayesian approach, since the manager’s constraints on the price solution represent prior information and this information should be incorporated into the prior distribution of the parameter estimates. In this essay we illustrate how statements about optimal prices imply informative prior distributions that can be used in a traditional Bayesian approach. This Bayesian method improves the quality of the pricing decisions made by managers. It demonstrates how managers can be viewed as experts who have well developed opinions about how prices should be set.

My second essay explores “cross-market discounts” where firms try to attract consumers by offering discounts in other unrelated markets. A prominent example of this promotion strategy is the discounts in gasoline offered by many grocery retailers across North America, Europe and Australia. In this essay, we use an analytical model to investigate the major forces driving the profitability of this novel promotion strategy. We consider a generalized scenario in which purchases in a source market lead to price discounts

redeemable in a target market. Our analysis shows that this strategy can be a revenue driver by simultaneously increasing prices as well as sales in the source market, even though sales are negatively elastic in price, *ceteris paribus*. Moreover, it distributes additional consumption (motivated by the discount) in two markets and, under diminishing marginal returns from consumption, this can simultaneously increase firm profits and consumer welfare more effectively than traditional nonlinear pricing strategies. Our study provides many other interesting insights as well, and our key results are in accordance with anecdotal evidence obtained from managers and industry publications.

My third essay studies how business customers make multi-product purchase decisions and how the distributors who sell those products can make inferences about their demand functions with incomplete information. For mature markets, any increase in sales for an existing customer must come at the expense of the sales of another competing distributor. One would expect these competing distributors to respond either directly by lowering prices for targeted customers or more broadly by lowering prices for non-targeted customers. The problem is that distributors rarely observe a competitor's price directly, and must infer competitor response indirectly from their own observations about customer purchases. In this research we propose that customers make their product orders by minimizing procurement costs and we impose first order conditions to characterize regions in the parameter space where consumer will buy from each distributor. We use those conditions to estimate an empirical model of purchase behavior that enables us to identify the likelihood of each consumer buying from the competitor or simply changing his consumption patterns.

We apply our proposed model to a wholesale food distributor and we find widespread heterogeneity in purchase patterns. As expected some customers are loyal, while others are not, and the remainder fall in between. The empirical results shade light on the competitive elements of customer demand that cannot be study with traditional reduced form response models. For example we found that while some costumers satisfy most of their requirement from one of their distributors, other consistently split their demands among them. Our proposed methodology could also help to guide strategic decision making. In our empirical application we found that price sensitivity of customers making most of their purchases with the focal supplier are less affected by the volume of purchases in previous periods. We expect this result to provide valuable information for vendors to negotiate prices with the customers.