Research Statement

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My research interests lie in the areas of Industrial Organization and Microeconomics. Two common themes underly and unify most of my work: how economic agents interact with each other in the market place and how certain changes (technology, policy etc.) affect competition and welfare. In particular, I have worked on the following topics: (1) the role of consumer information, (2) low-price guarantees, (3) multi-dimensional product differentiation and (4) various other pricing and product strategies. My CV lists all of my publications and working papers.[1]

1 The Role of Consumer Information

The rapid growth of information technology allows firms to collect and utilize detailed information about consumers' preferences. In this area I am interested in understanding how firms interact with each other in the presence of such information and how the improvement of this information affects the evolution of prices, profits and welfare.

There is an extensive literature on third-degree price discrimination. A common assumption in this literature is that firms have the ability to segment consumers into either two groups or infinitely many groups (perfect price discrimination). In **[1]** we propose a partition of the characteristics space that encompasses the two extremes as special cases. The better the quality of consumer information is, the finer the partition. This approach is more realistic and it uncovers new and interesting equilibrium relationships. In particular, we show that the relationship between equilibrium profits and the quality of information is non-monotonic (U-shaped).

The next step is to extend this analysis in several directions including (i) firm asymmetry, (ii) free entry, (iii) information sharing and (iv) collusion ([2, 3, 4, 5]). In [2], we consider a duopoly vertical differentiation model and show that the low quality (smaller) firm will refrain from engaging in price discrimination. In [3], we allow free entry and find that imperfect price discrimination (facilitated by moderate levels of consumer information) minimizes inefficiency. In [4], we allow rival firms to share information about their customers and find that information sharing will take place if firms are sufficiently asymmetric. [5] shows that more accurate consumer information makes collusion more difficult to sustain.

[1] Copies of my published articles and working papers can be downloaded from SSRN at `http://papers.ssrn.com/sol3/cf_dev/AbsByAuth.cfm?per_id=398784`.

Another project **([6])** examines the role of consumer information in product customization. Firms invest in product customization technology and then compete in prices. We show that if brand name effects (which capture product characteristics that cannot be customized) are weak, then firms invest asymmetrically in product customization technology which reduces price competition. On the other hand, if brand name effects are strong then both firms make extensive investments in product customization.

Other projects in this area ([13, 14]) consider newer developments in the price discrimination practice and literature. [13] is motivated by the practice of coupon trading on Ebay. We find that when the fraction of coupon traders increases, couponing becomes less attractive and firms respond by sending fewer coupons and of lower value, leading to higher equilibrium prices and profits. In [14] we show that perfect price discrimination can raise profits in a two-sided market. Moreover, the features of the equilibrium are qualitatively very different from those in a one-sided market. In particular, the prices a platform charges in its rival's turf are not constant and equilibrium prices are *not* distribution-free, both opposite to the results in one-sided perfect price discrimination models.

2 Low-Price Guarantees

The advancing of information technology not only allows firms to collect information about consumers, but also fundamentally alters the way consumers obtain information about firms. For example, consumers can visit retailers' web sites or price-comparison sites to conduct comparison shopping. To attract savvy shoppers, many retailers offer low-price guarantees (LPGs).

We collected data on prices and LPG policies at several consumer electronics retailers. Our data spans the periods before and after the introduction of a Most-Favored Customer (MFC) clause by Best Buy, a feature which we exploit in **[9]**. We find that, after Best Buy introduced the MFC clause, it reduced its prices and its competitors responded by cutting prices further. The same data was used in [15] [no draft] where we investigate the relationship between firms' pricing (price levels and price dynamics) and the type of their LPGs.

My research in this area also includes theory work. In **[11]** I employ a fully dynamic model and show that LPGs robustly facilitate tacit collusion, by reducing a deviating firm's immediate deviation profit. In contrast, existing literature on LPGs usually employ static models and the results are shown to be sensitive to modeling assumptions such as types of guarantees (matching or beating), hassle cost and consumer heterogeneity. This contrast between dynamic and static models is due to the difference between the equilibrium concepts in the two types of models. In a static model, any equilibrium has to be immune from incentives for any deviation, including infinitesimal deviation. In a dynamic model, however, one can ignore infinitesimal deviations since they lead to infinitesimal immediate gain but finite loss in ensuing punishments and firms never have incentive

for such deviations. In [16] I introduce firm asymmetry (duopoly vertical differentiation) and show that price-matching guarantee hurts the profit of the low quality firm and thus can serve as a tool for predation by the high quality firm. Aside from this anticompetitive incentive, I also identify a competitive rationale for the adoption of price-matching guarantee. The key feature is *quality free-riding*, which occurs when shoppers free-ride on quality at the high quality firm but buy from the low quality firm at a lower price. A natural response to quality free-riding is for the high quality firm to adopt a price-matching guarantee.

3 Multi-Dimensional Product Differentiation

More recently I have worked on projects analyzing competition in multi-dimensional product characteristics spaces ([17, 18, 19]). My research in this area employs multi-dimensional models to analyze pricing and product strategies and show that the results can be qualitatively different between one-dimensional and multi-dimensional models.

In **[17]**, we analyze the welfare impacts of price discrimination using a two-dimensional Hotelling model where firms can choose which dimension(s) to price discriminate on. We find that when firms price discriminate on one but different dimensions or when firms price discriminate on both dimensions, profits go down, mimicking the standard results in one-dimensional models with *best-response asymmetry*. However, when firms price discriminate on one and the same dimension, profits go up and uniform price lies in between the discriminatory prices, similar to findings in one-dimensional models with *best-response symmetry*. The intuition is the following. Price discrimination has two opposite effects in our model. The first effect is the well-understood *intensified competition effect* which exists in both one- and two-dimensional models. The second effect is the *reduced demand elasticity effect* which exists in our two-dimensional model but not in traditional one-dimensional models. The reduced demand elasticity effect dominates when firms price discriminate on one and the same dimension, but is dominated when firms price discriminate on one but different dimensions or when firms price discriminate on both dimensions. We then endogenize firms' price discrimination decisions and show that price discrimination on one and the same dimension can be supported as a subgame perfect Nash equilibrium. Our results suggest that academics and regulators need to use more caution with the practice of price discrimination even under best-response asymmetry. Another project ([19]) extends the analysis to general consumer distribution and characterizes conditions under which similar results would hold.

Existing studies have employed multi-dimensional models to analyze firms' location choices, usually under uniform distribution. A recurring theme is that firms have incentive to maximize product differentiation on the dominant dimension but minimize differentiation on other dimensions (*Max-Min*). In [18], we employ a multi-dimensional model with general consumer distribution. The

degree of product differentiation is measured by unit transport costs as well as firms' locations. We first fix firms' locations and show that equilibrium prices can increase or decrease with unit transport cost. Next, we fix unit transport costs and endogenize firms' location choices. We find that *Max-Min* may not be an equilibrium any more and there may exist other types of equilibria.

4 Other Pricing and Product Strategies

Market structure and price dispersion: Non-linear pricing, where firms make a menu of products for consumers to self-select, has attracted significant attention in recent years. One of the main issues and a source of controversy in this literature is the relationship between market structure and price dispersion. Most of the empirical literature investigating this relationship has imposed a monotonic structure. In **[12]**, we develop a theoretical model and uncover a non-monotonic effect which encompasses contradictory findings in the literature. This non-monotonic relationship is confirmed using panel data in the U.S. airline industry. In particular, an increase in competition is associated with greater price dispersion in concentrated markets but is associated with less price dispersion in competitive markets (i.e. an inverse-U relationship).

Pricing-to-market: An extensively studied question in the trade literature is whether and how an exporter can adjust destination-specific markups to accommodate changes in exchange rates, a phenomenon called "pricing-to-market" (PTM). Most PTM studies use export unit values as the price variables which usually aggregate data on heterogeneous products. In [7] we employ a model with heterogeneous products and find that false evidence of PTM always exists when using unit values. Moreover, the size of the bias increases with the level of product differentiation. Our results suggest that some of the positive PTM results in the literature could be an artifact of the product heterogeneity embodied in unit values rather than evidence of market power and imperfect competition.

Consumer sorting: Many agricultural and natural resource goods are divided into a limited number of grades with each grade encompassing a range of qualities. Quality variability then leads to consumer sorting where buyers expend effort to identify goods of higher quality within a grade of goods. In [8] we find that allowing consumer sorting can increase profit, even when it reduces profit within the category of goods being sorted. This is because sorting within the lower quality category reduces its substitutability with the higher quality category, which in turn allows the firm to extract more surplus from the high quality category.

Loyalty programs: In [10] we investigate whether and how loyalty programs can facilitate tacit collusion. Prominent examples of loyalty programs include frequent-flier program by airlines and frequent-guest programs at hotels. We show that various types of loyalty programs (with or without commitment) facilitate tacit collusion by reducing deviation profit.

Product choice: A common assumption in studies employing Salop's circular models is that firms are symmetrically located on the circle. If entry is allowed, then firms relocate after entry so they are still symmetrically located. In [21] we characterize conditions for this assumption to hold, using a two-stage (location-then-price) circular model with general transport cost function. Both our necessary condition (for general N firms) and our sufficient condition (for 2 firms) involve the third derivative of transport cost, so having convex transport cost in general is neither necessary nor sufficient to determine equilibrium location choice.

Market foreclosure: It is well known that uniform pricing may lead to the foreclosure of weak market(s) in which case third-degree price discrimination would expand market coverage and improve efficiency unambiguously. Most existing studies analyzing the impact of price discrimination have assumed that market foreclosure does not occur under uniform pricing. In [20] [no draft], I first show that welfare results under this assumption comparing uniform pricing and price discrimination may not hold anymore once market foreclosure is allowed. Next, I compare firm(s)' incentives for market foreclosure across different market structures (monopoly vs. duopoly) and then analyze how foreclosure incentives vary with the intensity of competition in the case of duopoly. I also show that strategic market foreclosure (foreclosing a market when there is positive demand) can be an equilibrium feature under duopoly but not under monopoly.

5 Other Research

Placement of Economics PhDs: In a current project ([22] [no draft]), we collected CVs for job market candidates from top 60+ Economics PhD programs in the US for the 2007-2008 job market. From these CVs, we extracted candidate characteristics including individual characteristics (e.g., gender, nationality, adviser ranking) and program characteristics (e.g., program ranking and size). In Fall 2008 we tracked the placements of these candidates. Placement outcomes include job type (academic, government, private sector and temporary) and job location (within or outside U.S.). We then regress placement outcomes on candidate characteristics. For job type, we find that females are less likely to be placed into academic jobs and more likely to be placed into government jobs relative to male candidates, everything else the same. For job location which we include only foreign candidates, we find that males are more likely to return to their home continents relative to their female counterparts. These two empirical evidences are linked and consistent with each other through a stylized theory model with the following feature. Foreign candidates who return to their home continents are likely to face less competition from local labor forces for academic jobs than for nonacademic jobs, implying better match value to candidates for foreign academic jobs. Correspondingly, foreign placements are more likely to be academic jobs compared to placements within the U.S. and foreign female candidates are also less likely to return than their

male counterparts. We also find significant differences for candidates from a set of countries in terms of placement outcomes, especially job location.

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