Platform Pricing at Sportcard Conventions *

Ginger Zhe Jin  Marc Rysman
University of Maryland  Boston University
NBER

March 23, 2009

Way Preliminary draft! Comments welcome

Abstract

We identify several testable predictions from the theoretical literature on the economics of two-sided markets. We provide among the first reduced-form empirical tests of this literature in a new data set on sportscard conventions in the United States in the early to mid 1990’s. These conventions are a two-sided market since convention organizers must set admission and table fees to attract consumers and dealers. Some basic predictions are well borne out in the data.

*We thank Mark Armstrong, John List and seminar participants at the conference on the Future of Academic Communication at the University of Michigan for advice and comments. David Rapson, Haizhen Lin, Supatcha Mahathaleng and Lauren Moon provided excellent research assistance. All errors are our own.
1 Introduction

This paper empirically evaluates recent theoretical results about two-sided markets in the context of sportscard conventions. The theory of two-sided markets is an important recent development in industrial organization (see Armstrong, 2006; Rochet & Tirole, 2006). We present a theoretical model of two-sided markets that is particularly relevant for sportscard conventions. Our model delivers several interesting results that extend previous theoretical work. We then test those results in a new data set on sportscard conventions that is well-suited for these purposes. We believe that our paper is the first to subject the pricing predictions from the theory of two-sided markets to rigorous reduced-form empirical tests.

The literature on two-sided markets studies markets that with two (or more groups) of agents that 1) interact through an intermediary and 2) the participation or usage of each group of agents affects the utility of the other groups of agents. The intermediating firm is sometimes refereed to as a “platform” for interactions between the agents. This literature studies the “platform firm” in a market with indirect network effects. For example, consumers value video game consoles that are served by many game developers and developers value consoles that attract many of consumers. Similarly, sportscard dealers prefer conventions with many consumers (holding competition constant) and consumers prefer conventions with many dealers. The literature in the economics of two-sided markets studies the choices of intermediaries in markets with indirect network effects, and has particularly focussed on pricing. This differs from the previous literature on network effects, which tended to focus on technology adoption and network size, although this distinction is not perfect. For more on network effects, and definitional issues in
two-sided markets, see Farrell & Klemperer (2007), Rochet & Tirole (2006) and ?.

Sportscard conventions are events, typically lasting one to four days, at which sellers (dealers) of sports cards interact with consumers that visit the convention. For several reasons, sportscard conventions provide an excellent environment in which to study the theory of two-sided markets, particularly the predictions for pricing. First, conventions are two-sided markets. A successful convention requires both buyers and dealers to appear at the convention, and a convention organizer must take this account in setting prices. Second, pricing is very simple and observable. Dealers and consumers pay separate fixed fees only. There are no transaction fees or other complicating issues. We observe these fixed fees in a set of uniformly formatted classified advertisements in a trade magazine. Third, there are a huge number of conventions in the United States, more than two thousand per month at the height of their popularity, which gives us tremendous leverage for econometric estimation, as well as important panel variation in market structure. ¹

We present a theoretical model based on Armstrong (2006) of competition between platforms in a two-sided market. We use our model to establish two important results that we bring to data. The first is that more competition on one side of the market has a larger negative effect on prices on that side than the other side. New to our model, we show that the price on the other side of the market can even increase. Second, as foreshadowed in Armstrong & Wright (2007), if competition increases on one side of the market, a platform

¹As a comparison to sportscard conventions, consider the video game industry, a canonical example in theoretical papers on two-sided markets. With video games, the number of important firms in the platform and game market is less than 25, contracts are complex and secret, and technological change makes time series variation difficult to interpret.
reduces price on that side more if the price on the other side is constrained not to move. We argue below that both of these results would be difficult to rationalize without the theory of two-sided markets.

We find support for our two theoretical results in our empirical work. For our first main result, we require variation in competition that affects one side of the market more than the other. For this, we distinguish between the number of competitors that are nearby in geographical distance from those that are far. For instance, suppose a consumer is equidistant between two conventions that are far from each other, say 100 miles apart. The consumer will likely pick just one of the conventions to visit. However, a dealer may split its collection and establish a presence at both conventions. In the parlance of Rochet & Tirole (2003), the consumer single-homes whereas the dealer multi-homes. As established in the theory of two-sided markets, platforms compete more heavily for single-homing consumers. In our empirical results, we find that platforms that face more close competitors within 25 to 50 miles lower prices for both consumers and dealers. Similarly, competitors within 100 to 150 miles lead to lower prices to consumers. But these far competitors lead to no change in dealer prices, or even higher prices, consistent with a scenario in which far conventions compete more heavily for consumers.

The second main result depends on conventions whose prices are constrained on one side of the market. To capture this issue, we use conventions that charge zero admission fee to consumers, about half the conventions in our data set. Presumably, they would not change this price in response to small changes in the number of competitors. We show that conventions with free admission reduce the price to dealers significantly more in response to competition than those with positive admission fees.

Several papers seek to empirically evaluate two-sided markets. Rysman
(2004) estimates the positive feedback loop between advertising and entry in the Yellow Pages market and to evaluate the welfare effects of entry. Kaiser & Wright (2006) study pricing in the German magazine market and Argentesi & Filistrucchi (2007) studies market power in the Italian newspaper market. Lee (2008) evaluates exclusive contracting in the video-game market. Each of these papers is structural in the sense that it estimates an explicit theoretical model, which makes it difficult to detect if the model does not hold. Our paper differs in that we take a “reduced-form” approach. We do not impose a theoretical model but rather seek to determine whether correlation in data is consistent with proposed theories. Such an approach seems natural given that both the theoretical and empirical literatures are at such an early stage. Another paper taking a reduced-form approach to this area is Genakos & Valletti (2007), who show that lower termination revenue for cellular phone providers leads to higher fees to subscribers.\(^2\)

\section{Industry and Data}

Collecting sports cards and sports memorabilia is a popular pastime in the United States. Sports cards are small cards with a picture of a professional player and the player’s statistics. Baseball cards are the most popular. Collectors value cards of top players in top years, as well as complete sets and high quality cards. Collectors are often interested in other types of memorabilia, such as game balls or other equipment, or player signatures. The

\(^2\)A related empirical literature focuses on indirect network effects, such as Gandal, Kende & Rob (2000), Saloner & Shepard (1995) and ?. Consistent with the theoretical literature on network effects, these papers focus on technology adoption rather than pricing by an intermediary.
popularity of collecting cards can vary a great deal, including seasonally with
whether a sport is in season, and regionally with the success of the local team.
A major event in our data set is the strike in Major League Baseball in 1994,
which hurt the popularity of the league and of collecting baseball cards.

Sports card conventions provide short events for dealers and consumers to
come together. While a number of dealers establish retail shops, many deal-
ers trade entirely at conventions. A small convention may last one day and
consist of 10 tables set up at a mall. The largest conventions have 250 tables,
last a week and take over a large convention center in a major city. Conven-
tion organizers rent the location, advertise the convention and charge fees to
dealers and consumers. Conventions often promise the appearance of pro-
fessional athletes who will provide signatures for free. Organizers primarily
profit for the fees they charge, although some organizers are also dealers who
will trade cards at the convention. Both the organizer and dealer markets are
extremely unconcentrated and are characterized by many small participants,
many of whom have separate full-time jobs unrelated to sports cards.

Pricing at conventions is very simple. Consumers and dealers pay a fixed
fee to the convention organizer. Typically, consumers pay less than $2, with
about half of the conventions in our data set offering free admission. Dealers
pay the “table fee”, typically $50 to $250. The table fee allows the dealer
to set up a table at the convention. Prices at multi-day events may be more
complicated, with prices varying by day (for instance, weekend prices are
typically higher) or with lower per-day fees for admission over multiple days.
Also, we observe some discounts from the table fee for purchasing multiple
tables.

Our data set is based on the trade magazine *Becket Baseball Card Monthly.*
This magazine provides articles on baseball and collecting, market prices for
huge numbers of cards, and most importantly for our purposes, listings for sports card conventions (the “Convention Calendar”). Listing is free and, as we understand it, every convention would be sure to place a listing in this magazine. The magazine requires that listed conventions have at least 10 tables, although this does not appear to be binding (see below). Each calendar covers the month of the issue, so the October 1997 issue has listings for all conventions in that October.

Our data set consists of the convention listing from a selection of issues of this magazine. Convention organizers fill out a standard form and listings follow a uniform pattern, which is amenable to computer interpretation. To create our data set, we scanned in all of the listings and used an Optimal Character Recognition (OCR) program (in particular ABBYY PDF Transformer 1.0) to convert these scans to Microsoft Word files. Then we wrote computer programs to parse the results into a usable data set. Each convention lists the city or town in which it occurs. We match these towns to a list of towns from the U.S. Census and assign the longitude and latitude of the town to the convention. Hence, we assume that each convention is located in the population center of the town in which it occurs. We drop conventions that do not occur in the continental United States.

Both the OCR step and the parsing step created many errors, which we corrected for by hand. Also, matching the town name in the listing to a census town sometimes required judgement, but was usually straightforward,

---

3We thank John List for providing us with his collection of Becket Baseball Cards Monthly.

4The listings provide addresses which in principal could be used to more accurately identify locations. However, many addresses are descriptive (“VFW Hall” or “Westgate Mall”) and therefore difficult to geocode. Even for the entries that provide a a street address, cleaning them would be an enormous task.
especially because we could check the listed address to make sure it made sense. There were more errors in months with more listings because the magazine switched to smaller font sizes, so it was important to do a thorough manual check in order to eliminate this potential selection issue. We dropped some listings that did not provide town names that we could reliably match to a location in the census. Altogether, we have data on 50,450 conventions in 36 months over 9 years.

For each listing, we use the dates of the convention, the town and state, the number of tables, the admission fee for consumers and the table fee for dealers. For prices, we always took the price for a single day of admission if there were discounts for multi-day admission. We used the simple average of prices if there were different prices for different days. We took the price for a single table if there were discounts for multiple tables.

Our selection of magazines range from April, 1989 to December, 1997, for a total of 36 issues. As the magazines are drawn from a personal collection, it is not a continuous set of magazines. We made a number of attempts to find missing issues, for instance at public libraries. We purposely stopped collecting data after 1997, which coincides with the popularity of the World Wide Web. There is a significant decline the number of conventions during the late 1990’s which makes our approach difficult since we rely on the presence of competition to create our tests. Table 1 lists the issues of the magazine in

---

5 We discarded some information: the exact location, the times of day of each convention and the contact name and number. The contact names are potentially very interesting but difficult to clean reliably.

6 The impact of the Web on the convention market represents an interesting topic in its own right, as in Emre, Hortascu & Syverson (2005) for booksellers and travel agents. We have not pursued the issue in part because it would be difficult to determine the channel by which the Web affects conventions. Not only does the Web represent an alternative method
Table 1: Number of conventions and average by 3 digit zip code for each month in data set.

<table>
<thead>
<tr>
<th>Date</th>
<th>mean count</th>
<th>Date</th>
<th>mean count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1989 Apr.</td>
<td>1.90</td>
<td>497</td>
<td>1994 Oct.</td>
</tr>
<tr>
<td>Aug.</td>
<td>1.80</td>
<td>386</td>
<td>1995 Feb.</td>
</tr>
<tr>
<td>1990 Nov.</td>
<td>2.80</td>
<td>1276</td>
<td>Apr.</td>
</tr>
<tr>
<td>Dec.</td>
<td>2.84</td>
<td>1278</td>
<td>May.</td>
</tr>
<tr>
<td>1991 Nov.</td>
<td>3.97</td>
<td>2206</td>
<td>Aug.</td>
</tr>
<tr>
<td>1992 Jan.</td>
<td>3.90</td>
<td>1805</td>
<td>Nov.</td>
</tr>
<tr>
<td>Apr.</td>
<td>4.23</td>
<td>2477</td>
<td>1996 Feb.</td>
</tr>
<tr>
<td>Jul.</td>
<td>4.35</td>
<td>2294</td>
<td>Jun.</td>
</tr>
<tr>
<td>Oct.</td>
<td>3.99</td>
<td>2233</td>
<td>Sep.</td>
</tr>
<tr>
<td>Nov.</td>
<td>4.16</td>
<td>2294</td>
<td>Oct.</td>
</tr>
<tr>
<td>1993 Feb.</td>
<td>3.57</td>
<td>1797</td>
<td>1997 Feb.</td>
</tr>
<tr>
<td>Mar.</td>
<td>3.75</td>
<td>1950</td>
<td>Apr.</td>
</tr>
<tr>
<td>Apr.</td>
<td>3.70</td>
<td>2084</td>
<td>May.</td>
</tr>
<tr>
<td>Jul.</td>
<td>3.64</td>
<td>1840</td>
<td>Jun.</td>
</tr>
<tr>
<td>1994 Feb.</td>
<td>3.41</td>
<td>1646</td>
<td>Jul.</td>
</tr>
<tr>
<td>May.</td>
<td>3.63</td>
<td>1827</td>
<td>Aug.</td>
</tr>
<tr>
<td>Jul.</td>
<td>3.38</td>
<td>1963</td>
<td>Oct.</td>
</tr>
<tr>
<td>Aug.</td>
<td>3.32</td>
<td>1516</td>
<td>Dec.</td>
</tr>
</tbody>
</table>

the data set, along with the number of conventions in each issue. Figure 1 graphs this series. There is a peak in activity in the Summer and Fall of 1992 when there are regularly more than 2000 conventions in a month. There is a steady decline afterwards, presumably due to the baseball strike in 1994 and the popularity of the Internet. In 1997, there are less than 1000 conventions per month.

We are interested in oligopoly interactions, so it is useful to get a sense of the number of conventions in any given region. Table 1 provides the mean number of conventions per 3-digit zip code by month for zip codes that have at least one convention. The overall average is 3.15, and this ranges from 1.90 to 4.35 in months with low and high activity. A graph looks like Figure 1 for trading cards, the Web represents an alternative leisure activity which substitutes for card collecting altogether.
almost exactly. Not surprisingly, the distribution underlying these means is highly skewed. Table 2 displays the number of 3-digit zip code-months with each count of the number of conventions. For instance, there are 6,886 zip code-months in which we observe only 1 convention in a month, which represents 43.04 percent of the data. Zip code-months with three or less conventions represent almost 75% of the data, and 10 or less represents 95% of the data. There is a tail of observations with a large number of conventions, the maximum being 49 conventions in a 3 digit zip code in a single month.

The number of tables at a convention is an important explanatory variable for price. We treat the number of tables as an exogenous measure of the quality of the convention. Clearly, the quantity of dealers that purchase a table at the convention may be endogenous to the price of a table. However, the “number of tables” listed in the calendar is determined well before a final count of how many dealers will appear is available. We regard the posted number as “cheap talk” that serves to inform readers of the expected size of the event. Consider that the “number of tables” variable falls disproportionately on multiples of 5 (like 10, 15, 20 etc.), unlike a true measure
Table 2: Number of conventions per 3-digit zip code.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6,886</td>
<td>43.04</td>
<td>43.04</td>
<td>11</td>
<td>135</td>
<td>0.84</td>
<td>96.1</td>
</tr>
<tr>
<td>2</td>
<td>3,285</td>
<td>20.53</td>
<td>63.57</td>
<td>12</td>
<td>88</td>
<td>0.55</td>
<td>96.65</td>
</tr>
<tr>
<td>3</td>
<td>1,745</td>
<td>10.91</td>
<td>74.48</td>
<td>13</td>
<td>91</td>
<td>0.57</td>
<td>97.22</td>
</tr>
<tr>
<td>4</td>
<td>1,154</td>
<td>7.21</td>
<td>81.69</td>
<td>14</td>
<td>65</td>
<td>0.41</td>
<td>97.62</td>
</tr>
<tr>
<td>5</td>
<td>717</td>
<td>4.48</td>
<td>86.17</td>
<td>15</td>
<td>52</td>
<td>0.33</td>
<td>97.95</td>
</tr>
<tr>
<td>6</td>
<td>458</td>
<td>2.86</td>
<td>89.04</td>
<td>16</td>
<td>49</td>
<td>0.31</td>
<td>98.26</td>
</tr>
<tr>
<td>7</td>
<td>376</td>
<td>2.35</td>
<td>91.39</td>
<td>17</td>
<td>46</td>
<td>0.29</td>
<td>98.54</td>
</tr>
<tr>
<td>8</td>
<td>243</td>
<td>1.52</td>
<td>92.91</td>
<td>18</td>
<td>23</td>
<td>0.14</td>
<td>98.69</td>
</tr>
<tr>
<td>9</td>
<td>207</td>
<td>1.29</td>
<td>94.2</td>
<td>19</td>
<td>25</td>
<td>0.16</td>
<td>98.84</td>
</tr>
<tr>
<td>10</td>
<td>169</td>
<td>1.06</td>
<td>95.26</td>
<td>&gt;19</td>
<td>185</td>
<td>1.2</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 2 describes the distribution of the number of tables. The mean is 41.6 and the median is 35. The distribution is approximately log normal. The 99th percentile is 160. The magazine requires that conventions have at least 10 tables but this does not appear to be binding. A number of conventions list less than 10 tables and the number of conventions listing 10 is not large compared to surrounding numbers. For instance, 589 conventions

7We do not observe other measures of quality. However, some conventions take out display advertisements in the calendar section, and from these it is clear that larger conventions offer extra features such as autograph sessions with athletes, door prizes and free raffles.
Table 3: Distribution of the number of tables.

<table>
<thead>
<tr>
<th>Perc.</th>
<th>Tables</th>
<th>Perc.</th>
<th>Tables</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
<td>75</td>
<td>50</td>
</tr>
<tr>
<td>5</td>
<td>15</td>
<td>90</td>
<td>70</td>
</tr>
<tr>
<td>10</td>
<td>20</td>
<td>95</td>
<td>90</td>
</tr>
<tr>
<td>25</td>
<td>25</td>
<td>99</td>
<td>160</td>
</tr>
<tr>
<td>Median</td>
<td>35</td>
<td>Mean</td>
<td>41.6</td>
</tr>
</tbody>
</table>

Table 4: Distribution of table fee

<table>
<thead>
<tr>
<th>Perc.</th>
<th>Tables</th>
<th>Perc.</th>
<th>Tables</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
<td>75</td>
<td>50</td>
</tr>
<tr>
<td>5</td>
<td>15</td>
<td>90</td>
<td>80</td>
</tr>
<tr>
<td>10</td>
<td>20</td>
<td>95</td>
<td>102.5</td>
</tr>
<tr>
<td>25</td>
<td>25</td>
<td>99</td>
<td>165</td>
</tr>
<tr>
<td>Median</td>
<td>35</td>
<td>Mean</td>
<td>43.7</td>
</tr>
</tbody>
</table>

List 10 tables and 1,502 list 15, and 4,212 list 20. We find missing listings or listing of 0 number of tables at 1,853 observations and drop these in our statistical work.

Most conventions, 77.1%, last only one day. Almost all (98.8%) last three days or less. Most take place on weekends. In our data, 49% cover a Saturday, 53.7% cover a Sunday and 81% cover Saturday or Sunday.

The dependent variables in our empirical work are the prices. Table 4 displays the distribution of the table fee. The mean is $43.7 and the median is $35. The distribution is approximately log normal, with a long tail of expensive conventions. The 99th percentile is $165 but we observe a few with table fees greater than $1000.

A striking feature of the distribution of the admission fee is that 52.9% of conventions feature free admission. A further 29.6% charge a fee of $1. There is little further variation, with much of it falling on multiples of 50 cents. The
95th percentile is $2. These features lead us to model the admission fee as a binary variable so we simply predict whether admission is free or not. With more than 80% of the observations choosing 0 or 1, this seems like a decent approximation. Furthermore, using a model that incorporates some continuity in the dependent variable (such as the tobit model) still requires us to estimate a non-linear model and it is challenging to incorporate fixed effects in such models, but for the binary logit case. Figure 2 graphs the distribution of admission fees in a histogram.

We compute the number of competitors that a convention faces by counting the number of conventions within a given range of time and geographic distance. For example, we calculate the number of conventions on the same day within 25 miles. To do so, we use any competing convention that has at least one day that overlaps with the convention in question. As stated above, we calculate distance based on the latitude and longitude of the relevant

---

8We experimented with models such as linear models (solved by OLS) and the tobit but we found little of interest. Perhaps it is not surprising that our explanatory variables do not appear important in predicting such small differences in prices, (e.g. whether a convention charges 50 cents or a dollar).
Table 5: Average number of competitors by distance

towns in the U.S. Census. Table 5 provides average number of competitors by different distances. Note that computing the “within three days” variable, we treat the observation as missing for any convention for which we do not have data on conventions within three days. So for instance, a convention on April 30, 1989 would be problematic since we do not have the May, 1989 issue so we cannot count all conventions within three days. Hence, Table 5 displays a lower number of observations for the “same weekend” row than the “same day” row.

3 Model

In this section, we study a model of a two-sided market in order to derive testable implications for our empirical work. We base our work closely on the model of Armstrong (2006) and the extensions in Armstrong & Wright (2007). The models are useful for representing the sports card convention market because they address competition between two platforms that charge only a fixed fee to each consumer and do not charge based on the number of trades a consumer makes through the platform. We extend their model to allow for a market expansion effect. While doing so complicates the model such that we analyze it numerically, it also provides more realistic results to take to data.
Consider two groups of consumers 1 and 2. We will sometimes refer to markets 1 and 2, indexed by \( m \). Consumers are distributed uniformly in locations 0 to \( L \) in each market, with consumer \( i \) in location \( l_i \). There are two firms (or “platforms”) \( A \) and \( B \). The firms sell to both sets of consumers simultaneously. The location of firm \( j \) in market \( m \) is \( l_j^m \).

Consumers value a firm based on how many consumers the firm serves in the other market. Suppose firm \( j \) sells to \( n_j^1 \) and \( n_j^2 \) consumers in markets 1 and 2. The utility to consumer \( i \) in markets 1 is:

\[
v + \alpha n_j^2 - p_j^1 - t|l_i - l_j^1|
\]

where \( v \) represents the stand-alone utility of purchase, \( \alpha \) represents the value of conferred by sales in market 2, \( p_j^1 \) is the price of firm \( j \) in market 1, and \( t \) is the travel cost. Utility to consumers in market 2 is defined analogously. Consumers pick the firm that gives the highest utility. We assume that firms have no costs. We assume that consumers purchase from only one firm, and therefore we do not consider the case of multi-homing. We also do not explicitly consider externalities within a group of consumers, which might arise if one set of consumers are card dealers that compete with each other. Wright (2005) presents a model with within-group competition that turns out to be just a change of variables from the model we consider.

We are interested in cases in which first, some consumers between the two firms prefer to purchase from either firm to not purchasing and second, some

\[9\] Consumer \( i \) in market 1 bears no relationship with consumer \( i \) in market 2. We do not index \( l_i \) by market for notational convenience. Note also that one set of consumers may be selling a product to the other set but we refer to both sets as consumers, as they consume the services of the platform firm.

\[10\] Armstrong & Wright (2007) show that if consumers obtain \( v \) only once when multi-homing, it is generally not restrictive to assume that consumers single-home in this model.
consumers (on the ends of the lines) do not purchase. The first condition ensures that there is a competitive interaction between the firms and the second ensures that there is a demand expansion effect to lower prices.

Armstrong (2006) obtains simple analytic solutions by placing firms at the ends of the line. However, the lack of a demand expansion effect leads to some unrealistic implications. While we can solve our version of the model analytically, the resulting equations are difficult to interpret. Instead, we can make useful inferences from numerical computations. We parameterize the model as follows:

**Assumption 1** \( L = 3 \). \( l_1^A = l_2^A = 1 \). \( l_1^B = 2 \). \( 1 < l_2^B < 3 \)

Assumption 1 locates firms some distance from the ends of the distribution of consumers.

We are interested in comparative statics of prices in \( l_2^B \). To get a sense of the whole set of prices, consider the specification with \( t = 1 \) and \( \alpha = 0.3 \). These parameters imply that for \( l_2^B = 2 \), all consumers in both markets between locations 1 and 2 purchase while some consumers on each end in both markets do not purchase. Then, prices are:

\[
\begin{align*}
p_1^A &= 0.60 - 0.07l_2^B \\
p_2^A &= 0.01 + 0.22l_2^B \\
p_1^B &= 0.57 - 0.065l_2^B \\
p_2^B &= -0.57 + 0.52l_2^B
\end{align*}
\]

Not surprisingly, firm A increases its price as firm B becomes farther away in that market. However, we also see that firm A decreases its price (in market 1) as firm B becomes farther away (in market 2). This surprising result is a feature of the two-sided set-up we analyze.

More generally, allowing \( \alpha \) and \( t \) to vary, we can show that: \(^{11}\)

\(^{11}\)We use \( \propto \) to mean “proportional to.”
This result implies that $p_1^A$ decreases as firm $B$ becomes farther away in market 2 if $0 < \alpha < 0.831t$. Finding that prices increase in competition would be a very surprising result that would be difficult to replicate in a model with only single-sided interaction.

In empirical implementation, we do not have measures of competition that strictly affect one side of the market and not the other. However, we do have measures that we believe affect one side more than the other. These results suggest that the table fee should be less affected than the consumer fee by competition that is primarily for consumers. To the extent that our measurement of consumer competition is very accurate, we might even see the table fee increase in competition for consumers.

4 Empirics

We present a series of regressions that explore the questions raised in the theoretical section. The first regression simply relates prices to a measure of competition. This regression does not address any issues raised by two-sided markets but rather serves to verify that our measure of competition affects the dependent variable in a sensible way. Results appear in the first four columns of Table 6. For each regression, we include unreported fixed effects for 3-digit zip codes, time (at the level of the month) and the day of the week. The day-of-the-week dummy variables are set to one for each day a convention covers. For instance, a convention that appears on a Friday and
a Saturday has both the Friday and Saturday dummy variables set to one. In order to study a more homogenous data set, we restrict the data set to conventions that last less than four days.

The dependent variable for the first two columns is a binary variable set to one if the convention sets an admission fee greater than zero. We use Chamberlain’s conditional logit model (cite?). The variable of primary interest is the effect of competition. In column one, competition is measured as the count of conventions within 25 miles that appear on the same day. That is, competing conventions must overlap by at least one day in the calendar. Column 2 uses a distance of 50 miles. We add one to the number of conventions and take the log.

We see that both measures of competition have a negative effect on the likelihood of setting a non-zero admission fee and that this effect is significantly different from zero at a confidence level of 1%. While economists normally expect competition to lead to lower prices, it is not unusual to find a positive correlation between entry and prices in empirical work because of unobserved geographic heterogeneity. That is, locations that have high demand for some unobservable reason tend to have many entrants and high prices. However, we conclude from this regression that our measure of competition and our fixed effects strategy properly addresses this omitted variable problem, at least in part.

We see similar results when we use the log of the table fee as the dependent variable. We use a linear model for the table fee and estimate with linear

---

12 We use conditioning to address the location fixed effects and capture the rest as dummy variable regressors.

13 Unfortunately, we cannot compute economic magnitudes for the conditional logit since marginal effects for non-linear models depend on the level of the explanatory variables and the fixed effects are not recoverable.
panel data techniques. Again, for distances of both 25 and 50 miles, we see negative coefficients that are precisely estimated. The effect is not large – the elasticity is around -0.02. But we believe this to be an upper bound due to the positive correlation induced by unobserved heterogeneity. Note that the number of observations is slightly lower when we use the table fee because the table is missing for a number of observations. Restricting the admissions fee regressions to observations in which the table fee is present does not change results (although leads to slightly less observations than in the table fee regression since the fixed effect approaches drop groups for which the dependent variable does not vary, which happens more often for the binary admission fee variable than the continuous table fee).

Both regressions include two other control variables, the log of the number of tables and the log of the duration of the convention (measured in days). Not surprisingly, bigger conventions charge more both to consumers and to dealers. Similarly, longer conventions charge more to dealers. However, we find the surprising result that longer conventions are less likely to charge consumers, even though length is presumably correlated with quality. The role of quality in two-sided market settings is largely unexplored in the theoretical literature, but one explanation could be that price elasticities for dealers and consumers change at different rates as quality increases. Hence, dealers may be particularly price inelastic to long conventions or become particularly responsive to consumer attendance. In contrast, consumers maintain or increase their elasticity or respond less to dealer attendance. In these cases, long conventions find it optimal to admit consumers for free, attract many consumers and exploit dealers.\footnote{An alternative explanation is that longer conventions are run by more sophisticated organizers who recognize the value of admitting consumers for free. We doubt that any convention organizer does not understand the two-sided nature of this market, but we}
Table 6: Regressions on competition and constrained conventions

Next, we distinguish between “near competition” and “far competition”. We define near to be those conventions within 25 or 50 miles, and far to be those within 100 or 150 miles, not including near competitors. Again, we require all competitors to overlap in calendar time by at least one day. Because we expect that these far competitors might affect dealers and consumer differently, we expect to see the implications of two-sidedness in these results. Results appear in Table 7. We see that for all definitions of distance, both near and far competition make free admission more likely. All effects are significant at traditional confidence levels. Not surprisingly, the coefficient on far competition is smaller, although this may in part be due to the different sizes of the near and far competition variables. Near competition also drives down table fees with effects similar to what we found in Table 6.
However, far competition measured within a 100 mile radius has no significant effect on dealer prices, and far competition measured within 150 miles has a positive effect on prices. Our model of two-sided markets provides a potential explanation: if far conventions compete for consumers but not dealers (or more strongly for consumers than dealers), than we expect to see far competition lead to lower prices for consumers and higher prices for dealers. This is a natural hypothesis: consumers facing distant conventions will typically attend only one, whereas dealers can split their inventories and set up tables at two conventions. The key feature of our result is the pairing of the negative coefficient on one side of the market with the positive coefficient on the other side.\textsuperscript{15}

An alternative explanation for the positive coefficient on far competition is that unobserved temporal-geographic heterogeneity causes this result. This idea is rather hard to formulate however, because we include time and location fixed effects and because we find a negative coefficient on the near competition. While it is plausible that there is heterogeneity that varies over time and space jointly, it must also somehow operate in a wider area more strongly than a local area.

The second theoretical point that we wish to study is that conventions constrained on one side of the market respond more strongly to competition than those that are not constrained. We interpret conventions that set a zero admission fee to be constrained. Obviously, they are not truly constrained to use free admission, but presumably these conventions would not change

\textsuperscript{15}In theory, one might expect to see this result in near competition as well. For instance, we could see negative coefficient on consumers but a positive coefficient on dealers. Without specifying an explicit model, our prior in this exercise was that nearby competition would lower prices for everyone.
<table>
<thead>
<tr>
<th>Dependent Var.</th>
<th>Admission Fee</th>
<th>Table Fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Near Mileage</td>
<td>25 25 50 50</td>
<td>25 25 50 50</td>
</tr>
<tr>
<td>Far Mileage</td>
<td>100 150 100 150</td>
<td>100 150 100 150</td>
</tr>
<tr>
<td>ln(Near Comp)</td>
<td>-0.104 *** -0.108 *** -0.073 *** -0.076 ***</td>
<td>-0.022 *** -0.023 *** -0.016 *** -0.017 ***</td>
</tr>
<tr>
<td></td>
<td>(0.026) (0.026) (0.024) (0.024)</td>
<td>(0.004) (0.004) (0.003) (0.003)</td>
</tr>
<tr>
<td>ln(Far Comp)</td>
<td>-0.062 *** -0.043 * -0.065 *** -0.046 *</td>
<td>-0.001 0.006 * -0.002 0.007 **</td>
</tr>
<tr>
<td></td>
<td>(0.024) (0.025) (0.024) (0.025)</td>
<td>(0.003) (0.003) (0.003) (0.003)</td>
</tr>
<tr>
<td>ln(# of tables)</td>
<td>0.81 *** 0.812 *** 0.808 *** 0.801 ***</td>
<td>0.281 *** 0.281 *** 0.281 *** 0.281 ***</td>
</tr>
<tr>
<td></td>
<td>(0.027) (0.027) (0.027) (0.027)</td>
<td>(0.004) (0.004) (0.004) (0.004)</td>
</tr>
<tr>
<td>ln(Duration)</td>
<td>-1.699 *** -1.711 *** -1.698 *** -1.684 ***</td>
<td>0.809 *** 0.803 *** 0.810 *** 0.804 ***</td>
</tr>
<tr>
<td></td>
<td>(0.060) (0.062) (0.060) (0.061)</td>
<td>(0.008) (0.008) (0.008) (0.008)</td>
</tr>
<tr>
<td>Observations</td>
<td>47606</td>
<td>45965</td>
</tr>
</tbody>
</table>

Standard errors in parenthesis, *** for 1% confidence, ** for 5%, * for 10%

Notes: Admission fee is estimated by a conditional logit model for being non-zero. Table fee is estimated logged in a linear model.
All models include fixed effects for zip codes (3 digit level), time (monthly) and day-of-the-week (on for each day a convention covers).
Near competition is the number of conventions with the "Near Mileage" number that overlap in the calendar. Far competition uses the "Far Mileage" number, and is not inclusive to near competition. We add 1 to each number to address log zeros.

Table 7: Regressions on near and far competition

their fee in response to small changes in exogenous variables. There is a sense in which every convention is constrained as they tend to use round numbers for the admission fee so it does not appear to be a truly continuous choice variable. However, we view the conventions with free admission as the “most constrained” in the sense that they would be least likely to adjust their admission fee in response to local changes in their market variables.

Returning to Table 6, the last two columns regress the log of the table fee on a dummy variable for having a zero admission fee (the constrained firms) and, of most interest, an interaction between this dummy variable and competition. In these cases, the independent competition variable becomes insignificant and instead we see the negative effect on the interaction term, with essentially double the magnitude. That is, most of the negative effect of competition that we observed earlier appears to be coming from the constrained firms. As theory predicts, constrained firms respond more strongly to competition than unconstrained firms.
5 Conclusion

We identify several testable predictions from the theoretical literature on the economics of two-sided markets. We provide among the first reduced-form empirical tests of this literature in a new data set on sportscard conventions in the United States in the early to mid 1990’s. These conventions are a two-sided market since convention organizers must set admission and table fees to attract consumers and dealers. Some basic predictions are well borne out in the data.
References


