MAJOR LEAGUE BASEBALL: DYNAMIC TICKET PRICING AND MEASUREMENT COSTS

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Abstract

This paper discusses dynamic ticket pricing by Major League Baseball and how it applies to the measurement or transaction explanation of pricing. Key reductions in the cost of measuring margins that vary in value, such as the win/loss record of the opposing team, are identified, and these reductions in measurement cost help explain the switch from static to variable to dynamic pricing of tickets. Instructors of intermediate microeconomics and managerial economics that wish to discuss dynamic pricing may find this example interesting to sports oriented students.

Key Words: major league baseball, dynamic ticket pricing, measurement costs

JEL Classifications: A2, D4, M2

Introduction

Several decades ago, Major League Baseball (MLB) teams set prices for their stadium seats at the beginning of the season and did not adjust these prices as the season progressed. In the last decade, some teams have adopted dynamic pricing for some of their tickets. This system has been used for years in the airlines and hotel industries and on websites such as eBay and Amazon.com (Bitran and Mondschein, 1995; Kines, 2010; Demmert, 1973). With dynamic pricing, the price of tickets is adjusted on a daily or hourly basis, right up to the time of a game, in accordance with changing patterns of demand. By responding to market fluctuations, dynamic pricing allows firms to adjust prices to correspond with buyers' changing willingness to pay.

The airline industry is often characterized as a success story in dynamic pricing. Indeed, it utilizes this technique so skillfully that most of the passengers on any given plane have paid different ticket prices for the same flight. With the advent of improving information technologies and forecasting software, dynamic ticket pricing spread to the sports business in 2008 when the San Francisco Giants became the first Major League Baseball (MLB) team to use this technique in the pricing of single-game tickets. Moreover, dynamic ticket pricing is now being used across Major League Soccer, the National Basketball Association, the National Hockey League, NASCAR, and college football. The purpose of this paper is to analyze and describe the introduction of dynamic pricing to MLB.

While undergraduate textbooks in intermediate microeconomics and managerial economics include extensive discussions on pricing strategies, they do not generally discuss dynamic pricing. For example in intermediate microeconomics, neither Pindyck & Rubinfeld nor Goolsbee, Levitt & Syverson discuss which margins to price, nor how frequently to change prices. In managerial textbooks, McGuigan, Moyers & Harris do mention dynamic pricing, but

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only in a complicated business to business internet sales context. Boyes mentions peak load pricing in an example related to electricity markets, but does not describe the circumstances under which it becomes optimal to change prices.

Since the adoption of dynamic pricing by MLB, several papers have been published dealing with this topic (Drayer, Shapiro, and Lee, 2012; Kobritz and Palmer, 2011). As with this paper, the advantages and disadvantages of dynamic pricing are addressed in the context of the professional sports industry (Kyle and Sibdari, 2009). What this paper contributes is an explanation of change; if dynamic pricing works so well, why was it adopted decades ago in the airline and hotel industries yet not introduced to MLB until 2008? Drayer et al suggest rising costs created a “need” for more revenue. This paper claims that MLB teams have always “needed” revenue, and that what has changed is the cost of measuring and pricing different factors that change the value of a particular ticket, such as the win/loss record of the opposing team. Measurement cost theory helps explain the introduction of dynamic pricing to MLB.

A Primer on Measurement Costs

Measurement or transaction cost theory was developed in the 1980s (Barzel, 1982, 1989) to address limitations of the perfect information assumption of Neoclassical economics. Starting with most of the assumptions of Neoclassical theory, including many maximizing buyers and sellers, rising marginal costs, and diminishing marginal value, measurement cost theory added the assumption of positive transaction costs. These are real costs associated with buyers and sellers protecting property rights when engaging in economic transactions. Below is an example to make these abstract concepts clear.

Suppose the product is fresh tomatoes, and start with all of the Neoclassical assumptions including homogeneous goods. Each tomato is identical to any other tomato, and the market price acts to equate the supply of tomatoes with the demand for tomatoes. The price may be in either dollars per tomato, or dollars per pound of tomato. These units of measurement are interchangeable and irrelevant, for each tomato is identical, so a pound of tomatoes always contains the same number of tomatoes. This is the theory that is taught as supply and demand in introductory economics courses.

But now drop the assumption of homogeneous tomatoes; let them vary by size. Add a cost for both counting and weighing tomatoes, with the cost of weighing greater than the cost of counting. Suppose initially sellers choose to market their tomatoes with a price per tomato in order to economize on the cost of weighing. What will happen?

If tomatoes are priced on a per unit basis, yet the units vary in size, maximizing consumers will compete to acquire the larger tomatoes; they will spend resources sorting to find the larger tomatoes. Each consumer will evaluate tomatoes until the expected value of finding another large tomato has decreased to the cost of searching for one more tomato – the standard marginal condition of utility maximization. The cost of sorting is a transaction costs, which may be defined as the costs buyers and sellers incur to ensure that they are receiving the maximum value from a transaction (Barzel, 1989).

When a margin of value such as the size of the tomato is not priced, and buyers compete for the more valuable items by spending resources (in this case sorting), the un-priced value is considered *Common Property* or *Left in the Public Domain.* While each consumer may be maximizing, competition by means of sorting does not maximize the aggregate value of all tomato transactions. This is because the same smaller tomato is repeatedly evaluated (and rejected) by consumers. The cost of sorting the same small tomato again and again is a deadweight loss – no one receives it. The aggregate value of tomato sales would be higher if tomatoes were only sorted once.

The cost of excess sorting is born by both buyers and sellers. Since consumers anticipate incurring sorting (transaction) costs when purchasing tomatoes, their willingness to pay is reduced by this expected costs. This results in deadweight loss analogous to the deadweight loss of a tax, and in the same way as a tax, the loss in value is divided between buyers and sellers. Sellers may decide to reduce multiple sorting costs (and therefore increase consumers' willingness to pay) by performing the sorting themselves. Perhaps they sort tomatoes into two categories, large and small, and price each accordingly. This reduces the value to customers from sorting the tomatoes, and since there is less to be gained by sorting within the presorted category, consumers will do less of it. Sorting by consumers could be eliminated entirely if sellers perform sorting to a fine enough scale – not two categories, but a continuum of categories. Of course this is the same as weighing each tomato.

What drove the sorting equilibrium was the assumption that weighing is more expensive than counting. However, technological changes have reduced the cost of weighing tomatoes. The inclusion of automatic scales integrated into the cash register have eliminated the role of a separate produce clerk. Sellers responded to this reduction in the cost of weighing by switching pricing from dollars per tomato to dollars per pound. This eliminated the benefit from customers sorting tomatoes for size, and therefore reduced the transaction costs of buying and selling tomatoes. Sellers captured some of this lower cost by charging a higher price based on consumers greater willingness to pay.

This example may be summarized as follows. Goods have many attributes or margins that vary in value. Consumers spend resources trying to find units that are of the maximum value net of the price paid. These resources are one form of transaction costs, and they may be reduced by selecting a pricing mechanism that applies a price per unit of value to the margins with the greatest variability in value. Measurement cost theory predicts that maximizing sellers will select the pricing mechanism that creates the greatest value net of transaction costs. This general result will be extended and applied to the introduction of dynamic pricing to MLB.

Margins of Value in Baseball Pricing

The item sold at a MLB event, a ticket to a seat, has many margins that vary in value. The seat may be located close to or far from the field. All locations near the field are not of the same value. If the particular location is to be priced separately from other locations, the seller must determine which seats command a higher price. The seller must also enforce seat assignments, or buyers may move from low cost seats to unsold high cost seats.

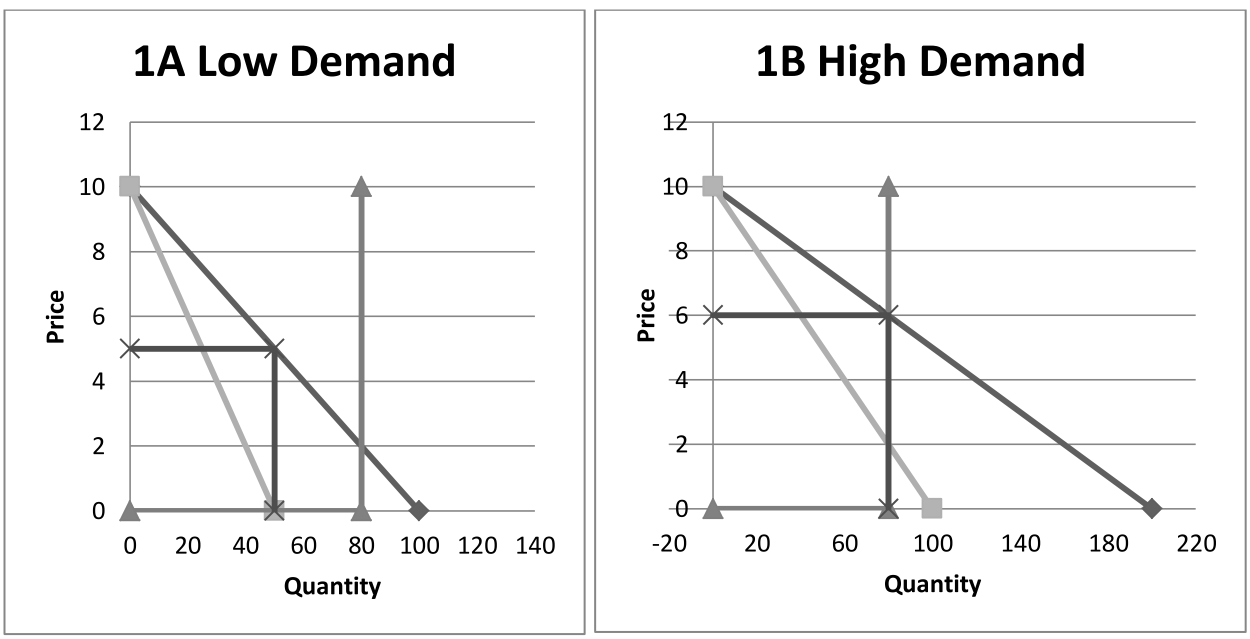
There are many other sources that contribute to the variability of the value of a seat. Factors that will cause this variation include how far in advance the ticket is purchased, the win/loss record of the team as the season progresses, the opposition team, the win/loss record of the opposing team as the season progresses, the weather forecast, and other entertainment events scheduled on the same date. Each of these factors may change the value of a seat, and each may have a differential impact on the change in value of different seats. For example, a competing event such as a rock concert may reduce the value of bleacher seats more than seats near the field.

In the absence of measuring costs, teams would price each of these margins correctly, resulting in no greater consumer surplus for one seat or game than any other seat or game. Since seats would not vary in value net of price, consumers would not spend any time competing for seats. There would never, for example, be lines for tickets or the need to make advanced purchases (Barzel, 1974). Of course the margins described are expensive to measure, so teams leave some unmeasured and un-priced, resulting in search costs on the part of consumers. It should be noted that this conclusion assumes that consumers' utility functions are identical. However, individual consumers might value these characteristics differently and thus different seats might provide different levels of consumer surplus. Thus, there would still be transactions costs.

In the example of tomatoes described in section two, the transaction costs were excessive search costs. Competition for items of above average value reduced the net gains from transacting. In the case of MLB these costs took the form of purchasing tickets too far in advance, and waiting too long in line for same day purchases (Barzel, 1974). Another pricing complication, and deadweight loss from mispricing, occurs from the capacity constraints of stadiums, which is the topic of section four.

Pricing With Capacity Constraints

An important element in the technology of some industries, such as MLB and airline flights, is capacity constraints (Feng and Xiao, 2001; Oren, 1985). In order to illustrate how these constraints impact pricing, we begin with an example of a parking lot. The lot has 80 spaces, and there are other parking lots nearby, but not on the same block. Some customers prefer this parking lot, but they are willing to select a different lot if there are not any spaces available or if the price is too high. Given imperfect substitutes, the monopoly model helps clarify pricing decisions to maximize profit (Badinelli, 2000).



Figures 1A and 1B. In 1A the profit maximizing price of $5 and quantity of 50 is not affected by the capacity constraint of 80. In 1B Marginal Revenue is positive at the capacity constraint of 80. Additional sales would increase revenue if the constraint were not binding.

Figure 1A illustrates the case where the demand for parking is relatively low, and it does not make sense to fill the lot every day. The marginal cost of servicing another customer is zero up to the point where all the spaces are in use. Beyond that point it is not possible to add another customer, so the marginal cost curve becomes vertical at 80 spaces. The parking lot owner's total profit is maximized where the marginal revenue obtained from renting parking spaces equals the marginal cost of providing them (which in this case is zero), at 50 parking spaces. To rent 50 spaces, the parking lot operator sets a price of $5 per space. Note that the capacity constraint of 80 spaces does not influence the price or quantity – 30 spaces are normally left empty. And since marginal cost is zero, profit maximization is equivalent to revenue maximization (Dana, 1999).

Contrast this low demand situation with the relatively high demand situation of Figure 1B. In this figure, profit maximization again occurs where the marginal revenue curve intersects the marginal cost curve--that is, at 80 parking spaces. But in this case, marginal revenue is above zero at this output. While the parking lot operator could increase revenue by renting more than 80 spaces, this is not possible since there are only 80 spaces to rent. The best choice for the parking lot operator is to fill the lot by charging a price of $6 per space.

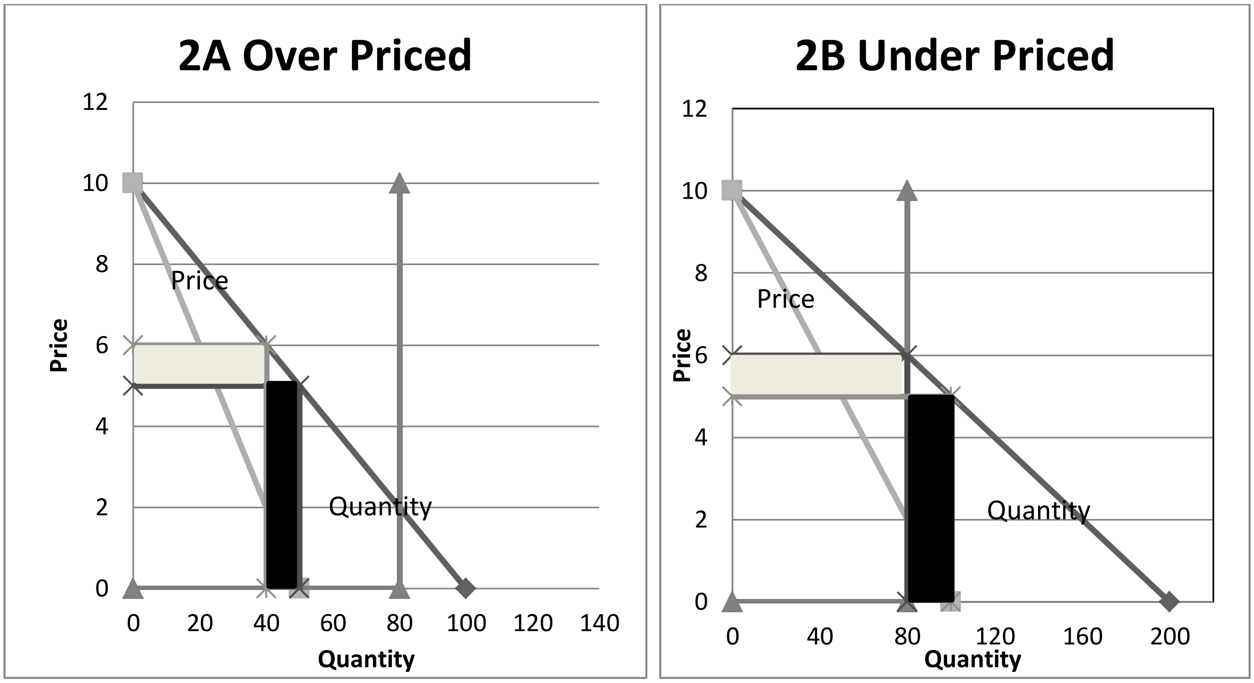
The previous example addressed monopoly pricing in a world where demand is known with certainty, but price discrimination is not possible. The focus of this analysis is the change in pricing that occurs when measurement of willingness to pay is expensive, and therefore demand is not known with certainty. What is the effect of misestimating demand and therefore overpricing or underpricing a product (Borland and MacDonald, 2003)?

Figure 2A illustrates the effect of parking-space overpricing. Suppose the parking lot operator believes demand is high, and sets a price of $6, when demand is in fact low, so that the optimal price is $5. At the $6 price, only 40 customers will rent spaces instead of the 50 customers that would rent spaces if the price was $5. This reduction in quantity (the "quantity effect") leads to a $50 loss in revenue--10 parking spaces times $5, or $50. But the 40 customers who do rent parking spaces pay a price of $6 instead of $5, resulting in $40 of additional revenue (the "price effect"). Therefore, the overpricing of parking spaces causes a net loss of revenue to the operator equal to $10 -- $40 in gain and $50 in loss.

Figure 2B illustrates the effects of parking-space underpricing. Suppose the parking lot operator believes demand is low, and sets a price of $5, while in fact demand is high, so that the optimal price is $6. This mis-estimation reduces the operator's revenue by $80--the $1 lower price times the 80 units rented. There are also 20 additional customers who would like to rent a space at $5, but are unable to do so (McAfee and Velde, 2004) . There does not exist any offsetting quantity effect. The lot operator must put out a “lot full” sign.

Comparing Figures 2A and 2B, the revenue losses from “overpricing” ($10) are smaller than the revenue losses from “underpricing” ($80). One way to think about this is to compare revenue changes for small pricing errors both when the capacity constraint is not binding (Figures 1A and 2A) and when it is binding (Figures 1B and 2B). In Figure 2A, at the point of profit maximization, the quantity effect of another sale (the dark gray area) is offset by the price effect (the light gray area) of lowering the price to make the additional sale. Since these two effects offset each other at the point of maximization, small errors in pricing yield very small changes in profitability whether the price is too high or too low.

In the case of Figure 2B, underpricing results in a negative pricing effect (the light gray area), but there is no offsetting positive quantity effect (the dark gray area) --because the parking lot is full. If the error had been too high a price in 2B, there would exist a quantity effect, for sales would have been reduced. But the price effect would have (partially) offset the quantity effect, resulting in only a small change in revenue and profits. Given a binding capacity constraint, the effects of overpricing and underpricing are therefore not symmetric. Losses are



Figures 2A and 2B. In 2A the dark gray area represents the Quantity Effect – the change in revenue from additional sales. The light grey area represents the Price Effect – the additional revenue from a higher price. In *2B the dark gray Quantity Effect – the additional revenue from additional sales at a lower price – does not exist because of the capacity constraint. Therefore the net change in revenue from a lower price is composed only of the negative price effect without an offsetting positive quantity effect.*

greater from underpricing, and firms will therefore err on the side of overpricing and leaving empty parking spaces (or baseball stadium seats).

Combining these ideas leads to the conclusion that it is generally better to overprice, and make the capacity constraint non-binding. If in fact demand is lower than anticipated, the price effect somewhat offsets the quantity effect whether or not the capacity constraint was anticipated to be binding. But if demand is higher than anticipated, if the constraint was binding, there is not an offsetting quantity effect.

The Historical Development of Baseball Pricing – Static and Variable Pricing

MLB baseball pricing reflects technology with fixed capacity constraints as described in section four, and variation in willingness to pay based on seat location and the ever changing demand determinants described in section three. The history of ticket pricing in MLB can be divided into two parts—static pricing and dynamic pricing. Section five describes how static pricing evolved into what may be called variable pricing. Section seven describes the introduction of dynamic pricing.

Traditionally, baseball teams charged a single price for a particular seat for all home games played throughout the season. Such prices were set months before the season began. With this pricing scheme, only one margin was priced – the location of the seat – leaving all other variability in value in the public domain. In microeconomics terms, this pricing system can be viewed as being akin to "menu cost," the cost to a firm resulting from changing its prices.

Menu costs include updating computer systems, hiring consultants to develop new pricing strategies, as well as the literal costs of printing price quotations (menus) and communicating new prices to customers. Because of this expense, firms sometimes do not always change their prices with every change in supply and demand, leading to price rigidity. In the past, repricing an entire baseball stadium was an arduous, time consuming, and expensive endeavor, thus contributing to a team's desire to maintain a static pricing policy. However, recent improvements in computer technologies and the fact that most tickets are now sold electronically appear to have detracted from the menu cost argument.

Why did firm using static pricing only price one margin of value, the location of the seat? Drayer, Shapiro and Lee suggest that teams did not price other margins of value because of low organizational costs such as low player salaries, and the switch to pricing these margins resulted from increases in organizational costs. But this explanation is inconsistent with profit maximization. From the perspective of which margins to price, team salaries are a fixed cost, and a standard result of profit maximization is that fixed costs do not determine the extent (how much) of any activity.

The explanation of this paper is that the variability in value of these margins was lower than the cost of measuring and pricing them. The profit maximizing MLB teams left these margins in the public domain because any gains in revenue from pricing them were less than the cost of pricing them. For example, during some seasons the Red Sox may find games against the Yankees might command a premium over games against other teams. But if the costs of determining this premium for thousands of different seats exceeded the additional revenue from creating these special prices and tickets, the Red Sox would elect to choose not to create special prices for Yankee games. This attribute of value would be left in the public domain, and fans would gain access to it by standing in line for tickets against the Yankees.

What made the location of the seat worth pricing, while all other attributes were un-priced? Variations in seat location – nearer or farther from the field – is a margin that does not change over time, since of course the seats do not move. And since it only has to be measured once, it is a relatively low cost margin to price. In an era of non-computerized printing of tickets, determining different prices for seat location and creating tickets with different prices was an expensive process. By using static pricing, that cost only had to be incurred once, at the beginning of the season.

MLB ticket pricing therefore included variations in price for only one inexpensive –to-measure variation in value – seat location. It did not account for changing demand conditions that were known at the beginning of the season, such as the identity of the opposing team, or demand conditions unknown at the beginning of the season, such as the win/loss record of the opposing team or the weather forecast (Rascher, D., McEvoy, C., Nagel, M., and Brown, M., 2007). Given the expense of measuring the variation in value from both sources of variability, and the cost of re-pricing thousands of tickets manually, it is not surprising teams found it more efficient to set prices at the beginning of the season.

By the early 2000s, static ticket pricing evolved into a variable pricing system for many teams, in which tickets for some games were priced higher than tickets for other games. This was still a form of static pricing, for prices were set at the beginning of the season, and would not change in reaction to changing determinants of demand. Teams charged higher ticket prices for those games that were perceived to be more alluring (or more valuable) to fans and thus entailed stronger fan demand. For example, during 2008-2011, the Seattle Mariners priced about half of their games on a variable basis. When the highly popular Boston Red Sox or the San Francisco

Giants came to Seattle, tickets included a premium charge of $5 in addition to the regular price; if these teams came to town on a summer weekend, the premium charge was increased to $7 per ticket. The Mariners found that by charging higher prices when demand was anticipated to be more inelastic and lower prices when demand is more elastic, the team's total revenue increased compared to the total revenue that was generated by pricing tickets at a fixed price for all games played throughout the season. Yet under this variable pricing system, ticket prices for prime games, weekend games, and value games were locked in for the entire season; they were static and thus did not change as the season evolved.

Varying ticket prices in this way occurred because the cost of measuring and pricing these margins - all based on the schedule at the beginning of the season – decreased. How did the cost of measuring these margins change? The most obvious change was the development of computerized information systems. These systems automatically recorded whether or not a given seat was sold, and the price and date at which it sold. These computer information systems were adopted by increasing numbers of US businesses throughout the 1980s and 1990s. Not surprisingly, measurement and pricing of additional margins followed. The automated recording of prices reduced the cost of measuring past sales at different prices. And automated systems dramatically reduced the cost of applying premiums to some tickets and not others. In 2012, the Seattle Mariners followed the lead of other teams and switched to a dynamic ticket pricing strategy.

The Development of a Secondary Market: StubHub

Prior to the development of the Internet, the resale or secondary market for tickets was dominated by individuals selling tickets on the date of the game in face-to-face transactions with purchasers. Sellers would be a combination of fans wanting to sell unwanted tickets (such as season ticket holders) and professional “scalpers” engaging in arbitrage. MLB made concerted efforts to suppress the secondary market; however this became increasingly difficult with the development of online markets such as EBay (Courty, 2003).

Eventually MLB, in cooperation with eBay, formed StubHub, an online secondary market for tickets. Teams get a commission from StubHub as well as the ability to keep tabs on what fans are paying for their product on the open market. StubHub takes a 25 percent commission after the sale occurs (10 percent from the buyer, 15 percent from the seller). Sellers range from season ticket holders to holders of single-game tickets who want to sell tickets that would otherwise go unused. Because of the large number of buyers and sellers, no individual has pricing power, which leads to a competitive market for resold tickets. In this market ticket prices change constantly – dynamic pricing in the extreme.

StubHub was important in the development of dynamic pricing. It developed a market, with clearly posted prices, in which prices changed in response to changing demand conditions. While “scalpers” have historically provided a secondary market, in informal secondary markets price information is expensive to acquire. How does a potential buyer standing outside a stadium know if the price the seller requests is competitive? StubHub reduced the cost of price information, facilitating trade. Since the market was approved and owned by MLB, buyers became more confident that the product they received – tickets – would be honored by teams.

Simply put, StubHub has turned the sometimes murky world of ticket reselling into an open and transparent process. Fans can easily purchase and sell tickets online without lurking outside a stadium prior to a game, warily looking around to make sure authorities don’t see the financial transaction. However, StubHub has become so popular that fans often shop at the online reseller for tickets before checking with a baseball team's box office. That leaves teams with an unsold inventory of tickets. Therefore, dynamic pricing has come to be viewed as a way that teams could fight back to capture ticket sales lost to StubHub. By monitoring ticket prices on StubHub, and incorporating that information into their dynamic pricing algorithm, teams can adjust their ticket prices to better reflect real-time demand and supply. Therefore, when the secondary market has tickets available for, say, $8 on a Wednesday night game in September, a team with hundreds or thousands of tickets available can compete by reducing its ticket prices and offering other benefits, like food coupons or vouchers for future game tickets. As a result, the baseball team receives added income rather than the secondary-ticket vendor or the scalper.

Dynamic Pricing and MLB

With the development of StubHub, fans gained access to a market for MLB tickets that used dynamic pricing. But the benefits of the market went mostly to individuals who purchased tickets at low prices from the teams, then resold them at higher prices when conditions permitted. Consider a team that has an unexpectedly good season. The team's owners based ticket prices on an "average" season, but since the team started to perform above expectations, willingness to pay for tickets was above expectation. Scalpers would purchase additional seats at the low fixed price posted by the team, and then sell them at higher prices as the team's tickets became sold out. The team would not receive the full value of the increased demand for its tickets, since the team would not raise the price of unsold seats (Happel and Jennings, 2002; Hansen and Gauthier, 1989).

Switching to dynamic pricing allowed the teams to raise prices when demand increased unexpectedly, and lower prices when demand declined unexpectedly. With the development of changing prices on the secondary market, fans became more familiar with dynamic pricing. But for dynamic pricing to work, the team has to estimate changes in demand before sellers on the secondary market. Otherwise, scalpers could purchase underpriced tickets before they were re-priced, eliminating gains to the teams. This requires the ability for the teams to first forecast demand changes, then re-price potentially hundreds of thousands of unsold tickets (Muret, 2010). Adoption of dynamic pricing required another decrease in the cost of measuring variation in value.

The implementation of this type of forecasting and re-pricing is similar to the topic of "Moneyball," Michael Lewis' popular book and movie on baseball analytics. In this story, a student of the game overturned decades of ingrained thinking and persuaded a team (the Oakland Athletics) it could win by sophisticated data analysis. In the dynamic pricing case, the person challenging the system was not a former baseball player, but instead a 26 year old baseball fan completing a Ph.D. in economics at the University of Texas.

In 2007, Barry Kahn founded Qcue Inc. to market his dynamic pricing model. Kahn was able to persuade the San Francisco Giants to try dynamic pricing in about 2,000 of its worst bleacher seats for the 2009 season. By the end of the season, San Francisco had a 20 percent attendance increase in its test seats and an extra $500,000 in ticket revenue. The success of this experiment resulted in the Giants using dynamic pricing for all single-game tickets in 2010, and all seasons since that time, armed with computer-program assistance of Qcue Inc., based in Austin, Texas. By 2013, 20 MLB teams were practicing dynamic ticket pricing. Qcue is the market leader, accounting for more than 95 percent of all dynamically priced baseball tickets. Digonex Technologies Inc. also offers dynamic ticket pricing services to MLB.

Concerning the Giants, although dynamic pricing has led to higher ticket prices for some of its games, the Giants to date have not attempted to match prices on the secondary market. For example, when the team was selling tickets to a Boston Red Sox game for $90 in August, 2013, similar locations for the same game were priced at $350 per ticket on StubHub. Therefore, the Giants were attempting to increase ticket revenue by using dynamic pricing, but they were not trying to maximize ticket revenue. In effect, the Giants were "leaving money on the table," probably to avoid being accused of price gouging by unhappy fans. Also, the Giants have used dynamic pricing to charge a lower price for tickets to less attractive games in an attempt to increase sales. Not only has this been a good public relations policy for the team, but lowering ticket prices has increased attendance and ancillary revenue such as parking, concessions, and merchandise that would be limited if tickets are priced too high. Since its adoption in 2009, dynamic ticket pricing has helped the Giants fill its AT&T Park with fans. In 2013, for example, the team's home-game attendance averaged 41,584, with 99.2 percent of the Park's seats sold, the highest in MLB. This strong performance occurred in spite of the Giants having a losing season (76 wins and 86 losses) and not making the playoffs.

So why did it take so long for dynamic pricing to penetrate the sports industry? According to Barry Kahn, , accurately pricing tickets is very difficult. In its initial stages, Qcue had both emotional and technical barriers to overcome. The company was changing the way things had been done for so many years, moving from pricing tickets 9 months out and keeping them static, to allowing the price to change right up until the first pitch. That required educating those in charge of ticketing operations and also the fans. Teams were hesitant to embrace this idea over fears of turning off fans; some viewed it as institutional price gouging without realizing that it's a lesson in Economics 101. Also, technical challenges were substantial. It used to take 3 days to make a price change within a ticketing system. That's 72 hours and countless steps to make a single change, let alone changing prices across every section of the stadium, across up to 81 home games a year. But with the advent of dynamic-pricing technologies, teams can now change thousands of prices with a single click (Rishe, 2012).

The sophisticated forecasting models of Qcue and Diogonex include dozens of variables that affect the demand for their clients' tickets. Once a program has placed a value on such variables, which differ from team to team, the program projects the value of future games and gives recommendations on how prices should be determined for each seat in the stadium. Thus, the forecasting model becomes a software overlay to a team's ticket system. It remains up to a team's management to decide whether or not to revise prices, and by how much. Although most team managements meet about once a week throughout the season to make pricing decisions, more frequent price changes are possible. For example, the management of the San Francisco Giants meets three to four times a week to revise prices. The dynamic model of Qcue has the potential to allow price revisions every five minutes.

While dynamic pricing allows teams to change prices, teams still face constraints in how low prices may fall. For example, if the price of a season ticket package is $20 per game, and the price of a single-game purchase is $25, the cost under dynamic pricing could increase above the $25 amount or decrease to $20, but never fall below $20. Otherwise, the season-ticket holders would likely switch to buying single game tickets. Thus, the season-ticket price places a floor under the dynamic price. This is also consistent with the benefits of overpricing, as described in section four.

Consider the Seattle Mariners who currently use dynamic pricing for all of their single-game tickets. Subscribing to the services of Qcue, the Mariners' pricing strategy takes into account pitching matchups, injuries to key players, team performance, fireworks displays at particular games, the weather, day of the week, and so on. These factors affect how much Mariners fans perceive the value of a game to be. Ticket prices are based on how much, or how little, fans are willing to pay, right up to game-time. Each day, the calculation changes as starting pitchers are announced, team records change, and tickets are sold, prompting the team to recalibrate prices. With Qcue's technology, thousands of price changes take just a few minutes. Table 1 provides examples of the Mariners' prices for bleacher seats, seats behind first base, and seats behind home plate for games against the Boston Red Sox, Texas Rangers, Los Angeles-Anaheim Angels, Kansas City Royals, Oakland Athletics, and Cleveland Indians as quoted on July 7, 2013 (subject to change as demand conditions change). Notice the discrepancy in the prices of an identical category of seats, depending on the Mariners' opponent, day of week, and so on.

Of all of the professional sports, MLB provides the best opportunity for dynamic ticket pricing. Compared to other sports such as professional basketball and hockey, baseball teams play twice as many games, their stadiums are twice as large, and the percentage of season ticket holders represents a smaller fraction of total sales. Other factors include an exclusive playoff system where only a limited number of teams advance, and outdoor stadiums where weather often plays a role. Has dynamic pricing been a success? Qcue estimates that its clients have increased revenue by an average of about 30 percent in high demand situations and about 5-10 percent in low demand situations (Rishe, 2012).

Table 1: Dynamic Ticket Pricing and the Seattle Mariners, 2013

	Lower Deck, Behind First Base	Upper Deck, Behind Home Plate	Center Field Bleachers
Boston Red Sox			
Monday, July 8	$72	$34	$19
Thursday, July 11	73	35	24
Los Angeles Angels			
Friday, July 12	61	29	18
Cleveland Indians			
Monday, July 22	61	12	14
Texas Rangers			
Tuesday, August 27	61	28	14
Kansas City Royals			
Tuesday, September 24	46	19	6
Oakland A's			
Friday September 27	53	24	9

Source: Seattle.Mariners.mlb.com

Conclusion

The use of dynamic ticket pricing by MLB teams is in its infancy, and thus, there remain many unanswered questions regarding its usefulness. However, a number of teams have adopted this strategy and it appears that it will become increasingly popular in the years ahead not only in baseball, but in other sports. By providing a primer on dynamic ticket pricing as applied to MLB, our paper hopefully makes a contribution to pricing topics that are currently taught in intermediate microeconomics and managerial economics courses.

MLB teams sell seats at games that are fundamentally non-homogenous. Customers' willingness to pay is influenced by such variables as seat location, game date, the opposing team, the win/loss record of each team, and the weather. Setting homogenous prices nine months ahead of time leaves much of the customer's variability in willingness to pay un-captured by the teams. Historically these potential profits were retained by fans purchasing underpriced seats, or scalpers engaging in arbitrage, or competed away by excess standing in lines or expensive to operate "scalper" markets.

Variable pricing, in which teams selected different prices for seats at games with predictably higher or lower value, transferred some of these gains from fans and scalpers to the teams, and decreased transaction costs. The switch to variable pricing followed the introduction of business information systems, which reduced the cost of measuring and pricing these margins of value. But other sources of variability in value could not be predicted nine months in advance. By switching to dynamic pricing, where the price of a seat varied over time based on changing demand conditions, teams have been able to capture more of the value of the services they provide. This switch required decreases in the cost of measuring the variability in value, and decreases in the cost of re-pricing tickets to match this changing value. The development of specialized forecasting software by firms such as Qcue created this decrease in measurement cost, and resulted in the introduction of dynamic pricing to MLB.

Traditional, static ticket pricing requires relatively long-range planning. It is grounded in knowing what fans consider value and organizing to anticipate how they might react to a team's performance throughout a season. Now, with dynamic ticket pricing, the planning has switched to the short term; the only real long-term consideration is which forecasting formula will be used in the season's pricing strategy. But even if teams did not have a sophisticated computer model for forecasting the demand for tickets, and they could not precisely measure all the factors that fans care about, they could still have a general idea about which games would sell better in advance. Therefore, they could increase the price of unsold tickets to those games even if they didn't know the optimal, profit-maximizing amount by which to change the price. The point is that the pricing of tickets does not have to be between no dynamic pricing and optimal dynamic pricing—there seems to be some middle ground that could increase team profits.

Although dynamic pricing strives to help teams recoup some of the ticket revenue that is lost due to the mispricing of tickets, challenges remain for this strategy. A first concern is that dynamic pricing may give fans too many choices. If fans are confronted with a broad array of confusing prices, they may decide to buy their tickets elsewhere or decide not to purchase tickets at all. As psychologists have explained, choosing between a multitude of salad dressings tends to paralyze a person's decision making and leave that person dissatisfied. Can the same be said for ticket sales, especially when they include daily (sometimes hourly) fluctuations in price? Also, what should a team do if a game is rained out? To avoid the risk of offending fans, should a team provide fans with a ticket to another game even if the ticket to the subsequent game is priced higher than the ticket to the rained out game? Charging an additional fee for a ticket to a subsequent game might offend fans. The general point is that dynamic pricing needs to keep things simple to avoid confusion. It remains to be seen how dynamic ticket pricing will play out.

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