

**Subsidized Monopolists and Product Prices: The Case of Major League
Baseball**

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Abstract: In this paper, I analyze the setting of ticket prices when teams receive subsidization from the public. I model teams as entertainment providers, where entertainment is generated by selling wins and amenities. I argue that subsidization of teams generally comes from subsidizing the amenities in and surrounding the teams' stadiums. Subsidization of the amenities lowers the marginal cost of providing them to fans and should drive ticket prices lower. The empirical analysis suggests that this is the case. The average team playing in a 5 year old public stadium charges a ticket price that is 40 cents less than the same team playing in a private stadium of the same age.

1. Introduction

When requesting public funds for a stadium that will house a sports team, stadium proponents often commission an economic impact statement: a study that attempts to show the effect that a new stadium will have on the local economy. Not surprisingly, these documents often amount to cheerleading and have been refuted by many independent researchers. Indeed, independent economists generally come to the conclusion that constructing a new sports stadium does not improve employment and wages in a local economy. For example, Baade and Dye (1990), Rosentraub, Swindell,

Przybylski, and Mullins (1994), Baade (1996), Noll and Zimbalist (1997), and Coates and Humphreys (1999) and (2000) all conclude that professional sports are not net generators of economic activity. Other researchers have found that professional sports do provide intangible benefits to their local economies (for example, Carlson and Carlino (2003)), but some have estimated the value of the intangibles do not, by themselves, warrant full subsidization of a new stadium. For example, Johnson, Grootuis, and Whitehead (2001) argue that the value of public goods generated by the Pittsburgh Penguins is less than the cost of a new arena.

One area of attention that has not been given much attention is the effect of subsidies on general business decisions of sports teams, such as deciding how much to charge for admission to games. The ticket pricing strategies of professional sports teams has presented an interesting puzzle to analysts. Teams competing in the four major sports in the US (football, baseball, hockey, and basketball) each have some monopoly power in their home markets. If team owners maximize profits, they would price their tickets in the elastic portion of the fans' demand for the team's product. Over the years, many researchers have found that, at least on average, team officials price tickets in the inelastic portion of their demand curves, suggesting that teams could raise ticket revenue by raising ticket prices. See Fort (forthcoming) for a nice summary of this literature. An explanation of this finding is that sports teams are not single-product producers but are, instead, the producer of many products. It may well be the case that teams set ticket prices in the inelastic portion of demand, leading to lower revenues from ticket sales than

if they priced tickets higher. But this lost ticket revenue is more-than-made-up by sales of beer, soda, hot dogs, and other products (Sandy, Sloane, and Rosentraub (2004)).

While this explanation is quite plausible, it may be incomplete. If a profit-maximizing business owner receives a subsidy that lowers its marginal cost, it would rationally produce more output, but to sell it, it would have to offer the product at a lower price. If the subsidy is large enough, this could drive the business to price its product in the inelastic portion of its demand curve.

In this paper, I argue that sports teams produce entertainment for fans consume, entertainment is generated by performance on the field and amenities at the stadium. For example, at San Francisco's AT&T Park, the home of the San Francisco Giants of Major League Baseball, young fans can play on slides encased in a giant Coca Cola bottle and can play ball in a miniature stadium. While subsidies for sports teams generally are not designed to directly help the on-field performance of teams, they do affect the cost of providing amenities. In such cases, I argue that subsidies given to sports teams lower the marginal cost of providing entertainment and drive team officials to charge lower ticket prices than otherwise.

The rest of the paper is organized as follows: section 2 presents the theoretical model. Section 3 presents the empirical results. Section 4 concludes.

2. Theory: Public Subsidies and Ticket Prices in Sports

In most analyses of the demand for sports, authors develop models in which sports teams are assumed to maximize profits by producing wins (for example, see Fort and Quirk (1995) and Quirk and Fort (1992)). But recent empirical evidence by Alexander (2001) suggests that the pricing decisions made by sports teams are made with an eye towards the overall market for entertainment in their local cities.

Suppose that team “i” in an n-team league produces units of entertainment, E_i , which are then consumed by fans. Let units of entertainment be a function of the quality of the team, measured by its winning percentage, and the amenities at the ballpark. In sports within a league, the quality of a team is measured by its performance relative to the performance of the teams that it plays. For detailed examinations of the production of winning, I direct the interested reader to Fort and Quirk (1995) and to Szymanski (2003 and 2004). For brevity, I suppress the dependence of wins on the relative talent level for brevity, letting team winning percentage for team i be given by w_i . Note that $w_i \in [0,1]$ and $\sum_{i=1}^n w_i = 1$.

Amenities at a team’s stadium or arena are also measured in units, $a_i \geq 0$. These amenities are generated by items such as concession stands, video replay boards, play areas for kids, and interactive games.

Suppose that the marginal cost of a win is constant at ϕ_w . The cost of winning is thus $\phi_w w_i$. Amenities are also assumed to be exchanged in a competitive market at a price of ϕ_a yielding a cost for amenities of $\phi_a a_i$. The team's total cost of producing entertainment is thus given by $C_i(w_i, a_i) = \phi_w w_i + \phi_a a_i$.¹ Note that this cost function represents the costs of an unsubsidized team.

Let the demand for the team's entertainment be given by the twice continuously-differentiable function $P_i[E_i^d(w_i, a_i)]$. $E_i^d(\bullet)$ is a twice continuously-differentiable function that represents the number of units of entertainment demanded by fans.

Entertainment is assumed to be increasing in its arguments. The team is assumed to have market power in the entertainment market, implying $\frac{\partial P}{\partial E_i^d} < 0_i$. The second derivative of price with respect to entertainment is assumed to be zero. The second derivative of entertainment with respect to w_i and a_i is also assumed to be zero. Other demand factors, such as local population, per-capita income, and the prices of other entertainment options that affect the demand for entertainment are acknowledged but are, for simplicity, not under the control of the team and are thus suppressed in the notation.

The team's revenue function is given by $R_i(w_i, a_i) = P_i[E_i^d(w_i, a_i)] * E_i^d(w_i, a_i)$ and its profits are given by

¹ Since all other factors of production are treated as fixed, their costs are fixed and are ignored in this analysis.

$\pi_i(w_i, a_i) = R_i(w_i, a_i) - C_i(w_i, a_i) = P_i[E_i^d(w_i, a_i)] * E_i^d(w_i, a_i) - \phi_w w_i - \phi_a a_i$. The team is assumed to maximize profits by choosing w_i and a_i .

Let the team receive an exogenous per-unit subsidy of s_i that goes towards paying for the amenities. Consider a team plays in a public stadium. If the local government picks up part of the tab of cleaning the bathrooms or providing security, this can be thought of as a subsidy for amenities². In this case, the cost of providing the amenities becomes

$(\phi_a - s_i)a_i$ and the team's profit function is

$$\pi_i(w_i, a_i) = R_i(w_i, a_i) - C_i(w_i, a_i) = P_i[E_i^d(w_i, a_i)] * E_i^d(w_i, a_i) - \phi_w w_i - (\phi_a - s_i)a_i.$$

The first-order conditions are given by

$$\frac{\partial \pi_i(w_i, a_i)}{\partial w_i} = \frac{\partial P_i}{\partial E_i^d} \frac{\partial E_i^d(w_i, a_i)}{w_i} E_i^d(w_i, a_i) + P_i[E_i^d(w_i, a_i)] \frac{\partial E_i^d(w_i, a_i)}{w_i} - \phi_w = 0 \quad (1)$$

and

$$\frac{\partial \pi_i(w_i, a_i)}{\partial a_i} = \frac{\partial P_i}{\partial E_i^d} \frac{\partial E_i^d(w_i, a_i)}{a_i} E_i^d(w_i, a_i) + P_i[E_i^d(w_i, a_i)] \frac{\partial E_i^d(w_i, a_i)}{a_i} - (\phi_a - s_i) = 0. \quad (2)$$

Note that the second-order conditions are satisfied by the assumptions. (1) therefore implicitly defines the equilibrium team winning percentage and (2) implicitly defines the

² Subsidies to sports teams are often grouped into three different categories: construction and land-acquisition subsidies (which include indirect subsidies of financing construction as discussed by Zimmerman (1997)), infrastructure subsidies, and operating subsidies. I make no distinction regarding the type of subsidy in the paper. The interested reader is directed to Long (2005), who meticulously calculates the subsidies received by teams in the 4 major American sports.

level of amenities chosen by the team in equilibrium. Comparative static analysis yields that the level of amenities is increasing in the subsidy level which, in turn, yields a higher level of entertainment offered by the team and, thus, a lower ticket price chosen by the team³.

Intuitively, subsidization lowers the marginal cost of providing entertainment, giving an incentive for teams to provide more entertainment. But in order to give fans an incentive to use the amenities, team officials must set lower ticket prices for admission into the stadium. We now move to the empirical section of the analysis.

4. The Empirical Model, The Data, and The Empirical Results

In this section I empirically explore the question of ticket setting under subsidization. In the theory, a team that is subsidized will set its ticket price lower than otherwise. To explore the relationship between subsidization and pricing, I use data from Major League Baseball (MLB) during the period 1991-2003 and explore versions of the general model

$$P_i = X_i\beta + s_i\gamma + \varepsilon_i \quad (3)$$

³ Define FOC (2) as $G = \frac{\partial P_i}{\partial E_i^d} \frac{\partial E_i^d(w_i, a_i)}{a_i} E_i^d(w_i, a_i) + P_i [E_i^d(w_i, a_i)] \frac{\partial E_i^d(w_i, a_i)}{a_i} - (\phi_a - s_i)$.

Then $\frac{\partial a}{\partial s} = -\frac{G_s}{G_a}$ by the implicit function rule. $G_s = 1$ and $G_a < 0$ since G_a is the second-order

condition. Therefore, $\frac{\partial a}{\partial s} > 0$. Since entertainment is increasing in amenities and price is decreasing in entertainment, higher subsidies yield lower prices charged by the team.

which describes the relationship between the price team i charges for its tickets and its determinants. P_i is the logarithm of real team ticket price published by the Team Marketing Report (TMR) database and obtained from Rod Fort's website. Each ticket price reported by TMR represents the weighted average price of tickets reported by teams. For each team, TMR researchers take ticket prices for each section in each team's stadium and weight them by the number of seats in each section. This weighted average series therefore controls for differences in seat quality throughout a stadium.

X_i represents various factors that determine the demand for the entertainment provided by the team and the unsubsidized marginal cost of providing entertainment. The variables included in the X_i matrix are as follows:

1. Logarithm of team attendance
2. A dummy equal to one for teams that made the playoffs in the previous season either as a division winner or, after 1994, as a wild card team
3. The previous season's team winning percentage
4. The age of the stadium (entered quadratically)
5. The logarithm of employment in the team's local SMSA's market
6. The logarithm of real per-capita income in the team's local SMSA's market

All monetary values are in real 2003 dollars and were adjusted using the CPI for all urban consumers. All team productivity data was obtained or calculated from the Sean Lahman database (<http://www.baseball1.com>). Employment and per-capita income was obtained from the Regional Economic Information System (REIS) database published by the Bureau of Economic Analysis. Stadium age information was obtained at various stages

of the project from which this paper was developed from <http://www.ballparks.com> and <http://www.ballparksofbaseball.com>. I also include dummy variables for each of the years during the sample period. 2003 is the reference year for the dummies.

During the sample period, four expansion teams (Colorado and Florida in 1993 and Arizona and Tampa Bay in 1998) began play. For each of these teams in their expansion year, lagged winning percent values are missing. To be able to include these records in the analysis, I set lagged winning percentage equal to 0.400. I based this value on the performance of expansion teams that appeared during the sample period. In doing so, I assume that fans of expansion teams expect their new teams will perform as well as a team that won 40% of its games last season⁴.

s_i represents the subsidy provided to the team. As a proxy for subsidization, I include the proportion of the team's stadium that is privately-owned. While rough, teams playing in publicly-owned stadiums will have much of the upkeep of stadium amenities picked up by the public body that owns the stadium while teams that own their own stadiums will generally have to provide their own maintenance. Additionally, private ownership proportion controls for the proportion of the team's stadium construction cost that was paid through public sources (the correlation between the proportion of the stadium owned by the public ownership and the proportion of original construction costs paid by the public is 0.5618 which has a p-value of less than 0.0001). Since the construction

⁴ In 1993, Colorado and Florida had an average winning percentage of 0.404. In 1998 Tampa Bay and Arizona had an average winning percentage of 0.395. .

subsidy's effect on team ticket prices should change over time, I have included this variable interacted with the age of the stadium.

β and γ are vectors of parameters to be estimated. ε_i is a random error term. Ticket prices are set between seasons with an eye towards the expected demand for tickets. To the extent that team officials properly estimate demand, team attendance and team ticket prices may be simultaneously-determined. Consequently, I estimate three models using a two-stage least squares process in a fixed effects model, a random effects model, and a random effects model with an AR1 process. In these models, I estimate the logarithm of team attendance in the first stage using team winning percentage as an instrument. Lastly, I estimate a random effects model with an AR1 process that does not include team attendance as an independent variable.

Table 1 provides the summary statistics. Table 2 provides the regression results. The models in the first three columns are the 2SLS models and the model in the fourth column is the random effects model where I control for an AR1 process. The parameter estimates for team attendance in the 2SLS models are each negative but insignificant. The previous season's winning percentage is positively correlated with team ticket prices and highly significant in every model. Thus, the better a team performs, the higher its ticket prices will be next season. This effect occurs because the demand for a team's game tends to be higher the year after the team performs well because fans expect the high quality to continue. The playoff dummy had a positive relationship with team ticket prices in each model, but the effect was not significant in the non-AR1 models. The

playoff dummy was significant in the two AR1 models. The parameter for stadium age is negative but highly significant in every model suggesting that as a team's stadium ages, its ticket prices fall. But the positive and significant parameter for the stadium age's quadratic term suggests that the fall diminishes over time. This result is plausible because new stadiums generate interest among the population. Initially, some locals who do not usually attend games will attend just to see the new ballpark. But the existence of a new ballpark is unlikely to alter these locals' preferences for sports. So the impact of a new ballpark on attendance drops off over time.

The parameter on the logarithm of employment is negative and significant in the non-AR1 models but positive and significant in the two AR1 models. Real per-capita income has a positive estimated coefficient. The estimate is insignificant in the non-AR1 models but significant in the AR1 models. The time dummies d1991 to d2001 are all negative suggesting that team ticket prices were lower during these years relative to 2003. Each of these dummies was significant except for d2000 and d2001. The coefficient on d2002 was positive and insignificant. These results suggest that after controlling for other factors, ticket prices for the average team did not vary significantly between 2000 and 2003.

The parameter estimate on the age-private ownership proportion interaction term is positive and significant in every model. These results are consistent with the theoretical predictions: teams that play in public stadiums, on average, charge lower ticket prices.

Moreover, as the stadium gets older and needs more maintenance and repair work performed, the difference in ticket prices become more pronounced.

Figures 1 and 2 present graphs representing estimated ticket prices for the average team playing in either a 100% privately-owned stadium or a 100% publicly-owned stadium. The ticket prices are calculated for stadiums of various ages. The average team was assumed to have won 50% of its games last year, have not made the playoffs, and have the average level of employment and per-capita income as given in Table 1. The reference year is 2003. I used the parameter estimates from column 4 in Table 2 in the calculations. Figure 1 shows a graph of the estimated ticket prices for the two facility types. As suggested by the parameter estimates, as a stadium ages, the ticket prices charged by teams fall but fall faster for teams that play in public stadiums. Figure 2 presents the difference in ticket prices for different stadium types of different ages. When the stadium is brand new, the ticket prices charged by the teams are the same regardless of stadium type. When the stadium is 5 years old, the team in the public stadium charges a price that is 40 cents less than the same team playing in a private stadium. If the stadium were 10 years old, the estimated ticket price would be 80 cents more in the private stadium. When the stadium is 20 years old, the team that plays in the private stadium charges about \$1.50 more for tickets.

5. Conclusion

In this paper, I have analyzed the setting of ticket prices when teams receive subsidization from the public. I model teams as entertainment providers, where entertainment is generated by selling wins and amenities. I argue that subsidization of teams generally comes from subsidizing the amenities in and surrounding the teams' stadiums. Subsidization of the amenities lowers the marginal cost of providing them to fans and should drive ticket prices lower. When the team plays in a privately-owned stadium, it incurs more of the costs of providing (and maintaining) amenities, costs that are then passed onto fans. The empirical analysis suggests that this is the case. Of course with a public stadium, fans of the team do pay for the amenities in the stadium, but in sometimes hidden ways. But these costs come via taxes and reductions in public spending on other projects.

One thing that I do not advocate in this paper is the giving of subsidies to sports teams. Indeed, the question of whether subsidies should be given depends on the public goods qualities of sports teams, their value, and the distortions that come from giving subsidies and imposing taxes to pay for them. However, this paper does shed light on the effect that subsidies have on the prices paid by fans.

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Table 1 - Summary Statistics

	Mean	Std. Dev
Team Winning Percentage	0.50005	0.003886
Attendance	2246401	38804.87
Employment	3162841	2445189
Age of Stadium	29.0925	1.322348
Real Per-capita Income	33928.7	243.0395
n	346	

Table 2 - Longitudinal Regression Results

	2SLS			
	Fixed Effects 2SLS*	Random Effects 2SLS*	AR Random Effects 2SLS*	AR Random Effects
Log of Attendance	-0.0142384 <i>0.0827991</i>	-0.0121995 <i>0.0793837</i>	-0.0372263 <i>0.0600155</i>	-
Made Playoffs Last Year	0.0147519 <i>0.0216629</i>	0.0147713 <i>0.020794</i>	0.0242931* <i>0.0136379</i>	0.0240829* <i>0.0136577</i>
Last Year's Winning Percentage	0.5799994*** <i>0.1701068</i>	0.5749689*** <i>0.162093</i>	0.2622483*** <i>0.0924422</i>	0.2460734*** <i>0.0882316</i>
Stadium Age	-0.0130373*** <i>0.0021137</i>	-0.0129904*** <i>0.0020148</i>	-0.0117822*** <i>0.0015923</i>	-0.0112983*** <i>0.0013549</i>
Stadium Age Quadratic Term	0.0001132*** <i>0.0000282</i>	0.0001129*** <i>0.0000268</i>	0.0001012*** <i>0.0000217</i>	0.0000969*** <i>0.0000201</i>
Log of Employment	-0.5608607** <i>0.2938196</i>	-0.4697361* <i>0.2526121</i>	0.0660367* <i>0.0351094</i>	0.0635844* <i>0.0347053</i>
Log of Real Per-capita Income	0.3192887 <i>0.3151844</i>	0.2754194 <i>0.2975824</i>	0.5507072*** <i>0.1852974</i>	0.5445672*** <i>0.1842834</i>
Age-Private Ownership Proportion Interaction	0.0174526*** <i>0.0047122</i>	0.016732*** <i>0.0043369</i>	0.0044764*** <i>0.0010911</i>	0.0043642*** <i>0.0010761</i>

Table 2 Continued

d1991		-0.3672653*** <i>0.0659605</i>	-0.3620675*** <i>0.0615759</i>	-0.2553217*** <i>0.0457368</i>	-0.2582759*** <i>0.0453218</i>
d1992		-0.3815554*** <i>0.0646528</i>	-0.3749953*** <i>0.059855</i>	-0.2661372*** <i>0.0433427</i>	-0.2675889*** <i>0.0430971</i>
d1993		-0.3435048*** <i>0.0621485</i>	-0.3383662*** <i>0.0584377</i>	-0.238647*** <i>0.0453281</i>	-0.2458084*** <i>0.0437587</i>
d1994		-0.3040122*** <i>0.066051</i>	-0.2992078*** <i>0.0613153</i>	-0.2149764*** <i>0.0439126</i>	-0.2081894*** <i>0.0421958</i>
d1995		-0.3237078*** <i>0.0611957</i>	-0.3201026*** <i>0.0570326</i>	-0.2491899*** <i>0.0421786</i>	-0.2416366*** <i>0.040054</i>
d1996		-0.2950087*** <i>0.0497122</i>	-0.2926634*** <i>0.0467142</i>	-0.2279462*** <i>0.0378751</i>	-0.2274503*** <i>0.037701</i>
d1997		-0.235759*** <i>0.0425841</i>	-0.2343959*** <i>0.0402949</i>	-0.183948*** <i>0.0350006</i>	-0.1854538*** <i>0.0348151</i>
d1998		-0.1560082*** <i>0.0334046</i>	-0.1547268*** <i>0.0318339</i>	-0.1397942*** <i>0.0309856</i>	-0.1425915*** <i>0.0305906</i>
d1999		-0.0764365** <i>0.0312442</i>	-0.0761792** <i>0.0299378</i>	-0.0755994*** <i>0.029074</i>	-0.0784714*** <i>0.0286624</i>
d2000		-0.0360421 <i>0.030972</i>	-0.036143 <i>0.0297107</i>	-0.0538894** <i>0.0267869</i>	-0.055985** <i>0.026533</i>
d2001		-0.0155148 <i>0.0307996</i>	-0.0160824 <i>0.0295331</i>	-0.0275732 <i>0.0235467</i>	-0.0303281 <i>0.0231163</i>
d2002		0.0059267 <i>0.0300199</i>	0.0058686 <i>0.0287893</i>	0.0012612 <i>0.0175439</i>	0.001316 <i>0.0175655</i>
Intercept		7.78006 <i>4.788311</i>	6.861296 <i>4.302186</i>	-3.318214* <i>1.974721</i>	-3.758574** <i>1.822637</i>
n		346	346	346	346
R-Squared					
	within	0.7674	0.7677	0.7466	0.7482
	between	0.0286	0.0458	0.4735	0.4809
	overall	0.1222	0.1566	0.6443	0.6486
Hausman		-	-	16.82	19.98
Breusch Pagan LM		-	-	285.88***	291.76***
Wooldridge		-	-	97.605***	106.211***

*Instrumented variable: log of team attendance. Additional Instrument: team winning percentage

Figure 1

Real Ticket Prices - Average Team in Different Aged Stadiums

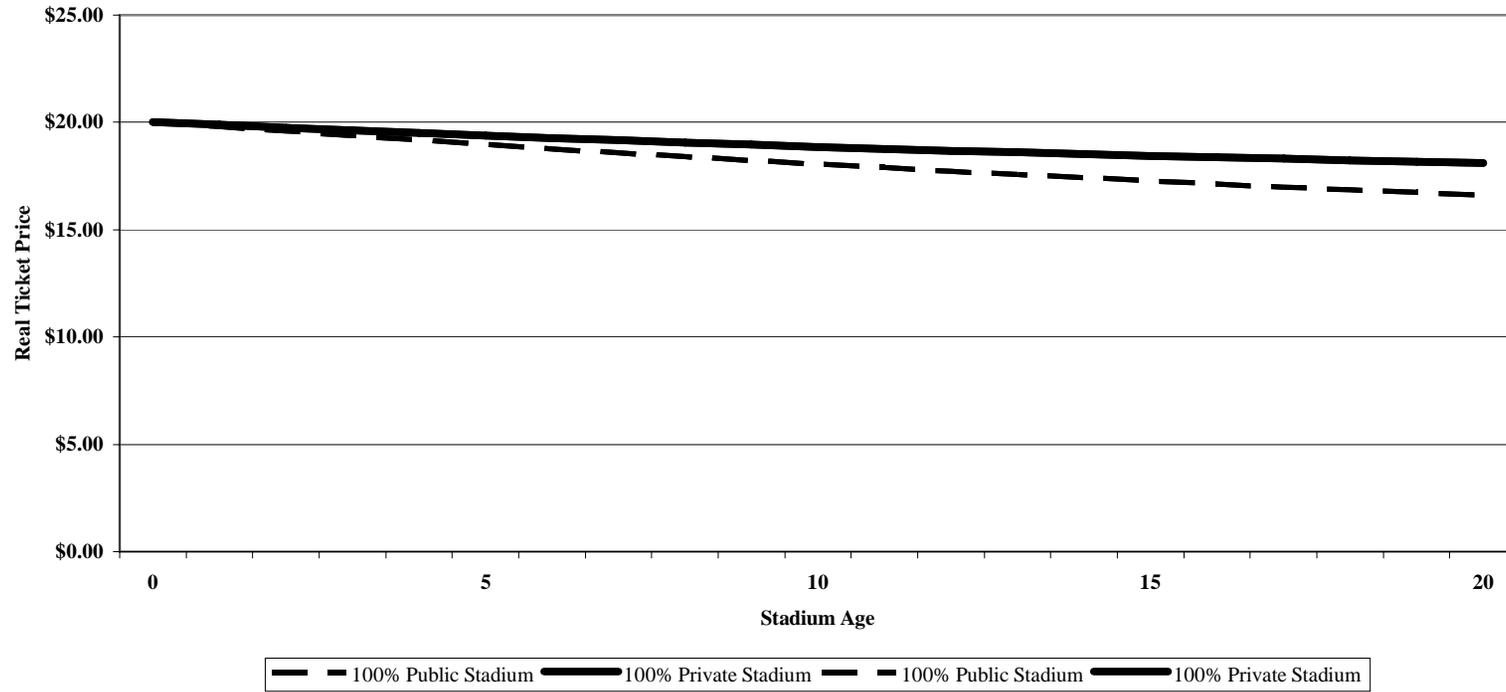


Figure 2

Difference Between Average Team's Real Ticket Prices (Private - Public)

