CONTEMPORARY ECONOMIC POLICY

STADIUM CONSTRUCTION AND MINOR LEAGUE BASEBALL ATTENDANCE

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The established literature shows that new stadium construction for major league baseball (MLB) teams can increase attendance, but there are limited studies at the minor league level. We use a data set encompassing all A, AA, and AAA minor league baseball teams from 1992 to 2006 to estimate the impact of stadium construction on minor league attendance. This data set includes almost 200 teams, over half of which constructed a new stadium during the 15-year observation period. Over a 10-year period our results show that new stadiums increase attendance by 1.2 million fans at the AAA level, 0.4 million at the AA and high A level, and 0.2 million at short season low A. A cost benefit analysis suggests that increased ticket sales do not offset the stadium costs, in line with previous works on MLB. (*JEL* H0, L83)

I. INTRODUCTION

Arguments espoused by many public officials and team owners in favor of providing substantial, or even excessive, public subsidies for building professional sports stadiums have become familiar. In the market for major league sports teams, new stadiums are often portrayed as a key component in keeping a team in a city and in keeping that team competitive. Team owners often seek public subsidies to offset construction costs of a new or renovated stadium, arguing that their team cannot capture all of the external benefits generated by performance on the field. In a major metropolitan area, these external benefits can be significant even if they are not easy to quantify or capture, and they have been used to justify large public subsidies for stadium construction. While public subsidies should be smaller with smaller stadiums, it is not clear if these subsidies are excessive or if they lead to an inefficient construction decision. Agha (2011) suggests there are public benefits to minor league teams in terms of increased per capita income, although only at certain levels. Examining public funding of stadium construction through the lens of the novelty effect at the minor league level allows us to probe the efficiency of team-level revenue decisions and can help us calculate total impacts if public subsidies are combined with private funds.

Like major league baseball (MLB) teams, minor league teams often receive public support to finance the construction of their new stadium. Marcheck (2004) estimates that public funding for minor league stadiums is typically on the order of 85% of the construction costs through the sale of public bonds. These bonds are paid in part by team revenues and while public funding of professional sports stadiums is not without public debate (see Siegfried and Zimbalist 2000; Coates and Humphreys 2008), most of the attention to this phenomenon has occurred for major league teams. In this article, we focus on identifying and estimating the novelty effect for new and newly renovated minor league baseball stadiums. During our sample period of 1992 to 2006, 100 of the 192 minor league stadiums were new or newly renovated. This is considerably more occurrences of new stadium

*The authors would like to thank Sean Forman for help obtaining the data and participants at the Western Economics Association meetings for feedback.

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ABBREVIATIONS

APG: Average Per Game
FCI: Fan Cost Index
GLS: Generalized Least Squares
MLB: Major League Baseball
TMR: Team Marketing Report

Contemporary Economic Policy (ISSN 1465-7287)
Vol. 32, No. 1, January 2014, 144–154
Online Early publication May 3, 2013

doi:10.1111/coep.12016
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construction than in studies of MLB stadiums, which is limited to no more than about 30 new or newly renovated stadiums. Further, these observations occur in a shorter period of time, so the degree to which time and "culture" change new stadium impacts is minimized.

By looking at new and newly renovated stadiums at the minor league level, we can provide additional depth to the knowledge of the novelty effect as it has not been examined anywhere besides the major league level of professional sports. Proponents of public stadium construction subsidies often suggest that the benefits from new stadium construction for major league teams are larger than just the additional attendance and concession sales that accrue to the team owner. Major league teams will often have fans reaching across a large population, so providing a minimal level of public funding is often thought to be reasonable, but often not to the extent that is provided (Coates and Humphreys 2008). One might think that minor league baseball teams do not often attract support across a large population, so the benefits that accrue from a minor league baseball team would most likely show up only in increased ticket and concession sales and in serving as a training ground for the MLB affiliate. However, recent research by Agha (2011) showed that minor league teams at the AAA and high A level led to increases in local per capita income and new stadiums at the AA level increased local per capita income. In this article, we generate estimates of the benefits from new minor league stadium construction to baseball revenue that can be compared to estimates of major league stadiums and can possibly serve to calibrate the estimates of public benefits accruing from new major league stadium construction including the potential increases in income found by Agha (2011).

Our results show that, similar to new MLB stadiums, new minor league baseball stadiums tend to increase attendance, but this increased attendance drops off more slowly than it does for MLB stadiums. We also find that new MLB stadium construction does not take fans from minor league baseball stadiums. In fact, the opposite may be true. We conclude the article with a basic cost benefit analysis comparing estimated attendance increases at each of the three minor league levels to stadium construction cost. In general, we find that the costs outweigh any potential baseball revenue gains. We also provide a simple case study of three teams (one at each minor league level) by comparing the increase in attendance and projected revenues to actual stadium cost. Our estimates suggest that at the A and AA level, the projected yearly increase in ticket revenues are only 2%–3% of the stadium costs, while in AAA the projected yearly increase is closer to 7%. The case study suggests that at the AAA level there is the potential for new revenues to approach stadium costs; however, the evidence at lower levels (A–AA) suggests that stadium construction costs outpace increased ticket revenue.

II. LITERATURE REVIEW

Two contrasting streams of stadium feasibility analysis have emerged in the literature: those results generated in the academic literature, and those results coming from consulting firms. Coates and Humphreys (2008) provide a review of these two literature strands and note how the streams diverge in weighting the intangible benefits flowing from "Big League City" status. A growing literature probes the magnitude of these public and often intangible benefits (Johnson and Whitehead 2000; Johnson, Groothuis, and Whitehead 2001; Groothuis, Johnson, and Whitehead 2004). Nevertheless, Coates and Humphreys (2005) provide their own cost feasibility estimates for four MLB baseball stadiums and conclude that government-subsidized baseball stadium construction is inefficient. We offer minor league stadium cost feasibility estimates of our own, and achieve results that are in agreement with other major league analyses generated in the academic literature that in general stadium construction costs outweigh increased revenues.

A growing body of research is slowly beginning to show that many of the same factors that attract fans to MLB games can influence attendance at minor league baseball games. Recently, Gitter and Rhoads (2010) found that winning has a limited ability to bring more fans out to the minor league baseball park. The result is consistent with the standard thinking in the industry that at most winning might change attendance 1%–2% (Hardballtimes.com 2007). Siegfried and Eisenberg (1980) model demand for minor league baseball, Gifis and Sommers (2006) determine the impact of promotions on minor league baseball attendance, Krautmann, Gustafson, and Hadley (2000) examine minor league training costs of MLB players, and Davis (2006, 2007) looks at location decisions of minor league baseball teams. Finally, Colclough, Daellenbach, and Sherony (1994) provide the only attempt we have found to measure any kind of novelty effect stemming from minor league baseball stadium construction as they estimate the economic impact of building a minor league baseball stadium through a case study of one team.

Until now, estimating the impact of building a minor league baseball stadium has been limited to studying the direct and indirect economic impacts of the stadium and team on the community. While on a much smaller scale than for MLB stadiums, Colclough, Daellenbach, and Sherony (1994) get similarly stylized results from a regional input–output model. We aim to keep pushing baseball research in a direction that calls attention to the similarity of fans of MLB and minor league baseball by highlighting the novelty effect of new stadiums on attendance in minor league baseball. To this end, we apply the models developed by Coates and Humphreys (2005) and Clapp and Hakes (2005) for estimating MLB stadium impacts to minor league baseball. Given the results found in other areas of minor league baseball research, perhaps it is not surprising that our results show new stadiums for minor league baseball teams increase attendance. And similar to MLB stadiums the increase in attendance falls over time, but not as quickly as it falls for major league stadiums.

III. DATA AND ECONOMETRIC MODEL

We utilize data from three sources. Attendance and performance data for minor league baseball from 1992 to 2006 was provided by the website Baseball-Reference.com (Sports Reference LLC 2007). The data set is extremely rich as it includes every minor league team at the A, AA, and AAA level for the years 1992–2006. This data set was used previously (Gitter and Rhoads 2010). The second data set concerns the year of stadium construction. The construction dates for stadiums were obtained from the website (www.BallparkReviews.com). The final source of data was average MLB ticket prices to control for substitution effects. The prices for all MLB team years 1992–2006 were retrieved through team marketing report (TMR) as part of the fan cost index (FCI), which is a basket of goods that a typical family of four might purchase while attending a game.[1] Unfortunately, parallel data are unavailable for minor league teams as TMR has collected only 63 team/year observations in 2005 and 2006 at the minor league level. In Appendix B, we discuss data on the ticket prices that are available after the period of interest. We later use available price data in our cost benefit analysis, and like the Winfree and Fort (2008) analysis of minor league hockey, we control for time invariant factors through team fixed effects. We have an unbalanced panel due to team movement and because four teams at each minor league level were added as part of MLB's expansion during the 1990s.

The dependent variable of interest is average per game (APG) attendance. The average attendance per game over the sample was 2,461 at the A level, 3,890 at the AA level, and 6,017 at the AAA level. Table 1 provides descriptive statistics, while the functional form of the regression estimate can be found in Equation (1).

The main variable of interest is the impact on attendance of a new stadium. Of the 192 teams in the data set, 100 teams built a new stadium during the sample period. Around 4% of the minor league teams in the sample in any given year were playing in a brand new stadium. Similar to the Coates and Humphreys (2005) and Clapp and Hakes (2005) estimates of MLB stadium construction impacts on attendance, we use binary indicators for the first 10 years of the stadium to measure stadium impacts. Several indicator variables are included where $\text{Age}_i = 1$ if the stadium is of age "i." Also, we utilize indicators for the final year (Final) of the old stadium and penultimate year (Penult), by including two additional binary indicators to control for potential nostalgic effects.

The variables for new stadiums may not reflect novelty effects if other factors influence demand. One possibility is that if new stadiums were larger and capacity constraints were binding in older stadiums the measured effects of the new stadium variable could be due to increased capacity. This seems unlikely as our calculations suggest that stadiums built after 1990 have nearly 10% less capacity on average than those built before 1990. This is similar to the MLB level where teams moved from multipurpose stadiums that included capacities of 50,000 or more to smaller baseball only stadiums where the capacity is typically 40,000 or

1. TMR's FCI tracks the cost of attendance for a family of four. In the analysis, we use only the MLB ticket price data, but using the FCI yields results that are not substantially different. The FCI includes four average-price tickets, four small soft drinks, two small beers, four hot dogs, two game programs, parking, and two adult-size caps.

TABLE 1
Descriptive Statistics

	A Level		AA Level		AAA Level	
	M	***SD***	***M***	***SD***	***M***	***SD***
APG attendance	2,461	1,607	3,890	1,566	6,017	2,083
(TEAM) Win %	50.00%	0.08	50.00%	0.06	50.20%[c]	0.06
New stadium[a]	3.7%	0.19	5.4%	0.23	3.8%	0.19
Stadium 1 year old[a]	4.1%	0.2	5.6%	0.23	3.8%	0.19
Stadium 2 years old[a]	4.0%	0.2	5.0%	0.22	3.8%	0.19
Stadium 3–4 years old[a]	7.9%	0.27	9.1%	0.29	9.1%	0.29
Stadium 5–6 years old[a]	7.8%	0.27	9.7%	0.3	8.2%	0.28
Stadium 7–8 years old[a]	7.5%	0.26	9.3%	0.29	7.2%	0.26
Stadium 9–10 years old[a]	6.8%	0.25	7.1%	0.26	6.3%	0.24
Final year of old stadium[a]	1.7%	0.13	1.7%	0.13	2.5%	0.16
Penultimate year of old stadium[a]	1.5%	0.12	1.5%	0.12	2.3%	0.15
New MLB stadium local[a]	1.6%	0.13	2.6%	0.16	1.9%	0.14
1-year-old MLB stadium local[a]	1.9%	0.14	2.4%	0.15	1.9%	0.14
Local × MLB ticket price[b]	3.6	4.85	2.9	5.29	2.6	4.56
Close minor new stadium	2.6%	0.16	2.1%	0.14	0.9%	0.09
Close minor 1-year-old stadium	2.7%	0.16	1.8%	0.13	0.9%	0.09
City's MSA population	1,815,314	3,656,610	823,509	984,878	1,208,486	591,471
City's MSA income	29,981	5,889	30,453	5,892	30,606	4,000

[a]Indicates the variable is a binary variable which = 1 if true.
[b]Local × MLB ticket prices is the average cost of an MLB ticket in $1,982–1,984 for the nearest MLB team if that MLB team is within 100 miles.
[c]Winning percentage is not 50% due to exclusion of Canadian teams.

less. Similarly, if teams raise prices when a new stadium is built the estimated novelty impact would diminish. In Appendix B, we present a regression of stadium age on ticket prices. Our ticket price data is limited to 2006–2010, which was a time when stadium construction was substantially lower. So roughly only 2% of teams built a stadium in the years 2006–2012 compared to 4%–5% during the sample years of 1992–2006. In short, the results show newer stadiums (less than 10 years old) are associated with average ticket prices higher than stadiums more than 10 years old by roughly one dollar in the first 6 years. These numbers are used in our analysis of gate revenue.

The magnitudes of attendance at the different levels (A, AA, and AAA) vary substantially.[2] We pool our analysis but include terms that control for the level of the team. In total, teams in our sample period—about 5% of the sample—switched levels and five of these teams also built new stadiums. We include controls for the level with two binary variables—AA and AAA—that equal 1 when the team is at the level consistent with that variable. We also test for difference in the effect of new stadiums (Age) by level by interacting the stadium variable with the two binary level variables.

Coates and Humphreys (2008) posit that feasibility studies for stadium construction (particularly those done by nonacademic economists) often overestimate economic impacts of new MLB stadiums by ignoring the possibility of consumers substituting MLB attendance for other forms of entertainment. Gitter and Rhoads (2010) achieved results that were consistent with the hypothesis that MLB is a substitute for minor league baseball; minor league attendance increased during the MLB strike and with the cost of ticket prices in the nearest MLB market (within 100 miles). LocalMLBcost controls for MLB ticket prices of teams within 100 miles. To estimate the impact of the construction of a new MLB stadium we include two additional binary indicators (Age_MLB_i). We only consider MLB stadiums within 100 miles (local = 1) of the observed minor league team because Gitter and Rhoads (2010) found that when MLB ticket prices in the local markets (local×MLBcost) increased so did minor league attendance. We

2. There are three sub-levels within A: high, low, and short season. Further breaking down the level into subgroups does not appear to impact the results substantially so we elect to pool these three sublevels into a single group.

also test if building a new stadium reduces attendance for other teams in the area by including a variable that measures if another minor league team within 50 miles opened a new stadium in the past 2 years (CloseMinor).

To help estimate the potential demand for tickets we utilize a measure of population in the city's MSA (Population) and MSA income in real 2006 dollars (Income). Gitter and Rhoads (2010) showed winning had a small impact on minor league attendance, so we include both winning percentage (Win%) and lagged winning percentage (LAGWin%). Finally, we include year fixed effects (YEAR) for each of the years 1992–2005, with 2006 omitted.

$$
\begin{aligned}
(1)\ \text{APG}_{jt} = {} & \beta_0 + \sum_{k=0}^{9} \alpha_{1+k}\text{Age}_{kjt} + \beta_1\text{AA} \\
& + \beta_2\text{AAA} + \sum_{k=0}^{9} \alpha_{11+k}\text{Age}_{kjt} \times \text{AA} \\
& + \sum_{k=0}^{9} \alpha_{21+k}\text{Age}_{kjt} \times \text{AAA} + \alpha_{30}\text{Final}_{jt} \\
& + \alpha_{31}\text{Final}_{jt} \times \text{AA} + \alpha_{32}\text{Final}_{jt} \times \text{AAA} \\
& \alpha_{33}\text{Penult}_{jt} + \alpha_{34}\text{Penult}_{jt} \times \text{AA} + \alpha_{35}\text{Penult}_{jt} \\
& \times \text{AAA} + \gamma_1\text{local} \times \text{Age\_MLB}_{0jt} \\
& + \gamma_2\text{local} \times \text{Age\_MLB}_{1jt} + \gamma_3\text{local} \\
& \times \text{MLBcost} + \gamma_4\text{CloseMinorNew}_{0jt} \\
& + \gamma_5\text{CloseMinor1Year}_{0jt} \\
& \beta_3\text{Population} + \beta_4\text{Income} + \beta_5\text{Win\%}_{jt} \\
& + \beta_6\text{LAGWin\%}_{jt-1} + \delta_t\text{Year}_{jt}
\end{aligned}
$$

Similar to Clapp and Hakes (2005) we use generalized least squares (GLS) to estimate the equation with controls for heteroskedasticity and autocorrelation. A modified Wald test rejects the null hypothesis that there is no groupwise heteroskedasticity (p value $< .001$). We also find the presence of autocorrelation using the Woolridge (2002) test for autocorrelation and reject the null hypothesis that the errors are not correlated (see regression results in Table 2 for F-statistics).

IV. RESULTS

In this section, we provide estimates of the coefficients in Equation (1). Like Coates and Humphreys (2005) we use these estimates in a comparison of the costs of stadium construction to estimate the potential increase in revenue from a new stadium. We provide both generalized estimates for each level using our estimates and a case study of three teams (Cedar Rapids, Jacksonville, and Toledo), one at each level. The results suggest that A and AA stadiums provide additional revenue substantially below construction costs, while at the AAA level new revenues seem to approach costs.

A. *Model Estimation*

The results of our estimations shown in Table 2 strongly show that new stadiums tend to increase attendance for minor league teams just like they do at the major league level. These effects are consistent for all three levels, with larger impacts at the AAA level and smaller ones at AA. Not only do these stadiums increase attendance in the first year of use, but the impacts are lasting even 10 years after their construction.

In years in which clubs constructed a new stadium (New Stadium), attendance increased by about 1,200 (49%), 900 (23%), and almost 2,200 (37%) fans at the A, AA, and AAA levels, respectively. These increases are statistically significant at the 1% level. Like major league teams, the positive attendance impact of a new stadium steadily declines, although there is still some evidence of increased attendance 10 years later. If the impacts are totaled over a 10-year period, we find that constructing a stadium adds over 870,000 fans at the AAA level and 240,000 at the AA level based on the average number of games played per year.[3] At the single A level some leagues play a 76-game schedule and some play a 140-game schedule (half of those games are at home). The average impacts between high and low level A are not substantially different. Over the 10-year period for low level A (with the shorter schedule) new stadiums increase attendance by about 240,000 fans and for the higher A level with the 140-game schedule the increase is just under 500,000 fans. In the next section, we discuss why in some cases new stadiums may have larger impacts at the A level compared to the AA level.

There does not appear to be any boost to attendance in a stadium's last year or two as both

3. This calculation was made using the average number of games played for each team, since most of the time teams lose one or two games a year to rain outs that are not rescheduled.

TABLE 2
Impacts of Stadium Construction on Average per Game Attendance

				Interacted Coefficients				
Variables	**Coefficient**	**SE**	**T-STAT**	**Variable Interacted**	**Level**	**Coefficient**	**SE**	**T-STAT**
New stadium	1,219	87	14.07	New stadium	AA	−363	180	−2.02
Stadium 1 year old	1,152	78	14.86	Stadium 1 year old	AA	−525	111	−4.74
Stadium 2 years old	1,011	78	12.99	Stadium 2 years old	AA	−268	121	−2.22
Stadium 3 years old	992	79	12.48	Stadium 3 years old	AA	−564	138	−4.08
Stadium 4 years old	754	79	9.58	Stadium 4 years old	AA	−435	139	−3.14
Stadium 5 years old	514	69	7.42	Stadium 5 years old	AA	−389	136	−2.87
Stadium 6 years old	508	79	6.43	Stadium 6 years old	AA	−409	135	−3.03
Stadium 7 years old	409	76	5.35	Stadium 7 years old	AA	−479	135	−3.55
Stadium 8 years old	333	71	4.69	Stadium 8 years old	AA	−337	129	−2.6
Stadium 9 years old	290	69	4.21	Stadium 9 years old	AA	−240	128	−1.88
AA	1,533	43	35.37	Penultimate year	AA	−572	180	−3.18
AAA	3,220	141	22.77	Final year of old stadium	AA	−1105	206	−5.35
Final year of old stadium	203	96	2.12	New stadium	AAA	977	218	4.49
Penultimate year	77	85	0.91	Stadium 1 year old	AAA	1014	180	5.63
New minor league stadium close	16	71	0.22	Stadium 2 years old	AAA	1120	191	5.86
1-year-old minor league stadium close	38	49	0.76	Stadium 3 years old	AAA	615	198	3.11
Winning percentage	514	108	4.77	Stadium 4 years old	AAA	656	198	3.3
Lagged winning percentage	256	104	2.45	Stadium 5 years old	AAA	275	194	1.42
Total population	0.172	0.017	10.34	Stadium 6 years old	AAA	246	197	1.25
MSI income	0.016	0.006	2.48	Stadium 7 years old	AAA	−36	191	−0.19
New MLB stadium local	13	62	0.21	Stadium 8 years old	AAA	200	176	1.13
1-year-old MLB stadium local	17	58	0.29	Stadium 9 years old	AAA	−38	144	−0.26
Local × MLB ticket price	12	6	1.81	Penultimate year	AAA	−654	219	−2.99
Constant	1,321	212	6.25	Final year of old stadium	AAA	−992	240	−4.13

$N = 1,409$ (total), N for level A $= 840$, N for level AA $= 303$, N for level AAA $= 266$.
F-Stat Woolridge test for autocorrelation = 19.4. Year fixed effects results are omitted.

the final and penultimate variable are negative, except perhaps at the A level. This contrasts with MLB where fans may have been drawn to historic ballparks in the final season such as Yankee Stadium and Tiger Stadium.

Our results are consistent with the results of Gitter and Rhoads (2010). First, while winning has a statistically significant impact on attendance, the associated increase of going from a 0.500 to 0.600 win percentage ball club is a little more than 51 fans a game in the current year and 26 fans in the next year. We also find that higher local MLB ticket prices also increase attendance by roughly 50 fans a game for a one standard deviation in increase in local ticket prices. It appears that there were not statistically significant impacts of new MLB stadiums or minor league stadiums close to the team of interest.

B. A versus AA and Robustness Checks

The larger impacts in A for a new stadium compared to AA as seen by the negative coefficient on the interaction of the new stadium variables and AA may be due to the larger amount of heterogeneity in attendance at the A level. Top drawing A level teams draw roughly the same number of fans as the top AA teams, but many A level teams draw far fewer fans per game. For example, of the top 50 teams in average attendance at the AA or A level, 24 are at the A level. Roughly the same ratio holds among the top 5, 10, or 20 A and AA teams. However, at the bottom end of the distribution all but one of the bottom 50 teams in terms of attendance per game are at the A level.[4] This may reflect greater heterogeneity in older stadiums between A and AA or other market factors. Unfortunately, we do not have information on teams' previous stadiums. The larger impacts from A level stadium construction compared to the AA level may also be a function of the lower minimum stadium

4. The lone team in the bottom 50 was the Port City Roosters of Wilmington, NC, a team that existed for only two seasons.

TABLE 3
Estimated Average Revenue from Additional Fans After New Stadium Construction

Level	Average Stadium Construction Cost in 2006 Constant Millions ($)	Average 2006 Ticket Price ($)	Estimated Fans (Millions) Added from a New Stadium over 10 Years	Additional Revenue over 10-year period; Millions ($)	Cost Per Fan Added ($)
AAA	33.10	8.58	0.88	7.54	37.67
AA	20.20	7.22	0.24	1.74	83.92
High A	18.65	6.40	0.50	3.21	37.24
Low A	15.54	7.60	0.26	1.96	60.34

capacities recommended for the lower level by MLB in Attachment 58 of the major league rules (see Gitter and Rhoads, 2012). This would allow for a larger increase in stadium capacity with new construction at the A level compared to the AA level, which could then lead to a larger increase in A level attendance.

We ran several robustness checks on the difference between A and AA. First, we determined that the differences were not due to a few outliers as the results do not change substantially when we drop the four A level teams with the highest average attendance. We did notice that these top attendance A teams were located within 100 miles of their affiliate, so when we rerun the regression with no teams located within 100 miles of any MLB team (roughly one-third of the sample) we find that the impacts in AA are larger than A. However, it does not appear to be an issue of market size as A level teams see larger impacts than AA teams in MSP with population of over 500,000. Finally, we tested for but did not find any evidence that A level teams in Florida which also served as spring training homes for MLB teams were influencing the results.

We also performed several robustness checks on the impact of a new stadium. Replacing the dependent variable with the log of average attendance still yields significant impacts for the first ten years of a new stadium at A and AAA and significant impacts for the first 7 years at AA. We also varied the time controls by using a trend term or individual team trend term and the main results are not substantially impacted. Finally, we removed several controls unrelated to the impact of the new stadium and the results did not substantially change (robustness check results are available on request).

C. Cost Benefit Analysis

To begin our cost benefit analysis we provide a generalized comparison using our aggregate estimates of revenue increases and compare them to construction costs from a recent report by Marcheck (2004). This report provides stadium construction costs for around 90% of the minor league stadiums built between 1990 and 2004 and suggests that public funds make up about 85% of the typical financing structure of a minor league stadium development deal. Table 3 below shows the average cost to construct a new ballpark ranging from $33 million at the AAA level to $15.5 million at the low A level. We calculate the potential revenue for a minor league baseball team by using the average price of a ticket in 2006 at each level based on a limited sample of about six teams at each level conducted by TMRs (see Appendix A for ticket price data). The additional revenue from a new stadium is then estimated by multiplying the average ticket price by the increase in fans over a 10-year period taken from the results earlier in Section IV.A. The revenue estimate will likely be relatively high, as it does not include a discount rate. On the other hand, it does not include additional revenue streams such as parking and concessions.

Nevertheless, even with the generous (nondiscounted) estimate of new stadium revenues that come from new fan spending, stadium construction costs appear to exceed marginal revenue. At the AAA level, new revenue is about one-third of construction cost; it is closer to one tenth of construction cost at the AA and low A levels. The final column shows that the cost per additional fan ranges from $48 at AAA, $84 at AA, $37 at High A, and $60 at low A.

Of course, revenue comes from more than ticket sales. Like MLB, the revenue stream for minor league baseball also includes concessions, parking, and souvenirs. Since 2005, TMRs have collected data to construct a FCI for minor league baseball, which includes a generous basket of goods and can be used to estimate minor league baseball team revenues. At the AAA level the FCI is over $22 a fan. The FCI likely represents an overestimate of average revenue, as minor league teams often provide a large number of discounted tickets and concessions. Furthermore, it is unclear if the average fan is represented by the basket. We therefore think of the FCI as an upper bound on new revenue. At all levels, the stadium construction cost per new fan appears to clearly exceed the additional revenue.

Coates and Humphreys (2005) also note that revenues might increase in newer stadiums as fans may pay more for tickets in stadiums with better facilities. In Appendix B, we find that newer stadiums were associated with a roughly $1.60 increase in ticket price in the stadium's first year and around $1.00 in years 2–7. New concession stands may also increase non-ticket revenue. To calculate the projected marginal revenue from constructing a new stadium we divide the sample into old and new fans. We provide a simple equation below where revenue from a new stadium (NR) will be equal to the revenue from new fans and the additional revenue from fans who had previously attended games at the old stadium but now pay higher prices. The price of attending a game at a new stadium is represented by (P_{new}), which is greater than the price to attend a game in the old stadium P_{old}. These prices represent a basket of attending a minor league baseball game that includes a ticket, concessions, and souvenirs for a representative consumer. The two quantities represent the new fans, Q_{new}, who would not have attended a game at the old stadium and the old fans who would have attended a game at the old stadium, $Q_{old.}$ We assume that new revenue must exceed the cost of the stadium for construction to be profitable. Given that this ignores the marginal cost of increased stadium's staff labor costs (ushers, ticket takers, concession stand workers) associated with more fans, this will be a generous estimate of profitability.

$$\text{NR} = P_{\text{new}} Q_{\text{new}} + (P_{\text{new}} - P_{\text{old}}) Q_{\text{old}}$$

Table 4 below calculates the increase in revenue required to pay for construction of a new stadium. We include two estimates of revenue from new fans: the average price of a minor league baseball ticket in 2006 and the FCI from 2006, which is a basket that includes a ticket, concessions, and souvenirs. We examine these figures over a 10-year period. The number of new fans over 10 years is taken from our estimates in the previous section of novelty effects and the

TABLE 4
Required Additional Revenue Per Fan for Stadium Cost to Equal New Revenues

	Additional Revenue over 10 Years Needed Per Fan to Pay for a Stadium (P_{new} = FCI), $	**Additional Revenue over 10 Years Needed Per Fan to Pay for a Stadium (P_{new} = Average Ticket Price), $**
AAA	2.93	4.58
AA	4.75	5.39
High A	4.08	6.19
Short Season A	9.87	10.58

number of old fans is calculated using the 2006 average attendance for the appropriate level of minor league baseball. Below, we express the additional revenue required from each old fan for new stadium revenues and construction cost to be equal.

$$\frac{\text{Stadium Cost} - P_{\text{new}} Q_{\text{new}}}{Q_{\text{old}}} = P_{\text{new}} - P_{\text{old}}$$

At the AAA level, our estimates suggest that average additional revenue from an old fan must be between $2.93 and $4.58 for stadium construction costs to be covered. This is substantially larger than our estimate of increase in ticket prices in Appendix B of $1.60 in the first year and roughly $1 in years 2–7. This amount increases for lower levels. This suggests the only way new stadiums can increase revenue is if they are accompanied by increases in spending of at least 10% or more of the FCI, which already seems to be an overestimate.

Note that Coates and Humphreys (2005) estimated that it would take an additional $6.40 from each fan to maintain bond payments to pay for the new Oriole Park at Camden Yards in Baltimore. They additionally point out this is likely an underestimate since increasing price would decrease the number of fans, and that their estimate represents 32% of the ticket price which is not an insignificant portion of the old ticket price. Our results suggest that at AA and A the percent increase would have to be even higher than the Coates and Humphreys estimates for the MLB team. This seems unlikely, since prices are substantially smaller for low minor league teams, compared to MLB teams.

While we could benefit from having data on fan expenditures in old and new stadiums to compare to our estimates, we can try to put these numbers in perspective. At the A

TABLE 5
Projected New Revenues ($1,000) for Three Minor League Teams

	Cedar Rapids A		Jacksonville AA		Toledo AAA	
Year	**Fans from New Stadium (in 1,000s)[a]**	**New Revenue (in $1,000)**	**Fans from New Stadium (in 1,000s)**	**New Revenue (in $1,000)**	**Fans from New Stadium (in 1,000s)**	**New Revenue (in $1,000)**
2002	67	$428			273	$2,337
2003	45	$289	125	$901	222	$1,904
2004	49	$312	185	$1,338	250	$2,139
2005	55	$352	125	$901	262	$2,244
2006	47	$299	170	$1,226	274	$2,350
2007	39	$249	161	$1,161	295	$2,529
2008	36	$226	129	$933	290	$2,481
2009	41	$259	119	$861	264	$2,262
Average new revenue per year (in $1,000)		$302		$945		$2,281
Construction cost (in $1,000)		$14,500		$34,000		$32,900
Average revenue/total cost		2%		3%		7%

[a]The attendance in the last year of the old stadium was roughly 133,000 for Cedar Rapids; 230,000 for Jacksonville; and 300,000 for Toledo.

level, it seems unlikely that a new stadium would increase per fan revenue in an amount equivalent to or greater than the average ticket price. At the AAA level, the additional amount needed per fan is about the price for one item at the concession stand. So one can imagine a new stadium increasing revenue in an amount similar to cost with slight increases in ticket and concession prices; however, large profits from new stadiums seem unlikely.

We try to illustrate the relationship between new revenue and stadium construction cost by examining estimates from one team from each level of minor league baseball in Table 5 below. These teams are located in Cedar Rapids (IA), Jacksonville (FL), and Toledo (OH). Each city is within one standard deviation of their level's average income and population so they are reasonably representative of their levels. The cities were mainly chosen because their teams built stadiums about midway through our sample period and because the construction costs of each of three cities stadiums were easily available. The stadiums in Cedar Rapids and Toledo opened in 2001 and cost about $14.5 million and $34 million, while the stadium in Jacksonville opened in 2002 and cost $32.9 million. In each of the three cities we present the average attendance in the year prior to the stadium's construction and the years following. Attendance increased substantially in the first year in the new stadium for each team; in Cedar Rapids and Jacksonville the increases were 50%, while the increase was over 90% in Toledo. We include attendance data through 2009 for each team and use 2006 average league ticket prices to calculate revenue by year, as we do not have year-by-year price data for individual teams. Coates and Humphreys (2005) provide a similar analysis for MLB teams and show that even in the first year of the new stadium additional revenues do not cover the payments on bonds used to fund stadium construction costs for four MLB teams. Our results in Table 5 for Cedar Rapids and Jacksonville show additional estimated revenues from the increased attendance at the new stadiums are only 2% and 3% of the total construction cost, which is well below a likely bond payment or opportunity cost of capital. These results are consistent with our estimates based on league averages suggesting that the new revenue stream generated from A and AA level stadiums is substantially lower than the stadium's construction cost. At the AAA level revenues are over 7% of the total cost in Toledo, which is consistent with our findings that new revenues may approach construction costs for AAA teams. While these results appear inefficient, overall they are consistent with a public choice explanation of subsidizing minor league baseball stadium construction while suggesting civic pride in minor league cities is nonnegligible (see Groothuis, Johnson, and Whitehead

2004). Further research into both these phenomena at the minor league level could be useful.

Coates and Humphreys (2008) point to a near consensus among economists that public subsidies of professional sports stadiums should be eliminated, although Agha's (2011) findings of potential impacts of minor league baseball on per capita income suggest minor league teams may be different. While our estimates, like Coates and Humphreys (2005), are somewhat imprecise due to lack of total revenue data, two trends of note seem to emerge that are in agreement with the consensus view of economists. First, a privately financed stadium is unlikely to be profitable at the A and AA level. Second, even at the AAA level, the additional fan revenue that results from the novelty effect is not likely to be much higher than construction cost. While these trends do not appear to be inconsistent with the continued call by owners for public funding of stadium construction in the United States, our results suggest that minor league stadiums are not engines of economic growth unless their impacts go beyond ball park revenue.

V. CONCLUSION

The novelty effect for minor league baseball stadiums is similar to that of MLB stadiums, as fans of minor league baseball appear to respond to new stadiums in much the same way as fans of MLB baseball. The major difference we identified in this article seems to be that additional attendance at minor league stadiums resulting from the novelty effect does not fall off as quickly as it does for MLB stadiums. It is likely that fewer substitute entertainment opportunities in minor league cities exist compared to major league cities making the novelty effect wear off relatively more quickly in the major league cities.

A more precise measure of the benefits that flow from new stadium construction can be useful in the ongoing popular debate over how much the public sector should subsidize stadium construction and renovation projects for MLB teams. Those who support subsidies for new major league stadium construction typically point to public goods benefits such as the status that accompanies being a "big league city." This designation can lead to higher self-esteem for all citizens in the city (see Coates and Humphreys 2008) and has been used to partly justify subsidization of stadium construction or renovation. Because minor league baseball teams cannot provide "big league city" status, our results provide what likely amounts to a minimum level of private benefits an owner of a baseball team can expect to earn in the form of the novelty effect. Our results can thus serve to calibrate the public and private benefits that are expected to flow from MLB stadium construction or renovation. This knowledge can be especially helpful in guiding the public debate over how large to make public subsidies for MLB stadiums.

APPENDIX A

TABLE A1
2006 Ticket Price Data from Team Marketing Reports

City	Team	Level	Average Ticket Price 2006 ($)
Aberdeen	Ironbirds	(A)	9.75
Billings	Mustangs	(A)	5.39
Clearwater	Threshers	(A)	6.01
Dayton	Dragons	(A)	8.50
Fort Wayne	Wizards	(A)	7.30
Greeneville	Astros	(A)	5.66
Hagerstown	Suns	(A)	6.32
Helena	Brewers	(A)	5.80
Idaho Falls	Chukars	(A)	6.58
Lake Elsinore	Storm	(A)	7.74
Lancaster	Jet Hawks	(A)	6.95
Modesto	Nuts	(A)	6.67
Peoria	Chiefs	(A)	9.01
Rancho Cucamonga	Quakes	(A)	7.26
Salem-Keizer	Volcanoes	(A)	9.00
Spokane	Indians	(A)	6.34
St. Lucie	Mets	(A)	4.06
Vermont	Lake Monsters	(A)	6.80
Wilmington	Blue Rocks	(A)	8.27
Jamestown	Jammers	(A)	4.95
Mahoning Valley	Scrappers	(A)	7.17
Altoona	Curve	(AA)	6.95
Connecticut	Defenders	(AA)	8.54
Erie	Seawolves	(AA)	7.17
Harrisburg	Senators	(AA)	6.36
Mississippi	Braves	(AA)	8.84
Tennessee	Smokies	(AA)	7.80
Wichita	Wranglers	(AA)	6.67
Buffalo	Bisons	(AAA)	9.13
Columbus	Clippers	(AAA)	8.74
Indianapolis	Indians	(AAA)	10.05
Iowa	Cubs	(AAA)	8.15
Norfolk	Tides	(AAA)	9.10
Richmond	Braves	(AAA)	8.20
Tacoma	Rainiers	(AAA)	6.72

APPENDIX B: TICKET PRICES AND STADIUM CONSTRUCTION

Using the Baseball America yearly digests from 2006 to 2010, we constructed a measure of ticket prices for roughly 80% of the minor league teams. It is worth noting that 2006 was the first year that Baseball America reported minor league ticket prices, so we are unable to link the price data to our analysis directly. The measure was taken using an average of the lowest and highest ticket prices for each team, which were the only available ticket price data in the digest. We found in 2006 that average ticket prices were $6.88, $7.72, and $8.87 at the A, AA, and AAA levels. This is close to the measurement from Team Marketing reports. In that report, a subset of teams reported actual average ticket price to be $7.10, $7.760, and $8.58 at the A, AA, and AAA levels. We then ran a regression on the constructed price variable using the 466 team year observations, random effects, stadium age, city, income, league level, population, and year fixed effects. The results below show that ticket prices in the first year of a new stadium increase by $1.60 and the ticket price increase falls to roughly $1.00 in years 2–7 with a downward trend falling to statistically insignificant differences by year 9. Statistical significance is greatly reduced when the model is estimated separately by level due to the limited sample.

TABLE A2
Regression on Average Ticket Price for 2006–2010

	Coefficient	**SE**	**T-STAT**
New stadium	1.62	0.41	3.95
Stadium 1 year old	0.98	0.33	2.98
Stadium 2 years old	0.88	0.34	2.59
Stadium 3 years old	1.20	0.32	3.74
Stadium 4 years old	0.99	0.29	3.44
Stadium 5 years old	0.85	0.28	3.01
Stadium 6 years old	0.88	0.26	3.38
Stadium 7 years old	0.76	0.25	3.06
Stadium 8 years old	0.49	0.24	2.05
Stadium 9 years old	0.29	0.20	1.45
Income	0.03	0.02	1.63
Population (100,000)	0.03	0.03	0.91
AA	0.85	0.47	1.81
AAA	1.79	0.51	3.47
2007	0.39	0.11	3.64
2008	0.69	0.12	5.99
2009	0.92	0.14	6.59
2010	1.23	0.15	8.32
Constant	4.30	1.21	3.56

$N = 466$.

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