Baseball Strikes and the Demand for Attendance

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Abstract

Professional baseball has experienced numerous work-stoppages over the last 30 years, including three which resulted in the cancellation of games. Existing estimates of the demand for attendance at Major League Baseball games has found that only those events which caused the loss of games influenced attendance. This paper revisits the issue of whether strikes affect attendance and finds that even those lockouts and strikes that do not cause games to be canceled are associated with significantly lower attendance. Moreover, despite dramatic differences in the severity of the three strikes that canceled games, one cannot reject the hypothesis that the effects are the same. Finally, the evidence here suggests that attendance is adversely affected by events leading up to negotiation of a new Basic Agreement between the players and the owners.

Professional baseball narrowly averted a work stoppage during the 2002 season. That a strike was avoided is surprising if one realizes that since the players organized for the purposes of collective bargaining in the mid-1960's, every time an agreement between the players and owners expired some sort of work stoppage followed. The 1994-95 work-stoppage is undoubtedly the most severe sports labor disruption to date. Not only did it result in the cancellation of the last third of the 1994 season, including the playoffs and the World Series, but it spilled over into the 1995 season. Yet it still took more than 6 months after the expiration of the agreement signed to end that strike, and a date being set for another strike to begin, before the Major League Baseball Players Association and Major League Baseball settled on a new contract.

Over time the issues between the players and the owners have varied, though the basic problem has been the same. Owners want players to have less freedom to sell their services on the open market, players want more freedom to do so. Consequently, battles have been fought, and largely won by the players, for the right to salary arbitration, and for free agency. The owners have tried to soften the blow of salary arbitration and free agency. They have sought to lengthen the number of years of service a player must have before being eligible for arbitration or free agency, they have tried to impose high costs on teams that sign top-line free agents, and they have sought salary caps.[1]

This paper is not about the labor-management issues per se, but is about the effects of these disputes on attendance at major league ball-parks. Owners and players alike need to understand the consequences of their actions, particularly since it is ultimately the fans that pay the bills. In this paper we estimate the relationship between

[1]Zimbalist (1992) provides an excellent history of labor-management relations from the 1870s until 1992.

average attendance per major league baseball game for each team over the period 1969 to 1996. In other words, we have a cross section-time series data set in which the dependent variable is the average attendance at major league baseball games of a given team in a specific year. After controlling for ticket prices, incomes, populations, quality of play and players, and lagged attendance per game, we estimate the effect on attendance per game of strikes or lockouts. Existing work on the effects of labor unrest in baseball would suggest that the lack of a strike in 2002 meant there was no impact of the discord on attendance. This paper raises doubts about that conclusion.

It seems obvious that all strikes and lockouts are not the same. For example, the strikes that have occurred in baseball since 1969 have varied in duration and in severity. The first instance of a baseball strike was in 1969. In this case, spring training was delayed but the regular season and post-season went off as planned. The strikes of 1972, 1981, and 1994-95 are the only incidents that resulted in lost games. In 1972, the players struck for 13 days, and 86 games were lost. The strike of 1981 lasted for 50 days and about 700 games were lost. The strike of 1994 put an end to the season, resulted in the cancellation of the playoffs and the World Series, and delayed the start of the 1995 season. In all, the strike lasted 232 days and resulted in 920 games being canceled. Sprinkled throughout the period are strikes or lockouts in 1973, 1976, 1980, 1985, and 1990 which lasted for various lengths of time ranging from 2 days, in 1985, to 32 days, in 1990, but which did not cause any games to be canceled. We find that these strikes and lockouts did not all result in the same repercussions at the gate.[2]

[2] Coates and Humphreys (2002) show that strikes and lockouts have no discernible effect on the economies of the cities the franchises call home.

On the other hand, we find some surprising similarities across the different strikes. Attendance appears to follow the same time path from one strike to the next, for example, and for the 1972 and 1981 strikes the affects are not statistically different from one another. These strikes are found to have generated equal reductions in per game attendance of about 10 to 12% while the 1994-95 strike caused about a 24% reduction. We also find that despite having no effect on the number of games played, the events in 1973, 1976, 1980, 1985, and 1990 generate statistically significant reductions in season attendance of between 3 to 7%. In those instances, players were "locked out" or walked out on strike. The question this raises is whether labor management discord that does not include a work-stoppage, like the 2002 situation, results in lost attendance.

The rest of this paper is organized as follows. The next section briefly describes the literature on demand for attendance. This paper fits squarely into that literature, but while our emphasis is not on income and price elasticities of demand for attendance, we do produce evidence on the size of those important concepts. The best measure of price is a matter of some debate in the literature, and one of the technical issues addressed here. We follow the literature review with a discussion of the data set and the estimation scheme. The results are reported and discussed in the fourth section and we conclude with a brief summary.

Attendance literature

Because attendance is a major source of revenue for all sports teams, modeling the demand for attendance is an integral part of sports economics. The two earliest attendance models were done in the 1970s (Demmert 1973; Noll 1974). Neither examined the effects of strikes, but each found the effects of ticket prices to be problematic. The appropriate measure of ticket prices is an issue in the literature to which this paper will make a contribution.

The attendance models published since Demmert's and Noll's seminal papers have generally included data about population characteristics, stadium characteristics, and the availability of substitutes as well as price and team quality data.[3] Some have focused on special issues.[4] One such special issue is the topic of this paper, the effects of baseball strikes and lockouts on attendance.

Coffin (1996) introduces dummy variables for the strike years of 1972 and 1981 with team annual attendance as the dependent variable. His estimates indicate that the strike in 1972 had little impact on attendance in that year, but that per team attendance was down by over 700,000 as a consequence of the 1981 strike. However, since the 1981 strike lasted 50 days and cost over 700 games, finding attendance per team significantly lower in that year than in other years is not at all surprising. Coffin did not attempt to assess the extent to which the effects of the strikes carried over into other years. Schmidt and Berri (2002; 2004) address exactly that issue.

Using a time-series of aggregate attendance for MLB, Schmidt and Berri (2002; 2004) test for the impact of the strikes in 1981 and 1994-95. Their base model does not include any behavioral variables to explain attendance demand, but simply focuses on the stability of the time-series. They find, not unexpectedly, that attendance was harmed by

[3] Examples of such studies include the Demmert (1973), and Noll (1974) studies mentioned above as well as work by Siegfried and Eisenberg (1980), Coffin (1996) and Bruggink and Eaton (1996).

[4] For example, Kahane and Shmanske (1997) examine the effects of roster instability on attendance. Schmidt and Berri (2001) consider the effects of competitive balance, Knowles, Sherony, and Haupert (1992) look for the effect of uncertainty of outcome, and Domazlicky and Kerr (1990) examine the role of the designated hitter rule.

the strikes in 1981 and 1994-95, but they also find that attendance recovers from the effects of those strikes in the next year. They (2002) find that other episodes of labor-management unrest have no effect on attendance, either in the season in which they occur or in any other seasons. Indeed, the only other non-random influences on attendance are the post-World War II shock that makes attendance 20% larger than it had been previously and the National League expansion in 1993.

The existing evidence on the effects of strikes in professional baseball is, apparently, clear. Both Coffin (1996) and Schmidt and Berri (2002; 2004) find that the 1981 strike lowered attendance, and Schmidt and Berri find that the 1994-95 strike did as well. The effects found by Schmidt and Berri are substantial, 30% in 1981 and 35% in 1994-95. However, Schmidt and Berri's results indicate that those effects are short lived, as they do not appear to carry over into the subsequent season. No previous research has found any impact of the strikes or lockouts that cancelled no games.

Discussion of Data

The attendance data used in this paper follows each franchise in the United States from 1969 until 1996, including franchises that move and franchises that come into existence through expansion. This means that two franchises, the Montreal Expos and the Toronto Blue Jays, are omitted from the analysis. The attendance variable is the attendance per game for an individual team averaged over the entire season. Various approaches have been taken in the literature, some researchers using per game or annual attendance by team (Demmert 1973; Noll 1974; Coffin 1996; Kahane 1997), some using game by game attendance across a season (Bruggink and Eaton 1996), and still others using league-wide annual attendance per team (Schmidt and Berri 2002; 2004). Each approach has its advantages and disadvantages. The approach taken here, to use annual attendance per game for each team, allows us to test a fully specified demand for attendance using ticket prices that vary cross-sectionally and over time. The primary question of this paper is whether demand for attendance is affected by labor unrest, that is, whether the demand function is shifted as a result of strikes and lockouts. To answer this question requires a fully specified demand function.[5]

A difficulty with specifying this demand function is that no ticket price series exists for each team through the entire period. For this reason, several alternative regressions are estimated, each using different price data. The sample period ends with 1996 rather than continuing until 2000 and beyond because the one ticket price series available after 1990 is not constructed the same before and after 1996. Specifically, in 1997 and after the prices are constructed including luxury boxes whereas before 1996 luxury boxes are not included.[6]

Researchers estimating attendance models for Major League Baseball have two choices for the price variable. One is to construct an average ticket price using a seating chart and price schedule to calculate the weighted-average price of available seating. This type price variable is available for the period from 1969 to 1988. The other price option is to divide each team's gate receipts by its total attendance. Such a variable is available for

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[5] An additional issue, raised by a referee, is whether early season strikes and late season strikes differ in their impact on average attendance because early season games have lower attendance than late season games so losing them would have a smaller impact on the average than would losing the late season games. This is an interesting possibility and is more fully addressed below.

[6] Moreover, pricing behavior seems quite different after 1996. For example, between 1992 and 1993 only 4 teams raised prices by more than $1 on average, between 1993 and 1994, 12 teams did so with three of them raising average price by more than $2. Two of the teams that raised price by more than $2 opened new stadiums that year. Between 1996 and 1997, 12 teams raised prices more than $1, and five of them raised price by more than $2. Only one franchise opened a new stadium that year. Finally, between 1997 and 1998, 16 teams raised price more than $1, 11 of those by more than $2, 6 of those by more than $3, and 3 by more than $4.

the period 1990 through 1996. The latter method can be considered the "actualized" average ticket price. Both methods have their advantages and disadvantages and their proponents and detractors. The bottom line of this debate is that either the ticket price is measured with error or it is endogenous. In either case, an appropriate estimation technique to control for the data problem is instrumental variables regression. Consequently, we use IV techniques, and this enables us to assess which type price variable works best in the estimation of attendance.

The raw price variable for the period 1990 to 1996 was constructed using the gate receipt data from Rodney Fort's MLB Business Pages website and the total attendance for each team for each year.[7] The nominal average ticket prices are deflated by the Consumer Price Index using a base year of 1983. This variable is called GATE.

The price variable for the earlier period, 1969 through 1988, comes from two sources, Doug Pappas's Business of Baseball website[8] and Roger Noll's price series available on Rodney Fort's web page. Both Pappas and Noll use the seating-chart method to construct the price variable, and their prices are very similar. The correlation coefficient is about 0.92. The problem is that neither series is complete for the full period 1969 through 1988. Pappas's data is complete for the early 1970s, but has a gap from 1986 through 1991, while Noll's series has a gap between 1971 and 1975 and is not constructed at all for before 1971. Noll's data extends through 1988. We have done the analysis on the period 1969 to 1985, so that we have a consistent price series, but we also constructed a price variable from the Pappas and Noll variables to extend the coverage

[7] The url for this website is http://users.pullman.com/rodfort/SportsBusiness/MLB/MLBFrame.htm.
[8] The url for Pappas' website is http://roadsidephotos.com/baseball/index.htm.

through 1988.[9] We took the average of the average seat price variables from Pappas and Noll whenever both were available, and used the one that existed whenever only one exists. The Pappas variable is called SEAT, the constructed price is NOLL-PAPPAS.

Other variables in the demand equation include population (POP) and real per capita personal income (REAL INC). The Standard Metropolitan Statistical Area population is available for all of the areas that had a Major League Baseball team.[10] It is also common in the literature on attendance demand to include the percent of the population that is black (PCTBLACK) and one paper (1996) also uses the percent of population that is Hispanic (PCTHISP). We use each of these variables as a regressor.

Variables that account for the history of the franchise are also commonly used in attendance demand models. We use the age of each franchise (TEAM AGE) to capture the effect of having a long history in a city as well as the novelty effect of having an expansion team in a city. Additionally, we control for the effects of the quality of the stadium using its age (STAD AGE) and a dummy variable indicating if that stadium is in its last year of operation (LAST YEAR). We hypothesize that younger parks will have greater attendance, all other things constant, than older parks, so we expect the stadium age variable will have a negative coefficient.[11] However, in the last year a stadium is in

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[9] We do not use the Pappas variable for the period 1991 through 1996, which he gets from the Team Marketing Report, because when these years are added, the estimation of the price elasticity deteriorates. The values in the Pappas price series jump dramatically from 1985 to 1991, and even from 1988, the end of the Noll series, to 1991. Because these prices seem so different, and because the estimation results deteriorate, we do not report results when using the 1991 through 1996 Pappas prices. We do not use these data for the period after 1996 because the computation changes in 1997 to include club seating.

[10] There are some approximations necessary as the SMSA does not perfectly coincide with the market area of the teams. For example, the Texas Rangers (Arlington) and the California/Anaheim Angels (Anaheim) play in SMSAs that may not be completely indicative of their market. In order to account for this discrepancy, the Angels' population data is from the Orange County SMSA while the Rangers' comes from the Dallas SMSA. Real per capita personal income also comes from the SMSAs.

[11] The stadium age variable is not a perfect control for the effects we want to capture. Possible alternative variables are dummies indicating the stadium has opened recently or some other sort of indicator of novelty. We avoid these variables because they are highly subjective (how does one decide how long the

operation, we expect attendance to be greater, all other things equal, as fans express nostalgia for the old park. One important factor that must be held constant to find the effects hypothesized for stadium age and last year of operation is the capacity of the stadium. Consequently, stadium capacity is included as an explanatory variable (CAPACITY).

Models of attendance demand also control for the quality of the team, both via its success on the field and through the abilities of its players. We control for the success of a team using winning percentage in the current season (WIN PCT) and in the previous season, and by a dummy variable indicating appearance in the playoffs in the previous season (LAG PLAYOFF).[12] Although a team's winning percentage at the end of the season is not known until the season is over, it is a reasonable proxy for the team's performance throughout the season. Last season's winning percentage (LAGWIN PCT) and playoff experience proxy for fans' expectations for the coming year and the decision to buy season tickets. Greater values of either winning percentage variable and playoff participation are expected to raise attendance in the current season.

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novelty effect lasts?) and, consequently, less intuitive. A case-in-point is Coffin's (1996) attendance study which uses a variable that begins at 4 in the first year a stadium is open and declines by one each year until it reaches zero in the fifth and every subsequent year after the facility opens. His justification is that "[f]ollowing some experimentation … [this method] led to the best results" (p.38) and the approach clearly addresses the issue of "novelty" effects. However, the age of stadiums affects attendance in more ways than simply as a novelty. Aging stadiums are less comfortable and offer fewer amenities than newer facilities. The experience of the trip to the ballpark is less satisfying in a decrepit facility than in a modern one, even after novelty effects are controlled for, so a variable like Coffin's misses important determinants of attendance.

[12] For expansion teams we substitute the contemporaneous winning percentage for the lagged winning percentage. We assume that actual winning percentages of expansion franchises are reasonably close to what their fans expected them to be going into their inaugural seasons. For example, for the inaugural season of the Seattle Mariners, the lagged winning percentage is set equal to the actual winning percentage of the Seattle Pilots expansion team from 1969. The Mariners won 35% of their games in 1977, while the Pilots won 39.5 percent of their games in their first, and only, season of play.

If two baseball teams have the same record, same size market, etc., but one has a superstar and the other does not, the team with the star would be expected to draw more fans. We capture the prowess of the players on a roster with two variables, all-time All-Stars (AAS) and BLACK INK. All-time All Stars is developed from the website Baseball-Reference.com which counts the number of players that were ever on an All-Star roster that are on a team in a given season. "Black ink" is a term used by Baseball-Reference.com that means a player led the league in a category.[13] The black ink variable used here includes more than just league leaders. It is calculated as the number of times, in a given season, players from each team show up in the top ten of their league's leader boards for the following statistics: batting average, home runs, runs batted in, wins, earned run average, and pitcher strikeouts. Admittedly, these variables are not perfect measures of the ability of star players to attract fans, but they are objective and should be a good proxy of the overall star power on a team.

The focus of this paper is on the effects of strikes and lock outs in Major League Baseball on attendance. These events are accounted for in three ways. First, strikes and lockouts that result in no games being cancelled are lumped together in one variable. Three of these occurred during spring training (1973, 1976, and 1990), and the 1980 event occurred in May, leaving the vast majority of the season to play after the strike. Consequently, if these events had any effect on attendance per game it is most likely that affect is spread throughout the entire season. The one exception is the strike of 1985 that took place in August. Because this strike occurred during the period of relatively high demand, its effects on attendance may differ from those of the other events that did not

[13] Baseball encyclopedias and baseball cards tend to highlight league-leading statistics with boldface—hence the term "black ink."

cause the loss of any games. Nonetheless, for each of these seasons the variable LOCKOUT takes the value one, and in all other seasons the lockout variable is zero. An assessment of the differential impact of 1985 is discussed below.

A second set of variables is four indicators, one for each of the year of the strike and the three following years for those three strikes which resulted in the loss of regular season games, 1972, 1981, and 1994-95. These variables are STRIKE1, STRIKE2, STRIKE3, and STRIKE4. The choice to highlight the year of the strike and the three succeeding years recognizes the fact that each strike or lockout occurred at the expiration of a Basic Agreement, and the variables correspond to the three year length of the typical Basic Agreement between the MLBPA and the owners. In addition, the examination of subsequent years allows one to assess whether the effects of the strike spill over into the following seasons and, in the case of STRIKE4, whether fans may stay away as reports of the impending labor dispute spread as the expiration date of the Basic Agreement nears.

For example, the players struck in 1972. STRIKE1 equals 1 for 1972. STRIKE2 equals 1 for 1973 and identifies the first year under a new Basic Agreement, STRIKE3 equals 1 in 1974 the second year under the agreement, and STRIKE4 equals 1 in 1975, the third, and final, year under the Basic Agreement. Summing up the strike variables, STRIKE1 equals 1 in 1972, 1981, and 1995; STRIKE2 equals 1 in 1973, 1982, and 1996; STRIKE3 equals 1 in 1974 and 1983; and STRIKE4 equals 1 in 1975 and 1984. [14] STRIKE3 and STRIKE4 are not equal to one in 1997 and 1998, respectively, because those years are not in the data for the reasons outlined above.

[14] We also estimated the model with STRIKE1 equal to one in 1994, STRIKE2 equal to 1 in 1995, and each variable zero otherwise. The results are nearly identical to those reported here and are available upon request.

These three strikes may have vastly different effects. Moreover, the 1985 strike may differ from the other LOCKOUT years. The strike of 1972 lasted 13 days and resulted in the loss of 86 games. The strike of 1981 was much more severe, lasting for 50 days and causing 712 games to be lost. Most severe of all is the strike of 1994-95 which resulted in the loss of 920 games spread over the 1994 and 1995 seasons and the cancellation of the 1994 playoffs and World Series.[15] The games lost as a result of the 1981 and 1994-95 strikes amount to 25 and 33 percent of the regular season schedule. The 86 games lost in 1972 is an order of magnitude smaller.[16]

To allow for the possibility that the effect of the strike in 1972 may be different from the strike in 1981 and 1995, both because of the differences in severity and because of the possibility that the early season 1972 strike is unlike the mid and late season strikes of 1981 and 1994-95, we also estimate the model with dummy variables that indicate each year individually, as well as each of the succeeding three years.[17] The use of these year dummy variables to indicate the strike year and the following years inherently reflects the effects of the trends in per game attendance confounding the interpretation of these variables as strike effects. In a regression that includes a dummy variable for each of 1972, 1973, 1974, 1975, 1981, 1982, 1983, and 1984, which enables one to assess if the effect on attendance is the same in corresponding years across both strikes, the

[15] The result was to lose 52 days from the 1994 season and 25 days from the 1995 season. Zimbalist (2003) says that 938 games were lost from the regular season schedule. The 920 lost games comes from (2002).
[16] An alternative approach is to use the number of games lost, per team, as a regressor. In most years this variable is zero, but in strike years it is the number of games lost divided by the number of teams. This approach produces very similar results as the approach reported on below. Moreover, if the STRIKE1, STRIKE2, STRIKE3, and STRIKE4 variables are regressors along with this games lost variable, the former carry coefficients and t-statistics like those reported below, while the latter is not remotely statistically significant. These results are available upon request.
[17] We also included a dummy variable for 1985. That variable was rarely significant and uniformly positive, suggesting that the 1985 strike in early August was not different from the other strikes and lockouts from which no games were lost.

variables may behave very much like a non-linear time trend. To control for this, the analysis includes the lagged value of the per game attendance as an explanatory variable (LAGATT_G). Inclusion of the lagged dependent variable raises the question of stability of the model. Unit root tests, whether the coefficient on the lagged dependent variable is equal to 1, soundly reject the null hypothesis. Schmidt and Berri (2002) reach a similar conclusion on annual league-wide attendance data.

One last set of variables used in the analysis must be discussed. The measurement error and endogeneity issues with the ticket price variables suggest use of an instrumental variables technique. We use city specific dummy variables in a first stage regression, along with the stadium, player and demographic variables described above, to predict the ticket prices. One might contend that the city specific effects belong in the attendance equation directly. However, results for the price variable are more stable and more frequently consistent with economic theory when the city specific effects are in the first stage equation than when they are in the attendance demand equation.

Table 1 reports the descriptive statistics for each of the variables except the city specific dummies for all of Major League Baseball and for each league individually for the period 1969 through 1996. GATE, SEAT, and NOLL-PAPPAS have fewer observations than the other variables because they are not available for the full sample period as was discussed above.

Results

In this section we discuss the results of estimating the demand for attendance at Major League Baseball games and the effects that labor-management unrest have on that attendance. Table 2 reports results of instrumental variables estimation of the attendance demand equations for each of the three price variables when the four STRIKE variables are regressors. The evidence of Table 2 indicates that attendance demand is price inelastic, that attendance demand is persistent from year to year, and that the greater the on-field success the greater the success at the ticket window. Stadium and franchise age, player quality, and the city's population base are also generally significant determinants of attendance. Average income, racial composition of the city, stadium capacity, and the league the team plays in, are generally not statistically significant determinants of attendance.

Turning to the effects of strikes and lockouts, the LOCKOUT variable is statistically significant in the LN GATE and LN NOLL-PAPPAS equations. This suggests that attendance is down by about 3 to 7 percent even after minor labor-management dustups. Recall that most of these events occurred during spring training and none caused cancellation of any regular season or post-season games. Neither Schmidt and Berri (2002; 2004) nor Coffin (1996) find these events to be statistically significant. The estimates in the LN NOLL-PAPPAS equation seem the most reliable of the three. The data covers three extra seasons relative to the LN SEAT model, and it covers several events whereas the time period for the LN GATE model only had one lockout.

STRIKE1 is significantly negative in all three equations. The coefficients indicate that in the year a strike occurs attendance per game is lowered by about 12 to 13 percent relative to the average attendance level through to 1988. Using the LN SEAT and LN NOLL-PAPPAS models, attendance rebounds the year following the strike to about

6% above trend. Using the LN GATE price variable, the only price variable that covers the 1994-95 strike, the evidence is that attendance fell by 24% in 1995 as a result of the strike of 1994-95. Fan ire over the cancellation of the previous season's playoffs and the World Series is clearly evident in this drop off which is nearly double that for either of the earlier strikes. Attendance appears to bounce back to the trend level in 1996, similar to the findings of Schmidt and Berri (2002; 2004), as the variable for the year after the strike is not statistically different from zero. Interestingly, attendance dips below trend three years after the strike in both the LN SEAT and LN NOLL-PAPPAS equations, perhaps signaling some residual resentment on the part of fans about the previous strike as negotiations over the next collective bargaining agreement begin.

Tables 3 and 4 present results of estimating the models when each year of a strike is identified separately, followed by each of the next three years. This approach allows each strike to be distinct compared to the approach reported in Table 2 where each strike had the same effect. The disadvantage of this approach is that the variables indicating the strikes act very nearly like a set of year fixed effects so that interpretation of the effects as being the result of the strikes is problematic. Consequently, the models are estimated two ways, once with a nonlinear trend as an explanatory variable (Table 3) and once with it as an instrument but not in the demand equation (Table 4). The results are quite similar between the LN SEAT and the LN NOLL-PAPPAS equations both with and without the trend variable. Two differences of note are that the inclusion of the nonlinear time trend as a regressor results in 1) smaller price elasticity estimates which are no longer statistically different from zero and 2) the income elasticity has the wrong sign and is not statistically significant. When the nonlinear trend is omitted from the equation, the price elasticity estimates are statistically significant and about the same size as those reported in Table 2. The income elasticity in the LN NOLL-PAPPAS equations is statistically significant and about the same size as in Table 3.[18]

Consider 1972 and 1981, the years the strikes occurred. Attendance is lower by a statistically significant amount estimated between 10 and 12% for 1972 and between 11 and 16% for 1981. By contrast, Schmidt and Berri [Schmidt, 2002 #43;Schmidt, 2004 #55] find no effect of the 1972 strike. Moreover, tests of the equality of the coefficients for 1972 and 1981 can not reject the null hypothesis despite the rather dramatic difference in the severity of the two strikes and the differences in when the two strikes occurred during the season.[19] The effects for 1973 and 1982 are generally not different from zero. However, when the nonlinear trend variable is not in the demand equation, the effects of 1982 are positive and statistically significant. One possibility is that these values reflect the strong economic recovery under way in 1982. On the other hand, tests of the equality of the 1973 and 1982 effects can not reject the null hypothesis. Likewise, equality of the effects for 1974 and 1983, and 1975 and 1984 cannot be rejected, indicating that the time path of the repercussions of the two strikes is the same. Note that this implies that attendance is affected by labor-management relations in the year of the strike and in the last year of a Basic Agreement between the owners and the Major League Baseball Players Association. The result also means that modeling the strikes with a common STRIKE1, STRIKE2, etc., as in Table 2, is supported by the data.

The final set of results introduces forecasts of ticket prices as an explanatory variable. In this way, the data from 1969 through 1996 can all be used in the

[18] No estimates are available for the LN GATE model as the price series does not go back before 1990.
[19] A table of the test statistics is available upon request.

regressions.[20] Table 5 presents these results when the trend is included, Table 6 when it is not. Note that the price and income variables have the expected signs and are statistically significant in Table 6, and that price has the right sign and is significant in Table 5.[21] Coefficients on other variables are generally consistent with the IV results in Tables 2, 3 and 4. The one clear exception to this generalization is the consistently positive and significant effects of BLACK INK. These suggest that an additional league leading player raises attendance per game by between 0.5 and 0.7%.

As for the effects of the strikes, the evidence is that the strike and lockout variables are not all zero. F-tests easily reject the null hypothesis for the regressions that include strike effects in either Table 5 or Table 6. Of more interest is the question of whether the effects in the year of the strike are the same across all three strikes, as is imposed by the use of the STRIKE variables. For the model that includes the time trend, one cannot reject the null hypothesis that the effects are the same for the 1972 and 1981 strikes, as before. However, one can reject the null hypothesis that the effects are the same in 1972, 1981, and 1995. The F-statistic is 3.28, with 2 and 695 degrees of freedom. In other words, the 1994-95 strike had a statistically different impact on attendance once the strike was resolved than had the earlier strikes, at least if the attendance equation includes the nonlinear time trend.

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[20] The equation for predicting the average ticket price has as the dependent variable the PAPPAS variable, in log form, and uses all the explanatory variables in the model and city specific dummy variables. The adjusted R^2 for the regression is 0.66. There are 39 variables, including the city specific effects, and 19 of them are individually significant at the 10% level or better, 11 of those are city dummies. The others include log of population, percent black, log of stadium age, All Time All-Stars, Black ink, log of the team age, winning percentage, and a nonlinear time trend. Results are available upon request.

[21] The t-statistics in the table are conditional as the standard errors on which they are based have not been corrected for the use of the fitted price variable as a regressor. The results are, however, generally similar to those of the instrumental variables estimates reported in the earlier tables. Moreover, the corrected standard errors are only about 2.5% larger than the conditional ones, so the effects on t-statistics and p-values are small.

When the model does not include the trend variable, the results are different. Specifically, without the trend as a regressor, one cannot reject the null hypothesis that the 1972, 1981, and 1994-95 strikes had the same effect on attendance. The F-statistic for this test is 2.16, with 2 and 696 degrees of freedom.

The years after the strikes are not statistically different from one another. In other words, the hypothesis that 1973, 1982, and 1996 are alike cannot be rejected in either model. It is also not possible to reject the null hypotheses that 1974 and 1983, the second year after the first two strikes, are alike, nor can one reject the hypothesis that 1975 and 1984 have the same effects. In other words, the effects of the two earlier strikes have the same time path until the next Basic Agreement, and the 1994-95 path seems the same though it is not possible to follow that path all the way to the next round of bargaining.

Conclusion

Major league baseball avoided a work stoppage during the 2002 season. During the negotiations, a commonly heard statement was that baseball had never recovered from the strike of 1994. Schmidt and Berri (2002) published evidence from time-series analysis suggesting that the effects of strikes on attendance have historically disappeared in the season following the strike. They suggested the same was true for the 1994 strike, especially if one looked over the period 1993 to 1996. This, they say, is appropriate because 1993 and 1994 prior to the strike both exhibited very high attendance. The results here bear out the point that strike effects do not carry over into subsequent years. The strike effects here are, on the other hand, substantially smaller than those reported by Schmidt and Berri, who find that attendance is lower by 30% in 1981, and by 35% in

1994. Moreover, the evidence here suggests that the earlier strikes, those in 1972 and 1981, had the same consequences for attendance despite substantially different durations and games canceled. Additionally, the results of this paper indicate that the relatively minor labor management squabbles that we have labeled LOCKOUT had real effects on attendance in the years they occurred. This is a new finding of this research.

There is also support in the evidence here for several other hypotheses about attendance at professional sporting events. For example, the results here strongly support the link between success on the field and at the gate. Teams with better winning percentages this year and that made the playoffs last year attract more fans per game than unsuccessful teams. We also find that teams playing in older stadiums attract fewer fans. The estimates suggest that a 10% increase in stadium age results in between a .25 and a .5% reduction in per game attendance. Additionally, the results suggest that teams that have been in existence longer do better at the gate. There is mixed evidence on the effects of high quality players and on nostalgic effects in the last year of use of an existing stadium.

Demand for baseball attendance is found to be quite price inelastic and it does not matter whether price is measured using the seat price or the average gate approach so long as the estimation accounts for the likely endogeneity and measurement errors in the price series. Finding demand to be price inelastic is a puzzle. Most economists would agree that Major League Baseball has a substantial degree of market power. That market power, it is generally asserted, would result in monopoly pricing, that is, setting price to operate on the elastic portion of the demand curve. An important question for future research is, therefore, what explains baseball teams operating on the inelastic portion of the demand.

Did the labor unrest of 2002 have an impact on attendance? The evidence here, that attendance is lower in the last year of a Basic Agreement, suggests that it did, even though the two sides ultimately resolved the issues without resort to a work stoppage. These effects are likely to have dissipated before the end of the season but may partially explain the drop in attendance of over 4.6 million, about 156,600 per team, from 2001 to 2002.

Table 1: Descriptive Statistics

VARIABLE	MLB Obs	MLB Mean	MLB Std. Dev.	AL Obs	AL Mean	AL Std. Dev.	NL Obs	NL Mean	NL Std. Dev.
ATTEND	754	22179.51	9282.30	395	20994.67	8739.93	359	23483.15	9690.52
GATE	176	6.76	1.08	91	7.02	1.18	85	6.48	0.88
SEAT	400	6.15	0.99	213	6.16	0.98	187	6.15	1.00
NOLL-PAPPAS	471	6.05	0.98	251	6.07	0.99	220	6.04	0.98
POP	754	3684.18	2447.92	395	3434.14	2283.17	359	3959.29	2592.68
REAL INC	754	15296.65	2798.65	395	15379.62	2513.32	359	15205.36	3083.25
PCTBLACK	754	13.73	6.44	395	13.16	6.83	359	14.35	5.94
PCTHISP	754	8.76	9.19	395	7.46	8.27	359	10.20	9.92
STAD AGE	754	28.86	22.96	395	34.16	25.52	359	23.04	18.08
TEAM AGE	754	46.82	34.29	395	43.80	32.74	359	50.15	35.68
LAST YEAR	754	0.02	0.15	395	0.03	0.16	359	0.02	0.14
AAS	754	11.95	3.52	395	11.90	3.65	359	11.99	3.36
BLACK INK	754	4.78	3.02	395	4.60	3.00	359	4.97	3.04
WIN PCT	754	50.06	6.88	395	50.02	6.88	359	50.11	6.88
LAG WIN PCT	754	49.94	6.88	395	49.94	6.91	359	49.94	6.86
LAG PLAYOFF	754	0.17	0.38	395	0.16	0.36	359	0.19	0.39
CAPACITY	754	51.38	8.85	395	50.76	10.25	359	52.05	6.93
LN NOLL-PAPPAS	471	1.79	0.16						
LN ATTEND	754	9.91	0.44						
LN GATE	176	1.90	0.15						
LN SEAT	400	1.80	0.15						
LN POP	754	8.02	0.61						
LN REAL INC	754	9.62	0.17						
LN STAD AGE	754	2.98	0.98						
LN TEAM AGE	754	3.44	1.04						
LN CAPACITY	754	3.92	0.18						
STRIKE1	755	0.10	0.30	396	0.10	0.29	359	0.10	0.30
STRIKE2	755	0.10	0.30	396	0.10	0.29	359	0.10	0.30
STRIKE3	755	0.06	0.24	396	0.06	0.29	359	0.06	0.30
STRIKE4	755	0.06	0.24	396	0.06	0.24	359	0.06	0.24
LOCKOUT	755	0.16	0.36	396	0.16	0.37	359	0.15	0.36
NL	755	0.48	0.50						

Table 2: Instrumental Variables Estimates of Common Strike Effects

	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
LAG LN ATTEND	0.753	0.000	0.741	0.000	0.749	0.000
LN SEAT	-0.248	0.044				
LN GATE			-0.214	0.089		
LN NOLL-PAPPAS					-0.236	0.003
LN POP	0.042	0.065	0.059	0.018	0.030	0.136
LN REAL INC	0.148	0.200	0.033	0.760	0.199	0.024
PCT BLACK	0.001	0.643	0.001	0.684	0.001	0.490
PCTHISP	0.003	0.136	-0.001	0.222	0.002	0.165
LN STAD AGE	-0.052	0.007	-0.022	0.194	-0.051	0.004
LN CAPACITY	-0.032	0.532	0.031	0.685	-0.056	0.235
AAS	-0.002	0.573	0.006	0.069	-0.001	0.857
BLACK INK	0.008	0.074	0.005	0.256	0.008	0.045
LAST YEAR	0.037	0.622	0.162	0.078	0.027	0.721
LN TEAM AGE	0.030	0.054	-0.006	0.728	0.037	0.011
WIN PCT	0.023	0.000	0.017	0.000	0.022	0.000
LAG WIN PCT	-0.013	0.000	-0.007	0.004	-0.013	0.000
LAG PLAYOFF	0.062	0.035	0.023	0.502	0.085	0.002
NL	-0.021	0.380	-0.007	0.729	-0.022	0.301
LOCKOUT	-0.034	0.152	-0.066	0.017	-0.044	0.040
STRIKE1	-0.125	0.000	-0.239	0.000	-0.134	0.000
STRIKE2	0.063	0.021	0.030	0.424	0.057	0.033
STRIKE3	-0.049	0.148			-0.060	0.058
STRIKE4	-0.060	0.044			-0.072	0.009
CONSTANT	0.817	0.489	1.640	0.062	0.546	0.559
R SQ.		0.84		0.84		0.85
OBS.		375		174		446

Table 3: Instrumental Variable Estimates of Individual Strike Effects

	Coefficient	P-value	Coefficient	P-value
LAG LN ATTEND	0.707	0.000	0.709	0.000
LN SEAT	-0.087	0.359		
LOG NOLL-PAPPAS			-0.074	0.421
LN POP	0.065	0.008	0.048	0.024
LN REAL INC	-0.080	0.542	-0.018	0.872
PCT BLACK	0.001	0.676	0.001	0.585
PCTHISP	0.004	0.020	0.003	0.028
LN STAD AGE	-0.050	0.009	-0.049	0.006
LN CAPACITY	-0.026	0.611	-0.042	0.386
AAS	-0.002	0.533	0.000	0.954
BLACK INK	0.008	0.073	0.007	0.049
LAST YEAR	0.046	0.581	0.043	0.611
LN TEAM AGE	0.020	0.200	0.027	0.070
WIN PCT	0.023	0.000	0.022	0.000
LAG WIN PCT	-0.012	0.000	-0.012	0.000
LAG PLAYOFF	0.061	0.037	0.086	0.001
NL	-0.018	0.439	-0.019	0.343
LN TREND	0.065	0.005	0.067	0.001
LOCKOUT	-0.041	0.195	-0.052	0.031
y72	-0.107	0.003	-0.111	0.003
y73	0.041	0.338	0.045	0.256
y74	-0.088	0.084	-0.094	0.061
y75	-0.110	0.007	-0.115	0.004
y81	-0.155	0.001	-0.164	0.000
y82	0.062	0.123	0.053	0.132
y83	-0.046	0.290	-0.059	0.110
y84	-0.049	0.272	-0.065	0.075
CONSTANT	2.771	0.036	2.351	0.031
R SQ.		0.84		0.85
OBS.		375		446

Table 4: Instrumental Variable Estimates of Individual Strike Effects

	Coefficient	P-value	Coefficient	P-value
LAG LN ATTEND	0.735	0.000	0.742	0.000
LN SEAT	-0.197	0.029		
LOG NOLL-PAPPAS			-0.217	0.010
LN POP	0.050	0.035	0.032	0.109
LN REAL INC	0.095	0.431	0.184	0.038
PCT BLACK	0.001	0.653	0.001	0.482
PCTHISP	0.003	0.100	0.002	0.156
LN STAD AGE	-0.053	0.006	-0.053	0.003
LN CAPACITY	-0.035	0.503	-0.060	0.220
AAS	-0.002	0.600	0.000	0.943
BLACK INK	0.008	0.068	0.008	0.037
LAST YEAR	0.020	0.792	0.016	0.826
LN TEAM AGE	0.027	0.080	0.036	0.013
WIN PCT	0.023	0.000	0.022	0.000
LAG WIN PCT	-0.013	0.000	-0.013	0.000
LAG PLAYOFF	0.061	0.036	0.085	0.002
NL	-0.020	0.387	-0.022	0.289
LOCKOUT	-0.010	0.744	-0.034	0.154
y72	-0.113	0.002	-0.121	0.001
y73	0.012	0.769	0.024	0.557
y74	-0.078	0.128	-0.093	0.070
y75	-0.088	0.027	-0.101	0.010
y81	-0.119	0.006	-0.144	0.001
y82	0.104	0.007	0.080	0.026
y83	0.000	0.999	-0.027	0.441
y84	-0.008	0.851	-0.040	0.278
CONSTANT	1.334	0.283	0.713	0.458
R SQ.		0.84		0.85
OBS.		375		446

LN TREND is an instrument, but not a regressor.

Table 5: Full Period Regressions with Predicted LN SEAT as Ticket Price

	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
LAG LN ATTEND	0.715	0.000	0.721	0.000	0.724	0.000
LN SEAT (predicted)	-0.110	0.017	-0.096	0.027	-0.092	0.034
LN POP	0.029	0.049	0.031	0.025	0.030	0.032
LN REAL INC	0.014	0.805	-0.053	0.334	-0.032	0.577
PCT BLACK	0.000	0.851	0.000	0.890	0.000	0.997
PCTHISP	0.001	0.144	0.001	0.163	0.001	0.141
LN STAD AGE	-0.025	0.003	-0.025	0.002	-0.026	0.001
LN CAPACITY	0.002	0.957	0.014	0.703	0.007	0.842
AAS	0.002	0.259	0.003	0.123	0.003	0.150
BLACK INK	0.006	0.051	0.006	0.029	0.006	0.029
LAST YEAR	0.132	0.002	0.127	0.002	0.124	0.002
LN TEAM AGE	0.019	0.044	0.017	0.064	0.018	0.050
WIN PCT	0.019	0.000	0.019	0.000	0.019	0.000
LAG WIN PCT	-0.009	0.000	-0.009	0.000	-0.009	0.000
LAG PLAYOFF	0.067	0.001	0.057	0.002	0.054	0.005
NL	0.001	0.913	0.001	0.967	0.000	0.973
LN TREND	0.060	0.000	0.059	0.000	0.061	0.000
LOCKOUT			-0.047	0.006	-0.044	0.019
STRIKE1			-0.177	0.000		
STRIKE2			0.034	0.094		
STRIKE3			-0.079	0.002		
STRIKE4			-0.091	0.000		
1972					-0.115	0.002
1973					0.042	0.268
1974					-0.085	0.016
1975					-0.107	0.002
1981					-0.159	0.000
1982					0.056	0.105
1983					-0.061	0.071
1984					-0.065	0.053
1994					0.015	0.655
1995					-0.239	0.000
1996					0.012	0.720
CONSTANT	1.957	0.000	2.503	0.000	2.292	0.000
ADJ R SQ.		0.85		0.87		0.87
OBS.		725		725		725

P-values based on conditional standard errors.

Table 6: Full Period Regressions with Predicted LN SEAT as Ticket Price

	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
LAG LN ATTEND	0.756	0.000	0.763	0.000	0.762	0.000
LN SEAT (predicted)	-0.171	0.000	-0.155	0.000	-0.146	0.001
LN POP	0.012	0.408	0.014	0.297	0.014	0.312
LN REAL INC	0.154	0.001	0.087	0.056	0.113	0.017
PCT BLACK	0.001	0.449	0.000	0.639	0.001	0.541
PCTHISP	0.002	0.099	0.001	0.113	0.001	0.102
LN STAD AGE	-0.023	0.006	-0.023	0.004	-0.025	0.002
LN CAPACITY	-0.007	0.856	0.005	0.900	-0.004	0.905
AAS	0.001	0.560	0.002	0.346	0.002	0.370
BLACK INK	0.005	0.067	0.006	0.040	0.006	0.035
LAST YEAR	0.111	0.010	0.108	0.008	0.105	0.010
LN TEAM AGE	0.028	0.002	0.026	0.003	0.027	0.003
WIN PCT	0.019	0.000	0.019	0.000	0.019	0.000
LAG WIN PCT	-0.010	0.000	-0.011	0.000	-0.010	0.000
LAG PLAYOFF	0.070	0.001	0.060	0.002	0.057	0.003
NL	-0.001	0.956	-0.002	0.899	-0.001	0.928
LOCKOUT			-0.043	0.012	-0.033	0.081
STRIKE1			-0.179	0.000		
STRIKE2			0.040	0.047		
STRIKE3			-0.072	0.005		
STRIKE4			-0.081	0.001		
1972					-0.147	0.000
1973					0.013	0.727
1974					-0.092	0.010
1975					-0.103	0.004
1981					-0.142	0.000
1982					0.081	0.018
1983					-0.041	0.222
1984					-0.049	0.147
1994					0.028	0.407
1995					-0.230	0.000
1996					0.028	0.390
CONSTANT	0.658	0.165	1.179	0.011	0.962	0.047
ADJ R SQ.		0.85		0.87		0.87
OBS.		725		725		725

P-values based on conditional standard errors; LN TREND an instrument.

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