Competitive Balance and Attendance

The Case of Major League Baseball

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Both the popular press and industry insiders have claimed that the growing gap between the "rich" and "poor" teams in major league baseball has led to a greater disparity on the field of play and that the eventual outcome of this gap will be lower attendance. The purpose of this inquiry is twofold. First, an investigation into the level of competitive balance reveals that relative to major league baseball's historical record and contrary to the contentions of the media, the 1990s was the most competitive decade on the field of play. Second, the previously unexplored link between aggregate attendance and league competitive balance is examined. This investigation suggests that a relationship between these factors does indeed exist, whether one explores the relationship strictly across time or with the use of a panel data set.

> The essential economic fact concerning professional team sports is that gate receipts depend crucially on the uncertainty of outcome of the games played within the league. As the probability of either team winning approaches 1, gate receipts fall substantially. Consequently, every team has an economic motive for not becoming "too" superior in playing talent compared with other teams in the league. On the other hand, gate receipts of the home team are an increasing function of the probability of the home team winning for some range beyond a probability of .5, so that every team has an economic motive to be somewhat superior to the rest of the league.
>
> —El-Hodiri & Quirk (1971, p. 1306)

The seminal work of El-Hodiri and Quirk (1971) laid forth the essential dilemma facing a professional sports league. Each team strives to put together a level of talent that increases the probability that it will defeat its opponents. However, if the team achieves too much success with respect to the objective of win maximization, the objective of profit maximization may be compromised. In the

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words of Walter Neale (1964), whose seminal work preceded El-Hodiri and Quirk (1971) by 7 years, the prayer of a premier team such as the New York Yankees must be, "Oh Lord, make us good, but not that good" (Neale, 1964, p 2).

The success of the Yankees and the Atlanta Braves in the 1990s has led some to question whether these two franchises have become "too good." The Yankees' historical domination of major league baseball has been well documented. Their sweep of the Braves in the 1999 World Series gave the Yankees their 25th championship in the 20th century. Although the Yankees had not won a single championship for 18 years following their 22nd in 1978, in the latter half of the 1990s, the team reasserted its supremacy in professional baseball.[1] From 1995 to 1999, the Yankees won four division titles, four American League (AL) championships, and three World Series titles.

The Yankees' mastery of the AL in the 1990s was nearly matched by the Braves' performance in the National League (NL). With the exception of the 1994 season, when a dispute between labor and management eliminated the latter part of the season, the Braves won a division title every year from 1991 to the close of the decade. These division titles resulted in five league championships, and although they won only a single World Series in this span, the Braves clearly dominated NL baseball in the 1990s.

How did these two teams reach their respective high levels of on-field performance? An Associated Press (1999) article released soon after the conclusion of the 1999 season noted that the Braves and Yankees not only dominated their competition on the field but also led their respective leagues in player compensation. The link between payroll and on-field performance extended beyond the Braves and Yankees. The same article also observed that all 8 playoff teams in 1999 ranked among the top 10 in spending on player salaries. Furthermore, since the players' strike of 1994 to 1995, only 1 team not ranked in the top half in player payroll has managed to appear in postseason competition.

The disparity between the rich and poor teams in major league baseball prompted the following observation from Commissioner Bud Selig: "The evidence is very clear that we have a disparity problem. We are going to crack it, because it is essential to the growth of the game" (McKinley, 2000, p. C20).

The above evidence suggests the following two hypotheses. First, disparity in player compensation reduces competitive balance. Given that the dramatic differences in team payrolls occurred in the 1990s, one would suspect that competitive balance in major league baseball would be significantly lower in this decade relative to the history of the AL and the NL. Second, Selig's comment suggests that fan attendance relates to competitive balance. In other words, one would conclude that increases (or decreases) in a league's competitive balance would have a positive (or negative) impact on aggregate league attendance. The purpose of this inquiry is to record how competitive major league baseball was in the 1990s and, furthermore, how changes in competitive balance typically affect fan attendance.

The organization of this inquiry is as follows: The second section examines the level of competitive balance in the 1990s and also throughout the history of major league baseball in the 20th century. The third section briefly reviews previous studies that have examined the relationship between competitive balance and fan attendance. The fourth section offers our examination of these two factors, which was conducted using time-series data as well as a panel data set covering a smaller time period. Concluding observations are offered in the final section.

MEASURING COMPETITIVE BALANCE

The present analysis incorporates a competitive balance measure that largely follows the work of Noll (1988) and Scully (1989) by comparing a league's outcomes with those that would be expected if all teams had equal playing strengths. However, unlike previous literature that has employed competitive balance measures comparing the standard deviations of team wins with those that would be expected if wins were random (Quirk & Fort, 1997) or examined the dispersion and season-to-season correlations of team winning percentages (Balfour & Porter, 1991; Butler, 1995; Quirk & Fort, 1997), the present analysis uses the conventional economic measure of inequality, the Gini coefficient.[2]

The analysis of the distribution of wins within professional baseball is theoretically similar to the analysis of the distribution of income within a population. Hence, the method we have chosen is borrowed from previously published research examining income inequality.[3] The Gini coefficient is a common and rudimentary unit of measurement where questions of inequality are central. More specifically, the coefficient provides a single unit measure for the degree to which a relationship deviates from equality. Given that equality represents perfect competitive balance, the measure captures much of the literature's intuition.

The Gini coefficient has a defined range between 0 and 1, where 0 indicates perfect equity and 1 indicates perfect inequity. In the present context, a value of 0 would be obtained in the unique situation where each team won 50% of its games, that is, where wins are evenly distributed. The further that wins deviate from this situation, the larger the associated Gini coefficient and the lower the degree of competitive balance. The specific Gini coefficient measure (G) adopted in this inquiry is (Lambert, 1993):

$$G_i = (1+\frac{1}{N_i}) - \frac{2}{N_i^2 \mu_{x_i}} * (x_{N,i} + 2 * x_{N-2,i} + 3 * x_{N-2,i} + + N * x_{1,i}) \tag{1}$$

where, in the present context, N represents the number of teams, x_N represents the winning percentage of team N, μ represents the average value of x, and i represents the time period. In addition, each team is ranked relative to its winning percentage such that $x_N \geq x_N - 1 \geq \ldots \geq x_1$.

The data on team winning percentages were obtained from *The Complete Baseball Record Book* (Carter, 1998) for each year from 1901 to 1998.[4] *The Complete*

TABLE 1: Competitive Balance Measure Descriptive Statistics

Descriptive Statistic	*American League Gini Coefficient*	*National League Gini Coefficient*
Sample	1901 to 1999	1901 to 1999
Mean	0.094	0.093
Median	0.095	0.091
Maximum	0.156	0.168
Minimum	0.049	0.048
Standard deviation	0.024	0.026
Observations	99	99

TABLE 2: American League and National League Gini Coefficients in the 1990s

Year	*American League*	*National League*
1990	0.059	0.062
1991	0.059	0.065
1992	0.068	0.072
1993	0.060	0.103
1994	0.071	0.075
1995	0.088	0.070
1996	0.071	0.061
1997	0.067	0.063
1998	0.083	0.097
1999	0.084	0.085
Mean	0.071	0.075

Baseball Record Book also provides information on the number of teams in the AL and the NL. Since 1960, each league has expanded on several occasions. Hence, the value of N has changed over time.[5] Finally, as each game must have a winner and a loser, the value of μ will be 0.5.[6]

Table 1 reports various descriptive statistics for the two Gini coefficient measures. It can be seen that in the 20th century, the average and median levels of competitive balance in each league were essentially equal. The maximum values for each league occurred in the first half of the century: The high value in the AL occurred in 1932, and the maximum in the NL was achieved in 1909. The minimum values, which occurred in the NL in 1968 and in the AL in 1974, each occurred after the advent of the amateur draft but prior to the introduction of limited free agency. Does this result suggest that baseball has become less competitive in the free agency era?

Before such a question can be answered, further evidence must be considered. Such evidence is offered in Tables 2 and 3. Table 2 lists the competitive balance

TABLE 3: American League and National League Gini Coefficients by Decade

Decade	*American League*	*National League*
1901 to 1909	0.106	0.138
1910 to 1919	0.111	0.099
1920 to 1929	0.099	0.096
1930 to 1939	0.118	0.098
1940 to 1949	0.095	0.105
1950 to 1959	0.105	0.086
1960 to 1969	0.084	0.088
1970 to 1979	0.083	0.077
1980 to 1989	0.074	0.071
1990 to 1999	0.071	0.075

measures for both leagues in the 1990s. Although the latter half of the decade saw an increase in the Gini coefficient and therefore a decrease in competitive balance relative to the minimum values achieved in the early 1990s, major league baseball appears to have been more competitive in the last decade of the century than the typical result achieved over the past 100 years. Table 3 offers additional evidence in support of this position, reporting the mean of the Gini coefficient for each decade in the 20th century.[7] From these results, it can be seen that the era of free agency has been the most competitive in major league baseball's history.

The difference between competitive balance in the 1990s and in the remainder of the century is further highlighted in Figures 1 and 2, where the estimated AL and NL Gini coefficients for the period from 1901 to 1999 are illustrated. Consistent with the literature, where it is generally agreed that competitive balance has improved over the past few decades, both AL and NL measures have a distinct downward trend beginning around 1960. The timing is consistent with the findings of Scully (1989), where the increase in competitive balance coincides with the establishment of the reverse-order amateur draft and the relatively free movement of franchises. In addition, there is a distinct downward trend continuing in the late 1970s, which is consistent with the findings of Balfour and Porter (1991). These authors described the introduction of free agency as having a positive effect on competitive balance.

The first hypothesis suggested previously has been shown to be inconsistent with the reported evidence. Despite the domination of the Yankees and the Braves, major league baseball was more competitive in the 1990s than in any other period of its history. Previously, it was contended that competitive balance and attendance were linked. Will this theoretical relationship be confirmed by the empirical evidence? The answer to this question begins with a brief review of past literature that examined this issue.

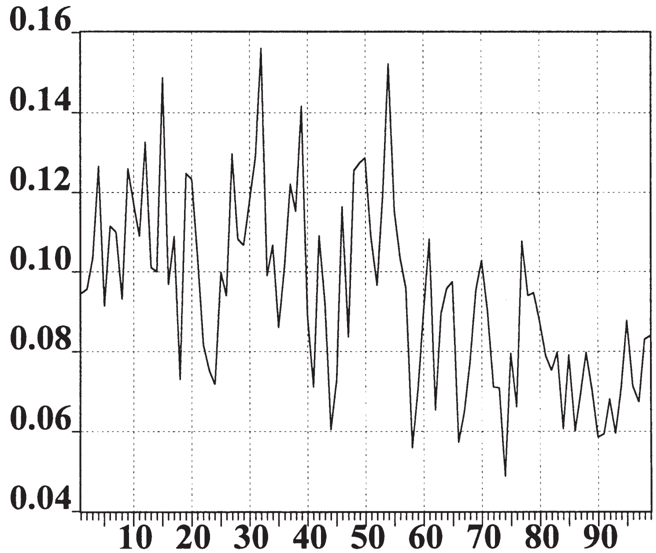

Figure 1: American League Gini Coefficients, 1901 to 1999

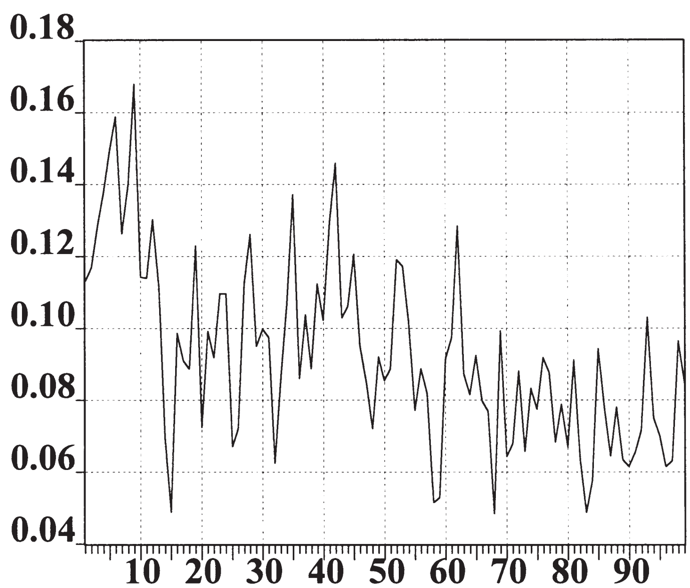

Figure 2: National League Gini Coefficients, 1901 to 1999

COMPETITIVE BALANCE AND ATTENDANCE: A REVIEW OF THE LITERATURE

The determinants of fan attendance have been laid forth previously in the literature, although the issue of competitive balance has not been consistently considered. Early studies examining consumer demand for major league baseball include the work of Demmert (1973) and Noll (1974). The demand for minor league baseball was explored by Siegfried and Eisenberg (1980). Each of these studies considered the impact of team quality as measured by season winning percentage but failed to examine the issue of competitive balance.

These early studies generally examined the relationship between a team's aggregate season attendance and various on- and off-field team characteristics. More recent studies have examined short-run demand, where the unit of observation was a single game. In the context of these studies, competitive balance has been implicitly explored by considering the impact of uncertainty of outcome on fan attendance. Jennett (1984) offered a study of Scottish league football in which he examined the relationship between single game attendance and the final score of the contest. Peel and Thomas (1988), in a study of English football, improved on Jennett's (1984) study by considering an a priori measure of uncertainty: pregame odds data. Borland and Lye (1992), in a study of Australian-rules football, measured uncertainty in terms of the difference in league standing of the two teams participating in the contest. Each of these studies found that uncertainty of outcome had a positive impact on fan attendance.

Short-run demand and uncertainty of outcome have also been examined recently with respect to major league baseball. Knowles, Sherony, and Haupert (1992) followed the lead of Peel and Thomas (1988) by considering the betting line as the *ex ante* measure of uncertainty. Their study of the 1988 season found that attendance is maximized when the probability of the home team winning is 0.6. Rascher's (1999) study of the 1996 season examined a larger sample of games and a greater number of independent variables. Rascher's (1999) study demonstrated that fans prefer to see the home team win, and consistent with the work of Knowles et al. (1992), fan attendance is maximized when the home team's probability of winning is 0.66. Each of these studies suggested that a home team with a high probability of winning a contest will see a decline in fan attendance, indicating that uncertainty of outcome is a significant determinant of demand.

Each of these studies considered the impact that uncertainty of outcome has on the likelihood that consumers will attend a single game. Although these studies implicitly measured the importance of competitive balance, the impact of league competitive balance on attendance remains unexplored. The purpose of this study is to examine the relationship between these two factors. Unlike previous studies, two sets of data will be used in this investigation. In addition to the more traditional panel data set, a time-series data set that examines the entire available history of major league baseball will be employed.

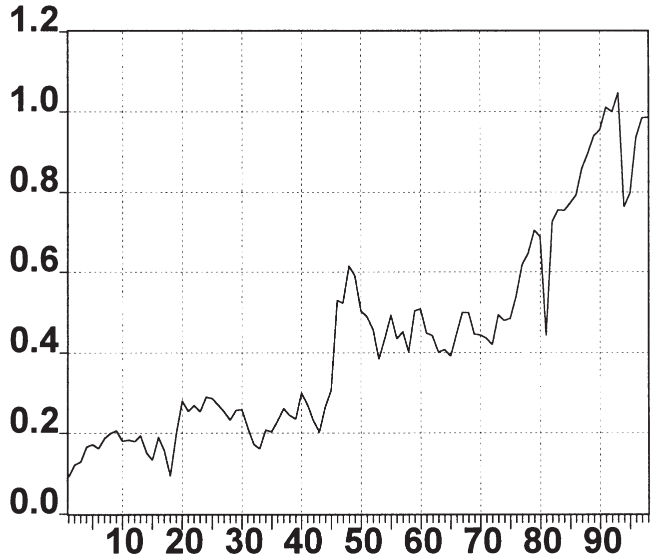

Figure 3: Scaled Average American League Attendance, 1901 to 1998

COMPETITIVE BALANCE AND ATTENDANCE: EMPIRICAL EVIDENCE

The Attendance Data

In addition to the measure of competitive balance, the present analysis requires data on fan attendance. The relevant data were obtained from *The Complete Baseball Record Book* (Carter, 1998). This source provides annual data for each year from 1901 to 1998. In addition to aggregate data from the AL and NL, this source also provides individual team attendance information. To ease the interpretation of these data, we made several modifications to both the aggregate and individual attendance figures.

The first of these modifications was an adjustment of the data for periods of expansion, which affect total attendance without any additional exogenous effect. Specifically, we deflated each attendance series by the number of teams to produce an average attendance figure. The second modification was a scaling of the data in terms of the 1992 attendance figure. Figures 3 and 4 depict the scaled average total attendance series for the AL and NL.

While these figures highlight the general upward trend attendance has followed over time, they also indicate that the series have been influenced by several large outliers. The outliers represent the effects of two world wars and of baseball's owner-labor strife of the 1980s and 1990s. For example, the ends of both world wars and the corresponding return of U.S. soldiers resulted in large positive spikes

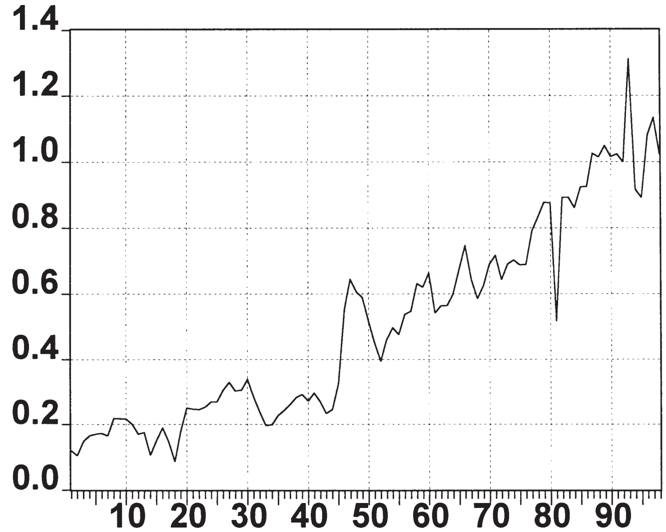

Figure 4: Scaled Average National League Attendance, 1901 to 1998

in attendance in 1918, 1919, and 1946. The 1981 and 1994-1995 labor disputes accounted for the large negative spikes observed in those years.[8]

Time-Series Analysis

As an initial exploration, we examined the impact of the competitive balance measure on the time-series behavior of the scaled AL and NL attendance data. Our general approach followed the intervention and transfer function analysis described in Enders (1995). This approach allows the researcher to examine the impact of one or more exogenous variables on the entire univariate time path of the independent variable.[9] Intuitively, the approach first estimates a plausible autoregressive integrated moving average (ARIMA) model and then examines the impact of a limited number of exogenous variables.

Specifically, consider the following first-order autoregressive process:

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + \alpha_2 z_t + \varepsilon_t, \tag{2}$$

where y_t represents the variable of interest and z_t represents the intervention or transfer variable. The initial step of the procedure is to estimate a parsimonious model that captures the univariate behavior of the attendance variables. However, a necessary prerequisite for the approach is that $|\alpha_1| < 1$, that is, that y_t is stationary. Moreover, the "spurious regression" issues described by Granger and Newbold (1974) raise concerns about the stationarity of both z_t and y_t. Therefore, Tables 4 and

TABLE 4: Augmented Dickey-Fuller (ADF) and Phillips-Perron Unit Root Tests: Attendance (sample: 1903 to 1998)

	ADF Statistic (p)	*Phillips-Perron Statistic* (l)
American League		
Constant	–0.395 (2)	–0.395 (3)
Trend	–2.304 (2)	–2.849 (3)
National League		
Constant	–0.320 (2)	–0.738 (3)
Trend	–3.262 (2)*	–4.898 (3)***
Major league baseball		
Constant	–0.165 (2)	–0.486 (3)
Trend	–2.663 (2)	–3.643 (3)**
d(American League)		
Constant	–6.639 (2)***	–11.465 (3)***
Trend	–6.695 (2)***	–11.482 (3)***
d(National League)		
Constant	–7.988 (2)***	–14.107 (3)***
Trend	–7.993 (2)***	–14.062 (3)***
d(Major league baseball)		
Constant	–7.166 (2)***	–12.591 (3)***
Trend	–7.203 (2)***	–12.583 (3)***

NOTE: The ADF statistics were computed using p lags and a constant. The choice of p was based on minimization of the Schwartz-Bayesian criteria. The Phillips-Perron statistics were computed using the first-order autoregressive process including a constant. The choice of truncation lag (l) is based on Newey and West (1994).
*significant at the 90% critical level. **significant at the 95% critical level. ***significant at the 99% critical level.

5 report the results of both augmented Dickey-Fuller (ADF) and Phillips-Perron tests to determine the integrated level of the attendance and Gini series. The incorporated lag structure was determined by minimization of the Schwartz-Bayesian Criterion for the ADF test and by the lag truncation suggested by Newey and West (1994) for the Phillips-Perron statistic.[10] The specific choice is reported in parentheses. Given these results, we estimated the behavior of the attendance variable as I(1), and following Box and Jenkins (1976), we incorporated the variables' first differences.

However, further examination of the differenced AL and NL attendance data's autocorrelation functions and their associated Ljung-Box Q-statistics revealed significant spikes at Lag 2, suggestive of a second-order moving average, for the AL equations and at Lag 5, suggestive of an fifth-order moving average, for the NL equations. Because the approach and the associated hypothesis test require a well-specified ARIMA model, we included a second-order moving average and a fifth-order moving average term within the AL and NL equations, respectively.

In addition, the attendance series has been subjected to several exogenous shocks. Such "random" shocks occurred at the ends of World War I and World War II (in 1918, 1919, and 1946) and also due to a series of well-publicized labor disputes (in

TABLE 5: Augmented Dickey-Fuller (ADF) and Phillips-Perron Unit Root Tests: 1-Year Gini Coefficients (sample: 1903 to 1998)

	ADF Statistic (p)	*Phillips-Perron Statistic* (l)
American League		
Constant	–2.599 (2)*	–3.084 (3)**
Trend	–4.219 (2)***	–4.860 (3)***
National League		
Constant	–2.898 (2)**	–2.582 (3)
Trend	–4.275 (2)***	–4.171 (3)***
d(American League)		
Constant	–7.636 (2)***	–10.596 (3)***
Trend	–7.600 (2)***	–10.668 (3)***
d(National League)		
Constant	–6.833 (2)***	–7.618 (3)***
Trend	–6.803 (2)***	–7.555 (3)***

NOTE: The ADF statistics were computed using *p* lags and a constant. The choice of *p* was based on minimization of the Schwartz-Bayesian criteria. The Phillips-Perron statistics were computed using the first-order autoregressive process including a constant. The choice of truncation lag (*l*) is based on Newey-West.
*Significant at the 90% critical level. **Significant at the 95% critical level. ***Significant at the 99% critical level.

1972, 1981, and 1994). To control for these outliers, we included a number of dummy variables($z[18]$, $z[19]$, $z[46]$, $z[72]$, $z[81]$, and $z[94]$).[11] In addition, because attendance rebounded after the strike years (in 1982 and 1996), $z(82)$ and $z(96)$ were introduced.

A final dummy variable was introduced for the 1993 season. For this season, the NL experienced a rise in attendance unequaled in the post–World War II period. Impressively, aggregate NL attendance increased by nearly 13 million fans or roughly 33%. The increase was well above the 1983 to 1992 average of slightly more than 1 million per year.[12] In part, the rise may be attributed to the unique behavior of the two expansion teams that began play in 1993: the Colorado Rockies and the Florida Marlins. Specifically, the two teams had a total attendance of nearly 7.5 million, accounting for more than half of the overall increase. Moreover, the Colorado Rockies, playing in Denver's Mile High Stadium, set a major league attendance record in their debut year, drawing more than 4.4 million fans. Although the "expansion effect" was controlled for by the use of the average measure, the effect of the 1993 expansion was significantly larger than in any other expansion period, when average attendance actually decreased by an average of 1%.[13] Therefore, we also included the variable $z(93)$.

With respect to the impact of competitive balance, we were concerned that the fans' preference for competitive balance may be a function of the time period considered. If a league were competitively imbalanced in a given season, one might expect a decline in fan attendance. However, one would expect further declines if the imbalance persisted from season to season. In other words, a fan would be more accepting of a team that failed to compete in a given season if the fan knew that next season, the team would have a chance to be competitive. If the slogan "wait until next year" begins to lose meaning, fan attendance should begin to decline more dramatically.

To capture this effect, we not only examined competitive balance within each particular year but also computed 3-year and 5-year averages. The averages capture the intuition that fans may not be as concerned with a one-time change in competitive balance but rather are more interested in the time path of the measure. The 3-year and 5-year Gini coefficients are calculated by averaging each team's winning percentage over the period and ranking these in descending order.[14]

The impact of the above-listed dummy variables and competitive balance measures is captured by the following time-series representations:

$$\Delta y_{it} = \alpha_i z^G_{it-1} + \sum_{k=1}^{h} \alpha_{ik} z(k)_{ik} + \beta_i MA_{it} + \varepsilon_n \tag{3}$$

where y_i represents our adjusted aggregate attendance for the *i*th league (i.e., the AL or NL), $z^G{}_i$ represents the aforementioned league Gini measures, $z(t)_k$ represents the h exogenous outlier dummy variables, and t denotes the 96 time periods. Following the earlier discussion, we hypothesized that $z^G{}_i$ should have a negative impact on league attendance.[15]

Table 6 reports the results of estimating various versions of Equation 3 for both AL and NL attendance and the various competitive balance measures.[16] Overall, the results provide fairly strong support for the importance of competitive balance in determining attendance.[17] In particular, all Gini measures returned the hypothesized negative impact and were generally statistically significant at the 1% level.[18]

To illustrate the impact of competitive balance, we used the maximum and minimum Gini measures to provide an estimate of the "bounds of the impact." From Table 2, it can be seen that the 1-year AL Gini measure varies from 0.049 to 0.156, and the 1-year NL Gini measure ranges from 0.048 to 0.168. Given that the AL Gini measure in 1998 was 0.083 and that the average AL team attendance was 2,237,143, the bounds would be 2,157,447 and 2,275,174. This represents an increase of 38,031 fans for each team for the low Gini measure of 0.049 and a reduction of 79,696 for the high measure of 0.156. With each team playing 81 games at home in a regular season, the decline in average attendance in the AL if the league realized the lowest level of competitive balance would be just under 1,000 fans per contest. As for the NL, where the Gini measure for 1998 was 0.097 and the average team attendance was 2,056,876, the bounds would be 2,024,725 and 2,078,960. This represents an increase of 22,084 for each team for the low Gini measure of 0.048 and a reduction of 32,151 for the high measure of 0.168. Such a range implies that a movement in the NL from the lowest level of competitive balance to the highest would again result in fewer than 1,000 additional fans viewing each game.

TABLE 6: Time-Series Estimates of the Impact of Competitive Balance on American and National League Total Attendance

	American League Total Attendance			*National League Total Attendance*		
	1	*2*	*3*	*4*	*5*	*6*
z(46)	0.230***	0.250***	0.234***	0.199***	0.187***	0.189***
	(0.037)	(0.038)	(0.037)	(0.039)	(0.036)	(0.035)
z(81)	–0.238***	–0.232***	–0.245***	–0.372***	–0.388***	–0.391***
	(0.036)	(0.038)	(0.037)	(0.039)	(0.038)	(0.037)
z(82)	0.263***	0.270***	0.269***	0.442***	0.444***	0.439***
	(0.037)	(0.037)	(0.037)	(0.040)	(0.038)	(0.038)
z(93)	0.045	0.045	0.037	0.244***	0.226***	0.213***
	(0.037)	(0.039)	(0.037)	(0.040)	(0.039)	(0.039)
z(94)	–0.317***	–0.318***	–0.323***	–0.393***	–0.406***	–0.417***
	(0.038)	(0.040)	(0.039)	(0.043)	(0.043)	(0.044)
z(96)	0.123***	0.117***	0.097**	0.174***	0.169***	0.157***
	(0.037)	(0.039)	(0.039)	(0.044)	(0.044)	(0.044)
League Gini$_{t-1}$ (1-year)	–0.478***	—	—	–0.207	—	—
	(0.146)			(0.147)		
League Gini$_{t-1}$ (3-year)	—	–0.417***	—	—	–0.318**	—
		(0.188)			(0.152)	
League Gini$_{t-1}$ (5-year)	—	—	–0.563***	—	—	–0.405***
			(0.173)			(0.149)
Adjusted R^2	0.707	0.691	0.711	0.778	0.787	0.793
Durbin-Watson statistic	2.122	1.988	2.069	1.864	1.854	1.864
SSE	0.037	0.038	0.037	0.043	0.043	0.042
Diagnostic tests						
Breusch-Godfrey (4)	0.943	0.188	0.868	1.991	2.201	2.329
	(0.919)	(0.910)	(0.929)	(0.104)	(0.076)	(0.063)
Jarque-Berra (2)	0.344	0.920	5.050	2.042	2.380	1.603
	(90.842)	(0.631)	(0.080)	(0.360)	(0.304)	(0.449)
White's test (2)	0.695	0.435	0.595	0.579	0.396	0.259
	(90.739)	(0.936)	(0.827)	(0.841)	(0.954)	(0.991)

NOTE: *SSE* = sum of squared errors. In addition to the designated independent variables, the American League equations contain an additional second-order moving average term, and the National League equations contain an additional fifth-order moving average term. The coefficients are reported with their standard errors. Finally, the diagnostic tests are for serial correlation (Breusch-Godfrey), normality (Jarque-Berra), and heteroskedasticity (White's test) within the estimated residuals. Finally, *p* values are in parentheses.
*Significant at the 90% critical level. **Significant at the 95% critical level. ***Significant at the 99% level.

Panel Data Analysis

A common criticism of the time-series analysis used in the preceding section is that it fails to incorporate any economic theory. Specifically, the construction of Equation 3 fails to recognize various factors that may influence an individual's choice to attend games (i.e., price, team quality, income, and size of the market). A second common criticism is that the results represent the aggregate behavior of the attendance variables and therefore may neglect much of the individual team variation that may be important in determining total attendance. Therefore, we next turn to a subset of the data to examine the importance of these issues.

A difficulty with estimating a demand function for attendance is the lack of price data. Following Scully (1989), a rudimentary demand function for baseball game attendance would relate the quantity of tickets purchased to ticket prices, quality, real income, and size of the market. Although team price data are not available for the entire 1901-1998 sample, we were able to obtain individual team ticket prices for a subset of major league baseball history. Specifically, Quirk and Fort (1997)[19] provided a measure for team ticket prices for 12 AL and 11 NL teams for the period from 1975 to 1988.[20] Moreover, the individual ticket prices represent a weighted average to capture the variety of seats available for purchase. Finally, the ticket prices were deflated to represent real 1991 dollars.

The availability of individual team ticket prices allowed us to investigate the impact of our competitive balance measures on individual team attendance. However, the demand analysis required a measure of individual team attendance rather than the aggregate measures incorporated within the earlier time-series analysis. As with the aggregate measures, the relevant individual team attendance data were obtained from *The Complete Baseball Record Book* (Carter, 1998) and were scaled by the individual team's 1988 attendance figure.

In addition to price and quantity measures, we required measures for team quality, per capita income, and size of market. Following Scully (1989), we calculated a proxy of quality by team winning percentage.[21] These data were also obtained from *The Complete Baseball Record Book* (Craig, 1998). *The Survey of Current Business* (U.S. Department of Commerce, Bureau of Economic Analysis, various years) provided estimates of each city's per capita income. A common proxy for a team's market is the size of its metropolitan statistical area, which was obtained from *The Statistical Abstract of the United States* (U.S. Department of the Treasure, Bureau of Statistics, various years). As with our earlier analysis, there was some concern over the stationarity of these variables. Therefore, we computed ADF and Phillips-Perron tests for the individual team data. Overall, nearly all of the data, including individual team attendance, were estimated as I(0).[22] However, a degree of correlation may still exist; that is, the data may be stationary but still contain a first-order autoregressive process. Therefore, we included a lagged attendance term within the demand function.[23] Finally, the earlier 1981 strike and 1982 rebound dummy variables were also included.

Following the above argument, the estimated demand function takes the following form:

$$y_{jt} = a_j + \alpha_{yj} y_{jt-1} + \sum_{k=1}^{h} \alpha_{kj} x_{jt}^{DF} + \alpha_{gj} z_{it-1}^{G} + \alpha_{81j} z(81) + \alpha_{82j} z(82) + \varepsilon_{jt} \quad (4)$$

TABLE 7: The Impact of Competitive Balance on American League Individual Team Attendance

	1	*2*	*3*	*4*	*5*	*6*
Team price (P_{it})	–0.240***	–0.265***	–0.216***	—	—	—
	(0.070)	(0.056)	(0.059)			
Team (P_{it} / Wp_t)	1.445***	1.476***	1.494***	—	—	—
	(0.081)	(0.077)	(0.063)			
Team win (Wp_{it})	—	—	—	–0.797***	–0.802***	–0.793***
				(0.005)	(0.006)	(0.004)
Pop (Pop_{it})	0.031***	0.033***	0.029***	0.049***	0.050***	0.051***
	(0.011)	(0.010)	(0.010)	(0.002)	(0.002)	(0.002)
Per capita (y_{it})	0.396***	0.358***	0.316***	0.723***	0.687***	0.678***
	(0.062)	(0.048)	(0.048)	(0.008)	(0.006)	(0.005)
z(81)	–0.449***	–0.415***	–0.435***	–0.465***	–0.434***	–0.444***
	(0.030)	(0.028)	(0.015)	(0.006)	(0.005)	(0.003)
z(82)	0.283***	0.331***	0.425***	0.290**	0.298***	0.331**
	(0.037)	(0.028)	(0.038)	(0.007)	(0.005)	(0.006)
Gini_{t-1} (1-year)	0.155***	—	—	0.157***	—	—
	(0.054)			(0.011)		
Gini_{t-1} (3-year)	—	–0.103***	—	—	–0.044***	—
		(0.031)			(0.009)	
Gini_{t-1} (5-year)	—	—	–0.280***	—	—	–0.113***
			(0.038)			(0.010)
Adjusted R^2	0.532	0.530	0.532	0.448	0.446	0.446
SSE	0.346	0.347	0.346	0.376	0.376	0.376

NOTE: *SSE* = sum of squared errors. American League teams are the Baltimore Orioles, Boston Red Sox, California Angels, Chicago White Sox, Cleveland Indians, Detroit Tigers, Kansas City Royals, Milwaukee Brewers, Minnesota Twins, New York Yankees, Oakland Athletics, and Texas Rangers. The estimates represent incorporating logged data and a seemingly unrelated regression methodology. In addition, all equations contain lagged attendance and winning percentage variables. The coefficients are reported with their respective standard errors.
*Significant at the 90% critical level. **Significant at the 95% critical level. ***Significant at the 99% critical level.

The dependent variable, y_j, represents the individual *j*th team attendance, and x^{DF}represents the *h* various team demand factors. As before, $z^G{}_i$ represents various *j*th teams' league *i* Gini measures, z(81) and z(82) represent earlier dummy variables, and *t* denotes the 14 time periods.

Tables 7 and 8 report the results of estimating league versions of Equation 4 using the seemingly unrelated regression (SUR) approach. The SUR approach provides generalized least squares estimates while correcting for possible cross-section-specific heteroskedasticity and for possible contemporaneous correlation.[24] In addition to the common log representation in columns 1, 2, and 3, we estimated "quality- adjusted" ticket price formulations in columns 4, 5, and 6 of Tables 7 and 8.[25] Following Scully (1989), the quality-adjusted ticket price formulations were calculated by dividing ticket price by winning percentage. Scully's explanation for the

TABLE 8: The Impact of Competitive Balance on National League Individual Team Attendance

	1	*2*	*3*	*4*	*5*	*6*
Team price (P_{it})	–0.214***	–0.319***	–0.323***	—	—	—
	(0.059)	(0.067)	(0.054)			
Team win (Wp_{it})	1.002***	0.047***	1.019***	—	—	—
	(0.045)	(0.045)	(0.043)			
Team (P_{it} / Wp_{it})	—	—	—	–0.706***	–0.808***	–0.779***
				(0.040)	(0.036)	(0.047)
Pop (Pop_{it})	–0.050***	–0.056***	–0.049***	–0.067***	–0.071***	–0.060***
	(0.016)	(0.016)	(0.016)	(0.013)	(0.013)	(0.014)
Per capita (y_{it})	0.253***	0.275***	0.182***	0.537***	0.531***	0.436***
	(0.038)	(0.043)	(0.050)	(0.036)	(0.029)	(0.055)
z(81)	–0.639***	–0.644***	–0.620***	–0.638***	–0.649***	–0.601***
	(0.019)	(0.022)	(0.019)	(0.015)	(0.011)	(0.021)
z(82)	0.396***	0.448***	0.468***	0.393**	0.466***	0.455***
	(0.026)	(0.028)	(0.026)	(0.016)	(0.021)	(0.031)
Gini_{t-1} (1-year)	–0.123***	—	—	0.084***	—	—
	(0.033)			(0.026)		
Gini_{t-1} (3-year)	—	–0.067*	—	—	–0.126***	—
		(0.037)			(0.020)	
Gini_{t-1} (5-year)	—	—	–0.139***	—	—	–0.182***
			(0.042)			(0.045)
Adjusted R^2	0.846	0.845	0.848	0.813	0.815	0.829
SSE	0.178	0.179	0.177	0.191	0.189	0.187

NOTE: *SSE* = sum of squared errors. National League teams are the Atlanta Braves, Chicago Cubs, Cincinnati Reds, Houston Astros, Los Angeles Dodgers, New York Mets, Philadelphia Phillies, Pittsburgh Pirates, St. Louis Cardinals, San Diego Padres, and San Francisco Giants. Seemingly unrelated regressions using logged data. In addition, all equations contain lagged attendance and winning percentage variables. The coefficients are reported with their respective standard errors.
*Significant at the 90% critical level. **Significant at the 95% critical level. ***Significant at the 99% critical level.

purpose of this measure begins by noting the general practice of teams setting prices prior to each season based on expectations of team performance. Although it is likely in any given year that a certain percentage of teams will not realize these expectations, ticket prices are not typically altered. In other words, if teams do better than expected, they do not raise prices during the current season. Rather, ticket prices are raised at the conclusion of the season in question. However, fans may not respond to the actual dollar value of the ticket but rather to the amount of resources they are devoting per unit of team quality. Scully contended that the quality-adjusted ticket price captures the fans' true valuation of the product being purchased.

The results of estimating AL and NL versions of Equation 4 were generally consistent with expectations. Moreover, the equations seemed to be well-specified because most coefficients were both of the expected sign and statistically significant. For example, the price coefficient reported in column 1 of Table 7 indicates that a $1 reduction in price would have increased the average AL individual team attendance from 2,073,505 to 2,149,395, an increase of just under 76,000 fans in 1988. As a point of comparison, Scully (1989) estimated a similar equation for the demand for attendance. His results suggest that a $1 reduction would yield an additional 172,000 fans. Scully's estimate of own-price elasticity was (–0.63), which implies, according to standard economic theory, that major league baseball teams do not maximize profits in the short run. Although the own-price elasticity derived from the analysis presented here (–0.949) is below the elastic range suggested by short-run profit maximization, conventional tests would not reject an elastic response. Similar results were obtained for the NL equations.

The same equation yielded a team quality measure (winning percentage) that was also positive and significant. Given that one additional win would increase a respective team's end-of-year winning percentage by (0.006), an additional win would have been worth nearly 21,000 additional fans in 1988.[26] Although the resulting estimate was smaller within the NL equations, the team quality measure was always significant and suggested that an additional win would have increased the average NL attendance in 1988 by approximately 25,000. These results are well within range of the estimate obtained by Scully (1989), who estimated that an additional win would increase attendance by just over 21,500.

With respect to the two additional demand variables, population and per capita income, the results were generally consistent with expectation. Specifically, with respect to our real per capita income measure, all equations returned the hypothesized positive (normal good) coefficient and generally followed the findings of Scully (1989). The result from the AL (Table 7, column 1) suggests that a $100 increase in per capita income would increase individual team attendance by 2,074 fans. The NL (Table 8, column 1) returned nearly identical results, indicating that a $100 increase would increase fan attendance by 2,093.

As for the population variable, only the AL equations produced the expected positive sign. The AL result (Table 7, column 1) suggests that an additional 100,000 in population would increase average team attendance by nearly 13,000. This result is roughly consistent with Scully's (1989) finding of 18,000. The population results for the NL are not as strong. In particular, the estimated negative coefficient suggests that a rise in population would decrease fan attendance.[27]

The relationship between competitive balance and attendance in the panel data set revealed a surprising result. Contrary to the time-series results, the estimated coefficient for the single-year competitive balance measure was generally significant and positive within the two leagues. Such a result would indicate that fans do not prefer parity within a given season. Although such a contradiction is difficult to explain, the direction of the impact of this factor may have switched due to the focus on the latter time period. As was highlighted in the earlier section, competitive balance within major league baseball has increased substantially over time. Although the time-series estimates examined the impact over the entire range of values, the panel data incorporate only the more recent period. In particular, the years exam-

TABLE 10: Panel Gini Measures: The Impact of Moving to Most Competitive and Least Competitive (change in individual team yearly attendance)

	American League		*National League*	
	Measure	*Attendance Change*	*Measure*	*Attendance Change*
1-year Gini				
Minimum	0.060	–86,476	0.049	–73,502
Maximum	0.108	+102,967	0.094	+40,080
3-year Gini				
Minimum	0.051	+42,140	0.034	+145,683
Maximum	0.089	–75,782	0.074	–62,262
5-year Gini				
Minimum	0.048	+91,459	0.031	+198,488
Maximum	0.079	–190,452	0.065	–90,368

NOTE: The average 1-, 3-, and 5-year Gini measures were 0.079, 0.062, and 0.056 for the American League, respectively, and 0.079, 0.074, and 0.051 for the National League, respectively. The average attendance in 1988 was 2,073,505 in the American League and was 2,092,783 in the National League.

ined were a period of relatively high levels of competitive balance. It is possible that the preference for single-season competitiveness has changed given that league dominance over the smaller time period was a relatively rare occurrence. Although such a change may have occurred with respect to the single-year measure, the estimates of both the 3-year and 5-year Gini coefficients were significantly negative, suggesting that fans responded adversely to persistent competitive imbalance. These results suggest that fans may not prefer competitive balance in a given season, but over time, the slogan "wait till next year" must remain valid for the teams located toward the bottom of the standings.

From the panel data set, what is the estimated impact of competitive balance on team attendance? This question is addressed from two perspective. First, an incremental change in the competitive balance measure would occur if the weakest franchise in a given year defeated the strongest. Tables 9 and 10 record the impact of such an event for the single-year, 3-year and 5-year Gini measures.[28] For the single-year measure, such an incremental decrease in the Gini coefficient would result in a decrease of more than 6,000 in the average AL team's per year attendance. A slightly smaller decrease in NL attendance would occur as a result of such an incremental improvement in competitive balance.

When one considers competitive balance over longer periods of time, the impact on attendance becomes increasingly positive. For the 3-year measures, the impact of the weakest team defeating the strongest for 3 consecutive years would cause an attendance increase of more than 6,000 for the typical AL team in a season. A larger impact was estimated for the NL. The impact of an incremental change on the 5-year Gini measure is even stronger. From these results, one could conclude that the negative impact of competitive imbalance increases as the imbalance persists.

As with the time-series measure, we also considered the range of the Gini measures. For the 1988 season, a movement to the minimum value of the competitive balance measure would have led to a decrease of more than 85,000 in each team's per season attendance. Again, the same movement in the 3-year measure would have caused a change in attendance in the opposite direction. As one moves to the 5-year measure, as noted, the impact of competitive balance on attendance increases. Within the subsample (1974 to 1988), the 5-year AL Gini measure varies from 0.048 to 0.079, and the 5-year NL Gini measure varies from 0.031 to 0.065. Given that the 1988 AL Gini measure was 0.056 and that average team attendance was 2,073,505, the bounds would be 1,883,053 and 2,164,964. In other words, a movement from the least to the most competitive observation over this time period would have increased the average attendance by over 280,000 fans or over 3,400 people per game. As for the NL, where the Gini measure was 0.051, and the average team attendance was 2,092,783, the bounds would be 2,002,415 and 2,291,271. A movement from the minimum to the maximum competitive balance in the NL would have led to an increase in average attendance of nearly 290,000 people. Similar to the AL results, this represents an increase of over 3,500 fans per contest.

Interestingly, these results are significantly larger than those that were estimated within the earlier time-series analysis. To investigate whether this was an outgrowth of the panel approach or of the shortened sample, we estimated a time-series representation for the period from 1975 to 1988. The results suggest that the impact of competitive balance on attendance has risen. Given that the number of alternatives, both within athletics and within entertainment in general, has increased, such a rise is not surprising. However, the increase represents only roughly half of the total difference observed within the panel estimates. The remaining difference may reflect the fact that the panel sample represents teams that have an established history. One might expect that these teams would be affected by changes in competitive balance more dramatically than newer teams that are still novel in their respective regions.

CONCLUDING OBSERVATIONS

The purpose of this inquiry was to investigate two questions. First, did competitive balance in major league baseball worsen in the 1990s? Contrary to popular opinion, the findings reported here generally indicate that the 1990s was the most competitive decade in major league baseball's history. Although the gap between rich and poor teams in baseball may be widening, this has yet to significantly affect the level of competitiveness on the field.

The second question centers on the relationship between aggregate league attendance and competitive balance. Previous research has suggested that improvements in competitive balance have a positive impact on league attendance. However, researchers had not investigated whether this relationship held at the aggregate level.

This issue was examined using both a time-series analysis that considered virtually the entire history of major league baseball and a panel data set that investigated the years for which price data exist. The results of each inquiry generally confirm previous theoretical work indicating that league competitive balance has a significant impact on league attendance. However, both the magnitude and sign of the estimated relationship did depend on the data set that was examined. With respect to the time-series analysis, changes in competitive balance were a significant determinant of attendance, although the change in attendance per game was relatively small. The investigation of the panel data set revealed that the direction of the impact of competitive balance depended on the time period considered in estimating the Gini coefficient.

The panel data exploration suggested that fans responded negatively to improvements in single-year competitive balance. However, as one considers improvements in competitive balance over 3 and 5 years, the fans' reaction becomes increasingly positive. Such a result suggests that fans have recently begun to develop a distaste for improvements in parity in a given season. Over time, however, fans react negatively to persistent competitive imbalance. These findings suggest that if divergence in player compensation across teams does eventually result in dramatically less competitive balance over time, Major League Baseball can expect significant declines in average attendance.

NOTES

1. The Yankees' supremacy has led to more than a bit of unhappiness for the authors, who unfortunately were born fans of the Boston Red Sox and Detroit Tigers, respectively.

2. This follows from Schmidt (2001), who used the Gini coefficient to examine the impact of expansion on competitive balance.

3. Following the advice of an anonymous referee, we also used the standard deviation to measure competitive balance. The results, which are available from the authors on request, were qualitatively similar.

4. Data for the 1999 season were obtained from Major League Baseball (2001).

5. The AL expanded by two teams in 1961, 1969, and 1977; the NL expanded by two teams in 1962, 1969, and 1993. In 1998, each league expanded by one team. However, the Milwaukee Brewers also moved from the AL to the NL, thereby leaving the AL with 14 teams and the NL with 16 teams at the end of the century.

6. Two exceptions to this general condition are possible. First, the introduction of interleague play in 1997 allowed for each league's μ to differ from 0.5. Second, a divergence from a mean of 0.5 was also possible prior to interleague play. Traditionally, games scheduled to make up for those postponed earlier in the season due to inclement weather are not played when the teams in question are noncontenders. When this occurs, the number of games played for each team differs, and hence, the league's μ is not exactly 0.5. Given these possibilities, the actual mean winning percentage was used in the calculation of the Gini coefficients rather than the assumed value of 0.5.

7. Quirk and Fort (1997) previously offered a decade-by-decade look at competitive balance. Their investigation also began with the first decade of the century but concluded in 1990. In addition to the use of an alternative measure of competitive balance, the research reported here extends the previous work to the end of the 1990s. The results offered here do not differ substantially from the earlier work with

respect to the pre-1990 time period. Rather, as noted in the text, the improvements in competitive balance noted by Quirk and Fort in the free agency era are shown here to continue into the last decade of the century.

8. A spike in attendance also occurred in 1972, when much of the owner-labor strife began.

9. As highlighted in the following section, an alternative approach would be to specify a set of exogenous variables whose behavior is hypothesized to determine attendance behavior. In the present context, such an analysis would require population, income, price, and additional demand data. Each of the data requirements limits the sample size. Indeed, the price requirement itself limits the sample to the years 1975 to 1988. This approach is examined in the section on panel data.

10. Use of the Akiake Information Criteria produced similar results.

11. The dummy variables are independent of one another. For example, z(81) equals 1 for 1981 and 0 for all other periods. An alternative approach would be to introduce a dummy variable for all strike years, that is, *z*(strike), which would equal 1 in 1981 and in 1994. However, this approach would constrain the responses to be equal and would therefore be more restrictive.

12. Bruggink and Eaton (1996) used 1993 data to ascertain the demand determinants for individual games. However, given the unique nature of 1993, one should use caution in interpreting these results.

13. Interestingly, although the Rockies became the newest expansion team to make the playoffs in 1995, and the Marlins became the newest expansion team to win the World Series in 1997, neither team has come within 600,000 of its 1993 attendance levels. It is possible that the reduction in attendance was an outgrowth of the 1994-1995 strike. However, it would seem more likely that the record levels had more to do with the novelty of the new teams and with the Rockies playing at Mile High Stadium. Coors Field, where the Rockies currently play, has a seating capacity some 40% lower than that of Mile High Stadium.

14. These are available from the authors on request.

15. Actually, Equation 3 has a much stronger interpretation. Specifically, if αi is found to be significantly different from 0, changes in competitive balances are found to permanently change individual team attendance. This is true regardless of the magnitude of the coefficient (see Enders, 1995).

16. On the advice of an anonymous referee, we estimated log versions of Equation 3. The results were qualitatively similar in sign and significance to those reported in Table 6. In addition, log data are examined in the section on panel data and in Table 7.

17. To ascertain whether the equations are properly specified, the Breusch-Godfrey test for serial correlation, the Jarque-Berra test for normality, and White's test for heteroskedasticity were performed. The results are reported in the final column of Table 6. Impressively, nearly all of these statistics are well outside their 10% critical levels.

18. Following the advice of an anonymous referee, we investigated the robustness of the competitive balance result to the exclusion of the dummy variables. Interestingly, the results were almost identical. In contrast, however, the diagnostic tests, especially the Jarque-Berra statistic, were affected significantly.

19. Actually, Quirk and Fort (1997) only reported ticket prices from 1975 to 1980. We thank Rodney Fort for providing the additional data for 1981 to 1988.

20. The 12 AL teams are the Baltimore Orioles, Boston Red Sox, California Angels, Chicago White Sox, Cleveland Indians, Detroit Tigers, Kansas City Royals, Milwaukee Brewers, Minnesota Twins, New York Yankees, Oakland Athletics, and Texas Rangers. The 11 NL teams are the Atlanta Braves, Chicago Cubs, Cincinnati Reds, Houston Astros, Los Angeles Dodgers, New York Mets, Philadelphia Phillies, Pittsburgh Pirates, St. Louis Cardinals, San Diego Padres, and San Francisco Giants.

21. On the advice of an anonymous referee, we calculated a proxy of team quality by using a "games behind" variable. The variable did not influence the following results. In addition, similar to the winning percentage responses, the estimated league coefficients suggest that by moving one game closer to the division leader, an AL team would increase its attendance by nearly 32,000, and an NL team would increase its attendance by nearly 22,000.

22. One of the factors reducing the concern over nonstationarity is the fact that only 14 years of data were incorporated within the panel data set. The individual team ADF and Phillips-Perron tests are avail-

able from the authors on request. In addition, we completed the panel section by differencing most of the incorporated data. The results were similar to those reported with respect to the competitive balance measure. However, the findings with respect to population and income were inconsistent with standard economic theory. These results are available from the authors on request.

23. Consistent with the lack of nonstationarity, the estimated coefficient on lagged attendance (α_{yj}) was generally closer to (–0.20) and significantly different from (–1.0).

24. We further estimated league panel versions of Equation 4 using weighted generalized least squares that incorporated team-specific fixed effects. The results obtained from this approach were qualitatively similar to those reported in Tables 7 and 8.

25. We also estimated nonlog versions of the panel equations. These results were similar to those reported in Tables 7 and 8. These are available from the authors on request.

26. We also included the team's winning percentage from the previous season. In contrast to the results of Scully (1989), the resulting coefficient was always negative. However, the inclusion or exclusion of the lag failed to affect the estimates of the coefficients. These results are available from the authors on request.

27. The result for the NL equations was robust to alternative specifications.

28. The year examined was 1988, the last year examined in the panel data set.

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