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Major League Baseball and the Competition for Leisure Dollars in America, 1920-1941

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Abstract

Major League Baseball faced increased competition from radio broadcasts and improvements in motion pictures during the 1920s and 1930s. The "Roaring Twenties" were followed by the Great Depression. As social norms changed, some owners fought for the right to stage home games on Sundays. Owners put an increased emphasis on promoting home runs, eventually allowed radio broadcasts, and added lights to their stadiums. We include variables for these changes, to estimate the effects upon both home attendance and owners' net income between 1920 and 1941. Team performance, home runs, number of Sundays a team had home games, the installation of lighting, and radio broadcasts of games, all raised attendance while increases in the unemployment rate reduced it. Of these, the number of Sundays on which a team had home games, radio broadcasts, and the unemployment rate had no effect on real net income. All the other variables that raised attendance also raised real net income.

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Introduction

Major League Baseball (MLB) during the 1920s and 1930s is an excellent candidate for an industry study as it was a time of challenges and innovation. Although MLB baseball attendance and net income before taxes rose during the 1920s, other forms of commercial leisure and recreation also enjoyed a boom; in some cases, their relative gains eclipsed those of MLB. During these years, movies introduced sound and color and radio broadcasts spread across America. Did baseball's slump of the early 1930s merely reflect general economic conditions, or was increased competition also responsible? We also examine to what extent loosening of Sunday "Blue Laws" and changes the owners instituted such as allowing radio stations to broadcast their home games, raising home runs, and adding stadium lighting to make night games possible affected MLB attendance and net income.

We are able to address these questions quantitatively, because owners provided both attendance and net income data to a Congressional committee in 1951. All teams supplied home attendance and net income before taxes for the 1920-41 seasons. We can therefore compare effects not only of the usual factors affecting baseball attendance but also of changes in "Blue Laws" and technology upon both attendance *and* net income.

Because ticket price data for the 1920-1941 period are lacking, we did not estimate a traditional demand curve as many previous studies using data from more recent seasons did. However, we do examine the non-price determinants of demand and net income over the same period. Given the scarcity of data, few other papers estimate net income or revenue.

Baseball During the 1920s and 1930s

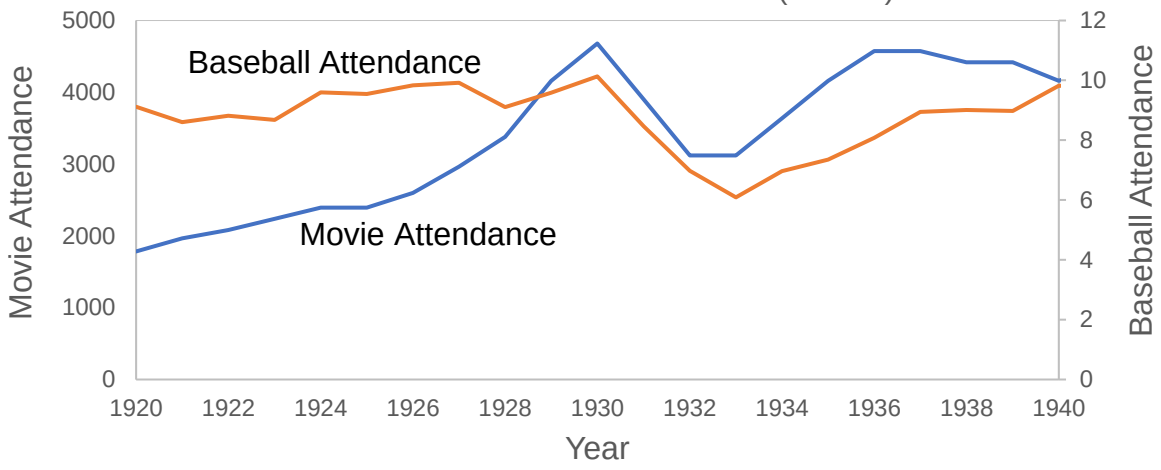
In 1920, MLB consisted of two leagues, each with eight teams. The 16 teams were located in 11 cities, all of which were in the northeast quadrant of the United States. MLB owners were cautiously optimistic as the 1920 season opened. They had survived a challenge from the Federal League (a rival league that played during the 1914 and 1915 seasons). They had survived World War One's upheavals. The 1920s brought new upheavals, including an infamous gambling scandal revolving around the 1919 World Series, but MLB won a victory in the Supreme Court case emanating from a lawsuit filed by the former Baltimore Federal League team. The Supreme Court ruled that baseball was not interstate commerce and was therefore exempt from antitrust laws (Federal Base Ball Club of Baltimore v. National League of Professional Base Ball Clubs, 259 US 200).

Americans enjoyed greater amounts of leisure time during the 1920s as work weeks shortened and discretionary income to spend on leisure activities increased. Historians and sportswriters heralded the 1920s as a "Golden Age" for sports, including college football, golf, and boxing. Baseball prospered. The Great Depression slowed the upward trend in spending on leisure activities (Table 1), but many leisure industries rebounded as the 1930s ended. Figure 1 shows the path of both baseball and movie attendance over these years.

Because we have data for both attendance and net income, we can ascertain some subtleties in the relationships. For instance, a team might sell broadcasting rights for its home games and improve its net income, even though its attendance might fall. Since an owner did not have to share revenue from broadcasting his home games with the visiting team's owner—unlike gate revenue—owners might have been willing to sacrifice some attendance in return for a sufficiently lucrative radio contract.

Owners considering electric lights weighed increased attendance and revenue from night games against the costs of installing and maintaining such lights. Although teams in cities with larger populations may have had an advantage in attracting fans, this opportunity for greater revenues may have been offset by greater expenses. Results using data from the 1929, 1933, and 1939 seasons demonstrated that the New York Yankees, New York Giants,

Figure 1
Annual Baseball and Movie Attendance (Millions)



Sources: US Congress 1952, 1617-1618; US Department of Commerce, Bureau of the Census 1975, vol. 1, 400. Movie Attendance for 1920 and 1921 is from a linear extrapolation.

Table 1
Economic and Recreation Variables

Year	Annual Baseball Attendance (millions)	Real Gross National Product (billions of 1958 $)	Annual Movie Attendance (Millions)	Percent of Households with Radio Sets	Private Consumption Expenditures on Recreation (millions of 1958 $)
1921	8.61	127.8	1,966	0	3,923
1923	8.67	165.9	2,236	2	4,999
1925	9.54	179.4	2,392	10	5,401
1927	9.92	189.8	2,964	24	5,999
1929	9.59	203.6	4,160	35	7,311
1930	10.13	183.5	4,680	46	6,911
1931	8.47	169.3	3,900	55	6,271
1932	6.97	144.2	3,120	60	5,171
1933	6.09	141.5	3,120	61	4,915
1934	6.96	154.3	3,640	64	5,272
1935	7.35	169.5	4,160	66	5,542
1936	8.08	193.0	4,576	69	6,302
1937	8.94	203.2	4,576	73	6,809
1938	9.01	192.9	4,420	79	4,804
1939	8.98	209.4	4,420	80	5,104
1940	9.82	227.4	4,160	82	5,693
1941	9.69	263.7	4,420	83	8,422

Sources: US Congress 1952, 1617-1618; US Department of Commerce. Bureau of the Census 1975, vol. 1, 210-211, 224, 400. Personal Consumption Expenditures on Recreation are adjusted for a discontinuity.

Chicago Cubs, and Brooklyn Dodgers incurred greater real gross operating expenses (for a given current season's win-loss record) than the other 12 teams (Surdam 2011, 93-94 and 367-68, note 131). In other words, teams playing in larger cities faced greater costs of doing business, thereby partially offsetting their advantage in drawing power.

Previous Studies of Demand for Major League Baseball

Many researchers have investigated demand for MLB. Henry Demmert (1973), Roger Noll (1974), Gerald Scully (1989), and John Siegfried and Jeff Eisenberg (1980) pioneered these efforts. Donald Alexander (2001), Robert Baade and Laura Tiehan (1990), Dennis Coates and Brad Humphreys (2007), Zulal Denaux, David Denaux and Yeliz Yalcin (2011), and Young Lee (2018) followed these early efforts. These researchers usually regressed attendance against a variety of independent variables for team quality, demographics, and economic factors either on a game-by-game or season-by-season basis. They focused on late twentieth-century seasons. Team quality as measured by lagged or current win-loss records, metropolitan population, another team occupying the same city, and playing in a new stadium usually had statistically significant effects upon attendance. Earlier cross section studies used pooled ordinary least squares, while later researchers used fixed-effects or sometimes random-effects models. These studies used a variety of ticket-price variables; Alexander (2001), for instance, used an average-ticket price variable.

In some cases, researchers used revenue as the independent variable. Kenneth Brown and David Surdam (2014) used a fixed-effects regression and found that the average revenue per attendee (as a proxy for average-ticket price) and attendance were negatively related and statistically significant. The current season's win-loss record had a positive and significant impact on average revenue. Dummy variables for a new team in a city and shared city were negatively related and statistically significant.

John Burger and Stephen Walters (2003) investigated the determinants of real revenues. They found that market size, a team's current win-loss record, and a new or significantly-renovated stadium strongly influenced team local revenues. Daniel Brown and Charles Link (2008), who built on the work of Burger and Walters, examined real revenues from 1995-2001. They found that the *previous* season's win-loss percentage and the metropolitan population raised local revenues. They did not use variables for ticket prices, Sunday games, radio or television broadcasts of home games, or night games. John Bradbury (2019) used MLB revenues from 2006-2015 as his independent variable. He found that team quality, postseason play, population, and the reciprocal of stadium age all had positive and significant coefficients. Income per capita and multiple teams in the metropolitan statistical area did not have significant coefficients. As this brief review of empirical analyses of attendance and revenue indicates, there is considerable overlap in the factors used to estimate both.

The Data

Economists studying professional team sports have heeded one warning: beware of false profits. Owners and their accountants have learned to be modest in public forums. Due to discretionary aspects in reporting their financial conditions, owners could often portray themselves as sportsmen willing to absorb losses in order to provide the local residents with professional sports.

A Congressional committee forced baseball team owners to provide data on both attendance and net income before taxes for the years 1920-1950 (US Congress 1952, 1599-1608 and 1617-1618). All teams provided net income figures for 1920-1950 except the Boston Braves who did not provide numbers for the first three years. Accountants from Arthur Andersen, the formerly prominent accounting firm, examined and prepared the figures for

Congress. The owners also provided more detailed financial information for the 1929, 1933, and 1939 seasons.

Given that researchers rarely use home revenue instead of attendance, the question of how inter-related these variables are is an interesting one. For the three seasons above, the correlation between home revenues (used to estimate average-ticket prices but unadjusted for the gate-share payments, which would have been proportionately similar across teams) and attendance was 0.98 (based on forty-five observations, as three teams did not supply home revenues for 1929). As a comparison, for the 1946, 1950, and 1952-56 seasons, the correlation coefficient was 0.89.

There are ways to check the accuracy of the data. The teams' nominal away revenues were consistent with the leagues' gate revenue-sharing rules. In some cases, the teams' nominal home revenues tallied with the leagues' rules on remitting a fixed percentage to the league office. The National Baseball Hall of Fame Museum and Library holds detailed financial records for the New York Yankees (1915-1944) and Philadelphia Phillies (1935-1939).

One factor affecting net incomes was not present during the period examined. Baseball owners of the 1920s and 1930s did not use the player-depreciation tax adjustment that became popular and prominent after World War Two. Therefore, their net income figures were not distorted by the favorable tax treatment afforded later owners. As many of the owners of teams during our time period retained their teams for several years, any such depreciation allowance would have been depleted years earlier in any event.

Baseball attendance figures are also available from John Thorn, Pete Palmer, and Michael Gershman's *Total Baseball* (2011). These figures represent attendees paying full price for tickets and do not include attendees coming in on Ladies Day, free passes, children's passes, and other promotions; there are no records available regarding the number of such attendees. These attendance numbers match those in the Congressional report (US Congress 1952, 1617-1618). The attendance figures are consistent with the gate revenue-sharing rules.

Paucity of Ticket Price Information

As mentioned earlier, we are not estimating demand curves with ticket prices as an independent variable. Data on average-ticket prices are available for only the 1929, 1933, and 1939 seasons. So, we estimate *non-price determinants* of a team's season attendance and net revenue. Todd Jewell and David Molina (2005, 164-165) provide an example of an estimation of attendance without ticket prices.

However, nominal ticket prices, were generally stable over the period we examined. Owners raised ticket prices before the 1920 season after having maintained stable prices for many years. The owners approved a measure raising ticket prices on February 11, 1920 that raised the minimum ticket price to 50 cents on that date. Owners could set prices of reserved and box seats to reflect local demand (*New York Times* 1920).

Although year-by-year ticket prices were not available for all of the teams, the existing information suggests that the owners charged 50 cents for bleachers, one dollar for general admission, between $1.25 and $1.50 for reserved seats, and somewhat more for box seats. For instance, the New York Yankees charged $0.50, $1.00, $1.50, and $2.00 for the four classifications. A Yankees' official explained that the 50-cent multiples were designed to reduce ticket sellers short-changing customers and to process ticket orders quickly (Ferdinand Lane 1929, 516). Owners appeared to have maintained the same ticket prices with minor adjustments throughout the 1920s and during the Great Depression.[1]

[1] Pricing strategies were unsophisticated by modern standards. There was no variable pricing with respect to opponent and season tickets were small in number.

Despite declines in the Consumer Price Index (CPI) during the early 1920s and again in the 1930s, baseball owners were reluctant to cut ticket prices. In 1932 American League President William Harridge said "Any suggestions that admission prices be lowered because of prevailing conditions, overlook the fact that during the boom period baseball made no attempt to take advantage of easy money" (*New York Times* 1932). A few years later Ford Frick, President of the National League, said that he would oppose price slashing because baseball had not raised ticket prices several years earlier when other amusement prices were increased (*New York Times* 1935).

The owners' refusal to lower nominal ticket prices during the economic tumult may have reflected their belief that fans would vote with their feet: Fans could literally migrate from box and reserved seats to general admission and bleacher seats by buying tickets for cheaper seats in seasons when their discretionary incomes fell. Some fans, of course, voted not to enter the stadium at all (Surdam 2011, 35-38).

This process of moving to cheaper seats is supported by home revenue figures. The owners submitted nominal home revenue figures for 1929, 1933, and 1939. The average home revenues net of gate-sharing (roughly 30 cents per ticket) received per attendee in the American League were virtually identical for 1929 and 1939 ($0.71 and $0.69 respectively) but fell during 1933 to $0.60, indicating that the proportions of seats sold shifted towards the cheaper seats. The National League demonstrated a similar pattern. In *real terms* the 1933 average home revenues per attendee rose above that of 1929 (Surdam 2011, 321, Table 7), with the fall in the CPI more than offsetting the nominal fall in this variable. Motion picture theater operators may have faced a similar reaction to the Great Depression, as movie-goers could opt to see a new film in a later-run theater, where the ticket prices were cheaper.

The combination of stable nominal ticket prices and fluctuations in the CPI created variation in the real price of tickets. By maintaining stable nominal ticket prices in the face of declines in the CPI, owners were, in effect, raising real ticket prices significantly during the depths of the Great Depression. Consequently, to the extent that decreases in the CPI meant increases in real ticket prices, we expect that the coefficient on the CPI would be positive, though this may be dampened by the ability of attendees to switch to cheaper seats. Our data for the CPI are by metro area (US Bureau of Labor Statistics 1941, 45-78).

Another factor that affected ticket prices was the amusement tax on movie and baseball tickets imposed during World War One. The war tax was 10 percent on all tickets costing forty cents or more. The federal government rescinded the tax midway through the 1928 baseball season but then reinstated the tax midway through the 1932 season. Teams generally added the tax onto their existing ticket prices. For instance, the Yankees adjusted their $0.50, $1.00., $1.50, and $2.00 ticket prices to $0.55, $1.10, $1.65, and $2.20 (Surdam 2011, 38-39). We use a dummy variable for the seasons in which the tax was imposed. Because the war tax was assessed for only half of the 1928 and 1932 seasons, we coded these seasons as 0.5 instead of 1.

Factors Affecting Attendance and Net Income

We included a variety of independent variables. Our performance measures included win-loss percentage (wins divided by games for the whole season), the previous season's win-loss percentage, and a dummy for having won the pennant in the previous season.

We also added two measures of offense: home runs and stolen bases. Baseball owners may have attempted to increase home runs to attract fans. In the wake of Babe Ruth's home run binge of 1919 (all of 29 home runs), the owners may have tampered with the baseball (the so-called "lively ball"). In addition, they banned several "trick pitches" that discomfited hitters. The game witnessed a home run surge and a reduction in the old style of "scientific baseball", where teams used bunts, hit and run plays, and stolen bases to eke out runs. As home runs

came to dominate the game, stolen bases receded in importance (Surdam and Michael Haupert 2018, 136-139, 290-292).

Our indicators of market size and economic conditions include the metro population, real GNP per capita, and the unemployment rate. We were unable to find annual estimates of population by city, so we used a linear interpolation of census numbers for city population from 1920 to 1930 and from 1930 to 1940 (US Department of Commerce 1944, 8-10).

We used annual numbers for real GNP (US Department of Commerce 1975, vol. 1, 210-211, 224, 401) and the unemployment rate (ibid., 126), but both at the national rather than the metro level. White collar workers who had often made up a large share of weekday attendance at day games were sometimes assigned production jobs (Stanley Lebergott 1989). So, the impact of unemployment on attendance may have been more severe than in more recent economic downturns.

Stadium characteristics include a dummy for the first year a new stadium was in operation; a dummy variable equal to one if a stadium was owned by the team; the number of doubleheaders; whether a stadium had lights; and the number of games played on Sundays. The Yankees moved into Yankee Stadium in 1923; Cleveland moved into Memorial Stadium mid-season in July 1933. We coded Cleveland's new stadium as 0.5 for 1933 and 1 for 1934. After the 1934 season Cleveland returned to League Park for most of their games.

We used a dummy variable set equal to one if a team owned the stadium in which it played home games. These teams would not pay explicit stadium rental but would incur maintenance costs, depreciation, and foregone interest earnings on the capital invested in the stadium. Renting a stadium from another owner might leave the renter vulnerable to getting a poorer selection of prime playing dates, as conflicts arose between the Yankees and Giants with the Polo Grounds and the Browns and Cardinals with Sportsman's Park in St. Louis. The Giants' threats to take a majority of Sunday dates and also to evict the Yankees were bluster. The two teams split the Sundays almost evenly (there were 24 or 25 Sundays each season), mostly because each team played half the Sundays on the road (Surdam and Haupert 2018, 112-113).

George F. Cahill developed and set out to sell a portable yet powerful lighting system for baseball in 1909 (Michael Benson 1989, 101). Minor League and barnstorming teams pioneered the use of electrical lighting. But Major League owners scorned night baseball as bush-league tactics. Cincinnati Reds official Leland Stanford MacPhail convinced the owners of the lackluster team to install lights. The team's inaugural game under the lights proved successful. Even with the Reds' success with night baseball in 1935, though, the other team owners remained skeptical. Only when MacPhail took over the Brooklyn Dodgers and repeated his success with night baseball, did the owners finally acquiesce to night baseball. By the end of the 1941 season, 11 teams had installed lights (Surdam 2011, 224-243; Jonathan Light 1997, 511). League rules typically allowed teams to stage seven night games per season; the St. Louis Browns received permission to play 14 home night games (Surdam 2011, 226 and 236). Given the uniformity in the number of games staged by each owner pursuing night baseball, we used a dummy variable for teams installing electric lights for home games; this should identify the per-season changes in attendance or net income from having the ability to stage night games.

Holiday doubleheaders often attracted the largest crowds of the season. Doubleheaders during this period were principally twin-bills, meaning one ticket for both games, although owners sometimes staged a game in the morning and a second in the afternoon that required separate admissions. Other doubleheaders resulted from games that had been rained out earlier in the season. Charlie Bevis (2010, 124-125) documents the rise in Sunday doubleheaders as a response to falling weekday attendance and as a way of offering two games for the price of one. Owners were initially reluctant to increase them. The impact of double-headers on attendance could have been small as fans may have used them as a

substitute for pricier single games on surrounding dates. Siegfried and Eisenberg (1980) and Stephen Layson and M. Taylor Rhodes (2011) provide some evidence from more recent data that supports this.

The few owners without the legal right to play home games on Sunday in 1920 hoped to gain such rights. Playing professional baseball on Sundays was a divisive issue well into the twentieth century. Main-line Protestants enforced “Blue Laws” prohibiting many leisure and recreational activities on Sundays. The ability to play professional baseball on Sundays moved from the western cities of St. Louis, Chicago, and Cincinnati to Cleveland and Detroit before World War One (Table 2). The Washington Senators gained the right to play Sunday ball during the war, while the New York and Brooklyn teams got the right in 1919. The Massachusetts and Pennsylvania clubs had to wait until 1929 and 1934, respectively. Since Sunday was often the best-drawing day of the week, these five teams operated at a disadvantage relative to the other 11 clubs. Philadelphia owners John Shibe and Connie Mack frequently bemoaned their inability to stage games on Sundays (*New York Times* 1926; 1933; see Bevis 2003), for a general history of Sunday ball). We used the number of Sundays on which a team had home games during the season to measure the effects of Sunday games (number of Sundays was derived using game logs from Retrosheet.

Table 2
Debut Years of Changes in Major League Baseball

	Sunday Home Games	Radio Broadcasts	Electric Lights
American League			
Boston Red Sox	1929	1930	1947
Chicago White Sox	1900	1925	1939
Cleveland Indians	1911	1929	1939
Detroit Tigers	1901	1927	1948
New York Yankees	1919	1939	1946
Philadelphia Athletics	1934	1930	1939
St. Louis Browns	1902	1928	1940
Washington Senators	1918	1938	1941
National League			
Boston Braves	1929	1930	1946
Brooklyn Dodgers	1919	1939	1938
Chicago Cubs	1892	1925	1998
Cincinnati Reds	1892	1929	1935
New York Giants	1919	1939	1940
Philadelphia Phillies	1934	1930	1939
Pittsburgh Pirates	1934	1938	1940
St. Louis Cardinals	1892	1928	1940

Notes: Sunday Home Games: Year first having Sunday home games.
Radio Broadcasts: Year first having regular broadcasts of home games. Some teams stopped such broadcasts for 1934, and resumed broadcasting following year.
Electric Lights: Year first having home night games.
Sources: Light 1997, 511, 710; Surdam 2011, 190-193, 351.

Previous studies often used a dummy for cities with two teams to account for the effect of a substitute. Most such studies have included a single dummy variable to capture if the metro area had multiple major-league teams.[2] In a robustness test discussed below, we use two dummy variables in a random effects model. The first equals one if a city had two MLB teams (teams in New York, Chicago, Philadelphia, Boston, and St. Louis). The second equals one if the teams sharing a city were in the same league (Brooklyn Dodgers and New York Giants in the National League). Fans of the Dodgers and the Giants often filled the rival's ballpark, when their team was "on the road". However, in our sample both these dummies are time invariant and so perfectly collinear with team intercepts. As a result, they cannot be included separately in the fixed effects model which we estimate first, but the impact of these factors is included in the team intercepts.

Baseball faced greater competition for leisure-time and spending from radio and cinema during the 1920s and 1930s. The number of radio stations and the percent of households with radios rose dramatically from 1920 to 1930. Movie producers added sound and eventually color during these years; theater owners mimicked baseball owners and began offering popcorn and other concessions.

Radio broadcasts became popular during the 1920s and 1930s, but baseball owners eyed the new technology with varying attitudes. Many owners allowed live broadcasts of opening-day games during the 1920s, but these owners often refused to allow regular broadcasts of home games (Lowell Smith 1995). Some owners, such as William Wrigley of the Chicago Cubs, welcomed radio broadcasts. He even allowed radio stations to broadcast games without payment for rights (Surdam 2011, 198, 204).

Other owners, though, feared that radio would prove too close a substitute for live attendance and would, therefore, cut into the gate receipts. After the 1934 season, a few owners temporarily halted broadcasts of home games. Owners had difficulty ascertaining why attendance fell sharply in 1934, and some blamed radio broadcasts of home games (Surdam 2011, 198-213). These owners resumed such broadcasts the following year.

Once radio stations began offering payment for exclusive radio rights, baseball owners' attitudes toward radio broadcast of home games changed. The New York Yankees, however, were still refusing to broadcast their home games during the late 1930s; the team's board of directors made the trade-off explicit: Would the payments for broadcasting rights offset anticipated reductions in gate receipts (New York Public Library 1939 and 1941, "Minutes of a Special Meeting of the Board of Directors, October 24, 1939" and "Minutes of February 20, 1941 Meeting"; for a general history of radio and baseball, see Smith 1995)?

To measure the impact of the growth of radio ownership on attendance and net income we use data on the number of US households with radios from 1922 to 1941 (US Department of Commerce 1975, vol. 2, 796). Given that in 1920 there were only about 50 commercial radio stations in the US and about half of them were in Alaska (US Department of Commerce, June 1920, 9-10), and that the percentage of US households with radios was only about 0.2 percent in 1922, it is reasonable to set the values for 1920 and 1921 to zero.

We compute the percentage of US households with radios as the number of households with radios divided by the number of households. Data on households are available from the 1920, 1930, and 1940 decennial censuses (US Department of Commerce 1975, vol. 1, 41). We use a linear interpolation between successive censuses to estimate annual data on the number of households.

Steve Craig (2004) shows that the early rate of adoption of radio varied by region; in 1930 the percent of households with radios was 56.9 for the Northeast US but only 28.6 for the South. The decennial Censuses of both 1930 and 1940 asked households if they owned a radio and the percent of households with radios by metro areas is reported for each of these

[2] In this period the only interleague games were exhibition games.

two years (US Department of Commerce 1933, 70; US Department of Commerce 1944, 138-140). In 1930 this percentage for cities with baseball teams varied from 48.1 for Cleveland to 68.1 for Chicago. By 1940 this range narrowed from 93 for St. Louis to 97.9 for Detroit. Annual data are not available. With no data for metro areas prior to 1930 and an elongated s-shaped curve for adoption of new technology over time, it is problematic to interpolate annual values.

Instead, we first divide the percentage of households with radios for each metro area in 1930 and 1940 by the percentage of US household with radios for those years. Since there are no metro data prior to 1930 we use the 1930 ratio for it and earlier years. Because the ratios between cities converged between 1930 and 1940, we use a linear interpolation to generate ratios between 1930 and 1940. These weights capture differences in radio ownership across metropolitan areas. Finally, we multiplied the ratio for each metro area by the percentage of US households with radios to account for the trend in radio ownership. We also used a dummy variable for whether a team allowed live broadcasts of home games.

Although motion pictures had been around for two decades prior to 1920, the industry was maturing. By the late 1920s, most motion pictures included sound. Popcorn was introduced in 1925, color in 1927, and concessions in the early 1930s. Consumer expenditures on motion picture admissions more than doubled between 1920 and 1930 (US Department of Commerce 1975, 401); baseball's gate receipts were unlikely to have kept pace. The game's attendance rose from 9.12 to 10.13 million per year in the same period (US Congress 1952, 1617-1618). But because nominal ticket prices did not change much during the decade MLB's receipts likely rose by no more than 15-25 percent (Surdam and Haupert 2018, 102-104). We included annual values of weekly motion picture theater admissions (US Department of Commerce 1975, vol. 1, 400) divided by the US population.

Results

We ran fixed-effects panel regressions using each team's season attendance and net income as dependent variables.[3] The results are shown in Table 3. Both models were estimated using cluster adjusted standard errors at the team level.[4]

Current win loss-percentage and won pennant are both positive and statistically significant in both the attendance and net income models. This is consistent with previous research. A team's *previous* win-loss percentage is not statistically significant, suggesting that fans discounted past information on a team's quality in their decision to attend games. Previous win-loss percentage is also not significant in the net income regression.

Home Runs attracted more fans to the park and raised net income, but Stolen Bases was not statistically significant. So, the owners' efforts to increase home runs even if they came at a reduction in stolen bases appears to have been profitable.

Doubleheaders had no statistically significant effect on either attendance or net income. Sunday games raised attendance, as anticipated, but had no statistically significant effect on net income. We discuss this finding below.

The "Team Owns Stadium" variable has a negative coefficient which is significant at the 10 percent but not the 5 percent level in the attendance equation. It has a positive coefficient

[3] We also estimated the model using ln(attendance) as the dependent variable, but the results were inferior to those reported here.

[4] We also ran regression equations with average-ticket price per attendee as an independent variable. As noted earlier, average ticket price (home gate revenue) per attendee data were available only for the 1929, 1933, and 1939 seasons, and there were some missing observations. With only 45 observations; the results were statistically dubious, and are therefore not shown.

Table 3

Fixed-Effects Regressions for Attendance and Net Income

	Attendance (Annual in 1,000s)			Net Income (Annual in $1,000s)		
Variable	Coefficient	Robust S.E.	t-stat	Coefficient	Robust S.E.	t-stat
Win-Loss Percentage	12.23***	1.10	11.08	9.03***	2.01	4.49
Lagged Win-Loss Percentage	1.21	0.93	1.30	0.53	1.69	0.31
Won Pennant	70.85***	21.64	3.27	285.52***	39.30	7.27
Home Runs	1.40***	0.29	4.75	1.88***	0.54	3.50
Stolen Bases	-0.11	0.26	-0.43	-0.24	0.47	-0.51
Doubleheaders	-1.97	2.15	-0.91	-4.69	3.91	-1.20
Sunday Day Games	5.40***	1.91	2.82	-2.32	3.50	-0.66
Team Owns Stadium	-73.16*	42.60	-1.72	102.36	77.31	1.32
New Stadium	-46.80	75.29	-0.62	109.58	136.67	0.80
Lights	110.27***	25.98	4.24	128.34***	47.41	2.71
Radio Broadcasts	67.87***	21.31	3.19	52.24	38.67	1.35
Metro Population	3.01*	1.65	1.82	1.16	3.00	0.39
Metro Consumer Price Index	3.77***	0.96	3.92	5.49***	1.78	3.08
War Tax	27.20	21.95	1.24	169.15***	39.92	4.24
Unemployment Rate	-2.33*	1.18	-1.97	-0.29	2.17	-0.13
Movie Attendance Per-Capita	3.12	2.55	1.23	20.43***	4.64	4.40
Metro Percent of Households with Radio	-1.08	0.71	-1.53	-4.82***	1.30	-3.71
Constant	-784.26***	178.98	-4.38	-1672.72***	329.74	-5.07
n	349			349		
R-Squared Within	0.65			0.54		
R-Squared Between	0.75			0.67		
R-Squared Overall	0.71			0.57		

Notes: *** denotes p-value ≦ 0.01, ** denotes 0.01 < p-value ≦ 0.05, and * denotes 0 .05 < p-value ≦0 .10

in the net income regression, but it is not significant. We note though that the number of observations where teams did not own the stadium is small. New stadium is not significant in either the attendance or net income regressions. However, in our sample only two teams moved to new stadiums.

Although lights could have been adopted earlier, owners were reluctant to do so, but adding lights also significantly raised attendance and net income. Broadcasting games on the radio, which some owners were also reluctant to do, raised attendance by about 12 percent of mean attendance. This result suggests that broadcasting games created additional fans. However, the coefficient on broadcasting is not significant in the net income regression. Metro population was significant at the 10 percent level. The coefficient implies that an increase of 100,000 residents increased annual attendance by about 3,000.

As discussed in regard to fixed nominal ticket prices, an increase in the price level reduced real ticket prices, and so a positive sign is expected on metro CPI in the attendance regression. Its coefficient is positive and significant. Its coefficient in the net income regression is also positive and significant.

When we include both real GNP per capita and the unemployment rate, both of which are measured at national level, neither is significant in either the attendance or the net income regressions. However, in the attendance, but not the net income regression, when the unemployment rate is included by itself it has a negative and significant coefficient. When real GNP per capita is included by itself it has a positive and significant coefficient. These results indicate multicollinearity, which deflates the t-statistics when both are included. The correlation between the two is -0.51. We report the results with only the unemployment rate included. The only notable difference in the regression when the unemployment rate is replaced with real GNP per capita is that the percent of households with radios is significant at the 1 percent level. The coefficient on unemployment indicates that a one-percentage point increase in the unemployment rate reduced annual attendance by about 2,500.

The “Percent of Households with Radios” variable has a negative coefficient in both the attendance and net income regressions. Its p-value in the attendance regression is 0.31. However, its correlation with the unemployment rate is 0.70. So, multicollinearity likely deflates its p-value. It is significant in the net income regression.

The coefficient on movie attendance is positive but not significant in the attendance regression. Its insignificance suggests that baseball and movies may not have been very close alternatives or that consumers were generally willing to spend more for leisure.[5] Also, movies and radio replaced vaudeville and so removed another potential source of competition. Paradoxically movie attendance significantly raised net income. Since MLB teams were concentrated in urban areas of the northeast quadrant of the United States while motion picture theaters (and our movie attendance data) covered the entire nation, as an anonymous referee pointed out, the result may result from using an imperfect proxy variable.[6]

[5] A reviewer speculated that motion picture attendees had grown accustomed to buying concessions and transferred this preference to the ballpark. Since motion picture theaters generally did not sell concessions until the Great Depression, any causality might have been reversed (Douglas Gomery 1986, 21; John Izod 1988, 101). MLB owners reported net concessions revenues for 1929, 1933, and 1939. In real terms, these fell off between 1929 and 1933, but increased markedly by 1939. Net concessions revenue accounted for only 5.5 percent, 6.4 percent, and 7.0 percent of total revenues for those three years respectively (Surdam 2011, 320 and 326).

[6] The correlation between movie attendance and GNP per capital is 0.42. If the unemployment rate is excluded, the coefficient on movie attendance is positive and significant. If movie attendance is deleted the coefficient on the unemployment rate rises and its significance increases. This indicates that after controlling for other variables movie attendance does not make a significant contribution. We also note that the rise in cinema attendance is associated with an increase in the percentage of movies with sound and the number of theaters that were “wired” to present them.

The coefficients on win-loss percentage, pennant, home runs, lights, and metro CPI are all positive and significant in both the attendance and net income regressions. Sundays, team owns stadium, radio broadcasts, and metro population are significant, at least at the 10 percent level, in the attendance regression but not the net income regression. Movie attendance is not significant in the attendance regression but, oddly, is positive and significant in the net income regression.

Some of these differences have plausible potential explanations. Sunday games may have had higher operating costs. It is also possible that while increasing overall attendance, they may have attracted fans who would have attended on other days. Sunday fans may have also differed from weekday fans; Sunday attendance may have included families or working-class fans, who may have bought seats in the cheaper sections of stadiums or purchased fewer concessions than did weekday attendees. As mentioned earlier, teams in larger metropolitan areas may have had higher operating expenses. That radio broadcasts raised attendance, but not net income and that movie attendance raised net income, but not attendance is puzzling. While it is reasonable conceptually to argue that attendance and net income may be determined by different factors, our results show that this is indeed the case. The correlation between the two is 0.67, which is not especially large, but is significant at the 1 percent level.

In Table 4 we report results from a random effects model. Both the fixed effects and the random effects models are designed to account for unobservable characteristics of groups. The fixed effects model assumes that these characteristics are associated with the explanatory variables. Therefore, to produce consistent estimation, a dummy variable for each team is used. The random effects model assumes that the unobserved characteristics are not correlated with the explanatory variables, thus no dummy variables for teams are included. However, we must account for serial correlation, given the potential persistence of some unit specific characteristics.

Because team dummies are not included the random effects model can include a dummy for two teams in the same league, Shares City, and a dummy for the specific case where the city is shared by two teams from the same league, Shares City Same League. Both have a negative and significant coefficient in the attendance equation. The first indicates that attendance was lower if teams shared a city. The second indicates that all other things the same the New York teams had lower attendance possibly because the teams were in the same league. In the net income regression Shares City has a negative and significant coefficient, as expected, but the coefficient on Shares City Same League has no effect on net income. So, while the New York teams had lower attendance than otherwise, being in the same league did not decrease their net income.

In the attendance regressions the coefficient on the “Team Owns Stadium” variable is positive with fixed effects but negative with random effects. In both cases the coefficients are significant at the 10 percent level. Lights is significant in the fixed effects regression but is not quite significant at the 10 percent level in the random effects regression.

In the net income regression with fixed effects double headers, Sundays, team own stadium, and metro population are not significant even at the 10 percent level. In the random effects regression for net income double headers are almost significant at the 10 percent level, Sundays and team owns stadium are significant at the 10 percent level and metro population is significant at the 5 percent level.

For both attendance and net income there are some large differences between the coefficients in the fixed effects model and those in the random effects model. These differences suggest that the assumption that the random effects are not correlated with the explanatory variables is incorrect, and so the random effects model is inconsistent. The Hausman test rejects the null that the difference in coefficients is not systematic at the 1 percent level for the both the attendance and net income regressions.

Table 4

Random-Effects Regressions for Attendance and Net Income

	Attendance (Annual in 1,000s)			Net Income (Annual in $1,000s)		
Variable	Coefficient	Robust S.E.	t-stat	Coefficient	Robust S.E.	t-stat
Win-Loss Percentage	12.64***	1.24	10.22	8.32***	1.97	4.23
Lagged Win-Loss Percentage	0.73	1.05	0.70	0.20	1.67	0.12
Won Pennant	61.57**	24.70	2.49	286.12***	39.18	7.30
Home Runs	0.94***	0.28	3.37	1.85***	0.44	4.16
Stolen Bases	-0.20	0.29	-0.71	0.12	0.45	0.26
Doubleheaders	-4.45*	2.37	-1.88	-6.19	3.77	-1.64
Sunday Day Games	3.37**	1.67	2.02	-4.79*	2.68	-1.79
Team Owns Stadium	38.98*	22.58	1.73	-67.33*	36.00	-1.87
New Stadium	-49.25	86.30	-0.57	36.00	136.90	0.26
Lights	46.32	28.65	1.62	111.08**	45.57	2.44
Radio Broadcasts	143.25***	21.66	6.61	44.06	34.35	1.28
Metro Population	4.53***	0.44	10.35	1.60**	0.69	2.30
Metro Consumer Price Index	5.29***	1.09	4.84	6.41***	1.76	3.63
War Tax	44.89*	25.49	1.76	161.58***	40.50	3.99
Unemployment Rate	-2.67**	1.36	-1.97	-0.30	2.18	-0.14
Movie Attendance Per-Capita	0.65	2.93	0.22	18.43***	4.67	3.95
Metro Percent of Households with Radio	-0.44	0.73	-0.60	-3.88***	1.17	-3.32
Shares City	-107.94***	21.95	-4.92	-145.66***	35.00	-4.16
Shares City Same League	-110.85***	34.35	-3.23	-13.22	54.50	-0.24
Constant	-924.43***	190.73	-4.85	-1456.59***	306.96	-4.75
n		349			349	
R-Squared Within		0.61			0.53	
R-Squared Between		0.92			0.89	
R-Squared Overall		0.79			0.62	

Notes: *** denotes p-value ≦ 0.01, ** denotes 0.01 < p-value ≦ 0.05, and * denotes 0 .05 < p-value ≦0 .10

Conclusions

Previous research indicates that measures of team performance are a positive and significant determinant of baseball attendance. Metropolitan population is also often positive and significant. Team performance measures but not metro population are positive and significant in our sample. Previous research using ticket prices indicates that demand for baseball is in the inelastic region of the demand curve. In our sample nominal ticket prices were rigid, so that an increase in the price level reduced the real price of tickets. In our data this reduction raised attendance and real net income. The inverse relation between real ticket prices and real net income suggests that demand may have been in the elastic region. However, the CPI is a proxy for ticket prices and our results are for net income not revenues.

Previous research tends to find higher attendance when per capita income rises. Unlike previous studies where income data are available at the metropolitan level, we used US real GNP per capita. When it is included and the national unemployment rate is excluded, it has a significant and positive coefficient. When it and the unemployment rate are included, neither is statistically significant. When unemployment, but not real GNP per capita, is included, it has a negative and significant coefficient. So, our results for attendance are consistent with previous findings which typically use more recent data. We found that team performance raised real net income, but that both metro population and the unemployment rate were insignificant.

Our study covers a period when the unemployment rate rose to unprecedented levels and movies and radio broadcasts provided new alternative uses of leisure time. Neither increased movie attendance nor increased radio set ownership had a significant impact on baseball attendance. However, increased movie attendance, curiously, was associated with higher real net income for baseball teams while increased radio ownership decreased their real net incomes.

Owners could attempt to increase attendance and revenues in several ways. Increased home runs, the addition of lighting to play night games, Sunday games, and radio broadcasts all raised attendance. However, of these, only home runs and adding lights raised real net income. Our results suggest that attendance was not a very good proxy for real net income during a period of considerable change and innovation. Owners may have felt gratified simply to have survived the turmoil of the two decades.

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