What Explains Labor's Declining Share of Revenue in Major League Baseball?

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Abstract

This study examines reasons for the declining share of revenue going to Major League Baseball players. Though the players' union and team owners have proposed competing explanations, the phenomenon has not received any rigorous academic study. Economic theories for the similar decline of labor's share in the macroeconomy provide possible explanations. The ability to estimate baseball players' marginal revenue products through their performance offers a unique opportunity to examine the role of worker productivity in determining labor's share of income in general. The analysis indicates that the returns to player performance have declined and that collective bargaining agreement terms that promote revenue sharing among teams appear to play a significant role. In addition, increased returns from new non-player revenue sources have lowered the share of league revenue going to players. Competition from substitute labor inputs and changes in returns to physical capital do not appear to be important factors.

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"Bottom line, the players are upset. No, they are outraged. Players in the midst of long-term contracts are as frustrated as those still seeking employment. Their voices are getting louder and they are uniting in a way not seen since 1994."

– MLB player agent Brodie Van Wagenen, February 2, 2018 (Crasnick, 2018)

1. Introduction

The introduction of free agency in Major League Baseball (MLB) in 1976 greatly expanded MLB players' share of league revenue as salaries increased to approach players' marginal revenue products as a result of inter-team competition for labor (Sommers & Quinton, 1982). But after the initial increase, the players' share has fluctuated. Following findings of owner collusion during the 1980s, players saw a dramatic rise in their share of revenue in the 1990s before entering a period of general decline in the early-2000s. From 2003 until 2015, league revenue increased at an average rate of 6.6 percent per year while player salary compensation grew at only a 4.4-percent annual rate, creating a gap in income growth that appears to represent a new trend. During this period, the US macroeconomy experienced a similar decline in labor's share, which is curious given its previously-observed stability.

The declining labor share in baseball became a major source of contention during the 2017-2018 off-season, when the market for free agents was perceived to be abnormally weak. Just prior to spring training, players union executive director Tony Clark issued a rebuke of owners, noting that many talented baseball free agents remained unsigned at a time when MLB "revenues and franchise values [were] at record highs." He blamed teams for engaging in a "race to the bottom" by offering players lowball contracts, declaring the owners' behavior to be "a fundamental breach of the trust between a team and its fans and threatens the very integrity of our game." MLB responded to the charges by noting that many players had turned down "substantial offers, some in nine figures" and placed the responsibility on player agents for failing to properly "value their clients in a constantly changing free agent market" (Gartland, 2018). Is the falling revenue share a product of owner chicanery, as alleged by the players, or simply a response to changing market forces, as owners claim? Finding an answer requires examining changes in the professional baseball industry over time.

This study evaluates baseball's recent history to examine factors that may explain fluctuations in players' share of income. Section 2 presents stylized facts regarding labor's declining share in MLB and the US economy and posits potential explanations. Section 3 investigates the hypotheses empirically. Section 4 concludes the paper with a discussion of the findings. The analysis indicates that changes to the returns to on-field success, which were influenced through collectively-bargained rules, and the emergence of profitable technology-driven non-player inputs provide the best explanations for the decline in players' share of revenue. Neither the substitution of foreign labor nor changes in the return to stadium capital appear related to the share of income going to labor.

2. Stylized Facts and Potential Explanations

Perhaps not coincidently, the falling labor share in baseball has occurred at a time when the share of income going to all workers in the US economy has similarly declined. This is a curiosity given the observed stability of labor's share for much of the twentieth century that has long been viewed as a near constant by economists. The falling share of income going to workers in the macroeconomy has prompted economists to propose several explanations. Though none of the hypotheses provide a complete explanation, they provide a useful starting point for examining the phenomenon in baseball. Revenue and compensation data from MLB also provide the opportunity to examine changes in labor's revenue share in baseball's unique labor market, which may help in understanding the economy-wide phenomenon.

Figure 1 presents two measures of players' share of income in MLB and all workers' share of income for the entire US economy from 1990 to 2015.[1] The players' share of income is measured as the sum of total regular-season player salaries plus the share of playoff revenue paid to players, divided by total MLB revenue by year.[2] However, player income estimates from available player salaries require an adjustment. Because salary data is generally available only for players who appeared on opening day rosters, using available player

[1] MLB labor share excludes the strike years of 1994 and 1995. US labor share reported by US Bureau of Labor Statistics.
[2] See note 7 for a discussion of MLB revenue estimates. The players' share of playoff revenue is determined by a percentage of gate receipts from the minimum possible number of games per playoff series. Data is collected from Baseball Almanac (2018).

salaries to measure players' share of income will bias the estimate downwards. In fact, the growing practice of waiting to add players to major-league rosters until after the season has progressed, in order to take advantage of collectively-bargained salary restrictions, provides a possible explanation for the declining labor share. The number of players with unreported salaries in the sample increased substantially from 21 percent in the 1990s to 36 percent in the 2000s; therefore, it is possible that the apparent decline in labor's share is an artifact of teams' increased use of players without recorded salaries.

To address availability bias, I develop an adjusted-measure of labor share that proxies the wages of players whose salaries are not reported. For the most part, players added during the season are young or marginal players who are paid a prorated share of the league-minimum salary—which ranged from $100,000 (1990) to $507,500 (2015) per season during the sample—for the days that they were on an MLB roster. Identifying days on an MLB roster is difficult, because players on the roster do not always appear in games. Therefore, I identified every MLB player who appeared as a hitter or a pitcher in each year who did not have a recorded salary, and I assigned these players the league-minimum salary for that year when calculating labor's share of MLB revenue. This method overstates the level of compensation paid for part-time players, because it does not prorate salaries; however, the positive bias from this correction is small, and it ensures that the reduction in the labor share is not the result of teams increasing their use of players with unreported salaries.

The reported and league-minimum-corrected salary shares in Figure 1 show that the two estimates track closely together, with the league-minimum-corrected salary share being slightly above the uncorrected salary share. Though there does not appear to be any bias in reporting that makes the players' share appear to be declining when it is not, I use the corrected share for the remainder of the analysis as a precaution. It is important to note that the players' share does not cover all of labor's share of the baseball industry, because it does not include the compensation of non-player labor (front office management, coaches, medical personnel, game-day and facility operations staff, etc.) or minor-league players who are paid by MLB

franchises. Thus, while macroeconomic and MLB players' shares may respond similarly to economic factors, they are not directly comparable as raw measures of labor's share.[3]

Since 2000, labor's share of income in the US economy declined from approximately 63 percent to 57 percent in 2015. MLB players' share fell from 59 percent at its peak in 2003 to 45 percent (55 to 42 percent using the uncorrected players' share).[4] Figure 1 shows a similar reduction of US and MLB players' share of income over the period. Changes in the players' share tend to mirror fluctuations in the US labor share with a lag, possibly indicating responses to similar phenomena. Baseball players frequently work with long-run contracts, which could delay adjustments to external forces that might affect labor's share in the economy. Therefore, if the same factors that affect other sectors of the economy also affect MLB, then it would not be surprising for MLB salaries to adjust with a slower response.

Several hypotheses have been put forth and examined as potential explanations for the declining labor share in the US, generating a recent and large literature on the topic. Elsby, Hobijn, and Şahin (2013) provides a thorough survey of proposed explanations for the economy-wide decline in labor's share of income that provides a guide for exploring declining labor share in baseball.[5]

First, though the aggregate labor share was relatively stable through much of the twentieth century, fluctuation in labor shares across industries was somewhat common; thus, the perceived stability in labor's share may be partly attributable to changes in labor shares in sectors cancelling out in aggregate. Therefore, changes in the revenue-generating structures of specific industries and how they might affect labor's share is worth examining. In MLB, if players' marginal revenue products declined during this period, then a decline in labor's share would be expected as players became relatively less-valuable inputs.

[3] Comparisons to other North American professional sports leagues as a measure of labor's bargaining strength are also inappropriate, because they lack the extensive minor-league system that is funded almost entirely by MLB.
[4] Vrooman (2009) notes the growth of players' revenue share into the early-2000s, but time period of analysis ends before the trending decline that is the subject of this period was apparent.
[5] Approximately, one-third of the decline in US labor share is attributable to changes in proprietors share of income; however, this explanation is not applicable to MLB, because ownership and labor of teams are separate.

Second, lower unionization rates in the US economy may lower wages through reduced employee bargaining power. Baseball remained a unionized industry during this period of analysis, but changes in labor's bargaining strength may have played a role in players' share of revenue. The identifiable and discrete implementation of collective bargaining agreements (CBAs) allows for comparisons across labor contracts, and the findings may also provide information on the role of bargaining strength in wage determination in general.

Third, the offshoring of labor has allowed US industries to substitute cheaper foreign workers for domestic labor, putting downward pressure on wages. The corollary to offshoring in baseball is the importation of foreign talent. Throughout much of its history, MLB teams have relied mostly on domestic players. During this period, baseball experienced an increased importation of labor, largely from Latin America and Asia, and foreign players now account for more than one quarter of MLB players. Thus, the increased supply of baseball talent offers another possible pathway for the reduction in the players' share of revenue similar to offshoring labor in the general economy.

Fourth, technological innovation allowing physical capital and non-player inputs to substitute for labor may have lowered the returns to labor throughout the economy. As a spectator sport, changes in the value of non-player inputs, such as stadiums and consumption through broadcast media may lower the returns flowing to players.

In the following section, I examine the proposed contributors to the economy's labor share to MLB's player market separately.

3. Empirical Analysis

3.1 Changes in the Baseball Industry

I begin by examining changes in the baseball industry that have affected labor's share through the valuation of player contributions. The earliest studies of the economics of sports leagues identify performance (as measured by winning) as the chief determinant of revenues for profit-maximizing teams. Fans desire to observe and be associated with successful teams, and thus teams with more on-field success

ought to attract more fans and generate more revenue than less-successful teams. Scully (1974) uses winning as the sole determinant of team revenues, and further studies have found positive returns to on-field performance in baseball (Scully, 1989; Krautmann, 1999; Bradbury, 2010). Player marginal revenue products fluctuate with the returns to performance; therefore, changes in the value of on-field success ought to affect the share or revenue accruing to players. This provides a mechanism to determine how changes in player value contribute to fluctuations in labor's share.

Equation 1 presents a generalized empirical model developed by Bradbury (2019), which examines the determinants of revenue in the four major North American sports leagues to identify important determinants of team revenue. The study finds that on-field success, market size, and stadium age are the main determinants of revenue for MLB teams.

$$(1) \qquad Revenue_{it} = \alpha + \Phi \mathbf{Performance}_{it} + \beta_1 Market_{it} + \beta_2 Stadium_{it} + \beta_2 Yankees_{it} + \tau \mathbf{T}_t + \varepsilon_{it} + \nu_i$$

Revenue is the total revenue team *i* generates in year *t*, measured in 2015 dollars.[6] Revenue data are published in *Financial World* and *Forbes* and previously have been used in economic studies of sports leagues.[7] **Performance** is a vector of on-field success that contains three variables: run differential, run differential squared, and the lag of run differential. The run differential is highly correlated with winning and has the added advantage of further distinguishing quality between teams with similar winning percentages.[8] The quadratic functional form captures non-linear returns to success that may be increasing (as identified by Bradbury, 2019) or diminishing (as predicted by Rottenberg, 1956). I also estimate a specification that

[6] Dollar values are converted to 2015 MLB revenue values. Thus, changes in team revenue reflect changes in explanatory variables after controlling for the growth in league revenue.

[7] For example, see Berri, Leeds, and von Allmen (2015), Bradbury (2010), and Depken (2006). Data from various years, *Forbes* observations culled from internet searches of cached pages using the Internet Archive: Wayback Machine (https://archive.org/web/). *Financial World* observations from Papas, Business of Baseball Pages (http://roadsidephotos.sabr.org/baseball/). Data from both sources were compiled annually under the guidance of the same person (Michael Ozanian), thus the data are comparable despite being published by different outlets.

[8] Postseason participation is excluded for this analysis for simplicity, and any playoff effects are captured through the run differential variables. Though postseason participation is associated with enhanced revenue, it is highly correlated with winning, which complicates measuring the impact of on-field success from year to year. Estimates produced using winning directly are similar to the results using run differential.

includes the interaction of cohort-era indicator variables and the quadratic run differential variables to identify if performance changes are statistically different from each other across eras.

The market size of the host city is measured by its metropolitan area population, which has been shown to be positively correlated with MLB team revenue. Stadium is the reciprocal of stadium age (year of observation – year of opening +1). The reciprocal transformation provides the best fit of the model and conforms to the theoretical strong-but-diminishing novelty effect of a new stadium identified in MLB and other sports leagues (Coates & Humphreys, 2004). Bradbury (2019) identifies a unique market effect of the New York Yankees, and Yankees is an indictor variable equal to one for Yankees observations and zero otherwise. **T** is a vector of year effects, ε is a standard error term, and ν is a franchise-specific error term. I estimate the model using the Baltagi and Wu (1999) random-effects estimator, which corrects for identified first-order serial correlation in unbalanced panels.[9] Table 1 lists the summary statistics.

To measure the changes in the determinants of revenue over time, I estimate Equation 1 using four-year increments as well as a single specification for the entire sample. The four-year increments provide sufficient sample size variation for panel analysis and produce exactly six separate estimates over the sample, excluding the strike-shortened 1994 and 1995 seasons.[10] Table 2 presents the estimated relationship between on-field success and revenue during the cohort eras. The last model in the table estimates the relationship for the entire sample and includes indicator variables for each four-year increment and interactions with the run differential and run differential squared. The significant coefficient estimates indicate less revenue and lower returns to success in all eras after the 1990-1993 period. The quadratic and lagged success variables make the interpretation of the raw coefficient estimates difficult; therefore, Figure 2 presents the estimates graphically by four-year increments and as a whole.[11]

[9] Using the appropriate diagnostic tests, Bradbury (2019) determines random effects is the appropriate estimator; however, the analysis provides fixed-effects estimates that, unsurprisingly, produce similar results. In addition, other functional forms and variable specifications were examined to identify the best empirical model, which serves as the form used in this paper.

[10] Estimates using shorter and longer increments produced similar estimates.

[11] Estimates generated using the quadradic estimate of the current score differential in the present year and the discounted present value of score differential in the following year, based on the average revenue growth of the MLB.

The estimates show that the returns to performance are positive, and the returns are increasing in all but one period (1996-1999). Rottenberg (1956) and Neale (1964) make the case theoretically that the returns to success ought to diminish due to fan preference for uncertainty of outcomes. Diminishing returns are a common assumption in the sports economics literature, but this assumption does not have strong empirical support and is not supported by these estimates.

The one exception (1996-1999) is consistent with findings presented in Solow and Krautmann (2007), which uses different empirical methods to examine a similar time period and identifies diminishing returns to winning. A unique characteristic of this era was the existence of a "luxury tax" from 1997 to 1999, which required the top-five payroll teams to pay a 35-percent (34 percent in 1999) tax on salary amounts above the mid-point of salaries between the fifth- and six-highest team payrolls. Unlike the version of this tax that was reintroduced in 2003—which included a nominal salary threshold so high that few teams approached it and taxed overages at a mostly lower rate—the top-five payroll teams (which were successful on the field) faced this steep tax every year by decree, which necessarily reduced the returns to performance among the best teams in the league. Thus, the finding of diminishing returns is likely a product of this brief era and its institutions and not the result of consumer demand for competitive balance.

In general, it appears that the returns to performance are positive and increasing, a result that is also identified in basketball and hockey (Bradbury, 2019). This finding is consistent with evidence that finds little effect of competitive balance one the demand for sports (Berri, Schmidt, & Brook, 2007; Coates, Humphreys, & Zhou, 2014; Mills & Fort, 2014).

The estimates indicate that, over time, the returns to performance declined relative to the early 1990s, reaching their lowest level in the 2004-2007 period, and then improving from 2008 to 2015. A decline in the returns to on-field success means that player marginal revenue products (after adjusting for league revenue growth) were declining, and thus labor's share should be expected to decline. Therefore, the reduction in the returns to on-field success may contribute to the decline in labor's share of revenue. A possible source of this decline is that these periods loosely correspond with collective bargaining agreements (CBA), and thus I

examine the impacts of these agreements directly in the following subsection. In addition, I address other changes in industry structure that may have lowered the revenue share in subsection 3.5.

3.2 Union Influence through Collective Bargaining

MLB's relationship with its players and their union during the past four decades has been contentious at times—resulting in two major in-season labor strikes (1981 and 1994-1995) and findings of owner collusion in the latter-half of the 1980s—but the relationship has been mostly peaceful in reaching collective bargaining agreements without a work stoppage since 1995. However, agreements between the owner and players appear to have played a meaningful role in the players' share of income.

Figure 3 presents the players' share of revenue by year, separated by CBA. A sharp rise in labor's share followed the 1990 CBA, which was signed following an arbitrated dispute between players and owners that found owners colluded to restrict free agent salaries. Changes implemented with the new agreement, as well as a market free of collusion, were associated with a rapid rise in the players' share of revenue. This shift toward players likely made owners more willing to reverse the trend when the CBA expired following the 1993 season. The owners demanded a salary cap, which resulted in a strike that would cancel portions of the 1994 and 1995 seasons. The strike would come to an end just prior to the 1995 season and a temporary CBA in 1995 governed MLB similar to the 1990 agreement until the 1997 CBA.

Maxcy (2009) and Hill and Jolly (2017) find the revenue-sharing components of particular CBAs intended to improve competitive balance affected player compensation, which would similarly impact the players' share of revenue. As poor teams receive revenue sharing when losing, and successful teams must transfer additional revenue generated by further wins, the returns to success decline. The CBAs dictate complicated revenue-sharing plans with luxury taxes on high-payroll teams, thus the following descriptions of revenue-sharing arrangements in the CBAs are general.

The 1997 CBA introduced revenue sharing with an intended net transfer value of $70 million (approximately three percent of MLB revenue in 1997). The collection and distribution involved a "split pool" distribution—20 percent of net local revenue was contributed to a common pool and phased in an

equal distribution of 75 percent of revenues to all teams, with the remaining 25 percent allocated to below-average revenue teams. The 1997 agreement also imposed a luxury tax on payroll expenditures over a certain relative threshold (discussed above). The tax was 35 percent in 1997 and 1998, 34 percent in 1999, and was not in force from 2000 to 2002. Maxcy (2009) argues that perverse redistributive incentives created by the 1997 CBA resulted in low-revenue teams divesting from talent, because it lowered the returns to performance. Overall, during this CBA, the players' share increased; however, there are a few factors worth noting. First, during the first two years of the agreement, when the luxury tax of 35 percent was enforced, the labor share fell, and labor share increased after the tax expired. Also, MLB's revenue grew at a relatively high 12.2 percent annual rate during this time period, creating a level of wealth that may have made owners more willing to invest in player-talent even with revenue sharing. This was MLB's first significant revenue-sharing system, and its relatively low tax rate and split-pool format make interpretation of the competing incentive effects difficult to disentangle.

The 2003 CBA greatly increased revenue sharing with an intended net transfer value of $248 million (approximately 6.4 percent of MLB revenue in 2003) using a "straight pool" collection and redistribution of 34 percent of net local revenue. A luxury tax was reinstituted, beginning with a tax rate on above-threshold payroll expenditures at 22.5 percent for a first-time overage (17.5 percent in 2003), 30 percent for a second overage, and 40 percent for three or more overages. However, the payroll threshold was only exceeded by three teams (Boston Red Sox, Los Angeles Dodgers, and New York Yankees) during this CBA period. MLB revenue also grew at a more modest (relative to the previous period) 8.8 percent growth rate during this time. The implementation of the 2003 CBA coincided with a rapid decline of labor's share of income, which indicates a meaningful role of the CBA in determining labor's share. This finding is also consistent with Maxcy (2009), which argues that the 2003 CBA amplified the incentives of low-revenue clubs to divest in talent that was less valuable with revenue sharing.

The 2007 CBA reversed course and lowered revenue-sharing contributions from 34 to 31 percent of net local revenue and maintained the escalating luxury tax rates, which were paid by only three clubs (Boston Red Sox, Detroit Tigers, and New York Yankees) during the CBA period. MLB revenue growth declined to

4.5 percent during this period, which was its lowest growth rate during the sample. During the 2007 CBA, labor's share of revenue slightly increased following its implementation before decreasing. The decline in labor's share stalled and was stabilized relative to the previous period. This is consistent with the observation of Hill and Jolly (2017) that the 2007 CBA was associated with increased player salaries following the lowered revenue-sharing tax rate.

The 2012 CBA returned the revenue-sharing rate to 34 percent of net local revenue, and the agreement included rules for receiving funds, stipulating that a minimum amount of proceeds be spent on player payroll. Luxury tax contributions were lowered for first-time overages to 17.5 percent in 2013, and four or more threshold overages were taxed at 42.5 percent (2012) or 50 percent (2013 to 2016). Average MLB revenue growth was 7.2 percent during this period. The players' share further declined, which is consistent with increased revenue sharing decreasing the incentive for low-revenue teams to invest in talent.

Overall, fluctuations in the labor share corresponded somewhat with CBA incentives as predicted. Using the same empirical method employed in the previous section using four-year cohorts, I estimate the impact of performance on revenue during each CBA. If CBA rules lowered the value of success, then revenue functions should adjust accordingly to reflect the change. Increases in revenue sharing should lower the returns to performance, lowering the marginal revenue product of player contributions, and thus lower the players' share of revenue.

Table 3 reports the full regression results, and Figure 4 presents the estimated returns to performance graphically. I further estimate the returns to performance during the entire sample, using indicator variables for CBAs as well as interaction terms with run differential to denote changes in the returns to success by CBA, which are reported in the last two columns of the table. The mostly significant indicator and interaction-term coefficients indicate meaningful differences in the returns to success by CBA.

The estimates show a decline in the returns to on-field success after the implementation of the 1997 CBA, and that the performance returns fell to their lowest level during the 2003 CBA, which imposed the greatest level of revenue sharing. Revisions of the CBA in 2007 and 2012 were associated with increased

returns to performance, relative to the 2003 CBA; however, returns remained below the 1997 CBA level. In summary, the evidence indicates a strong role of collective bargaining between the players' union and the owners in determining the players' share of revenue.

3.3 Outsourcing Labor

In baseball, the equivalent of outsourcing inputs that have contributed to the declining share of US workers is the importation of foreign players to the United States. During the period of analysis, MLB experienced an influx of players from Latin American and Asia. Foreign players are not subject to the amateur draft and are frequently signed as free agents by MLB clubs. These players are substitutes for domestic labor inputs and may have lowered the wages that all players (foreign and domestic) could command. Figure 5 maps the players' share of revenue and share of foreign-born players in MLB from 1990 to 2015.

The relationship shows that while the percentage of US-born players declined, the foreign-share of the labor force is not strongly correlated with players' share of income ($r = 0.06$, $p = 0.76$). From the late-1990s to the early-2000s, players experienced their largest share of income, while the foreign share of players was growing at a rapid rate. If cheaper foreign talent placed downward pressure on player wages that reduced labor's share of income, then the players' share should not have risen as it did during this period. Thus, the importation of foreign workers appears to have played little role in the declining players' share of income.

3.4 Reorganization of Labor

Similar to the competitive pressure created by substitute foreign labor, players may face wage pressure from the innovative reorganization of existing talent, which would result in returns flowing to the principal implementing the technology (teams) and away from players. Baseball teams often combine players into "platoons" or "corps" of players to substitute for a position previously served by one primary player. A peculiarity of baseball is that batters tend to perform better against pitchers with the opposite dominant hand (i.e., right-handed hitters perform better against left-handed pitchers and vice versa) which is commonly known as the platoon advantage. Instead of using the same player in the lineup on a regular basis, teams

sometimes employ a platoon of two players, according to the handedness of the pitcher, to increase the productivity of both players. Platooning lowers the marginal products of the component players but increases the marginal product of their combined overall output, relative to what each player would have produced individually as the primary player.

For pitching, teams typically use a corps of relief pitchers who can be matched against opposing hitters to maximize their effectiveness, strategically inserting pitchers to eliminate the platoon advantage and pitch them in short stints to limit fatigue. Since the 1970s, teams have increased their use of relief pitcher specialists in place of starting pitchers or multiple-inning relievers (Baldini, Gillis, & Ryan, 2011).

It is possible that the increased use of position platoons/corps may have lowered player marginal products, and thus wages, as teams of lower-quality players began to serve as substitutes for positions served by a primary player. The increased output from combining player inputs in this way is the result of technological innovation implemented by the team.

Figure 6 maps the number of players used per team and the players' share of revenue over the sample by year. It shows a steady increase in the number of players used by team per season and is not correlated with the players' share of revenue; therefore, the reorganization of player inputs does not appear to be a plausible explanation for the decline in labor's share.

3.5 Returns to Non-Player Inputs

Baseball produces more output than just baseball games and employs labor and capital that is complementary to players. Teams offer concessions and other entertainment amenities to their customers as complementary products. The most obvious physical capital investment is the stadium. Franchises also employ non-players as workers to evaluate, train, scout, provide medical care, and manage activities. Clubs run extensive farm systems, which involve at least five levels of minor-league teams (each with 25-man rosters), as well as additional developmental squads and training camps around the world. If the returns to

non-player inputs increased relative to MLB talent inputs, then a decline in player wages would occur in accord with their diminished marginal revenue products.

3.5.1 Physical Capital

While changes in the value of many non-player inputs are difficult to observe over time, the returns to a particularly important piece of capital, stadiums, are observable. MLB teams generate revenue from ticket, concession, sponsorship, and advertising sales at stadiums. Previous studies of the returns to new stadiums show a novelty or honeymoon effect from increased demand brought about by increased fan interest and enhanced revenue streams (Bradbury, 2019; Depken, 2006; Poitras & Hadley, 2006; Coates & Humphreys, 2005; Clapp and Hakes, 2005; McEvoy et al., 2005). The novelty effect results in strong increased demand that diminishes quickly within approximately a decade of a stadium opening. If the importance of stadiums and related capital increased relative to labor inputs, then it should be observable in the novelty effects, with newer stadiums increasing in importance during the period.

Figure 7 maps the returns to stadium age estimated by Equation 1, and presented in Table 2, in four-year increments over the sample. The estimates reveal much stronger novelty effects earlier in the sample during the 1990s compared to the 2000s, when labor's share was declining, which is contrary to the hypothesis of capital generating relatively higher returns to labor. Thus, it appears that a shift of the returns to stadium capital did not contribute to the decline in the players' share of revenue.

3.5.2 Returns to Other Non-Player Inputs

Though teams did not experience increased relative returns to stadiums, returns to other forms of capital and non-player labor inputs may have been contributing factors. If the returns (Y) to baseball are a function of player labor (L) and non-player (N) inputs, and the returns to labor are less than non-player inputs $\left(\frac{\partial Y}{\partial L} < \frac{\partial Y}{\partial N}\right)$, then labor's share would be expected to decline. This is consistent with the quantity of fans consuming baseball expanding at a rate greater than the growth of the labor pool.

In 1990, MLB fielded 26 teams with an average season attendance of 2.11 million per team. In 2015, MLB fielded 30 teams with an average season attendance of 2.45 million per team. Thus, attendance increased by 16.6 percent, controlling for the labor stock of players provided to consumers. The increase is made possible by the non-rivalry of consumption of spectator sports. A portion of this growth may be attributable to growing population and interest in baseball; however, during this time MLB was drastically expanding its broadcast capability to extend beyond local markets where fans are served by one or two teams.

In 2000, MLB created MLB Advanced Media (MLBAM) to manage online activities that included ticket sales and broadcasting. In 2003, its MLB.tv began selling stand-alone broadcast packages that allowed fans to watch MLB games over the internet and thus increase baseball consumption. MLBAM has since partnered with other sports leagues and media companies to manage online operations and video streaming for non-baseball programming. Knowing MLBAM's contribution is difficult, because it is a privately-held company; however, in 2017, MLBAM sold a 75-percent share of its streaming subsidiary BAMTech to Disney for $2.58 billion, indicating its strong revenue contribution (Barnes & Koblin, 2017).

The MLBAM venture increased league revenue by expanding the distribution of its same labor product more widely to garner uncaptured revenue.[12] In addition, the revenue is shared equally across teams; therefore, teams cannot increase revenue through this channel by improving the individual team product. Though the returns to performance remain positive and increasing, the marginal contribution of labor to MLBAM revenues is small and thus a decline in labor's share of income is expected. The gains do not result from the increased marginal revenue product of players, and therefore this revenue should not be expected to flow to players in wages. This explanation is also consistent with the estimates of the returns to performance in Figure 2 that show lower returns after 2003, when MLBAM became a successful financial venture.

This explanation is consistent with the superstar firm hypothesis, developed by Autor et al. (2017), that technological changes allow for the concentration of sales among firms with high productivity. The

[12] Salaga, Otsfield, and Winfree (2014) notes the importance of MLBAM for generating revenue for MLB teams and its impact on revenue sharing.

authors find that as industries became more concentrated in the US economy, labor's share declined. Further analysis indicates that observed industry concentration was likely a response to increased productivity, and that a declining labor share is expected due to decreased value-added from labor from these more-profitable firms. In a similar fashion, MLB's monopsony power has been further enhanced by new non-player inputs, and thus capital flows to the more-productive technology-enhanced sector where the returns are higher than the player-labor sector.

4. Discussion and Conclusion

The falling share of revenue going to baseball players has generated contentious and competing explanations from players and owners, but this phenomenon has received no objective study. This analysis examines MLB's recent economic history and finds three main contributors to the declining labor share in baseball: falling returns to player performance, union bargaining strength, and the emergence of a new revenue stream that does not rely heavily on players as inputs. Competition for labor from substitute labor inputs (from foreign workers and the reorganization of existing workers) and physical capital (stadiums) have not played a large role in the decline of players' share of income.

Player wages are not growing as fast has league revenue because player marginal revenue products have been increasing at lower rate than revenue. Observations of the returns to success over time indicate that player performance became less valuable during this time-period, which should lower the returns flowing to players. The falling revenue share of MLB players is consistent with changes in labor's share in the hospitality and leisure industry, which experienced a decrease from 65.7 percent to 62.1 percent between 1987 and 2011 (Elsby, Hobijn, and Şahin 2013).

The share of income going to players differed across CBAs, which indicates an important role for collective bargaining between the players' union and owners in determining player compensation and offers a partial explanation for players' declining marginal revenue products. Revenue sharing creates perverse incentives by taxing teams that are successful and transferring the proceeds to losing teams. As revenue sharing increases, teams value player performance less, and labor's share fluctuated in accord with revenue-

sharing arrangements of CBAs. Recent CBAs have included more revenue sharing, which contributed the declining returns to performance and signals a weakening of union bargaining power.

In 2000, MLB developed an important new income stream from its online media venture MLBAM. This endeavor has provided owners with revenue that is equally shared across teams and does not enhance players' marginal revenue products. Player wages should not be expected to grow with this revenue stream; therefore, the decline in players' share of income is expected as league revenue from this source increases.

Overall, the declining share of revenue going to players appears to be a product of real changes to the baseball industry, which includes changes in labor relations as well as changes in the way teams derive income. Going forward, owners and players should be cognizant of these factors. In addition, this analysis of the baseball industry may provide insight into the similar declining labor share in the US economy.

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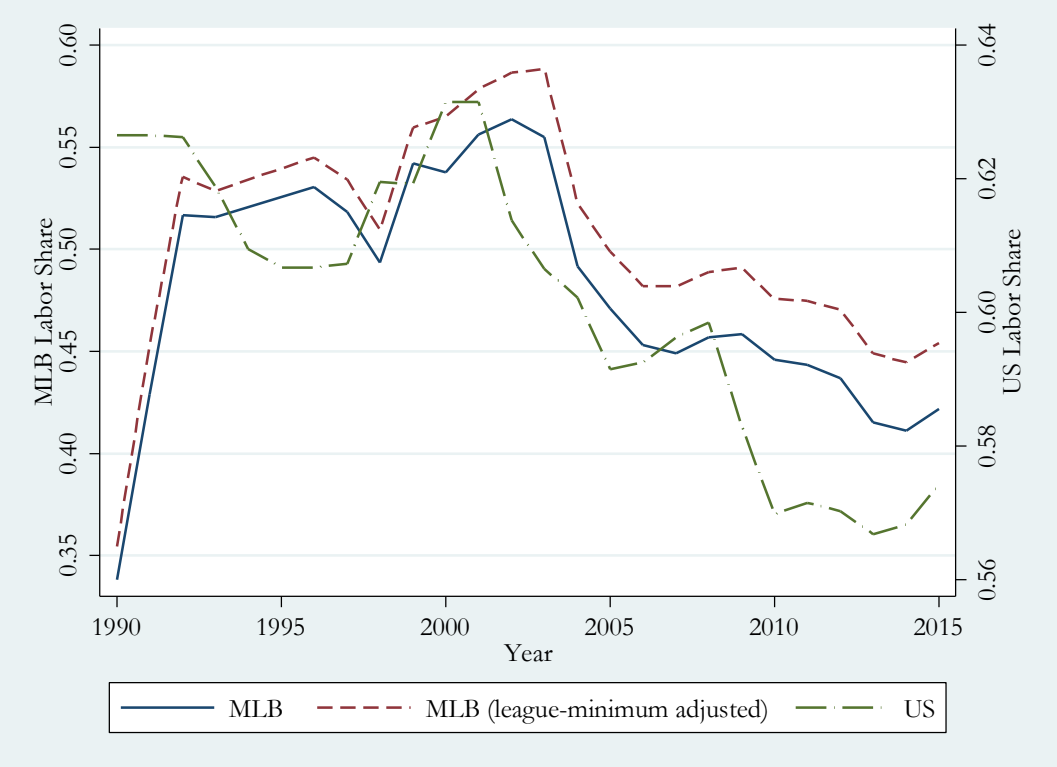

Figure 1. MLB and US Labor Share of Income (1990-2015)

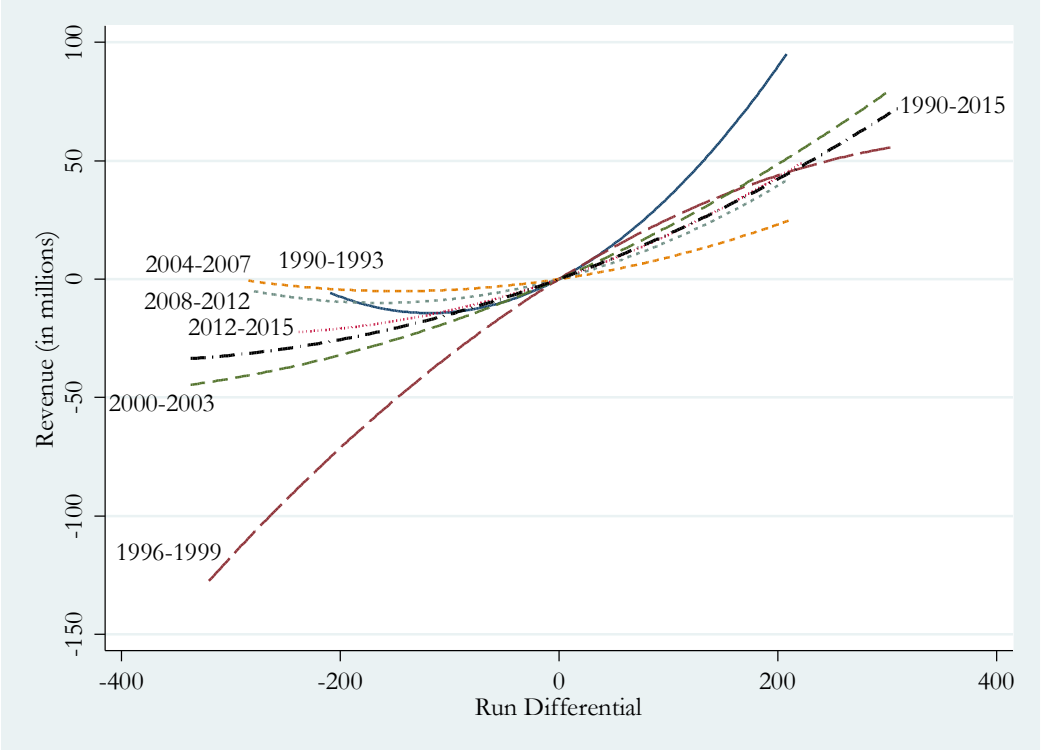

Figure 2. Returns to Success in MLB by Era

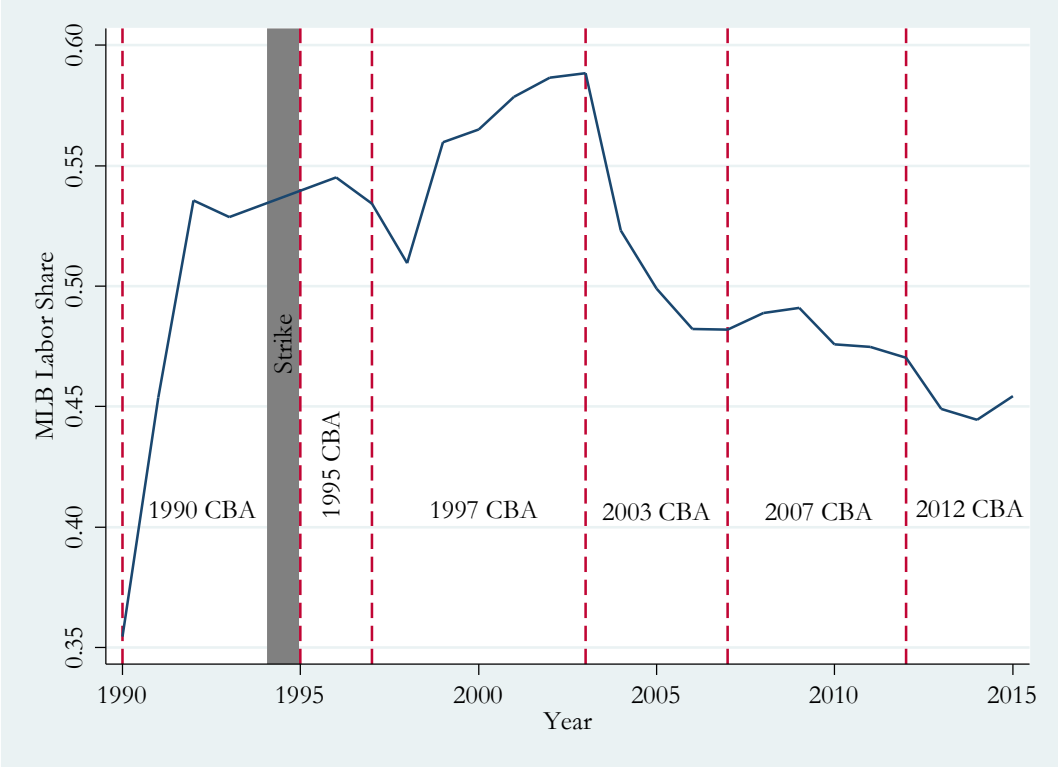

Figure 3. MLB Labor Share by Collective Bargaining Agreement (1990-2015)

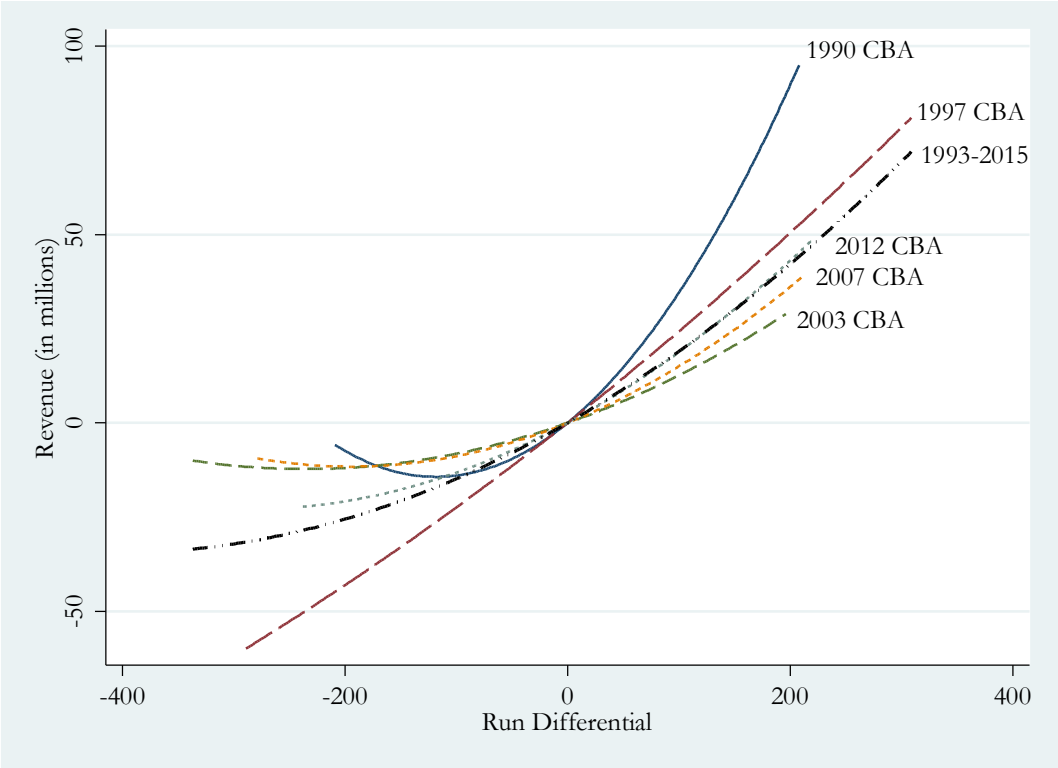

Figure 4. Returns to Success in MLB by Collective Bargaining Agreement

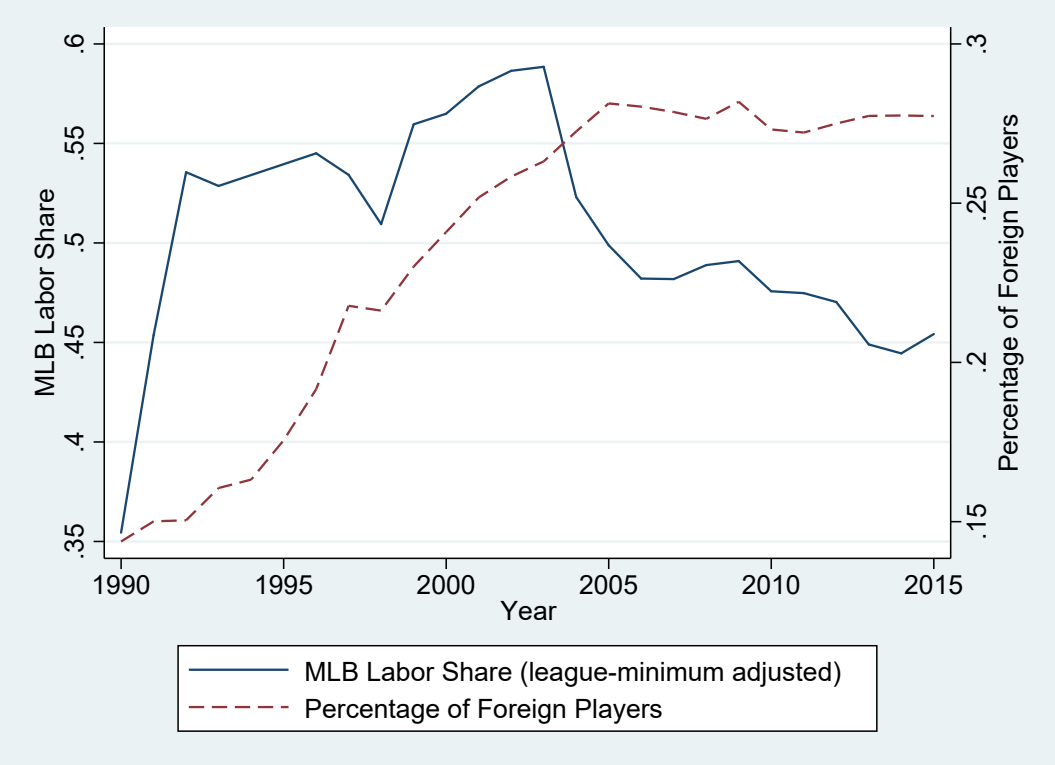

Figure 5. Percentage of Foreign Players and MLB Labor Share (1990-2015)

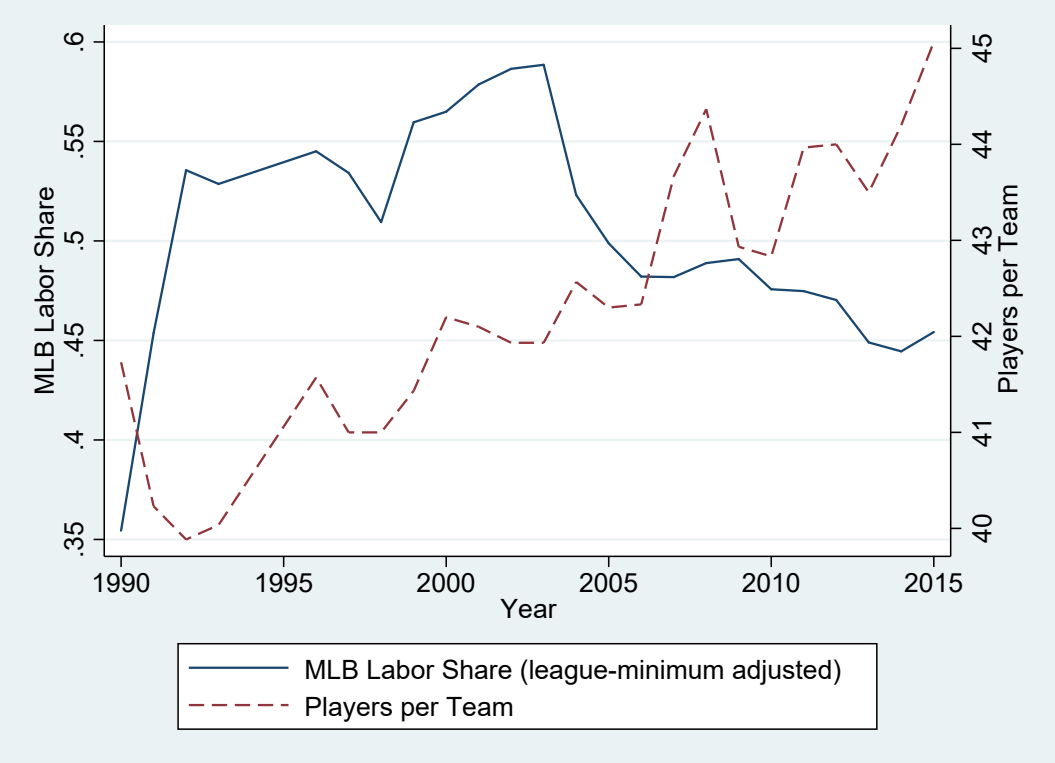

Figure 6. Players per Team and MLB Labor Share (1990-2015)

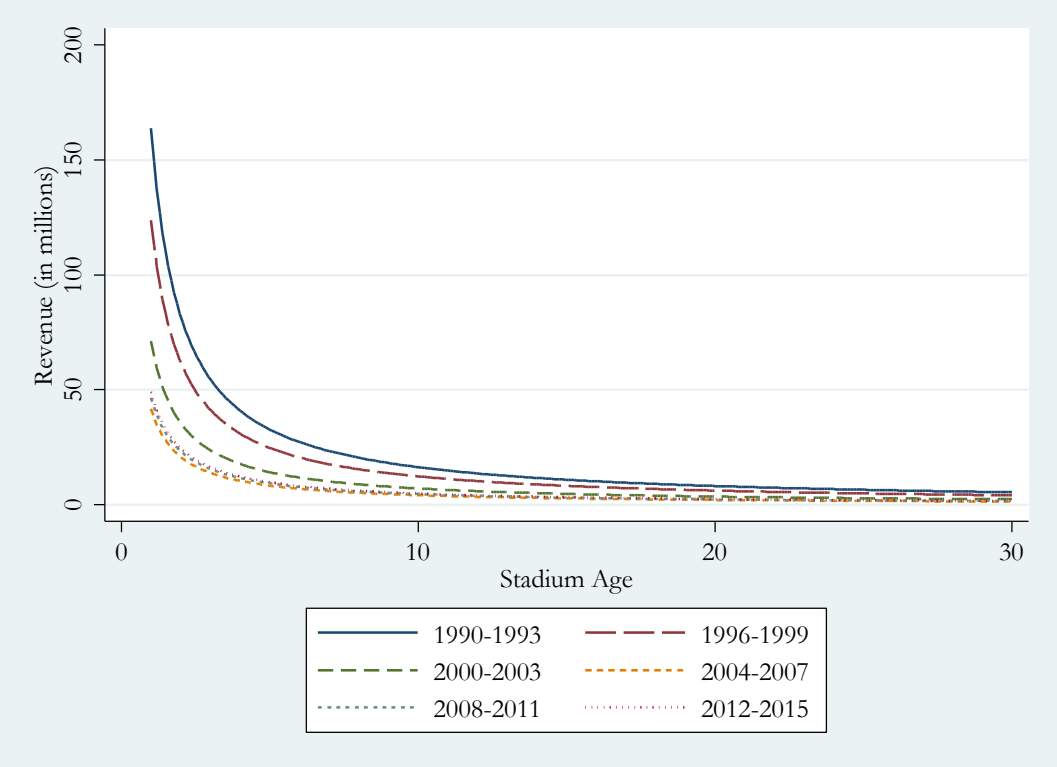

Figure 7. Returns of MLB Stadiums by Age (1990-2015)

Table 1. Summary Statistics

	Mean	Standard Deviation	Minimum	Maximum
Revenue	286.86	83.37	28.18	626.22
Score Differential	0	103.78	-337	309
Population	5,602,568	4,548,027	1,434,279	20,200,000
Stadium Age	26.07	24.82	1	104
New York Yankees	0.034	0.182	0	1

Table 2. Returns to Performance in MLB by Era

	1990-1993	1996-1999	2000-2003	2004-2007	2008-2011	2012-2015	1990-2015	1990-2015
Score Differential	0.10165	0.15128	0.12699	0.05303	0.07261	0.08493	0.10906	0.1604
	[1.83]	[3.47]**	[5.48]**	[2.64]**	[3.62]**	[3.63]**	[8.77]**	[4.70]**
Score Differential^2	0.00123	-0.00022	0.0002	0.00025	0.00038	0.00031	0.00021	0.0011
	[2.04]*	[0.92]	[1.81]	[1.80]	[2.67]**	[1.60]	[2.72]**	[3.22]**
Score Differential (t-1)	0.15556	0.14533	0.08273	0.01743	0.05407	0.08135	0.06474	0.06531
	[2.53]*	[3.25]**	[3.96]**	[1.01]	[2.78]**	[3.23]**	[5.16]**	[5.14]**
Population	0.00001	0.00000357	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
	[4.28]**	[1.45]	[2.94]**	[5.28]**	[4.53]**	[2.63]**	[3.41]**	[3.43]**
Stadium Age	164.05063	123.88745	71.10589	41.61923	46.40558	48.90423	80.44812	81.26343
	[4.89]**	[4.25]**	[7.03]**	[3.40]**	[4.62]**	[1.50]	[11.60]**	[11.70]**
New York Yankees	97.2033	210.03599	136.50399	121.61733	193.04402	187.12248	166.66451	168.91826
	[1.50]	[3.48]**	[2.60]**	[3.44]**	[6.04]**	[3.62]**	[3.67]**	[3.74]**
1996-1999 Cohort								-15.7627
								[2.09]*
2000-2003 Cohort								-29.91275
								[3.86]**
2004-2007 Cohort								-32.16109
								[4.02]**
2008-2011 Cohort								-33.14138
								[4.11]**
2012-2015 Cohort								-34.05861
								[4.12]**
1996-1999 Cohort * Score Differential								-0.00637
								[0.15]
1996-1999 Cohort * Score Differential^2								-0.0012
								[3.23]**
2000-2003 Cohort * Score Differential								-0.05575
								[1.30]
2000-2003 Cohort * Score Differential^2								-0.00094
								[2.52]*
2004-2007 Cohort * Score Differential								-0.10815
								[2.44]*
2004-2007 Cohort * Score Differential^2								-0.00089
								[2.22]*
2008-2011 Cohort * Score Differential								-0.09359
								[2.10]*
2008-2011 Cohort * Score Differential^2								-0.00093
								[2.34]*
2012-2015 Cohort * Score Differential								-0.06804
								[1.56]
2012-2015 Cohort * Score Differential^2								-0.00085
								[2.11]*
Year Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
R^2	0.57	0.6	0.58	0.66	0.79	0.56	0.57	0.57
Observations	104	114	120	120	120	120	698	698

Absolute value of z-statistics in brackets. * $p<0.05$; ** $p<0.01$. Constant and year effects not reported.

Table 3. Returns to Success in MLB by Collective Bargaining Agreement

	1990 CBA	1997 CBA	2003 CBA	2007 CBA	2012 CBA	All Years	All Years
Score Differential	0.09524	0.13735	0.07887	0.06914	0.08457	0.10906	0.16923
	[1.67]	[5.22]**	[3.85]**	[4.15]**	[3.65]**	[8.77]**	[4.99]**
Score Differential^2	0.00103	0.00009	0.00022	0.00031	0.00028	0.00021	0.00129
	[1.68]	[0.67]	[1.96]*	[2.57]*	[1.49]	[2.72]**	[3.75]**
Score Differential (t-1)	0.15868	0.10374	0.02711	0.05389	0.08095	0.06474	0.06505
	[2.51]*	[4.10]**	[1.44]	[3.22]**	[3.25]**	[5.16]**	[5.18]**
Population	0.00001	4.47E-06	0.00001	0.00001	0.00001	0.00001	0.00001
	[4.22]**	[1.77]	[4.80]**	[4.41]**	[2.71]**	[3.41]**	[3.44]**
Stadium Age	162.34737	95.6785	48.0735	51.79666	43.14256	80.44812	81.02359
	[4.75]**	[7.65]**	[4.72]**	[6.16]**	[1.40]	[11.60]**	[11.66]**
New York Yankees	101.39095	169.5283	124.69451	175.9045	186.681	166.66451	166.62518
	[1.58]	[2.69]**	[3.24]**	[5.31]**	[3.66]**	[3.67]**	[3.63]**
1995 CBA						-5.91094	4.89047
						[0.68]	[0.51]
1997 CBA						-30.23736	-18.17798
						[3.03]**	[1.75]
2003 CBA						-30.00365	-20.0877
						[2.98]**	[1.94]
2007 CBA						-29.47106	-19.06442
						[2.91]**	[1.82]
2012 CBA						-27.59107	-18.41408
						[2.70]**	[1.74]
1995 CBA * Score Differenial							0.01342
							[0.20]
1995 CBA * Score Differenial^2							-0.00116
							[2.51]*
1997 CBA * Score Differenial							-0.03839
							[0.96]
1997 CBA * Score Differenial^2							-0.0012
							[3.31]**
2003 CBA * Score Differenial							-0.0846
							[1.92]
2003 CBA * Score Differenial^2							-0.00109
							[2.86]**
2007 CBA * Score Differenial							-0.11361
							[2.69]**
2007 CBA * Score Differenial^2							-0.00113
							[2.91]**
2012 CBA * Score Differenial							-0.07814
							[1.80]
2012 CBA * Score Differenial^2							-0.001
							[2.47]*
Year Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.56	0.55	0.64	0.77	0.57	0.57	0.58
Observations	104	176	120	150	120	698	698

Absolute value of z-statistics in brackets. * p<0.05; ** p<0.01. Constant and year effects not reported.