Estimating the Ashenfelter Dip for Relocating Sports Franchises 1990-2023*

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Abstract

Unsurprisingly, the relocation of professional sports franchises is often justified by claims of financial underperformance in current markets. However, given the revenue sharing structure of sports leagues – as well as other measures designed to improve competitive balance – and the generally unwavering support of fans, it seems unintuitive that these franchises who relocate were truly "worse" financially than their competitors in the long run. Indeed, my research – utilizing both difference-in-difference and synthetic controls approaches – finds that while the relocation decision imposes significant costs both financially and in terms of fan interest (a kind of "Ashenfelter Dip" for franchises who relocate), the benefits to relocation long term are minimal. Franchises who simply rebuild stadia in their local communities

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can be seen to have significantly more positive outcomes, showing that relocation generates strongly negative effects. Any potential new market and new stadia effects for relocating franchises are generally washed out by the costs of relocation. These results highlight the need for leagues and policymakers to carefully evaluate relocation decisions, with a particular focus on community engagement.

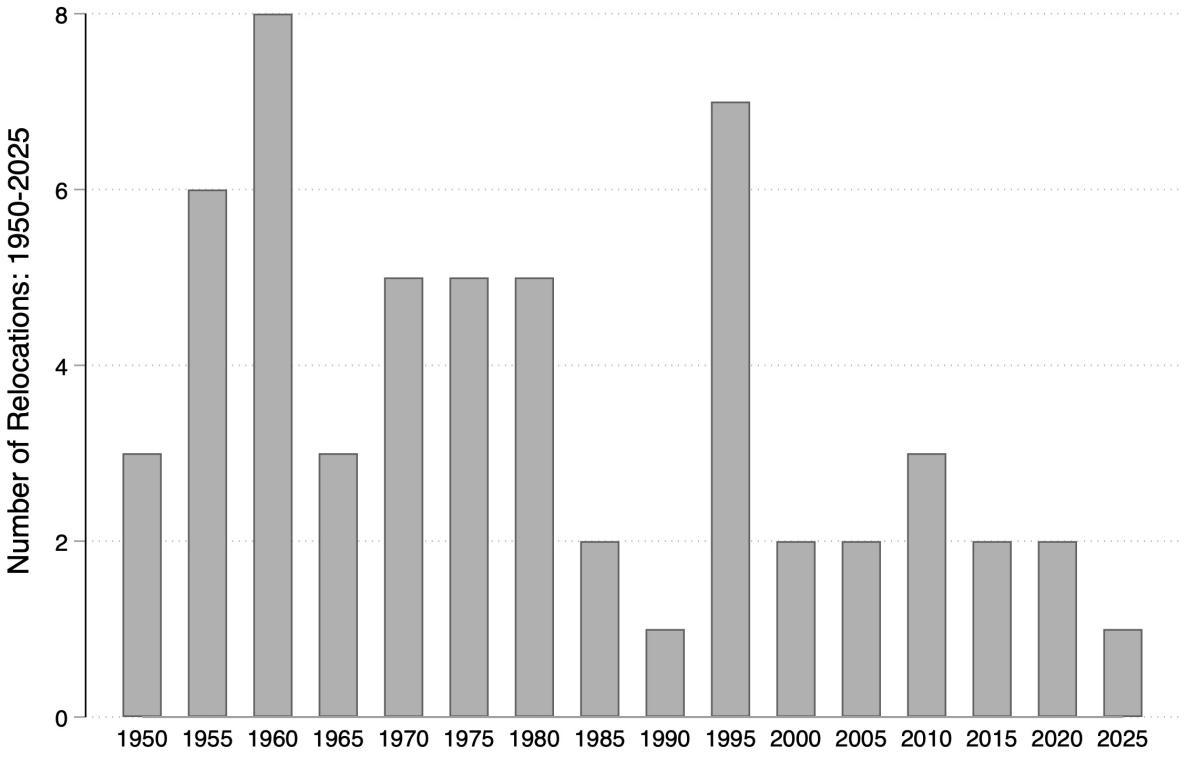
Introduction

The Ashenfelter Dip, first identified in 1974 by Orley Ashenfelter to describe the decrease in earnings directly preceding entering a training program,[30] has since become a ubiquitous marker in the analysis of treatment effects. Rather than a steady increase as a result of a training program, Ashenfelter identified the drop in earnings (likely signifying being laid off elsewhere or exhibiting low earnings potential) that creates a kind of selection bias into the training.[2] While a selection by a sports franchise into treatment (be it a new city or a new stadium) seems like it could intuitively fit this model, the underlying financial structure of professional sports leagues says otherwise. Sports leagues form an extremely unique market structure. While "competitors" in both an obvious and an economic sense, the ultimate success of the league depends on a type of cooperation: the quality of games which two franchises are able to produce. Additionally, while these leagues represent the epitome of competition on the field, the market structure of these leagues is often anything but, with leagues being granted what is essentially monopoly status[1]. Furthermore, these leagues together form one of the most lucrative markets in the world, with the combination of ticket sales and television revenue (not to mention the increasingly popular gambling markets) generating billions of dollars per year. Hence, sports franchises and leagues have a variety of potential routes but ultimately the same goal: to increase and maximize market share.

While leagues have primarily sought financial success so through a wide variety of en-

[1]Quirk and Fort (1999)[31] and others highlight the negative market effects resulting from this monopoly power.

Figure 1: Relocations Across the Four Major Leagues, 1950-2025



Source: https://www.azcentral.com/story/sports/nhl/coyotes/2024/04/11/arizona-coyotes-list-nhl-pro-sports-teams-relocation-history/73293689007/

dorsement deals and expansion franchises, the franchises themselves also have means of profit generation in the competitive market, primarily, what market do they choose to belong to? While no one denies that the decision of franchises to relocate comes with costs, the question of who bears the incidence, as well as the total detriment to the franchise and league, has yet to be comprehensively analyzed.

As the country expanded westward in the middle of the 20th century, so too did sports leagues. Franchises such as the Philadelphia Warriors, Brooklyn Dodgers, and Minneapolis Lakers all found new homes in the west, while expansion franchises such as the Phoenix Suns, Seattle Seahawks, and California Angels cemented these leagues as nationwide entities. While these decisions were made undoubtedly to capture untapped market potential, the space in which to expand was finite. Nonetheless, an urge of franchises to relocate persists

even to today. While movement within leagues has certainly cooled off, recent moves, like the relocations of the Oakland Athletics and Arizona Coyotes to Las Vegas and Salt Lake City[2], respectively, have reignited questions around what cities are (not) doing to successfully foster franchises. Alternatively, other teams (such as the Los Angeles Clippers, Texas Rangers, Buffalo Bills, to name a few) have pledged their dedication to their local communities, reinvesting in their cities with billion dollar stadia and infrastructure. While these franchises are undoubtedly taking vastly different strategies, the investigation into why – given the context of the franchises – these moves happen has generally not been analyzed. Hence, this paper seeks to investigate the effectiveness of these two routes in terms of creating profits and wins.

While much of the 2000s and 2010s featured little changes amongst sports leagues as seen in Figure 1, a number of high profile investments, from relocation to stadium infrastructure, have returned salience to the topic of finance and sports. Notably, the high-profile and controversial moves of the Oakland Raiders and Athletics towards Las Vegas (the Athletics will spend two seasons playing in Sacramento while their stadium in Las Vegas is being built) have raised cries of corruption from dedicated fans. Rather than maximizing franchise utility, these individuals claim, ownership instead has chosen to put their own interests ahead of the franchise, leading to a downward spiral of the franchise culminating with a "forced" relocation.[26] On the other side, ownership consistently raised concerns about the viability of continuing to invest in the community. Pressed on his inability to secure a deal for a new stadium in Oakland, owner John Fisher told impassioned fans that "it's been a lot worse for me than it's been for you."[9] For owners in a truly inviable market, the process of escaping contracts and finding suitable new venues in a new city can be an arduous process. This study therefore analyzes two distinct periods: the period after the physical relocation/reinvestment itself, as well as a theoretical "Post-Decision" period. As a potential Ashenfelter Dip would

[2]Officially, the Arizona Coyotes franchise ceased operations at the end of the 2023 season, and the Utah Hockey Club was created as an expansion franchise. However, the Utah Hockey Club acquired the players, coaching staff, and draft picks of the Coyotes, leading it to be widely considered as a lateral relocation.

suggest, the choice to relocate is subject to a kind of selection bias, which I argue is induced by the decision to relocate/reinvest, rather than the relocation/reinvestment itself. I use the term "decision" lightly because while it is supported empirically, it is not necessarily public knowledge at the time the decision is made[3].

Relevant Literature

The foundational model of the economic components of sports leagues is given by El-Hodiri and Quirk (1970).[15] Although their theoretical model does not include player-for-player transactions (trades) between franchises, they nonetheless conclude that franchises in locations with equal revenue potential will tend towards equal talent levels. Given that much data on franchises' financials was not made publicly available until the 1990s, true empirical analysis on these topics has been somewhat limited. Prior research has primarily examined long-term trends in revenue, salary, and profits, with little being done in examination of of specific franchise decisions. Mildner and Strathman (1999)[25] find that the main factors prompting teams to move (specifically in the MLB and NBA) appear to be Metropolitan Statistical Area (MSA) population growth, attendance, winning percentage, and other league factors (namely expansion of the league), but do not analyze the implications of relocation on franchises. Salaga et al. (2014)[35] propose a theoretical model in which teams in leagues with a fixed amount of talent (such as is true for the NBA, MLB, NFL, and NHL, given their relative monopolies over the sports) are incentivized to limit talent investment while increasing stadium investment. While others have noted positive effects of stadia investment on revenue, generally little has been done analyzing the effects of stadium investment on player investment (Zimbalist 2003[40] posits a synergistic relationship between the two but does not engage in rigorous econometric analysis). Additionally, Bradbury (2018)[5] utilizes ordinary least squares and finds that revenue is positively associated with on-field success in

[3]While much is often made of "snap" relocations, such as the Colts "move in the dead of night" from Baltimore to Indianapolis in 1983, most relocations occur over a period of many years. For instance, the then-Oakland Raiders were already entering initial discussions to relocate to Las Vegas by 2016.[19]

the MLB, NBA, and NHL, but not in the NFL.

In terms of sports and their economic salience, the literature is generally in agreement that sports investments have little spillover effects into the development of local economies. Siegfried and Zimbalist (2000)[36] summarize these findings. Baade (1996)[3] uses an event study to evaluate the extent to which new stadia investment altered the city's real per capita income growth relative to other cities where this investment did not occur. In addition to the minimal positive impact on local development, Baade also argues that owners and players benefit most from relocation, particularly relative to fans. Coates and Humphreys (1999)[14] clarify this event study model, additionally accounting for relocating franchises, and find potentially negative effects of sports investment on economic growth. While the net effect of franchise investment on economic development may be minimal, as Noll and Zimbalist (2001)[28] explain, at least a portion of the local economy (i.e. contractors and construction unions) nonetheless stand to lose or gain based on the decision of where to build a new stadium. Additionally, given that almost all new stadia are at least partially funded via public subsidies, local community members may prefer an overall better product of sports team, even at the expense of large-scale public subsidies. In line with standard economic theory, these monopoly sports leagues impose welfare costs through standard monopolistic controls and subsidies (i.e. Siegfried and Zimbalist 2000,[36] Noll 2003,[27] Noll 2003,[29] Kahn 2004[18]). However, Noll and Zimbalist (2001)[28] also advocate that local community members may simply prefer an overall better product of sports team (both player and stadia quality, which are impacted by franchise investment strategies), even at a personal expense.

While the impacts of relocation/reinvestment have been found to be minimal in regards to local economic development, analysis of sports franchises as they pertain to public policy still remains important, notably for their sociological and psychological salience. Card and Dahl (1994)[11] utilize a Poisson specification to estimate the effects of sports game outcomes on rates of domestic violence, while Mastromartino and Zhang (2018), Mastromartino and Zhang (2020),[24] Bang and O'Connor (2022),[4] and others offer compelling sociological evi-

dence for the importance of sports fandom as a community building mechanism. Hence, any potential Ashenfelter Dip in franchise performance is likely to have a variety of potentially unforeseen negative effects on the local community.

As for the effects of investments on franchises themselves, Tang and Zhang (2024)[38] use a "quantile-on-quantile" approach and find that in the context of soccer, general infrastructure investments (including stadia and training facilities) result in an increase in team revenue. In a specifically American context, Brown et al. (2004)[7] find a positive relationship between the building of a new stadium and team revenue for franchises building a stadium between 1995 and 1999, finding that revenue generation in the NFL primarily results from "stadium economics" as opposed to market characteristics. While Brown et al. use a Wilcoxon signed rank test, I hope that my difference in difference and synthetic control models will offer greater robustness, in addition to analysis over a larger sample. Additionally, Li et al. (2024)[22] use GIS spatial analysis to find that in the context of Chinese football (soccer) leagues, teams have incentive to move and cluster themselves in more populated, traditionally economically viable locations, seen in China by movement of teams eastward. While American sports leagues have at times exerted controlling influences over franchises (Lehn and Sykuta (1997)[21] detail the lawsuit between the Oakland Raiders and the NFL over the Raiders' prospective move to Los Angeles in 1984), analysis of financial viability of markets to host franchises has generally been lacking in the American context. Rascher and Rascher (2004)[33] describe the decision of where to relocate as highly idiosyncratic, but this study seeks to call into question the financial validity of such moves for the purposes of informing those outside of ownership, such as leagues and fans.

Finally, and most closely related to my analysis of new stadia investors, Bradbury (2024)[6] utilizes an event study approach similar to mine to estimate the novelty effect of new stadia. However, my analysis differs from Bradbury's (and others) in some notable ways. First, an analysis of new stadia effects like Bradbury's is intended to contextualize, but not dominate, the focus of my paper. Secondly, I do not simply follow the Difference in Difference specifi-

cation clarified by Callaway and Sant'Anna (2021)[10] which Bradbury exploits for additional robustness of findings. The main reason for this is that the first assumption of Callaway and Sant'Anna, the irreversibility of treatment, does not hold in my analysis. As I explain in the Data section, the time frame between multiple relocations and reinvestments is great enough to eliminate compounding effects. Bradbury himself finds that the novelty effects of stadia are seemingly finished within 10 seasons of stadia construction. Hence, I will have to continue with the typical two way fixed effects specification. As we will see, the two way fixed effects provide similar conclusions to a synthetic controls specification, leading me to believe that an assumption of homogeneous treatment effects can hold.

Data

This study examines impacts of relocation in the four major American professional sports leagues from 1990 to 2023[4]. Relevant team financial data was found through an aggregation of Forbes Magazines' annual franchise valuations, Financial World's valuations in the 1990s, and Commissioner's Reports on the status of their respective leagues. Population and income data were pulled from the American and Canadian censuses (with linear interpolation for years in between those surveyed). Finally, team record data was accessed through the leagues themselves. The 2004-05 season was omitted entirely for the NHL on account of the lockout which occurred that season, and attendance data for all leagues was omitted for the 2020 season due to the Covid-19 pandemic. Additionally, revenue data was missing for NHL franchises in 1996 and 1998 from these databases. This left us with 3,971 individual franchise-year observations.

One important detail to consider is what precisely defines a "relocation." While no consensus has been reached in previous literature, the definition generally seems to hinge on two criteria: sufficient distance and sufficient re-branding of the franchise. Hence, although

[4]Bradbury (2024) limits his analysis to 2019 to mitigate effects of the Covid-19 pandemic. I examine available points through the pandemic (attendance data is missing for the 2020 seasons), but find no significantly heterogeneous effects of the pandemic on franchises.

the New Jersey Nets moved only a short distance to Brooklyn in 2012, the re-branding of the franchise as a distinctly Brooklyn team has led it to be considered as a true relocation of the franchise. On the other hand, movements of franchises such as the Golden State Warriors from Oakland to San Francisco will not be considered, as the Warriors retained all previous logos and imagery. Finally, although the San Francisco 49ers moved over 50 miles from San Francisco to Santa Clara, the lack of re-branding has led many to discount it as a "relocation." I will generally consider them to not be a relocating franchise, but run a robustness check with them as one, and find quite similar results. Additionally, while the leagues themselves may adjust the historical records of franchises to allow for continuation in cities[5], given that I am examining the impact on the franchises themselves, these continuations will not be made.

Table 1: Relocating Franchises and their Associated New Stadia Investments

Franchise	**League**	**City Moving To**	**Year of Relocation**	**New Stadium Completed**
Minnesota North Stars	NHL	Dallas	1993	2001
Los Angeles Raiders	NFL	Oakland	1995	–
Los Angeles Rams	NFL	St. Louis	1995	1995
Quebec Nordiques	NHL	Denver	1995	1999
Cleveland Browns	NFL	Baltimore	1996	1998
Winnipeg Jets	NHL	Phoenix	1996	2003
Houston Oilers	NFL	Nashville	1997	1999
Hartford Whalers	NHL	Raleigh	1997	1999
Vancouver Grizzlies	NBA	Memphis	2001	2004
Charlotte Hornets	NBA	New Orleans	2002	–
Montreal Expos	MLB	Washington D.C.	2005	2008
Seattle Supersonics	NBA	Oklahoma City	2008	–
Atlanta Thrashers	NHL	Winnipeg	2011	–
New Jersey Nets	NBA	Brooklyn	2012	2012
San Francisco 49ers	*NFL*	*Santa Clara*	*2014*	*2014*
St. Louis Rams	NFL	Los Angeles	2016	2020
San Diego Chargers	NFL	Los Angeles	2017	2020
Oakland Raiders	NFL	Las Vegas	2020	2020

A final consideration of importance arose from "multiple movers," or alternatively, "multiple builders": franchises who relocated or reinvested twice during the analysis period. To mitigate the effects of a relocation or reinvestment being misplaced chronologically in the

[5]Notably, the current day Charlotte Hornets claim the history of the former Charlotte Hornets, who are now the New Orleans Pelicans, and the current day Cleveland Browns lay claim to all past Browns history, despite the franchise's relocation to Baltimore in 1996.

events study, I begin the pre-period for the second relocation/reinvestment at the midpoint between the two event years and consider the second move/relocation accordingly. Included in the appendix is a table showing the years of these multiple events, showing that these multiple events happened infrequently enough such that any effects are being felt in the tails of the event study. Additionally, expansion franchises are not included as stadia builders for stadia built less than 5 years after the formation of the franchise to avoid any confounding effects of expansion on our outcome variables of interest[6].

Empirical Methods and Design

As previously explained, I define a two way fixed effects model for both relocating and reinvesting franchises, described in Equations 1.1 and 1.2 below. For the rest of the paper I use the term "relocation" to describe the movement of teams as explained above. "Reinvestment" will refer to franchises who build a stadium without "relocating."

$$F_{it} = \alpha + \lambda_{kt} + \mu_i + X_{it}\beta + move_i * \sum_{y=-5, y\neq -1}^{y=10} \beta_y * \mathbf{1}(t - t^*_{ik} = y) + \epsilon_{it} \tag{1.1}$$

$$F_{it} = \alpha + \lambda_{kt} + \mu_i + X_{it}\beta + newstad_i * \sum_{y=-5, y\neq -1}^{y=10} \beta_y * \mathbf{1}(t - t^*_{i} = y) + \epsilon_{it} \tag{1.2}$$

In these equations, F_{it} is one of our desired outcomes: revenue, salary, revenue to expense ratio, average home attendance (all taken as the natural log), or winning percentage (measured in standard deviations from the league mean)[7] for franchise i (all of which will be

[6]Rascher (2007) offers insights into the economic impact of league expansion, but that is not a question this paper seeks to address.

[7]Given the interleague variation in winning percentages – a 12-4 season (0.75 winning percentage) in the NFL was seen as a successful but unremarkable season in the league's 16-game regular season format, while a mark of 120 wins (a roughly equal winning percentage in the 162 game season) has never been reached in the MLB, in addition to the NHL's points system in which teams earn 3 points for a win, 1 point for a loss in overtime/penalty shootout, and 0 points for a regulation loss – means that we will instead analyze the standard deviation from the mean wining percentage (or in the NHL's case, points percentage) to more accurately pool data between leagues.

taken as the natural log), in year t, where year t_i^* is the year of relocation or reinvestment for franchise i. By focusing on these outcome variables individually, we can hopefully examine not only whether profits are increased as a result of these moves/investments, but where that change is coming from. λ_{kt} represents a set of year fixed effects for each league k year t, 1990-2023, while μ_i represents a set of franchise fixed effects. I allow the year fixed effect to vary by league to capture interleague heterogeneity, but I also include relevant empirical results without this variation in the appendix. X_{it} represents a set of controls for franchise i in year t, including population of their home MSA, the MSA's income per capita (as well as a term multiplying the population by income per capita), an indicator for whether the franchise is located in Canada, and an indicator for whether the franchise is in a MSA which hosts another franchise in the same league to account for differential market characteristics between teams. The variable $move_i$ ($newstad_i$) equals 1 if franchise i relocated (reinvested) to a different MSA between 1990 and 2023, and 0 otherwise. Indicator variables $\mathbf{1}(t - t_i^* = y)$ measure the time relative to the relocation (reinvestment) year, t_i^*, and are 0 in all periods for nonrelocating (nonreinvesting) franchises. The scope of this event study will be from five years prior to the relocation (reinvestment) to 10 years after the relocation (reinvestment). Media rights contracts (one of the key sources of revenue for franchises) typically last around 10 years[34398]. Any data from before five years prior to the event or more than 10 years after the event is aggregated into the boundaries of the summation. Additionally, this model treats the year before the relocation (reinvestment) as the baseline year to which all years pre and post will be compared. These equations build off of the intuition of Bruggink and Rose (1990),[8] but differ in their particular focus on the supposed financial viability of the markets which teams find themselves in.

To account for (as well as measure) a potential Ashenfelter Dip among relocating franchises, I change the bounds of the summations used in Equations 1.1 and 1.2, as seen below in Equations 1.3 and 1.4.

[8]Vrooman (2012) notes that increased levels of revenue sharing likely contribute to an increase in league profits.

$$F_{it} = \alpha + \lambda_{kt} + \mu_i + X_{it}\beta + move_i * \sum_{y=-10, y\neq -5}^{y=10} \beta_y * \mathbf{1}(t - t_i^* = y) + \epsilon_{it} \tag{1.3}$$

$$F_{it} = \alpha + \lambda_{kt} + \mu_i + X_{it}\beta + newstad_i * \sum_{y=-10, y\neq -5}^{y=10} \beta_y * \mathbf{1}(t - t_i^* = y) + \epsilon_{it} \tag{1.4}$$

Additionally, I utilize a synthetic controls method in much the same fashion as I do with the event study to highlight the extent of the Ashenfelter Dip. This method constructs a weighted combination of non-relocating (exclusively non-expansion franchises who reinvested between 1990 and 2023) franchises in the same league to approximate the counterfactual outcome of each relocating franchise in the absence of relocation. For each relocating franchise, I create a synthetic control by selecting weights that minimize the pre-relocation differences in observed co-variates and trends. Estimates were created based on a dichotomous variable indicating whether the team is located in an MSA hosting another franchise, a dichotomous variable indicating whether the team is located in Canada, the outcome variable itself, as well as the outcome variable in the five seasons before the decision to relocate. The treatment effect is then estimated as the difference between the observed outcome of the relocating franchise and its synthetic counterpart during the post-relocation period[9]. Formally, we observe $1, ..., J+1$ franchises in each league over $t = 1, ..., T$ seasons. Let the pool of relocating franchises in a particular year be noted as $R \subset \{1, ..., J+1\}$, where $R = \{j_1, j_2, ..., j_{|R|}\}$. As previously explained, let the restricted donor pool be $U = \{1, ..., J+1\} \backslash \{R \cup E \cup S\}$ for each league, where E and S are the sets of expansion and non-reinvesting franchises, respectively. To state again clearly, U represents franchises founded before 1990 who chose to reinvest between 1990 and 2023. Let F_{jt}^N represent the given outcome variable for franchise $j \in \{1, ..., J+1\}$ and time $t = \{1, ...T\}$ in the absence of relocation, and let F_{jt}^I represent the outcome variable in presence of relocation (after relocation has occurred). For all fran-

[9] Abadie (2010),[1] Chulpkin and Kóczán (2022)[12] and others offer further details on synthetic control specifications

chises $j \notin R$, $F_{jt}^N = F_{jt}$ (the observed outcome) for all values of t. For all franchises $j \in R$, $F_{jt} = F_{jt}^N$ for $t = 1, ..., T_0$, and equals F_{jt}^I for $t = T_0 + 1, ..., T$. The impact of relocation on the relocating franchise (treatment effect on the treated) is thus denoted as

$$\beta_t = F_{jt}^I - F_{jt}^N$$

for all $j \in R$ and $t = T_0 + 1, ..., T$. The synthetic control estimator for F_{jt}^N is a weighted average of the outcomes of donor pool U,

$$\hat{F}_{jt}^N = \sum_{k \in U} W_k F_{kt}$$

where all W_k are non-negative and sum to one, and represent the relative contribution of franchise k to the estimate of the counterfactual F_{jt}^N. The characteristics used for weighting are described in the table below. The goal of the synthetic control is to approximate the trajectory that would have been observed for F_{jt} and $t > T_0$ without relocation. Hence, the synthetic control estimator equals the difference between the actual outcome for franchise j and the outcome values predicted by the synthetic control:

$$\hat{\beta}_{jt} = F_{jt} - \sum_{k \in U} W_k F_{kt}$$

for each $j \in R$[10]. These $\hat{\beta}_{jt}$ values are then averaged for each value of t.

As with the event study model, I run one specification where t is bounded between -5 and 10 (accumulating in the tails). Then, I run a specification where t is bounded between -10 and 10, and T_0^*, the new end of the pre-treatment period, occurs at $t = T_0 - 5$, five years before the move actually takes place. Essentially, the intuition is that the choice of relocation is not made over night: instead, there is a period of factors[11] which results in a

[10]While running a synthetic controls model on reinvesting franchises would provide useful context and insights, the high number of franchises rebuilding a stadium between 1990 and 2023 means that there are likely to be relatively few appropriate counterfactuals.

[11]Whether these factors are induced by fans/local governance or ownership is at the center of debates

franchise's relocation, at a cost to the franchise and to the fans. Due to the availability of data, this means that franchises relocating in the 1990s will not be included, as there would not be enough seasons to create robust synthetic controls. Comparisons of synthetic controls (controlling until the actual event of relocation) between the full and restricted samples are included in the appendix, and suggest that the restricted sample should well describe the entire sample.

Results

Event Study Model

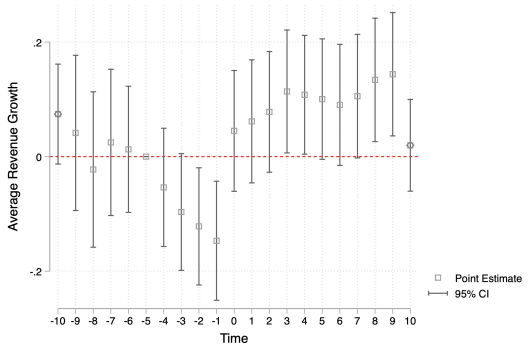
Figures 2 and 3 display the results of the event study specification on our key outcome variables with the year -5 baseline. Figures showing the results of the baseline specification in Equations 1.1 and 1.2 are presented in the appendix. One of the main surprising outcomes is that of attendance and ticket prices: one could assume that the motivations to relocate and reinvest are similar in that they both are attempting to fix some problem of an unappealing stadium/stadium experience. However, ticket prices fall for relocating franchises relative to five years prior to the move, with attendance also falling sharply. For reinvesting franchises, however, ticket prices and attendance are both seen to be weakly increasing in the period before the move to the new stadium. This confirms a kind of "anticipation effect," explained by Szymanski (2023)[37] and others, that exists for reinvesting but not relocating franchises. Given the significant amount of literature on the stubbornness and invariability of sports fans in their behaviors, it seems unlikely that this difference can be tied to any underlying differences in market characteristics [12]. Hence there seems to be a kind of demoralizing effect which the relocation situation has on fans. Additionally, given the universally positive values for relocating franchises in terms of revenue, revenue to expenditure, ticket price, and

around franchise relocation

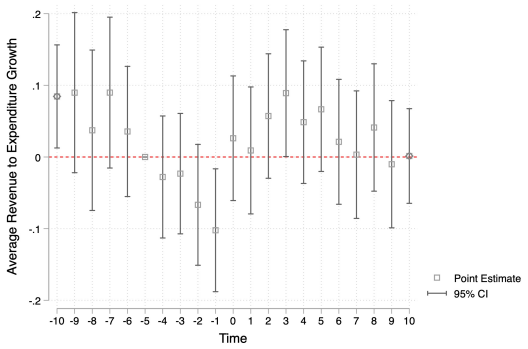
[12]Mastromartino and Zhang (2018)[23] highlight the abject irrationality of fans in their support for failing franchises

winning percentage, it is possible that the relocation decision occurs at an earlier time. I include a table similar to Table 2, just changing the baseline to year -6 in the appendix: while the coefficients change the alternative baselines do little to alter the general conclusions of the study.

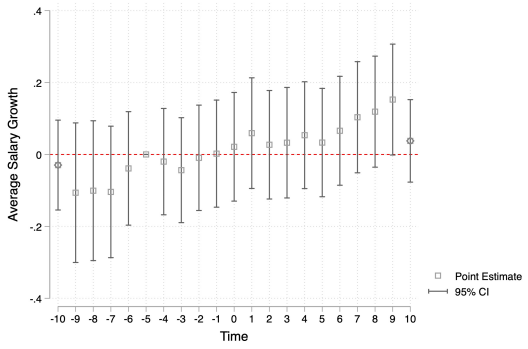
Figure 2: Event Study Results for Relocating Franchises, Year -5 Baseline



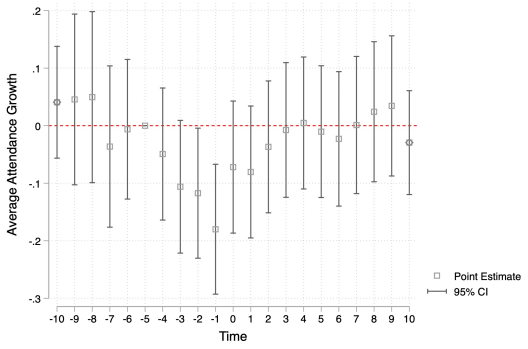
(a) Revenue



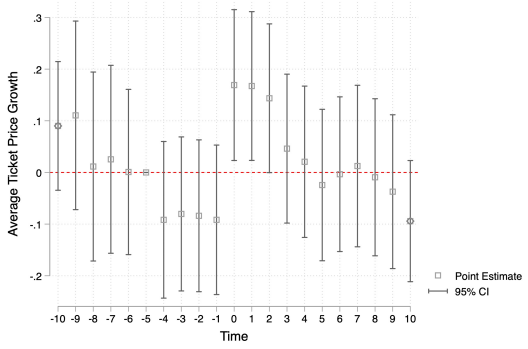
(b) Revenue to Expenditure Ratio



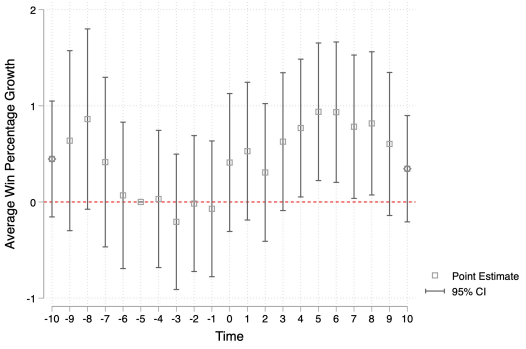
(c) Salary



(d) Attendance

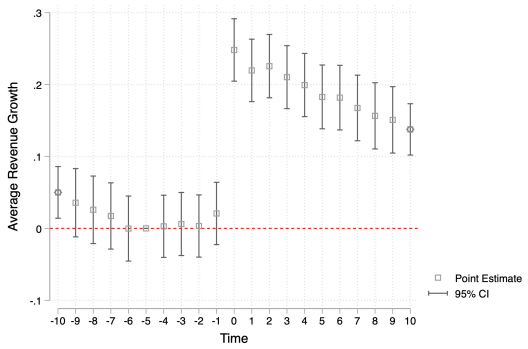


(e) Ticket Prices

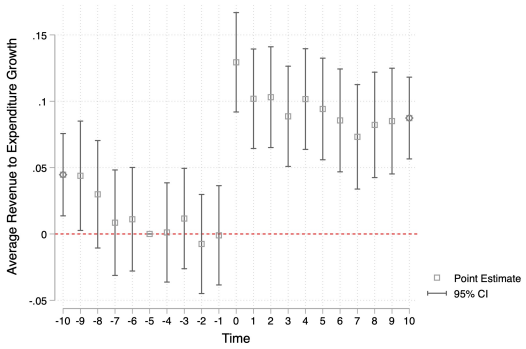


(f) Winning Percentage

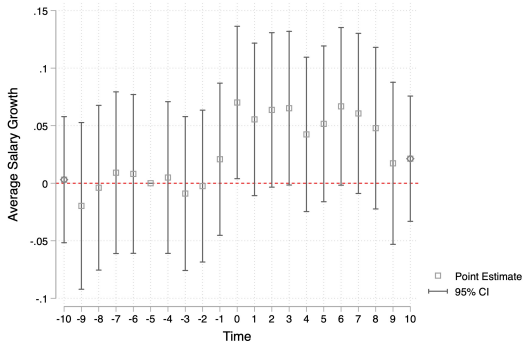
Figure 3: Event Study Results for Reinvesting Franchises, Year -5 Baseline



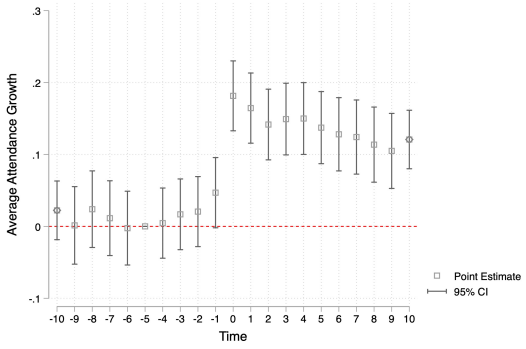
(a) Revenue



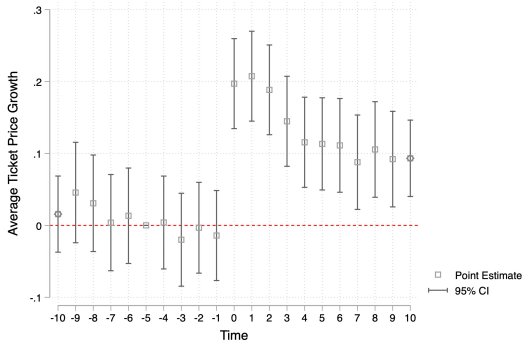
(b) Revenue to Expenditure Ratio



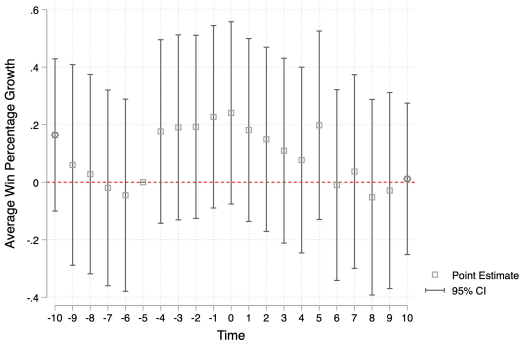
(c) Salary



(d) Attendance



(e) Ticket Prices



(f) Winning Percentage

Table 2 measures the cumulative changes in the outcome variables over three distinct time periods, relative to the year -5 baseline. The "Pre-Decision" period measures six to ten years before the reinvestment/relocation of the franchise. "Post-Decision" measures four to one years before the relocation/reinvestment (after a "decision" has theoretically been reached

Table 2: Cumulative Effects of Event Study

	Relocating			**Reinvesting**		
	Pre-Decision	*Post-Decision*	Post-Event	Pre-Decision	*Post-Decision*	Post-Event
Revenue	0.130711119	-0.419190109**	0.9999237**	0.128523777	0.032985431	2.079673758***
	(0.219378936)	(0.166878484)	(0.442374357)	(0.087944693)	(0.070911893)	(0.187752918)
Attendance	0.093445247	-0.452720841**	-0.194984052	0.056599139	0.08868922	1.515501018***
	(0.244295869)	(0.187048938)	(0.497556551)	(0.099730353)	(0.080179123)	(0.213082082)
Revenue/Expenditure	0.337176462*	-0.22007487	0.353783934	0.137980384	0.00419335	1.03213465***
	(0.180926843)	(0.137626497)	(0.36483684)	(0.075932425)	(0.061212056)	(0.162049959)
Salary	-0.3796074788	-0.07077122	0.705291301	-0.003312723	0.014317453	0.56239954**
	(0.314206218)	(0.239012269)	(0.633592158)	(0.134176903)	(0.108190021)	(0.286453955)
Winning Percentage	2.430252802	-0.263033662	7.062164594**	-0.187641552	0.78704441	0.913580523
	(1.515597966)	(1.15097697)	(3.053402944)	(0.649096011)	(0.522704749)	(1.385920879)
Ticket Price	0.238344077	-0.347699726	0.390689735	0.109192743	-0.033297945	1.456407846***
	(0.31426092)	(0.243347385)	(0.644484865)	(0.130005109)	(0.104966187)	(0.278532043)

*** p<0.01, ** p<0.05, * p<0.1

to relocate/reinvest, but the event has not occurred yet). Finally, "Post-Event" measures cumulative changes in the outcome variable from the year of relocation/reinvestment onwards. By accumulating the outcome variables in this way, we can reduce the effects of the different timing of new stadia coinciding with the relocation. In short, this table accumulates the results from Figures 2 and 3 into three time periods. Coefficients represent sums of the outcome variable over these respective time periods, and standard errors are included in parentheses. Analysis of the Ashenfelter Dip surrounding the relocation decision means our main columns of interest are Columns 2 and 4 (The Post-Decision columns). As we can see, relocating franchises see a decrease of roughly 42% relative to the baseline in the Post-Decision period, and an increase in revenue in the Post-Event period that is dwarfed by that of reinvesting franchises (0.988 vs. 2.101). Relocating franchises also see clear attendance losses, losing about 45% attendance total relative to the baseline in the Post-Decision period. Even in the Post-Event period, attendance is roughly 21% lower relative to the baseline, although this coefficient is not significant at any meaningful level. This does however highlight an important cost of relocation: the loss of a well established fan market in favor of a market generally unfamiliar with the franchise. As a result, generating fan interest becomes that much more difficult. This is also seen through the ability of franchises to raise fan "rents" through ticket prices. Reinvesting franchises saw 136% total increase in ticket prices relative to the year -5 baseline, while relocating franchises saw a much smaller and statistically in-

significant increase of 39%. Additionally, it appears as though relocation is even the worse decision for owner outcomes, as measured through revenue to expenditure ratio (a proxy for profits). Reinvesting franchises saw increases in this ratio by 97.5% relative to the baseline, relocating franchises saw no significant increase. The proxy variable is limited in that it may not accurately capture all of the benefits that ownership can reap through relocation, but this finding suggests that relocation may even be an irrational choice for owners.

That salary did not change significantly for relocating franchises is not a particularly surprising fact given the salary cap structures of the NBA, NHL, and NFL. For reinvesting franchises, the total increase of 62.17% over the 11 year post period equates to 5.65%, minimal increases in salary over time, although possibly signalling broader investment of the franchise alongside the stadia construction. This supports Zimbalist (2003)'s assertion, as well as the hypothesis of Salaga et al. (2014): financial advantages come from stadium investment, and generally not from player investment. Additionally, one wouldn't suspect that player performance (as measured through winning percentage) would be affected significantly by the environment in which they played. While this is true for reinvesting franchises, it is interesting that relocating franchises see a positive jump in performance. The reported coefficient is complicated to interepret, but the total 7 standard deviations gained above the year -5 baseline equates to a roughly 0.63 standard deviation increase per year in this time frame (anywhere from a 4-12 percentage point increase in winning percentage depending on the league). One possible explanation comes from Baade (1996), who argues that players are one of the largest beneficiaries of public subsidies given to franchises as incentives to attract/retain the franchise. If the subsidies are sufficiently large in the cities who attracted a franchise to relocate, this benefit to players could in turn incentivize improved performance.

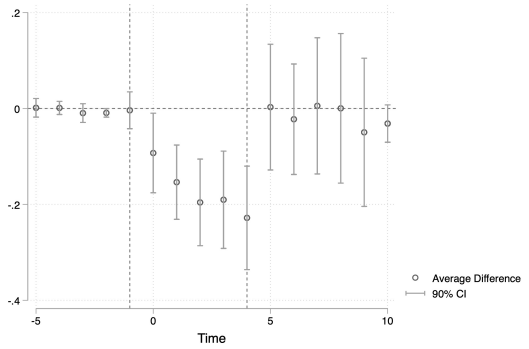
Synthetic Control Model

On account of the Ashenfelter Dip noted in the event study model, it becomes clear that proper counterfactuals for relocating franchises may not exist. To remedy this problem, I

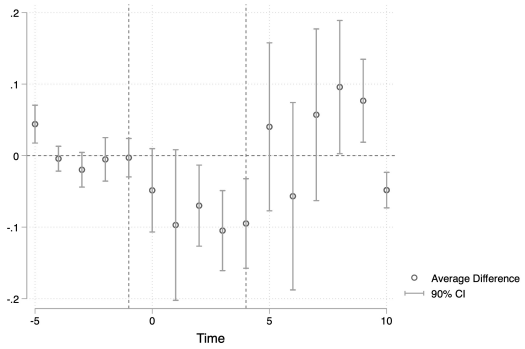
imagined that rather than the decision to relocate literally being made in the year before the relocation occurs, the decision was made at an earlier time period, based on the data to be roughly five years prior to the actual relocation. In Figure 4, Year 0 represents the year of the "decision" to relocate, and year 5 represents the actual season of relocation. A figure showing synthetic control estimates controlling until the actual relocation event is included in the appendix. First, the synthetic controls model believes that the event study model is an underestimate: the decision to relocate leads to a roughly 90% decrease in revenue, a roughly 40% reduction in revenue to expenditure ratio, a roughly 80% reduction in attendance, despite a strong decrease in ticket prices, as well as a reduction in team performance around the order of 0.8 standard deviations from the league mean. Furthermore, in the aftermath of the relocation, revenue, attendance, and winning percentage all fail to see significant increases relative to their synthetic controls. Hence, it is clear that within the context of relocation, the "novelty effect" of stadia does not outweigh the costs of relocation. The loss of revenue, fans, and hence ticket sales, not to mention a poorer product (seen through the reduction in winning percentage), are all significant costs to the league. While the simple answer would be to get these teams out of seemingly failing markets, this data shows that if relocation discussions hang around a franchise, success is that much harder to come by. Additionally, the fact that the relocation itself (which undoubtedly is subject to market analysis by the franchises themselves to ensure profitability) does not in fact have that much of a positive effect relative to the synthetic counterfactual is startling. Differentiating between the periods on which we control, it becomes clear that while relocating franchises may not have fair counterfactuals in the short run as they prepare to move (as shown in the appendix), they do have adequate comparisons in the long run, and relative to those long-run comparison groups, relocating brings very little benefit.

Table 3 attempts to accumulate the synthetic control differences over almost the same time periods as described in the event study model, with the Post-Event period simply being shortened from 10 to five years (with effects after five years still being aggregated in

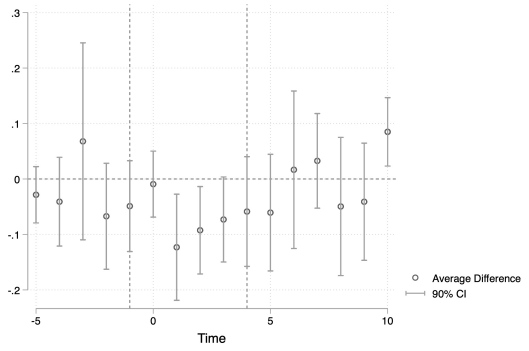
Figure 4: Synthetic Controls Results, Controlling Until Relocation Decision



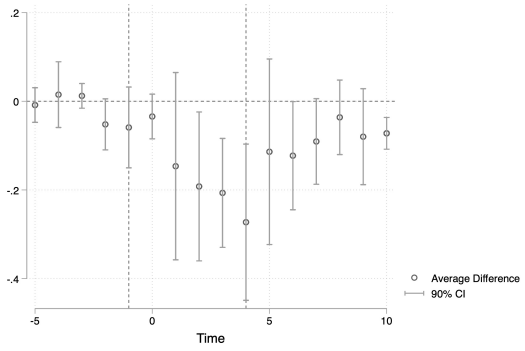
(a) Revenue



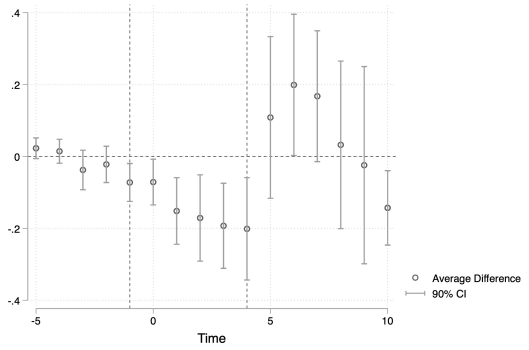
(b) Revenue to Expenditure Ratio



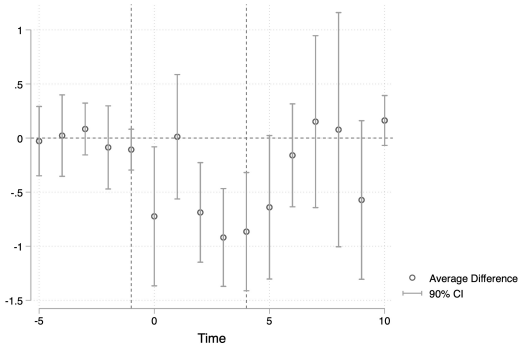
(c) Salary



(d) Attendance



(e) Ticket Prices



(f) Winning Percentage

the tail). Generally, these findings are quite consistent with the findings of the event study specification. Additionally, it is understandable that the synthetic control estimates present worse (more negative) outcomes for relocating franchises than the event study model. As seen in Table 2 and in line with other empirical work, reinvestment has a positive effect on almost

Table 3: Cumulative Effects of Synthetic Controls Model, Controlling Until Relocation Decision

	Pre-Decision	*Post-Decision*	Post-Event
Revenue	-0.019925263	-0.860604286***	-0.094661772
	(0.030398713)	(0.126015052)	(0.1925385)
Attendance	-0.092632405	-0.852367818***	-0.515807569***
	(0.084696352)	(0.211911812)	(0.180389136)
Revenue/Expenditure	0.011801362	-0.415367007***	0.164892077
	(0.034592375)	(0.095625371)	(0.146426529)
Salary	-0.117699012	-0.356535375***	-0.016956437
	(0.144284829)	(0.112998277)	(0.159671888)
Winning Percentage	-0.115733624	-3.183701515***	-0.980445564
	(0.423281014)	(0.734068215)	(1.063361645)
Ticket Price	-0.094613329	-0.788087606***	0.339849681
	(0.061600674)	(0.150432587)	(0.311375201)

*** p<0.01, ** p<0.05, * p<0.1

all of the variables measured in this study. The event study model showed a negative effect of relocation decisions relative to the same franchise: comparing to a reinvesting franchise who experienced a positive outcome change naturally will create more negative coefficients.

Relative to their synthetic controls, revenue falls much more steeply as a result of the relocation decision, roughly 86% total over the Post-Decision period (Column 2 in Table 3). This is coupled with almost equivalent drops in attendance (85%) and ticket price (78.8%). Furthermore, while the event study suggested some positive gains in the Post-Event period, the synthetic controls model finds persistent negative effects on revenue and attendance (ticket price has a small but positive increase, potentially suggesting that ticket price better captures stadia novelty effects than attendance). Put simply, relocating franchises fail to gain a competitive financial advantage in the long-run, sacrificing fan interest and short-term revenue along the way. The synthetic controls model also suggests the harm of relocation to owner outcomes, with a significant drop in revenue to expenditure ratio of 41.5%. Finally, the synthetic controls pick up on a trend not noticed in the event study model: a performance trend of "tanking." Salary is seen to be 35.6% lower on average for franchises as a result of the

relocation decision. Additionally, winning percentage is seen to be 3.18 standard deviations below the synthetic control in total over this period, a much greater difference than in the pre-decision period.

Finally, relative to their synthetic controls, relocating franchises see no long-term benefits in the Post-Event period. The coefficients of Column 3 in Table 3 are generally small and all highly insignificant, with exception to attendance. However, this change is in a negative direction (-51.5% as shown in Column 3 of Table 3), once again supporting the theory that relocation imposes significant costs to potential fan bases.

Conclusion

While previous research has focused on novelty effects and effects of franchises on their markets, thus far no research has analyzed the impacts of relocation in terms of its costs to franchises and the leagues in which they play. This paper was the first to attempt to analyze that problem. Further specifications and checks of robustness should be completed to more precisely estimate the costs of these decisions, but this paper hopes to lay a groundwork of information for league officials/policy makers. While anecdotal evidence universally supports the claim that franchises are struggling in the years prior to their relocation, this paper is the first to propose that these struggles should be considered endogenous to the relocation. Relocating franchises are seen to unambiguously experience decreases in revenue and attendance, and as seen in the synthetic control results, the dip in revenue in the "post-decision" period is followed by a return to average trends, not an increase relative to their comparative franchises. Additionally, relocation results in costs to fans, as attendance drops relative to expectations in the post-relocation period. Given the revenue sharing structure of these leagues, the dip in revenue for relocating franchises imposes costs on the league as a whole. Given the positive effects of stadia rebuilding, corroborating the results of Bradbury (2024), additional pressure from leagues to keep franchises in place would be recommended.

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Appendix

Table A1: Multiple Relocations/Reinvestments

Franchise	**League**	**Year of First Relocation or Reinvestment**	**Year of Second Relocation or Reinvestment**
Las Vegas Raiders	NFL	1995	2020
Los Angeles Rams	NFL	1995	2016
Atlanta Braves	MLB	1997	2017
Texas Rangers	MLB	1994	2020
Phoenix Suns	NBA	1992	2021

Table A2: Cumulative Effects of Event Study, Relative to Year -1 Baseline (No Consideration of Relocation Decision)

	Relocating		**Reinvesting**	
	Pre-Event	Post-Event	Pre-Event	Post-Event
Revenue	0.330007288**	2.294674107***	-0.025107391	1.93664073***
	(0.153702434)	(0.413760233)	(0.062738865)	(0.165725966)
Attendance	0.480693448***	1.319089638***	-0.124458707*	1.015137844***
	(0.157534423)	(0.420563351)	(0.068460672)	(0.180806046)
Revenue/Expenditure	0.350702732***	1.463603782***	0.036407213	1.064074979***
	(0.134871103)	(0.362963624)	(0.057683105)	(0.152547599)
Salary	-0.122554199	0.695155187	-0.089100671	0.334537346
	(0.234086957)	(0.629966351)	(0.10175166)	(0.269205546)
Winning Percentage	0.442410067	7.735964632***	-0.287497791	-1.476452929
	(1.096937177)	(2.933756874)	(0.484208731)	(1.278083917)
Ticket Price	0.162368016	1.391799188**	0.053749245	1.612785853***
	(0.21744417)	(0.58029765)	(0.093702417)	(0.245325047)

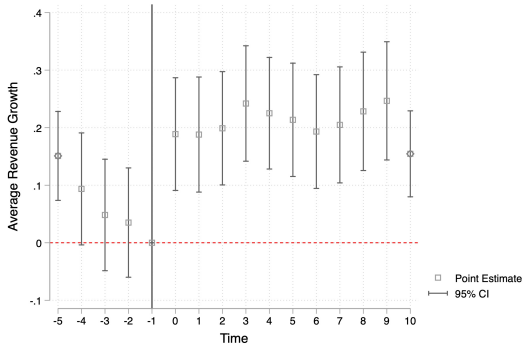
*** p<0.01, ** p<0.05, * p<0.1

Table A3: Cumulative Effects of Event Study, No League Variation in Year Fixed Effects

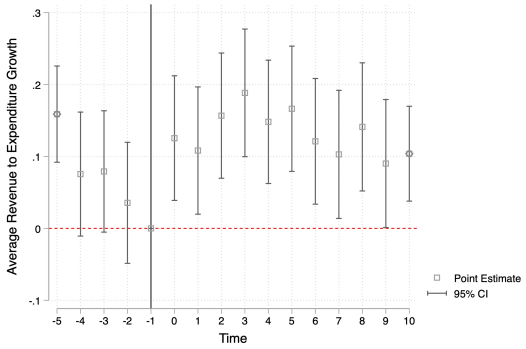
	Relocating			**Reinvesting**		
	Pre-Decision	*Post-Decision*	Post-Event	Pre-Decision	*Post-Decision*	Post-Event
Revenue	0.362743934	-0.469084647**	1.408469551**	0.060657228	0.119939525	2.337209976***
	(0.290227674)	(0.220482125)	(0.583358041)	(0.118098059)	(0.095272439)	(0.251910182)
Attendance	0.095729817	-0.515057122***	-0.120578458	0.071283613	0.121620389	1.567545207***
	(0.250970494)	(0.191353705)	(0.5094575)	(0.102196291)	(0.082230572)	(0.217947174)
Revenue/Expenditure	0.573018879**	-0.034015932	1.367514184***	0.05427809	0.089232146	1.040660516***
	(0.263291749)	(0.200044456)	(0.529312158)	(0.111422322)	(0.089870933)	(0.237576069)
Salary	-0.160199788	-0.012964817	1.121914674*	0.125119436	0.057271961	1.117064316***
	(0.35128078)	(0.266863361)	(0.706074869)	(0.148821683)	(0.120057898)	(0.317445499)
Winning Percentage	2.507388587*	-0.343636181	6.678763167**	0.334310894	0.703804762	0.586538007
	(1.490402251)	(1.130234028)	(2.992677975)	(0.635604253)	(0.512153865)	(1.354671397)
Ticket Price	0.449456439	-0.312816234	0.251343282	0.071174012	0.078473028	1.931535707***
	(0.345346847)	(0.267289781)	(0.707384626)	(0.140969407)	(0.11375635)	(0.301475901)

*** p<0.01, ** p<0.05, * p<0.1

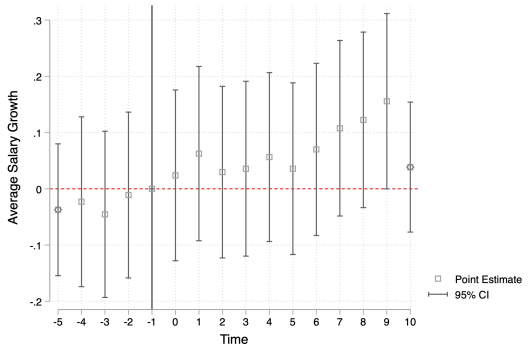
Figure A1: Event Study Results for Relocating Franchises, Year -1 Baseline



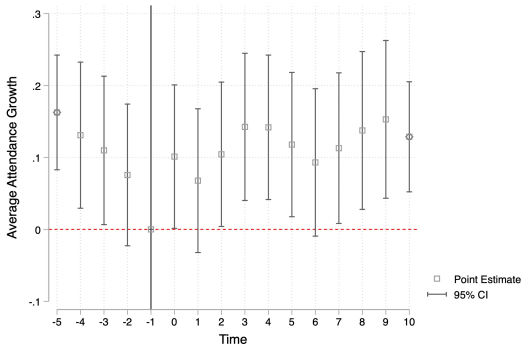
(a) Revenue



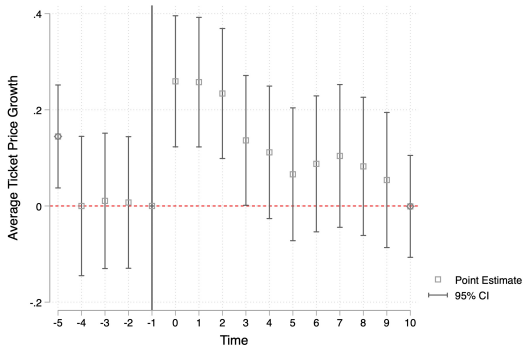
(b) Revenue to Expenditure Ratio



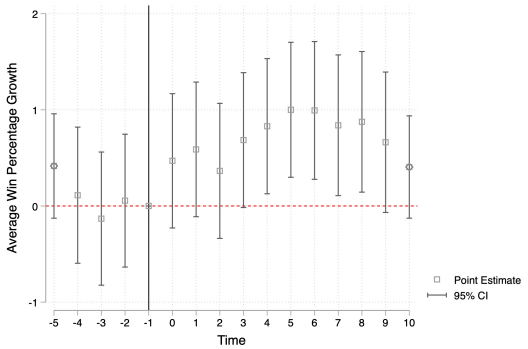
(c) Salary



(d) Attendance

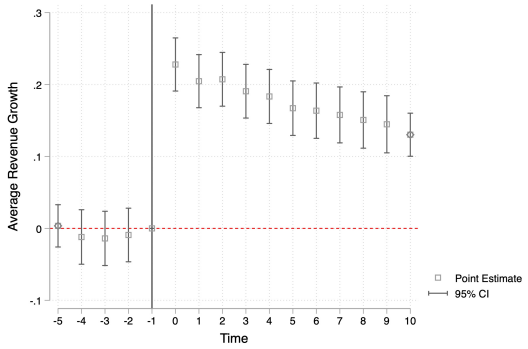


(e) Ticket Prices

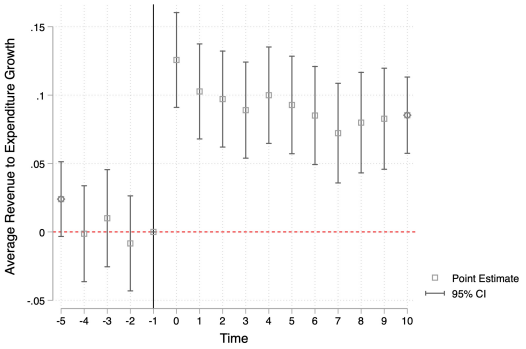


(f) Winning Percentage

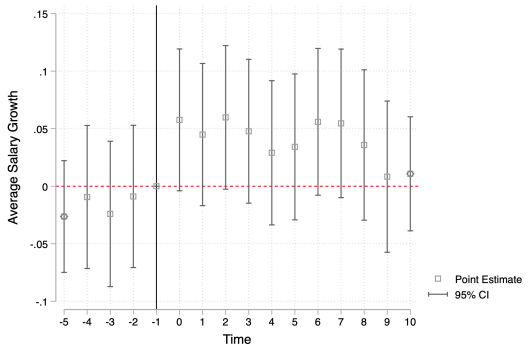
Figure A2: Event Study Results for Reinvesting Franchises, Year -1 Baseline



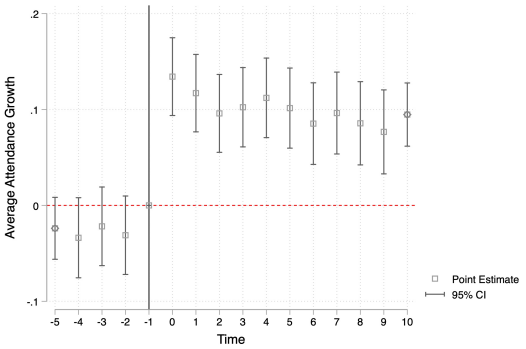
(a) Revenue



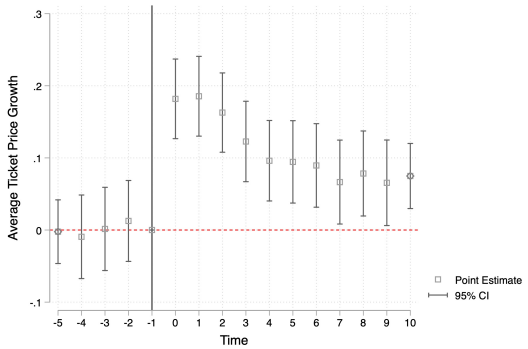
(b) Revenue to Expenditure Ratio



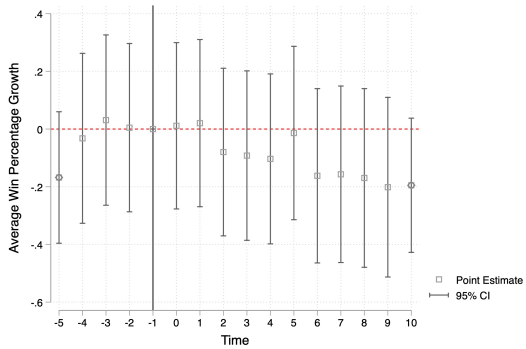
(c) Salary



(d) Attendance

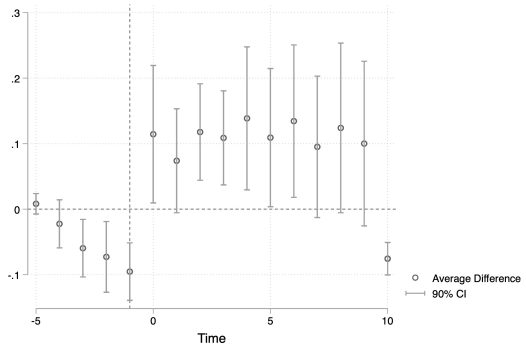


(e) Ticket Prices

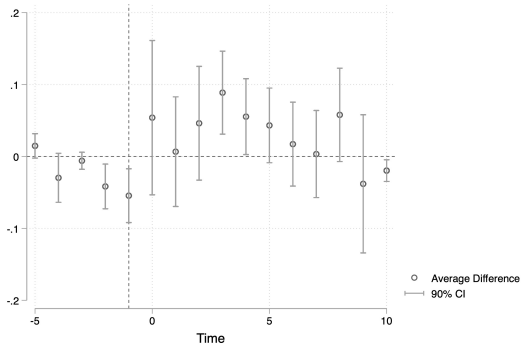


(f) Winning Percentage

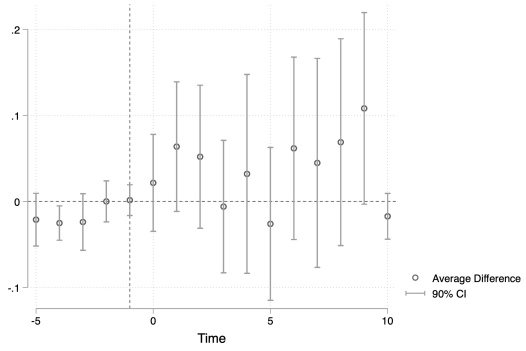
Figure A3: Synthetic Controls Results, Controlling Until Relocation



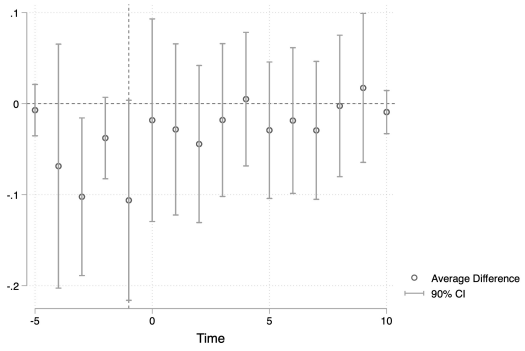
(a) Revenue



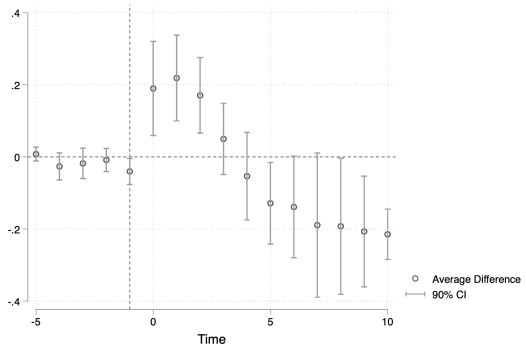
(b) Revenue to Expenditure Ratio



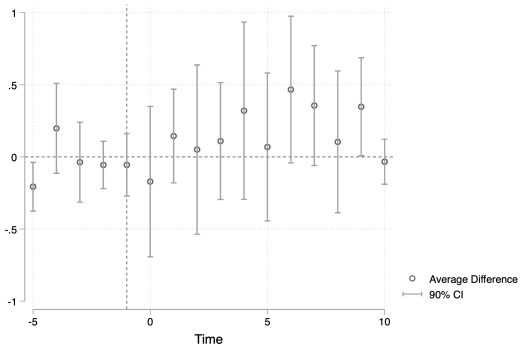
(c) Salary



(d) Attendance

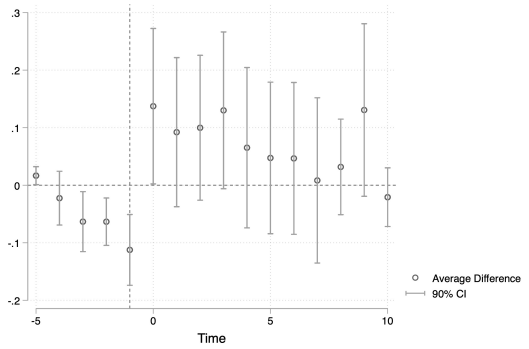


(e) Ticket Prices

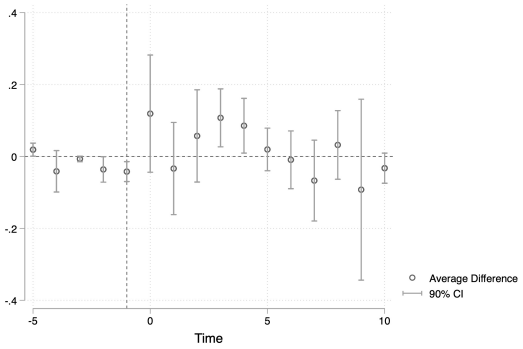


(f) Winning Percentage

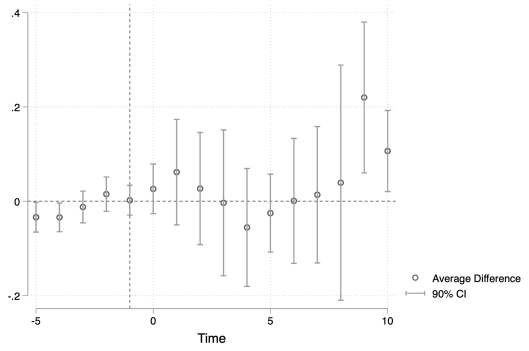
Figure A4: Synthetic Controls Results, Controlling Until Relocation, Restricted Sample



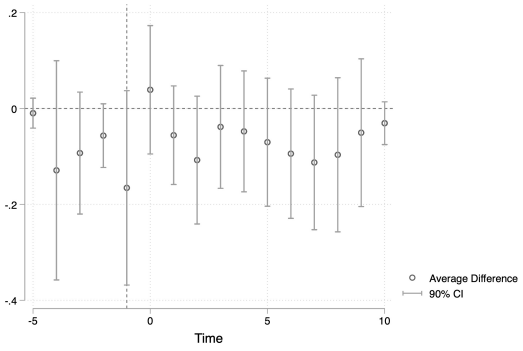
(a) Revenue



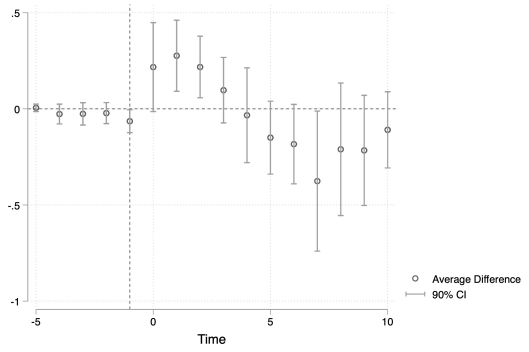
(b) Revenue to Expenditure Ratio



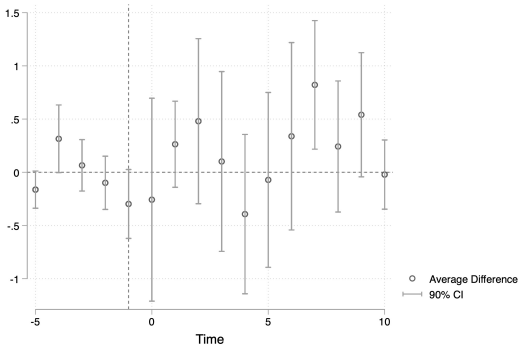
(c) Salary



(d) Attendance



(e) Ticket Prices



(f) Winning Percentage

Table A4: Cumulative Effects of Event Study, Decision Made at Year -6

	Relocating			**Reinvesting**		
	Pre-Decision	*Post-Decision*	Post-Event	Pre-Decision	*Post-Decision*	Post-Event
Revenue	0.067021208	-0.482880019**	0.859805897*	0.129837187*	0.034298842	2.082563261***
	(0.197624606)	(0.227507567)	(0.489459098)	(0.074367457)	(0.090805102)	(0.196717167)
Attendance	0.124437269	-0.421728818*	-0.126801603	0.068601743	0.100691823	1.541906746***
	(0.214013889)	(0.246525444)	(0.531103832)	(0.084386625)	(0.10285814)	(0.223481479)
Revenue/Expenditure	0.158950887	-0.398300445**	-0.038312331	0.082529956	-0.051257078	0.91014371***
	(0.162984963)	(0.187627859)	(0.403664418)	(0.064217528)	(0.078379908)	(0.169788134)
Salary	-0.185632301	0.123203956	1.132036689	-0.043724503	-0.026094326	0.473493625
	(0.283048506)	(0.325848477)	(0.701029437)	(0.113462164)	(0.138541019)	(0.300130678)
Winning Percentage	2.085484204	-0.60780226	6.303673679*	0.413513516	1.012916373	1.410498843
	(1.365314116)	(1.56993448)	(3.379657683)	(0.548818957)	(0.669774293)	(1.452096134)
Ticket Price	0.23401082	-0.352032982	0.38115657	0.042377804	-0.100112885	1.309414978***
	(0.277652704)	(0.326589956)	(0.703009501)	(0.106996896)	(0.131366808)	(0.284340796)

*** p<0.01, ** p<0.05, * p<0.1

Table A5: Cumulative Effects of Event Study, Including the San Francisco 49ers as Relocator

	Relocating			**Reinvesting**		
	Pre-Decision	*Post-Decision*	Post-Event	Pre-Decision	*Post-Decision*	Post-Event
Revenue	0.130711119	-0.419190109**	0.9999237**	0.128523777	0.032985431	2.079673758***
	(0.219378936)	(0.166878484)	(0.442374357)	(0.087944693)	(0.070911893)	(0.187752918)
Attendance	0.093445247	-0.452720841**	-0.194984052	0.056599139	0.08868922	1.515501018***
	(0.244295869)	(0.187048938)	(0.497556551)	(0.099730353)	(0.080179123)	(0.213082082)
Revenue/Expenditure	0.337176462*	-0.22007487	0.353783934	0.137980384*	0.00419335	1.03213465***
	(0.180926843)	(0.137626497)	(0.36483684)	(0.075932425)	(0.061212056)	(0.162049959)
Salary	-0.379607478	-0.07077122	0.705291301	-0.003312723	0.014317453	0.56239954**
	(0.314206218)	(0.239012269)	(0.633592158)	(0.134176903)	(0.108190021)	(0.286453955)
Winning Percentage	2.430252802	-0.263033662	7.062164594**	0.187641552	0.78704441	0.913580523
	(1.515597966)	(1.15097697)	(3.053402944)	(0.649096011)	(0.522704749)	(1.385920879)
Ticket Price	0.238344077	-0.347699726	0.390689735	0.109192743	-0.033297945	1.456407846***
	(0.31426092)	(0.243347385)	(0.644484865)	(0.130005109)	(0.104966187)	(0.278532043)

*** p<0.01, ** p<0.05, * p<0.1