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Series Editor: Dennis Coates

Victor A. Matheson
Robert Baumann *Editors*

The Economic Impact of Sports Facilities, Franchises, and Events

Contributions in Honor of Robert Baade

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Dennis Coates, Baltimore, MD, USA

The aim of this series is to provide academics, students, sports business executives, and policy makers with information and analysis on the cutting edge of sports economics, sport management, and public policy on sporting issues.

Volumes in this series can focus on individual sports, issues that cut across sports, issues unique to professional sports, or topics in amateur sports. Each volume will provide rigorous analysis with the purpose of advancing understanding of the sport and the sport business, improving decision making within the sport business and regarding policy toward sports, or both. Volumes may include any or all of the following: theoretical modelling and analysis, empirical investigations, or description and interpretation of institutions, policies, regulations, and law.

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Editors

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This book is dedicated to Rob Baade, and we the editors and all of the contributors wish him and his family a wonderful retirement.

Preface

It is safe to say that neither I nor my co-editor Rob Baumann would be sports economists today if not for Rob Baade. It was pure chance that I ended up two doors down from him on the 3rd floor of Young Hall at Lake Forest College. After many years of a long-distance relationship, my wife Jolie and I got married in 1997, and I moved down to Chicago to be with her. I was looking for any adjunct job in the Chicago area who would hire an ABD from Minnesota, and Lake Forest came calling.

After a year or so at the College, Rob came down to my office one day asking if I would be interested in working on a project together. As a PhD student struggling to figure out the research and publication game, how could I say no to this generous offer? He had already published his seminal work on stadium economics and wanted to take a look mega-events like the Olympics, Super Bowl, or Daytona 500 – yes, my first published paper with him was on NASCAR! Things started out a little rough. The first regression we ran looking at the economic impact of the 1996 Atlanta Summer Olympics had a negative adjusted-R^2, something I had previously thought was only possible in theory, not in practice. But it got a lot better, and we ended up co-authoring roughly 35 journal articles and book chapters together over our careers.

Rob didn't have to go out of his way to help a poor adjunct economics lecturer find his research footing, but that was how he operated. At the time I was at Lake Forest, Rob had coauthored with nearly everyone in the department, helping to advance so many careers other than his own. Indeed, while Rob certainly taught me a lot about sports economics, perhaps the most important thing I learned from him is to be generous in offering co-authorships, especially to students and pre-tenure professors. Of course, I took that to heart when I started at Holy Cross, and Rob Baumann joined our economic impact of sports team along with series of great summer research students, so many of whom have subsequently ended up as co-authors themselves. It is not an exaggeration to say that at least a dozen undergraduate students, most of whom have never even met Rob, ended up as published co-authors in economics because of him.

We hope the reader enjoys this collection of essays in honor of Rob covering a variety of topics relating to the economic impact of sports, an area of study over which he has had a huge influence.

It has been my pleasure to have Rob as a colleague and a friend for over 25-years now, and I wish him and his family a wonderful and well-deserved retirement.

Worcester, MA, USA Victor A. Matheson

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Introduction: A Few Words About Robert Baade

Kent Grote

Professor Robert Baade made a very successful career out of pursuing his academic passions in areas where he most desired to make a contribution: regional and international economics, sports, income inequality, and policy, among others. And his career, while both active and time-consuming, also allowed him to enjoy a personal life with his family and friends that brought balance and energy to everything Rob pursued.

Rob grew up in a sports family, with both a father and an uncle who played Division I college football. While football and basketball were Rob's primary sports in high school, he chose to pursue basketball in college, and this ultimately had a strong influence on his future career. Rob learned several important things about himself during his time in college. First, he learned that his undergraduate degree at

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the University of Wisconsin-Whitewater would not be enough to meet his academic aspirations. He had a strong interest in getting more training in a PhD program in economics because it would utilize his math skills and allow him to explore implications for social policy. Second, he loved college athletics, not just because of the sport and the play on the court but also because of relationships formed with teammates and coaches, which he did not necessarily want to give up after his undergraduate career. The culmination of these pursuits as an undergraduate resulted in Rob earning the Outstanding Scholar-Athlete Award for the University of Wisconsin System in his senior year.

After graduation, a career in professional sports attracted Rob, but his dedication to academics and its promise of a longer-term more fulfilling occupation won out. Rob ultimately chose to go to the University of Wisconsin-Madison to pursue graduate studies in economics because it was a highly rated program with an emphasis on institutional economics, which Rob was eager to explore. Rob completed his master's degree at the University of Wisconsin before being drafted and serving in Vietnam. He returned to Madison less than 2 years later to complete his PhD. While at Wisconsin, Rob found the academic challenges and rigor that he sought, and with the help of Ford Fellowships, he completed his PhD studies in 3 years. Professor Robert Baldwin, a distinguished international economist, mentored Rob at Madison. Professor Baldwin encouraged Rob to pursue high-level academic research while introducing him to other celebrated academics in the international economics field.

Based on his academic training at the University of Wisconsin, Rob had many options when it came time to search for his first academic position. But these options became more limited when he decided he would also like to coach college basketball in addition to pursuing a position as an economics professor. In fact, only a few institutions were interested in offering Rob both a coaching and academic position, and he ultimately decided to accept an offer from Lake Forest College that offered him an opportunity to do both. And upon accepting this position, Rob realized he also had something to prove to himself and to others who questioned his choice and his ability to be a serious scholar at a small liberal arts college.

Anyone familiar with Rob's career knows he was able to find success: not at a limited level and not just as a researcher. Rob was a star in the classroom. His position at the college started in 1973, and by 1980 he won the Great Teacher Award at the college for the first time, to be followed up by winning the highly coveted award four additional times before retiring in 2022. Teaching courses in international trade, international finance, advanced macroeconomics, and the economics of sport, among others, Rob engaged and inspired generations of students to explore their own academic interests and pursue careers that challenged them. Rob's research agenda began with a focus on international economics and income distribution, but in 1984 that agenda changed significantly as a result of a paper on "The Sports Tax" delivered at the Eastern Economic Association Meetings. Although Rob continued other research interests, his primary focus shifted to the economic impact of sports on local economies and often the appropriateness of public policy to promote largely private interests in sports. While, at first glance, this new agenda appears to be very

different from his earlier research, Rob views this as a natural progression of his broader interests in income inequality and economic policy that grew out of his graduate school education and research.

But it is this new research that Rob became known for both nationally and internationally. The small campus of Lake Forest College in the northern suburbs of Chicago became a landing place for the local and national media who sought interviews with Professor Baade regarding his alternative views on the regional impact of professional sports teams and stadiums. By the 1990s, Rob's recognition as an expert in the field expanded when he was asked to appear before the Senate Judiciary Committee: Subcommittee on Antitrust, Business Rights, and Competition to offer an alternative and more balanced perspective for policymakers to consider. And, in 1994, Rob was recognized for his contributions to his field by earning a Distinguished Alumni Award from the University of Wisconsin-Whitewater.

Rob's research led to many opportunities to attend high-profile international sporting events, where he was often an invited speaker, as well as give talks before some of the most highly recognized international sports organizations. To name a few, Rob was invited to speak at an event welcoming the World Cup in South Africa in 2010. A few years later, he was invited by the Brazilian government to give a talk on both the World Cup and Summer Olympic games that were being hosted in Rio de Janeiro. He was also an invited speaker and guest of the South Korean government for the Pyeongchang Winter Olympic games in 2018. Both FIFA and the International Olympic Committee invited Rob to speak to their organizations and provide a more balanced view on the economic impact of global sporting events. Rob also served as President of the International Association of Sports Economics from 2006 to 2010, a role that was extremely valuable to him because of the lifelong relationships he was able to form with colleagues from around the world.

In spring 2022, Rob chose to retire from Lake Forest College after almost 50 years of service to the college. He continues to be active in his research but has more time to spend with his family, especially his wife, Tracy, and his two sons, Braeden and Jarrett. Rob has been an example to us all as to how to find a personal niche in a rigorous, yet very broad, academic field and find success while also finding balance. He has also accomplished all of this while gaining the respect of his colleagues and students alike for being a caring and conscientious individual.

Robert Baade: Stadium Economics Pioneer

John Charles Bradbury

> *Sports are so intimately woven into the fabric of our culture that it seems inconceivable that stadiums will not be constructed in which to showcase our social jewels. Yet the rationale offered in defense of public subsidization of stadiums is decidedly economic.*
> *Robert Baade (1987, p. 18)*

1 Introduction

There are few topics on which there is more agreement among economists than the economic impact of sports stadiums. A recent survey of 30 economic experts found only one economist willing to argue that professional sports teams may generate sufficient return to justify the subsidies that stadiums receive, and even that economist based his argument on social benefits rather than any economic development stimulus.[1] Dennis Coates, Brad Humphreys, and I recently conducted a comprehensive review of all published academic research of the economic impact of sports teams and stadiums on host communities. We identified over 130 articles spanning five decades, which reach a consistent conclusion:

> *[N]early all empirical studies find little to no tangible impacts of sports teams and facilities on local economic activity, and the level of venue subsidies typically provided far exceeds*

[1] Chicago Booth survey of US economic experts to the statement: "Providing state and local subsidies to build stadiums for professional sports teams is likely to cost the relevant taxpayers more than any local economic benefits that are generated." The lone economist to disagree Michael Greenstone offered a classic positive externality justification: "Sports teams generate value that they cannot capture thru tixs/tv—Chicagoans benefited from Cubs winning [World Series]. Subsidies are compensation" (US Economics Experts Panel 2017).

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> *any observed economic benefits. In total, the concurrence of research findings demonstrates that sports venues are not an appropriate channel for economic development policy.* (p. TBD)

While the economics literature on the economic impact of sports stadiums and events is now vast and vibrant, it was largely devoid of any research when Dr. Baade began his study of the subject in the 1980s. Baade's early contributions shaped the future of this research in an influential way that might not be obvious to economists presently working in this field. When Baade published his first article on the subject in 1988, I was in junior high school. By the time I received my PhD in 2000, economists had already reached the consensus that public financing of stadiums was a poor investment. The collected volume of expert analyses regarding the economic impact of stadiums in *Sports, Jobs, and Taxe*s, to which Baade contributed three standalone chapters—the most of any author—concluded: "the local economic impact of sports teams and facilities is far smaller than proponents allege; in some cases it is negative" (Armacost 1997, pp. vii–viii).

Thus, much of my experience with this research occurred after Baade's seminal contributions had sparked its development. I was not aware of the importance of his early research until conducting the comprehensive review of this literature with Coates and Humphreys. In these papers, his approach for evaluating stadium subsidies and why they were occurring created a foundation that underpinned subsequent research which continues to the present day.

The field of sports economics is small, but we have our pioneers. Simon Rottenberg (1956) developed a framework for evaluating player talent allocation that anticipated the Coase theorem. Walter Neale (1964) elucidated the peculiar economics of sports leagues that naturally converge to joint entities cooperating in a cartel. Mohamed El-Hodiri and James Quirk (1971) provided a formal model for sports league operations. Gerald Scully (1974) developed a method to estimate the rents extracted by the reserve clause that bound professional athletes to their major league teams. Robert Baade deserves similar credit for first investigating the economic impacts of stadiums at a time when stadium financing was relevant yet largely unexamined by economists. Though his contribution is not defined by a single article, his research proved to be highly influential to this field of study.

In this chapter, I describe Baade's early work on the economics of stadiums to place it in its proper context as a seminal contribution to the sports economics literature. I review his papers through the lens of a researcher appreciating this scholarship ex post rather than as a contemporary who consumed it in the time it was produced. I do not know Dr. Baade well; thus, my impressions are not those of a close colleague but as fellow scholar who admires his work. I explain the motivations for his research program, summarize his contributions and their importance, and highlight the inspiration that his work provides for present and future economists studying stadium policy.

2 Stadium Mania

Baade's early work on sports stadiums developed in response to the swelling wave of venue construction that occurred in the late 1980s and early 1990s, as he described with his Lake Forest colleague Richard Dye, "Stadium mania is sweeping the United States" (Baade and Dye 1990, p. 1). Baade recognized not only the importance of stadium funding as a policy issue as it happened, but he also had the foresight to anticipate its growing relevance. From 1987 to 2010, 88 new venues opened to host teams in the four major US sports leagues (Major League Baseball, National Basketball Association, National Football League, National Hockey League) (Fig. 1).

The 1990s also saw a dramatic increase in public funding devoted to sports venue projects, which increased the policy relevance to economists. While it is tempting to focus on the relative decline of public funding going to stadiums (Fig. 2) as evidence of waning public involvement, the magnitude of public funding devoted to professional sports stadium is the pertinent policy metric because it reflects the opportunity cost to taxpayers. The real amount of public funds devoted to stadium construction has continuously increased since the 1990s, and the declining public share is an artifact of stadiums growing more expensive overall.

In fact, subsidies may contribute a small part to stadiums' growing costs because they incentivize owners to build more expensive venues. Quirk and Fort (1997)

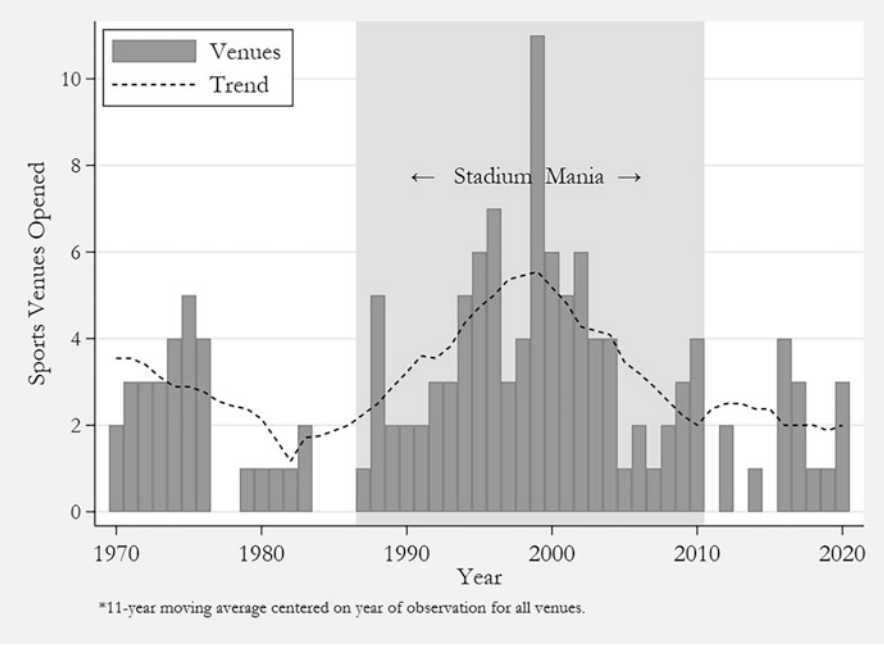

Fig. 1 Major league sports venues opened by year (1970–2020)

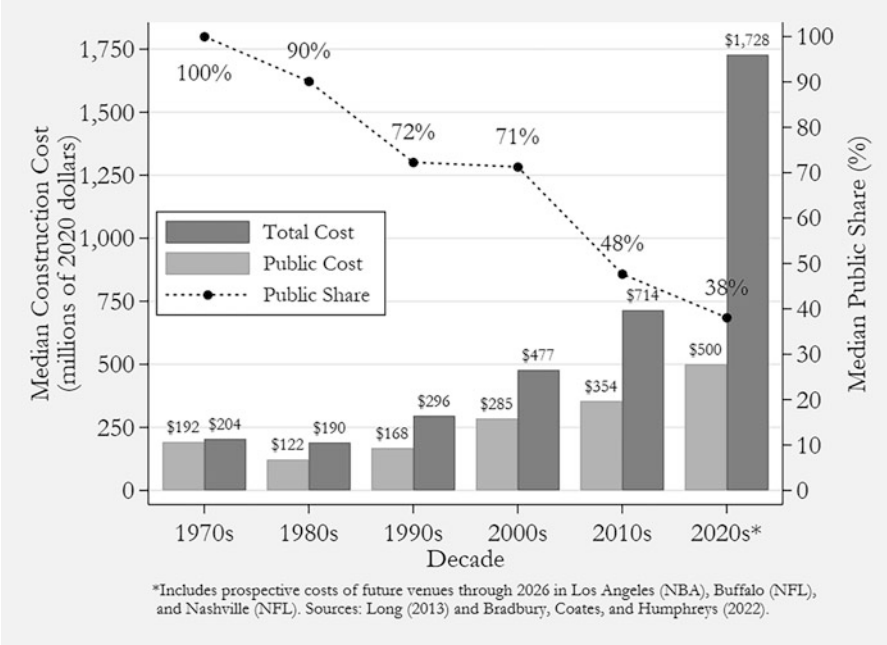

Fig. 2 Median sports venue funding by decade (1970s–2020s)

postulated that when team owners have primary control of a stadium's design, but do not bear the full construction costs, they are likely to "gold-plate" facilities with costly luxury amenities. Using a sample of stadiums from roughly the stadium-mania era (1987–2012), Propheter (2017) estimated that each $1 million in subsidies was associated with $36,600 in additional total construction cost per facility footprint acre, on average.

In a 1996 essay in *Real Estate Issues*, Baade (1996b) explored reasons why the United States was experiencing its stadium boom and how newer facilities differed from their predecessors. Baade notes: "One major lesson gleaned from the experience with new stadium construction is that stadiums are replaced not because of their physical obsolescence, but because of their economic obsolescence. Consequently, the shelf life of stadiums and arenas has been substantially reduced." The distinction between physical and economic obsolescence is important. Modern concrete and steel stadiums built during the first half of the twentieth century demonstrated themselves to be durable structures, routinely lasting 40–50 years. In some cases, stadiums have continued to operate as iconic homes to professional sports teams that last a century or longer (e.g., Fenway Park, Soldier Field, Wrigley Field), and many college venues routinely last many decades. Why were professional team owners so eager to replace stadiums built in the 1960s and 1970s that were just approaching 30 years of operation, when this expensive capital asset remained functional as a sports venue?

Baade presented several factors that were driving the push for new stadiums. For example, the NFL's revenue sharing agreement, which required all teams to share pooled revenue derived from national television contracts and general ticket sales equally, exempted revenue collected from luxury seating, stadium clubs, and in-stadium advertising. Owners like Joe Robbie (Miami) and Jerry Jones (Dallas) demonstrated there was significant revenue to be made from these sources, which motivated team owners build new stadiums that included these revenue streams.

Team owners of all leagues also came to realize that fans preferred newer fan-friendly structures, which boosted attendance and revenue. New stadiums could also be tailored to attract customers from the top of the income distribution, which expanded during the booming 1980s. Rather than serving more peanuts, hot dogs, and beer to more fans in expanded bleachers, owners began to cater to wealthy patrons with boutique concessions in more intimate and exclusive spaces. These features also served the growing corporate presence at ballparks, as Baade described, "Business once promoted and conducted in boardrooms and restaurants now is facilitated in skyboxes and stadium clubs." Though Baade does not mention it by name, he is describing the "novelty effect"—now one of the most well-established findings in sports economics—which he developed further in Baade (1996a) and Baade and Sanderson (1997).

Overall, the profit-maximizing motives of owners coupled with a newfound willingness of local governments to fund stadiums as economic development projects (discussed in the next section) resulted in stadium mania.

3 Stadium Economics

Baade recognized that the significant public funding going to stadiums had important policy implications that needed to be studied. Not only were the public contributions large, but stadium subsidies served to improve the profitability of private businesses that catered to a wealthy cohort of consumers. Though a budding sports economics community had emerged by this time, public financing of stadiums surprisingly was not yet a major area of interest. For example, two prominent volumes on the business of sports published around the time—*The Business of Professional Sports* (Staudohar and Mangan 1991) and *Diamonds Are Forever: The Business of Baseball* (Sommers 1992)—did not include any chapters on stadium subsidies.

Baade first explored the case for stadium subsidies in his policy study "Is there an economic rationale for subsidizing sports stadiums?" (Baade 1987). He described two channels through which stadiums might generate economic benefits to justify subsidies: first, from short-term spending by fans and visiting personnel and, second, as a long-term catalyst for urban renewal and local economic development by fostering a big-league image of the host locality. His empirical analysis revealed that "sports and stadiums frequently had no significant positive impact on a city's economy and, in a regional context, may actually contribute to a reduction in a

sports-minded city's share of regional income," thus setting the stage for academic papers to come (p. 19).

In 1988, Baade addressed the growing push for stadium subsidies in the influential essay "Sports stadiums and area development: A critical review" in *Economic Development Quarterly*, with Richard Dye. They argued that much of the pressure on local officials to fund stadiums at that time derived from the "urban scissors crisis," which cities faced from the elimination of federal grants to municipalities during the 1980s from the Ronald Reagan administration budget cuts. Baade (1996b) notes that the fraction of state and local government revenue provided by the federal level fell from 18.4% to 13.3% from 1980 to 1988. In response, stadiums were viewed as a potential development remedy for reclaiming economic activity and associated tax revenues now that the federal spigot of funding had been shut off. The promise of an anchor for tax revenue was exacerbated by team owners, who exploited local fears that beloved franchises would pull up and leave cities, like the Baltimore Colts (1984) and Oakland Raiders (1982). Franchises held significant leverage to extort significant subsidies from host cites because replacement teams to serve unmet local demand were restricted by the monopoly status of sports leagues. Even though voters were often reluctant to support using taxpayer dollars to attract or retain franchises, teams were able to use these advantages to garner significant public funding.

Baade and Dye also noted that publicized estimates that projected hosted games to be major drivers of economic activity were not convincing. These estimates came mostly from developer-promoters, government staffers, and hired consultants who presented prospective analyses using speculative assumptions regarding attendance, spending, and multiplier effects that were not well justified. Baade and Dye provide examples of studies with multipliers ranging widely from 1.2 to 3.2, exaggerated benefits, and other nonstandard justifications, which raised doubts about the methods and accuracy. Furthermore, these impact studies typically assumed that all stadium-related spending was net new spending. In reality, most spectator consumption is locally based, which means it represents a redistribution of existing spending. As an example, they presented California Institute of Technology economist James Quirk's informal analysis of one such study that touted economic benefits of $29 million a year from moving to a new stadium just eight blocks away, which is prima facie ridiculous. Overall, Baade and Dye concluded that existing promotional studies were not credible, and thus the economic development rationale for stadium subsidies was weak:

> *This look at the evidence leaves us skeptical of the economic development rationale for stadium subsidies. Careful analysis of impact studies has identified systematically optimistic assumptions on both the cost and benefit sides. The positive impacts on area development touted by stadium promoters do not appear to be strong enough to show up in aggregate measures of economic activity for individual cities that have built stadiums or gained pro franchises.* (p. 272)

Subsequent analyses by Crompton (1995) and Hudson (2001) would confirm the non-credibility of commissioned economic impact reports, which are sometimes referred to as "advocacy studies."

The obvious deficiencies of these advocacy studies set the stage for the development of econometric models that could better estimate the relationship between stadiums and host economies. After all, if economists were going to criticize existing estimates, no matter the motivation, it was incumbent upon them to provide alternate and credible methods. Thus, Baade and Dye follow up with two empirical studies that are the first econometric studies on the subject published in peer-reviewed academic journals.

An important choice that Baade and Dye made was to approach the desirability of stadium subsidies as an evaluation of the potential return on the public investment. They state their motivation explicitly: "The analysis here is undertaken from the point of view of the local taxpayers. The issue is whether there are appropriable or public-good type benefits to taxpayers generally which justify subsidies which have other sectors as the primary beneficiaries" (Baade and Dye 1988a, b, p. 38). This might seem like an inevitable choice in hindsight, but most existing economic research on stadiums at the time had focused on descriptive comparisons between public and private stadiums, profitability, and whom the chief beneficiaries might be (Okner 1974; Quirk and Fort 1997; Baim 1994).[2] This framework would influence how researchers (especially economists) would evaluate economic impacts in future studies, even as econometric methods that would evolve and improve over time.

In their 1988 study in *The Annals of Regional Science*, Baade and Dye estimated the impact of teams and stadiums on manufacturing employment, value added, and new capital expenditures on eight metropolitan statistical areas (MSAs) from 1965 to 1978 (14 years) and found no relationship. Their 1990 article in *Growth and Change* examined a sample of nine MSAs between 1965 and 1983 (19 years) and found the presence of new or renovated stadiums had uncertain impacts on levels of economic activity which can be negative when compared to development in the region.

Baade and Dye's earlier studies relied on separate time-series regression estimates for each MSA. Baade's 1996 study published in *Journal of Urban Affairs* upped the empirical rigor by expanding the sample to include 48 MSAs over 30 years while generating regression estimates using a pooled sample of panel data in addition to results from individual MSAs. Baade (1996a) estimated the impact of teams and stadiums on the metropolitan area's per capita income and state's employment share in the amusement and recreation and commercial sports sectors and discovered no consistent statistically significant effects. The policy implications, which Baade cited as a motivation for the study, were clear:

> *One purpose of this paper was to provide cities with a methodology and statistics for enhancing their perspective on a second rationale for public subsidization of professional sports, job creation. . . . In general, the results of this study do not support a positive correlation between professional sports and job creation. This finding, coupled with the absence of a positive correlation between professional sports and city real per capita income, suggests that professional sports realign economic activity within a city's leisure*

[2] This comment is not meant to diminish the importance of these contributions. My intention is to note that previous economic studies of stadiums were focused mainly on other aspects.

> *industry rather than adding to it. These results are at odds with what has been promised (often articulated through economic impact studies) by sports boosters.* (pp. 15-16)

Baade's article was published along with a dissenting view from a then-prominent stadium booster Thomas Chema, the former executive director of the Cleveland's Gateway Sports and Entertainment Complex, which hosts the Cleveland Guardians and Cavaliers. Chema (1996) took issue with Baade's policy inference that "cities should be wary of committing substantial portions of their capital budgets to building stadiums" for a host of reasons, most of which I think could be described as motivated whining. However, perhaps the most compelling criticism from Chema was that Baade's estimates derived from an outdated sample of stadiums that ranged from 1958 to 1987, which was dominated by spartan multipurpose cookie-cutter venues placed in a sea of parking lots in nonurban areas that were not intended to anchor economic development. Chema argued, "there is no merit in extrapolating from the flying saucers of Pittsburgh, Cincinnati, Philadelphia, etc., and drawing conclusions as to the public return from investment in today's Camden Yards and Jacobs Field" (p. 20). Chema insisted that sports facilities could be drivers of economic success if they were designed to promote external development, which is something that many early facilities lacked:

> *The key to sports venues being a catalyst for economic development is locating them in an urban setting and integrating them into the existing city infrastructure. It is the spin-off development generated by two million or more people visiting a specific area of a city during a concentrated timeframe which is critical. The return on the public investment in a ballpark or arena, in dollar and cents terms as opposed to the intangible entertainment value comes not from the facility itself, but from the jobs created in new restaurants, taverns, retail, hotels, etc., that spring up on the periphery of the sports venue.* (p. 20)

Chema is correct that stadiums constructed during the stadium mania era took on a new character. For example, Baltimore's Camden Yards, which opened in 1992 as the first retro-style ballpark, provided a fan-friendly experience with new income streams from luxury amenities and was designed to be integrated into the Inner Harbor neighborhood. Chema contended that these newer facilities had characteristics designed to avoid the flaws of obsolete facilities that Baade had used to make "a decade long career (or perhaps crusade) arguing against" stadium subsidies (p. 19).

While Chema cited selective evidence of development from the area surrounding the sports complex he once oversaw in Cleveland, his cherry-picked figures were not nearly as convincing as Baade's broader sample and analysis which were the most comprehensive estimates to date. Chema's concerns may have seemed reasonable in 1996—Nelson (2001) and Santo (2005) would make similarly ill-fated claims—but history has proved Baade right. A few short years later, Coates and Humphreys (1999) provided confirmation of Baade's estimates regarding per capita income, finding no impacts in income growth and negative impacts on income levels. Hudson (1999) found the presence of major league franchises was not associated with employment, which caused him to declare the policy question to be settled:

> *While economists have endeavored mightily, perhaps even obsessively, to perfect their scientific techniques, there is still considerable debate about the reliability of the*

> *conclusions reached through econometrics. However, while this effort at empiricism will never be confused with an experiment in the physical sciences, it certainly casts substantial doubt on the ability of a professional sports team to act as an economic engine. Therefore, this justification for access to public money does not stand up to close scrutiny.* (p. 407)

In Baade's contribution "The employment effects of teams and sports facilities" in *Sports, Jobs, and Taxes*, coauthored with University of Chicago economist Allen Sanderson (Baade and Sanderson 1997), the authors expanded on Baade's 1996a analysis by focusing on the employment effects of stadiums in order to examine the reallocation of leisure consumption within local communities.[3] Using a sample of ten cities over 36 years (1958–1993), Baade and Sanderson examined the impacts of an MSA's sports environment on its share of state employment in the amusement and recreation or the commercial sports industries in separate time-series regressions. They report two key observations from their estimates:

> *First, adding a professional sports team or stadium to a city's economy appears to realign leisure spending rather than adding to it and is therefore neutral with regard to job creation. Second, the fan base supporting professional sports appears to be insufficiently "foreign" to the city to contribute significantly to metropolitan economic activity.* (p. 109)

Coates and Humphreys (2003) further examined the impact of the teams and stadiums on sector-level employment and identified a tradeoff from a small boost in MSA employment in the amusement and recreation industry that was offset by decreased earnings and employment in other sectors, which supports the hypothesis that sports consumption represents a transfer in spending between sectors, not new spending.

In addition to evidence of the economic impotence of stadiums, Baade and Sanderson (1997) provided explicit estimates of the novelty effect—first proposed and estimated in Noll (1974)—which is the increased attendance and revenues for new stadiums. They found novelty effects range from 7 to 10 years, which is consistent with more recent estimates by Coates and Humphreys (2005) and Bradbury (2019).

Perhaps the most remarkable aspect of Baade's work on stadium economics is that his research findings have endured as empirical methods have improved and more data have become available. Bradbury et al. (2023) note that even though a majority of economic studies examining the economic impact of stadiums have been published in the past decade, the results have not changed:

> *Empirical research progressed from early studies of metropolitan areas using multiple regression analysis to rigorous event and case study methods designed to infer causal effects accounting for multiple confounding factors. Even as empirical methods improved, the findings remained largely consistent across this broad and vibrant literature.* (p. 1422)

It is now clear that Baade's victory in the debate over the economic impact of stadiums has been absolute, as economists have decisively rejected of the hypothesis

[3] Baade contributed two other timely essays (also with Sanderson) to the volume, examining stadium situations specific to Chicago and minor league baseball, which detailed the political, economic, and industry challenges that these venues faced.

that stadiums are economic catalysts. Baade's critics failed in thinking his inferences were drawn entirely from empirical analyses which are always open to sampling and methodology critiques. They did not appreciate Baade's economic intuition, which he stated clearly in his earliest writings, that the nature of spectator consumption promotes only re-shuffling of existing dollars, not new spending. Baade understood that sports stadiums do not manifest as engines of economic development because of some design flaw that could be tweaked for success by an astute urban planner; they fail because stadium-related spending is largely reallocated local spending. This may explain why stadium boosters like Chema, who built their careers (or perhaps crusades) on the promises of stadium-induced economic development, were appropriately fearful of Baade, whose economic intuition was sound and robust.

Since the 2000s, economists have devoted more effort to estimating potential benefits to sub-local development and nonpecuniary social benefits, which Baade always acknowledged as relevant social welfare considerations (Matheson 2019). However, estimates of neighborhood development and quality-of-life amenity externalities have found that any positive spillovers are well below the typical level of subsidies that sports venues receive.

Baade's influence with shaping the academic consensus regarding the efficacy of stadium subsidies is unquestionable. In 2005, Robert Whaples conducted a survey of American Economic Association PhD economist members, which included the query, "Local and state governments in the U.S. should eliminate subsidies to professional sports franchises." Of the respondents, 85% agreed, which caused Whaples to highlight it as one of the key points of consensus among economists across all issues (Whaples 2006). Baade's work played a primary role in advancing this thesis from conjecture to consensus understanding in a short period of time.

4 Mega-Events

While this chapter has focused on Baade's seminal role in understanding stadium economics, his contributions to the related literature on the economics of mega-sporting events should be mentioned, because they set the stage for much future research. Just as is the case with stadiums, public subsidies for major sporting events are often justified by claiming the potential for huge economic gains, and Baade's work proved these economic rationales to be unfounded.

In the late 1990s, Baade began his long collaboration with Victor Matheson (and later Robert Baumann) focusing on the economic impact of major sporting events on host communities. Over the course of the next two decades, the team produced over 30 journal articles and book chapters covering every type of mega-event imaginable ranging from huge international events like the World Cup (Baade and Matheson 2004a; Baade et al. 2021), Summer Olympics (Baade and Matheson 2002, 2016), and Winter Olympics (Baade et al. 2010) to national-level events like the Super Bowl (Baade and Matheson 2000b, 2006), Major League Baseball's All-Star Game (Baade and Matheson 2001) and World Series (Baade and Matheson 2008), and the

NCAA's March Madness basketball tournament (Baade and Matheson 2004d) down to more local events such as the Daytona 500 (Baade and Matheson 2000a) and college football games (Baade et al. 2008, 2011). In virtually all cases, Baade and his coauthors found economic impacts that were a fraction of those claimed by event supporters leading to the rise of the now well-known phrase that could be known as the "Baade Rule": If you want to know what the true economic impact of an event is, take whatever number is being claimed by the boosters and move the decimal point one place to the left. While the true provenance of that phrase is lost to history, laying it at the feet of Baade is as good as any, and some projections are so outrageous that two or more decimal-place adjustments would be more appropriate.

Baade also was among the first to question the wisdom of the trend that picked up steam in the 1990s of awarding mega-events like the Olympics to developing nations, concluding that these events are even worse deals for poor countries with less developed sports and tourism infrastructure and more pressing development needs (Baade and Matheson 2004c). In addition, Baade and his coauthors did not limit their explorations to major sporting events but also branched out into political conventions (Baade et al. 2009), natural disasters (Baade and Matheson 2007; Baade et al. 2007), and even the Rodney King riots (Baade and Matheson 2004b). It is mildly depressing to note that one of the few papers Baade wrote over his career where he found an economic impact far greater than that claimed by officials was in the estimates of long-term economic damage from the urban riots in Los Angeles following the trial (and acquittal) of the police officers accused of beating motorist Rodney King.

As is the case with his work on stadiums, it is tempting to become frustrated when Baade's results are contrasted with the exorbitant sums that cities and countries spend attracting these events. For example, Qatar has been reported to have spent in excess of $200 billion in its preparations for the 2022 FIFA World Cup, and media networks were filled with unfounded claims that the move of the 2021 MLB All-Star Game from Atlanta would cost the city $100 million in economic benefits. But the news is not all bad. For example, the International Olympic Committee had to completely change their bidding process to include measures of economic sustainability after voters in multiple cities rejected plans to host the 2022 Winter Olympics and 2024 Summer Olympics.

5 Public Policy

Though Baade's research contributions played a leading role in developing the academic consensus that building stadiums and hosting mega-events are not productive economic development projects, economists have not been particularly influential in effecting public policy. Though Baade convincingly demonstrated the ineffectiveness of stadiums as economic development stimulants during the early part of the construction boom, sports venue construction did not wane until most existing facilities were replaced over the next two decades (Fig. 1). Furthermore, public contributions continued to grow (Fig. 2). The result is that billionaire

team owners have been enriched at the expense of taxpayers, whom politicians and community leaders continue to assure that stadiums are wise public investments. Though this outcome may be disappointing to researchers hoping to guide policymaking, Baade's persistence as a visible and informed expert provides a model for economists to emulate.

In our recent survey of academic research on the economics of stadiums, Coates, Humphreys, and I refer to the continued public support for stadiums in opposition to the overwhelming research consensus that subsidies are bad policy as "the public funding paradox" (Bradbury et al. 2023). We offer several explanations for the divergence between expert advice and policymaker actions, which I summarize briefly below:

- Market power of sports leagues: As Baade noted in his research, each sports league operates as the monopoly provider of its major league sport; thus, team owners are able to extract maximum subsidies from host communities by threatening relocation without fear of competition or replacement by another team.
- Political bargaining asymmetry: A political economy explanation is that benefits of stadiums are concentrated among team owners who have a strong interest in receiving subsidies, while the costs are distributed widely over a polity which raises the costs to organizing political opposition. Owners can exploit this asymmetry to achieve political success; thus, stadium subsidies are a product of rational political incentives.
- Advocacy reports: Stadium boosters commission private reports to counter the academic consensus, which policymakers and the public are incapable of distinguishing from credible economics research findings. They are particularly useful for promoting the unique attributes of new stadium projects. Even though Baade began his research program to improve upon such privately commissioned studies, stadium advocates continue to employ these flawed analyses as a public relations tool.
- Local growth coalitions: While economists studying stadium subsidies have focused heavily on economic and public choice incentives, sociologists have identified another more subtle but important influence. Delaney and Eckstein (2003) highlight the importance of coalitions of local business and community leaders who tend to be supportive of stadium subsidies and use their public influence to advocate for stadiums on owners' behalf. This constituency views sports events as favorable for recruiting and socializing with other local influencers, and thus they are active in supporting stadium subsidy campaigns and influencing opinions of government representatives and the general public. Their influence is often exacerbated by the participation of local media members, who are willing to repeat stadium advocacy talking points and present advocacy studies as credible documents in news stories and editorials.
- Political pandering: Political scientists have found that voters perceive all economic development projects as favorable, and thus politicians may be supportive of stadium projects to pander to this misunderstanding by rationally ignorant voters (Jensen and Malesky 2018).

No single reason seems capable of explaining the chasm between research and policy on stadium subsidies, but they all likely contribute to the persistence of stadium subsidies.

An anecdote involving Baade's research provides enlightening insight as to how his research, and the research of other economists, has been perceived by policymakers. During the late 1990s and early 2000s, sociologists Kevin Delaney and Rick Eckstein conducted careful case study reviews of several campaigns for stadium subsidies to better understand their success. The authors report how Baade's research was considered by policymakers in one city:

> *But when ignoring the studies does not work, subsidy advocates often used another approach: they ridicule the methodology or the findings. One of our own experiences overtly illustrated this strategy, although in other cases we saw it work more subtly. While we were interviewing the vice-president of a major league baseball team, he pulled out a letter forwarded to him by the president of the city council (and later mayor of that city). The council member had received from a constituent a well-informed letter summarizing economist Robert Baade's critical research about the benefits of spending public dollars for private stadiums. The constituent had even attached one of Baade's scholarly articles. What was most interesting, however, was the handwritten note from the council president to the team executive, which read, "What do I say to a constituent who makes this argument against the new stadium?" The note did not ask whether Baade's argument was correct. Instead, it requested a strategy for responding to it. Clearly, the team executive and the politician were both searching for an effective tactic to counter possible community resistance that was supported by the findings of the study. When we asked the team executive how he responded to the city council president's query, he replied that he had read the article and discovered that Baade was only reporting on stadiums built before the 1980s.* ***He then asserted, with absolutely no evidence, that stadiums built since 1989 were different.*** (Delaney and Eckstein 2003, p. 33 emphasis added)

To paraphrase the apocryphal saying: in debates over the desirability of stadium subsidies, policymakers may hear economists like Baade, but they are not listening. The perks of bringing a professional sports team to town—hobnobbing with prominent team officials and athletes, gatherings in luxury boxes and stadium clubs with business executives and other local leaders, and access to exclusive sports events—make it difficult to resist the fallacy that stadiums offer a path to economic wealth. Noneconomists are unfamiliar with the complexities of empirical research and how peer review confers credibility; hence, stadium advocates have learned to exploit this understandable ignorance with much success. No matter how consistent and overwhelming the contrary evidence, "this one will be different!" provides sufficient confirmation of an outcome that politicians and local leaders wish to be true.

As frustrating as the lack of influence that economists have had over stadium policy may be, understanding the reasons why policymakers have disregarded economists' advice can help better frame and target our research findings to influence policy decisions. I offer three suggestions as to how economists may increase their influence over stadium policy.

First, economists should continue to examine the economic effects of stadiums, even though the consensus findings appear unlikely to change. The inevitable stadium booster retort of "this one will be different!" can most easily be rebutted

with studies that explicitly examine these differences (e.g., downtown stadiums, stadiums with ancillary mixed-use developments).

Baade did not just publish one academic paper, declare the matter settled, and move on to peruse other research projects. He provided a series of studies, each examining relevant issues and improving on his past work. Following Baade's example, economists have found new ways to examine stadium impacts beyond the panel comparisons of metropolitan areas that produced convincing null findings. Economists continued to adopt new methods developed during the "credibility revolution" in empirical methods to observe localized outcomes of stadium projects with new empirical techniques and study subjects, such as difference-in-differences (Harger et al. 2016; Stitzel and Rogers 2019; Propheter 2019), spatial hedonic pricing models of repeat sales (Humphreys and Nowak 2017; Joshi et al. 2020), examining hotel stays (Depken and Stephenson 2018; Chikish et al. 2019), and synthetic control method comparisons (Islam 2019; Bradbury 2022). These are just a small sample of studies, and economists should continue to use these and other methods to evaluate new stadiums as they come into being.

Second, economists need to better convey their findings to noneconomists. For example, a recent *New York Times* article credited the civic pride benefits of Buffalo hosting an NFL team as sufficient justification to subsidize a new stadium, stating that "Critics have savaged the deal. . .But many in the city say keeping the Bills in Buffalo is good for civic pride" (McKinley 2022). Though the article reported the strong agreement among economists that fiscal benefits were scant, it failed to report the findings of extensive economic research on nonpecuniary social benefits (Johnson et al. 2001; Huang and Humphreys 2014; Humphreys and Nowak 2017) also contradict the reporter's thesis. Policy-relevant findings should not remain inside knowledge. While journalists have a responsibility to become informed on reporting subjects, researchers bear the responsibility of presenting their findings in a way that is accessible to those unfamiliar with economics jargon and esoteric empirical methods that are common in academic journals.

In general, academic researchers are not incentivized to disseminate their findings beyond academic publications, yet Baade embraced his role as an expert communicator. Baade's research was motivated to better inform policy, and he took steps to do so by publishing papers that were targeted at policymakers, talking to inquisitive reporters who quoted his findings, and speaking in public venues.

Baade's career has demonstrated that there is a wider role for economists in influencing public policy debates. Economists seeking to influence policy should engage media members where their expertise is relevant, particularly in areas where they live. While stadium construction is a common phenomenon across the country, individual municipalities rarely face this policy question given the 30-year life span of stadiums. Local reporters who cover these projects are likely assigned to other beats (e.g., sports, business, local government) and thus may not be familiar with economics of stadiums. It is incumbent upon economists to serve as resources to media members and policymakers who are in need of guidance.

Third, in an effort to assist noneconomists in evaluating commissioned studies presented to justify stadium subsidies, I recommend that economists employ an

objective rubric for evaluating commissioned economic impact studies developed by Wassmer et al. (2016). The authors provide a set of evaluative questions that can be applied commissioned studies often touted by stadium advocates to justify subsidies. In most cases, policy decisions are time-sensitive, and the analysis will be forward-looking. This set of questions provides policymakers and media members with useful information to evaluate studies through a more critical lens.

As someone who has battled against the false claims of stadium advocates for the past 15 years, I cannot say that I am optimistic; however, I believe there is a role that economists can play on the margin to limit the damage of stadium subsidies. Baade has not just worked in these trenches, he dug them. His persistence and patience as an uncompensated advocate for sound public policy regarding stadium subsidies has been a significant donation to society that should be celebrated, especially when the siren song of switching sides to collect consulting dollars exists. Baade's career should serve as an inspiration to scholars to fight the good fight simply because it is the right thing to do. Ronald Coase (1994) famously advised economists not to despair over their limited policy influence:

> *If, as I am inclined to believe, economists cannot usually affect the main course of economic policy, their views may make themselves felt in small ways. An economist who, by his efforts, is able to postpone by a week a government program that wastes $100 million a year (what I would consider a modest success) has, by his action, earned his salary for the whole of his life...It is not necessary to change the world to justify our salaries. But does the advice of economists on public policy issues improve the situation in those cases in which it does have some influence? I take [the] main purpose to be not to raise our morale but to induce us to change our ways so that our advice will be worth following. If, as a result, we achieve my modest aim, we will at least earn our keep. . . . we will confer a great benefit on mankind—and be grossly underpaid.* (p. 57)

6 Conclusion

Robert Baade has not been alone in contributing to our collective understanding of the economic impact of stadiums, but he is unarguably the first among these groups to do so. In his earliest papers, he documents the growing public funding of stadiums and anticipates the stadium construction boom that would expand public contributions. His work established the basic economics of stadiums that is still used by economists today. For this reason, he deserves special recognition as a pioneer, and I hope that on the occasion of his retirement he can not only look back on his accomplishments happily but take pride that his approach and thinking still influence the field today and will continue into the future. Salut!

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The Unshakeable Belief in the Economic Impact of Sports

Nola Agha

1 Introduction

In 1987, Rob Baade asked, "Is there an economic rationale for subsidizing sports stadiums?" (p. 1). Since that time, academic economists have found little evidence to justify public subsidies, and yet billions more have been invested in major league, minor league, and college facilities in North America. Much has been written about why politicians continue to approve taxpayer dollars for private sports enterprises despite academic evidence finding no sound rationale. This chapter explores the power, influence, and meaning of the term "economic impact" to explain why scientific outcomes are unable to influence public policy decisions.

There are three problems with economic impact. First, it will never be a precise measurement due to the host of assumptions and the nearly impossible task of following each dollar that enters and exits an economy. Second, this highly imperfect metric is considered the necessary and irrefutable measurement of something that is nearly impossible to measure. As the media repeatedly and unquestioningly reports these faulty findings, the general perception of the large, positive impact of sport is engrained as truth. Finally, the public belief in the economic impact of sports appears to be unshakeable. Longitudinal analysis of belief in the ability of the Super Bowl to generate economic activity is strong and stable and remains positive even in the periods of most negative public sentiment.

Ultimately, economic impact is a vague term that seems to imply some form of large conspicuous spending. Media reports that equate this complicated estimation process with stadiums full of cheering fans have further perpetuated the misbelief that sports economic impact is large, positive, and unfailing.

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In the face of erroneous and intractable public beliefs, the solution is to reframe the analysis in ways that are more applicable to decision-making. Governments seek a rationale for subsidizing sports and can better evaluate their choices through a straightforward financial analysis of their ability to pay. Financial analysis focuses on sources of revenue (taxes) and expenses, which are usually present in the public record and require fewer assumptions. When revenues fall short of expenses, governments must raise taxes or cut public services. In this case, a redistributive analysis identifies who would benefit and who would be harmed from a government subsidy with no clear return on investment. Before explaining these solutions in detail, I first describe several problems with economic impact and provide evidence of the persistent belief in the existence of positive economic impact from sports.

2 Problem 1: Economic Impact Is an Exceptionally Complicated Estimation Problem Full of Assumptions and Fraught with Errors

2.1 Ex Ante Studies

Consultants commonly produce economic impact estimates of future sporting events, teams, or stadiums. These ex ante studies are, by definition, an estimate because the event has not yet occurred; thus, the studies will never be "correct." They involve estimating each new dollar that enters the economy and, when performed correctly, also subtract the dollars that left the economy due to the sport property in question. Assumptions are made about how many new visitors will attend, how long they will stay, and how much they will spend each day. Those three estimates, all of which could be wrong, are then multiplied, consequently creating a larger and more imprecise number. Further assumptions might be made regarding which businesses and industries received visitor spending in order to apply the correct multiplier. Or perhaps some (fantastical) number will be called a multiplier and used to multiply all of the previously imprecise spending information to achieve some much larger imprecise estimate (Baade and Matheson 2004; Crompton 1995). The worst studies will stop at this point and call themselves "economic impact" when in fact they are only measures of positive economic activity. They will fail to consider any costs or induced losses to the economy that would provide a more accurate estimate of net change.

Ex ante economic impact is, at best, a poor estimate. Despite years of inquiry and thousands of academic studies, researchers still do not have a full understanding of all of the assumptions necessary to conduct an ex ante study. Two examples can help illustrate this problem.

First, in estimating the economic impact of a baseball team, one must endeavor to count nonlocal visitors to the ballpark. Yet, to my knowledge, there are no studies that specifically acknowledge the number of visiting team *fans* from the visiting city.

This matters because an equal number of home team fans are likely to *leave* the local economy when the home team is on the road. The solution would be to exclude the visitors who are from the visiting team's city or to specifically reduce the team's economic impact by some estimate of the number of local fans who leave the local economy every year to watch the team on the road. I can find no evidence that either of these calculations has ever been considered while estimating the economic impact of a team, thus creating an overestimation. This exemplifies the two biggest challenges of ex ante studies: overly generous assumptions and the impossibility of imagining all of the possible costs to account for them before they occur.

Second, on the subject of resident spending, the general rule in ex ante studies has been to exclude residents. Yet, Agha and Taks (2018) showed there are 72 ways a resident can affect impact: 23 positively, 23 negatively, 22 not at all, and 4 indeterminant ex ante without further data collection on spending. To determine the actual impact, researchers would have to collect data on four variables: (1) the amount spent, (2) at each business industry, (3) in each geographic location, and (4) whether the timing of that spending was affected at all by the event. Using only two or three of these variables in combination was shown to result in incorrect estimates of impact. Due to the complexity of capturing all of the necessary variables (Dimitrovski et al. 2022) and the need to survey people who are not physically present during the event (Matheson and Baade 2006), economic impact surveys rarely capture enough correct information. Instead, shorter surveys with incomplete information induce more measurement error in the economic impact estimate.

2.2 Ex Post Studies

Academic economists prefer to evaluate economic impact after an event has occurred. Whereas the largest failure of ex ante studies is the inability to capture all of the possible ways money leaves the economy, ex post approaches more inherently capture "net" changes in the economy because the possible inflows and outflows (such as crowding out or leakages) have already occurred and affected the outcome variable. Those home team fans that left the economy and took their spending with them would, in theory, be captured if the time period of analysis was long enough.

If teams produce positive production and consumption externalities, as proponents claim they do, there should be measurable pecuniary effects in spending, income, sales tax collections, or jobs. Indeed, academic studies have operationalized economic impact by using all of these variables (e.g., Baade 1996; Baade et al. 2008; Baade and Dye 1990). A single variable is clear and direct and obviates the need for ex ante assumptions. But there are downsides to using a proxy. First, if a sport generates new spending but not new jobs, for example, any study that operationalized impact with a job-related metric would miss this important finding. Second, in most cases, it is not possible to econometrically identify an effect because its magnitude is proportionally small compared to the size of the geographic unit

(Agha and Taks 2019). Rascher et al. (2020) estimate an effect would be unlikely to be identified in the 383 largest US metropolitan areas if it was less than $300 million.

2.3 Ex Ante or Ex Post? It Doesn't Actually Matter

Academics and private consultants may well disagree about unacknowledged costs and inflated assumptions forever. But almost no one reads academic papers that live behind paywalls, and almost no one reads or critiques the assumptions in 50+ page reports. And even if one wanted to read them, in far too many cases government analysis is withheld, as in the recent case of both county reports (Investigative Post staff 2022) and state reports (Heaney 2021) related to the Buffalo Bills new stadium. Regardless of academic criticisms, economic impact studies will still be commissioned and will continue to represent poor estimates of reality. Why?

3 Problem 2: Economic Impact Is the Sine Qua Non Metric That Will Magically and Irrefutably Explain the Value of Events, Teams, or Stadiums

The world's largest sporting events require staggering financial provisions from the public. National-level events such as the Super Bowl or MLB All-Star Game similarly require public funds, and professional teams in North America demand public subsidies for sports venues. At a smaller but broader level, an ecosystem of local sports commissions spends public funds to host events ranging from regional youth swimming championships to lower-level professional sporting events like World Team Tennis. In all of these cases, governments consistently use economic impact as the sine qua non metric to seek justification for their public subsidization as the best investment. Economic impact studies become the de facto report required by event organizers, team owners, and government agencies, regardless of the estimation problems addressed in the previous section.

As examples, the West Michigan Sports Commission proudly proclaimed its 2021 amateur and youth sporting events generated $55 million in economic impact for West Michigan (Sanchez 2022), and Nashville, TN, estimated hosting games for the 2026 World Cup would generate (a wildly ridiculous) $700 million in economic impact for the city (Hills 2022). These two cases illustrate three additional problems of economic impact reports: they are ubiquitous, unchallenged, and unequivocally positive.

3.1 *Problem 2a. Sport-Related Economic Impact Reports Are Ubiquitous in the News*

Try this: navigate to news.google.com and search *sports "economic impact."* You will find dozens of new articles written every week on the economic impact of player drafts, WrestleMania, stadiums, equine complexes, the Olympics, professional teams, college football, golf courses, Quidditch tournaments, amateur wrestling trials, and more. The studies either advocate for new sports funding or justify past government spending. Regardless of why they were conducted, the outcomes are reported in the news. The reports are so frequent that the average person does not question why the economic impact of youth sports in a relatively rural region of Michigan is newsworthy.

A simple explanation for the prevalence of economic impact news stories is the nexus between local news and local sports teams. The Fourth Estate Benefit suggests that providing a reporter easy access to a game will result in more coverage and attention for the team which will lead to more excitement, attention, and ticket sales (Neale 1964). Likewise, a media company with more exclusive access to a team will produce better stories leading to increases in media consumption and sales. Armbrecht and Andersson explain that sports and news "have a symbiotic relation – both feeding on, and feeding, each other" (2016, p. 111). Thus, when a team makes threats to leave a community if they don't receive public funding for a new stadium, the local news has a vested interest in ensuring the team stays. Favorable presentation of economic impact studies commissioned by the team can influence the sentiments of both the median voter and local politicians.

Another explanation for the frequency of economic impact reporting is the 50% decrease in newspaper employees as the defunding of local media has led to hundreds of local newspapers closing each year (Adgate 2021). The pressure for fewer reporters to produce the same amount of content increases the odds that press releases from sports properties regarding favorable economic impact studies will be presented as news without the time taken to evaluate the content or find opposing viewpoints. In this environment, the West Michigan Sports Commission economic impact report becomes "easy" reporting and thus newsworthy by default. Upon careful reading, the Nashville World Cup impact (Hills 2022) is nearly identical to the press release issued by the organization that commissioned the impact study (Nashville Convention and Visitors Corp 2022). There are no facts in the news story that are not in the press release except for a list of other World Cup candidate cities. The three people quoted in the new story are the same three people quoted in the press release.

3.2 Problem 2b. Economic Impact Is Unchallenged and Presented as Fact

Just as the average person does not question the newsworthiness of a sports economic impact study, both journalists and media consumers alike regularly fail to question whether economic impact (which is an exceptionally complicated estimation problem full of assumptions and fraught with errors) is the appropriate metric to evaluate the issue. In the case of public financing of stadiums and arenas, economic impact is usually irrelevant to local governments as they evaluate public funding and seek to avoid diverting funds from existing public services. Instead, a tax analysis or a financial analysis of the government's ability to repay its portion of the project is a more useful metric.

Whether because of limited employees with tight deadlines or a tendency to give sports properties the benefit of the doubt, experts who understand how to correctly compute economic impact are rarely invited to comment on news stories (Delaney and Eckstein 2008). This prevents the possibility of evaluating the methodology, questioning the assumptions, finding errors, informing readers, or raising doubt about the grandiose figures.

More often, the conclusions of the commissioned studies are presented as fact. In the case of Nashville, the headline of the newspaper story reads, "Nashville hosting 2026 World Cup could generate economic impact of nearly $700 million, study says" (Hills 2022). Well, what did other people say? I have yet to see a news report stating, "Hosting the World Cup will not generate the economic impact that you think it will, Baade and Matheson say." More neutral reporting would result in a headline that reads, "Experts disagree on the potential economic impact of World Cup Games in Nashville."

3.3 Problem 2c. The Media Frames Economic Impact As Consistently and Unequivocally Positive

Whether intentional or not, news headlines and stories frequently and unquestioningly frame the topic of economic impact optimistically by emphasizing positive reports and omitting academic reports to the contrary (Delaney and Eckstein 2008). This results in headlines such as:

- "Summer sporting events to bring $70 million to Greensboro"
- "Tulsa win: PGA Championship brings $157.7 million economic impact"
- "Discover Kalamazoo Sports reports $15.4 million in economic impact in 2021"
- "2024 NFL draft to bring at least $200 million in revenue to Detroit, Roger Goodell says"
- "American Legion Baseball Tournament expected to have economic impact on Pelham"

– "Economic impact of Iowa football exceeds $110 million"
– "Tuscaloosa Tourism & Sports reports $32M economic impact in 2021"
– "Tokyo seen having $284 bn economic impact".

Beyond headlines, the content of these stories relies on declarative sentences such as, "Philadelphia's economic impact from the 2017 draft was $95 million, and the next year, the Dallas area reported $125 million. Last year, Cleveland's economic impact was $42 million" (Front Office Sports 2022b).

By presenting the team, event, or stadium as a vehicle for unchallenged, large economic impact, the reader understands the context and meaning from a misleading view of positivity. This action is called media framing. Entman (1993) explained that to frame an issue "is to select some aspects of a perceived reality and make them salient in a communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation and/or treatment recommendation of the item described" (p. 52). Persistent verbal and visual communication direct consumers to interpret an issue in a specific way by emphasizing what happens, what is important, and what matters (Gitlin 1980). These actions then shape public opinion.

To demonstrate the power of media framing, Lu et al. (2019) experimentally manipulated media content and found they could cause changes in residents' attitudes about the Olympic Games. In the real world, media frames are affected by those with the power and authority to influence how the media filters facts and shapes reality and ultimately affects public opinion (Lu et al. 2019; Sant and Mason 2015). For example, in the period before the Vancouver Olympics, proponents continually changed their messages about the positive impact from revenues, to economic consequences, to job creation (Sant and Mason 2015). This allowed the frame to stay positive to maintain the desired message.

Thus, the widespread, unchallenged, positive framing of the economic impact of sports has led to a self-fulfilling outcome where it is taken as truth. As a consequence, we find the third problem.

4 Problem 3: Public Belief in the Economic Impact of Sports Is Unshakeable

Baade (1987) reported that 60% of city managers believed stadium construction or renovation could be justified on economic grounds. Over three decades later, the public belief in the presence of sports-driven economic impact is still strong. As evidence, I provide data from a longitudinal survey on the legacy of Super Bowl 50 which was held on February 7, 2016, in the San Francisco Bay Area. But, first, let's set the stage.

4.1 The Context of Super Bowl 50

California is relatively unique in the number of stadium funding initiatives that have been defeated. The result is a higher portion of professional sports venues constructed primarily with private funds (San Francisco Giants Oracle Park in 2000, Golden State Warriors Chase Center in 2019, and Los Angeles Rams SoFi Stadium in 2020). Similarly, residents of San Francisco have historically shown little desire for public funds for stadium projects (Agostini et al. 1996). Super Bowl 50 was not played in San Francisco, but the city hosted the majority of visitors' overnight stays, the NFL's public and private fan festivals, and hundreds of corporate parties and events. The city's central business district also bore the brunt of the disruptions caused by organizing so many events. For example, the NFL's free fan festival called Super Bowl City was located above the region's busiest transit station, required the re-routing of 21 bus and streetcar lines for 3 weeks, and closed 14 streets (Agha and Taks 2018). At least 14 other Super Bowl-related events required street closures including red carpet events, private parties, and the NFL Owners' Dinner (ISCOTT 2016).

Super Bowl City was designed to be a free and fun public spectacle celebrating the event. In line with San Francisco's activist mentality, it was also the stage for protests against removing homeless for the event; protests against the police killing of Mario Woods, a young black man, 2 months prior; and protests by Uber drivers regarding their working conditions (Steinmetz 2016). The result was free fan festivities and live concerts mixed with heavily armed security (Wong 2016).

To further demonstrate the general local distaste for the event, the Super Bowl's art and cultural installation of creative signs in scenic locations throughout the city were vandalized in ways that reflected this sentiment. The words "Super Bowl" were rearranged to read "Sup Bro," "Superb Owl," "Oops," and "Up R Bowel" (Dowd 2016; Pape 2016).

4.2 Public Sentiment Toward Super Bowl 50

Beyond these subjective and possibly nonrepresentative acts of vandalism, graduate students at the University of San Francisco collected specific consumer sentiment data from online user comments from local news articles that related to the Super Bowl. Data collection took place over 4 weeks: 1 week before the Super Bowl City build-out; 1 week during Super Bowl City construction; 1 week when Super Bowl City opened and when the game and the bulk of parties, hospitality, and fan events took place; and 1 week during the post-event Super Bowl City teardown (in total, Thursday, January 18, 2016, to Thursday, February 14, 2016). The user comments were analyzed both qualitatively and quantitatively.

A qualitative content analysis of the user comments identified three specific negative themes: traffic around Super Bowl City was terrible, the security to get

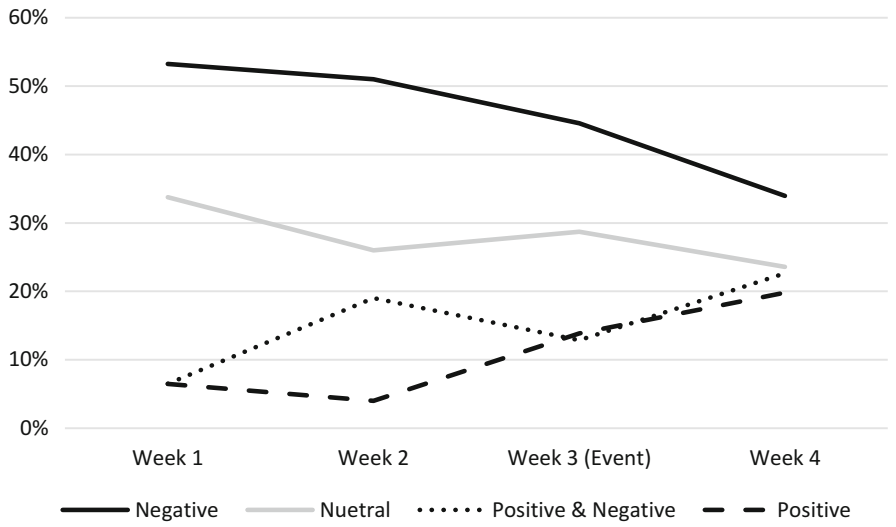

Fig. 1 Sentiment of comments about the Super Bowl over the period before, during, and after the Super Bowl City fan festival

into Super Bowl City was excessive, and the funding for Super Bowl 50 was not properly allocated. On the positive side, Super Bowl City was viewed as a family-oriented event that was good for the community.

In a study of Olympic cities, Kassens-Noor et al. (2019) found each city has its own trajectory in terms of timing of sentiment, although they found the proportion of negativity peaked before the event and then turned more positive as the event unfolded. Based on this, we expected the quantitative analysis of the comments to follow similar trends with increasing levels of positive sentiment during the event. Indeed, user opinions were strongly negative before the event with over 50% of the comments expressing negative sentiment in weeks 1 and 2 (Fig. 1). The proportion of purely positive comments was lowest in the second week when Super Bowl City construction began and traffic disruption fully materialized. As the event neared, purely positive comments increased but at their peak reached only 20% of total comments.

4.3 In a Period of Negative Public Sentiment, the Belief in Positive Economic Impact Persisted

A longitudinal survey on the legacy of Super Bowl 50 was conducted annually from 2016 to 2020. The first data collection took place 1 week before the event from January 24 to January 31, 2016. There were 616 usable responses to an online survey that was distributed through digital new sources in all nine counties in the greater

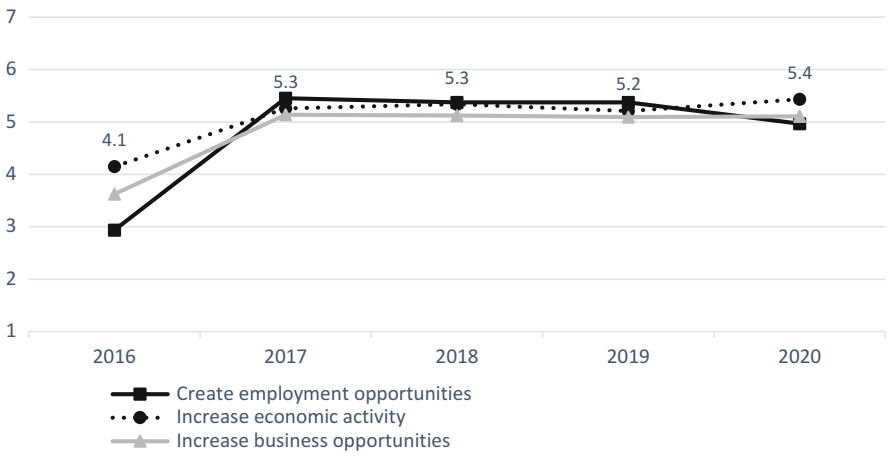

Fig. 2 Average extent of agreement (1 = *strongly disagree*, 7 = *strongly agree*) that the 2016 Super Bowl had positive economic effects. Note: Data labels are for "Increase economic activity"

Bay Area. In subsequent years, data were collected in person throughout all nine counties. Using stratified random sampling, responses were proportional to the fraction of each county's population to the total (Alameda 24%, Contra Costa 19%, Marin 4%, San Francisco 13%, San Mateo 7%, Santa Clara 25%, Solano 4%, Sonoma 4%, Napa 2%). Approximately 400 surveys were collected each year from 2017 to 2019. In 2020, the emergence of covid, stay-at-home orders, and people's general unwillingness to interact with strangers dropped the overall response to 235 useable surveys.

As part of a larger project, the survey included ten different demographic- and event-related questions plus 22 legacy items (seven-point Likert scale, 1 = *strongly disagree*, 7 = *strongly agree*). The remainder of this section focuses on three positively worded items related to economic impact. Respondents were asked, "Please indicate the extent to which you agree or disagree that the 2016 Super Bowl will do the following:

– Create employment opportunities.
– Increase economic activity.
– Increase business opportunities".

One week before the 2016 Super Bowl, respondents generally disagreed that the Super Bowl would create employment opportunities ($M = 2.9$, $SD = 1.8$), increase economic activity ($M = 4.1$, $SD = 1.8$), or increase business opportunities ($M = 3.6$, $SD = 1.7$). Even so, Fig. 2 shows that views on economic activity (the dotted line) never fall below the 4.0 level of indifference. This general negative view of the event in 2016 is consistent with research showing that media outlets publish more pessimistic stories before a large event (Buarque 2017; Zaharopoulos 2007) which corresponds to generally negative public sentiment.

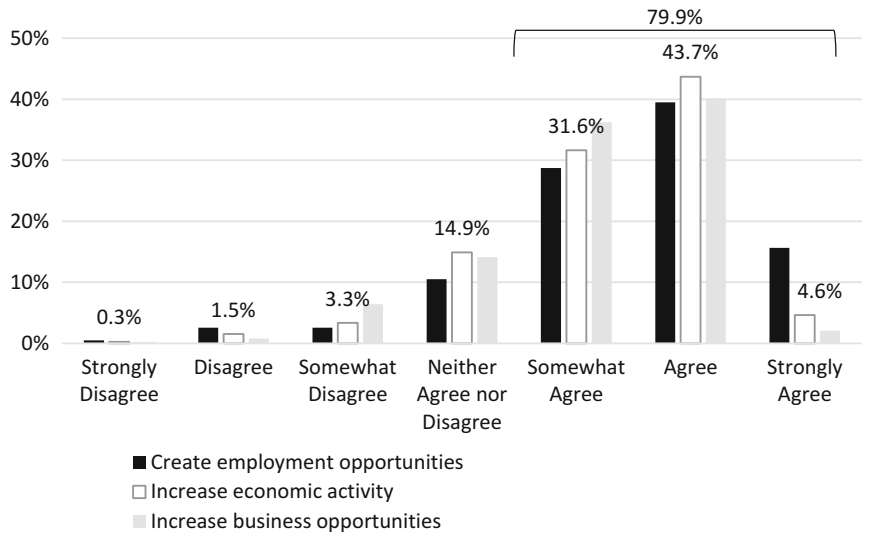

Fig. 3 2017 distribution of responses that the 2016 Super Bowl had positive economic effects. Note: Data labels are for "Increase economic activity"

In all post-Super Bowl years, "increases economic activity" ranges between an average of 5.2 and 5.4, which falls between Somewhat Agree and Agree (Fig. 2). Employment opportunities ($M = 5.3$) and business opportunities ($M = 5.1$) have very similar results. The most noteworthy outcome is the consistency of responses when not affected by the recency of the event. People rebound to a consistently positive view of sports events as leaving a beneficial legacy for jobs, businesses, and the economy.

Since averages can be misleading, Fig. 3 presents the distribution of responses in 2017 when 79.9% of respondents reported they somewhat agree, agree, or strongly agree that the Super Bowl increases economic activity. The results are consistent for every future year: 80.6% in 2018, 76.8% in 2019, and 79.6% in 2020.

On the other hand, Fig. 4 illustrates how different 2016 is from the remainder of the years. As alluded to above, the saliency of the event is exceptionally important. Despite negative media framing and sentiment before the event, a majority of respondents (52.8%) still agreed that the 2016 Super Bowl would increase economic activity, whereas only 28.6% agreed there would be an increase in employment opportunities, and 37.5% agreed there would be an increase in business opportunities. The belief in positive economic activity persists even in a period of negative sentiment and is stronger than other perceived gains from the event.

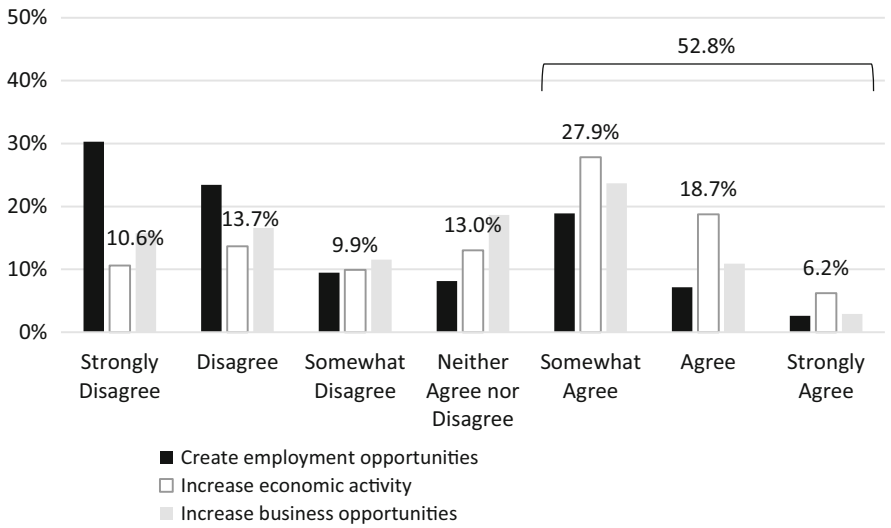

Fig. 4 2016 distribution of responses that the 2016 Super Bowl had positive economic effects. Note: Data labels are for "Increase economic activity"

4.4 Conclusion

The more negative coverage an event receives, the more negative the attitudes and public opinion toward the event (Lu et al. 2019; Sant and Mason 2015). But as established above, while this downward shifting pattern was similar for economic impact, the majority of people still believed it to be positive. At a time when public sentiment was primarily negative, when asked if the 2016 Super Bowl would increase economic activity, 52.8% of respondents somewhat agreed, agreed, or strongly agreed. In the years after Super Bowl 50, absent negative event coverage, the level of agreement was consistently 80%, indicating the acceptance of sports economic impact is unshakeable. Why?

5 Why Is the Public Belief in Positive Economic Impact So Persistent?

As established above, there is an overabundance of unchallenged, overly positive coverage of the economic impact of sports properties. Two additional reasons underlie this unwavering belief.

5.1 Direct Spending Isn't Economic Impact (But People Think It Is)

Most people believe that "economic" relates to money (Econlib 2022), and Merriam Webster defines "impact" as a significant or major effect. Thus, a rudimentary synonym for economic impact would be "significant amounts of money." This basic conceptualization is often reported in media framing, for example, the $55 million in "direct spending" in West Michigan (Sanchez 2022), and reinforces a simplistic belief that economic impact is equivalent to the appearance of large amounts of money.

Most readers would never know economic impact is contentious, difficult to compute, and worthy of careful reporting as it is rarely, if ever, defined when results are reported. This allows for errors and overstated assumptions to be easily reported as truth because they are framed as "significant amounts of money." For instance, in its economic estimates of the World Cup, the Nashville study erroneously took the $15 million cost of stadium renovations and treated it as "direct spending" that generated $36.4 million in positive impact gains. The result is the average person does not know what economic impact is, yet they think they understand what it means.

5.2 Conspicuous Spending Isn't Economic Impact (But People Think It Is)

Economic impact is often framed as conspicuous consumption. Imagine how often you've seen a local news report that sounds something like, "We're here at [insert your favorite stadium] where crowds are arriving for opening day. These bars are full and local businesses are thrilled." This type of reporting is found in verbal, visual, and written news. In its coverage of the 2022 F1 Monaco Grand Prix, Front Office Sports used a beautiful image of the Monaco harbor full of enormous yachts and, beyond it, the bay full of mega yachts larger than the buildings on shore (Front Office Sports 2022a). Notably absent were F1 race cars.

Not only is conspicuous spending an incorrect conceptualization of economic impact, it leads to the most common mistake in overestimating economic impact by ignoring inconspicuous and invisible costs: losses, leakages, and crowding out of both residents and normal visitors (Fourie et al. 2011).

We can visually see mega yachts in Monaco but not the typical tourists who were crowded out that week. We see the people who are spending money in full stadiums but not the 50% of team revenues paid to players who spend most of it outside the local economy (Siegfried and Zimbalist 2000). On nongame days, there are no TV reporters outside of stadiums saying, "Well folks, it's quiet here, the bars are empty, and there is no big spending happening today." On away game days, no worried headlines are touting, "Lots of money left the economy this weekend with all of the

	Total	Retail	Restaurants	Fast Food	Attractions
Δ Week 1 (1/23/16 - 1/29/16)	-18.0%	-11.7%	-24.6%	-15.6%	-14.7%
Δ Week 2 (1/30/16 - 2/5/16)	1.0%	-5.8%	13.7%	2.7%	-15.6%
Δ Week 3 (2/6/16 - 2/11/16)	9.7%	-3.9%	23.1%	30.6%	-6.2%
Δ Total	-3.5%	-7.1%	1.0%	3.5%	-12.4%

Fig. 5 Aggregate change in YOY sales by store type by week at Pier 39. (Source: Letter from Pier 39 CEO Taylor Safford to San Francisco Mayor Edwin M. Lee, March 8, 2016)

Bills fans traveling to Massachusetts to play the Patriots." Nor do we see the residents who stay home to avoid big traffic jams on game day.

During Super Bowl 50, conspicuous spending was prevalent in the news and focused on wealth, privilege, and excess consumption. Articles were written on the thousands of private jets arriving for the game (Rubenstein 2016), hot dogs sprinkled with real gold (Disbrow 2016), $1 million hospitality packages (de Guzman 2016), homeowners using Airbnb to rent out their properties for $10,000 or more per night (Said 2015), and endless stories on the 281 exclusive VIP parties filled with celebrities and stars.

In terms of inconspicuous costs, San Francisco experienced displacement of small merchants and street vendors (Johnson 2016) and slower business after a week of Super Bowl preparations (Koeppel 2016a). Two of the city's Fortune 500 businesses instructed their employees to work from home which resulted in a further reduction in normal economic activity (Agha and Taks 2018). In San Jose, airport traffic, hotel occupancy, and conferences were below normal levels (Heller and Stephenson 2021; Meacham 2016b), while downtown merchants saw overall lower business (Meacham 2016a). The South Beach Mission Bay Business Association, a group of businesses in an area adjacent to Super Bowl City, surveyed their members after the event and reported revenue losses for restaurants, dog groomers, and hair salons alike (Koeppel 2016b). And Pier 39, one of the city's largest tourist attractions, released a report to the mayor and the Super Bowl Host Committee indicating an overall decrease of 3.5% in sales (Fig. 5).

Although these inconspicuous costs were reported in the news, they were not fully included in the economic impact report. Nor did they make the same splash as the headline declaring, "Study: Super Bowl 50 Brought $240 Million Boost To Bay Area Economy" (Super Bowl 50 Host Committee 2016).

When the media frame of economic impact is conspicuous spending, it has no relationship to the correct definition yet reinforces the inappropriate and misleading belief that sports impacts are positive and large. This then reinforces the steadfast belief in the positive economic impact of sports.

6 How Do We Move Forward? What Is the Solution?

As academics, it appears we've lost the battle on media framing. If government agencies require ex ante economic impact studies and businesses still commission them, if mass media continues to report them as fact, and if people continue to believe economic impact is the appropriate metric to identify large, positive gains from sports, what can be done?

To answer this, we first have to understand the objective. In 1988, Baade and Dye asked, "Should local governments subsidize the construction and operation of sports stadiums?" (p. 265). Decades later, in 2022, this remains a pertinent question as politicians in Nashville, Buffalo, and Oakland each ponder spending $1 billion or more for replacement of NFL and MLB stadiums. Our goal is to help elected officials determine if there is a compelling government justification to intervene to more equitably or efficiently allocate resources. If welfare economics is our foundation, then we are identifying the alternative in which the marginal social benefit exceeds the marginal social cost by the largest amount. More simplistically, the government should have the capacity to pay for the stadium in a way that does not harm residents or that does not redistribute wealth from poor to rich. For all of the reasons discussed above, economic impact is a poor tool to make that assessment and achieve these goals. Instead, financial analysis and redistributive analysis are terms that have not been co-opted by overly positive headlines and are more straightforward forms of investigation that can better inform decision-makers.

6.1 Financial Analysis Better Represents the Government's Ability to Pay

Because study after study shows that teams, stadiums, and large events do not induce broader pecuniary economy-wide gains (Agha and Rascher 2021; Bradbury et al. 2022), the justification for public funding should be focused on a more specific government ability to pay for sports projects.

When a headline proclaims, "Super Bowl 50 Brought $240 Million Boost to Bay Area Economy," it implies the businesses and individuals within the Bay Area are the beneficiaries of economic impact. This distracts from the more important subject of analysis—the governmental units that provided funding (the cities of San Francisco, San Jose, and Santa Clara) but that did not receive $240 million in return. The economic impact figure is misleading when the real government gain from a Super Bowl is a small portion collected from sales, use, or hotel taxes. In the case of Super Bowl 50, the city of San Francisco spent $4.9 million and received $5.3 million in incremental hotel taxes (Bay City News 2016). The actual government gain is exceptionally important because it allows decision-makers to assess their ability to fund a sporting entity. Why would this simplistic financial analysis be an

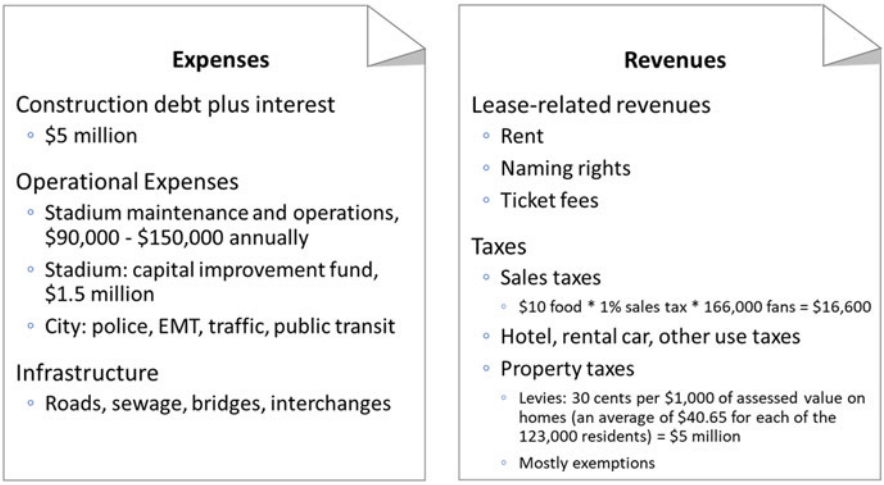

Fig. 6 Example of a financial analysis for the Cedar Rapids Kernels

improvement since it misses some important and inconspicuous costs that more realistically explain the overall effect of the event on the community?

First, in the vast majority of cases, financial analysis is more informative for decision-makers because it is easier to measure and understand. Underlying data on taxes, budgets, and spending is often publicly available which results in fewer erroneous assumptions. Figure 6 illustrates the primary expenses associated with most projects: construction, operational expenses, and infrastructure improvements. Revenues generally come from the sports property through items in leases and formalized contracts or from taxes levied in the area of interest.

As a brief case study, consider the expenses related to the Cedar Rapids Kernels a Class A affiliate of the Minnesota Twins. In 2002, the city spent $5 million to build Veterans Memorial Stadium. The city is also responsible for maintenance and capital improvements at the stadium although the specifics have varied over time depending on the lease agreement with the team. The city contribution was about $90,000 a year from 2002 to 2011 when it increased to about $150,000. By 2012, the team asked for and received a $3 million capital improvement fund of which $1.5 million came from Cedar Rapids.

On the revenue side, the Iowa state sales tax rate is 5%, with an optional 1% directed to the local government. If a hot dog and beer cost $10, local sales tax is 1%, and attendance is 166,000, then Cedar Rapids will earn $16,600 annually in sales tax revenue. Of course, this is incorrect not only because it is illegal to sell alcohol to children, but it also assumes every one of those 166,000 purchases was by a visitor who came to Cedar Rapids solely for the game. A handful of visitors might spend the night which could result in hotel, food, and rental car taxes. Except an equal number of Cedar Rapids fans might travel outside the city to see away games, taking an equivalent amount of spending (and thus tax revenues) out of the city. Property taxes

can also be used to pay off stadium debt and Cedar Rapids residents voted to impose a property tax levy of 30 cents per $1000 of assessed value on homes, for an average of $40.65 for each of the 123,000 residents.

In this simplistic accounting, the $5 million stadium construction cost was covered through property taxes, but even with overly generous and incorrect assumptions about sport-induced spending, city tax revenues are not sufficient to pay for capital improvements, annual operational expenses, and the unknown but real city expenses for games. This type of financial analysis is also beneficial for events since cities are often required to waive consumption taxes and provide specific direct payments to the host committees (e.g., the Super Bowl, FIFA World Cup, or Olympics). In most sports projects, the gulf between government revenues and expenses is so large that even blatantly false assumptions about sport-induced spending would lead to the same conclusion that the city would be unable to pay for its portion of the project. Academic research continues to support this idea—even if net new direct expenditures occur, they are insufficient to cover the public subsidy (Bradbury 2022b; Depken and Stephenson 2018; Matheson and Baade 2006).

Second, governments can justify spending that does not produce a financial ROI when there are other social benefits derived from pecuniary or nonpecuniary spillover effects. But studies consistently show sports investments lead to social costs or social benefits that are insufficient to justify funding (e.g., Bradbury et al. 2022). Illustrating the financial risks associated with lower-than-expected tax revenues can focus attention on the other city services that could suffer, which leads to the second solution.

6.2 *Redistributive Analysis Identifies Broader Harms or Benefits*

At the most simplistic level, distributive justice is defined as who gets what, with a particular focus on socially just outcomes. In assessing sports subsidies, the question is whether they will widen or narrow the gap between those with abundant resources and those with few. There are four pathways by which sports subsidies lead to private benefits and public costs through redistributing money, power, and resources within communities.

Benefits to Private Businesses

A new stadium is the largest contributor to increases in team valuation. As an example, Forbes estimated the NFL Minnesota Vikings were worth $1.6 billion in 2015. After opening a new stadium that received $800 million in public funds, it took only 2 years for the team value to reach $2.4 billion and the public subsidy to be fully capitalized into the private value of the team. New venues are constructed with

the intent to maximize revenue with smaller capacities and more luxury features, special clubs, suites, and courtside amenities that provide exclusivity and therefore higher prices that accrue to private team owners. Typical to nearly every new venue, the Buffalo Bills revealed a personal seat license (PSL) plan that would enable them to generate nearly a quarter of a billion dollars after already receiving $1 billion in public funding for a new stadium (deMause 2022).

Real estate transfers and gains are common as governments negotiate with private businesses during stadium development (Erie et al. 2010) or engage in land swaps in preparation for large events (Karmatz 2001). As Whitson and Horne explained, "...just like in Japan, the biggest boosters of Vancouver's Olympic bid have been the Vancouver corporate sector – precisely the group that stands to get most of the public money that will be spent on construction and promotion" (2006, p. 85).

Benefits to Individuals

In the case of North American professional sports franchises, their provision is not continuous—either government subsidies occur and the team stays locally or the team leaves. To the extent that residents positively value professional teams or sporting events, public subsidies allow them to experience community pride, happiness, and increased morale (e.g., Bradbury et al. 2022). Residents who attend games benefit from venues with more amenities, better sight lines, and improved concessions. Those who can afford it benefit from the increase in luxury seating and services. Whether fans or not, individual property owners can benefit from rising property values adjacent to some newly constructed venues (e.g., Bradbury et al. 2022) but not all (Propheter 2022).

Costs to Individuals

Residents who negatively value professional teams or sporting events will experience a disamenity from their presence, frustration at their existence, and no positive feelings of civic pride. Non-sports fans and sports fans alike experience increased traffic, congestion, noise, crime, and pollution (e.g., Bradbury et al. 2022).

Event attendees experience rising costs with new venues. The Buffalo Bills announced existing ticket holders would need to pay between $500 and $16,500 per seat for a PSL that would give them the right to purchase season tickets for between $900 and $3500. As a consequence, new stadiums make live entertainment increasingly unavailable to those who can least afford to pay.

Individual and corporate investors who benefit from increased property values also increase rents and reduce affordable housing. Since new stadiums tend to be built in low-income, racially diverse areas that are gentrifying (Lauermann 2023), sports developments often use eminent domain to displace residents. In the United States, thousands of homes have been seized and destroyed to build stadiums for the Los Angeles Dodgers, San Diego Padres, Atlanta Falcons, Atlanta Braves, Dallas

Cowboys, and Texas Rangers (Notte 2016). Outside the United States, 720,000 people were forcibly moved before the Olympics in Seoul, 1.5 million in Beijing, and thousands more in Rio (Donahue 2020).

Public Cost

Public costs can come in the form of increased expenses for event operations, stadium maintenance and capital improvements, construction debt, or new infrastructure. Public costs can also result from decreased revenue such as when developers, construction projects, or event operators receive tax exemptions or when a tax increment financing district reallocates new tax revenues away from existing city services. According to the last thorough analysis of the issue, Long (2012) found the typical new venue had hidden costs of $89 million for land, infrastructure, and lost property taxes.

The consequence of too few revenues and too many expenses can be an increase in local taxes (Bradbury 2022a), a reduction in public services (Whitson and Horne 2006), or delays in other needed capital projects (Baade 1996). Classic examples include the excessive debt from the Montreal Olympics (Whitson and Horne 2006) or Cincinnati raising sales taxes and property taxes, selling a hospital, laying off 1700 county employees, and delaying investments in schools and public transit (Preston and Kuriloff 2013). In suburban Atlanta, Cobb County closed libraries, reduced hours, laid off employees, cut police, and raised taxes to be able to pay their portion of debt for the Atlanta Braves' new stadium (Bradbury 2022a; deMause 2018).

Public Costs Lead to Additional Costs to Individuals

Alexander et al. (2000) estimated the debt incurred for stadium projects is equivalent to about half of a city's budget for housing and community services and 91% of its budget for highways. As illustrated above, when revenues fall short and stadium debt must be paid, the result is a reduction in public services that produce the greatest harm to those who rely most on those services and have the least capacity to adapt. These redistributions are not theoretical but are documented, as above, in both academic literature and popular press. In practice, public costs are ultimately costs to individuals.

6.3 Summary

When politicians contemplate public subsidies, they make normative judgments about what is "best," "fair," or "socially desirable," and, in theory, the government should not decrease efficiency or equity. At its core, a redistributive analysis

highlights the potential for concentrated benefits to a small number of powerful individuals and businesses at the expense of dispersed costs to the general public (Fort 2000). Because redistributive analysis requires fewer assumptions than for economic impact and focuses on the government (paying entity) as the source of analysis, it should, in theory, lead to better public policy decisions.

7 Conclusion

Media framing of positive economic impact has led to an unwavering public belief that is deeper and more powerful than transitory negative news about sporting events. The few stories that ask for expert academic opinion (e.g., McKinley 2022) are not sufficient to counteract the overwhelming onslaught of headlines touting, "NBA All-Star game brought almost $250M to Cleveland" (Slawson 2022). The belief that sports have positive "economic impact" is unshakeable.

In 1996, Baade observed, "To attract or retain a team, cities are offering staggering financial support and rationalize their largesse on economic grounds" (p. 1). In 2022, the situation is no different. Academic economists who find evidence contrary to promises of large positive gain continue to wonder how our scientific outcomes can make their way to public policy decision makers. It is my position that we should stop trying to change the engrained belief in economic impact and instead shift to financial and redistributive analysis that reframes the public subsidy conversation in terms of real and more important outcomes for residents and communities.

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The Local Economic Impact of Phantom College Football Games: Evidence from North Carolina

Craig A. Depken II

1 Introduction

The local economic impact of sporting and cultural events has been the focus of a large literature. While the evidence is mixed, it appears that many sporting events have minimal net economic benefits to the host city. Those events that appear to have positive economic impact tend to be multiple-day events such as the NFL Super Bowl or the MLB World Series. This paper contributes to the literature focusing on the economic impact of NCAA football games using a novel source of variation during the 2020 and 2021 COVID-19 pandemic. Specifically, the impact of actual games is coupled with "phantom" games that were scheduled before the 2020 college football season but were subsequently canceled because of the pandemic.[1]

Previous studies of economic impacts have relied upon the exogenous variation in events created by third-party schedulers (for regular season events) and end-of-season outcomes (for postseason events). For instance, in Coates and Depken (2009, 2011), Depken and Stephenson (2018), and Collins et al. (2022), the timing of events is generally outside of the control of the host city. Regular season professional and college games are scheduled by third parties that are ostensibly not connected with business owners in the host city. Therefore, the variation in event timing can reasonably be considered exogenous to the economic activity being modeled. Postseason bowl games are actively pursued by the host city even though the host

[1] I distinguish phantom games from "ghost games," which is the term applied to games played without fans. Ghost games were very common in European football (soccer) in the 2020–2021 season (see, e.g., Endrich and Gesche 2020; Fischer and Haucap 2021; Cross and Uhrig 2022).

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committee has limited control over the timing of the event. Postseason mega events such as the NFL Super Bowl are scheduled long in advance, and therefore the timing of the event can be reasonably considered exogenous to the economic activity that is being modeled.

Exogenous events that lead to games being cancelled are relatively rare. Noticeable exceptions include the Loma Prieta earthquake that suspended the 1989 Major League Baseball World Series, the aftermath of Hurricane Katrina in 2005 during which the NFL New Orleans Saints played their regular season games in San Antonio, Texas, and Oklahoma City, OK, and various other hurricanes and storms that have led to the cancellation of individual college and professional football, baseball, and basketball games. However, not until the fall of 2020 was there a widespread cancellation of previously scheduled games after which most of the games were not played at all. These cancelled games provide a novel source of variation for investigating the local economic impact of college football games. Many games were cancelled long in advance of their originally scheduled date, such as the FCS schedules that were cancelled or postponed until the spring 2021, whereas other games were cancelled days or a few weeks in advance because one or more players tested positive for the COVID-19 virus, thereby invoking protocols that called for games to be cancelled.

In this paper, I consider cancelled games as a different type of counterfactual to games that were played. Most often, all non-game days are used as a counterfactual to game days. In this paper, the "phantom games" are considered different than regular game days and traditional non-game days. It is of interest whether games that were cancelled have negative impacts on local economies and, if so, these negative impacts on the local economy should be considered part of the total social cost of the COVID-19 protocols in college football.

To preview the results, using monthly county data from the state of North Carolina from July 2015 to July 2022, the evidence suggests that FCS games played have a negative but statistically insignificant impact on the local economy, whereas FCS phantom games have a negative and statistically significant (at the 10% level) impact on the local economy. Not surprisingly, given that FBS schools typically draw more attention than FCS schools, FBS games played have a positive and statistically significant impact on the local economy, but FBS phantom games have a larger negative impact on the local economy, perhaps because FBS phantom games are also associated with students leaving campus and spending money outside of the host county. The evidence also suggests that invitational games, where the teams playing are not from the host county, have a relatively large impact on the local economy.

2 Context and Literature Review

The primary focus of this paper is college football games played in the state of North Carolina. College football has various levels of competition, and teams are most often associated with a conference of similar schools. While there are waves of conference realignment in college football, most teams in the state of North Carolina have been in the same conference for several years which provides a level of certainty in terms of rivalries and fan interest. College football games are most often played on Saturdays, although there are occasionally games played other days of the week, most notably Thursday and Tuesday nights. College football games are often considered drivers of local economic activity by university and college officials and local politicians as the games attract fans from both teams that often live outside of the host city and spend money during the weekend of the game on hotels, meals, tailgate provisions, school memorabilia, and merchandise.

There have been several papers investigating the impact of college football games on local economic activity that show a net positive but modest impact on total local economic activity in the month of a home game. Baade et al. (2008) investigate the impact of home college football and men's basketball games for Florida State University (in Tallahassee, Florida) and for the University of Florida (in Gainesville, Florida) from 1980 to 2007. They find that basketball games have no statistically significant impact on the local economy but that home football games generate approximately $2 million per game. Baade et al. (2011) study a wider array of cities and find no statistically significant impact of college football games on employment or personal income of the host cities.

Coates and Depken (2009) focus on the impact of home football games in four medium-sized cities in Texas. They find that college football games played by in-state rivals generate a significant level of taxable sales. Coates and Depken (2011) show that, among many other sporting and cultural events held in the state of Texas, college football games had modest net impacts on host city taxable sales. They also show that a home game in Waco, home to Baylor University, might have the same magnitude impact on the city's economy that Super Bowl XXXVIII had in Houston, Texas, in 2004. In the context of professional football games, Depken and Fore (2020) show that NFL Carolina Panthers games have positive impacts on restaurant revenues and average spending per customer in center city Charlotte.

This paper's context is college football played (and not played) in the state of North Carolina from 2015 to 2022. The innovation is that in the fall of 2020 many college football games that had been scheduled, sometimes years in advance, were cancelled or postponed because of the ongoing COVID-19 pandemic. For example, North Carolina schools Duke, North Carolina State, the University of North Carolina at Chapel Hill (UNC Chapel Hill), and Wake Forest University, all members of the Atlantic Coast Conference, played only conference opponents during the 2020 football season; all nonconference games were cancelled. Three other schools that play in the FBS, Appalachian State, the University of North Carolina at Charlotte (UNC Charlotte), and East Carolina, all experienced several games that were

postponed, rescheduled, or cancelled. North Carolina schools in the FCS delayed much of the fall football schedule in 2020 to the spring of 2021; thus, there were many games postponed or rescheduled from their original fall dates.

College football schedules are often determined years in advance, and fans often plan their attendance to various games long before the event. Thus, when games were cancelled in the fall 2020, it is likely that there were many fans of both teams that had planned to visit the host team for the game but, instead, did not visit. Games that were not played on their originally scheduled date, whether they were rescheduled or cancelled, are considered "phantom games" and provide a novel source of variation to help explain variations in local economic activity.

There is a large and growing literature that investigates the local economic impacts of sporting and cultural events in general. Early papers focus on aggregate data that are not necessarily the most effective means of detecting statistically significant impacts of the events. The early literature provided mixed results but generally supported the idea that there were significant increases in economic activity associated with mega events such as the National Football League's Super Bowl or Major League Baseball's World Series. However, smaller events, such as lower-tier college bowl games or regular season professional games, have relatively little net impact on economic activity in the host city. Over time, more granular data have become available both geographically and temporally allowing for a more nuanced analysis of the net economic impact of these events.

3 Data and Empirical Methodology

The primary variable investigated here is monthly county sales tax revenue for the 100 counties in the state of North Carolina from 2010 to 2022. Sales tax revenues are obtained from the North Carolina Department of Revenue. I collect cancelled, postponed, and actual college football games from espn.com and individual school websites. Deviations between the actual schedule played and that which was originally scheduled are considered phantom games. For certain schools, such as UNC Charlotte and East Carolina, there were changes to the 2020 football schedule that took place before the season started; for example, UNC Charlotte cancelled an early-season game with UNC Chapel Hill. Other games were cancelled during the season. For example, UNC Charlotte cancelled a game with Old Dominion University scheduled for November 14, 2020, only a few weeks before the game was to be played. UNC Charlotte then scheduled a substitute game with Gardner-Webb for the same day, but that game was subsequently cancelled a few days before it was to be played.

For each month-county observation in North Carolina, I identify the number of actual and phantom football FBS and FCS games. I also identify which month-county observations have college football invitational games, defined as football games between two teams that were not located in the hosting county, for example, Mecklenburg County (which contains UNC Charlotte) hosts two invitationals per

Table 1 North Carolina counties with FBS or FCS schools

County	School #1	School #2	School #3
Alamance	Elon (FCS)		
Cleveland	Gardner-Webb (FCS)		
Durham	Duke (FBS)	NC Central (FCS)	
Forsyth	Wake Forest (FBS)		
Guilford	NC A&T (FCS)		
Harnett	Campbell (FCS)		
Jackson	Western Carolina (FCS)		
Mecklenburg	UNC Charlotte (FBS)	Davidson (FCS)	Johnson C. Smith (FCS)
Orange	UNC Chapel Hill (FBS)		
Pitt	East Carolina (FBS)		
Wake	NC State (FBS)		
Watauga	Appalachian State (FBS)		

Table 2 Actual and phantom college football games (Jul 2015 to Jul 2022)

County	FBS games played	FBS phantoms	FCS games played	FCS phantoms
Alamance	0	0	34	7
Cleveland	0	0	36	5
Durham	43	5	37	7
Forsyth	42	2	0	0
Guilford	0	0	30	7
Harnett	0	0	36	3
Jackson	0	0	33	6
Mecklenburg	38	4	38	12
Orange	44	2	0	0
Pitt	42	2	0	0
Wake	46	2	0	0
Watauga	43	1	0	0

year – the Duke's Mayo Kickoff game and the Duke's Mayo Bowl (previously the Belk Bowl).

Table 1 lists the North Carolina counties that host one or more FCS or FBS schools along with the schools hosted. Mecklenburg County has three FBS or FCS teams, whereas Durham County has two. There are other college football teams in North Carolina, but they are all at levels of competition below the FCS level and are most often associated with relatively little attendance and expected impact on local economic activity. Table 2 lists the number of FBS and FCS actual and phantom games that occurred in each host county. As can be seen, Wake and Mecklenburg counties experienced the most actual FBS or FCS games, respectively. On the other hand, Durham and Mecklenburg counties experienced the most phantom FBS or FCS games, respectively. Overall, there were 18 phantom FBS games and 47 phantom FCS games during the sample period. It is anticipated that FBS and FCS games would have a positive or insignificant impact on county tax revenues as the games

Table 3 Descriptive statistics of the data

Variable	Mean	Std. Dev.	Min	Max
TAXREV	5,879,129	1.3×10^7	52,003.57	1.46×10^8
FCSGAMES	0.0251	0.2251	0	4
FCSPHANTOMS	0.0048	0.1049	0	4
FBSGAMES	0.0307	0.2550	0	4
FBSPHANTOMS	0.0018	0.0574	0	3
INVITATIONALS	0.0013	0.0393	0	2
PANDEMIC	0.1340	0.3406	0	1
d12TAXREV	507,960.10	1,729,498	-2.15×10^7	3.39×10^9
d12FCSGAMES	0.0034	0.2111	−3	4
d12FCSPHANTOMS	0.0003	0.1568	−4	4
d12FBSGAMES	0.0052	0.1817	−2	3
d12FBSPHANTOMS	0.0000	0.0867	−3	3
d12INVITATIONALS	0.0003	0.0359	−1	2
d12PANDEMIC	0.0000	0.5314	−1	1

Notes: Sample contains 9700 month-county observations from July 2015 to July 2022. The prefix "d12" indicates a 12-month difference

attract noncounty residents to visit for the game and spend additional money that would otherwise have been spent outside of the county. However, consistent with previous studies, it is possible that college football games have a net insignificant impact on local economic activity if nonresidents crowd out resident spending at sufficiently high levels.

The following estimating equation is specified:

$$\begin{aligned} TAXREV_{imy} = {} & \beta_1 FCSGAMES_{imy} + \beta_2 FCSPHANTOMS_{imy} + \beta_3 FBSGAMES_{imy} \\ & + \beta_4 FBSPHANTOMS_{imy} + \beta_5 INVITATIONALS_{imy} \\ & + \beta_6 PANDEMIC_{my} + \alpha_i + \delta_m + \gamma_y + \varepsilon_{imy}, \end{aligned}$$

where *TAXREV* is the sales tax revenue for county $i \in (0, 100)$, in month $m \in (1, 12)$, year $y \in (2015, 2022)$, α's are county fixed effects, δ's are month fixed effects, γ's are year fixed effects, and ε is a zero-mean error term. The explanatory variables include the number of FBS games (*FBSGAMES*), FBS phantom games (*FBSPHANTOMS*), FCS games (*FCSGAMES*), FCS phantom games (*FCSPHANTOMS*), the number of invitationals that involve two teams not located in the county (*INVITATIONALS),* and an indicator variable that takes a value of one if the month was during the pandemic from March 2020 to March 2021 (*PANDEMIC*).[2]

Table 3 provides the descriptive statistics of the data. The average monthly county tax revenue during the sample period is $5.87 million with a minimum of

[2]The estimating equation is not a full analysis of the economic impact of college football games as it is not a full cost-benefit analysis as described by Kesanne (2005) and Taks et al. (2011).

$52 thousand (Tyrrell County) and a maximum of $145.45 million (Mecklenburg County). The average number of FCS games is 0.02 with a maximum of 4 (Cleveland and Mecklenburg counties), the average number of FBS games is 0.03 with a maximum of 4 (Durham County), and the average number of invitationals is 0.001 with a maximum of 2 (Mecklenburg County).

The innovation in this paper is having specific counterfactual dates on which FBS and FCS games had been scheduled and advertised in advance but were cancelled or postponed. On average the number of FCS phantom games in a given month is 0.004 with a maximum of 4, whereas the average number of FBS phantom games in a given month is 0.001 with a maximum of 3.

One concern is that the sales tax data might not be stationary over time. A Levin-Lin-Chu (2002) panel unit root test with one lag yields a test statistic of 4.89 ($p = 1.00$) which suggests non-stationarity with one lag. Following Coates and Depken (2009, 2011), I take 12-month differences of the dependent and independent variables. A Levin-Lin-Chu panel data unit root test on the 12-month difference in sales tax revenue yields a test statistic of -9.20 ($p = 0.00$), suggesting that the 12-month difference is stationary. Taking the 12-month difference of the original estimating equation wipes out the α's and δ's and reduces the γ's to a single constant term β_0. Estimation is applied to the 12-month differenced data using ordinary least squares with standard errors clustered by county. The 12-month difference in the indicator variable for a month of the pandemic controls for various campus policies that mandated various remote learning policies, some of which allowed students to stay on campus in restricted living arrangements or required that students leave campus to return home for remote learning. In these months, it is anticipated that taxable activity would be lower regardless of whether actual or phantom football games occurred.

From Table 3, the year-over-year differences indicate that the average 12-month tax revenue change was $507 thousand with a minimum of $-$21.49 million (Mecklenburg County) and a maximum of $33.93m (Mecklenburg County). The 12-month change in games played ranges from -3 to 4 for FCS games and from -2 to 3 for FBS games. The 12-month change in phantom games ranges from -4 to 4 for FCS games and from -3 to 3 for FBS games. Finally, the 12-month change in invitational games ranges from -1 to 2.

4 Empirical Results

The empirical results are reported in Table 4. The impact of FCS games on county sales tax revenues is negative but not statistically significant. The average impact of an FBS game on host county sales tax revenue is positive with an estimated impact of $142,634 which is statistically significant at the 10% level and, at the prevailing state sales tax of 4.5%, corresponds to an increase in local taxable activity of approximately $3.16 million (= $142,634/0.045), which is very close to the estimated impact of $2 million in Baade et al. (2008). These results also compare

Table 4 Estimation results

Variable	Coefficient
d12FCSGAMES	−21,521
	(124,562)
d12FCSPHANTOMS	−692,444
	(466,423)
d12FBSGAMES	142,634*
	(77,161)
d12FBSPHANTOMS	−1,267,902**
	(590,576)
d12INVITATIONALS	2,803,249***
	(293,542)
d12PANDEMIC	−487,809***
	(140,882)
Constant	506,203***
	(109,748)

Notes: Dependent variable is the 12-month difference in county sales tax revenue. Sample contains 8500 month-county observations from July 2015 to July 2022. The prefix "d12" indicates a 12-month difference. Standard errors clustered by county reported in parentheses. The constant term is the average annual growth rate sales tax revenue over the sample period. *, **, *** indicates $p < 0.10$, $p < 0.05$, and $p < 0.01$, respectively

favorably to those from Coates and Depken (2011) which investigated the impact of college football games on sales tax revenue in host cities in Texas: insignificant positive impacts for FCS games and an estimated impact of $85,739 for FBS games. The differences might be the sample period (the Coates and Depken sample ends in 2008), the jurisdictions modeled (Coates and Depken model city tax revenue, whereas here I model county tax revenue), or the teams and events involved (Texas college football teams compared to North Carolina college football teams).

The impact of invitational football games in North Carolina is estimated to be approximately $2.80 million in additional tax revenues to the host county in the month of the invitational. This result is statistically significant and, at the prevailing state sales tax of 4.5%, corresponds to approximately $62.2 million (= $2.80m/0.045) in net additional spending associated with each invitational football game. These results differ from the results in Coates and Depken (2011) who find that NCAA bowl games and the Big 12 Championship game (which correspond with the Duke's Mayo Bowl and the ACC Championship game held in Mecklenburg County in the present study) had net negative impacts on sales tax revenues for host cities in Texas. Perhaps the differences arise because of the sample period, the jurisdictions modeled (city vs. county), or that the events in Texas are large enough to induce significant reductions in local spending through a crowding-out effect that does not occur in North Carolina.

The focus of this paper is the impact of phantom FCS or FBS football games, which were games scheduled but postponed or cancelled because of the COVID-19

pandemic. The results in Table 4 suggest that FCS phantom games each had an average negative impact on county sales tax revenues of −$692,444, but the parameter is not statistically significant. A test of the null hypothesis that the impact of FCS games is equal to that of FCS phantom games yields an F-statistic of 3.25 ($p = 0.07$), suggesting that the null cannot be rejected at conventional significance levels. However, the total net negative impact of a cancelled FCS game on a host county sales tax revenue is the difference between the two estimated coefficients of $670,922, which is statistically significant at the 10% level, and corresponds to an estimated decrease in economic activity of approximately $14.8 million.

The average impact of a phantom FBS game on host county sales tax revenues is estimated to be −$1,267,902 which is statistically significant at the 5% level. A test that the estimated impact of actual FBS games is equal to the negative of the estimated impact of phantom FBS games yields an F-statistic of 3.94 ($p = 0.05$) suggesting that the phantom FBS games might have had a larger negative impact on local sales tax revenue than actual FBS games played. The total net negative impact of a cancelled FBS game is the difference between the estimated impact of an actual FBS game and the estimated impact of a cancelled FBS game, estimated at approximately $1.41 million, which is statistically significant at the 5% level and corresponds with a reduction in economic activity of $31.3 million.

The final two parameters are those of the pandemic indicator variable and the constant term. The former suggests that, on average, county tax revenues fell by $487k during the peak pandemic months from March 2020 to March 2021. The latter suggests that average year-over-year growth in county sales tax revenues during the sample period was approximately $506k.

Overall, the empirical results suggest that the phantom FBS games had a larger net impact on host county tax revenues than FBS games that are played. The insight is not that the phantom games should have been played. Rather, the phantom games occurred during the height of the COVID-19 pandemic, and once FBS games were cancelled, the net impacts were larger. Indeed, a rough estimate is that the 18 cancelled FBS games in the fall of 2020 cost the host counties a combined $43.7 million in lost tax revenues, which should be included when calculating the total costs of the COVID-19 protocols. Future research could focus on the reasons behind this: was it because of students who left town after games were cancelled, were locals less likely to spend in the hospitality industry after a game was cancelled, or were there other reasons for reduced spending associated with a cancelled game?

5 Conclusions

This paper contributes to the literature that investigates the impact of sporting and cultural events on the local economy. Following Coates and Depken (2009, 2011), this paper models monthly county sales tax revenue in North Carolina as a function of FCS and FBS regular season games, invitational games, and county, month, and year fixed effects from 2015 to 2022. However, during the fall of 2020 (and to some

extent the spring of 2021), the COVID-19 pandemic led to many previously scheduled football games to be postponed or cancelled. A total of 18 FBS games were cancelled in the fall of 2020, and 47 FCS games were cancelled during the fall of 2020 and spring of 2021 in the state of North Carolina. These phantom games are included in the analysis as a separate set of "what if" games that serve as additional counterfactuals to actual games played.

The evidence suggests that cancelled FCS games had a negative but statistically insignificant impact on county sales tax revenue. The impact of phantom FCS games was also not statistically different than the impact of actual FCS games. On the other hand, FBS games had a positive and statistically significant impact on local sales tax revenue. However, phantom FBS games had a larger negative impact on sales tax revenues. This suggests that cancelled FBS games not only reduced spending by out-of-county residents but that there was additional lost taxable activity during the months when FBS games had been cancelled. This is in addition to the generic decrease in tax revenues that occurred during the pandemic months. Thus, phantom FBS games cost counties more than other counties during the pandemic. A final finding is that invitational games, such as early-season "kickoff" games, conference championships, and postseason bowl games, contribute a considerable amount to county tax revenues in the months they are held.

The results pertaining to regular season college football games in North Carolina compare favorably with results from Baade et al. (2008) and Coates and Depken (2011) who investigate the impact of college football games in Florida and Texas, respectively. Where the results here differ from Coates and Depken (2011) is in the impact of invitationals, which were associated with negative changes in local sales tax revenue in Texas but with positive changes in local sales tax revenue in North Carolina. Future research might investigate the causes of these differences in greater detail.

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Growth Effects of Sports Franchises, Stadiums, and Arenas: 15 Years Later

Dennis Coates

1 Introduction

In 1995, Brad Humphreys and I began studying the influence of stadiums and sports franchises on local economies. A bit surprising to us at the time was the fact that others had already delved into the issue, Robert Baade, in particular, both with Richard Dye (Baade and Dye 1988, 1990) and alone (Baade 1996). Perhaps remarkably, the findings from Baade's work have stood up quite well; the evidence on the economic impact of stadiums and franchises is at best small, most likely nonexistent, and at worst detrimental to per capita income, just as he found. This contribution reflects and honors the influence Rob Baade has had on the study of the economic influence of sports on metropolitan economies.

The study that Humphreys and I published in 1999 built upon the work of Baade and Dye (1988, 1990) and Baade (1996) by utilizing panel data methods and expanding the data to include all metropolitan areas that had any of an NFL, NBA, or MLB franchise at some point between 1969 and 1994. We found the presence of major sports franchises to have no significant impact on the growth rate of per capita personal income and to be negatively correlated with the level of per capita personal income in our sample. This paper returns to the questions asked by Coates and Humphreys (1999) using an additional 17 years of data and a number of new stadiums, arenas, and franchise movements. The data here cover 1969 through 2011 and add hockey and soccer franchises to the mix. They also include all standard metropolitan statistical areas (SMSAs) rather than just those areas that housed

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franchises in the major professional leagues. The analysis also adds two new dependent variables: wage and salary disbursements and wages per job. The results here are generally similar to those of Coates and Humphreys (1999); the array of sports variables, including the presence of franchises, arrival and departure of clubs in a metropolitan area, and stadium and arena construction, is statistically significant. However, individual coefficients frequently indicate a negative relationship between sports and per capita income, wage and salary disbursements, and wages per job.

Sports is big business, especially team sports such as football, basketball, and baseball. Whether the issue is contracts for professional players, broadcast rights, or universities switching conferences, the amounts of money seem unreal to most people. Given the money that changes hands in the business of sports, the belief that this business has a large influence on the local economy of the cities or metropolitan areas where the teams play is natural. Indeed, communities around the country are told frequently of the large economic effects of building a new stadium or arena and of acquiring or losing a team. Cities, counties, and states often find a way to subsidize construction of sports facilities and, in recent times, to subsidize operating expenses, too; they do so partly in response to the promised economic results.

The size and even the existence of these effects have been the subject of a large body of literature over the past 20 years. Several reviews of the literature exist, and this paper will discuss the broader literature in more detail in the next section. Coates and Humphreys (1999) was the first study in this literature to include in a single (time-series cross-sectional) regression all the cities that hosted at least one franchise from the National Football League (NFL), National Basketball Association (NBA), or Major League Baseball (MLB) at any point during the period 1969 to 1996. Moreover, that study's analysis includes variables for stadium and arena construction, for entry and exit of franchises, and for stadium and arena capacities, as well as for the presence of franchises for each of the three sports separately. Coates and Humphreys refer to this array of variables as the *sports environment*. They found that the entire sports environment matters for the level of real personal income per capita, in the sense that the array of sports variables is jointly statistically significant. But contrary to the promised increase, the presence of a major sports franchise lowers the income.

Whereas the array of sports variables is jointly statistically significant, few of the variables are individually so. Joint significance combined with individual insignificance can occur if individual variables are highly correlated and separating their individual influences is not possible. One solution to this problem is to obtain more data. As previously stated, this study returns to the analysis of Coates and Humphreys (1999) but with an additional 17 years of data. In the intervening period, a large number of new stadiums and arenas have been built, more teams have relocated, and some new teams have come into existence. In addition, a large number of stadiums built in the early and middle 1990s have now been around well beyond their "honeymoon" period, thus enabling an examination of their long-term effects that was not possible in the original Coates and Humphreys paper. Also, this expanded dataset provides the potential to get more precise estimates of the effects

of individual sports and the effects of entry and exit both because there are more SMSAs and years, which means more entries and exits, and because the inclusion of the NHL and MLS allows for reducing possible contamination of NFL and, especially, NBA effects due to correlations with those other sports. Moreover, the expanded data enables a reassessment of the two questions posed by Coates and Humphreys in 1999: (1) whether franchises, stadiums, and arenas affect the level of income per capita in a community and (2) whether they alter the rate of growth of income per capita.

The results of this exercise are largely consistent with the findings of Coates and Humphreys (1999) and of numerous other studies that have found that the effect of sports franchises and stadium and arena construction on local economies is weak or nonexistent. Indeed, franchises, stadiums, and arenas may be harmful rather than beneficial to the local community. Moreover, the results are not limited to per capita personal income but hold also for wage and salary disbursements and wages per job, two outcomes not considered by Coates and Humphreys in 1999.

The next section of this paper provides a summary of the existing literature on the effect of sports franchises on local economies. Subsequent sections describe the data, the estimating strategy, and the results, respectively. The final section restates the main findings and the contribution of this paper.

2 Literature

The literature on the effects of stadiums and sports on local economies began in earnest with papers by Robert Baade and Richard Dye (Baade and Dye 1988, 1990) and Baade (1996). Baade and Dye (1990) examine data covering 1965 to 1983 for nine cities and find that the effect of a stadium or franchise on the level of real income in those cities is uncertain. They also estimate that a stadium has a negative effect on a city's share of the region's income. Using a much larger sample than in Baade and Dye (1990), Baade (1996) shows no effect on income. His focus then turns to the city's share of state employment in the amusement and recreation sector and in the commercial sports industry. Baade's analysis focuses on ten cities covering the years 1964–1989 for Cincinnati and 1977–1989 for Denver. The results are mixed. For some cities, the number of stadiums—or the number of teams—is positive and significant. For others, the variables are negative and significant or not significant. When the cities are pooled into a single sample, neither the number of teams nor the number of stadiums is statistically significant.

Coates and Humphreys (1999) criticize the methodologies used by Baade and Dye (1990) and Baade (1996) for two reasons. First, the models suffer from omitted variable bias. The analyses have too few controls for the circumstances of the local and national economies and, in the case of Baade (1996), treat all sports and all facilities as if they would have equal effects. Coates and Humphreys (1999) suggest that it is likely that a football stadium used for games fewer than ten times a year would have a different effect than a baseball stadium used 81 times a year. Hence,

they split the sports variables by sport and facility type. Second, the dependent variable in many specifications is defined as a share variable. An increase in the city's share of state or regional employment may mean that overall employment rose—just faster in the city than elsewhere—or it may mean that the city took jobs from the rest of the state or region. The latter possibility is good for the city but clearly bad for the rest of the state. However, the former is not necessarily good for anyone, even the city. Suppose the stadium or franchise effect reduces employment everywhere, but by more outside the city than within it. In such a case, the city's share of employment will rise, but the stadium or franchise will not benefit either the city or the state. For those reasons, Coates and Humphreys (1999) eschew share variables in their analysis, focusing instead on the level and growth rates of real personal income per capita in the metropolitan areas.

Since Coates and Humphreys (1999), the literature on the effect of franchises and sports facilities on local communities has expanded rapidly. Although the focus on changes in income remained (Gius and Johnson 2001; Nelson 2001, 2002; Wassmer 2001; Santo 2005; Rappaport and Wilkerson 2001; Lertwachara and Cochran 2007; Austrian and Rosentraub 2002; Davis and End 2010), subsequent research also looked for effects (1) on employment and wages by sectors of the economy (Coates and Humphreys 2003, 2011; Hotchkiss et al. 2003; Miller 2002); (2) on sales tax collections (Coates 2006; Coates and Depken 2009, 2011; Baade et al. 2008); (3) on rents (Carlino and Coulson 2004; Coates and Gearhart 2008; Coates and Matheson 2011); (4) on property values (Tu 2005; Feng and Humphreys 2008; Humphreys and Feng 2012); (5) on hotel occupancy rates (Lavoie and Rodríguez 2005; Depken and Stephenson 2018); and on the daily foot traffic of nearby businesses (Abbiasov and Sedov 2023). Analysis expanded to specific events, including all-star games, championships, and mega-events such as the Olympics or FIFA (*Fédération Internationale de Football Association)* World Cup (Hotchkiss et al. 2003; Madden 2006; Porter 1999; Porter and Fletcher 2008; Baade and Matheson 2001, 2004a, 2006; Coates and Humphreys 2002; Coates 2006, 2012, 2013; Coates and Depken 2011; Matheson 2005; Coates and Matheson 2011; Leeds 2007); strikes and lockouts (Coates and Humphreys 2001; Zipp 1996); auto racing (Baade and Matheson 2000; Coates and Gearhart 2008); and collegiate events such as bowl games and the NCAA (National Collegiate Athletic Association) Men's Basketball Final Four Championship (Baade and Matheson 2004b; Baade et al. 2011; Coates and Depken 2009, 2011). For more details on the literature, see Siegfried and Zimbalist (2000, 2006), Coates and Humphreys (2008), Coates (2007), and Bradbury et al. (2022).

Few studies have found evidence that sports franchises, stadium or arena construction, or hosting of events such as the Olympics, World Cup, or Super Bowl generates benefits measurable in greater incomes, employment, or tax collections across broad metropolitan area economies. The two most prominent of these studies are Carlino and Coulson (2004) and Hotchkiss et al. (2003). Findings from both studies have been questioned, and the studies and their criticisms are discussed in detail. Carlino and Coulson (2004) use data from the 1993 and 1999 versions of the American Housing Survey to estimate a pseudo-panel model of rents in the 60 largest metropolitan areas. Their models include a dummy variable for the presence of an

NFL team as well as an array of housing, neighborhood, and city characteristic variables. Focusing on their results for housing units within the central city of the metropolitan areas, they report that the presence of an NFL franchise induces about an 8% increase in monthly rent. Carlino and Coulson interpret this increase as a measure of the social benefit of the football team. However, when observations from outside the central city are included, the estimated impact of the franchise becomes statistically insignificant, with four of five point estimates negative. Coates et al. (2006) criticize Carlino and Coulson's analysis of the central city observations for a variety of methodological issues, including the sensitivity of the results to inclusion or exclusion of some explanatory variables whose presence dramatically alters the sample size. In addition, a separate paper in this volume analyzes Carlino and Coulson's results and finds that their results don't hold for housing prices and that the high subsidies required by stadiums result in reductions in housing prices.

Hotchkiss et al. (2003) find that the 1996 Atlanta Olympics had a beneficial effect on employment and wages. Using a difference-in-differences approach, they estimate that counties that hosted events or were near to counties that hosted events saw employment grow 17% faster than counties that neither hosted nor were near to counties that hosted events. Their results suggest smaller and statistically weaker effects on wages. One issue with this study is the authors' interpretation of their results. For example, the estimating equation includes a dummy variable for counties that hosted events or were near to counties that did so (*VNV*), a dummy variable that indicates the period after the event (*POST*),[1] and the interaction of these dummies (*VNV* × *POST*). The omitted category is, therefore, counties that are neither host counties nor near host counties in the period before the Olympics. In their Table 1, Hotchkiss, Moore, and Zobay report the estimated coefficients on these variables as −0.2551 (*VNV*), 0.1788 (*POST*), and 0.1719 (*VNV* × *POST*), respectively, each of which is statistically significant at the 1% level or better. On the basis of the last coefficient, they conclude that employment increases 17% more in *VNV* counties than in non-*VNV* counties after the Olympics relative to employment in non-*VNV* counties before the Olympics. That observation is true, but it is misleading. Employment in the non-*VNV* counties grows faster after the Olympics than before the Olympics, also at a rate of about 17%, indicated by the coefficient on *POST*. In other words, relative to the non-*VNV* counties in the pre-Olympic period, both *VNV* and non-*VNV* counties have employment growth of about 17%; that is, hosting has no effect.

In their Table 2, Hotchkiss et al. (2003) report the results of interacting the *VNV*, *POST*, and *VNV* × *POST* variables with a linear time trend. For the log employment equation, the trend variable coefficient is 0.0035, the coefficient of the trend-*VNV* interaction is −0.0027, the coefficient of the trend-*POST* interaction is 2.1×10^{-5}, and that of the trend-*VNV* × *POST* interaction is 0.0018. Of these coefficients, only the trend-*VNV* and trend-*VNV* × *POST* coefficients are individually significant.

[1] In practice, this variable always took value of one for several quarters before as well as during and after the event.

Table 1 Metropolitan statistical areas hosting at least one professional sports franchise

Atlanta–Sandy Springs–Marietta, GA	Milwaukee–Waukesha–West Allis, WI
Baltimore–Towson, MD	Minneapolis–St. Paul–Bloomington, MN–WI
Boston–Cambridge–Quincy, MA–NH	Nashville–Davidson–Murfreesboro–Franklin, TN
Buffalo–Niagara Falls, NY	New Orleans–Metairie–Kenner, LA
Charlotte–Gastonia–Rock Hill, NC–SC	New York–Northern New Jersey–Long Island, NY–NJ–PA
Chicago–Joliet–Naperville, IL–IN–WI	Oklahoma City, OK
Cincinnati–Middletown, OH–KY–IN	Orlando–Kissimmee–Sanford, FL
Cleveland–Elyria–Mentor, OH	Philadelphia–Camden–Wilmington, PA–NJ–DE–MD
Columbus, OH	Phoenix–Mesa–Glendale, AZ
Dallas–Fort Worth–Arlington, TX	Pittsburgh, PA
Denver–Aurora–Broomfield, CO	Portland–Vancouver–Hillsboro, OR–WA
Detroit–Warren–Livonia, MI	Raleigh–Cary, NC
Green Bay, WI	Sacramento–Arden–Arcade–Roseville, CA
Greensboro–High Point, NC	Salt Lake City, UT
Hartford–West Hartford–East Hartford, CT	San Antonio–New Braunfels, TX
Houston–Sugar Land–Baytown, TX	San Diego–Carlsbad–San Marcos, CA
Indianapolis–Carmel, IN	San Diego–Carlsbad–San Marcos, CA
Jacksonville, FL	San Jose–Sunnyvale–Santa Clara, CA
Kansas City, MO–KS	Seattle–Tacoma–Bellevue, WA
Los Angeles–Long Beach–Santa Ana, CA	St. Louis, MO–IL
Louisville–Jefferson County, KY–IN	Tampa–St. Petersburg–Clearwater, FL
Memphis, TN–MS–AR	Virginia Beach–Norfolk–Newport News, VA
Miami–Fort Lauderdale–Pompano Beach, FL	Washington–Arlington–Alexandria, DC–VA–MD–WV

Taken together, the coefficients indicate that employment in host counties and counties near host counties trends downward before and after the Olympics, although less quickly after the Olympics.

Feddersen and Maennig (2013) also cast doubt on the findings of Hotchkiss et al. (2003). First, rather than the quarterly data used by Hotchkiss, Moore, and Zobay, Feddersen and Maennig analyze monthly employment data. Consequently, their figures focus more precisely on the time period of the event and the pre- and post-event periods. Second, Feddersen and Maennig have data by sector. Hence, the effects of hosting the Olympics can be traced to those sectors where they are most likely to occur, such as tourism, so that employment growth in unlikely sectors, such as manufacturing or financial services, is not attributed to the Olympics. Their conclusions are that (1) there is no persistent evidence of long-term employment boost attributable to the Olympics and (2) any increases that occurred were exclusively in Fulton County, the host to most of the events, during the month of the competition. Feddersen and Maennig's use of disaggregated data also reveals that

Table 2 Host-city and full sample wage and income variables

	Observations	Mean	Standard deviation	Minimum	Maximum
Host-city sample					
Personal income per capita	1978	$15,750	$3661	$8510	$31,815
Growth rate of personal income per capita	1932	0.0141	0.0006	n.a.	n.a.
Wage and salary disbursement	1978	$2.82E+07	$3.46E +07	$1,162,520	$2.75E +08
Growth rate of wage and salary disbursement	1932	0.0216	0.0008	n.a.	n.a.
Wage per job	1978	$19,648	$3246	$14,325	$43,172
Growth rate of wage per job	1932	0.0053	0.0005	n.a.	n.a.
Full sample					
Personal income per capita	15,738	$13,399	$3292	$4804	$38,651
Growth rate of personal income per capita	15,372	0.0136	0.0002	n.a.	n.a.
Wage and salary disbursement	15,738	$5,258,417	$1.52E +07	$15,561	$2.75E +08
Growth rate of wage and salary disbursement	15,372	0.0197	0.0003	n.a.	n.a.
Wage per job	15,738	$16,826	$2662	$10,926	$43,172
Growth rate of wage per job	15,372	0.0033	0.0005	n.a.	n.a.

Note: *n.a.* not applicable

the increased employment is limited to three sectors: arts, entertainment, and recreation; retail trade; and accommodation and food services.

The upshot is that doubt has been cast on the two most prominent academic pieces reporting positive general economic benefits, Carlino and Coulson (2004) and Hotchkiss et al. (2003). Consequently, Coates et al. (2006) and Feddersen and Maennig (2013) imply there is little evidence of general increases in income, wages and employment, tax collections, or rents and property values associated with the sports environment.

What other favorable evidence exists comes bundled with unfavorable evidence, as in the case of Baade and Dye (1990), described previously. Within a given city, although a broad-based benefit may be absent, localized benefits may exist. For example, property values near a stadium or arena may increase, as Tu (2005), Feng and Humphreys (2008), and Humphreys and Feng (2012) find. Each of these studies explicitly addresses the possibility that the effect of a stadium or arena may vary over the metropolitan area. In each case, property values are the dependent variable, with distance from a facility the explanatory variable of most interest. Each study finds that properties closer to the facility have higher property values. As distance from the

facility grows, the boost to property value declines. Coates and Humphreys (2006) and Ahlfeldt and Maennig (2012) find support for this possibility in referendums on stadium subsidies that show that the likelihood of a favorable vote is greater in precincts closer to the facility than in precincts farther away.

Indeed, localized benefits of this sort form the basis for some recommendations for stadiums and arenas as effective methods of urban revitalization (Austrian and Rosentraub 2002; Rosentraub 2006; Cantor and Rosentraub 2012; Nelson 2002; Santo 2005). These studies suggest downtown revitalization is beneficial, even at the cost of losses imposed on citizens living outside the central city. Indeed, the studies argue that urban renewal in the central city benefits the entire metropolitan area, though not in ways that are reflected in personal income. Coates (2007), however, contends that this urban renewal argument is just one of several forms of justification for income redistribution associated with stadium and arena development projects.

3 Data

The data for this project come from multiple sources. The dependent variables in the analysis are personal income per capita, wage and salary disbursements, and wages per job, which come from the US Department of Commerce's Bureau of Economic Analysis (BEA) website. Coates and Humphreys (1999) focus on personal income per capita and the growth in personal income per capita, but their subsequent work includes analysis of wages and salaries within specific sectors of the economy (Coates and Humphreys 2003) and analysis of earnings (Coates and Humphreys 2011). Wage and salary disbursements and wages and salaries per job are included in this analysis to enable focus on labor income as in these later studies.

The data cover the period 1969–2011 for each of 366 BEA metropolitan statistical areas (MSAs). These metropolitan areas are cities and all or parts of the economically integrated surrounding counties. The BEA consistently defines each area over the entire period by going back and adjusting the original data to be consistent with the modern circumstances. Of the 366 MSAs, 46 were home to a franchise in one or more of the American Basketball Association (ABA), MLB, Major League Soccer (MLS), NBA, NFL, or National Hockey League (NHL) for some period during the years from 1969 to 2011. Table 1 lists the 46 MSAs that hosted a franchise; the remaining 320 MSAs are listed in an appendix that is available on the Internet or by request to the author.

Personal income per capita, wage and salary distribution, and wages per job are deflated using the national annual average of the CPI-U (consumer price index for all urban consumers), with 1982–1984 equal to 100. Table 2 provides descriptive statistics for these income variables, for both the full sample and the host-city subsample. For the 366 MSAs over the time period, the average growth rate in real personal income per capita is 1.3%. The average level of real personal income per capita is $13,399 (over 15,738 local area–years, or 43 years for each of 366 MSAs). Mean growth in real personal income per capita in these 46 areas is

1.41% per year; mean real personal income per capita is $15,750. For areas that never had a franchise, the growth rate of real personal income per capita is 1.36%, and mean real personal income per capita is $13,062. Average annual population in the areas that had franchises is 2.75 million; for those that never had a franchise, the average annual population is 256,493. Average annual population growth rates are 1.30% for the areas that had franchises and 1.29% in areas that did not. Neither the growth rate of real personal income per capita nor the population growth rates are statistically significantly different between areas with and without franchises.

The explanatory variables in the models include the lagged value of the dependent variable, whether that variable is the level, the log, or the growth rate; population growth; an array of sports environment variables; city and year effects; and city-specific time trends. The sports environment variables are defined as in Coates and Humphreys (1999) with the addition of variables indicating NHL franchises, ABA franchises, and before and after hosting the Winter or Summer Olympics.

Each sport has a variable that indicates if an area hosted a professional team from that sport during a specific year. For example, in the New York City area, the MLB dummy variable will have a value of 1 in every year because the area had an MLB team in every year from 1969 to 2011. However, for the Washington, DC, area, the MLB dummy will be 1 for the years 1969, 1970, and 1971, when the Washington Senators played, and for the years 2005–2011, when the Washington Nationals played. But the MLB dummy will have a value of 0 for 1972–2004, the period when Washington, DC, was without an MLB franchise. Similar variables identify the years in which the areas had NFL, NBA, NHL, and MLS franchises. Note that no area had an MLS franchise before 1996, the year the league was founded. The analysis does not account for the presence of professional soccer clubs before 1996 although several short-lived leagues existed. Likewise, the analysis makes no accounting of the various short-lived football and hockey leagues, except the teams from those leagues that joined the NFL or NHL.

The ABA began play in the mid-1960s and competed against the NBA until the two leagues merged in the mid-1970s. Similarly, the American Football League (AFL) began play in 1960 and merged with the NFL in 1970. The two leagues agreed to a merger in 1966, with the creation of the Super Bowl being part of that merger agreement. However, the two leagues did not integrate their schedules until 1970. The analysis includes the ABA as a separate league for the few years of its existence in the early years of the data, and the cities that hosted teams in this league are so identified. For the period when the ABA joined the NBA, its existence is reflected in the NBA variable, and the ABA variable becomes 0. Those cities that did not join the NBA—Louisville and St. Louis—obviously have a value of 0 for the NBA variable. Because all the clubs from the AFL merged into the NFL and the agreement to merge came before 1969, the earliest year of our data, cities hosting AFL clubs in those early years are identified as having NFL clubs.

During the analysis period, areas acquired and lost teams. Areas that lost teams generally did so because an existing team moved to another area though MLS lost three teams that were dissolved. Cities obtained teams either by attracting an existing

team away from some other area or by being granted an expansion franchise. Cities and states have spent a great deal of money playing the stadium game. They have offered—or have been forced—to build a stadium to keep a team from leaving town or to bring a team to town, either through expansion or relocation of a franchise. The analysis includes variables that identify the year a team arrived in an area and the subsequent 9 years. Other variables identify the year a franchise fled a location and the subsequent 9 years. Franchises from all five sports relocated, and all the leagues expanded, so franchise arrival and departure indicators exist for all five sports. Variables for construction of a stadium or arena in each sport are also included. These too identify the first 10 years a facility is open. Stadium capacity and capacity squared are included for each sport as is an indicator of whether a stadium has multiple uses (i.e., houses both football and baseball teams or only one). Likewise, a variable identifies arenas that house both an NBA and an NHL franchise. Another variable identifies the small number of years a basketball club played in a domed stadium to allow for the possibility that attendance might be affected by the additional capacity or because sight lines and the viewing experience are poor in these facilities.

Finally, four variables identify the pre- and post-Olympic host periods for Los Angeles, Atlanta, and Salt Lake City. All four variables have a value of 1 in each of the 2 years before and after the event and in the year of the event. This overlap is done because identifying prior and posterior effects of a midyear event is impossible with annual data.

4 Empirical Model

The empirical approach taken in this paper is to estimate a panel data model with and without clustered standard errors. Clustering is by the MSA and allows the error term for each MSA to have a unique variance. Clustering has no effect on coefficient estimates, but it does alter the standard errors of the estimates, thereby leading to potentially different inferences from hypothesis tests. Formally,

$$y_{it} = \alpha_i + \gamma y_{it-1} + \sum_{j}^{J} \beta_j x_{jit} + \partial_i t_i + \mu_t + \varepsilon_{it},$$

where y represents the outcome of interest (either the level, the log, or the growth rate of real personal income per capita; wage and salary disbursements; or wages per job); x represents the explanatory variables (such as the sports environment variables); t_i indicates an SMSA-specific time trend; α, γ, β, δ, and μ are parameters to be estimated; and ε is a random error with a mean of 0 and variance that may differ by metropolitan area i.

The model is intended to capture as much of the systematic variation in the dependent variable as possible with the non-sports variables. The lagged dependent

variable and the SMSA fixed effects capture persistence in the dependent variable that may arise from the industrial structure, political organization and regulatory environment, geography and climate, and other local factors that either are time invariant or evolve slowly. The purpose is to capture all sources of income or wages and salaries that are inherent in the economic structure of the locality so that the sports variables do not inadvertently explain outcomes that are rightly attributed to other factors.

The model includes the lagged value of the dependent variable as well as SMSA fixed effects and SMSA-specific time trends, as do Coates and Humphreys (1999). Angrist and Pischke (2008) argue that models that include both fixed effects and lagged dependent variables require very stringent and unlikely assumptions for consistent estimation. Estimating the model with either lagged dependent variables or fixed effects imposes less stringent assumptions, but those models are not equivalent, nor is one model nested within the other. However, Angrist and Pischke (2008) demonstrate that estimates from the two models bound the true causal effect of the "treatment." Specifically, if the true model includes the lagged dependent variable but is mistakenly estimated with fixed effects, estimates of the causal effect will be larger than the true effects. Whereas if the true model is fixed effects but is mistakenly estimated with the lagged dependent variable, then the true effects are larger than the estimated effects. To maintain comparability with Coates and Humphreys (1999), this study estimates the equation with both fixed effects and the lagged dependent variable and with each separately to obtain the upper and lower bounds described by Angrist and Pischke (2008).

Consistent with Coates and Humphreys (1999), the null hypothesis is that all of the β attached to sports environment variables are 0, indicating that the sports environment has no effect on the dependent variable. The alternative hypothesis is that at least one of the sports coefficients is different from 0.

5 Results

It is important to determine whether the various measures of income in the sample are stationary. If they are not, then coefficient estimates will be biased and inconsistent, and inferences regarding the influence of sports on the local economy are unreliable. The panel unit root test of Im et al. (2003) is used to test for stationarity of the data. This test allows serial correlation in the variable being tested to be different for each MSA. In the test, the null hypothesis is that the data are nonstationary—that is, they have a unit root in each panel. The alternative hypothesis is that at least one panel is stationary. I test for stationarity on the full sample of MSAs and on the host-city subsample (i.e., those host cities which had a franchise at some time during the data time period). I also test for stationarity of the natural logarithm and the annual growth rate of the real value of the dependent variables. Each model includes a trend, and separate unit root tests are conducted using one, two, and three lags of the dependent variable.

Table 3 Im et al. (2003) panel unit root tests

	Full sample			Host sample		
	One lag	Two lags	Three lags	One lag	Two lags	Three lags
Levels						
Wage and salary	yes	yes	yes	yes	Yes	yes
Wage per job	no	no	yes	10%	10%	yes
Personal income per capita	no	no	no	no	No	no
Logs						
Wage and salary	yes	yes	yes	yes	No	yes
Wage per job	no	no	yes	no	No	no
Personal income per capita growth rate	no	no	no	no	No	no
Wage and salary	yes	yes	yes	yes	Yes	yes
Wage per job	yes	yes	yes	yes	Yes	yes
Personal income per capita	yes	yes	yes	yes	Yes	yes

Note: All models include a trend

Table 3 summarizes the panel unit root tests. In the full sample of 366 MSAs and the 46 host-city subsample of the MSAs, the level and the log of real personal income per capita are nonstationary, whereas the annual growth rate (computed as the difference in the log values from year to year) is stationary. Considering real wage and salary disbursements, the Im et al. (2003) tests reject the null of unit roots for all SMSAs in the full sample and in the host-city subsample, regardless of whether the variable is in level, logs, or growth rate. For the log of wages per job, the null hypothesis is not rejected in either sample but is rejected for levels and the growth rate.

Three dependent variables are possible, each of which is estimated in levels, logs, and growth rates. They are also estimated either with fixed city effects or with the lagged dependent variable as an explanatory variable, or with both. The models are estimated on the full sample of cities and the subsample of host cities. In addition, with year fixed effects and city-specific time trends, as well as the array of sports environment variables, each regression has a great many coefficient estimates. However, specific coefficients are not of particular interest, so the large array of estimates is in an appendix available from the author on request. The focus in this discussion of the results is on the joint significance of groups of sports variables: (1) the full set, (2) those indicating presence of a franchise, (3) those indicating entry, (4) those indicating exit, (5) those indicating stadium and arena capacity, (6) those indicating construction of new facilities, and (7) those indicating Summer or Winter Olympic host. Generally, the groups of variables are jointly significant, with the exception of the Olympic host group. The estimation results are also used to compute the sports and non-sports contributions to the dependent variables. These predictions consistently indicate that the sports contribution is relatively small and, in some cases, negative.

Table 4 Joint hypothesis tests: host cities

	Personal income per capita	Wage disbursement	Wages per job
Fixed effects model			
Regression	$f(127,1759) = 21.5$	$f(127,1759) = 291.2$	$f(127,1759) = 218.8$
	$p = 0.000$	$p = 0.000$	$p = 0.000$
Sports	$f(40,1759) = 1.19$	$f(40,1759) = 14.25$	$f(40,1759) = 9.50$
	$p = 0.194$	$p = 0.000$	$p = 0.000$
Franchise	$f(6,1759) = 0.50$	$f(6,1759) = 20.86$	$f(6,1759) = 8.28$
	$p = 0.808$	$p = 0.000$	$p = 0.000$
and capacity	$f(16,1759) = 1.47$	$f(16,1759) = 17.38$	$f(16,1759) = 8.76$
	$p = 0.102$	$p = 0.000$	$p = 0.000$
and entry and exit	$f(28,1759) = 1.45$	$f(28,1759) = 15.13$	$f(28,1759) = 9.53$
	$p = 0.061$	$p = 0.000$	$p = 0.000$
and construction	$f(36,1759) = 1.26$	$f(36,1759) = 15.45$	$f(36,1759) = 10.49$
	$p = 0.144$	$p = 0.000$	$p = 0.000$
Olympic host	$f(4,1759) = 0.52$	$f(4,1759) = 5.11$	$f(4,1759) = 0.51$
	$p = 0.723$	$p = 0.000$	$p = 0.728$
Lagged dependent variable model			
Regression	$f(127,1758) = 23.0$	$f(128, 1803) = 11{,}062$	$f(128, 1803) = 1342.6$
	$p = 0.000$	$p = 0.000$	$p = 0.000$
Sports	$f(35,1758) = 0.85$	$f(35,1803) = 3.41$	$f(35,1803) = 1.86$
	$p = 0.714$	$p = 0.000$	$p = 0.002$
Franchise	$f(6,1758) = 0.63$	$f(6,1803) = 3.86$	$f(6,1803) = 1.88$
	$p = 0.704$	$p = 0.001$	$p = 0.081$
and capacity	$f(11,1758) = 1.47$	$f(11,1803) = 6.03$	$f(11,1803) = 3.32$
	$p = 0.135$	$p = 0.000$	$p = 0.000$
and entry and exit	$f(23,1758) = 1.02$	$f(23,1803) = 4.02$	$f(23,1803) = 2.63$
	$p = 0.439$	$p = 0.000$	$p = 0.000$
and construction	$f(31,1758) = 0.89$	$f(31,1803) = 3.11$	$f(31,1803) = 2.06$
	$p = 0.645$	$p = 0.000$	$p = 0.001$
Olympic host	$f(4,1758) = 0.52$	$f(4,1803) = 3.11$	$f(4,1803) = 0.04$
	$p = 0.719$	$p = 0.015$	$p = 0.997$

Tables 4 and 5 report *F*-statistics and *p*-values for joint hypothesis tests. First, the tables report the test of significance of the regression. In each case, the null hypothesis is easily rejected. More relevant for the purpose of this paper, the tables report the statistics for the null hypothesis (1) that all sports variables have zero coefficients, (2) that variables indicating the presence of a franchise have a zero coefficient, (3) that the franchise and stadium and arena capacity variables all have zero coefficients, (4) that the coefficients in item (3) and all entry and exit variables have zero coefficients, and (5) that all coefficients in item (4) plus the facility construction variables all have zero coefficients. The tables also report the results for the null that the pre- and post-Olympic host variables all have zero coefficients.

Table 5 Joint hypothesis tests: full sample

	Personal income per capita	Wage disbursement	Wages per job
Fixed effects model			
Regression	$f(447,14,559) = 18.28$	$f(447,14,559) = 534.1$	$f(447,14,559) = 156.0$
	$p = 0.000$	$p = 0.000$	$p = 0.000$
Sports	$f(40,14,559) = 1.82$	$f(40,14,559) = 137.7$	$f(40,14,559) = 15.78$
	$p = 0.001$	$p = 0.000$	$p = 0.000$
Franchise	$f(6,14,559) = 1.34$	$f(6,14,559) = 179.87$	$f(6,14,559) = 8.32$
	$p = 0.236$	$p = 0.000$	$p = 0.000$
and capacity	$f(16,14,559) = 1.39$	$f(16,14,559) = 135.43$	$f(16,14,559) = 9.37$
	$p = 0.138$	$p = 0.000$	$p = 0.000$
and entry and exit	$f(28,14,559) = 1.87$	$f(28,14,559) = 154.5$	$f(28,14,559) = 16.97$
	$p = 0.004$	$p = 0.000$	$p = 0.000$
and construction	$f(36,14,559) = 1.90$	$f(36,14,559) = 150.0$	$f(36,14,559) = 117.44$
	$p = 0.001$	$p = 0.000$	$p = 0.000$
Olympic host	$f(4,14,559) = 0.88$	$f(4,14,559) = 52.5$	$f(4,14,559) = 3.15$
	$p = 0.476$	$p = 0.000$	$p = 0.014$
Lagged dependent variable model			
Regression	$f(447,14,558) = 18.63$	$f(448,14,923) = 29819.4$	$f(448,14,923) = 2441.2$
	$p = 0.000$	$p = 0.000$	$p = 0.000$
Sports	$f(35,14,558) = 1.41$	$f(35,14,923) = 29.2$	$f(35,14,923) = 3.30$
	$p = 0.053$	$p = 0.000$	$p = 0.000$
Franchise	$f(6,14,558) = 0.90$	$f(6,14,923) = 20.87$	$f(6,14,923) = 1.18$
	$p = 0.492$	$p = 0.000$	$p = 0.314$
and capacity	$f(11,14,558) = 1.40$	$f(11,14,923) = 40.7$	$f(11,14,923) = 4.15$
	$p = 0.167$	$p = 0.000$	$p = 0.000$
and entry and exit	$f(23,14,558) = 1.53$	$f(23,14,923) = 32.88$	$f(23,14,923) = 4.52$
	$p = 0.051$	$p = 0.000$	$p = 0.000$
and construction	$f(31,14,558) = 1.48$	$f(31,14,923) = 25.52$	$f(31,14,923) = 3.63$
	$p = 0.043$	$p = 0.000$	$p = 0.000$
Olympic host	$f(4,14,558) = 0.79$	$f(4,14,923) = 30.71$	$f(4,14,923) = 0.16$
	$p = 0.533$	$p = 0.000$	$p = 0.961$

All test results are reported for both the host-city and full samples and for models using only city fixed effects or using only lagged values of the dependent variable. Results in Tables 6 and 7 are not based on clustered standard errors.

The overall finding of these tables indicates that the sports environment variables are generally statistically significant as a group, whether the model uses fixed effects or lagged dependent variables, as long as the dependent variable is wage and salary distributions or wages per job. Interestingly, one generally cannot reject the null hypothesis that sports variables have no effect when the dependent variable is personal income per capita. This finding differs from a finding of Coates and Humphreys (1999) that the sports environment variables as a group affect personal

Table 6 Host cities: franchise and construction, fixed effects model

Variables	(1) Change in personal income per capita	(2) Wage and salary disbursement	(3) Real wage per job
NBA	−104.65	4,116,398	367.96
	(96.07)	(4,323,607)	(358.52)
ABA	−35.62	2,519,882	−292.02
	(88.74)	(2,815,277)	(262.44)
NFL	−323.73	−7.4051E+06	−384.23
	(227.01)	(5,232,057)	(713.26)
NHL	30.46	1,014,568	593.58
	(245.45)	(5,849,719)	(759.58)
MLB	17.27	1.8852E+07**	1368.27
	(193.36)	(7956904)	(1089.59)
MLS	−28.39	4957022**	1216.93***
	(116.72)	(2,184,858)	(428.33)
NFL stadium construction	−39.22	−2.7246E+06**	−492.45***
	(38.08)	(1,220,715)	(130.97)
MLB stadium construction	−53.41	325,878.0945	77.66
	(33.45)	(653,316)	(115.62)
MLS stadium construction	−108.22	−1.5118E+06	−755.48*
	(107.75)	(1,083,580)	(427.23)
Multiuse stadium construction	−0.17	1,457,322**	509.85***
	(39.55)	(627,123)	(164.50)
Multiuse arena construction	−23.64	920,331*	−27.67
	(26.28)	(493,217)	(79.16)
NBA arena construction	−21.27	203,769	−247.35
	(52.26)	(895,700)	(276.03)
NHL arena construction	54.10	−2.0045E+06	−672.10**
	(114.69)	(1,748,688)	(269.47)
Baseball dome	155.69	−1.8559E+06	−389.92
	(122.76)	(2,279,728)	(429.84)
Constant	−5776	−9.8307E+08***	−176,717***
	(5186)	(5.0472E+07)	(15,255)
Observations	1932	1932	1932
R-squared	0.6086	0.9546	0.9405
Number of metro id	46	46	46

Note: Robust standard errors are in parentheses
*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

income per capita. In that analysis, errors are clustered by SMSA. When conducting *F*-tests using clustered errors, the present study's results indicate joint significance of the sports environment variables when personal income per capita is the dependent variable. Results for wage and salary disbursement and wages per job are the same whether errors are clustered or not.

Table 7 Full sample: franchise and construction, fixed effects model

Variables	(1) Change in personal income per capita	(2) Wage and salary disbursement	(3) Real wage per job
NBA	−133.55	4,634,787	626.84*
	(92.58)	(4,212,081)	(379.37)
ABA	−132.38	3,390,478	258.28
	(82.10)	(2,642,226)	(249.19)
NFL	−284.82	−6.9263E+06	−108.67
	(243.29)	(5,801,641)	(863.65)
NHL	132.55	−1.7840E+06	−217.68
	(261.60)	(5,644,940)	(986.39)
MLB	−236.77	2.2531E+07**	2342.06*
	(183.33)	(9,340,837)	(1323.76)
MLS	−293.16**	4,328,156*	1201.23***
	(113.76)	(2,320,199)	(434.11)
NFL stadium construction	−67.95*	−2.0636E+06*	−406.56***
	(37.91)	(1,130,452)	(133.60)
MLB stadium construction	−46.36	546,861	121.41
	(42.99)	(853,904)	(146.23)
MLS stadium construction	−48.88	−1.1565E+06	−700.04
	(115.24)	(973,386)	(450.32)
Multiuse stadium construction	−21.28	1,525,976**	596.25***
	(39.37)	(618,124)	(166.99)
Multiuse arena construction	−17.38	1,151,363**	48.75
	(24.91)	(460,753)	(84.82)
NBA arena construction	19.69	−524,664	−488.08
	(37.20)	(1,241,377 8)	(344.22)
NHL arena construction	164.07	−1.3714E+06	−516.98*
	(123.18)	(2,281,493)	(305.65)
Baseball dome	237.36***	−98,134	88.40
	(90.30)	(1,768,820)	(193.51)
Constant	−3934.68***	−1.8442E+08***	−95,574***
	(1179.14)	(6,490,512)	(4031)
Observations	15,372	15,372	15,372
R-squared	0.36	0.94	0.83
Number of metro id	366	366	366

Note: Robust standard errors are in parentheses
*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Just as in Coates and Humphreys (1999), the finding that the sports environment affects income in the metropolitan area may not support the use of stadiums and arenas or professional sports franchises as tools for urban renewal and economic development. As will be explained, few of the individual variables are statistically significant, and those that are often have the wrong sign, thus indicating that the

Table 8 Host cities: franchise and construction, lagged dependent variable model

Variables	(1) Change in personal income per capita	(2) Wage and salary disbursement	(3) Real wage per job
NBA	−91.21	−216,912	−33.05
	(74.80)	(314,135)	(91.41)
ABA	−21.19	223,617	75.12
	(71.83)	(266,885)	(95.22)
NFL	−249.64**	−2.6364E+06*	79.00
	(117.91)	(1,319,529)	(211.30)
NHL	13.18	2,509,145**	593.00***
	(178.89)	(1,059,814)	(191.48)
MLB	−91.48	484,421	−193.95
	(170.87)	(1,773,990)	(338.12)
MLS	41.06	−48,427	227.53
	(87.28)	(785,732)	(325.13)
NFL stadium construction	−19.10	−164,932	−35.22
	(26.55)	(115,988)	(33.44)
MLB stadium construction	−34.96	185,738	0.67
	(29.79)	(232,837)	(38.54)
MLS stadium construction	−76.40	−97,797	−285.27
	(53.56)	(496,197)	(191.11)
Multiuse stadium construction	−43.51	−118,569	−25.59
	(29.04)	(207,698)	(34.17)
Multiuse arena construction	−23.59	28,469	−33.94
	(20.03)	(81,326)	(28.47)
NBA arena construction	−23.83	−8051	−62.41
	(54.05)	(103,648)	(77.38)
NHL arena construction	26.64	255,729	−147.82
	(101.34)	(352,967)	(127.21)
BA dome	128.02	417,184	283.11**
	(114.24)	(460,433)	(114.43)
Constant	504.28***	2,762,655***	1085.76***
	(98.29)	(758,975)	(301.64)
Observations	1886	1932	1932
R-squared	0.625	0.999	0.999

Note: Robust standard errors are in parentheses
*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

specific sports circumstance is linked to reductions rather than increases in the measure of income. Although sports is a determinant of personal income per capita, wage and salary disbursements, or wages per job, that does not mean sports raises those variables; joint significance does not mean that the sports environment is beneficial for the local economy. Tables 6, 7, 8, 9, 10, 11, 12 and 13 report on subsets of coefficients; Tables 6, 7, 8 and 9 report on franchise presence and facility

Table 9 Full sample: franchise and construction, lagged dependent variable model

Variables	(1) Change in personal income per capita	(2) Wage and salary disbursement	(3) Real wage per job
NBA	−108.20	−330,950	−54.33
	(73.30)	(333,907)	(95.80)
ABA	−45.33	−134,725	−13.93
	(67.13)	(231,948)	(78.21)
NFL	−160.93	−2.7598E+06*	49.76
	(153.46)	(1,439,918)	(208.99)
NHL	14.46	1,731,454*	443.77***
	(188.98)	(1,003,219)	(160.16)
MLB	−307.06*	529,949	−110.95
	(171.62)	(2,108,279)	(283.55)
MLS	−191.08**	−613,118	167.47
	(92.25)	(813,113)	(312.72)
NFL stadium construction	−51.45*	−283,927**	−79.48**
	(30.56)	(138,511)	(34.62)
MLB stadium construction	−33.94	237,740	12.38
	(37.36)	(256,856)	(36.25)
MLS stadium construction	−86.43	46,770	−288.37*
	(66.98)	(502,456)	(172.11)
Multiuse stadium construction	−47.11	−203,941	−41.57
	(36.31)	(227,557)	(43.39)
Multiuse arena construction	−19.91	102,564	−16.55
	(21.36)	(88,972)	(25.42)
NBA arena construction	−2.64	92,884	−18.11
	(40.01)	(162,401)	(55.51)
NHL arena construction	114.15	331,211	−125.25
	(101.58)	(556,715)	(121.91)
BA dome	202.82**	1,155,318*	396.11***
	(84.98)	(592,766)	(86.52)
Constant	240.76***	−128,708.91***	565.22***
	(28.64)	(20,259.85)	(75.46)
Observations	15,006	15,372	15,372
R-squared	0.364	0.999	0.987

Note: Robust standard errors are in parentheses
*** $p < 0.01$; ** $p < 0.05$'; * $p < 0.1$

construction; and Tables 10, 11, 12 and 13 report on entry and departure. Tables vary by whether the sample is host cities or all cities and whether the regression uses fixed effects or lagged dependent variables. The evidence from the individual coefficients is mixed across specifications and samples. Many variables are not individually significant, and they frequently have the wrong sign. It is common for them to be significant and of the wrong sign, thus suggesting a negative relationship between sports stadiums and the measure of income.

Table 10 Host cities: entry and exit, fixed effects model

Variables	(1) Change in personal income per capita	(2) Wage and salary disbursement	(3) Real wage per job
NBA entry	−4.69	118,748	93.70
	(43.67)	(958,067)	(124.27)
ABA entry	−34.09	541,814	63.00
	(48.62)	(668,301)	(150.34)
NFL entry	38.01	1,137,173	−0.2710
	(51.23)	(949,834)	(134.68)
NHL entry	112.32	−1.0860E+06	−165.64
	(115.41)	(723,407)	(156.03)
MLB entry	36.46	−246,375	72.93
	(53.29)	(641,779)	(173.13)
MLS entry	86.90	−466,071	−44.58
	(73.06)	(1,278,419)	(144.65)
NBA departure	−75.46**	1,055,230*	233.15
	(36.80)	(528,287)	(172.64)
ABA departure	16.84	−843,114	−43.49
	(43.69)	(954,483)	(165.84)
NFL departure	4.93	−1.2150E+06	−278.53*
	(42.89)	(753,747)	(160.92)
NHL departure	−92.53	146,867	118.47
	(58.60)	(661,531)	(125.57)
MLB departure	14.90	722,175	417.43
	(132.19)	(1,628,463)	(347.10)
MLS departure	280.25**	2,216,112	1489.49***
	(116.78)	(2,206,277)	(501.60)
Constant	−5776.44	−9.8307E+08***	−176,717***
	(5186.07)	(5.0472E+07)	(15,255)
Observations	1932	1932	1932
R-squared	0.609	0.955	0.941
Number of metro id	46	46	46

Note: Robust standard errors are in parentheses
*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Stadium advocates often point to the facility as anchoring other development (Chema 1996; Santo 2005; Austrian and Rosentraub 2002; Nelson 2002). For example, a facility serves as the main attraction for attendance at sporting events, concerts, and other types of entertainment, thereby providing an opportunity for other establishments to open or expand in the neighborhood. To assess this possibility, one must consider the effect over the first 10 years after construction of stadium or arena openings on the MSA. Whether the model is estimated with fixed effects or the lagged dependent variable, when all three possible dependent variables

Table 11 All cities: entry and exit, fixed effects model

Variables	(1) Change in personal income per capita	(2) Wage and salary disbursement	(3) Real wage per job
NBA entry	−41.31	−38,867	84.54
	(43.42)	(1,027,085)	(152.24)
ABA entry	−122.64**	1,252,948*	328.77**
	(54.89)	(710,527)	(163.13)
NFL entry	58.64	1,630,477*	174.93
	(49.27)	(987,080)	(143.72)
NHL entry	100.47	−790,875	−50.00
	(114.91)	(748,834)	(182.17)
MLB entry	22.71	260,343	273.48
	(56.89)	(626,157)	(177.70)
MLS entry	122.79*	280,384	198.27
	(68.98)	(1,255,193)	(128.42)
NBA departure	−99.46**	988,277*	153.00
	(48.80)	(579,592)	(161.56)
ABA departure	22.23	−1.2128E+06	−262.69**
	(45.24)	(891,392)	(119.85)
NFL departure	38.97	−1.1159E+06	−294.28*
	(44.86)	(750,732)	(172.89)
NHL departure	−15.73	461,355	106.83
	(58.50)	(654,389)	(135.45)
MLB departure	−36.29	1,770,029	875.39***
	(118.38)	(1,510,599)	(247.64)
MLS departure	31.89	3,104,169*	1686.05***
	(104.60)	(1,838,032)	(526.36)
Constant	−3935***	−1.8442E+08***	−95,574***
	(1179)	(6,490,512)	(4031)
Observations	15,372	15,372	15,372
R-squared	0.360	0.943	0.827
Number of metro id	366	366	366

Note: Robust standard errors are in parentheses
*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

are taken into account, only 7 of 42 stadium construction coefficients are individually statistically significant at the 10% level or better in the host-city sample. All seven of these coefficients come from the fixed effects specification; none comes from the lagged dependent variable models. Interestingly, four of the seven are negative. If one looks only at point estimates and not at individual significance, 16 of 21 stadium or arena construction variables have negative signs in the lagged dependent variable models, and 14 of 21 have negative signs in the fixed effects specifications. Given these findings, the hypothesis that construction of a stadium or

Table 12 Host cities: entry and exit, lagged dependent variable model

	(1)	(2)	(3)
Variables	Change in personal income per capita	Wage and salary disbursement	Real wage per job
NBA entry	21.83	−80,383	37.63
	(30.79)	(114,359)	(32.10)
ABA entry	−20.04	−419,673**	−47.21
	(39.54)	(168,940)	(38.28)
NFL entry	32.21	176,654	24.48
	(30.06)	(155,874)	(29.74)
NHL entry	72.72	−24,045	105.04
	(88.09)	(249,271)	(118.94)
MLB entry	41.92	−195,831	−37.99
	(36.30)	(222,390)	(50.97)
MLS entry	38.40	334,859	16.23
	(44.47)	(240,543)	(56.12)
NBA departure	−62.43**	134,302	−35.96
	(24.06)	(126,036)	(41.22)
ABA departure	14.20	257,396**	32.77
	(30.79)	(102,604)	(30.95)
NFL departure	−6.89	148,639	−23.86
	(30.13)	(188,272)	(35.44)
NHL departure	−74.91	−295,326	−50.74
	(49.59)	(207,964)	(55.33)
MLB departure	−53.52	36,099	−18.73
	(77.36)	(442,001)	(103.33)
MLS departure	71.91	454,383	409.04
	(80.62)	(503,914)	(318.56)
Constant	504.28***	2,762,655***	1086***
	(98.29)	(758,975)	(302.00)
Observations	1886	1932	1932
R-squared	0.625	0.999	0.990

Note: Robust standard errors are in parentheses
*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

arena fosters the local economic development, which is often claimed by construction advocates, has little support. Nonetheless, perhaps comparing host cities to host cities is inappropriate, and the better comparison is between host cities and nonhost cities.

In the full sample, with the lagged dependent variable as a regressor, 4 of 21 construction variables are individually significant at the 10% level or better. All four carry negative signs, and three of them relate to the NFL stadium construction. In the fixed effects specification, 7 of 21 construction variables have a statistically significant coefficient, and 4 are negative. If one looks only at point estimates and not at individual statistical significance, 13 of 21 coefficients are negative in the fixed

Table 13 All cities: entry and exit, lagged dependent variable

Variables	(1) Change in personal income per capita	(2) Wage and salary disbursement	(3) Real wage per job
NBA entry	−6.46	−185,198	−15.24
	(30.33)	(121,048)	(32.22)
ABA entry	−96.76**	−436,344**	−113.98***
	(40.61)	(178,833)	(36.21)
NFL entry	52.82	343,103**	22.46
	(34.83)	(159,053)	(31.91)
NHL entry	83.41	−12,835	89.32
	(89.09)	(243,465)	(118.70)
MLB entry	43.82	−145,980	−51.02
	(39.03)	(249,236)	(43.73)
MLS entry	117.70**	477,168*	68.62
	(48.05)	(267,521)	(50.92)
NBA departure	−97.95***	−27,997	−88.59**
	(33.12)	(131,716)	(40.29)
ABA departure	53.10**	32,057	−29.74
	(26.54)	(95,292)	(29.01)
NFL departure	31.86	403,040*	45.54
	(40.03)	(216,194)	(36.29)
NHL departure	−23.69	−157,170	−24.57
	(59.20)	(215,384)	(66.65)
MLB departure	−62.96	−162,153	−49.86
	(52.90)	(375,260)	(67.50)
MLS departure	−9.31	211,198	290.94
	(77.22)	(593,773)	(256.96)
Constant	240.76***	−128,709***	565.22***
	(28.64)	(20,260)	(75.46)
Observations	15,006	15,372	15,372
R-squared	0.364	0.999	0.987

Note: Robust standard errors are in parentheses
*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

effects specifications, and 14 are negative in the lagged dependent variable models. The evidence of a positive sign is a bit stronger in the full sample, in which hosts are compared to nonhosts, but the results still suggest construction has very little influence on personal income per capita, wage and salary distributions, or wages per job.

Advocates of stadium and arena construction often promote these policies as an attempt to attract a franchise or to keep an existing franchise from moving. The regression models include variables indicating the arrival or departure of a franchise. Support for sports as economic development would come in the form of positive effects of franchise entry or negative effects of franchise departure, or both.

Tables 10, 11, 12 and 13 report the coefficients on these entry and exit variables for each sample, host cities or all cities; for each of the three dependent variables; and for each specification, either fixed effects of lagged dependent variables. Each table has 18 franchise entry variables. These variables capture the effect of a new franchise in a city in each of the first 10 years after the arrival of the franchise. In the host-city sample, only 1 of 36 entry variables is individually statistically significant, and that variable shows a negative effect for the entry of an ABA franchise on wage and salary disbursements. Among the point estimates, seven entry variables have a negative sign in the lagged dependent variable equation, and eight are negative in the fixed effects specification. The lack of individually significant coefficient estimates suggests that entry of franchises has no effect on personal income per capita, wage and salary distributions, and wages per job when host cities are compared to other host cities. Regarding the full sample, more support exists for the positive effects of franchise entry. In the fixed effects specification, five individual coefficients are significant at the 10% level or better, and four of those are positive. In the model with the lagged dependent variable, six individual coefficients are significant: three are positive, and three are negative. All of the negative coefficients relate to entry of an ABA franchise.

Over the run of the sample period, numerous franchises left one city for another. Dummy variables capture the effect of these departures over the first 10 years after the team leaves town. When fixed effects are used on the host-city sample, two of the five individually statistically significant departure variables have a negative sign, as would be the case if a franchise leaving town harmed the local economy. But three of those five have positive coefficients: departure of a franchise was beneficial in personal income per capita, wage and salary disbursements, or wages per job. In the lagged dependent variable models, only two coefficients are individually significant—one positive and one negative. Regarding the full sample with fixed effects, three of seven individually significant variables have negative signs; in the lagged dependent variable model, only four variables are individually significant—two for each sign. The effect of franchise departure, given these results, is negligible, with a slight suggestion that a team leaving is beneficial in the various measures of income.

The final issue addressed is the contribution of sports to the local economy. Because groups of coefficients are jointly significant even though very few coefficients are individually significant, the overall contribution of sports to personal income per capita, wage and salary disbursements, or wages per job is calculated. Using the coefficients from the various models, one may compute the fitted portion of the dependent variable for each observation. The fitted portion is split into the contribution of sports and the contribution of everything else. Tables 14 and 15 report on these contributions: Table 14 for the host sample and Table 15 for the full sample. Looking first at the host-city sample, one sees that sports appear to make an enormous contribution to personal income per capita as the sports share is 0.22. That is, on average, a sport's contribution to personal income per capita is about 22% in the fixed effects model. However, this finding is misleading because this large value occurs in a model where the sports variables are not jointly statistically significant. In

Table 14 Sports and non-sports contributions: host cities

	Observations	Mean	Standard deviation	Minimum	Maximum	Share
Personal income per capita						
Fixed effects model						
Sports contribution	1932	46.96	96.99	−231.77	573.11	0.223
Non-sports contribution	1932	163.47	371.84	−1615	2314	0.777
Total	1932	210.43	368.38	−1344	2354	
Lagged dependent variable model						
Sports contribution	1886	−41.03	68.45	−227.38	256.28	−0.192
Non-sports contribution	1886	254.62	374.12	−1559	2470	1.192
Total	1886	213.59	374.89	−1564	2435	
Wage and salary disbursement						
Fixed effects model						
Sports contribution	1932	1,136,268	244,4381	−9,169,303	1.72E+07	0.04
Non-sports contribution	1932	2.73E+07	3.43E+07	1,059,716	2.69E+08	0.96
Total	1932	2.84E+07	3.47E+07	−314,705	2.63E+08	
Lagged dependent variable model						
Sports contribution	1932	555,501	1,395,228	−890,644	1.08E+07	0.02
Non-sports contribution	1932	2.79E+07	3.35E+07	540,350	2.66E+08	0.98
Total	1932	2.84E+07	3.47E+07	161,801	2.76E+08	
Wages per job						
Fixed effects model						
Sports contribution	1932	240.18	485.43	−1168	3002	0.012
Non-sports contribution	1932	19,444	3039	14,322	37,808	0.988
Total	1932	19,684	3216	14,696	40,810	
Lagged dependent variable model						
Sports contribution	1932	−7.09	91.35	−299.38	644.97	−0.000
Non-sports contribution	1932	19,691	3216	14,369	42,752	1.000
Total	1932	19,684	3243	14,369	43,033	

Table 15 Sports and non-sports contributions

	Observations	Mean	Standard deviation	Minimum	Maximum	Share
Personal income per capita						
Fixed effects model						
Sports contribution	15,372	6.81	50.20	−282.63	554.26	0.039
Non-sports contribution	15,372	167.23	263.18	−1107	1354	0.961
Total	15,372	174.04	262.33	−1034	1388	
Lagged dependent variable model						
Sports contribution	15,006	−4.18	33.61	−333.46	326.57	−0.024
Non-sports contribution	15,006	180.38	261.92	−943.77	1315	1.024
Total	15,006	176.20	261.82	−998.61	1266	
Wage and salary disbursement						
Fixed effects model						
Sports contribution	15,372	258,286	1,254,388	−7,180,484	2.08E+07	0.049
Non-sports contribution	15,372	5,045,262	1.46E+07	−298,094	2.69E+08	0.951
Total	15,372	5,303,548	1.52E+07	−298,094	2.63E+08	
Lagged dependent variable model						
Sports contribution	15,372	87,552	603,477	−894,144	1.21E+07	0.017
Non-sports contribution	15,372	5,215,996	1.47E+07	−286,917	2.66E+08	0.983
Total	15,372	5,303,548	1.52E+07	−286,917	2.77E+08	
Wages per job						
Fixed effects model						
Sports contribution	15,372	47.94	257.3305	−1372	3189	0.003
Non-sports contribution	15,372	16,795	2517.368	11,151	37,844	0.997
Total	15,372	16,843	2597.711	11,151	40,893	
Lagged dependent variable model						
Sports contribution	15,372	5.92267	45.06052	−272.824	574.9037	0.000352
Non-sports contribution	15,372	16,837	2631.192	10,950.95	42,879.2	0.999649
Total	15,372	16,843	2647.791	10,950.95	43,267.76	

those cases where the sports environment variables are jointly significant, the sports contribution is generally quite small, with the largest contribution reaching only 4%. The results are much the same for the full sample of cities, except that no sports contribution exceeds 5%.

6 Conclusion

The question of whether and to what extent the sports environment affects local economies has been discussed for years. Coates and Humphreys (1999) built on and extended existing work on the issue by pooling data from cities that hosted franchises in one or more of the NFL, NBA, and MLB over the period 1969–1996. Their evidence was that the overall effect of the sports environment was to reduce personal income per capita by a small amount. The present study updates Coates and Humphreys' analysis by extending the sample to include 1997–2011, incorporating both host and nonhost cities, and including the NHL and MLS in the analysis. Its findings are similar to the earlier findings. Specifically, the sports environment is a statistically significant factor in explaining personal income per capita, wage and salary disbursements, and wages per job. As in Coates and Humphreys (1999), few variables are individually statistically significant, and those that are often have the wrong sign. In other words, many of the individual coefficients are opposite to what proponents of stadium- and arena-led development would have hypothesized. That is, effects that proponents argue will be positive, such as stadium or arena construction and attracting a franchise, are frequently negative. Even when positive, these effects are generally quite small.

The results of using the models to forecast the contribution sports make to personal income per capita, wage and salary disbursements, and wages per job indicate sports play a role, but that role is small. The largest contribution sports have is less than 5%. As big as people perceive sports to be, the evidence here suggests sports franchises, stadium construction, and the other aspects of the sports environment account for less than 5% of the economy, with most estimates under 1.5% and some even negative, on average.

Overall, the results here are consistent with and confirm the findings of Coates and Humphreys (1999) that sports-led development is unlikely to succeed in making a community richer. If the local government is looking for a policy to foster economic growth, far better policies exist than subsidizing a professional sports franchise.

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The Consumer Surplus and Economic Impact of a Participatory Micro-Event: The Beech Mountain Metric

Peter Groothuis, Kurt Rotthoff, and John Whitehead

1 Introduction

The economic impact of sporting mega-events is a well-studied topic in sports economics. For instance, Robert Baade and coauthors have studied the economic impact of the World Cup (Baade and Matheson 2004), the Summer Olympics (Baade and Matheson 2002), the Winter Olympics (Baade et al. 2010), the Major League All-Star Game (Baade and Matheson 2001), the Super Bowl (Matheson and Baade 2006), and the Daytona 500 (Baade and Matheson 1999). The results of all these studies are that the economic impact rarely, if ever, justifies the public spending on the mega-events particularly if there are many locations bidding to host the event.

One area that is understudied is the economic benefits of local sports participation in events or micro-events. In a recent study, Andreff (2022) explicitly states that the "economics of competitive amateur sport" and "sport participation" are under-researched areas. Our study focuses on a local participatory bike race called the "Beech Mountain Metric" (BMM), an amateur road bicycle event. We measure both the economic impact of the event on the local economy and the consumer surplus benefits to participants using stated preference methods. Whitehead and Wicker

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(2018) estimate the consumer surplus of a trip to participate in the "Blood Sweat and Gears" road bicycle ride with willingness-to-travel questions. In this study, we also use the willingness-to-travel technique.

One problem with the stated preference data is that it might suffer from hypothetical bias where respondents state they will participate in the event in the future and then fail to attend leading to a difference between stated preferences and revealed preferences. Whitehead et al. (2016) find some evidence the stated preference data with a registration fee increase accurately predicts actual behavior with the price increase. Additionally, Whitehead and Wicker (2019) argue that combining revealed and stated preference data can be used to mitigate hypothetical bias in stated preference data. Using jointly estimated revealed and stated preference data models, a mitigation approach is to include a dummy variable for the stated preference scenarios to control for hypothetical bias. In this chapter, we attempt to replicate the Whitehead and Wicker (2019) results with data from 3 years of a similar, but smaller, road bicycle ride.

2 Data

Our data are from the amateur road bicycling event BMM. The BMM was a 100-kilometer ride that starts in Banner Elk, North Carolina, finishes at the top of Beech Mountain, and includes 8000 feet of climbing. In addition to the 100 km ride, there was also a shorter ride with 5600 feet of climbing. The first BMM was held on Saturday, May 17, 2014. The BMM was discontinued following the cancellation of the 2018 ride.

Following the 2014, 2015, 2016, and 2017 rides, an online survey was administered to registered BMM participants. Email invitations were sent to 728 riders who had registered for the 2014 BMM. After the initial email invitation was sent on May 20 and a reminder on May 27, 310 responses were received, and 297 riders completed the online survey. The completed response rate was 41%. Email invitations were sent to 655 riders who had registered for the 2015 BMM. After the initial email invitation was sent on May 21 and two reminders, 274 responses were received, and 266 riders completed the survey. The completed response rate was 41%. In 2016, email invitations were sent to 420 registered riders. After the initial email invitation on June 3 and a reminder on June 8, 132 responses were received, and 130 riders completed the survey. The completed response rate was 31%. We conducted a survey following the 2017 ride which was used in Whitehead and Wicker (2020). The 2018 BMM was cancelled due to bad weather, and then the BMM was discontinued due to declining participation. We use the data from the first 3 years of the BMM in this chapter to develop economic impact and willingness-to-travel analyses.

3 Economic Impact

3.1 Methods

Economic impact analysis considers the effect of an economic event on a defined local economy. Economic impacts are measured in terms of expenditures (i.e., income) and jobs generated in the local economy as a result of an event. Economic impacts include direct, indirect, and induced spending. Direct spending is the amount of money spent as reported by survey respondents. Indirect spending is the amount of money that is estimated to be spent in the local economy on inputs by industry. Induced spending is the amount of money that is estimated to be spent in the local economy by workers in the industry.

A number of community-based economic impact analyses have been conducted by students from the Appalachian State University Student Chapter of the National Association for Business Economics and faculty in the Department of Economics. These studies have community-based clients who have a demand for research but limited funds to support it. Clients have included the Beech Mountain Metric, Blood Sweat and Gears, and Blue Ridge Brutal road bike rides and the Blue Ridge Relay and New River Marathon runs. Economic impact estimates range from $150,000 to $1,000,000 for these local events.

Data for these community-based projects are obtained from online surveys using email lists of event participants. All the participants with valid email addresses (N) are sent an email message inviting them to complete the online survey. A follow-up email invitation is sent about 1 week later to those who have not responded. The sample size (n) is equal to the number of completed questionnaires. The response rate is equal to the completed questionnaires divided by the number of participants (n/N).

Respondents are asked if they are residents of the local area and if they traveled away from their home to attend the event. Only nonlocal visitors inject new spending into a local economy. The nonlocal visitation rate ($\%v$) is equal to the nonlocal visitors who traveled to the event (v) divided by the sample size ($\%v = v/n$). These visitors are asked to report the number of days or nights (D) spent in the local area and the number of friends and family members in their travel party (P). Respondents are asked to report the amount of money their travel party spent on their trip in several broad categories: food/supplies (F), lodging (L), travel (T), tourist attractions (A), and other spending (O). The registration or ticket fee revenue (R) is not reported in the survey but is included in the spending total.

The mean value of each spending category is calculated with zero values included for those respondents who did not spend money in that category. The mean value of total spending in each category, $S = [F, L, (T/2), A, O, R]$, is calculated as $\overline{S} = \sum_{i=1}^{v} S_i/v$, where $i = i, \ldots v$ visitors. Transportation spending is divided by two, assuming that one-half is expended outside the local economy.

An injection of spending circulates through the local economy to create indirect and induced spending. Economic impact (*EI*) per industry per respondent is estimated by multiplying average spending by industry-specific RIMS II multipliers (M) for the High Country region (Ashe, Avery, and Watauga counties): $EI_{ij} = \overline{S} \times M$. RIMS is an acronym for the Regional Input-Output Modeling System, a model developed by the U.S. Bureau of Economic Analysis. Multipliers for the High Country economic area were purchased by the Department of Economics in 2013. We use type II multipliers which estimate indirect and induced spending associated with the tourism sector. RIMS assumes that the event is not large enough to significantly affect the multipliers which is consistent with our micro-event study. Economic impact per respondent is summed over the number of nonlocal visitors to obtain economic impact per industry, $EI = EI_i \times (N \times [v/n])$.

3.2 Results

We estimate that in the 2014 BMM race there were 566 participants who traveled from their homes to the area (Table 1). For these participants, average total spending was $359 during their stay. Eighty-one percent of the BMM respondents who traveled to the event stayed overnight. The top two categories for expenditures were lodging and food/supplies. Average lodging expenditures were $161, and average food expenditures were $102. Summing total spending over the total number of nonlocal participants yields total direct spending of $203 thousand associated with the BMM event. Applying a RIMS II multiplier of 1.48 for the tourism sector yields a total economic impact of $301 thousand.

Considering those respondents who participated in the 2015 BMM ride and traveled from their homes to the area (n = 506), the average total spending was $365 during their stay. Eighty-three percent of the out-of-town respondents stayed overnight. Average lodging expenditures were $187, and average food expenditures were $128. Summing over the total number of nonlocal participants in 2015 yields total direct spending of $185 thousand associated with the BMM event. Applying a RIMS II multiplier yields a total economic impact of $273 thousand.

Table 1 Beech Mountain Metric surveys and economic impact

	2014	2015	2016
Registered participants	728	655	420
Completed surveys	297	266	130
Response rate	40.8%	40.6%	31.0%
Estimates:			
Participants	697	609	379
Nonlocal participants	566	506	321
Individual spending	$359	$365	$390
Aggregate spending	$203,162	$184,717	$125,147
Economic impact	$300,680	$273,382	$185,217

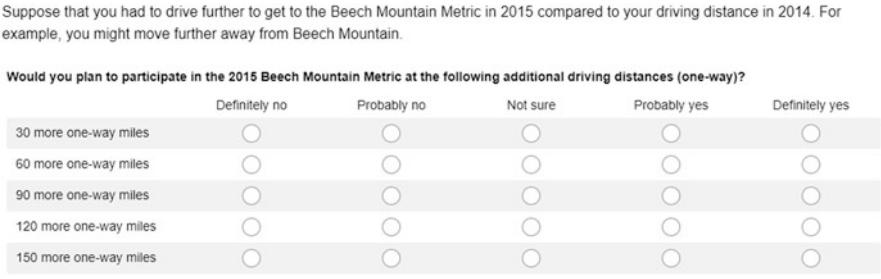
Considering those respondents who participated in the 2016 ride and traveled from their homes to the area (n = 321), the average total spending was $390 during their stay. Eighty-five percent of the respondents who traveled to the area stayed overnight. Average lodging expenditures were $232, and average food expenditures were $112. Summing spending on all categories over the total number of nonlocal participants in 2015 yields a total direct spending of $125 thousand associated with the BMM event. Applying a RIMS II multiplier, a total economic impact of $185 thousand is found.

For mega-events, there is always a potential for crowding out of other tourist activities when the mega-event occurs – such as the closing of the theaters during the London Olympics. With a micro-event, however, such as a participatory bike race, we expect that the crowding out effect is minimal particularly because this type of race occurs in two ski resort towns in May, after the winter ski season and before the summer tourist season.

4 Willingness to Travel

Two return visitation questions are asked in each survey. The first return visit intention question in the 2014 survey was: "Do you plan to participate in the 2015 Beech Mountain Metric?" The second question was: "Suppose that you had to drive further to get to Beech Mountain Metric in 2015 compared to your driving distance in 2014. For example, you might move further away from Beech Mountain. Would you plan to participate in the 2015 Beech Mountain Metric at the following additional driving distances (one-way)?" Respondents were presented with five different mileages (30, 60, 90, 120, and 150). The potential response options were definitely no, probably no, not sure, probably yes, and definitely yes (see Fig. 1).

Similar questions were asked in the 2015 survey and to about 50% of the respondents in the 2016 survey. We call these the "payment card" questions. In the 2016 survey, about one-half of the respondents received a "dichotomous choice" question, with each respondent being presented only one randomly selected


Suppose that you had to drive further to get to the Beech Mountain Metric in 2015 compared to your driving distance in 2014. For example, you might move further away from Beech Mountain.

Would you plan to participate in the 2015 Beech Mountain Metric at the following additional driving distances (one-way)?

	Definitely no	Probably no	Not sure	Probably yes	Definitely yes
30 more one-way miles	○	○	○	○	○
60 more one-way miles	○	○	○	○	○
90 more one-way miles	○	○	○	○	○
120 more one-way miles	○	○	○	○	○
150 more one-way miles	○	○	○	○	○

Fig. 1 Beech Mountain Metric willingness-to-travel survey question

Table 2 Stated preference return visitation responses by Beech Mountain Metric ride year (combined probably yes and definitely yes responses)

		2015		2016		2017			
		Payment card		Payment card		Payment card		Dichotomous choice	
	Distance	Yes (%)	n	Yes (%)	n	Yes (%)	n	Yes (%)	n
SP	0	83.48	224	85.33	184	85.71	56	94.12	51
SP	30	77.78	45	88.24	34	83.33	12	77.78	9
SP	60	66.00	50	60.00	45	78.57	14	81.82	11
SP	90	38.30	47	36.84	38	66.67	9	50.00	8
SP	120	31.11	45	28.95	38	16.67	12	33.33	3
SP	150	13.51	37	17.24	29	22.22	9	65.00	20
RP	0	45.54	224	41.30	184	42.86	56	31.37	51

Note: SP is stated preference and RP is revealed preference data

additional distance (Δd). The question read: "Would you plan to participate in the 2017 Beech Mountain Metric if you had to drive Δd more miles (one-way)?"

In order to compare the payment card and dichotomous choice question versions, we randomly select one of the payment card responses. In Whitehead and Wicker (2019), we include the first stated preference question with the zero additional miles question in the random selection for the payment card version of the data. In this chapter, we pursue a strategy that allows for a more efficient comparison between the stated preference and revealed preference data. One response from the five potential additional driving distances was randomly selected from the payment card additional distance questions for the empirical analysis, and all of the responses to the first stated preference question in the survey are included.

Whitehead et al. (2016) and Whitehead and Wicker (2018) investigated alternative recodings of the stated preference variable (e.g., definitely yes vs. probably and definitely yes). Following Whitehead et al. (2016), who found that the probably and definitely yes respondents more accurately predicted actual behavior, and Whitehead and Wicker (2018), who found that definitely yes models are less statistically robust, we code the answer as a stated preference return visit if the respondent answered either probably yes or definitely yes.

In Table 2, we present the stated preference and revealed preference registrations for the 2015, 2016, and 2017 BMM rides. The stated preference for return visitation for the 2015 ride year was 83% at the time of the 2014 survey. Only 46% of these riders actually registered for the 2015 year. The pattern is the same for the 2016 and 2017 ride years with over 85% saying that they would probably or definitely ride the following year but only about half that actually riding. In contrast, the percentage of respondents who state that they would definitely participate in the following year is slightly lower than the actual participation rate in each year.

Considering the responses to the second stated preference question, as distance traveled increases the return visitation decreases monotonically for each higher distance in years 2015 and 2016. This is not the case in the 2017 BMM ride year data, but this is likely due to the smaller overall sample.

4.1 Empirical Model

The empirical analysis is grounded in utility theory and follows Whitehead and Wicker (2019). Stated preference models for each year of the return visitation measures were estimated with dependent variables in Table 2. Each respondent has three observations for each year in which they answered the survey: the two stated preference observations, status quo distance and increased distance, and the revealed preference observation. These are stacked and we estimate a random parameter logistic regression model:

$$\ln\left(\frac{\pi}{1-\pi}\right) = \beta_0 + \beta_1 \Delta TC + \beta_2 Y + \beta_3 SP + \beta_4 (\Delta TC \times DC) + e_t^*$$

where π is the probability of a return visit, ΔTC is the change in travel cost, Y is household income, SP is a dummy variable for the stated preference observations, DC is a dummy variable for dichotomous choice question format, and e_t^* is a random error term where $t = 1, 2, 3$ (with subscripts for individuals suppressed for simplicity). The random parameters logit allows for preference heterogeneity across individuals. For the fixed coefficient logit model, the parameter vector, β, is assumed to be constant across individuals. To allow for preference heterogeneity, we assume that individual preferences randomly vary according to a population distribution such that $\beta_i = \beta + \sigma_i$, where β is an unknown but constant parameter for preferences and σ_i is an individual specific random error component for preferences that are distributed across individuals. The random parameter model is estimated with normally distributed coefficients and 500 Halton draws.

The change in travel cost (ΔTC) was measured as the sum of out-of-pocket travel costs and the opportunity cost of time using the following equation: $\Delta TC = (c \times 2 \times \Delta d) + (\gamma \times w \times (2 \times \Delta d/mph))$, where $c = 0.13$ is the operating cost per mile (American Automobile Association, 2015), Δd is the change in one-way distance (in miles), $\gamma = 0.33$ is the fraction of the wage rate, $w = Y/2000$, Y is household income, and mph is 50 miles per hour – the average driving speed in North Carolina. The mean change in travel cost is \$59, \$64, and \$64 in the 2015, 2016, and 2017 BMM ride years, respectively. Mean household income is \$128, \$139, and \$131 in 2015, 2106, and 2017 ride years. The estimation sample size is $n = 1545$ with 429 BMM riders. Eighty-two percent of these riders are represented in the data for one survey year, 17% answered two surveys, and 1% answered the survey after each BMM ride.

The monetary value of a revisit is the difference between what the consumer is willing and able to pay and the actual cost. In a simple linear logit model with just constant and slope terms, the monetary value (i.e., willingness to pay [WTP] for the event) is the consumer surplus area from the probabilistic demand curve bounded by the probability of intended visitation at an additional travel cost of zero and that which makes this probability of intended visitation equal to zero. We estimate this consumer surplus with the same truncated willingness to pay formula used in

Whitehead and Wicker (2019): $WTP = \frac{-1}{\beta_1} \ln(1 + \exp[\beta_0])$. Alternative combinations of the stated preference and dichotomous choice dummy variable coefficients are included in the constant to estimate *WTP* under different valuation scenarios.

4.2 Results

We find that the coefficient on the change in the travel cost variable is negative and statistically significant in accordance with economic theory (Table 3). This suggests that the results are internally valid – similar to previous research (Whitehead and Wicker 2018, 2019, 2020). The income effect is positive, indicating that a return visit is a normal good. The additional travel cost variable is interacted with the dichotomous choice indicator variable for the 2016 survey. The coefficient on this variable is positive and statistically significant indicating that respondents are more likely to state that they will visit the following year with a dichotomous choice question. The coefficient on the stated preference dummy variable is positive and statistically significant, indicating that the stated preference data overstates actual return visitation behavior.

The standard deviation estimates give information about the level of preference heterogeneity. The standard deviation on the travel cost coefficient is about 69% of the coefficient, indicating that less than 7% of the individual conditional mean coefficient estimates are greater than zero (i.e., have the wrong sign). The standard deviation for the income coefficient is not statistically different from zero. The standard deviation of the change in travel cost and dichotomous choice interaction is equal to 81% of its coefficient, implying significant preference heterogeneity. The standard deviation of the stated preference dummy variable is 58% of the coefficient estimate. This indicates that less than 4% of the individual conditional mean coefficient estimates are less than zero indicating that the respondents understate

Table 3 Random parameter logit return visitation model

	Definitely and probably yes (PYES)					
	Means			Standard deviations		
	Coeff.	SE	t-stat	Coeff.	SE	t-stat
Constant	−0.7365	0.1163	−6.33	1.0460	0.0814	12.85
Change in travel cost (ΔTC)	−0.0341	0.0024	−14.36	0.0234	0.0025	9.21
Income	0.0031	0.0007	4.70	0.0004	0.0005	0.80
ΔTC x DC (=1)	0.0207	0.0047	4.39	0.0255	0.0076	3.36
SP (=1)	2.0566	0.1391	14.79	1.1974	0.1126	10.63
χ^2[df]	51.44[5]					
AIC	1717.10					
Observations	1545					
Riders	429					

Note: *DC* dichotomous choice from Table 2

Table 4 Willingness to pay estimates

SP	DC	WTP	SE	t-stat
0	0	15.98	1.53	10.45
0	1	16.24	1.54	10.57
1	0	55.66	2.63	21.18
1	1	56.18	2.61	21.52

Note: *DC* dichotomous choice from Table 2

their return visitation behavior. These results are somewhat different than Whitehead and Wicker (2019) statistically. More importantly, however, we find little practical difference in the results.

The four willingness to pay (WTP) estimates reflect all combinations of the question format (payment card and dichotomous choice) and the type of preferences assessed (stated and revealed preferences) (Table 4). Setting the stated preference variable equal to zero simulates the revealed preference value of a return visit estimated with the payment card question format. Standard errors are estimated using the Delta method. The baseline WTP ($SP = 0$, $DC = 0$) for a return visit is \$16 which is 60% lower than the WTP estimate for a return visit to the Blood Sweat and Gears ride (Whitehead and Wicker 2019). This result makes sense given the greater demand for the Blood Sweat and Gears ride.

WTP estimated with the dichotomous choice question is no different than when estimated in the payment card format. This result contrasts with Whitehead and Wicker (2019) who found the payment card format to have higher WTP. Willingness to pay is \$40 greater when the stated preference data is simulated ($SP = 1$). This result is similar to the results in Whitehead and Wicker, who find substantial hypothetical bias in willingness to pay. In a model where we code only "definitely yes" stated preference responses as participating in the future BMM, the stated preference dummy variable is negative and statistically significant indicating that the stated preference data understates actual behavior. We do not present this model because the change in travel cost coefficient is much more price inelastic, increasing the WTP estimates above those presented in Table 4, which does not make economic sense (i.e., lower demand generates greater *WTP*). These results are similar to Whitehead and Wicker (2019).

Aggregating the baseline willingness to pay estimate over the number of participants yields an aggregate economic value estimate of \$11,143, \$9735, and \$6051 in the 2015, 2016, and 2017 BMM ride years, respectively.

5 Conclusions

We find that the economic impact benefits of the micro-event Beech Mountain Metric participatory bike race were \$301,000 in 2014 to the local community, while the consumer surplus to participants was about \$11,000. In 2015, the economic impact benefits were \$273,000, while the consumer surplus benefits were less

than $10,000. In 2016, the economic impact benefits had fallen to $185,000, while the consumer surplus benefits had fallen to under $8000. The consumer surplus benefits are most likely relatively low in magnitude because there are many bike races in the region to choose from including Blood Sweat and Gears and the Blue Ridge Brutal, both more popular races. Also, the WTP estimates are for a return visit and subject to diminishing returns. The economic impact benefits, however, are meaningful to a local economy, particularly during a slow time in tourism that occurs in May in the "High Country" region of North Carolina that depends upon tourism.

One important component of these types of studies, that Robert Baade has made clear over his many studies, is answering the question: "Are the use of public funds efficient to support sports teams or pay for mega-events?" He finds that in most cases the use of public funds is not efficient. However, when looking at micro-events, it is likely that the only public funds used are the wages paid to police for their time closing the roads where the bike race takes place. These costs are much lower than the economic impact to the local community suggesting that the use of this police time is efficient.

Focusing on the stated benefits measure we replicate Whitehead and Wicker (2019) for the Beach Mountain Metric using the willingness-to-travel technique. We find that using an intensity of preference correction can mitigate for hypothetical bias but using only individuals who are "definitely sure" will overcorrect the problem. Consistent with Whitehead and Wicker (2019), we find substantial hypothetical bias in WTP models. This result suggests that the definitely yes and the sum of the probably and definitely yes probabilities provide a useful estimate of the range of return visitation that could be used in micro-event planning.

Our results suggest that a small-scale participatory athletic event or a micro-event, ones that are often ignored by politicians, might be the one area that the use of public funds might be efficient. As such, these types of events are worthy of more study.

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The Dollar Value of an NFL Rivalry

Aju Fenn and John Crooker

1 Introduction

This paper and our paper on estimating the local welfare loss due to the credible threat of relocation of an NFL team, Fenn and Crooker (2009), were inspired by the research conducted by Professor Rob Baade. His paper on the economic impact of professional sports stadiums on the surrounding metropolitan areas inspired our work and that of many others (Baade and Dye 1990).

In May of 2002, Red McCombs, then owner of the Vikings, formally notified the state legislature that he had hired JP Morgan Securities to explore the sale or relocation of the team. He had been trying unsuccessfully to secure public funding for a new stadium for the Vikings. The public in Minnesota was aware that the team was seeking a new stadium and may be sold or may move prior to this formal announcement. In the spring of 2002, the NFL announced that it would realign divisions to make room for the expansion Houston Texans. One of the divisions under consideration was the old NFC Central Division which contained the Minnesota Vikings, the Green Bay Packers, the Chicago Bears, the Detroit Lions, and the Tampa Bay Buccaneers. At the time it was not widely known exactly which team or teams would remain in the same division. This presented an opportunity to estimate the local welfare of an existing rivalry under a credible scenario. The added credible threat that the Vikings themselves may be sold and/or moved added to the credibility of elimination of an existing rivalry. The NFL did move the Tampa Bay Buccaneers

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to the newly created NFC South division. The remaining teams from the old NFC Central Division stayed together and played in the renamed NFC North division.

The issue of sports rivalries is not new, and there is an established social science literature on the subject. Cobbs, Sparks, and Tyler find that NFL fans exhibit the most animosity toward rivals based on schadenfreude, disidentification, prejudice, and relationship discrimination (Cobbs et al. 2017). They use a survey of 4,828 fans across five US professional leagues: Major League Baseball (MLB), Major League Soccer (MLS), the National Basketball Association (NBA), the National Football League (NFL), and the National Hockey League (NHL). They also present a useful survey of the social science literature on the sociology and psychology literature on the factors that contribute to the formation and growth of a rivalry. Rivalries have been used as control covariates in studies for attendance demand of professional and collegiate sports, for example, Wooten (2014), Paul (2003), Falls and Natke (2016), and Lemke et al. (2010). There are also studies of the impact of rivalries on television viewership of professional sports contests such as Sung et al. (2017) and Sung (2014).

There is also a literature on measuring the monetary value of sports rivalries by examining the impact of the outcomes of individual games on monetary measures such as ticket prices and stock prices of teams. Sanford and Scott (2016) quantify the impact of a rivalry on the fans' willingness to pay (WTP) for tickets for college football games while controlling for other relevant variables. Demir and Rigoni (2017) measure the impact on the stock price, ceteris paribus, of Lazio and Roma soccer clubs in Italy's Serie A by fan investors given the outcomes of games played by these teams. They find that when club supporters experience a negative performance of their own team, then the result of their archrival impacts their investment decisions. They find that a loss by one's preferred team combined with an unexpected negative performance by the archrival is lower than a loss by the preferred team combined with an unexpected positive performance by the archrival on the stock price of the preferred team. To the best of our knowledge, there have been no studies that attempt to quantify the value of an NFL rivalry when the rivalry itself is under a credible threat due to team sale and divisional realignment. This paper measures the value of an existing NFL rivalry when team relocation was a credible threat.

2 Theory

2.1 Applying Random Utility Theory to Value an NFL Rivalry

Koppen (2001) states that random utility theory can be generalized and applied to a wide range of situations in which individuals are modeled as making choices probabilistically. Domencich and McFadden (1975) used random utility theory to model the probability that an individual would select a particular mode of transportation (e.g., walking, public transit, or personal car). We apply these techniques to

gain an understanding of the value that Minnesotans place on the NFL rivalry between the Viking and Packers.

We begin first by positing a utility function conditioned on the performance of the Vikings against the Packers in a particular NFL season. In this initial setting, we do not consider uncertainty. In Sect. 2.3, we introduce uncertainty and its impact on our fans. We follow that up in Sect. 2.4, by allowing for two types of fans: (1) Vikings fans and (2) everyone else. In Sect. 2.5, we develop a statistical model fitted with data from our sampling of Minnesotans to predict type 2 fan (i.e., non-Vikings fans).

Section 2.6 introduces a random utility model (RUM) for this application. We work from the theoretically based utility our fans (type 1 or type 2) receive from the NFL rivalry. We develop a likelihood function that is consistent with RUM approaches, given the observed data and the theoretical model. We then estimate this maximum likelihood function and recover the parameters of the individual fan indirect utility functions. We use these parameters to estimate a type 1 and type 2 fan's willingness to pay to preserve the Vikings-Packers rivalry. These parameters include one that measures the fan's marginal indirect utility of a dollar of wealth.

We measure willingness to pay of a type 2 fan (non-Vikings fans) to preserve the rivalry by including a referendum question in the survey that asks fans to trade off dollars to ensure the rivalry remains intact. Using the seminal work by Cameron (1988) with referendum data, we can use this parameter to recover the fan's valuation for the NFL rivalry between the Vikings and the Packers.

Section 2.7 identifies the "choke price" or maximum amount a (type 1) Vikings fan would pay to retain the Vikings-Packers rivalry. Section 2.8 uses the results from this sample to infer value for all Minnesotans (both type 1 and type 2 fans) for the value of the Vikings-Packers rivalry.

2.2 Preferences

We write the season outcome such that the Vikings best the Packers as $v \succ p$. We will also use w to indicate the fans' level of household wealth. The outcome in which the Vikings are bested by the Packers is $v \prec p$. It is reasonable that:

$$U(v \succ p, w) > U(v \prec p, w),$$

where $U(\cdot)$ is the utility function of a Vikings fan. That is, Vikings fans prefer the outcome in which the Vikings best the Packers.

The season outcome such that the Vikings never play the Packers is $v \rightleftharpoons p$. It also seems reasonable that:

$$U(v \succ p, w) > U(v \rightleftharpoons p, w).$$

This is simply stating that Vikings fans enjoy the outcome in which the Vikings best the Packers over the outcome in which the rivalry contest does not take place.

It is not clear theoretically that $U(v \prec p, w) > U(v \rightleftharpoons p, w)$. That is, we do not have a theoretical reason that Vikings fans would prefer the outcome in which the Vikings are bested by the Packers over the outcome in which the rivalry game does not take place. In fact, it may very well be that $U(v \prec p, w) < U(v \rightleftharpoons p, w)$. A Vikings fan may be worse off experiencing the Vikings bested by the Packers than having the Vikings never play the Packers at all.

2.3 Uncertainty

In this section, we incorporate the fact that for an upcoming season, fans lack the certainty of knowing whether the Vikings will best the Packers or vice versa. We write the probability that the Vikings best the Packers in any given season as θ. This implies that the probability that the Vikings are bested by the Packers is $1 - \theta$. The expected utility given the rivalry matchups occur in a season is:

$$E[U|R = 1] = \theta U(v \succ p, w) + (1 - \theta)U(v \prec p, w),$$

where R is an indicator that takes on a value of 1 if the Vikings and Packers rivalry matchups occur in a season. The expected utility with no rivalry contests is:

$$E[U|R = 0] = U(v \rightleftharpoons p, w).$$

A Vikings fan such that $E[U|R = 1] > E[U|R = 0]$ would have positive willingness to pay (WTP) for the rivalry matchups occurring in a season. This maximum WTP solves the equation:

$$U(v \rightleftharpoons p, w) = \theta U(v \succ p, w - wtp) + (1 - \theta)U(v \prec p, w - wtp).$$

A Vikings fan such that $E[U|R = 1] \leq E[U|R = 0]$ would have nonpositive willingness to pay for the rivalry matchups in a season.

Given not all Minnesotans are football fans or even Vikings fans, we allow for two distinct types of fans that will exhibit different behaviors when responding to the survey instrument. We will allow for type 1 fans to be Vikings fans and to exhibit value for the Vikings-Packers NFL rivalry. Anyone not identified as a type 1 fan will be included as type 2 fan. Theoretically, we force all type 2 fans to have zero value for the Vikings-Packers rivalry.

2.4 The Fans' Perspective

We use Contingent Valuation Methodology (CVM) and a mail order survey of 1400 randomly selected Minnesota households. The raw data for this paper and for the paper on relocation of the Minnesota Vikings were collected using the same survey. A representative copy of the survey is available in Appendix. Our survey was administered in the summer of 2002 to avoid the emotional highs and lows of the season and to deal with the fear of checking the mail caused by the 2001 anthrax mail attacks by Bruce Irvin. It is an understatement to say that we were extremely lucky with the timing of and the response to our mail survey. For details on the survey methodology and sample characteristics, we refer the reader to Fenn and Crooker (2009).

The survey instrument includes several questions that generate data to inform us on the value of the theoretical parameters. The question that allows us to impute the dollar value of the NFL rivalry is the Contingent Valuation (CV) question:

> League realignment may place the Packers in a division other than the NFC Central due to NFL TV revenue considerations. Would you be willing to pay $B to keep the Packers in the Central Division as a team that the Vikings play twice a year as division opponents?

By introducing a bid amount, the survey respondents are trading off dollars in an effort to retain the NFL rivalry contest between the Vikings and Packers. Given Cameron's (1988) work, we can measure the marginal rate of substitution between indirect utility and dollars as we demonstrate in Sect. 2.6. First, we consider how type 1 fan and type 2 fan survey respondents are likely to respond to this CV question.

Type 1 Fan

We suppose that type 1 fan is such that it is possible that:

$$E[U|R=1] > E[U|R=0].$$

After making the substitutions from Sect. 2.3, we model that this fan will respond "Y" to the CVM question when:

$$\theta U(v \succ p, w-B) + (1-\theta)U(v \prec p, w-B) - U(v \rightleftharpoons p, w) \geq 0.$$

Similarly, the fan will respond "N" when:

$$\theta U(v \succ p, w-B) + (1-\theta)U(v \prec p, w-B) - U(v \rightleftharpoons p, w) < 0.$$

Type 2 Fan

We suppose that for type 2 fan it is possible that:

$$E[U|R=1] \leq E[U|R=0].$$

This fan type will always respond with an "N" to the CVM question for any positive $B. Thus, type 2 fan respondents have no value for the NFL rivalry pitting the Vikings against the Packers.

2.5 Predict Type 2 Fan Membership

To this point, we have developed a theoretical framework to consider how Minnesotans may respond to the survey instrument. Our framework allows for two different fan types. Our modeling approach needs to sort these two fan types into two pools corresponding to these fan types. We use the survey to develop a protocol for separating the fan types. Survey question 34 asks:

Which of the following best describes your attitude toward the Vikings-Packers rivalry?

- I am a Vikings fan.
- I am a Packers fan.
- I am not a fan of either team but I follow sports.
- I do not pay attention to the Vikings-Packers game results.

Survey question 35 asks:
What best describes your feelings toward the Packers?

- I hate the Packers and love to see them lose to anyone.
- I do not like the Packers and love it when the Vikings beat them.
- I do not dislike the Packers but want the Vikings to win.
- I don't pay any attention to Vikings football.
- I do not care about the Vikings-Packers games.
- I am a Packers fan.

We designate all survey respondents that answer question 34 with **I am not a fan of either team but I follow sports** or **I do not pay attention to the Vikings-Packers game results** as **type 2 fan**. Also, all respondents that answer question 35 with **I don't pay any attention to Vikings football** or **I do not care about the Vikings-Packers games** will be designated as **type 2 fan**. The variable type 2 fan takes on a value of 1 for these respondents and a value of 0 for all other respondents. Summary statistics for our survey data appear in the table below. We see that based on our sorting protocol, 23.85% of our survey respondents are type 2 fans. The other variable names used in the table are explained below.

Attend_LYR is the number of Vikings home games (including preseason home games) that the respondent attended in the 2001–2002 NFL season. **TV_LYR** is the number of Vikings games (including preseason games) that the respondent watched on TV during the 2001–2002 NFL season. **Attend_CUR** is the number of Vikings home games (including preseason home games) that the respondent will attend during the 2002–2003 season. At least one survey respondent incorrectly answered 12, because the maximum number of home games is ten. **TV_CUR** is the number of Vikings games (including preseason games) that the respondent watched on TV during the 2002–2003 NFL season. **Sea_Tix** is a dummy variable that takes on a value of one if the respondent is a Vikings fan season ticket holder and a value of zero otherwise. **VK_Merch** is approximately how many dollars the respondent spends on Vikings merchandize per year. **VK_Read** is a dummy variable that takes on a value of one if the respondent answered that they read about the Vikings daily or weekly during the season and zero otherwise. **VK_Discuss** is a dummy variable that takes on a value of one if the respondent claimed that they discussed the team's fortunes with friends, family, or co-workers on a daily or weekly basis during the season and zero otherwise. **VK_DieHard** is a dummy variable that takes on a value of one if the respondent claimed to be a die-hard fan and a value of zero otherwise. **VK_Fun** is a dummy variable that takes on a value of 1 if the respondent answered that without Vikings football their level of fun would fall slightly or fall a great deal. **VK_PK_Att** is the number of Vikings-Packers games that the respondent will attend during the 2002–2003 season. **VK_PK_TV** is the number of Vikings-Packers games that the respondent will watch on television during the 2002–2003 season. **VK_PK_Read** is a dummy variable that takes on a value of one if the respondent reads about the Vikings a few days per week or daily during the week preceding the Vikings-Packers game and a value of zero otherwise. **VK_PK_Discuss** is a dummy variable that takes on a value of one if the respondent claims that they discussed the Vikings team fortunes with friends, family, or co-workers a few days per week or daily during the week preceding the Vikings-Packers game and a value of zero otherwise.

demog_single, demog_married, demog_male, and demog_white are all dummy variables that take on values of one if the respondent is single, married, male, and white, respectively. Otherwise, these variables take on a value of zero. **demog_hshld_size** is the number of people that reside in the respondent's household. **demog_birthyr** is the respondent's year of birth. **demog_Minn** is a dummy variable that takes on a value of one if the respondent has lived in Minnesota for more than 20 years and zero otherwise. **demog_educ_HS** is a dummy variable that takes on a value of one if the respondent has at least completed high school and a value of zero otherwise. **demog_income** is the respondent's reported income. **demog_kids** is the number of children that the respondents reported.

Viking Interest

	Min	First quartile	Med	Mean	Third quartile	Max	Standard deviation
Type 2 Fan	0	0	0	0.2385	0	1	0.4266
Attend_LYR	0	0	0	0.3269	0	10	0.9635
TV_LYR	0	2	10	8.236	14	20	6.28
Attend_CUR	0	0	0	0.3878	0	12	1.171
TV_CUR	0	0	8.75	8.202	15	20	6.55
Sea_Tix	0	0	0	0.01413	0	1	0.1181
VK_Merch	0	0	0	21.89	25	720	52.78
VK_Read	0	0	1	0.742	1	1	0.4379
VK_Discuss	0	0	1	0.5654	1	1	0.4961
VK_DieHard	0	0	1	0.6678	1	1	0.4714
VK_Fun	0	0	0	0.3481	1	2	0.4841
VK_PK_Att	0	1	1	1.032	1	3	0.3654
VK_PK_TV	0	0	0	0.5671	1	3	0.7948
VK_PK_Read	0	0	1	0.7191	1	1	0.4498
VK_PK_Discuss	−1	0	1	0.5371	1	1	0.5026
demog_single	0	0	0	0.1873	0	1	0.3905
demog_married	0	0	1	0.6908	1	1	0.4626
demog_hshld_size	0	2	2	2.509	4	18	1.517
demog_male	0	0	1	0.7261	1	1	0.4463
demog_white	0	1	1	0.9258	1	1	0.2623
demog_birthyr	1907	1940	1950	1950	1960	1985	14.8
demog_Minn	0	1	1	0.8975	1	1	0.3035
demog_educ_HS	0	0	0	0.2085	0	1	0.4066
demog_income	7500	37500	52500	52918	67500	85000	22899
demog_kids	0	0	2	2.008	3	9	1.715
N	566						

Estimating a Model Predicting Type 2 Fan Membership

In Sect. 2.5, we use the answers to survey questions 34 and 35 to classify each respondent into two fan type categories. In this subsection, we model the probability that a fan is a type 1 fan. Based on the survey responses of simply being a Vikings fan or responding that you do not dislike the Packers may not constitute the same level of certainty for the researcher that the respondent is a type 1 fan as the respondents that indicate they hate the Packers and love to see them lose to anyone. Because of his researcher uncertainty, we used a probit model to predict the likelihood that a fan is a type 1 fan. We model the probability that a fan is a type 1 fan ($y = 1$) below:

$$\Pr(y = 1) = \Phi\Big(\gamma_0 + \gamma_1 AttendLYR + \gamma_2 TVCUR + \gamma_3 VKDieHard + \gamma_4 VKPKAtt + \gamma_5 VKPKRead + \gamma_6 VKPKDiscuss + \gamma_7 Birthyear + \epsilon\Big),$$

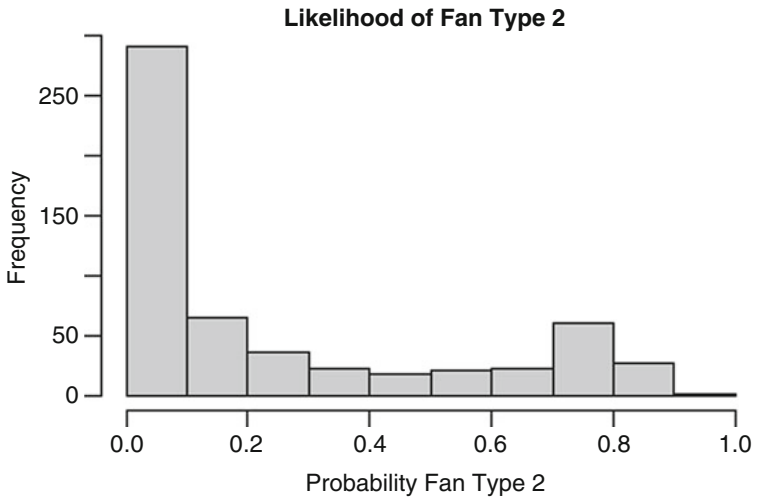
where $\Phi(\cdot)$ is the probability density function of the standard normal distribution. The estimated model parameters appear in the table below.

	Estimate	Std. error	Z value	Pr(>|z|)
(Intercept)	26.76	10.36	2.584	0.009767
Attend_LYR	−0.4441	0.2265	−1.96	0.04995
TV_CUR	−0.07478	0.01767	−4.232	2.312e-05
VK_DieHard	−0.7047	0.1826	−3.859	0.0001137
VK_PK_Att	0.6569	0.2732	2.404	0.0162
VK_PK_Read	−0.5126	0.1895	−2.705	0.006829
VK_PK_Discuss	−0.6438	0.2045	−3.148	0.001645
demog_birthyr	−0.0137	0.005322	−2.575	0.01003

Based on the estimated model parameters, we see that attendance at games in the previous season (Attend_LYR), watching games in the current season on TV (TV_CUR), identifying as a "die-hard" Vikings fan, reading sports news related to the Vikings-Packers game, discussing with friends and family the Vikings-Packers game, and older fans (demog_birthyr) are all statistically significant and characteristics that suggest the respondent is more likely to be of type 1 fan. The corollary is that these characteristics make it less likely that the respondent is of type 2 fan.

Likelihood of Type 2 Fan Membership

Based on the estimated model parameters in section "Estimating a model predicting type 2 fan membership", we can calculate the predicted likelihood that a survey respondent is a member of the type 2 fan base. The histogram containing these predictions is given below. According to the histogram, only 24% of fans selected at random are more likely than not to be type 2 fan. We get this number by adding the number of fans (134), in the bars in the categories from 0.5 to 1 probability, and dividing by the total number of respondents (566). Our predictions from the model above are consistent with the responses from survey questions 34 and 35. In the survey, based on our definition of type 2 fan in Sect. 2.5, only 23.85% of our survey respondents are type 2 fans.



2.6 *Valuing an NFL Rivalry*

In this section, we introduce the RUM theory. Based on our theoretical discussion in Sect. 2.4, we stated a Vikings fan in the type 1 fan category will answer "Y" to the CVM question when:

$$\theta U(v \succ p, w - B) + (1 - \theta)U(v \prec p, w - B) - U(v \rightleftharpoons p, w) \geq 0.$$

We introduce the following linear indirect utility function parameterizations. In general, using the form $U(\cdot) \equiv V(\cdot) + \epsilon_i$, where:
$V(\cdot)$*is the indirect utility function and* ϵ_i *is the error term*,we write:

$$\theta(V(v \succ p, w - B) + \epsilon_{1i}) + (1 - \theta)(V(v \prec p, w - B) + \epsilon_{2i}) - V(v \rightleftharpoons p, w) - \epsilon_{3i} \geq 0.$$

That is, we model the probability that the fan will answer "Y" to the CVM question according to:

$$Pr\{\theta Vv \succ p, w - B + \epsilon_{1i} + 1 - \theta Vv \prec p, w - B + \epsilon_{2i} - Vv \rightleftharpoons pw - \epsilon_{3i} \geq 0\}$$
$$Pr\{\theta Vv \succ p, w - B + 1 - \theta Vv \prec p, w - B - Vv \rightleftharpoons pw$$
$$+ \theta\epsilon_{1i} + 1 - \theta\epsilon_{2i} - \epsilon_{3i} \geq 0\}.$$

Using the following linear parameterization of the indirect utility functions:

$V(v \succ \mathrm{p}, \mathrm{w} - \mathrm{B}) = \alpha + \alpha_{\mathrm{w}}(w - B) + \alpha_{v1}$, $V(v \prec \mathrm{p}, \mathrm{w} - \mathrm{B}) = \alpha + \alpha_{\mathrm{w}}(w - B) + \alpha_{v2}$, $V(v \rightleftharpoons p, w) = \alpha + \alpha_w$ and $\epsilon_i = \theta\epsilon_{1i} - (1 - \theta)\epsilon_{2i} - \epsilon_{3i}$.

We can rewrite the previous probabilistic statement as:

$$\begin{aligned} &Pr\{\epsilon_i \leq \theta(\alpha + \alpha_w(w - B) + \alpha_{v1}) + (1 - \theta)(\alpha + \alpha_w(w - B) + \alpha_{v2}) - \alpha - \alpha_w w\} \\ &\quad Pr\{\epsilon_i \leq \alpha + \alpha_w(w - B) + \theta(\alpha_{v1} - \alpha_{v2}) + \alpha_{v2} - \alpha - \alpha_w w\} \\ &\quad Pr\{\epsilon_i \leq \theta\alpha_{v1} + (1 - \theta)\alpha_{v2} - \alpha_w B\} \end{aligned}$$

The parameter α measures the autonomous component of fan's indirect utility function, α_{v1} is a fan's indirect utility associated with the Vikings besting the Packers, α_{v2} is a fan's indirect utility associated with the Vikings being bested by the Packers, and α_w is the marginal indirect utility associated with a dollar of income.

Using our results from Sect. 4, we reason that if the respondent answered "Y" to the CVM question, they must be a type 1 fan. Thus, the probability of the "Y" is:

$$Pr\{\epsilon_i < \theta\alpha_{v1} + (1 - \theta)\alpha_{v2} - \alpha_w B\}$$

If the respondent answered "N" to the CVM question, they may be either a type 1 or type 2 fan.

We model the likelihood as:

$$y \cdot \pi(1 - Pr\{\epsilon_i < \theta\alpha_{v1} + (1 - \theta)\alpha_{v2} - \alpha_w B\}) + (1 - \mathrm{y}) \cdot (1 - \pi),$$

where y is assigned the value 1 when the respondent answers "Y" to the CVM and 0 otherwise, π is the predicted likelihood the individual is type 1 fan, and $1 - \pi$ is the likelihood the individual is type 2 fan (estimated in section "Estimating a model predicting type 2 fan membership"). In the next section, we consider how we can apply maximum likelihood to estimate the model parameters across a sample of Minnesotans.

Maximum-Likelihood Estimation

The likelihood function developed in Sect. 2.6 is suitable if every individual in the sample was homogeneous or, at least, if each fan type was homogeneous. As this is unlikely to be the case in any applied setting, we extend our model to account for individual tastes and preferences to define:

$$\begin{aligned} &\theta_i\alpha_{v1,i} + (1 - \theta_{\mathrm{i}})\alpha_{v2,i} \approx \beta_0 + \beta_1 TVLYR_i + \beta_2 ATTCUR_i + \beta_3 VKGood_i \\ &\quad + \beta_4 VKRead_i + \beta_5 VKMerch_i + \beta_6 VKPKTV_i + \beta_7 VKPKDiscuss_i + \beta_8 Male_i \\ &\quad + \beta_9 Married_i + \beta_{10} Kids_i + \beta_{11} HSEDUC_i + \beta_{12} NONWhite_i + \beta_{13} Minnesota_i \\ &\quad + \epsilon_{ML,i}, \end{aligned}$$

where β_0, β_1, …, β_{13} are unknown model parameters and $\epsilon_{ML,\ i}$ are unknown stochastic terms with a mean of zero and finite variance. This parameterization allows for us to model the mapping from individual characteristics into an indirect utility function for the expected indirect utility from the Vikings besting the Packers. Results from estimating the likelihood function allowing for individual fan heterogeneity appear below.

	Estimate	Std. error	T value	Pr(> t)
Alpha_w	0.0197	0.007566	2.604	0.009216
intercept	−0.5189	0.3747	−1.385	0.166
TV_LYR	−0.02075	0.01668	−1.244	0.2133
ATT_CUR	0.0847	0.05896	1.437	0.1508
VK_Good	0.6622	0.1523	4.349	1.37e-05
VK_Read	−0.6459	0.2467	−2.618	0.008836
VK_Merch	0.0001088	0.001444	0.07535	0.9399
VK_PK_TV	−0.1536	0.1044	−1.472	0.1411
VK_PK_Discuss	0.9003	0.1933	4.657	3.211e-06
Male	0.1545	0.1778	0.8695	0.3846
Married	−0.04055	0.1732	−0.2342	0.8149
Kids	0.08257	0.04368	1.89	0.0587
HS_EDUC	−0.2379	0.1795	−1.325	0.1851
Non_White	−0.5447	0.3652	−1.491	0.1359
Minnestoa	0.09306	0.2773	0.3356	0.7372

Based on the estimated coefficient on α_w, we find that the marginal indirect utility associated with a dollar of wealth is 0.0197. The reciprocal of 0.0197 is 50.76. Cameron (1988) establishes that this reciprocal yields the dollar value of 1 unit of utility for this particular parameterization of the indirect utility function. That is, about $50.76 buys 1 unit of utility in this model. We go on to convert the other effects into their corresponding dollar values by dividing the coefficients by 0.0197. Discussing the Vikings and Packers game with friends and family has a marginal indirect utility of 0.9003. Using these two coefficients together, the ratio of the coefficient on VK_PK_Discuss to the coefficient on α_w, we have the marginal value of discussing the Vikings and Packers game with friends and family measured in dollars as $\frac{0.9003}{0.0197} = \$45.70$. That is, for type 1 fans, the marginal benefit of discussing the Vikings and Packers game with friends and family is $45.70. It is the ratio of these coefficients to the marginal indirect utility associated with a dollar that allows us to transform the value of the characteristic to a dollar value (Cameron, 1988).

Forcing the parameters that had statistically insignificant estimates to take on zero, we estimate the restricted model indicated by the table below.

	Estimate	Std. error	T value	Pr(> t)
a_w	0.01866	0.007439	2.509	0.01212
intercept	−0.7077	0.2073	−3.414	0.0006393
VK_Good	0.6895	0.138	4.997	5.821e-07

(continued)

	Estimate	Std. error	T value	Pr(> t)
VK_Read	−0.6107	0.2353	−2.596	0.009434
VK_PK_Discuss	0.9	0.1762	5.108	3.254e-07
Kids	0.08754	0.04039	2.167	0.03022

For this restricted model, we find that $53.59 buys 1 unit of utility. Those that view the Vikings as a public good are willing to pay an additional $36.57 to maintain the Vikings-Packers rivalry. Those that report reading about the Vikings-Packers rivalry are estimated to have a $32.73 lower value for the Vikings-Packers rivalry game. Fans that discuss the Vikings-Packers rivalry with friends and family are willing to pay $48.23 more to maintain the rivalry game. Finally, fans with kids are willing to pay an additional $4.69 to keep the rivalry games. The intercept implies a -$37.93 valuation for fans unassociated with any of the other characteristics.

The average fan that views the Vikings as a public good, reads about the Vikings, discusses the Vikings and Packers rivalry game with friends and family, and has kids has an estimated value for the rivalry at $19.22. The average fan that views the Vikings as a public good, discusses the Vikings and Packers rivalry game with friends and family, and has kids has an estimated value for the rivalry at $51.95.

2.7 The Vikings-Packers Choke Price

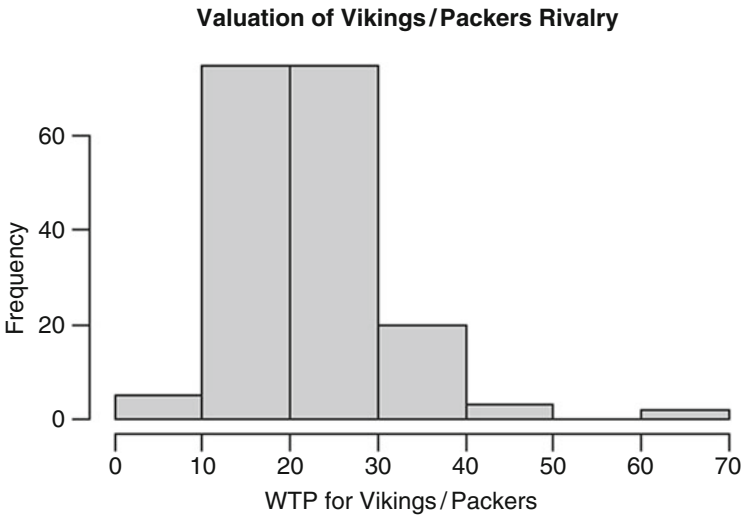
We can determine the "choke price," i.e., the bid such that survey respondent is expected to answer the CVM question with an "N" as the amount B_i such that:

$$B_i^c = \frac{\beta_0 + \beta_3 VKGood_i + \beta_4 VKRead_i + \beta_7 VKPKDiscuss_i + \beta_{10} Kids_i}{\alpha_w}.$$

The omitted parameters are forced to zero in this expression. Calculating this value for each respondent in our survey provides a distribution of willingness to pay for the NFL rivalry between the Vikings and Packers. We find 386 respondents with a zero value for the rivalry and 566 respondents with a positive value. Of the survey respondents, 40.5% have no value for the rivalry and 59.5% have a positive value. Among those with a positive value, the average value is $22.50. The mean for the full sample is $13.38 per household.

Histogram of WTP for Vikings-Packers Rivalry

A histogram of the maximum willingness to pay for the rivalry (the choke price from the previous section) appears below.



2.8 The Value of the Vikings-Packers Rivalry to Minnesotans

At the time of the survey, there were 1,323,569 households in Minnesota. Our results above found an average value of $7.16 for the rivalry per household. Presuming that our random sample is reflective of the population of Minnesota, an expected total valuation for the rivalry game between the Vikings and Packers can be approximated by multiplying $7.16 per household by the total number of Minnesota households 1,323,569. This product is $9,476,754. That is, Minnesotans value the Vikings and Packers rivalry game at $9,476,754.

Our view is that this CVM question was a take it or leave it scenario. This would imply that this approximately $9.5 million valuation represents the value of the rivalry for all time. The 30-year average fixed rate mortgage in the USA was 6.43% on August 2, 2002. Presuming a constant annual benefit, the present value of a series of rivalry games in a given NFL season is $572,540.90. This is calculated as:

$$Rivalry = \sum_{t=0}^{\infty} \frac{y}{(1+r)^t},$$

where ***Rivalry*** is the discounted present value of the rivalry, ***y*** is the annual benefit of the rivalry contests, and ***r*** is the discount rate. From this study, we posit that ***Rivalry*** = $9,476,754 and a reasonable approximation for the discount rate is ***r*** = 6.43%. Solving for ***y*** the annual benefit of the rivalry, we find:

$$y = \frac{Rivalry}{\sum_{t=0}^{\infty} \frac{1}{(1+r)^t}},$$

Recognizing that $\sum_{t=0}^{\infty} \frac{1}{(1+r)^t}$ is a geometric series and using $\boldsymbol{r} = 0.0643$, we find $\sum_{t=0}^{\infty} \frac{1}{(1+r)^t} = \frac{1+r}{r}$ or 16.5521. The annual benefit of the Rivalry is:

$$y = \frac{\$9{,}476{,}754}{16.5521} = \$572{,}541.$$

That is, the annual benefit of the Rivalry is $572,541. In 2022 dollars, the Vikings-Packers rivalry is $946,355.

There is also some concern that we decomposed fans into only two types: Vikings fans and fans that are disinterested in the Vikings and/or the Vikings-Packers rivalry. This decomposition ignores Packers fans located in Minnesota. In the data, respondents that identified as Packers fans are included in the decomposition with Vikings fans. The number of respondents identifying as Packers fans made up a very small fraction of the data set at under 5%. The estimated parameter results are robust to the inclusion or exclusion of these fans.

A possible extension of this work could survey populations in two cities around an NFL rivalry. It would be interesting to explore if there are differences in the value of these rivalries across cities and if the value of a rivalry in a city is a function of the relative success of the local team in the rivalry games and in the NFL.

Appendix: A New Stadium for the Minnesota Vikings: What Is Your Opinion?

(1) How many Vikings home games did you attend last season (Fall 2001 & January 2002)? (The Vikings play eight regular season home games.)

_____Games

(2) How many Vikings football games did you watch on TV last season (Fall 2001 & January 2002)? (The Vikings play 16 regular season games.)

_____Games

(3) If you did attend a Vikings fan game, approximately how much did you pay for your single game ticket? (If you did not attend a game, please circle number 2.)

1. _____Dollars.
2. I did not attend a game last year.

(4) How many Vikings home games will you attend this season (Fall 2002 & January 2003)? (The Vikings play eight regular season home games.)

_____Games

(5) How many Vikings football games will you watch on TV this season (Fall 2002 & January 2003)? (The Vikings play 16 regular season games.)

_____Games

(6) Are you a season ticket holder?

1. Yes.
2. No.

(7) Approximately how much time does it take you to reach the Metrodome from your home for a Vikings fan home game?

_____Minutes

(8) Approximately how much do you spend each year on Minnesota Vikings merchandize (clothing, baseball caps, etc.)?

_____Dollars.

(9) Which of the other teams do you follow closely? (Circle all that apply.)

1. Minnesota Timberwolves
2. Minnesota Wild
3. Minnesota Lynx
4. Minnesota Thunder
5. University of Minnesota Football
6. University of Minnesota Basketball
7. University of Minnesota Baseball
8. University of Minnesota Hockey
9. University of Minnesota Wrestling
10. St. Paul Saints
11. Other pro-football team (e.g., Packers, Bears, etc.)
12. Other sports teams

(10) What is your level of interest in the National Football League?

1. I am a big fan (I watch games in person or on TV frequently).
2. I am a casual fan (I watch games sometimes).
3. I do not care about the National Football League.
4. I dislike the National Football League.

(11) During the season, how often do you read about Vikings Football in newspapers, magazines, or online?

1. Never
2. Once a week
3. A few days per week
4. Daily

(12) During the season, how often do you discuss Vikings football with friends, family, and co-workers?

1. Never
2. Rarely
3. A few days per week
4. Daily

(13) What best describes your level of interest in Vikings Football?

1. I am a die-hard fan. (Live and die with the Vikings. I am happy if they win and unhappy if they lose.)
2. I am a casual fan. (I like the Vikings but don't lose sleep over them.)
3. I am a fair-weather fan. (I follow the Vikings if they are winning.)
4. I don't pay any attention to Vikings football.
5. I am tired of hearing about Vikings football.

(14) Without Vikings football, do you believe your personal level of fun would:

1. Improve a great deal
2. Improve slightly
3. Remain unchanged
4. Fall slightly
5. Fall a great deal

Please read the following and answer the questions which follow:

The Minnesota Vikings organization would like to see the Vikings play in a new stadium here in Minnesota. They believe that the revenue from the new stadium will allow the Vikings to remain competitive in the NFL. The Vikings say that a new stadium will cost between $450 and $500 million.

Presently, we have estimates from private and university economists on the typical Minnesotans' share of this amount. This would be your share of the cost if public funding for a new stadium were approved. While we have only an approximate cost to the typical Minnesotan, the cost to individuals would vary with income and geographical location. Please answer carefully even if you view the cost stated below as very high or very low. It is important that you indicate whether you would agree or disagree to pay the stated figure if it were your share for a new stadium.

(15) Would you be willing to pay $ out of your own household budget during the next year to make a new stadium possible?

1. Yes.
2. No.

(16) Which of the following best describes why you are willing to pay for a new Vikings stadium? (Please circle the most important reason.)

1. I like to attend Vikings games.
2. I like to watch the Vikings on TV.
3. I like to talk about Vikings football with others.
4. Having a team in town that may win the Super Bowl would be good for the area.
5. The facilities in the Metrodome (seats, bathrooms, etc.) are not satisfactory.
6. I support the joint stadium with the University of Minnesota.
7. Others (please describe).

(17) If you would not be willing to pay for a new stadium, which of the following reasons best describe why? (Please circle the most important reason.)

1. Taxes should not be used for a football stadium.
2. I do not care about Vikings football.
3. I pay too much in taxes already.
4. The Metrodome is fine as it is.
5. The Metrodome should be renovated.
6. Red McCombs (the owner of the Vikings) has enough money.
7. I would rather pay for a Twins stadium.
8. Others (please describe).

(18) Do you believe that the Vikings will leave town if they do not get a new stadium approved within the next few years?

1. Yes.
2. No.

(19) Do you think that a new stadium would bring greater prestige to the Twin Cities area?

1. Yes.
2. No.

(20) Do you think that a new stadium would help the Vikings win the Super Bowl?

1. Yes.
2. No.

(21) At the same ticket prices, how many Vikings football games would you attend each year in a new stadium? (For your information, the Vikings played eight regular season home games last year.)

_____Games

(22) If ticket prices were to increase by $5 per game, how many Vikings football games would you attend each year in a new stadium? (For your information, the Vikings played eight regular season home games last year.)

_____Games

(23) Presently, both the Vikings and the Twins are seeking new stadiums. Which one of these teams would you support for a new stadium?

1. Vikings
2. Twins
3. Neither
4. Both

(24) Presently, the Vikings are considering a joint stadium along with the University of Minnesota. Would you be more likely to support the Vikings if they propose a joint stadium?

1. Yes.
2. No.
3. Indifferent.

(25) What is your marital status?

1. Single
2. Divorced
3. Married
4. Not married but in a committed relationship

(26) How many people live in your home/apartment?

_____People

(27) What is your gender?

1. Male
2. Female

(28) What group do you most identify with?

1. White
2. African-American
3. Asian-American
4. Latino
5. Others (please describe)

(29) In what year were you born?

_____Year

(30) How long have you lived in Minnesota?

1. Less than a year
2. About a year
3. 2–5 years
4. 6–10 years
5. 11–20 years
6. More than 20 years

(31) How much education have you completed?

1. 8 years or less
2. 9, 10, or 11 years
3. High school diploma or GED
4. Some college but no diploma
5. College diploma
6. Graduate or professional school

(32) To the best of your memory, what was your income before taxes last year?

1. Less than $15,000
2. Between $15,000 and $29,999
3. Between $30,000 and $44,999
4. Between $45,000 and $59,999
5. Between $60,000 and $74,999
6. $75,000 or more

(33) How many kids do you have?

_____Kids

Questions on the Vikings-Packer Rivalry:

The following questions pertain to your interest in the Vikings when they play the Green Bay Packers.

(34) Which of the following best describes your attitude toward the Vikings-Packer rivalry?

1. I am a Vikings fan.
2. I am a Packers fan.
3. I am not a fan of either team but I follow sports.
4. I do not pay attention to the Vikings-Packers game results.

(35) What best describes your feelings toward the Packers?

1. I hate the Packers and love to see them lose to anyone
2. I do not like the Packers and love it when the Vikings beat them.
3. I do not dislike the Packers but want the Vikings to win.

4. I don't pay any attention to Vikings football.
5. I do not care about the Viking-Packers games.
6. I am a Packers fan.

(36) How many Vikings-Packers games will you attend this year?

1. Zero
2. One
3. Two

(37) How many Vikings-Packers games will you watch on TV this year?

1. Zero
2. One
3. Two

(38) During the week preceding the Vikings-Packers game, how often do you read about Vikings football in newspapers, magazines, or online?

1. Never
2. Once a week
3. A few days per week
4. Daily

(39) During the week preceding the Vikings-Packers game, how often do you discuss Vikings football with friends, family, and co-workers?

1. Never
2. Rarely
3. A few days per week
4. Daily

(40) League realignment may place the Packers in a division other than the NFC Central due to NFL TV revenue considerations. Would you be willing to pay $_____ to keep the Packers in the Central Division as a team that the Vikings play twice a year as division opponents?

1. Yes
2. No

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The Effect of National Political Conventions on Hotel Occupancy: Updated Evidence

Abhimanyu Aurobindo, Lauren R. Heller, and E. Frank Stephenson

1 Introduction

It is often claimed that national political conventions bring millions of dollars to their host cities. However, thanks to the pioneering work of Robert Baade with a variety of coauthors, evidence suggests this is not necessarily the case (Baade et al. 2009). Over the course of his career, Baade has written widely on the economic impacts of "mega-events," starting with the impact of stadiums and professional sports teams and expanding to include all sorts of events from the Olympics and the World Cup to even Hurricane Katrina (Baade and Dye 1988, 1990; Baade 2006; Baade and Matheson 2002; Baade et al. 2007). Building on this foundation and using data on daily hotel occupancy for cities hosting the 2008 and 2012 Democratic and Republican National Conventions, Heller et al. (2018) found that host cities did experience increases in hotel stays and revenue but that the increases were not nearly as much as the groups who ran the conventions claimed. Given that these conventions took place more than a decade ago and were held in different cities, it could be the case that the previous findings were an anomaly or a result of particular idiosyncrasies of the cities in which they were held. For these reasons, this paper uses a similar methodology to Heller et al. (2018) to examine the economic effects of the 2016 Democratic National Convention held in Philadelphia, Pennsylvania, and the 2016 Republican National Convention held in Cleveland, Ohio. The new results tell a consistent story: Political conventions do indeed bring visitors and revenue to a host city but at a level far below what event promoters suggest.

Before turning to this paper's analysis, it is important to note why daily hotel occupancy data are well suited for studying tourist inflows associated with large

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events like political conventions. First, daily hotel data allow researchers to control for "normal" hotel occupancy at the time of the convention by incorporating month-of-year and day-of-week effects. Hotel occupancy in many cities takes an inverse U-shape over the course of the year, remaining relatively low during winter months and peaking during summer months (when political conventions are typically held). Likewise, hotel occupancy in many cities is higher on weekdays than weekends, though there are exceptions such as New Orleans which has relatively low business travel but robust weekend tourism. Since national political conventions are typically held on weekdays (Mondays through Thursdays), they take place on days that would already have higher than average occupancy in many host cities. Thus, controlling for such effects, and allowing those effects to vary by city, is important for isolating net tourism inflows.

Second, daily hotel data allow researchers to determine if there are spillover effects before or after large events since promoters often claim that tourists stay a few days more than necessary. To that end, Heller et al. (2018) find large increases in hotel room rentals starting a few days before the 2008 and 2012 national conventions, so capturing these visitors would be part of an accurate assessment of those conventions. However, the authors also found that hotel occupancy was significantly lower in the days following conventions and argue that accounting for such "hang-over" effects is also an important part of accurately analyzing political conventions.

Beyond Heller et al. (2018), several other recent papers have used daily hotel occupancy data to assess the economic effects of various events. Depken and Stephenson (2018) consider a wide array of sports events held in the Charlotte metropolitan area. Their findings include large effects for NASCAR events held at Charlotte Motor Speedway, modest effects associated with the NFL Carolina Panthers, and no significant effect for the NBA Charlotte Hornets. Chikish et al. (2019) use a similar approach to examine the effect of sporting events and concerts held at the Staples Center in Los Angeles and find no effect associated with sporting events of any type. Baumann et al. (2021) examine the effect of MLB's All-Star Game. Likewise, Baumann et al. (2022) analyze a broad array of events including sports and concerts hosted at sports arenas. Heller and Stephenson (2021) examine the effect of the Super Bowl on four recent host cities. Their conclusions include that the net gain in room rentals is considerably smaller than the gross number of rentals by Super Bowl fans and that the effect is heterogeneous across cities (depending on normal occupancy levels).

Since the benefit to Super Bowl host cities is heterogeneous, the same might be expected for cities hosting large political conventions. Hence, as noted earlier, this paper examines the effect of conventions on 2016 host cities and is a valuable expansion of previous work.

2 Empirical Framework

The 2016 Democratic National Convention was held in Philadelphia from July 25 to 28, and the 2016 Republican National Convention was held in Cleveland from July 18 to 21. We use daily hotel room data from 2014 to 2018 from each city's metropolitan area collected from STR, a firm which focuses on data in the hotel industry. Descriptive statistics for each city's rooms let, ADR, and total hotel revenue are reported in Table 1.

The regression model for each city takes the basic form:

$$\mathrm{DEP_t} = \beta + \Omega\mathrm{CONVENTION} + \gamma\mathrm{OTHEREVENTS} + \theta\mathrm{FE} + \varepsilon,$$

where $\mathrm{DEP_t}$ is the hotel occupancy measure being used: the number of rooms rented, the average daily room rate (ADR), and hotel revenue in thousands of dollars. The matrix CONVENTION contains dummy variables for each of the 4 convention days, as well as for the 3 days before and after the convention. The vector of coefficients to be estimated, Ω, gives the effect associated with each day of the convention in the respective host city.

To mitigate the potential for omitted variable bias and for comparison with the estimated effects of hosting a national political convention, the matrix OTHEREVENTS contains an array of dummies for various other events held in Cleveland and Philadelphia. The events for Cleveland include the annual Cleveland marathon and home games played by the Indians, Cavaliers, and Browns. In Philadelphia, the other events include the annual Philadelphia Marathon, the Penn Relays, a visit by Pope Francis in 2015, and home games played by the Eagles, Flyers, Phillies, and 76ers. The Penn Relays is a 4-day event, and the Pope's visit is a 3-day event. For the marathons and NFL franchises' home games, there is also a day before dummy included in the OTHEREVENTS matrix because fans might arrive a day early for those events given the morning starting time for marathons and the early afternoon kickoffs for many NFL games.

To control for hotel occupancy changes over time and across days of the week and months of the year, the matrix FE includes year, month, and day of week fixed

Table 1 Descriptive statistics for hotel occupancy variables

Variables	Mean	Std. dev.	Min	Max
Cleveland hotels				
Rooms	14,117	3395	4542	22,822
ADR	102.32	13.58	74.49	260.90
Revenue	1477.41	521.54	350.07	5629.46
Philadelphia hotels				
Rooms	32,277	6848	12,737	47,023
ADR	126.66	17.49	87.32	276.3
Revenue	4173.73	1324.98	1125.54	12,352.49

$N = 1826$. The revenue variables are reported in thousands of dollars

effects. β is an intercept and ε is an error term. Augmented Dickey-Fuller tests reject the presence of a unit root for all six dependent variables so the models are estimated using OLS with Newey-West corrected standard errors to control for serial correlation present in the error term.

3 Results

The results of the Cleveland regressions are reported in Table 2, while Philadelphia's results are reported in Table 3. Controls for days of the week, month, and year are included in the models but omitted from the tables for brevity. The high R^2 values (above 0.60 for the Philadelphia models and above 0.70 for the Cleveland models) indicate much of the variation in the hotel occupancy variables is explained by the included regressors. Many of the coefficients are very precisely estimated, with many *t*-ratios greater than 10 and over 50 for a handful of variables.

In both cities, the convention is associated with significant increases in hotel room rentals. In Cleveland, there are positive effects on the night before the convention and for all 4 days of the convention. However, as in Heller et al. (2018), there is a significant "hangover" effect as indicated by the negative coefficients on the 3 days after the convention. Taken together, the convention increases room rentals by approximately 15,000 room nights. Philadelphia also sees positive effects on the convention nights and the night before the convention, as well as a hangover effect immediately following. All told, the effect for Philadelphia is about 40,000 room nights, which is considerably larger than the effect in Cleveland. As seen in Heller et al. (2018), the effect of conventions can vary considerably across host cities. In this case, most of the difference is probably attributable to the Democratic convention in Philadelphia having nearly twice as many delegates (4763) as the Republican convention in Cleveland (2472). It may also be the case that the massive security restrictions put in place for the Cleveland convention in particular muted the effect of the number of delegates who chose to bring families and friends, which could also dampen the result for Cleveland in comparison to Philadelphia (Ross 2016; Tobias 2016).

Both cities also experience increases in hotel revenue. In Cleveland, the total increase in hotel revenue is approximately $19.5 million, while in Philadelphia the total increase is about $39 million (roughly twice as large as Cleveland). Likewise, ADR in both cities is more than $100 higher than usual on the night before the convention and roughly $150 higher over the four nights of each convention. As noted by Baumann et al. (2009) and Heller and Stephenson (2021), the large increases in ADR observed in both cities mean that a significant portion of the revenue gains flowed to out-of-town hotel owners, thereby muting the economic gains to the host cities.

As for the other events, Cleveland's professional sports teams' home games and the night before the Cleveland Marathon are all associated with increases in room rentals, ADR, and hotel revenue. The effect for the Cleveland Browns is similar to

Table 2 Cleveland regression results

Variables	(1) Rooms	(2) ADR	(3) Revenue
Republican convention			
Day3BefCle	−868.9**	55.78***	762.0***
	(388.6)	(1.711)	(63.27)
Day2BefCle	18.17	78.94***	1406***
	(389.1)	(1.731)	(64.02)
DayBefCle	7788***	153.4***	3864***
	(379.7)	(1.713)	(61.60)
CleConv	4509***	145.9***	3630***
	(422.8)	(2.108)	(72.33)
DayAftCle	−4509***	20.05***	−248.1***
	(388.6)	(1.711)	(63.27)
Day2AftCle	−3851***	−0.0529	−426.1***
	(389.1)	(1.731)	(64.02)
Day3AftCle	−2004***	2.413	−216.3***
	(379.7)	(1.713)	(61.60)
Cavs	391.0***	2.467***	78.85***
	(118.0)	(0.547)	(19.98)
Indians	441.4***	1.732***	77.07***
	(157.5)	(0.588)	(24.82)
Browns			
Day before	1385***	6.020***	227.9***
	(355.2)	(1.147)	(53.61)
Game day	1425***	6.195***	215.2***
	(305.3)	(1.135)	(44.88)
Cleveland marathon			
Day before	3119***	11.71***	529.8***
	(417.3)	(2.396)	(93.71)
Race day	2564***	13.86***	424.0***
	(376.9)	(1.430)	(59.13)
R-squared	0.714	0.740	0.721

Newey-West corrected standard errors in parentheses. Models also include day of week, month of year, and year fixed effects. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Depken and Stephenson's (2018) finding of about 1700 room nights on NFL game days, but the positive effect associated with the Cleveland Cavaliers stands in contrast their finding no effect for NBA games in Charlotte. The difference in NBA results may be attributable to LeBron James returning to the Cavaliers from 2014 to 2018.

In Philadelphia, both the Pope's visit and the Penn Relays generate an additional 3258 nightly room rentals, though the Penn Relays last 4 days, while the Pope's visit was a 3-day event. Interestingly, the ADR increase for the Penn Relays is considerably smaller ($10 vs $86) than the Pope's visit; this likely indicates that college

Table 3 Philadelphia regression results

	(1)	(2)	(3)
Variables	Rooms	ADR	Revenue
Democratic convention			
Three days before	88.06	29.02***	992.9***
	(706.2)	(1.619)	(135.7)
Two days before	489.0	43.97***	1728***
	(725.2)	(1.645)	(139.6)
One day before	10,012***	124.5***	5619***
	(714.9)	(1.662)	(137.0)
Convention days	8799***	145.5***	7452***
	(787.2)	(1.776)	(154.9)
One day after	−4343***	13.64***	−139.5
	(706.2)	(1.619)	(135.7)
Two days after	−2147***	6.441***	−90.81
	(725.2)	(1.645)	(139.6)
Three days after	3255***	26.46***	1130***
	(714.9)	(1.662)	(137.0)
Sixers	−413.8	−1.015	−107.5*
	(312.2)	(0.842)	(60.74)
Phillies	562.1	0.661	95.60
	(347.3)	(0.957)	(71.75)
Eagles			
Day before	636.9	3.604*	213.4
	(645.2)	(2.059)	(139.5)
Game day	1612**	3.772**	291.4**
	(670.8)	(1.834)	(132.9)
Flyers	277.6	0.601	29.94
	(294.5)	(0.767)	(57.39)
Philadelphia marathon			
Day before	1762	12.54***	637.5***
	(1155)	(2.818)	(235.1)
Race day	−5275***	−10.09***	−883.5***
	(907.8)	(2.584)	(182.4)
Penn relays	3258***	10.35***	798.0***
	(626.0)	(2.212)	(143.0)
Pope's visit	3258***	86.36***	3367***
	(997.4)	(1.961)	(137.0)
R-squared	0.663	0.615	0.641

Newey-West corrected standard errors in parentheses. Models also include day of week, month of year, and year fixed effects. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

athletes stay in relatively cheap hotels. As a result of the lower ADR increase associated with the Penn Relays, it generates only about $800,000 of additional hotel revenue per night, while the Pope's visit generates more than $3.3 million per

night. As for home games by Philadelphia's professional sports franchises, there are no large or statistically significant effects associated with the Flyers, 76ers, or Phillies. Game days for the Eagles see about 1600 additional rooms let (again, similar to Depken and Stephenson 2018) as well as increases in ADR and hotel revenue. The Philadelphia Marathon is estimated to have a large negative effect, but this may be an artifact of the marathon always being run on a Sunday in November. Since November is a low occupancy time of the year and Sunday is the lowest occupancy day of the week, the Philadelphia Marathon variable probably amounts to a dummy variable for a low occupancy time of the year.

4 Conclusion

Our results indicate that the conventions bring in a significant number of hotel room rentals to the city. However, the amount of revenue brought in by hotels is still vastly below the claims of the host committees. In 2016, the Cleveland Host Committee claimed that the convention brought $110.1 million of direct spending and $188.4 million of economic benefit for Cleveland and the surrounding counties, which is far more than the approximately $19.5 million of hotel revenue in this analysis (Cleveland 2016 Host Committee Press Release on Economic Impact 2017). Admittedly, people coming to the convention will have to spend on more than just hotel rooms. They buy food, transportation, and other necessities. However, it is extremely unlikely that even after adding all these other purchases, $188.4 million of benefit, or approximately seven times the hotel revenue estimates of this paper, actually occurred. They also claim 104,000 hotel rooms were rented out, an estimate which fails to account for the normal patterns of hotel occupancy during this time (hotels are not usually completely vacant when a political convention is not in town). In other words, this paper's estimate of 15,000 room rentals is reflective of the *additional* impact on hotel rooms above normal patterns and is therefore a much more nuanced analysis of economic impact.[1]

Similarly, the Philadelphia Convention and Visitors Bureau also overstates hotel revenue and occupancy (2016 Annual Report-For the Record 2017). While the Bureau claims 84,000 hotel rooms were rented because of the convention, this paper's results indicate only an additional 40,000 hotel rooms let. The Philadelphia event promoters also claim that the convention brought in $132.9 million of direct spending and $230.9 million of economic impact, which is significantly larger than the approximately $39 million generated by our estimates. As was the case in Cleveland, it is extremely unlikely that, even with other purchases by convention goers, there was $230.9 million of economic impact.

[1] At the risk of saying "we told you so," Lauren Heller predicted that this might be the case in an Op-Ed in the *Cleveland Plain Dealer* (Heller 2016).

Overall, our results show that while national political conventions provide significant increases in host cities' hotel occupancy, their effects are significantly overstated by the host committees in each location. Since visitor inflows are one of the most important factors in the overall economic benefit associated with hosting a political convention, our results imply that large claims of economic impact are likely to be substantially exaggerated.

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The Dallas Cowboys' Relocation and Intra-metropolitan Sales Tax Revenue Impacts Across Cities and Industries

Geoffrey Propheter and Shihao Dai

1 Introduction

Since Baade and Dye (1988), scholars have brought empirical analysis to bear on subsidy proponents' claim that sports facilities are a boon to local economic development. While employment and wages have received considerable attention in the intervening years (Bradbury et al. 2022), the impact of sports facilities on public finance is perhaps of greater importance given that taxpayers bear the burden of subsidies in the form of risk to public service funding. Among subsidy proponents' claims is that new facilities will generate substantial sales tax revenue. A small but growing literature on the sales tax impacts of facilities casts doubt on this conclusion (Baade et al. 2008), with authors highlighting facilities' role as magnets for economic activity but in the process drawing it away from other areas. Such redistributions could explain metropolitan-level null effects (Agha and Rascher 2021), and redistribution is suggested in prior sales tax research (Coates and Depken 2009, 2011; Propheter 2014).

This study offers a direct test of spending redistributions across cities within the same metropolitan area using the relocation of the Dallas Cowboys from Irving to Arlington. Both cities are sales-taxing jurisdictions; both are located in the Dallas metropolitan area; and the sites for Texas Stadium and AT&T Stadium are 12 miles apart. We extend the literature by also studying spending redistributions across industries. We use the synthetic control method on city-level and industry-level sales tax revenue data for all municipalities in the Dallas metro area from 2002 to 2016. We find that total sales tax revenue in both cities increases following the relocation of the Cowboys, but the effect size is trivial and roughly equal to a

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rounding error in the city budgets. The combined net effect across both cities and all industries is two million dollars a year, about a quarter of which goes to three local governments (Irving, Arlington, and the Dallas transportation authority) and the balance to the state. The increase is about one half of 1% of the combined annual sales tax collections in the two cities during the observation period, highlighting the relative insignificance of major league sports on taxable consumption at the jurisdiction level. We also find that the new stadium increased spending in the accommodation, food services, and entertainment industries, but these were offset by relatively large losses in retail spending. Our findings help explain metropolitan-level null effects in consumer spending, giving empirical weight to arguments that professional sports do more to redistribute tax revenue streams than grow them (Coates and Humphreys 2003, 2011).

The remainder of this chapter is organized as follows. In the next section, we briefly review existing research and detail the study's motivation. We then discuss the theoretical and mechanical aspects of the synthetic control method. We also discuss more of the Cowboys relocation context and our data. After presenting our results, we close the chapter with a brief recapitulation and suggestions for further research.

2 Sports Facilities, Redistribution, and Sales Tax Revenue

Leading up to the 1990s, subsidy proponents argued that sports facilities could boost regional economic activity. Beginning with Baade and Dye (1988), considerable subsequent empirical work demonstrated this logic was flawed (Baade 1996; Baade and Dye 1990; Baade et al. 2008; Coates 2007). Though the sports facility economics literature has evolved to focus primarily on estimating neighborhood-level effects (Bradbury et al. 2022), using the most compelling research design to date, Agha and Rascher (2021) confirm the null effect.

The leading hypothesis for null regional effects is that sports facilities simply redistribute economic activity across neighborhoods. The mechanism by which this occurs is further hypothesized to be substituted consumption, whether in time or space. There are at least two forms the substitution can take. The first is substituted spending within jurisdictions. Spending by crowds could displace spending that would have happened in the area anyway by local residents. Major league sports may attract an outside dollar to a facility's vicinity as lawmakers intend, but if the negative externalities associated with pro sports (congestion and crime, for instance) incent locals to save money they otherwise would have spent or spend their dollar elsewhere, the net effect near the facility could be close to zero. When such substitutions happen within jurisdictions, metro areas, or regions, dollars from one part of the area migrate to other parts, and subsequently the aforementioned null effect would persist when economic activity is measured at these levels.

The second mechanism is for spending to be redistributed across industries. The introduction of major league sports into an area reorganizes economic activity, as

industries complementary to sports enter and grow, while noncomplementary industries decline and exit (Humphreys and Zhou 2015). Even if dollars do not substitute across space and time, sports may prompt a dollar to migrate from one industry to another—from grocery stores to restaurants, for instance, when fans eat out on game days. Moreover, industry-level substitutions could have tax revenue implications for local governments. If there is a tax differential between substituted goods and services, jurisdictions may see increases or decreases in tax revenue. Groceries are often exempt from sales taxes, for example, while restaurants are not. Thus, substituting from the former to the latter, all other things equal, grows the taxable sales tax base and increases sales tax revenue. On the other hand, residents may spend money at a facility that they would have spent at a different business. If the facility's debt is secured by facility-generated tax revenue, perhaps through a sales tax increment financing district, then this will impose a net decrease on the jurisdiction's general fund.

Despite the prevalence of the substitution theory to explain null macro-level effects, the empirical evidence corroborating it directly is scant. Propheter (2014) is one exception. He maps how sales tax revenue changes across Cook County municipalities when the village of Bridgeview, Illinois, constructed a new Major League Soccer stadium for the Chicago Fire. While most of the 168 municipalities in the county were unaffected by the stadium, 11 experienced increased sales tax revenue flows, while 26 experienced decreases. In a tangential literature on college sports, Coates and Depken (2009) highlight possible sales tax revenue redistributions across municipalities in Texas. We have a bit more evidence of redistributed economic activity across industries. Coates and Humphreys (2003, 2011) document wage and employment increases and decreases across industries, and though not an industry-level analysis, Depken and Fore (2020) show that professional sports can change the timing of economic activity but not necessarily lead to net improvements in business outcomes.

This study provides a direct test of economic activity substitution within a metro area and across industries. We take advantage of the Dallas Cowboys' relocation from Texas Stadium in Irving, Texas, to AT&T Stadium in Arlington, Texas. The two sites are about 12 miles apart and located in separate municipalities that are part of the Dallas-Fort Worth metro area. Dehring et al. (2007, 2008) provide rich background on the Cowboys' relocation. Our contribution to the Cowboys' story is to explore how the relocation impacted each jurisdiction's sales tax revenue stream. We not only advance the literature by mapping flows across municipalities but also across industries. Our purpose is to provide more direct evidence of the economic redistributions suggested by the regional-level null economic impact effects observed in past studies.

We use annual industry-level sales tax revenue from 2002 to 2016 and the synthetic control method to model the respective counterfactual revenue streams in both Irving and Arlington. We consider revenue from the following industries: accommodation and food services; arts, entertainment, and recreation; retail trade; and all other taxable goods and services. The first three industries were selected

because they are complementary to professional sports (Humphreys and Zhou 2015). We discuss our synthetic control approach in more detail in the next section.

3 The Synthetic Control Method (SCM)

SCM was developed by Abadie and Gardeazabal (2003) and subsequently popularized by Abadie et al. (2010, 2015). Abadie (2021) provides an accessible review of SCM mechanics, data needs, and theoretical considerations. Because much of the modern sports facility economic literature focuses on case studies, SCM is a natural fit for the field, evidenced by its increasing usage (Islam 2019; Bradbury 2022a, b, c; Propheter 2020a; Pyun 2019).

The logic of SCM is to construct a counterfactual treated unit using information from a pool of otherwise similar untreated units. By way of example, Propheter (2020a) evaluates how building permit activity was affected by the construction of the Golden 1 Center in Sacramento, California. After defining the arena's vicinity in terms of census tracts, he constructed a pool comprising all other census tracts in the city limits. Crucially, he excludes from the pool all census tracts that plausibly received treatment. Credible inferences in SCM require two of the same conditions common to every other quasi-experimental research design: exogenous treatment and an absence of contemporaneous events. Both are defensible by argument only, but in SCM scholars can manipulate the composition of the donor pool to strengthen a claim of exogeneity by excluding any untreated units that may have experienced spillover effects. In the Golden 1 Center case, for example, since economic activity does not follow arbitrary boundaries like census tracts, it is plausible that tracts just outside of his definition of "area" receive some treatment, whereas tracts, say, 10 miles away do not. Thus, restricting the donor pool to the latter types of tracts improves the credibility of the estimated causal effect.

The SCM counterfactual is a weighted average of the pretreatment untreated units in the donor pool. Weights are derived from a factor model where factor scores are constant across pretreatment units but vary over time and loadings are constant over time but vary across units. As with all weighting schema, one needs a decision rule to choose among competing weight compositions. Abadie et al. (2010, 2015) recommend choosing the weights whose combination minimizes the root mean square percentage error (RMSPE).

Our unit of analysis is the municipality level, and we focus on only municipalities in the Dallas-Fort Worth metropolitan statistical area. We chose to limit the donor pool to only Dallas area municipalities in order to hold consumer preferences for spending on the Cowboys constant. Were we to estimate counterfactual Irvings and Arlingtons using municipalities elsewhere in the state, we would be less likely to account for heterogeneity in such preferences. We further limit the donor pool to 72 municipalities in the Dallas metro area with complete sales tax data. Our observation period begins in 2002 and ends at 2016, leaving an 8-year novelty effect period (Coates and Humphreys 2005).

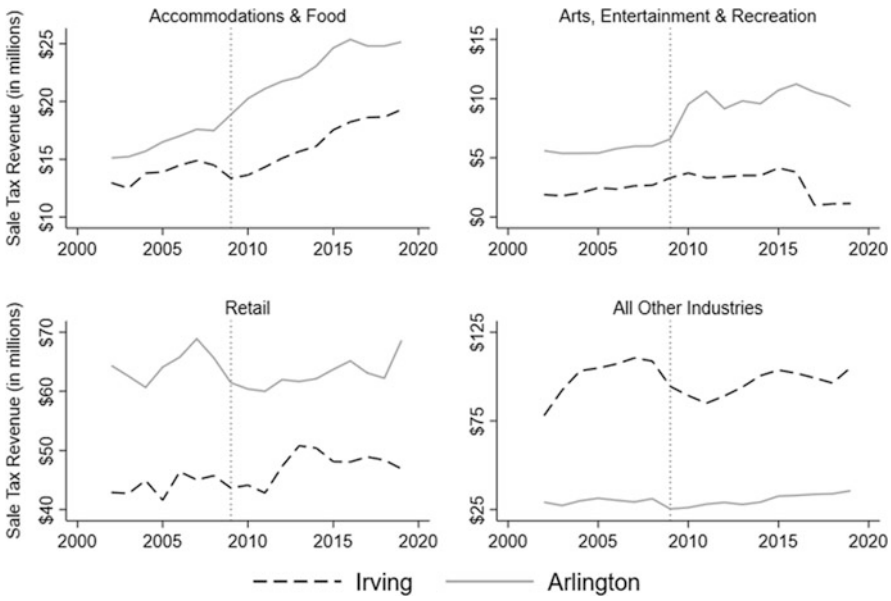

Fig. 1 Annual sales tax revenue by city and industry

The outcome variable is annual sales tax revenue at the municipality level, which we obtained from the Texas Comptroller of Public Accounts. Figure 1 shows how the tax revenue changes over time between cities and industries. We highlight three industries because they are complementary to sports to varying degrees: accommodations and food services (NAICS 72); arts, entertainment, and recreation (NAICS 71); and retail (NAICS 44–45). These industries are the lowest NAICS level for which the comptroller provides data. Some interesting differences between the two cities are noteworthy. Irving, for instance, derives more of its sales tax from industries that are major league sports substitutes, which was the case even before the Cowboys announced its relocation. From 2002 to 2008, 62% of Irving's sales tax revenue came from substitute industries compared to 26% of Arlington's. From 2009 to 2016, after the Cowboys moved, Arlington's reliance on complementary industries declined slightly on average by two percentage points and Irving's by three percentage points. Both are small enough to be due to randomness rather than the Cowboys' relocation.

Moreover, that reliance on substitute industries appears to be hardly affected by the relocation suggests any intra-metropolitan sales tax revenue impacts occur within or across complementary industries. It is difficult to see these impacts in Fig. 1 when comparing Irving and Arlington, since the two municipalities look very different in terms of their sales tax base. For accommodations and food service, there is a noticeable decline in Irving and a noticeable increase in arts, entertainment, and recreation after the Cowboys moved. There is not much evidence of sales tax effects otherwise. Of course, these conclusions are suspect, since Irving and Arlington are

unlikely to be good comparisons for each other. We use SCM to improve inferences about the industry effects of the Cowboys' relocation.

In order to improve the pretreatment fit of the weighted untreated cities, we allow matching on each jurisdiction's total sales tax rate, the dollar value of its sales tax base, and the number of taxing establishments. The tax rate and base are the inputs into the sales tax revenue calculus. The sales tax rate is the combined state, city, county, and special district rates, if any applied. The state imposes a 6.25% rate, and local governments can impose up to an additional two percentage points. The sales tax base, meanwhile, measures the amount of taxable sales activity in a city. As not all transactions are subject to the sales tax, taxable sales is a less precise indicator of economic activity (Stitzel and Rogers 2019). Nonetheless, it is the appropriate measure for evaluating the similarity in total size of taxable activity across jurisdictions. The tax base enters the SCM uniquely for each industry. Establishments allow for matching on firm supply, and these supply shocks affect revenue but may be captured by tax rates and taxable activity. Importantly, since we are modeling revenue on different bases for different cities, not every matching variable will enter the same a model. Establishments may be important for explaining some pretreatment trends but not others, for instance.

We also include as matching variables past values of sales tax revenue. One strategy since SCM's inception has been to include all past values of the outcome in the factor model. Kaul et al. (2022) recommend against this, since doing so saps the non-outcome matching variables of explanatory power. They demonstrate how weights, and therefore SCM conclusions, are sensitive to the number of lagged outcome values included in the model. This is not to say that lagged outcome values are inappropriate in SCM. Indeed, they are crucial, since controlling on prior values of the outcome implicitly controls for prior unobserved factors that may affect future outcome values. Instead, the problem is that if all past values of sales tax revenue enter the factor model, the sales tax rate and sales tax base cease to matter, statistically speaking. Yet public policy may change the value of the rate and base in any given year, and modeling only past values of sales tax revenue will ignore such changes, thereby introducing bias. Through experimentation, we allow the RMSPE to determine which past values of the outcome ought to be included.

4 Empirical Results

Table 1 details mean values of the matching variables for the actual and synthetic Irvings and Arlingtons for each industry. In order to conserve space, past values of sales tax revenue are omitted. Since Irving and Arlington are the treated units, we exclude from the donor pool Arlington when constructing the synthetic Irving and Irving for the synthetic Arlington. The data highlight the value of SCM. In every case, the synthetic control is a considerably better approximation of the pretreatment actual values than what is produced by a naive aggregation of all untreated municipalities.

Table 1 Comparison of actual and synthetic municipalities and industries

	Actual	Synthetic	Mean of all untreated
Irving			
Accommodations			
Sales tax rate, 2004	8.25	8.15	8.1
Sales tax base, 2008	175.7	176.0	63.8
Establishments, 2004	633.8	651.1	244.1
Arts			
Sales tax rate, 2004	8.25	8.16	8.1
Sales tax base, 2008	32.5	32.6	9.6
Retail			
Sales tax rate	8.1	8.3	8.1
Sales tax base, 2007	546.0	563.1	189.2
Establishments, 2002	1644	1623	598
Establishments, 2007	1645	1717	651
All other industries			
Sales tax rate	8.1	8.2	8.1
Sales tax base, 2004	1251.3	1238.5	171.7
Sales tax base, 2008	1317.6	1315.1	181.2
Arlington			
Accommodations			
Sales tax rate, 2004	7.50	8.00	8.1
Sales tax base,2008	218.5	217.7	63.8
Establishments, 2004	843.5	801.9	244.1
Arts			
Sales tax rate, 2004	7.5	8.2	8.1
Sales tax base,2008	74.9	73.9	9.6
Retail			
Sales tax rate	7.7	7.7	8.1
Sales tax base, 2006	822.0	821.5	181.1
All other industries			
Sales tax rate	7.7	7.9	8.1
Sales tax base, 2002	402.4	369.5	175.3
Sales tax base, 2005	398.3	385.7	174.2
Sales tax base, 2008	389.4	375.9	181.2

Note: Sales tax revenue and base is inflation-adjusted to 2020 using the Consumer Price Index. The sales tax base is in millions of dollars. Past values of sales tax revenue are included in the synthetic construction but are omitted to conserve space

Figure 2 graphs the actual and synthetic results for both cities and the four industry categories. In most cases, the pretreatment period fits well. The exception is Irving's retail sales tax revenue, which displays much more annual volatility than donor cities. That being said, the size of the pretreatment prediction error is relatively small, and the data give no little reason to believe anything but a null effect. For Arlington, the causal effect of the Cowboys' relocation is an increase in sales tax

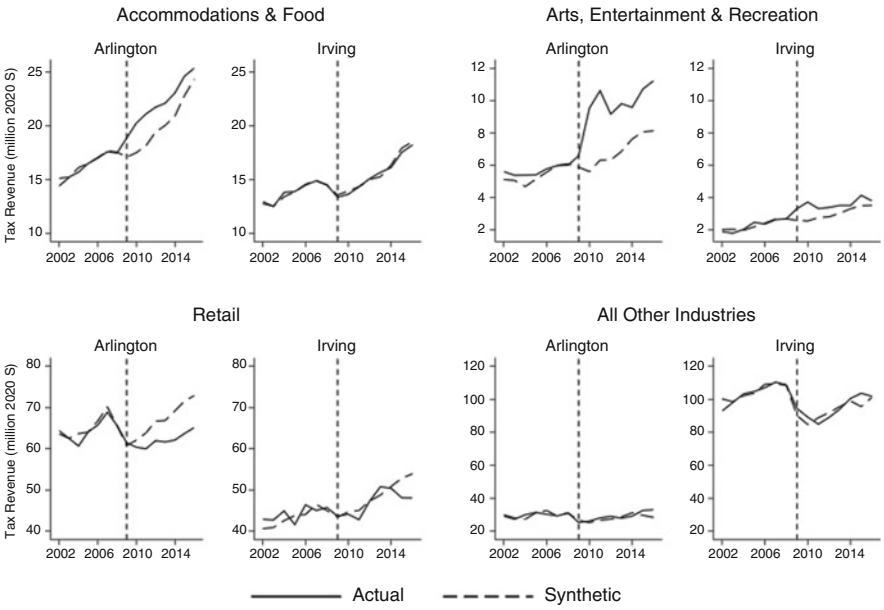

Fig. 2 Synthetic control results by city and industry

Table 2 Cumulative sales tax revenue by city and industry

Industry	Irving	Arlington	Total
Accommodations and food service	$0	$18.4	$18.4
Arts, entertainment, and recreation	$8.3	$25.4	$33.7
Retail	$0	($40.2)	($40.2)
All other industries	$6.8	($2.3)	$4.5
Total	$15.1	$1.3	$16.4

Notes: Dollars are in million and inflation-adjusted to 2020 using the consumer Price index. Figures are the cumulative estimated treatment effects from 2009 to 2016 for effect sizes statistically different from zero

revenue from accommodations and food services industries as well as from the arts, entertainment, and recreation industries. These gains, though, are offset by revenue losses in the retail industry and substitute industries. This result is consistent with Coates and Humphreys (2003) who found similar redistributions between retail and food in employment and earnings. For Irving, losing the Cowboys increased sales tax revenue from the arts, entertainment, and recreation and substitute industries. The city's revenue from accommodations and food services and retail were unaffected by the relocation. In other words, losing the Cowboys increased the city's total sales tax revenue.

Based on the estimated treatment effect sizes, we calculated the cumulative sales tax effect of the Cowboys' relocation for both cities across industries. These figures are reported in Table 2. All dollars are expressed in 2020 terms and adjusted using

the Consumer Price Index. Treatment effect estimates not statistically different from zero were treated as zero, and hence zeros in the table indicate industries where all treatment effects were not different from zero. The cumulative figures are based on sales tax revenue from 2009 to 2016. Irving is better off without the Cowboys by its share of the $15.1 million net gain, or $1.83 million. (Irving's sales tax rate during the posttreatment period is 8.25%, but only one percentage point is for the city and another one percentage point for the Dallas transit authority. The state receives 6.25 percentage points.) About half of this comes from spending shifting away from the Cowboys into other entertainment in Irving. Over the 8-year period, the annual average gain to Irving proper is about a quarter of a million dollars per year, which is about a half percent of the city's annual total sales tax revenue during this time frame.

Though we have no data to support it, we suspect the spending is from locals to the east and northeast of the metro area that have a longer travel distance to Cowboys games in Arlington. The distance could be enough for them to substitute spending into other Irving-based entertainment options or personal services. Another explanation is that the price of attending Cowboys games increased in the new stadium, pricing Irving consumers out of the market and prompting them to substitute into other taxable activities. The Cowboys' Fan Cost Index, for instance, increased 40% in real terms from 2008 to 2010; the stadium opening in 2009.

Arlington, meanwhile, is also better off with the Cowboys, but unlike Irving the effect size is so small that it is essentially zero. The net effect to the city and state is $1.3 million, which is about $162,500 annually. Arlington's share is a trivial $39,000 annually with the balance to the state. This is about one-tenth of 1% of the city's annual sales tax revenue during the period. The data also show redistributed spending with gains in accommodation and food services and entertainment coming at the expense of retail. This result is consistent with Propheter (2020b) who found that a new arena in Sacramento negatively impacted the survival of retail establishments.

The combined effect across both cities and all industries is a $16.4 million increase in sales tax revenue, an annual average of $2.05 million, 92% of which is generated in Irving. The two cities combined only receive about one quarter of a million dollars a year from the Cowboys' relocation, again Irving benefitting the most from the Cowboys leaving. The Dallas metro authority receives another quarter of a million dollars a year from its 1% sales tax rate in Irving. The state receives the remaining $1.55 million, which is additional revenue to it. From the state's perspective, then, it is better for the Cowboys to play in Arlington, but this is not because the team increased taxable spending in Arlington but rather because its departure increased taxable spending to Irving.

5 Robustness Checks

The synthetic control method lends itself to a variety of robustness checks to help gauge the sensitivity of estimated treatment effects to the matching variables and treatment date selected. To conserve space, we only report results for arguably the most common test, in-space placebos. The in-space placebo estimates synthetic controls for each donor city but treating each as though it received treatment. Since these cities do not receive treatment, there should be no effect attributable to the Cowboys' relocation. We report the treatment effect for each placebo unit in Fig. 3. Each placebo treatment effect is in light gray, and the treatment effect for Irving and Arlington is displayed in black for reference. The data show the treatment effects are unique to Irving and Arlington.

Aside from the in-space placebo, we also conducted the leave-one-out placebo, in-time placebo for anticipation effects, and various different outcome lag combinations. These tests are described in Abadie (2021) and Ferman et al. (2020), among other sources. The leave-one-out placebo test did not reveal concerns that the main results are sensitive to any particular donor city. Moreover, the pretreatment fit in each model was not sensitive to defining treatment in earlier periods; we tested placebo relocation years of 2008, 2007, and 2006. Finally, while there was some expected sensitivity to the lagged outcome combination chosen, none of the alternatives produced estimates meaningfully different from the main results, giving us confidence that using the RMSPE for selecting models was appropriate.

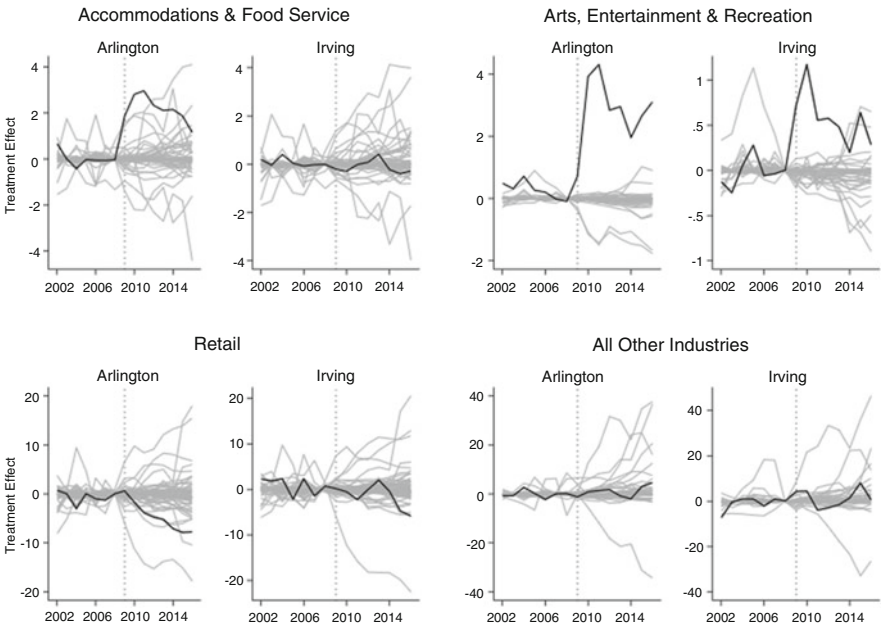

Fig. 3 In-space placebo tests

6 Conclusion

We study sales tax revenue changes between Arlington and Irving due to the Cowboys' relocation from the latter to the former using annual revenue data from 2002 to 2016. Using the synthetic control approach, we show that the team leaving Irving increased the city's sales tax revenue but that it arriving in Arlington also increases that city's sales tax revenue. The gains to Irving of losing the team are about 15 times greater than the gains to Arlington of acquiring the team. We hypothesize two explanations for these effects: Irving spectators being priced out of the new stadium either because ticket prices increased or because travel costs increased. It is left to future research to evaluate which explanation has greater merit. We also show the stadium redistributed spending across industries within the Dallas metro area. The retail industry is the biggest loser with $40.2 million over the 8-year posttreatment observation period shifting toward non-retail industries.

While these estimated treatment effects are statistically different from zero, they are not of any practical significance. In both cities, the net increase in sales tax revenue of the Cowboys' relocation is less than 1% of the city's annual total sales tax revenue, a rounding error in municipal budgets. Moreover, the results help explain regional null effects observed in prior studies. Gains in Irving and Arlington accommodation and food services and entertainment are offset by losses in Arlington retail. The net gain when aggregating the cities and industries together is $2.05 million, half of which goes to local governments but which is a trivial share of its combined total sales tax revenue collections, which averaged about $90 million annually from 2009 to 2016.

This study is the first to explore the redistributive effects of a new sports facility on sales tax revenue across industries and cities, but it should not be the last. The study context, while useful for the research question, lacks certain features that could prove more useful for evaluating the redistributive effects of facilities. The level of treatment here was at the city level, but a more thorough analysis would use establishment-level data. Stitzel and Rogers (2019) use establishment-level data in Oklahoma City, but their outcome is not taxable sales activity, and therefore they do not measure impacts to public finance. They also do not study a context where a team moved within a metro area. It would also be useful to disaggregate industries even further. For example, we cannot separate spending on the arts from spending on entertainment. Finally, intra-metropolitan team relocations have happened elsewhere: the Warriors from Oakland to San Francisco, the Pistons from Auburn Hills to Detroit, and the Braves from Atlanta to Cobb County. Studying other contexts may be insightful.

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Impacts of Mega Sporting Events: Does the Moderate View Still Apply?

Arne Feddersen and Wolfgang Maennig

1 Introduction

Rob Baade is one of the pioneers who showed that the "booster" arguments of the proponents of staging major sporting events (e.g., Olympic Games, FIFA World Cup, Super Bowl) or of the construction of new sports stadiums do not hold up statistically. Already in the 1980s (Baade 1987; Baade and Bast 1987; Baade and Dye 1988a, b), he warned that the host city or region hardly experiences significant positive economic effects – not in employment, income, or (local) tax revenues. His later studies, such as Baade and Matheson (2002) for the Olympics, Baade and Matheson (2004) for the 1994 World Cup in the USA, Baade et al. (2008a) on Metropolitan Statistical Areas (MSA) in the USA which hosted the final of the National Football League (NFL) – the Super Bowl – or Baade et al. (2008b) on taxable sales related to the 2002 Winter Games in Salt Lake City, confirmed his early findings. Accordingly, he urged caution in subsidizing such activities.

In the last four decades, most academic peers who have conducted ex post analyses for a variety of sporting events in several sports and different regions of the world have followed Baade in this argument. For example, analyzing the 20 largest economies in the world, Szymanski (2002) shows that the gross domestic product (GDP) growth of the host countries was significantly reduced in the years of the FIFA World Cup. Almost exclusively nonsignificant or even negative effects can be found for the 1974 FIFA World Cup in Germany (Hagn and Maennig 2008) and

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for the 2006 FIFA World Cup also in Germany (Feddersen et al. 2009; Feddersen and Maennig 2012; Hagn and Maennig 2009). Using the example of the 1972 Olympic Games in Munich, Jasmand and Maennig (2008) find a significant income effect but no labor market effect. Billings and Holladay (2012), comparing the Olympic Games hosts from 1956 to 2004 to the finalist cities in the Olympic bidding process, find no long-term impacts of hosting the Olympics on population, real GDP, or trade openness between 1950 and 2005. Porter (1999) and Coates and Humphreys (2002) find no significant positive effects for the Super Bowl.

Bradbury et al. (2022) summarize the empirical evidence by stating that regardless of the city or region in the study, estimation method, which model specification, or outcome variable, econometric ex post analyses published in refereed scientific journals basically contain no evidence that major sporting events – or sports stadiums and teams – have a measurable economic effect on the host region.[1]

2 Academic Boosters, Breaking Up the Consensus?

During the last two decades, some studies have been published that may break down this broad consensus among economists.

Lybbert and Thilmany (2000) estimate the impact of four US Olympic host cities on county-level employment and net migration and find significant positive impacts. These positive impacts are greater for Summer Olympic hosts than for Winter Olympic hosts.

Examining the 1996 Olympic Games in Atlanta, Hotchkiss et al. (2003) test an alternative intervention point from 1991 to 1998 to address the fact that (most of) the Olympic investments take place years prior to the games. They find the best fit for 1994, which is 2 years prior to the games. Their data end in 2000, which allows examination of any Olympic effects with a maximum lag of 4 years. In their preferred model (level-shift difference-in-differences), Hotchkiss et al. (2003) show a significant increase of 17.2% or 293,000 additional workers in counties that hosted Olympic Games competitions compared to the rest of the counties in the state of Georgia.[2] This result is well above the optimistic ex ante forecast by

[1] Note that some studies find negative economic impacts of mega sport events. For example, testing the effects of the Olympic Games in Seoul in 1988, Barcelona in 1992, Sydney in 2000, and Beijing in 2008 on, inter alia, tourism and foreign exchange earnings with an autoregressive moving average (ARMA) model, Mitchell and Steward (2015) exclusively find negative impacts of the Olympics for the host countries, with the exception of a positive level shift of tourist numbers for South Korea. Nitsch and Wendland (2017) compare Olympic cities, candidate cities, and other large cities in host and candidate countries over the period from 1860 to 2010 and find that being awarded the Summer Olympics has – if any – a negative impact on the population size.

[2] Since, in this case, a semilogarithmic regression is used, the results would have had to be corrected according to the method of Halvorsen and Palmquist (1980). In this case, the increase in employment would have been as high as 18.8%, or 324,000 additional workers.

Humphreys and Plummer (1995). A robustness check by Hotchkiss et al. (2003) shows, however, that there are no significant wage increase effects.

Sterken (2006) examines the impact of the organization of the Olympic Games and the FIFA World Cup on the growth rate of GDP per capita in host countries. First, the GDP growth rates of the host countries are determined for the individual years. A weighted average growth rate for major economies from 1870 onward is used as a proxy for the world GDP growth rate and subtracted from the respective national host GDPs. Using the resulting average excess growth rates of the host countries over a 15-year window to analyze the relation between the sporting event and economic growth, he concludes that the effects of the Olympic Games are significantly positive, while those of the FIFA World Cup are not.

Analyzing the Olympic Games from 1960 to 2012, Rose and Spiegel (2011) suggest a permanent export boost of 39% in Olympic host countries. Brueckner and Pappa (2015) analyze the economic effects of bidding for (or hosting) the Olympic Games on macroeconomic indicators such as investment, consumption, and output. They find that the decision to apply(!) for the Games increases the output significantly 8 and 3 years before the actual event by 0.98 and 0.77 percentage points, respectively. For Olympic hosts, they find positive effects of 1.74, 2.60, and 1.41 percentage points at 3, 4, and 5 years preceding the games, respectively. The cumulative effect on output from 10 years before the games to 7 years after the games reaches approximately 15%. Analyzing the 2010 FIFA World Cup in South Africa, Pfeifer et al. (2018) use satellite data on night light luminosity as a proxy for economic activity and find a significant reduction of unemployment by 1.3 percentage points for the average World Cup municipality in the preparation period, becoming nonsignificant in the year of the event. In particular, investments in transport infrastructure in rural areas seem to have longer-lasting positive effects.[3]

Firgo (2021) finds that hosting Olympics Games boosts regional GDP per capita by approximately 4.5 percentage points in the year of the event and the following 5 years. According to his estimates, the Winter Olympics do not have a positive impact on host regions. Wood and Meng (2021) analyze the 2018 Olympic Winter Games in Pyeongchang and – by using input–output tables and tourism data – calculate a positive effect of 1.9 trillion South Korean won on national output compared to the operational cost of 1.7 trillion South Korean won. Furthermore, they calculate that the infrastructural investment of 11.5 trillion South Korean won may have induced 18.5 trillion South Korean won of gross domestic product. Fourie and Santana-Gallego (2022), updating Fourie and Santana-Gallego (2011), estimate that the Summer Olympic Games produce an increase of 18% in national inbound tourism.

For the sake of completeness, it is worth mentioning that Veraros et al. (2004), for the announcement of Athens as the host for the 2004 Olympic Games, and Dick and Wang (2008), for several host city elections, show significant abnormal returns on

[3] It must be highlighted that such a result does not, of course, in itself, justify the spending of taxpayer money as this does not take opportunity costs of alternative projects into account.

the relevant countries' stock markets on the days of the election of the Olympic host city, with the effects being larger for small economies than for large economies.

3 Methodical Issues and the Problems of Impact Estimates

Baade et al. (2011) compare the analysis of the economic effects of major sporting events with the proverbial search for a needle in a haystack: due to the organizational requirements, mega-events are usually held in large, developed industrial regions. For example, they point out that the economic effect of the Super Bowl of approximately USD 300 million, which is typically assumed by the NFL, is less than 0.1% of the annual personal income of a large metropolitan region such as Los Angeles. Regarding the methodological problems that these dimensions entail for the econometric ex post analysis, the authors point out that any positive economic effects triggered by major sporting events presumably perish within the natural economic cycle due to their relatively small size and, thus, might statistically disappear in white noise. A further complication is that relevant secondary data (e.g., national income, employment figures, and tax income) are often available only for larger administrative levels (e.g., regions or federal states) or longer time intervals (e.g., quarterly or annually). However, in the case of an excessive aggregation of the data, nonsignificant estimation results can be attributed to the "inability" of the econometric methods used to isolate any positive effects that may be present from these strongly aggregated data. Therefore, in particular, ex post analyses that use highly aggregated data may not use appropriate empirical strategies to isolate the economic effects.

Accordingly, some econometric ex post analyses use data for smaller geographic/administrative units. In the USA, these are often MSAs (e.g., Coates and Humphreys 1999, 2003; Matheson 2005). In addition, smaller administrative units, such as districts in Germany (e.g., Jasmand and Maennig 2008) or counties in the USA (e.g., Hotchkiss et al. 2003; Feddersen and Maennig 2013b), are used as the basis. Studies based on city-level data are provided by Carlino and Coulson (2004), Hagn and Maennig (2008, 2009), and Feddersen et al. (2009). Additionally, a few studies use data that are spatially disaggregated below the city level. These are mostly studies of real estate prices or apartment rents (e.g., Ahlfeldt and Maennig 2008, 2009; Coates and Humphreys 2006; Tu 2005).

It should also be noted that most major sporting events only last between 1 day and 4 weeks. In addition to potential effects from infrastructure investments during the preparation period, a tourism-induced economic impulse limited to such short periods will not, with great certainty, be identified when using annual figures. Studies based on quarterly data (e.g., Baade et al. 2008b; Feddersen and Maennig 2012; Hotchkiss et al. 2003), monthly data (e.g., Allmers and Maennig 2009; Baade et al. 2011; Feddersen and Maennig 2013b; Hagn and Maennig 2009), or even daily data (Baumann et al. 2009) may be more appropriate in many cases.

Empirical work based on macroeconomic indicators can be problematic when the effects of major sporting events are concentrated in a few sectors, such as hotels,

restaurants, retail, and leisure and entertainment. Accordingly, Baade et al. (2008a, b), Coates and Humphreys (2003), Feddersen and Maennig (2012, 2013b) use sectorally disaggregated dependent variables, again mainly with the result of nonsignificant effects.

It is also worth discussing which economic indicators are suitable as dependent variables in the context of econometric ex post studies, in particular because studies of the labor market and income data hardly show any significant effects from major sporting events. The transmission mechanism – possibly influenced by labor market policy – could conceal a primary effect on the classic labor market and income variables. Correspondingly, some works use taxable sales (Baade et al. 2008a, b; Coates 2006; Leeds 2008), rents (Carlino and Coulson 2004; Coates and Matheson 2011), property prices (Ahlfeldt and Maennig 2008, 2009; Tu 2005), number of arriving air travelers (du Plessis and Maennig 2011; Baumann et al. 2009), hotel occupancy rates (Lavoie and Rodriguez 2005; Porter and Fletcher 2008), or overnight stays (Allmers and Maennig 2009) as a dependent variable.

Two dominant strategies have emerged in the sports economics literature as statistical methods for isolating the effects of major sporting events. Within the first group, which includes the work of Baade and Matheson (2001), Coates and Humphreys (2002), and Matheson (2005), an attempt is made to calibrate a growth model using panel data from the pre-event period. Using this model, a value for various target indicators (e.g., GDP) is predicted for the event period and compared to the actual observed value of the indicator in that period. This prediction is therefore interpreted as economic development without a major sporting event. Deviations of the actual situation from this estimated value will be considered an effect triggered by the (mega) event.

The second group of econometric ex post studies – Hotchkiss et al. (2003), Jasmand and Maennig (2008), Feddersen et al. (2009), and Feddersen and Maennig (2012, 2013b) are examples – uses the so-called difference-in-differences models. These models use the economic development in comparable regions where the major sporting event did not take place as a counterfactual scenario and compare it with the development in the host region. The structure of these models is intended to prevent the estimation results from being driven both by a general macroeconomic shock or fundamental differences between the control and treatment groups.

Choosing the appropriate control group for the host city/region/country and the modeling of the development trends that would have arisen without the event at the host city/region/country is problematic. Feddersen and Maennig (2013a) show that the very positive results of Hotchkiss et al. (2003) are driven by a problematic modeling of their difference-in-differences model, as they do not account for the existence of different trends in economic development between the control and treatment groups. Using the same data but simultaneously allowing for level and trend shifts, Feddersen and Maennig (2013a) are unable to reject the hypothesis that

the 1996 Olympics had no significant impact on the employment figures.[4] Their result is more in line with Baade and Matheson (2002), who – in some specifications – discover negative impacts of the Atlanta Olympics. In their most optimistic estimate, they find a maximum of 42,500 additional jobs in the Olympic venue counties in the state of Georgia, at least 40% of which were transitory. This figure implies a 3.42% increase in local employment in Atlanta and a 0.05% increase in US employment. In a sectoral analysis of the Atlanta Games using monthly data, Feddersen and Maennig (2013b) suggest a small increase of 29,000 jobs, exclusively for the Olympic month, exclusively in Fulton County, and exclusively in a few specific sectors.

The economic boost reported by Rose and Spiegel (2011) may be attributed to a problematic definition of the control group (sample selection bias), as they compare Olympic host nations, such as the USA, Japan, Germany, Canada, Italy, Spain, and Australia – some of the most privileged countries in the world – to all other countries in the world, including much less privileged countries, such as Uganda, Burundi, and Gambia. Maennig and Richter (2012) demonstrate that when using the matching strategy of Rosenbaum and Rubin (1983) and estimating propensity scores, and thus identifying the countries that are structurally similar to the bidding and hosting countries but are not bidders themselves, the Olympic impacts disappear.

The economic contribution reported by Brückner and Pappa (2015) may be an example of both a problematic identification of the counterfactual scenario (variable selection bias) and a problematic definition of the control group. Concerning the control group, Brückner and Pappa (2015) also compare the economic performance of the Olympic host nations to those of all other countries in the world, including much less privileged countries. In contrast, Langer et al. (2018) use propensity score matching and address the problematic construction of the counterfactual scenario by Brückner and Pappa (2015) by including variables that have been found to be significant drivers of economic growth, such as government spending growth, fertility, life expectancy, and human capital. By otherwise using the same data as Brückner and Pappa (2015), Langer et al. (2018) do not find significant economic effects from the Olympic Games.

On the other hand, the "moderates" who tend toward nonsignificant effects of major sporting events must be countered with the fact that the "Baade consensus" could be an example for the discussion of the concept of statistical significance: Recently, hundreds of researchers signed a comment in *Nature* that argued against "singling out one particular value (such as the null value)." They warned against a "dichotomization as statistically significant or not" because "an interval that contains the null value will often also contain non-null values of high practical importance" (all quotes: Amrhein et al. 2019, pp. 306–307).[5]

[4] Note that Hotchkiss et al. (2015), in a reply to Feddersen and Maennig (2013a), insist on large significant and positive effects of the Atlanta Games.

[5] Note that Baade himself understands the potential problem of underpowered statistical test: Baade and Matheson (2006) find that the economic impact of the Super Bowl is not statistically

To check for the probability of a type II error, i.e., about the probability of erroneously failing to reject a false null hypothesis, Maennig et al. (2022) start by replicating the econometric model of Hagn and Maennig (2009),[6] who do not find any significant employment effect of the 2006 FIFA World Cup in Germany. Maennig et al. (2022) challenge the findings from different angles. First, they find substantial near multicollinearity in the data according to different measures. However, after designing models with better conditioned regressor matrices, an employment effect could still not be demonstrated.

Second, Maennig et al. (2022) show that the shape of the power functions is flat over the relevant range of values, pointing to the risk that economically relevant employment effects cannot be detected with the aid of the statistical tests considered. In this case, the type II error, i.e., the probability of erroneously failing to reject a false null hypothesis, is of economic relevance: even an appreciable decline in unemployment in the World Cup venues of 6 to 7 percentage points would not be recognized in 50% of all simulated cases with the two-tailed *t* test and in 35–40% of the cases with the one-sided *t* test, respectively. Thus, the (estimated) probability of a type II error is large. Therefore, the low power of the *t* tests may potentially prevent the detection of even substantial employment effects of the World Cup. Using an equivalence test with the tolerance level $\varepsilon = 0.1$, Maennig et al. (2022) find that only values greater than |10| percentage points can be excluded.

In summary, Maennig et al. (2022) agree with the Baade consensus in not being able to statistically prove employment effects of the 2006 World Cup within the framework of the econometric models analyzed, but they warn that the power of the tests is presumably too low to uncover or exclude significant and economically plausible effects with a reasonable probability. For future studies on the issue, they suggest checking the power of the tests and whether economically relevant effects can be detected with the aid of the statistical tests considered. They add that testing against the one-tailed alternative of a positive economic effect might be a reasonable option. Additionally, they propose that researchers discuss confidence intervals for the economic impact under consideration. Finally, they suggest simulation experiments as one concept that may be used to discuss the lower and upper impact limits.

significantly different than $0. But they also generated a point estimate and 95% confidence interval estimate for the actual economic impact of $90 million +/− $210 million.

[6] Hagn and Maennig (2009) use data and models that resemble those of earlier studies on the subject; the problems found may thus be of more general interest.

4 Conclusion

The same applies to the sobering "Baade consensus" as to any other consensus: it is good if it is questioned from time to time. In this respect, it is good if some present (booster) publications question the consensus that has been valid for two or three decades.

Note that for some of the studies that question the Baade consensus, replicative studies find problematic modeling of the development trends that would have arisen without the event, potential sample selection biases, and potential variable selection biases. Furthermore, it is notable that most of the booster publications use highly aggregated data such as national GDP or national exports (often on a yearly basis), whereas the previous work from the Baade consensus used increasingly disaggregated datasets to check whether the sobering nonsignificant results were found only because the analysis of the economic effects of major sporting events resembles the proverbial search for a needle in a haystack (Baade et al. 2011). This change can be justified only if major sporting events generate nationwide effects; therefore, approaches that, for example, compare Olympic counties with other counties in the Olympic host country are misguided.

However, the booster estimates must be reflected in the spending impulses associated with the corresponding sporting events and the multipliers (and accelerators) otherwise found in empirical research. Data on the (direct plus indirect) total costs of the Olympic Games as well as on public spending related to the games are rare and may be heavily influenced by political considerations, and, where available, their reliability may not meet the standards of academic research (Baade and Matheson 2016; Flyvbjerg et al. 2021). There is minimal agreement regarding the correct measurement of the size of Olympic investments. However, even using the highest investment figures available, the average Olympic investments for the games from 1992 to 2012 did not exceed an unweighted 1% of national gross domestic product per year, and this figure is heavily influenced by the cases of Barcelona, Spain, in 1992 and Athens, Greece, in 2004 (Langer et al. 2018).

The more recent booster contributions, which peak with estimates in permanent export boost of 39% in Olympic host countries (Rose and Spiegel 2011) and a cumulative effect on output from 10 years before the games to 7 years after the Olympic Games of approximately 15% (Brueckner and Pappa 2015), are based on implicit multipliers of up to 15. These multipliers are too large compared to the majority of the latest findings in fiscal policy research with multipliers in a range of 0–1 (Coenen et al. 2012). Thus, such estimates bear the risk that policy-makers might be misguided in believing that organizing the Olympic Games is one of the most efficient approaches to fiscal spending, inducing multiplier effects of incomparable size. Their results run the risk that policy-makers (and public opinion) will feel assured by beliefs brought forward by the usual ex ante "impact studies" on the Olympic Games, promising trillions of additional GDP, hundreds of thousands of additional jobs, a self-financing of the Olympic Games (secured by multiplier effects), and so on.

The booster contributions mentioned in Sect. 2, which estimate significant but much lower effects, do not yet mean that the expenditure on major sporting events is economically efficient. The income-boosting effects, which sometimes only accrue in small static areas, have to be compared with the (mostly) statewide expenditures. Pfeifer et al. (2018), who show employment gains in host cities at the local level, concur: "It seems at least debatable whether the same amount of money invested in, say, health or education, could not have boosted economic growth much further than the World Cup did." Coates and Humphreys (2008, p. 299) name construction or maintenance investments in the context of freeways, public transport systems, hospitals, or schools as further alternatives.

Thus, it seems fair to state that the Baade consensus is still up-to-date. The use of increasingly sophisticated and advanced econometric methods and procedures as well as the development of new data and sources does little to change its basic empirical evidence. It remains clear that there is presently almost no reliable scientific evidence for the existence of significant positive effects from major sporting events that justify the relevant (public) spending. Thus, the hopes for income and employment effects should not be part of rational motivations to bid for mega sporting events.

However, this does not mean that there is no reasonable justification for state support when applying for and holding major sporting events. There are probably a number of positive effects such as "happiness" or "feel-good" effects (e.g., Kavetsos and Szymanski 2010; Hilgers et al. 2010; Dolan et al. 2019) (part of the) that justify government subsidies. Or, as Rob Baade would often tell reporters who would call him for a comment on a league's reported economic impact for an event, "These events might make us happy, but there isn't much evidence that they make us rich."

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The Effect of Sports Franchises on Property Values: The Role of Owners Versus Renters

Katherine A. Kiel, Victor A. Matheson, and Christopher Sullivan

1 Introduction

Over the past few decades, cities in the USA have competed to receive and maintain professional sports franchises. In an effort to be successful, local governments have routinely subsidized professional sports franchises through below-cost lease deals, preferential tax treatment, and even direct cash payments, often in order to build new stadiums. In the state of New York and the city of Buffalo approved $850 million in public subsidies to build the Buffalo Bills a new stadium. This taxpayer handout is the largest ever for a stadium project in the USA, but Buffalo only held the record for a short time as Nashville offered over $1.2 billion in public handouts for a new domed stadium for the Titans. Given the large public subsidies involved, economists since Robert Baade wrote his seminal works in the late 1980s have devoted considerable effort into uncovering whether or not the economic benefits of sports franchises warrant these handouts.

While teams and leagues often publicize economic impact studies that purport large benefits from professional sports franchises, the overwhelming majority of academic studies have found little or no direct economic benefits from either sports teams or new sports facilities. For example, previous studies of employment (Baade 1996; Baade and Sanderson 1997; Coates and Humphreys 2003), personal income

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(Baade 1996; Coates and Humphreys 1999, 2001; Lertwachara and Cochran 2007), taxable sales (Baade et al. 2008), and hotel occupancy rates (Lavoie and Rodriguez 2005; Baumann et al. 2022) have all found that stadiums and franchises have insignificant effects on real economic variables. Indeed, the most present comprehensive literature review of over 130 studies on the economic impact of sports facilities clearly confirms the earliest findings of Robert Baade who described at most a very limited economic impact of professional sports teams and stadiums on host cities (Bradbury et al. 2022).

Of course, while the potential economic benefits of sports franchises are touted by sports boosters, it is entirely possible that the primary social benefits of sports teams are indirect or intangible. Sports franchises can be considered a cultural amenity that may promote civic pride, result in a vibrant and dynamic city, and improve the livability of a metropolitan area. In other words, sports teams may not make you rich, but they may make you happy. Of course, such indirect benefits are generally hard to measure as they are nonmarket goods. Yet, it is important to accurately and completely estimate these benefits in order to test whether the costs of getting and keeping a sports franchise outweigh the benefits to the city that hosts the team.

With this idea in mind, and given the lack of evidence of direct economic impact, researchers have used a variety of methods to measure the indirect economic impact of sports franchises. Johnson et al. (2001, 2004, 2006) use contingent valuation to estimate the benefits of the presence of a sports franchise for local citizens. While the survey data show that local residents would be willing to pay significant sums to have a professional sports franchise in their city, in each study the observed willingness to pay was less than the amount of the public subsidy.

A second broad technique encountered in the existing economics literature for identifying the indirect benefits of a sports team is hedonic pricing. Hedonic methods estimate nonmarket benefits by observing market goods that are impacted by the nonmarket benefits one desires to estimate. In terms of sports franchises, the hedonic approach utilizes the fact that goods that provide positive (negative) externalities will increase (decrease) house values in a city. If sports franchises provide significant public benefits to their host cities, then these benefits will be capitalized into the value of housing in areas with professional sports teams as people are willing to pay more to live in cities with valuable cultural attractions. Similarly, people may be willing to work for lower wages in cities with a higher standard of living (see, e.g., Blomquist et al. 1988). By using the hedonic technique to estimate the compensating differential, the willingness to pay can then be used to calculate a dollar value for the public benefits the franchise provides to the city.

Carlino and Coulson (2004) provide the first such attempt to measure the benefits of sports franchises using hedonic pricing. They utilize rental values and report that the presence of an NFL team in a city increases rents in the central city of an SMSA by a statistically significant 8%; thus, the franchises generate a positive externality. The authors report that the franchises create $139 million economic value through increased rents in the city on average per year (p. 45). When they expand their data set to include rental units outside the central city in an SMSA, they find an increase of 4%, but that result is not statistically significant.

The numbers calculated by Carlino and Coulson capture the perceived benefits to renters and landlords, not to homeowners. Since nearly 70% of all Americans own their own homes (Hoover.org), it is crucial that the benefits to owners are also measured. In addition, if the teams are subsidized through public spending, those costs might be capitalized differently for owners than for renters (Welch et al. 2007).

This paper therefore estimates the public benefits to homeowners in cities with NFL franchises by examining housing prices rather than housing rents. Similar to Carlino and Coulson, we find that the presence of an NFL franchise has no statistically significant effect on housing prices in an SMSA. Different from them, we do not find a statistically significant effect in the central city of the SMSA. Furthermore, we also test whether the presence and size of the subsidy to the team affects values and find some evidence that higher subsidies for NFL stadium construction lead to lower house prices. This suggests that the benefits that homeowners receive from the presence of a team are negated by the increased tax burden due to the subsidies paid to the franchises.

2 Background

As noted previously, Carlino and Coulson's (2004) analysis utilizes housing rental data from the American Housing Survey (AHS) and finds that the presence of an NFL franchise is associated with an increase in rental prices in the central city of an SMSA of between 4% and 8%, although they do not find a statistically significant impact on rents in the full SMSA. In a comment on the Carlino and Coulson paper, Coates et al. (2006) point out that by cleaning the rental data and removing units with very low rents, the impact of the NFL on rents in central cities disappears. In their reply, Carlino and Coulson (2006) report that after cleaning the data as suggested by Coates et al. the NFL effect remains. They state that the difference in results might be due to a different method of clustering the standard errors.

As mentioned by Coates et al., it would be interesting to see if the impact on property values is similar to the effect on rents (page 125). They suggest that this would be likely since there should be a high degree of correlation between rents and values. Testing this is possible since the American Housing Survey contains data on house values as well as rental prices. Carlino and Coulson give two reasons for using rental data rather than property data: they are concerned both about the accuracy of owner stated values and about the speed with which information about the location of a franchise is incorporated in values.

The first concern is unwarranted as Kiel and Zabel (1999) have shown that differences between sales prices and owner stated values are unrelated to characteristics of the house or the neighborhood. Thus, hedonic regressions based on owner stated values will yield reliable estimates of the impact of sports franchises on house values.

The second concern is more problematic. Carlino and Coulson argue that rents "will go up only upon the arrival of the team" (page 33), whereas values will increase

when the arrival of the team is anticipated or is merely a rumor. It is also possible that rents are "sticky" due to leases and so do not change immediately. Dehring et al. (2008) show that house values are impacted by the rumors of a new stadium, so it is likely that values respond earlier in the process compared to rents which might make modeling the timing of the arrival and departure of franchises more difficult.

However, from a theoretical standpoint, it is unclear whether the impact on values would be the same as that on rents (even if the timing issue was resolved). There are several reasons why the impact might differ. The first is that homeowners and renters may have different preferences for sports franchises. This could be due to differences in demographics such as age, income, or family structure.

A second reason that owners and renters may differ in their response to a sports franchise is because the franchise is a public good. Expenditures on public goods such as education can be capitalized differently in the two types of housing. As Welch et al. (2007) show, spending on public protection and capital facilities increase both rents and values, but "factors affecting the exchange value of housing" impacts values, while "the rental market responds more to factors that affect the use value of housing" (page 149). These differences may be caused by rent capturing the present amenities of the city, while house values would capture the values of present and future amenities since it is the discounted value of the stream of rents (Banzhaf and Farooque 2013). Thus, differences in how franchises are perceived over time may lead to different impacts on rents versus values.

A third reason for different impacts is the type of financing used for the franchise. If any change in taxes due to the financing of the franchise (or its stadium) impacts landlords differently than homeowners, then we would expect to see differences in the impact on rents versus values. (See Freeman et al. (1993) for a discussion of rents, values, and taxes, page 380–383.)

In examining the literature on implementing the hedonic technique, several authors discuss whether rents or values should be used. Freeman et al. state that market transactions data (such as reported rents) are preferable but that since a "majority of residential housing is owner-occupied" (page 375), housing values could also be used. In the latter situation, the sales price represents the discounted present value of the stream of expected rents. Taylor (2003) points out that rental prices can be used, but "while future changes in amenities may be capitalized into sales prices, they are not expected to be capitalized into rents" (page 341). Thus, using rents rather than house values may change the interpretation of the estimated coefficients.

This paper replicates the Carlino and Coulson model using house values rather than rents. One might expect that the results would be quite similar, assuming that rents and values are correlated within any given metropolitan area, as suggested by Carlino and Coulson. However, if owners have different preferences, or if they view the public benefits or costs of a franchise differently than do renters, or if the impact of financing differs over the two groups, the results could be different.

3 Model

In order to test for the public benefits of a local sports franchise, we use the hedonic technique (Rosen 1974). We control for the characteristics of the house and its surrounding area that contribute to the value of the house. We can then include variables on the existence of a sports franchise in order to estimate the benefits, if they exist. The model to be estimated is:

$$\ln(\text{value})_{ijt} = \beta_{0i} + \beta_1(\text{housing characteristics})_{ijt} + \beta_2(\text{city characteristics})_{jt} + \beta_3(\text{NFL franchise})_{jt} + \beta_4(\text{year dummy variable})_t + \beta_5(\text{city dummy variable})_j + \mu_{ijt}$$

where *i* indexes the house, *j* indexes the city, and t indexes time. The error term is the sum of two parts, η_{ijt} which is $N(0, \sigma^2_\eta)$ and ε_i which is $N(0,\sigma^2_\varepsilon)$.

This model is similar to that specified by Carlino and Coulson with the exception that the owner stated value of the house is the dependent variable rather than the stated rent paid. Our null hypothesis is that our results will not differ from theirs. However, as discussed above, there are several reasons why our results might be different.

Using the 1993 and 1999 American Housing Survey data sets, we collect information on the 53 cities that Carlino and Coulson included (see their Table 3 for the list). Houses in those cities are included in our data set if they were a single family home that was occupied at the time of the interview. We remove observations that did not report any bedrooms or bathrooms and those that were in areas where we were unable to find data on crime or taxes. Over 8,000 observations remain. Table 1 provides a list of the variables included in our regressions along with descriptive statistics. Because not all of Carlino and Coulson's variables are well defined in their paper, in cases where definition was unclear we approximate them as best we could. We also add the percent of the population in the city that is black, as well as whether the unit has a basement and whether the owner reports leaks in the unit. We do not include whether the unit has a garage, is detached, is in a low- or high-rise building, or includes monthly electricity costs in the rent. We also do not include the resident-reported neighborhood crime and noise variables, nor whether the unit is rent controlled or is subsidized. Thus, we expect the same signs but not necessarily the same values on the estimated coefficients.

Multicollinearity is a potential concern with this data set. Carlino and Coulson mention multicollinearity between the NFL variable and air quality as a reason why some of their coefficients are not statistically significant (page 42). In our data set, the only variables with correlations above 0.5 are Age and Age2, Yr93 and Unemp, Yr93 and PCPI, and Crime and Unemp (see Table 1 for definitions). Thus, it seems unlikely that simple collinearity will cause problems in our estimated regressions.

In Table 2, we list the SMSAs that saw activity in professional football franchises (NFL) between 1993 and 1999. In the NFL, there were six cities that took teams in, two cities that had major stadium renovations, and four cities that lost their franchises. All of the cities that gained teams did so at a cost; our table shows the dollar value of subsidies that were required by the franchises in order to move. These

Table 1 Descriptive statistics

Variable	Description	Mean	St. dev.	Min.	Max.
LNVALUE	Log of market value of house (source: AHS)	11.76	0.83	0.69	13.21
AGE	Age of house (source: AHS)	40.82	21.40	0	80
AGE^2	Age of house squared	2,124.6	1,873.9	0	6,400
AQI	Air quality index which measures the number of days that the index is greater than 100 (source: U.S. EPA)	41.34	31.97	0	189
BATHS	# of full bathrooms in unit (source: AHS)	1.66	0.72	1	10
BEDRMS	# of bedrooms in unit (source: AHS)	3.18	0.83	1	10
BLK	Percent of population that is black (source: 1990 data are from 1998 state and metro data book, and 1998 data are from the 2000 statistical abstract of the U.S.)	14.29	7.56	1	42.2
CRIME	Violent crimes per 100,000 (source: FBI website and 2000 state and county data book)	818.0	375.5	253.6	2,470
DABAN	=1 if owner reports abandoned buildings in neighborhood, =0 otherwise (source: AHS)	0.036	0.190	0	1
DAIRSYS	=1 if house has air-conditioning, =0 otherwise (source: AHS)	0.58	0.494	0	1
DCELLAR	=1 if unit has a basement, =0 otherwise (source: AHS)	0.48	0.50	0	1
DHOLES	=1 if owner reports holes in walls, =0 otherwise (source: AHS)	0.006	0.08	0	1
DJUNK	=1 if owner reports trash in neighborhood, =0 otherwise (source: AHS)	0.078	0.27	0	1
DLEAK	=1 if owner reports leaks in unit, =0 otherwise (source: AHS)	0.16	0.37	0	1
DPUBSEW	=1 if house is on public sewer, =0 otherwise (source: AHS)	0.923	0.27	0	1
HALFB	# of half bathrooms in unit (source: AHS)	0.46	0.59	0	10
NFL	=1 if NFL team is located in city, =0 otherwise	0.65	0.48	0	1
PCPI	Per capita personal income (source: Bureau of Economic Analysis)	29,252	5,112	17,918	43,193

(continued)

Table 1 (continued)

Variable	Description	Mean	St. dev.	Min.	Max.
POP	Population of SMSA (source: U.S. Census Bureau)	5,197,436	4,853,287	846,227	20,102,875
POPCHCC	Change in population from 1980 to 1990 for 1993 Obs. & 1990–1996 for 1999 Obs.	0.097	0.108	−0.284	0.673
SUB	Public subsidies given to NFL franchises from 1993 to 1999 (source: Long 2005)	16.3	55.05	0	244
SPNDTAX	Log (spending per capita) – Log (taxes per capita) (source: 1992 data are from the 2000 statistical abstract of the U.S., and 1996 data are from the 2000 City and county data book)	0.89	0.24	0.43	1.711
YR93	=1 if year is 1993, =0 if year is 1999	0.25	0.43	0	1
UNEMP	Unemployment rate in the county (source: BLS)	5.11	1.79	1.4	12.2
City fixed effects					

Sources: American Housing Survey, U.S. Census Bureau, FBI Uniform Crime Reports, Bureau of Labor Statistics, Statistical Abstract of 2000, City and County Data Book 2000, Long (2005), Matheson Data

monies were primarily spent on the construction of new stadiums for the relocating team. Table 2 also shows the dates when it was announced that teams would be moving to a city. The earliest is Jacksonville where on November 30, 1993, it was awarded an NFL franchise. If there were rumors prior to this that the city would receive the franchise, then house values in the 1993 survey might be biased, since values might respond to rumors. For the other cities, the announcement date was much later than 1993 so the impact of rumors should be minimal.

In this paper, we estimate our equation for different geographic definitions as Carlino and Coulson did. First, we utilize all houses in the SMSA available in the data set. We do this because the existence of the franchise should yield the same public benefits throughout the area; however, the tax implications due to the presence of a new franchise can differ. Given that we have franchises located in both urban areas (Jacksonville) and suburban areas (Detroit), we felt it best to look at the largest area possible. In addition, we also estimate the regressions using only those houses located in the central city of the SMSA to more closely replicate the earlier work.

Our results are presented in Tables 3 (which uses the entire sample) and 4 (which uses only houses in the central city of each SMSA). In the first column of Table 3, we estimate the model (with White standard errors) including the house's characteristics, neighborhood characteristics, and city characteristics as well as city dummy

Table 2 NFL franchise activity during study period

City/league[a]	Franchise in	Franchise out	Subsidy (in millions)[b]	Subsidy details
Jacksonville	1995 (announced 11/93)		$166	City bond issue, state rebate, lodging tax, ticket surcharge
Oakland	1995 (announced 6/95)		$213	City and county bonds
St. Louis	1995		$322	Bonds: Backed 25% by city (convention center activities), 25% by county (hotel tax), 50% by state
Baltimore	1996 (announced 2/96)		$203	State of Maryland backed tax exempt revenue bonds
Nashville	1997		$213	Hotel/motel sales tax
Cleveland	1999 (announced 11/95)		$244	County sales tax
Los Angeles		1995		
Milwaukee		1995		
Cleveland		1996		
Houston		1997		
San Diego	1997 (stadium renovation)		$150	
Tampa	1998 (stadium renovation)		$179	

Data compiled from Long (2005), National Sports Law Institute, LeagueofFans.org, Ballparks.com
[a]Data from Long (2005) on "Reported Public Subsidy"
[b]Charlotte and Buffalo had stadium renovations during the study period but were not in the AHS data set

variables. The results are generally as expected; the age of the house affects value in a nonlinear fashion. Bathrooms and bedrooms as well as air-conditioning increase the value, while abandoned buildings and trash in the neighborhood decrease the value. Areas with higher income levels have higher house values, while areas with higher spending relative to taxes have lower values. Metropolitan areas with larger rates of increase in population have higher values, while areas with higher unemployment have lower values.

The variable of interest is "NFL"; our results show that the presence of an NFL franchise in the SMSA does not have a statistically significant impact on local house prices. This is similar to Carlino and Coulson's finding that rents are not impacted in an SMSA due to the presence of an NFL franchise. In the third column, we estimate

Table 3 Regression results on full sample

	(1)	(2)	(3)	(4)
Variables	Lnvalue	Lnvalue	Lnvalue	Lnvalue
	Robust standard errors		Clustered standard errors	
NFL	**−0.0623**	**0.0317**	**−0.0623**	**0.0317**
	(0.0429)	**(0.0512)**	**(0.107)**	**(0.116)**
Subsidy		**−0.000955*** **		**−0.000955** **
		(0.000281)		**(0.000437)**
Age	−0.00360***	−0.00346***	−0.00360	−0.00346
	(0.00117)	(0.00117)	(0.00266)	(0.00264)
age2	2.57e-05*	2.43e-05*	2.57e-05	2.43e-05
	(1.42e-05)	(1.42e-05)	(3.93e-05)	(3.90e-05)
Aqi	0.00257***	0.00196***	0.00257*	0.00196
	(0.000679)	(0.000694)	(0.00137)	(0.00139)
Baths	0.287***	0.288***	0.287***	0.288***
	(0.0186)	(0.0186)	(0.0212)	(0.0215)
Bedrms	0.0603***	0.0599***	0.0603***	0.0599***
	(0.0112)	(0.0112)	(0.0125)	(0.0125)
Blk	−0.00462	0.000545	−0.00462	0.000545
	(0.00731)	(0.00734)	(0.0157)	(0.0138)
Crime	−2.68e-05	3.82e-05	−2.68e-05	3.82e-05
	(5.64e-05)	(5.99e-05)	(0.000122)	(0.000140)
Daban	−0.376***	−0.377***	−0.376***	−0.377***
	(0.0456)	(0.0454)	(0.0744)	(0.0740)
Dairsys	0.199***	0.198***	0.199***	0.198***
	(0.0176)	(0.0176)	(0.0345)	(0.0342)
Dcellar	0.0802***	0.0783***	0.0802***	0.0783***
	(0.0244)	(0.0244)	(0.0287)	(0.0289)
Dholes	−0.0661	−0.0625	−0.0661	−0.0625
	(0.0862)	(0.0858)	(0.0757)	(0.0754)
Djunk	−0.250***	−0.252***	−0.250***	−0.252***
	(0.0264)	(0.0263)	(0.0353)	(0.0348)
Dleak	0.0525***	0.0534***	0.0525**	0.0534**
	(0.0182)	(0.0182)	(0.0238)	(0.0236)
Dpubsew	−0.184***	−0.183***	−0.184***	−0.183***
	(0.0304)	(0.0304)	(0.0257)	(0.0251)
Halfb	0.171***	0.172***	0.171***	0.172***
	(0.0169)	(0.0168)	(0.0157)	(0.0156)
Pcpi	2.84e-05***	2.31e-05***	2.84e-05***	2.31e-05***
	(5.44e-06)	(5.58e-06)	(7.70e-06)	(7.90e-06)
Pop	−8.49e-09	−9.14e-09	−8.49e-09	−9.14e-09
	(7.09e-09)	(7.10e-09)	(1.09e-08)	(1.20e-08)
Popchcc	0.404***	0.484***	0.404*	0.484**
	(0.116)	(0.121)	(0.219)	(0.229)

(continued)

Table 3 (continued)

	(1)	(2)	(3)	(4)
Spndtax	−0.258***	−0.209***	−0.258**	−0.209**
	(0.0657)	(0.0668)	(0.0997)	(0.0860)
Unemp	−0.0440***	−0.0570***	−0.0440	−0.0570*
	(0.0149)	(0.0154)	(0.0287)	(0.0287)
yr93	0.137**	0.0892	0.137	0.0892
	(0.0606)	(0.0618)	(0.104)	(0.101)
Constant	10.86***	11.01***	10.86***	11.01***
	(0.229)	(0.235)	(0.347)	(0.349)
Observations	8,662	8,662	8,662	8,662
R-squared	0.404	0.404	0.404	0.404

Robust standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

the regression but cluster the standard errors by SMSA (Wooldridge 2002). Again, the NFL coefficient is statistically insignificant.

When these equations are estimated using the smaller sample of houses located in the central city, the results do not change (see Table 4 columns 1 and 3). In contrast to Carlino and Coulson who find a stronger impact on rents when limiting their sample to the central city, we do not find a statistically significant impact using either sample. Indeed, the most important finding of Carlino and Coulson, and the one that brought the most attention to the work, was the discovery that rental units in the central city portions of areas with NFL franchises had significantly higher prices than similar units in non-NFL cities.

It is possible that our estimated coefficient on NFL is statistically insignificant because homeowners view the benefits of the franchise differently than do renters. This may be due to differences in socio-demographics between the two groups. It is also possible that the groups respond differently to the public good aspect of the franchises. Welch et al. (2007) report that owners and renters respond differently to different types of public goods. As they state, "homeowners, by far, bear most of the costs and enjoy the financial benefits of service provision while renters, by and large, do not" (page 145). They suggest that "the ownership market responds to factors affecting the exchange value of housing... while the rental market responds more to factors that affect the use value of housing" (page 149).

It is also possible that the financing of the franchise leads to differences between house prices and rents. In the case of a new NFL franchise, the public subsidy provided to obtain the franchise will likely be borne by the owners of housing; in this case, we would expect the franchise to provide positive public benefits but also negative costs. Thus, the overall impact on owners could be zero, as we have estimated. Landlords would similarly be able to charge higher rent as found by Carlino and Coulson but would face higher costs, reducing the value of their property, a cost not identified by those authors.

Table 4 Regression results on central city sample

	(1)	(2)	(3)	(4)
Variables	Lnvalue	Lnvalue	Lnvalue	Lnvalue
	Robust standard errors		Clustered standard errors	
NFL	**−0.0792**	**0.0687**	**−0.0792**	**0.0687**
	(0.0620)	**(0.0758)**	**(0.117)**	**(0.120)**
Subsidy		**−0.00145*** **		**−0.00145** **
		(0.000433)		**(0.000563)**
Age	−0.00523***	−0.00505***	−0.00523*	−0.00505*
	(0.00194)	(0.00193)	(0.00272)	(0.00273)
age2	6.20e-05***	6.01e-05***	6.20e-05*	6.01e-05*
	(2.25e-05)	(2.25e-05)	(3.39e-05)	(3.39e-05)
Aqi	0.00340***	0.00263**	0.00340**	0.00263*
	(0.00101)	(0.00103)	(0.00159)	(0.00155)
Baths	0.327***	0.328***	0.327***	0.328***
	(0.0249)	(0.0249)	(0.0294)	(0.0296)
Bedrms	0.0360*	0.0365**	0.0360	0.0365
	(0.0185)	(0.0185)	(0.0269)	(0.0270)
Blk	0.00266	0.00982	0.00266	0.00982
	(0.0114)	(0.0112)	(0.0189)	(0.0163)
Crime	−0.000162	−7.60e-05	−0.000162	−7.60e-05
	(0.000104)	(0.000109)	(0.000174)	(0.000196)
Daban	−0.305***	−0.307***	−0.305***	−0.307***
	(0.0585)	(0.0583)	(0.0527)	(0.0521)
Dairsys	0.227***	0.226***	0.227***	0.226***
	(0.0279)	(0.0279)	(0.0467)	(0.0464)
Dcellar	0.110***	0.107***	0.110**	0.107**
	(0.0391)	(0.0391)	(0.0460)	(0.0455)
Dholes	−0.108	−0.0949	−0.108	−0.0949
	(0.124)	(0.124)	(0.143)	(0.144)
Djunk	−0.217***	−0.220***	−0.217***	−0.220***
	(0.0338)	(0.0337)	(0.0335)	(0.0335)
Dleak	0.0292	0.0307	0.0292	0.0307
	(0.0319)	(0.0319)	(0.0380)	(0.0377)
Dpubsew	−0.175**	−0.177**	−0.175*	−0.177*
	(0.0845)	(0.0846)	(0.0956)	(0.0959)
Halfb	0.170***	0.170***	0.170***	0.170***
	(0.0206)	(0.0205)	(0.0217)	(0.0213)
Pcpi	2.33e-05***	1.64e-05*	2.33e-05**	1.64e-05
	(8.48e-06)	(8.71e-06)	(1.12e-05)	(9.82e-06)
Pop	−1.18e-08	−1.45e-08*	−1.18e-08	−1.45e-08
	(7.60e-09)	(7.67e-09)	(1.07e-08)	(1.20e-08)
Popchcc	0.0691	0.101	0.0691	0.101
	(0.210)	(0.210)	(0.386)	(0.369)

(continued)

Table 4 (continued)

	(1)	(2)	(3)	(4)
Spndtax	−0.276**	−0.165	−0.276*	−0.165
	(0.126)	(0.130)	(0.157)	(0.113)
Unemp	−0.0145	−0.0347	−0.0145	−0.0347
	(0.0281)	(0.0289)	(0.0479)	(0.0488)
yr93	0.0623	−0.000913	0.0623	−0.000913
	(0.0990)	(0.101)	(0.138)	(0.130)
Constant	10.51***	10.23***	10.51***	10.23***
	(0.616)	(0.606)	(1.030)	(0.825)
Observations	3,368	3,368	3,368	3,368
R-squared	0.525	0.526	0.525	0.526

Robust standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

To test this hypothesis, we include a variable that measures the amount of subsidy an SMSA has paid to entice the franchise to their location for the eight cities that attracted new franchises between 1993 and 1999. We test whether these subsidies result in increased local taxes, which are then capitalized into the house values. It should be noted that other cities in our sample could have increased subsidies other than direct stadium construction handouts during this time period designed to keep franchises in place. We know of no such changes in local government policies in any NFL cities during the time in question, and any such subsidies are likely to be small compared to stadium construction costs, but the issue is still worth mentioning. In Table 3 column 2, we report the results from the equation which also controls for the amount of the subsidy that the team required ("Subsidy"). The NFL coefficient is still statistically insignificant; however, the estimated subsidy coefficient is negative and is statistically significant for regression equations covering both the entire SMSA (Table 3) and only houses in the central city of each SMSA (Table 4). For the estimates covering the entire SMSA, the results indicate that in areas which have publicly funded the franchise, house values decrease by 0.095% for every 1 million dollar increase in the subsidy. We again estimate the same equation using the cluster technique for the standard errors as before (see Table 3, columns 2 and 4), and the results do not change in any meaningful way. Houses in the central city experience a 0.145% decrease in home value for every 1 million dollar increase in the subsidy (Table 4).

It is possible that the subsidy variable is endogenous so that cities with higher house prices are more or less likely to vote to award subsidies to sports franchises. In order to examine this possibility, we test an instrument for the subsidy variable. The percent of the SMSA population that voted for the Democratic candidate in the 1992 and 1996 presidential campaigns is used for house prices in 1993 and 1996, respectively. This is a strong instrument; when a regression is run with the subsidy as the dependent variable, the percentage Democratic vote is negative and statistically significant. When the Durbin-Wu-Hausman test for endogeneity is conducted,

however, the null hypothesis that the subsidy variable is exogenous cannot be rejected. The regression with percent Democratic votes as the instrument yields a result where subsidy is no longer statistically significant. However, the other coefficient that we are interested in, the impact of the NFL franchise to the city, remains statistically insignificant. (These results are available from authors upon request.)

It is not clear if the instrumental variable approach is necessary. The Durbin-Wu-Hausman test suggests that it is not necessary in order to be able to interpret the coefficient on the subsidy variable, but the inclusion of the instrument makes the statistical significance of the subsidy variable disappear. Under both OLS and instrumental variable approaches, the presence of an NFL franchise has no statistically significant effect on housing values. Thus, we continue to find strong evidence that NFL franchises do not affect housing prices, even in the central city, but the evidence is present but somewhat weaker that sports subsidies serve to reduce housing values.

4 Conclusions

In this paper, we extend the work by Carlino and Coulson who suggest that sports franchises are public goods that increase the quality of life in an area by examining the impact of the franchises on housing values rather than rents. Like Carlino and Coulson's findings on rents, we find that the presence of an NFL franchise does not lead to higher house values in an SMSA overall, all else held constant. Unlike Carlino and Coulson's findings on rents, however, we find that the presence of an NFL franchise has no statistically significant effect on housing values in the central city. Any public good aspect of NFL teams that Carlino and Coulson claim to have captured in their original study of rental housing does not appear to be capitalized into owner-occupied housing values.

We then test whether those franchises that required public subsidies impact house values differently and find that higher subsidies lead to lower house prices. This suggests that even if franchises do create positive externalities, the capitalization of the required subsidies causes housing prices to fall. In other words, evaluating the public good value of an NFL franchise requires an examination of both the potential costs and the benefits.

Furthermore, our results, when combined with those obtained by Carlino and Coulson, suggest that in order to capture all costs and benefits of a sports franchise to an area, one must examine the impact on both owners and renters. These two groups may perceive the costs and benefits differently, as others have found with other types of public goods. Indeed, the presence of an NFL team may not be as beneficial to local residents as previous research has concluded.

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The Impact of Sports Teams on the Urban Economy: Evidence from the St. Louis Rams' Departure

Brad R. Humphreys

1 Introduction

A large literature analyzing the economic impact of professional sports teams and games on nearby communities exists. Economists' interest in this line of research stems from the fact that, in the United States, government heavily subsidizes the construction and, in some cases, the ongoing operation of facilities where professional sports teams play. Proponents of these subsidies claim that games played in facilities generate tangible local economic benefits and that new facilities pay for themselves. A large body of peer-reviewed research concludes otherwise, finding no evidence of tangible economic benefits (Bradbury et al. 2022).

Robert Baade and coauthors developed much of the early evidence that professional sports teams do not generate tangible local economic benefits in host cities. He undertook one of the first critical economic analyses of stadium subsidies and financing (Baade and Dye 1988). He developed the first empirical evidence that the presence of professional sports teams in cities was not associated with increases in the level of metropolitan area (MA) real personal income (Baade and Dye 1990) and both growth in MA per capita income and MA to MA trade with other cities (Baade 1996). He also made a number of other substantial contributions to this literature, including Baade and Matheson (2000) and Baade and Matheson (2001).

This chapter extends the research of Baade, and others, by analyzing the departure of a professional sports team, the St. Louis Rams, from their host city to Los Angeles after the 2015 National Football League (NFL) season. The chapter analyzes a novel local outcome variable, the number of businesses, employment, and annual payroll at local firms in the bar and restaurant industries using a difference-in-

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differences (DiD) approach. Outcomes in these industries have been linked to the presence of professional sports teams in cities (Coates and Humphreys 2003). The departure of the Rams represents a reasonable application of the DiD method.

A few previous papers focused on team arrivals and departures to estimate the economic impact of professional sports teams on the local economy. For example, Lertwachara and Cochran (2007) analyzed the arrival of 33 new professional football, basketball, ice hockey, and baseball teams in US cities over the period 1969–2000 with an event study framework and found evidence of negative economic impacts generated by the arrival of new teams. Another study employed the synthetic control method to analyze the impact of the arrival of three new professional football teams in Charlotte, Jacksonville, and Nashville using the synthetic control method and found no evidence of significant economic impact (Islam 2019). A third recent paper analyzed the move of the Atlanta Braves to a new stadium in Cobb County on commercial property values using the synthetic control method and found no evidence of positive effects, despite significant commercial development around the facility (Bradbury 2021). This chapter contributes to that line of research.

These papers emphasize the importance of construction of a valid counterfactual in order to assess the economic impact of professional sports teams and games on the local economy. This chapter extends this literature by focusing on the departure of an NFL team, the St. Louis Rams, from their former home to Los Angeles after the 2015 season using a DiD approach where the absence of the team in the city represents the treatment. The results show increases in employment, annual payroll, and the number of establishments in restaurants following the departure of the Rams, with some sensitivity of the results depending on the spatial treatment area definition. The evidence that the number of restaurants, employment at restaurants, and restaurant payrolls increase following the departure of the Rams from St. Louis demonstrates the importance of the displacement effect when assessing the total economic impact of professional sports in urban economies. This displacement effect also represents a mechanism explaining the lack of evidence that professional sports generates tangible local economic benefits.

1.1 Research Context

A substantial body of research addresses the impact of professional sports teams on local economic outcomes. Much of this research focuses on developing evidence on the direct economic impact of teams and fans in the local economy. A strong consensus that professional sports generates no significant net new economic impact in local economies exists in this literature (Bradbury et al. 2022). Games played by professional sports teams clearly concentrate existing consumer spending in and around facilities on game day. This highly visible outcome emphasizes the importance of explaining why this economic activity does not represent net new economic activity in the local economy.

The displacement effect represents one possible mechanism for this lack of net new economic impact. The displacement effect refers to a broad, related class of economic activities and decisions that affect local economic outcomes (Crompton and Howard 2013). In general, the displacement effect consists of counterfactual outcomes that do not occur because economic activity does occur in and around sports facilities on game day.

This makes the displacement effect difficult to understand for many noneconomists. Examples of counterfactual outcomes generating the displacement effect include the spending that fans attending games do not make at other businesses in the area, spending not made by residents near sports facilities because they choose to avoid the area around the facility on game day due to crowding and traffic, and spending not made in other cities by visitors who chose not to go there because the attractiveness of professional sports events led them to visit a city with a professional sports team.

The importance of the displacement effect represents a common theme in the work of Robert Baade. Like this chapter, much of Baade's work focused on case studies of specific events, like the Super Bowl (Baade and Matheson 2000), Major League Baseball's All-Star Game (Baade and Matheson 2001), the NCAA Men's Basketball Tournament (Baade and Matheson 2004a, b), the World Cup (Baade and Matheson 2004a, b), college football games (Baade et al. 2008), college football and basketball games (Baade et al. 2011), and the Winter Olympic Games (Baade et al. 2010). These papers uniformly report little or no evidence these events generated positive economic impact in local economies and emphasized the importance of displacement effects in explaining the results.

2 Empirical Analysis

I exploit the departure of the Rams from St. Louis to Los Angeles following the 2015 NFL season as a natural experiment to generate evidence on the economic impact of professional sports on the local economy using a difference-in-differences (DiD) approach. The condition of the stadium the team played and the terms of the lease between the team and the local stadium authority appear to be the reason the team left, so the departure is likely unrelated to any local economic conditions in St. Louis. The Rams played their last home game at the end of December, facilitating the use of annual data in this analysis. The following sections describe the data, methods, and results.

2.1 Data Description

Annual data at the county level come from two sources: County Business Patterns (CBP) data from the Census Bureau and county economic characteristics data from

the Regional Economic Information System (REIS) collected and disseminated by the Census' Bureau of Economic Analysis. CBP data file contains detailed information on establishment counts, employment, and payroll for North American Industry Classification System (NAICS) industries and subindustries aggregated to the county-year level. This makes CBP data useful for an analysis of the economic impact of a professional sports team from a metropolitan area, since the existing evidence shows that any impact will likely manifest only in specific industries linked to attendance at professional sporting events like bars, restaurants, and retail (Coates and Humphreys 2003).

The analysis sample spans the period 2012 to 2019. This period includes the last 4 years the Rams played in St. Louis and the first 4 years after their departure for Los Angeles. I focus on outcomes in the 12 counties in the St. Louis, MO-IL metropolitan statistical area (MSA) which includes six counties, the independent St. Louis City in Missouri, and five counties in Illinois.[1]

The analysis focuses on outcomes in two NAICS industries closely related to attendance at NFL games: drinking places (alcoholic beverages) (NAICS 7224) and restaurants and other eating places (NAICS 7225). For brevity, I refer to NAICS 7224 as "bars" and NAICS 7225 as "restaurants" even though these industries contain a wider variety of establishments. For example, the restaurant sector contains snack bars and cafeterias and restaurants selling alcohol. I do not analyze outcomes from NAICS 711 (performing arts, spectator sports, and related industries) because CBP suppresses many cell counts in counties in this industry due to the small number of establishments in each county.

I analyze three economic outcome variables contained in the CBP files for both of these NAICS industries, aggregated to the county level: the total number of establishments in each county-year, total employment in each county-year, and total payroll in each county-year. I adjust the payroll data for inflation using the Consumer Price Index for All Urban Consumers (CPI-U). I supplemented the CBP data with the annual population in each county in the sample to control for other factors affecting the number of local businesses. The analysis sample contains 96 county-year observations.

Table 1 contains summary statistics for the analysis sample. The payroll variables are expressed in thousands of 2019 dollars. The bar industry in the average county contains about 40 firms employing about 300 people with an annual payroll of about $4.8 million. The higher payroll in the arts/sports industry compared to bars implies a much higher average salary, as expected. The size of the restaurant industry, with 383 firms, 8400 employees, and a $132 million annual payroll, exceeds the bar industry by a substantial margin.

The average county in the sample contains about 228,000 residents over the sample period. However, this variable contains substantial county-level heterogeneity. Five counties in the sample have average populations of 50,000 or less. St. Louis

[1] St. Louis County, St. Louis city, Franklin Co., Jefferson Co., Lincoln Co., St. Charles Co., and Warren Co. MO. Clinton Co., Jersey Co., Madison Co., Monroe Co., and St. Clair Co, IL.

Table 1 Summary statistics, $N = 96$

	Mean	SD
Employment bars	296.9	333.9
Payroll bars	4848.7	5849.7
Establishments bars	39.4	37.9
Employment restaurants	8406.4	11222.3
Payroll restaurants	131930.2	185997.1
Establishment restaurants	383.3	490.5
County population (000)	228	264.1

City, St. Louis County, and Charles County MO all have annual population more than 300,000. Similar heterogeneity exists in the CBP data, with many counties having small numbers of firms and employees in the bar and restaurant industries.

2.2 Empirical Method

The analysis focuses on the impact of the departure of the Rams from St. Louis following the 2015 NFL season. I employ a difference-in-differences (DiD) method in which specific counties are treated in the years following the departure of the Rams at the end of the 2015 NFL season. Under this approach, the economic activity generated by residents of the St. Louis MSA concentrated in and around the Rams' stadium on game days could be spent on other consumer services in other parts of the MSA after the team left. The two-way fixed effect DiD models take the general form:

$$Y_{cit} = \kappa_i + \tau_t + \beta_1 Post_{it} + \beta_2 POP_{it} + \varepsilon_{it} \quad (1)$$

where Y_{cit} is one of the three outcome variables (c: number of establishments, number of employees, or annual payroll) in one of the two NAICS industries (bars or restaurants) in county i in the St. Louis MSA in year t. κ_i is a county fixed effect and τ_t a year fixed effect. POP_{it} is county population in year t, and the unobservable parameter β_2 captures the effect of changes in population on the outcome variables. The population of a county can affect the number of establishments and employment in these two industries. ε_{it} is an unobservable, mean zero, heteroscedastic equation error term capturing the impact of all other omitted factors on the outcome variables.

The explanatory variable of interest, $Post_{it}$, is a DiD indicator variable equal to one in all treated counties in the years following the departure of the Rams. Details about the spatial treatment assumptions can be found below. The parameter of interest, β_1, captures the effect of the departure of the Rams on local economic outcomes. If the parallel trend assumption holds, this parameter estimate reflects the causal impact of the departure of the Rams on local economic outcomes in the two industries.

Spatial Treatment Assumptions

Again, displacement spending generated by the presence and absence of the Rams in the pre-treatment period represents the underlying mechanism for this DiD analysis. Local residents spent substantial money in the stadium while attending Rams games, as well as patronizing bars and restaurants near the stadium. After the team left the MSA, this local spending occurred somewhere else in the MSA at some other time. The spatial impact of this change in spending depends on where local fans attending Rams games live and where they engage in consumption spending.

Little evidence exists about the spatial distribution of the homes and local shopping areas of fans attending professional sporting events. This complicates identification of the appropriate spatial treatment units in this analysis. To address this, I estimate DiD models with three alternative spatial treatment areas. Model 1 assumes that the independent City of St. Louis represents the only treated spatial unit in the sample and all other counties in the St. Louis MSA are not treated by the Rams' departure. The Rams played home games in the city. This represents the narrowest possible treatment area in the analysis data set. This effectively assumes that all Rams-related consumer displacement spending remained in the city after the team departure and none occurs in other parts of the MSA.

Model 2 assumes that the City of St. Louis and the contiguous St. Louis County MO represents the only treated spatial units and all other St. Louis MSA counties are not treated. These two areas have the largest populations of all counties in the MSA, so many fans attending Rams games could reside in one of these two areas. Model 3 assumes that the Rams' departure affects all counties in the MSA. This represents the broadest spatial treatment area definition of the location of Rams-related displacement spending occurs. Patterns of variation in the DiD parameter estimates can provide information about the nature of the displacement spending generated by the team departure.

Figure 1 shows the Missouri and Illinois counties in the St. Louis MSA. The independent City of St. Louis, labeled "City" in Fig. 1, contains the Rams stadium. The Mississippi River runs roughly through the center of the MSA separating the counties in Illinois on the right of the figure from the counties in Missouri on the left of the figure.

Outcome Variable Pre-trends

The assumption of parallel pre-trends in the pre-treatment period must hold for DiD models to return plausibly causal estimates of the economic impact of professional sports. This means that the trends in the outcome variables in the treated and control units must be similar before the treatment takes place. Fig. 2 contains visual evidence that this assumption holds in the analysis sample. Figure 2 shows the annual average values of all six outcome variables across all 12 counties in the sample, along with the 95% confidence interval for the annual average for each year. The relatively small number of counties in the sample leads to relatively large confidence intervals. Again, the entire MSA represents the broadest definition of treated areas in this setting.

Fig. 1 Counties in the St. Louis MSA

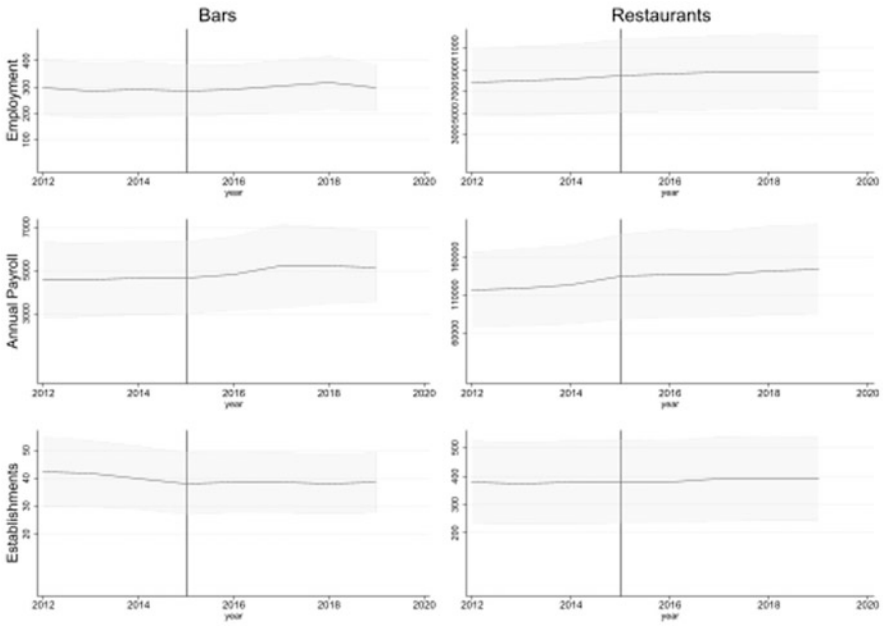

Fig. 2 Outcome variable pre-trends

Table 2 Difference-in-differences parameter estimates by industry

NAICS 7224 – bars			
	City	City and county	All MSA counties
Employment	48.01	−91.76	−6.64
	0.08	−1.07	−0.15
Payroll	3055.14	619.58	615.59
	3.37	0.35	0.90
Establishments	−0.41	−11.07	−4.22
	−0.08	−1.92	−1.23
NAICS 7225 – Restaurants			
Employment	756.54	1655.10	909.61
	1.27	3.56	2.69
Payroll	22434.80	57501.73	26164.37
	1.14	3.60	2.24
Establishments	22.8	28.51	10.97
	2.53	6.86	2.17

Note: *t*-statistics appear below parameter estimates on the table

From Fig. 2, the parallel pre-trend assumption appears valid. There are no apparent changes in the trends before the team departure. There could be a slight downward trend in the number of bars per county prior to the team departure. Examining the average values, the number of bars declined from 42 per county to 38 per county over the period 2012–2014. But given the relatively large confidence interval, this decline does not appear to be statistically important.

2.3 Results

Table 2 shows the results from estimating Eq. (1) using OLS, cluster correcting the estimated standard errors by county, and correcting for heteroscedasticity using the standard White-Huber sandwich correction. All these models contain county and year fixed effects and county population as a control variable, but Table 1 reports only the DiD parameter estimate of interest, β_1, from Eq. (1). Each parameter estimate and t-statistic (shown below the parameter estimate) on the table comes from a separate DiD regression model. Each column uses a different spatial treatment area as described above, and each row uses a different dependent variable. The top panel contains results for bars and the bottom for restaurants. A positive and statistically significant parameter estimate means that outcome variable increased following the team departure relative to the pre-treatment period and the untreated counties.

The results in the column labeled "City" assume that the post-departure treatment area contains only St. Louis City. The results in this column contain some supporting evidence for the displacement effect. Annual payroll in bars in St. Louis City increased by about $3 million after the team departure, but no increase in bar employment or establishment occurred. This impact could reflect an increase in bar patronage that is large enough to affect revenues but not large enough to lead to more hiring or entry by new firms. About 22 new restaurants opened in the city in the post-departure treatment period relative to the control counties.

The column headed "City and county" contains results assuming that the post-departure treatment area includes the city and St. Louis County. Bars in these two areas experienced no change following the team departure. The departure affected restaurants, leading to significant increases in employment, annual payroll, and the entry of new firms. This represents strong evidence of displacement effects on restaurants. The third column results include all MSA counties in the treatment area. This model is equivalent to a t-test of differences in means before and after the team departure. These results also support the presence of important displacement effects in the restaurant industry but not bars. The entire MSA experienced significant increases in restaurant employment, payroll, and the number of establishments after the team departure.

The effect sizes for these impacts range from 6% to 10% for restaurant employment, 12–19% for restaurant annual payroll, and 2–3% for the number of restaurants. The larger effect sizes come from the treatment area defined as all MSA counties. The results show strong evidence supporting the presence of displacement effects in restaurants following the departure of the Rams. Consumer spending in the stadium appears to spread out to other parts of the MSA following the departure of the Rams, leading to increased business activity in local restaurants throughout the MSA.

3 Conclusions

Displacement spending represents a relatively elusive concept, in terms of finding empirical evidence supporting or denying its existence, that nonetheless influences the overall economic impact of professional sports on cities. Relatively little direct evidence supporting the importance of the displacement effect exists. The lack of evidence supporting the claim that professional sports generate tangible economic benefits for cities, in the form of increases in wages, employment, and taxes, suggests that substantial displacement spending must occur when a new team enters a city or an existing team leaves.

This chapter develops evidence that displacement spending exists, using the departure of an NFL team, the Rams, from St. Louis following the 2015 season. The analysis exploits this departure in a difference-in-differences approach. The results indicate that narrowly focused displacement spending occurred in the MSA after the departure of the team. Employment, payroll, and the number of establishments in the local restaurant industry all increased substantially MSA wide

following the team departure. However, the impact affected only the restaurant industry and not bars. This may reflect the narrow scope of the bar industry in the CBP data and associated NAICS codes. The bar industry contains only establishments serving alcohol and not food.

This chapter furthers our understanding of the role played by professional sports teams in the local economy. Games played by professional sports teams clearly concentrate economic activity in facilities on game day. Empirical economic research assumes that the lack of a positive net economic impact when a new team arrives in a city, or the lack of a negative impact when a team leaves, as well as the lack of a negative impact during strikes and lockouts (Coates and Humphreys 2001), reflects displacement spending. The results presented here support that assumption. Verifying that displacement spending exists strengthens the conclusions in the research finding no evidence of tangible economic impacts of professional sports, since the main mechanism behind this lack of impact exists.

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Major Stadium Construction in the Twin Cities: If We Build It, Will Construction Employment Increase?

Phillip A. Miller

1 Introduction

In this essay to honor Rob Baade, I examine the impact of major sports facility construction on local construction industry employment in the Minneapolis-St. Paul-Bloomington, MN/WI MSA also known as the Twin Cities MSA. From 2001 to 2021, four major stadiums were built within the Twin Cities metropolitan area: US Bank Stadium, Target Field, Huntington Bank Stadium, and Allianz Field for the NFL's Minnesota Vikings, MLB's Minnesota Twins, the University of Minnesota Golden Gophers football team, and Major League Soccer's Minnesota United, respectively. The first three stadiums are in Minneapolis, MN, and the latter is in St. Paul, MN.

To justify government subsidies for teams and stadium projects, proponents typically commission economic impact studies to illustrate the gains to the wider community generated by the teams and projects. Those who have examined the historical record, however, generally have found that these positive spillovers have not panned out.

For instance, Baade (1996) finds little evidence that the existence of teams and the number of new playing facilities in cities leads to higher levels of local employment. Baade and Dye (1990) note that having playing facilities built or renovated may not increase local personal income and may actually decrease a city's share of its regional economic development. Hudson (1999) examines whether the relocation

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of a sports franchise into or out of an area leads to tangible economic benefits within that area, which he does not find. Coates and Humphreys (1999) find that a city's professional sports environment, or a change in that environment, has no impact on the growth rate of local personal income and some franchises may actually decrease local personal income levels.

In an analysis of particular sectors within local economies, Coates and Humphreys (2003) show that professional sports franchises positively impact the average earnings of workers in the amusement and recreation sector within cities. However, they find a lower level of employee earnings in the eating and drinking establishment sector. They also find a negative relationship between the existence of pro sports in metropolitan areas and employment in the service and retail trade sector in the local economy. This suggests that spending on sports is essentially redistributed from within local economies; rather than going out to eat, fans go out to a ball game instead. Moreover, this redistribution of consumer spending explains their 1999 findings.

Propheter (2019) examines establishment-level data from Colorado to assess whether building a sports stadium or relocating an existing team has an effect on employment at establishments near the playing facility. He finds that constructing a new soccer stadium to house the Colorado Rapids of the MLS had no effect on employment in establishments near the facility. In addition, he notes that relocating the Rapids from the city of Denver to the Denver suburb of Commerce City had no effect on employment at establishments near the old playing facility or the new facility.

Baade et al. (2008) show that new playing facilities, mega events, and new teams have no appreciable positive impact on local sales taxes in Florida and may even reduce them. They also find that disruptions in playing schedules from strikes and lockouts do not result in lower taxable sales in Florida. Coates and Humphreys (2001) also examine the effect of strikes and lockouts in professional sports on cities and show no evidence that labor strife harms local economies. In addition, they investigate the relocation of NBA franchises and find that losing an NBA franchise has no impact on the franchise's former city's economy. Siegfried and Zimbalist (2000) and Coates and Humphreys (2008) each survey the literature on the economic impact of sports and state that researchers consistently find evidence that having major sports teams and undergoing major playing facility projects does not generate positive tangible economic benefits to local economies.

Coates (2007) also reviews the literature on the local economic impact of professional sports and notes little to no positive impact on tangible benefits in local economies. However, he finds that researchers examining the intangible benefits of sports, such as the value of civic pride derived from sports, have calculated these to be sizeable. However, he describes the difficulty in measuring these intangibles, which leads to uncertainty about their true size. Yet even in the absence of this uncertainty, despite their size, the value of these intangibles is insufficiently large to warrant generous public subsidies.

Researchers have also examined the relationship between sports facility construction and the local construction industry, and that is the focus of this research. Miller

(2002) examines time series data to see whether playing facility construction had a noticeable effect on the local construction industry. Specifically, he examines data from the St. Louis, MO, metropolitan area from 1971 to 1998. During this period, St. Louis built the Enterprise Center (formerly the Kiel Center) and The Dome at America's Center (formerly known as the Trans World Dome). The Enterprise Center is the home arena for the St. Louis Blues NHL club. The Dome at America's Center is the former home stadium of the now-Los Angeles Rams of the NFL.

Noll and Zimbalist (1997) suggest stadium construction substitutes for, or crowds out, other construction projects. Consequently, they caution including construction worker incomes as a benefit of stadium construction. If sports facility construction projects crowd out other construction projects locally, then the incomes of construction workers building playing facilities will be effectively offset by incomes that they would have earned in the crowded out projects.

Miller develops a formal theoretical model that applies this substitution effect to local construction industry employment. When a new stadium is built, construction workers at the job site must either be drawn from other projects or from the ranks of the unemployed. If they are drawn from other projects, researchers should not find evidence of different employment levels during periods of playing facility construction.

In contrast, Miller notes that 1997 RIMS II multipliers for the state of Missouri assume that each $one million spent on construction leads to nearly 12 new construction jobs in the state. Assuming the majority of these jobs are in the St. Louis MSA, the $170 million (nominal) cost of the Enterprise Center should have generated over 2000 new construction jobs. The $280 million (nominal) cost for The Dome at America's Center should have generated over 3300 construction jobs. However, Miller finds no evidence of any impact on employment in the St. Louis construction industry employment during construction.

Richardson (2016) uses quarterly panel data for New Zealand's various territorial local authorities (TLAs) and examines the impact of playing facility construction on local construction industries. He examines the effect of facility construction on local construction employment growth and TLA-level growth in GDP.

Richardson breaks out facility construction into two general sets: construction of particular types of playing facilities and the total number being constructed in a particular quarter.

In the first set, he separates playing facilities into four types: stadiums, arenas, motorsport facilities, and velodromes for cycling races. To control for facility type in his regressions, he employs the use of dummy variables. When broken out by facility type, he finds that stadium and motorsport facility construction projects positively correlate with construction employment growth while projects are being built. He also shows that only stadium construction correlates with higher employment growth in local construction industries after project completion.

In the second set of models, he controls for the aggregate number of playing facilities being built at a time. He finds a positive relationship between the number of facilities being built and local construction employment growth but only when projects were ongoing.

Turning to TLA GDP growth, Richardson shows no association between the total number of playing facilities constructed and local GDP, neither during nor after construction.

Broken out individually by facility type, he finds only stadium construction correlates with increased TLA GDP growth during construction. After project completion, only the construction of arenas positively correlates with greater TLA GDP growth.

Richardson also examines a separate set of dynamic models. In each of these models, he adds lagged versions of the dependent variable to capture potential TLA-specific effects.

Analyzing the dynamic models, he shows that the total number of facilities being constructed in a period positively correlates with construction employment growth, both during and after construction.

Breaking out facilities by type, he finds that building stadiums and motorsport facilities associates with higher construction employment growth while projects are ongoing. However, only the building of stadia and velodromes positively correlates with employment growth post-construction.

Lastly, Richardson finds no evidence from his dynamic models that playing facility construction, either overall or broken out by facility type, leads to higher TLA GDP growth.

Now let us turn to the theory of how playing facility construction affects local construction employment.

2 The Theory

In this paper, I apply the model of local construction employment developed by Miller (2002). Miller provides the formal theory, so I will only summarize it below and direct the interested reader to Miller's article.

As noted above, construction projects substitute for, or "crowd out" (Noll and Zimbalist, 1997), other construction projects. That is, when a construction firm works on a project, there is another project it could have worked on. If the firm makes choices to maximize profit, it chooses the project that generates the highest marginal profit among all other potential projects. Thus, when construction workers build a playing facility, they are effectively not working on other projects at that moment. If this substitution effect holds, we should not observe any change in the level of employment in the local construction industry during periods of stadium construction.

3 Empirical Analysis

For the empirical analysis, I apply the empirical models and methodology of Miller (2002) to analyze the local construction industry in the Twin Cities metropolitan area. The sample period I analyze starts in the first quarter of 2001 (2001 Q1) and ends in the third quarter of 2019 (2019 Q4). During the sample period, four new playing facilities, each a stadium, were built in the Twin Cities metropolitan area: Target Field for the Minnesota Twins, US Bank Stadium (Vikings), Huntington Bank Stadium (University of Minnesota Golden Gophers football), and Allianz Field (Minnesota United).

I only examine stadium construction for major professional and college sports in this analysis. The St. Paul Saints, a minor league baseball club formerly with no MLB affiliation, became affiliated with the Twins as its AAA minor league baseball team, the highest level of Minor League Baseball. I do not include a control for the building of the Saints stadium in downtown St. Paul, which was built during the sample period, because minor league baseball stadiums typically are much smaller and, when being built, would be much smaller construction projects.

3.1 The Data

I draw from several sources to construct the data in this analysis. The data are quarterly time series, and all local data are from the Twin Cities MSA. This MSA covers 14 counties in Minnesota and two counties in Wisconsin. Minnesota has the bulk of the population and the majority of economic activity in the MSA.

I obtain construction industry employment and earnings for the Twin Cities MSA from the Quarterly Workforce Initiative (QWI). Values for both variables are available at the QWI Explorer website at https:qwiexplorer.ces.census.gov on the US Census Bureau's website. Both variables are from private establishments only and as such are not representative of the entire construction industry in the Twin Cities.

In the raw data, each of these two variables are available by the state portion of the MSA. Therefore, for each quarterly observation, there is an employment value and an earnings value for the Minnesota portion of the Twin Cities MSA and likewise for the Wisconsin portion.

In addition, the raw employment and earnings data are not seasonally adjusted. I seasonally adjusted both variables using the X11 procedure in SAS which is an "adaptation of the US Census Bureau's X-11 seasonal adjustment program" (SAS Help Center 2022b). I seasonally adjust both variables by state.

After seasonally adjusting each variable, I calculate employment and earnings for the metropolitan area as a whole. The employment variable measures the number of employees working in private construction firms at the beginning of each quarter. So

to calculate MSA-wide construction industry employment, I simply add the value for the Minnesota portion to that of the Wisconsin portion.

The earnings data measure the average monthly earnings for employees of private construction firms employed by the same firm for the entire quarter (i.e., stable employment). To calculate an average earnings variable for the entire metropolitan area, I calculate a weighted average earnings variable using construction industry employment in each state's portion of the MSA as weights.

I expect Twin Cities construction employment to correlate with national investment conditions. To control for these conditions, I obtain private nonresidential fixed investment from the St. Louis Federal Reserve Bank's Federal Reserve Economic Data, or FRED, at the banks' website at fred.stlouisfed.org. This variable is seasonally adjusted and expressed at an annual rate in billions of US dollars.

To control for other construction activity in the Twin Cities, MSA, I use building permits data from the FRED database. Specifically, this variable measures the number of new private housing units authorized by building permits. The variable is seasonally adjusted and available by month. To obtain a quarterly value, I average the three monthly values for each quarter.

To control for interest rates, I obtained Moody's AAA corporate bond yield from the FRED database. The value for each observation is expressed as a percent and not seasonally adjusted. I use the X11 procedure in SAS to seasonally adjust the raw data in the same manner as the employment and average monthly earnings data described above.

In the regressions below, I include an average value of the interest rate variable since investment spending decisions are not likely to be based only on the present interest rate. If investment decisions use recent rate history as an indicator of future rates, then lagged interest rates may play some role in investment spending decisions and thus construction industry employment. To include prior interest rate history in the analysis, I calculate two average interest rates, each being the average of four quarters. One is the average interest rate beginning three quarters prior and ending at the present quarter's interest rate for each observation (lag 3 to lag 0). The second is the average starting four quarters prior up to one quarter prior for each observation (lag 4 to lag 1).

To control for ongoing stadium construction in each quarterly observation, I define two types of variables. The first type consists of dummy variables, each set to 1 in a quarter if a particular playing facility was under construction at some point during the quarter and set to 0 otherwise. As described above, four new major sports stadiums were built during the sample period, and I name each dummy after the nickname for the team for which each stadium was built: Twins, Vikings, Gophers, and MN United (Minnesota United).

The second type of variable consists of a single variable which I term "Total." This variable is the total number of major sports stadiums being constructed and is the sum of the four stadium construction dummies described above. Richardson (2016) uses a similar variable in his analysis on New Zealand playing facility construction.

Table 1 New stadium construction in the twin cities MSA

Stadium construction information	Team	League	Broke ground	Quarter	Opened	Quarter
Huntington Bank stadium	University of Minnesota Gophers football	Big 10 (NCAA)	30-Sep-06	2006 Q3	12-Sep-09	2009 Q3
Target field	Twins	MLB	30-Aug-07	2007 Q3	12-Apr-10	2010 Q2
US Bank stadium	Vikings	NFL	3-Dec-13	2013 Q4	22-Jul-16	2016 Q3
Allianz field	Minnesota united	MLS	12-Dec-16	2016 Q4	13-Apr-19	2019 Q2

All dates from Wikipedia https://en.wikipedia.org

To define the beginning and ending quarters for each stadium's construction period, I use data from Wikipedia. This website gives a "Broke Ground" date, which I assume is when construction began. It also gives an "Opened" date which I assume is when construction ended. These dates are presented in Table 1.

The price level variable used in this study is the consumer price index (CPI) for all items and all urban consumers, also available from the FRED database. The base period for the CPI is 1982–1984. All dollar values are put in real terms using the CPI, with 2021 Q3 being the base period.

Lastly as noted above, the sample period for the variables used in the regressions below runs from 2001 Q1 to 2019 Q4. There are 76 observations for all variables.

The list of variables, a short description of each, and their summary statistics are given in Table 2a and 2b. This table is in two parts. Table 2a provides the short descriptions, and Table 2b provides the summary statistics. Note that I provide neither the standard deviation, the maxima, nor the minima for the dummy variables since these take on only values of 0 or 1.

3.2 The Empirical Models

I use ARCH models as employed by Miller (2002) in his study of the St. Louis, MO, MSA construction industry employment. The basic model I analyze is:

$$E = \alpha X + \beta Stad + v.$$

E is the level of employment in the local construction industry. α is a (k x n) matrix of parameters to be estimated. X is an (n x k) matrix of exogenous variables. β is a (k × m) matrix of parameters to be estimated, and *Stad* is an (m × k) matrix containing the stadium construction variables discussed above. v is a (k × 1) matrix of stochastic error terms.

Table 2a Variables and short descriptions

Variable	Description
Employment	QWI private construction employment beginning of Qtr counts entire MSP MSA (seasonal adjustment calculation by author)
Real investment	Real private nonresidential fixed investment, billions of dollars, base: 2021Q3
Building permits	Lagged new private housing units authorized by building permits for Minneapolis- St. Paul -Bloomington, MN-WI (MSA)
Avg Int rate (lag = 0–3)	Avg AAA Bond Yield Q0-Q3, percent
Avg Int rate (lag = 1–4)	Avg AAA Bond Yield Q1-Q4, percent
Real average earnings	QWI real private construction average monthly earnings full Qtr employment (stable) (seasonal adjustment, weighted avg. calculated by author), base: 2021Q3
CPI lag = 2	CPI lagged 2 Qtrs, base: 1982–1984 = 100
Gophers	Gophers Stadium construction dummy
Vikings	Vikings stadium construction dummy
MN united	MN united FC Stadium construction dummy
Twins	Twins Stadium construction dummy
Total	Total number of stadiums being constructed in quarter

Table 2b Summary statistics for variables

Variable	N	Mean	Std Dev	Minimum	Maximum
Employment	**76**	**76642.41**	**10976.79**	**54470.28**	**93805.61**
Real investment	**76**	**738.331302**	**174.737771**	**487.33357**	**1087**
Building permits	**76**	**1257.6**	**636.163455**	**320.985588**	**2437.41**
Avg Int rate (lag = 0–3)	**76**	**4.9529467**	**1.0646844**	**3.38755**	**7.461975**
Avg Int rate (lag = 1–4)	**76**	**5.0086076**	**1.091982**	**3.658275**	**7.617775**
Real average earnings	**76**	**1819.77**	**235.499224**	**1501.36**	**2301.91**
CPI lag = 2	**76**	**215.433478**	**24.2719677**	**173**	**255.283**
Gophers	**76**	**0.1710526**	–	–	–
Vikings	**76**	**0.1578947**	–	–	–
MN united	**76**	**0.1447368**	–	–	–
Twins	**76**	**0.1578947**	–	–	–
Total	**76**	**0.6315789**	**0.6897749**	**0**	**2**

For quarter q where $q = 1, \ldots k$ in an ARCH model, this error term takes the form:

$$v_q = \varepsilon_q - \gamma v_{q-1}$$

$$\varepsilon_q = \sqrt{h_q} u_q$$

$$h_q = \omega + \rho\varepsilon_{q-1}^2$$
$$u_q = iid(0,1)$$

Following Miller (2002), I analyze two general types of models: an ARCH model and a two-stage instrumental variables ARCH model. Within each type, I analyze two groups. In group A, the *Stad* matrix contains the four stadium dummies described above. In group B, the matrix consists of the variable Total, the total number of stadiums under construction in the Twin Cities MSA which, for each quarter, is the sum of the four stadium dummies.

3.3 Regression Results: ARCH Models

I ran Q and LM tests on all models discussed below, and most models showed the presence of ARCH effects. I estimated all models as ARCH (1) with maximum likelihood estimation.

To select the autoregressive lag in each model, I use the backstep option in SAS. This option has the software determine the appropriate lags to be estimated via a stepwise autoregressive process (SAS Help Center 2022a). This process iteratively removes insignificant parameters until only significant parameters remain. I initially start with a high order of lags, 12. The general results of the stepwise autoregressive process are as follows: all models have an AR1 component, one has an AR8 component, four have an AR9 component, one has an AR11 component, and four have an AR12 component.

Table 3 presents the ARCH model results.

The estimated intercepts are positive and highly significant in every model except 3A.

The parameter estimates on real investment are positive and significant at the 10% level or better in each model in Table 3 except for models 4A and 2B. The significant estimates range between 33 and 68; a one-billion dollar increase in real private nonresidential fixed investment correlates with between 33 and 68 more jobs in the Minneapolis-St. Paul metro area's private construction industry.

The parameter estimates on building permits are insignificant in every model in Table 3. Thus, I find no evidence in Table 3 that building permits and local construction employment are correlated.

The parameter estimates on the average interest rate (lag 0 to lag 3) are significant at the 10% level or better in models 3A and 4B. They are also of similar magnitudes and positive. Both parameter estimates on the average interest rate (lag 1 to lag 4) are positive but only significant in model 4B. The positive sign on interest rates is not as expected. Perhaps this is due to the rates being proxies for lagged investment spending. The interest rate variables used in the regressions are nominal and involve lagged terms. Given the supply of money, higher lagged investment spending would increase the demand for money which, in turn, would increase the nominal interest

Table 3 ARCH results

Variable/Model	1A	2A	3A	4A	1B	2B	3B	4B
Intercept	64671***	48073***	381.0756	9113***	53154***	53981***	−1940***	2262***
	157.4328	*423.7789*	*360.609*	*439.9624*	*5737*	*18.5529*	*140.3234*	*161.7487*
Real investment	33.705**	60.4016*	63.3894*	59.6278	52.7622***	51.6809	67.3243**	63.2922**
	15.906	*32.47*	*37.5319*	*37.99*	*9.62*	*36.2537*	*31.4232*	*30.1964*
Building permits	–	0.296	0.1798	1.6711	–	−0.0578	0.3768	0.2789
		8.4316	*3.9577*	*4.0792*		*6.4448*	*2.7279*	*2.9667*
Avg Int rate (lag = 0–3)	–	–	6127* *3208*	–	–	–	6071** *2600*	–
Avg Int rate (lag = 1–4)	–	–	–	4901 *3537*	–	–	–	5679** *2454*
Gophers	−1452 *1574*	−1415 *5059*	−2499 *3678*	3309 *2343*	–	–	–	–
Vikings	723.8501 *4543*	2498 *7205*	−638.4052 *7673*	806.4178 *6928*	–	–	–	–
MN united	−650.7687 *5248*	804.6795 *8696*	−1490 *8504*	2749 *4006*	–	–	–	–
Twins	−777.0719*** *41.2675*	272.604 *9288*	−265.2375 *6045*	−2068 *4997*	–	–	–	–
Total	–	–	–	–	−506.957 *426.1742*	−563.8329 *3070*	−1484 *2196*	−1124 *2075*
AR1	−0.9982***	−1.1386***	−1.0643***	−0.9856***	−1.078***	−1.0699***	−1.063***	−1.0426***
	0.0305	*0.2675*	*0.2255*	*0.0971*	*0.0173*	*0.112*	*0.1616*	*0.1376*
AR8	–	0.324 *1.5915*	–	–	–	–	–	–
AR9	–	−0.1779 *1.4298*	0.1028 *0.6114*	–	–	–	0.0992 *0.4409*	0.0346 *0.3499*
AR11	–	–	–	–		–	–	–

					0.0912*** *0.0204*			
AR12	–	–	0.0103 *0.4817*	–	–	0.084 *0.1326*	0.0115 *0.3586*	0.0666 *0.3078*
ARCH0	5273158***	12343262***	7966904***	10801427***	1311480***	10631652***	6154540***	6392367***
	0.1565	*3.8135*	*6.7647*	*1.1323*	*28.0073*	*0.318*	*0.556*	*0.5177*
ARCH1	0	0	0	0	0.0497	0	0	0
	0	*0*	*0*	*0*	*0.154*	*0*	*0*	*0*
Total R-Sq	0.9853	0.9901	0.9872	0.972	0.9902	0.9901	0.9866	0.9849

***Significant at 1% level or less
**Significant at 5% level or less and above the 1% level
*Significant at 10% level or less and above the 5% level
Standard errors given below their respective parameter estimates in italics

rate. The lagged investment spending would also increase construction employment. If the lagged investment spending is for projects that continue for multiple quarters, then lagged investment spending would increase present quarter construction employment.

The parameter estimates for the individual stadium dummies are insignificant except for the Twins dummy in model 1A. This estimated parameter is negative and suggests that the metropolitan area had about 777 fewer construction jobs area-wide while the Twins stadium was under construction.

For all other stadium dummies, the estimated parameters suggest no correlation with those construction projects and local construction employment. Taken as a group, the parameter estimates for the four stadium dummies provide evidence that there is most likely no correlation between constructing a major sports stadium and local construction industry employment levels.

The parameter estimates on the Total variable are insignificant across all models in Table 3. Overall, the evidence in this table suggests that, taken in the aggregate, sports stadium construction had no significant impact on local construction employment in the Twin Cities metropolitan area.

3.4 Two-Stage Instrumental Variables ARCH Results: Second Stage

Miller (2002) suggests that including nonresidential fixed investment as a regressor in the models may control for spending on stadium construction. Thus, he estimates separate models substituting a construction firm employee income variable for nonresidential fixed investment. Since worker income, generally defined, and employment may be simultaneously determined, he estimates two-stage instrumental variables ARCH models. In the first stage, he estimates a model for his income variable using the CPI lagged two quarters as an instrument.

In the second stage, he estimates the employment models, substituting predicted values of his income variable in place of nonresidential fixed investment. I apply that methodology in this analysis.

In the first stage, I estimate real average monthly earnings of construction industry employees in the Twin Cities MSA using the same regressors as presented in Table 3 except investment. In place of this variable, I substitute the CPI lagged two quarters.

I present and discuss the results from the first-stage regressions in the appendix. The second-stage results are presented in Table 4. As in the ARCH models discussed above, I use the backstep process in SAS to select the autoregressive lags for both stages, and the ARCH models are estimated with the maximum likelihood method. All second stage models have an AR1 component, two have an AR8 component, three have an AR9 component, and five have an AR12 component.

The estimated intercept is positive and highly significant in each model.

Table 4 Two-stage ARCH results

Second stage								
Variable/Model	**1A**	**2A**	**3A**	**4A**	**1B**	**2B**	**3B**	**4B**
Intercept	66044***	44253***	−8612***	67413***	61152***	50301***	32646***	40103***
	230.6308	*397.2916*	*221.0746*	*786.8285*	*10,199*	*33.1312*	*289.6122*	*409.0521*
Predicted real earnings	10.6123*	23.5663***	28.3756***	−5.1106	13.9385**	19.6143**	16.943	18.9439
	6.1402	*9.0021*	*9.3973*	*38.3367*	*6.5715*	*7.684*	*19.1097*	*31.4577*
Building permits	–	0.5066 *6.3133*	0.6983 *3.4245*	−0.065 *8.7214*	–	0.4854 *5.6278*	−2.3145 *7.2433*	−2.6464 *10.2733*
Avg Int Rate (lag = 0–3)	–	–	6123**	–	–	–	3820	–
			2662				*4013*	
Avg Int Rate (lag = 1–4)	–	–	–	3028	–	–	–	2423
				8629				*5246*
Gophers	−1236 *1690*	−238.083 *5116*	−324.3154 *4252*	124.9629 *4405*	–	–	–	–
Vikings	867.1647 *3893*	4001 *5908*	2365 *4044*	4967 *5241*	–	–	–	–
MN United	462.7944 *5123*	1353*** *251.5169*	– 543.7788*** *106.5687*	2288 *8363*	–	–	–	–
Twins	−1803 *2765*	790.4226 *7137*	87.6596 *5014*	112.8464 *6671*	–	–	–	–
Total	–	–	–	–	−392.7695 *502.4433*	897.7456 *2458*	−1472 *3910*	−1380 *3857*
AR1	– 0.9941***	−1.1096***	−1.0304***	−1.1126***	−1.053***	−1.0536***	−1.0384***	−1.0455***
	0.0333	*0.1563*	*0.1229*	*0.1862*	*0.0121*	*0.0739*	*0.1023*	*0.1043*

(continued)

Table 4 (continued)

Second stage								
Variable/Model	**1A**	**2A**	**3A**	**4A**	**1B**	**2B**	**3B**	**4B**
AR8	–	0.2089 *0.9679*	–	0.232 *1.2816*	–	–	–	–
AR9	–	−0.0842 *0.8952*	0.0211 *0.322*	−0.0911 *1.2078*	–	–	–	–
AR12	–	–	0.0871 *0.2815*	–	0.0809*** *0.0206*	0.0791 *0.0927*	0.0999 *0.1099*	0.0897 *0.1132*
ARCH0	5372175***	12524563***	9053797***	13577022***	1603440***	10872292***	11839589***	12055495***
	2.1104	*1.7156*	*0.3113*	*8.727*	*21.9622*	*0.2077*	*0.3545*	*1.2055*
ARCH1	0	0	0	0	0.009828	0	0	0
	0	*0*	*0*	*0*	*0.1523*	*0*	*0*	*0*
Total R-Sq	0.9806	0.983	0.9769	0.982	0.9874	0.9821	0.9869	0.9866

***Significant at 1% level or less
**Significant at 5% level or less and above the 1% level
*Significant at 10% level or less and above the 5% level
Standard errors given below their respective parameter estimates in italics

The parameter estimates on real predicted earnings are significant at the 10% level or better in models 1A, 2A, 3A, 1B, and 2B and insignificant otherwise. All significant parameter estimates are positive. The significant results suggest that a $1 increase in real earnings correlates with between 10 and 29 more construction jobs in the Minneapolis-St. Paul metropolitan area.

The parameter estimates for building permits are insignificant in every model. Thus, I find no evidence in Table 4 of correlation between building permits and local construction industry employment in the Minneapolis-St. Paul metropolitan area.

The parameter estimates for the average interest rate (lag 0 to lag 3) are only significant in model 3A in Table 4, and the significance is at the 5% level. Neither parameter estimate on the (lag1 to lag 4) average interest rate is significant. Overall, I find some evidence in Table 4 that average interest rates correlate positively with local construction employment in the metropolitan, but most evidence points to no correlation between the variables.

Turning to the parameter estimates on the individual stadium dummies, most are insignificant in Table 4. The exceptions are the estimated parameters on the MN United dummies in models 2A and 3A. The estimate in model 2A is positive and highly significant, and the estimate in model 3A is negative and highly significant. For the group of stadium-specific dummies, there is some evidence of correlation between stadium construction and local construction employment in Table 4. However, even with the significant parameters, there is no clear evidence of positive or negative correlation. The majority of the estimates are insignificant.

All parameter estimates on the Total variable are insignificant in Table 4. So, taken individually or in the aggregate, the results in the table suggest there is most likely no correlation between major sports stadium construction projects and local construction employment.

4 Conclusion and Discussion

In this essay honoring Robert Baade, I examine the Twin Cities MSA construction industry to estimate whether there is any correlation between local construction industry employment and the construction of major sports playing facilities. During the sample period I use in this paper, four large stadiums were constructed in the Twin Cities MSA, three in Minneapolis, and one in St. Paul. Using data from a variety of sources and the maximum likelihood ARCH estimation method, I ran several regressions including controls for stadium construction projects undertaken during the sample period. I was unable to find consistent correlation, positive or negative, between building a major sports stadium and construction industry employment. One explanation for the lack of consistent correlation may be due to construction jobs at stadium projects effectively substituting for jobs at other local construction projects. Had the stadiums not been built, construction workers likely would have worked on other projects. If so, policymakers should use caution when

considering subsidies for the construction of a major sports stadium as a way to increase construction employment in a local area.

Appendix: First-Stage Regression Results and Discussion

In this appendix, I present and discuss the first-stage results of the two-stage instrumental variables ARCH models. Table A.1 presents the results from the first stage.

The estimated intercepts are negative and significant in models 3B and 4B. The other estimates for the intercept are insignificant.

The parameter estimates on the CPI lagged two quarters are positive and significant at the 10% level or better in every model. The parameter estimates range between 5 and 12, suggesting that a one-point increase in this CPI measure is correlated with an extra $5–12 in quarterly construction industry earnings in the Twin Cities metro area.

The parameter estimates on building permits are positive and highly significant in models 4A, 3B, and 4B. The remaining three estimates are insignificant. The significant parameters suggest a 100-unit increase in building permits is correlated with between an extra $4 and $12 in quarterly earnings.

None of the parameter estimates on the average interest rate measures are significant. Thus, these estimates show no correlation between real construction worker earnings and average interest rates.

Most of the parameter estimates on the individual stadium dummies are insignificant. The estimates for the Gophers dummy are negative and highly significant in models 2A and 3A. They suggest that real construction industry quarterly earnings were approximately $63 to $64 lower while the Gophers football stadium was being built. The estimate for the Twins dummy is only significant in model 4A and suggests earning were about $48 lower while Target Field was under construction. The estimates for the Vikings dummy and the MN United dummy are positive and highly significant in model 4A. Otherwise, the estimates are insignificant.

Lastly, the parameter estimates on the Total variable are insignificant in every model.

Although there is some evidence of correlation between real average construction industry earnings and major stadium construction, the direction of correlation is indeterminate. Moreover, most evidence shows particular projects have no significant impact on real earnings. The insignificant estimates for the parameters on the Total variable in every model are consistent with projects having no impact. Therefore, there most likely is no correlation between construction industry earnings and major stadium construction projects.

Table A.1 Two-stage ARCH results

First stage

Variable/Model	1A	2A	3A	4A	1B	2B	3B	4B
Intercept	536.8485	257.9709	−67.5548	−121.6996	−30.4384	362.6597	−936.6927***	−862.6561***
	1228	*729.831*	*690.9879*	*191.753*	*229.5919*	*515.2963*	*326.1228*	*293.6694*
CPI lag = 2	5.7733*	7.6004**	8.6117***	8.3235***	8.8856***	6.8906***	11.4159***	11.1878***
	3.1682	*3.0023*	*2.8348*	*0.6731*	*1.2542*	*2.3381*	*1.0201*	*0.927*
Building Peimits	–	−0.0234	−0.0263	0.043***	–	−0.0149	0.1171***	0.116***
		0.0195	*0.0206*	*0.0121*		*0.0218*	*0.0144*	*0.0149*
Avg Int rate (lag = 0–3)	–	–	21.0009	–	–	–	27.3954	
			39.1852				*21.4065*	
Avg Int rate (lag = 1–4)	–	–	–	11.0428	–	–	–	22.1926
				9.5101				*18.623*
Gophers	−42.6912 *89.2538*	−63.7332*** *17.4288*	−65.9271*** *16.6285*	19.6955 *16.3512*	–	–	–	–
Vikings	4.4186 *110.0452*	1.2364 *124.7245*	−5.2425 *118.8621*	47.8933*** *14.6939*	–	–	–	–
MN united	−9.4904 *110.2822*	−14.1927 *141.5885*	−19.9421 *160.4398*	149.2211*** *21.3886*	–	–	–	–
Twins	−32.5224 *103.7734*	−32.6125 *35.5273*	−33.9459 *28.9517*	−48.3946*** *15.3539*	–	–	–	–
Total	–	–	–	–	1.0854 *12.8758*	−31.3271 *32.6727*	20.9853 *17.4157*	22.4478 *18.1819*
AR1	−0.9957*** *0.052*	−0.9507*** *0.0742*	−0.9368*** *0.0786*	–	−0.531*** *0.1264*	−1.0003*** *0.0628*	−0.3787*** *0.1447*	−0.3918*** *0.1479*
AR3	–	–	–	–		–	–	–

(continued)

Table A.1 (continued)

First stage

Variable/Model	1A	2A	3A	4A	1B	2B	3B	4B
					−0.4407*** *0.1111*			
AR12	–	–	–	–	–	0.0968 *0.0986*	0.3172** *0.1447*	0.3143** *0.138*
ARCH0	981.7815***	738.357***	620.999**	391.8498	679.7762***	862.3361***	1279***	1299***
	277.2933	*274.3091*	*268.517*	*247.9942*	*197.4383*	*224.9874*	*480.4374*	*488.3808*
ARCH1	0.3754	0.6694*	0.8855	1.1412***	0.5544**	0.4949*	0.2651	0.256
	0.2555	*0.4065*	*0.4577*	*0.4136*	*0.2539*	*0.2946*	*0.2514*	*0.248*
Total R-Sq	0.9716	0.9728	0.9725	0.9492	0.9765	0.9719	0.9691	0.969

***Significant at 1% level or less
**Significant at 5% level or less and above the 1% level
*Significant at 10% level or less and above the 5% level
Standard errors given below their respective parameter estimates in italics

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The Effect of Having an On-Campus College Football Stadium on Attendance

Kelly Malone and Michael A. Leeds

1 Introduction

Every Saturday in the fall, college football stadiums are flooded with fans ready to experience the pageantry of college football. But not all major college teams – which we define as schools that are eligible for the College Football Playoff (also known as the Division I Football Bowl Subdivision of the NCAA) – have their own stadium on campus to call home. There are countless reasons why a school would not have its own stadium, such as budgetary or space limitations, but understanding this impact on game-day attendance can be beneficial to athletic departments, colleges, and the cities in which they are located.

While college football, like the NFL, depends less on gate revenue than it used to, attendance still can be a significant source of revenue for athletic departments. An on-campus facility also gives a university the chance to show off its campus to prospective students who attend the game or even watch the game on TV. It can also help the university strengthen its ties with alumni who return to campus and – in the case of state universities – impress state legislators who control university budgets. (See, e.g., Humphreys 2006; Clotfelter 2019.) While an extensive literature, pioneered by Robert Baade (see especially Baade and Dye 1988a, b, 1990), indicates

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that stadiums of any kind are not a good investment for a city, local officials might still prefer an on-campus facility if it attracts more fans.

In this paper, we use data from the 2019 football season for the 127 colleges that are eligible for the College Football Playoff – and hence can be regarded as "big-time" programs – to test for a relationship between attendance on game day and the location of the home team's stadium. No matter how we specify the estimating equation, we fail to reject the null hypothesis that there is no relationship. We therefore conclude that the location of the stadium has no discernable effect on attendance at big-time college football games.

The next section of this paper provides a review of the relevant literature. While many studies deal with attendance at sports events, only a handful deal explicitly with attendance at college football games. In Section 3, we construct a theoretical model that shows what variables are relevant for our study and why they are relevant. We also provide an empirical framework to test the hypothesis that an on-campus stadium increases attendance. Finally, this section presents and describes the data we use in our analysis. Section 4 presents the results of our analysis. A conclusion follows.

2 Literature Review

Few, if any, areas in economics generate such universal agreement as the proposition that sports facilities do not contribute significantly to the local economies surrounding them. A generation of research, starting with the pioneering work of Baade and Dye (1988a, b, 1990) and extending through the recent work of Bradbury (2022), has almost uniformly borne this conclusion out. (Agha and Rascher (2021) reach similar findings for the impact of minor league baseball stadiums.)

Unfortunately, while the literature on professional sports is vast, relatively little attention has been paid to the economic impact of intercollegiate sports. Two studies, however, find little difference from the impact of professional sports. Baade et al. (2008, 2011) find that college football games have little to no positive impact on the local economies and – in some cases – might be economically harmful. In more narrowly focused studies, Coates and Depken (2009, 2011) find that college football games have no significant impact on local tax revenues.

This paper, however, asks a slightly more nuanced question than "does a college football team boost the local economy?" Instead, we ask whether the location of the stadium might affect attendance and thus impact whatever economic effect the football games have. Fortunately, there is also a vast literature on attendance demand in professional sports, dating back at least to Neale (1964). The studies evaluate a wide array of factors that potentially affect attendance and cover sports leagues ranging from Spain's *La Liga* (Buraimo and Simmons 2009) to Japan's Nippon Professional Baseball (Leeds and Sakata 2012). Here, too, the literature on the demand for intercollegiate sports is relatively sparse, with only four (relatively) recent papers dealing directly with the demand for college football attendance: Price and Sen (2003), Leonard (2005), Falls and Natke (2014), and Augustin et al. (2018).

Perhaps the most prominent factor in studies of attendance is the quality of the game. Knowles et al. (1992) are perhaps the first to claim that fans want to see their team win – but not win too often. The possibility that fans might be turned off by a team that wins too frequently is known as the uncertainty of outcome hypothesis (UOH). A survey by Borland and MacDonald (2003) set the optimal likelihood of a home victory at about 60%. Recent studies have challenged the UOH. Coates et al. (2014), for example, find little evidence to support the UOH. Instead, they find that loss-averse fans derive utility from how their team performs relative to reference points.

Winfree et al. (2004) argue that Major League Baseball teams that are located closer together must share the market, resulting in lower attendance for each team. Falls and Natke (2014) adapt this to college football by including a dummy variable that indicates whether an NFL franchise is within 50 miles of the college. Leonard's model of college football demand (2005) also accounts for a geography-based variable, though he uses the distance between the home team and the visiting team.

Most of the studies of attendance at professional sports events focus on major league teams, with the implicit understanding that attendance at lower levels of the sport will be less and perhaps dependent on different factors. However, even the highest level of college football, the Power 5 conferences, has a clear hierarchy regarding performance and attendance. It is therefore important to capture these differences in a study of attendance. Price and Sen (2003), for example, use dummy variables to indicate the conference of the home team.

The most relevant previous paper for our study – Augustin et al. (2018) – comes at attendance from an unusual angle, investigating the impact of beer sales on the demand for college football. They find a negative correlation between attendance and the availability of beer at college football games. However, they stop short of asserting a negative, causal relationship between beer sales and attendance.

Unfortunately, the four studies of college football cited above all focus on game-by-game attendance. Hence, many of the variables that they use, such as the weather on game day, whether the game is a rivalry game, and whether the game is televised, are irrelevant for our study, which focuses on average annual attendance.

3 Model and Data

Ideally, we would perform a difference-in-differences analysis to see whether schools that move their stadiums on or off campus experience a change in attendance; data limitations preclude utilizing a panel study like Falls and Natke (2014). Only a couple of Group of 5 schools have made such a switch over the last decade. The University of Pittsburgh was the last Power 5 school to make such a move, and it did so in 1999. Indeed, the median number of years that a Power 5 school has occupied its present stadium is 89.5 years. While Group of 5 schools tend to have shorter tenures, they have been in their present homes for a median of 51 years. The data thus do not support the use of difference-in-differences techniques.

Assume that a typical fan's utility is a function of the number of local college's football games she attends (g) and the amount of a composite commodity (x) she consumes:

$$U = U(g, x) \tag{1}$$

The fan is limited by her income (M) and the cost of attending a game. (For simplicity, we assume that x is the numéraire.) We divide the cost of attendance in two. The first part is the literal price of tickets to the game (p). The second part is the transaction cost of attending the game (t). This includes the opportunity cost of the time spent getting to and from the stadium:

$$M = (p + t)g + x \tag{2}$$

Given this framework, it is easy to show that the fan maximizes utility where:

$$\partial U/\partial g \diagup \partial U/\partial x = p + t \tag{3}$$

The optimal number of games the fan attends is thus a function of the marginal utility of attending a game, the price of admission, and the time-cost of attending the game.

The marginal utility of attending – and hence the optimal number of – games could rise if games were more entertaining to the home audience. As established in the literature, this is a function of the likelihood of a victory and the quality of the opponent. The quality of the experience might also be enhanced by a superior facility. (See Schreyer and Ansari 2022, for a useful survey of the literature.)

The taste for attending a game would also affect the marginal utility. Schools with a long history of football – particularly a successful history – will be more attractive than schools that do not share that tradition. On the other hand, the existence of alternative forms of entertainment, such as the presence of a nearby professional team, would lessen the taste for attending a college game and reduce the optimal number of college games consumed.

The existence of an on-campus stadium could affect several of the above factors. Attending a game on campus might enhance the atmosphere surrounding the game, especially for present students and alumni. Even casual fans might prefer attending a game at a facility devoted to the team rather than one devoted to, say, the local professional team.

While a centrally located, off-campus stadium might be neither more nor less convenient for the nonstudent, the time-cost of attending a game off campus could be significantly greater for present students, who represent a large portion of the potential audience for many teams.

We test the hypothesis that, all else equal, on-campus stadiums draw larger crowds with the basic equation:

$$ATT_i = \beta_0 + \beta_1 WP_i + \beta_2 TOTWINS_i + \beta_3 NFL_i + \beta_4 CAP_i + \sum_j \gamma_j CONF_{ij} + \beta_5 ONC_i + \varepsilon_i \quad (4)$$

The dependent variable in Eq. 4 is the annual attendance at home games for school i in the 2019 football season. While more recent data are available, the 2020 and 2021 seasons were both severely affected by the coronavirus pandemic. We use both the absolute level of attendance and the natural logarithm of attendance as dependent variables.

WP_i is the winning percentage of team i. Coates, Humphreys, and Zhou (2014) cite the likelihood of a home victory along with outcome uncertainty as a determinant of attendance. The overall performance of the home team captures the former effect. Because both current and recent attendance could affect the taste for attendance, we use winning percentage for both the present year and the previous year. We enter WP_i as a number ranging from 0 to 1000 rather than from 0 to 1 so we can interpret WP_i^2. This term, however, is never significant and thus is not included here.

$TOTWINS_i$ is the total number of wins a college accumulated by 2021. This figure reflects both length of a school's history (Notre Dame has more wins than Central Florida) and the school's winning tradition (Michigan has more wins than Indiana).

The taste for attending a college might also be affected by the presence of a professional team nearby. Following Falls and Natke (2014), we capture proximity to a professional franchise with NFL_i, a dummy variable that equals one if an NFL team played its home games within 50 miles of the university. While we suspect the impact of this variable is negative, the presence of a professional team could also reflect a greater taste for football among the local population. This might offset the negative substitution effect.

Some schools might be capacity constrained and able to draw more fans than their facility can accommodate. For this reason, we include the seating capacity of each stadium,[1] CAP_i.

We also include a series of dummy variables to capture the impact of being in a particular conference. Major college football, by which we mean schools eligible for the College Football Playoff, is divided into two unequal parts, the Power 5 conferences and the Group of 5 conferences. The Power 5 conferences (ACC, Big 12, Big Ten, Pac−12, and SEC) dominate the college football landscape and generally are far more popular than the less prestigious Group of 5 conferences (AAC, C-USA, MAC, MWC, and Sun Belt). We use both conference dummies and an indicator of belonging to a Power 5 conference to capture this effect.

Our variable of interest is an indicator of whether the school played its games on campus in 2019, ONC_i. A positive coefficient indicates that an on-campus stadium leads to greater attendance.

[1] In regressions not shown here, we used percent of capacity as a measure of attendance. The explanatory power of this regression was low, and few explanatory variables were statistically significant. Results are available upon request.

Stadium age, undergraduate enrollment, and postseason rankings for 2018 and 2019 as well as preseason rankings for 2019 are also used as explanatory variables. We anticipated that aging facilities might discourage attendance, while a larger student population and a better team (or at least the expectation thereof) would increase attendance.[2] However, all these variables proved to be consistently insignificant and are not shown here.

We identify college stadiums using the *Active Cities* and *HERO Sports News* website. Data on attendance come from NCAA records. Team records for 2018 and 2019 as well as overall wins are from the college football portion of sports-reference.com (SRCFB 2022). The distance from NFL teams is determined using Google Maps.

Means of relevant variables appear in Table 1. We show means for the total sample and for the Power 5 and Group of 5 subsamples, which are almost identical in size. As expected, attendance is much higher for Power 5 schools, which play in much larger stadiums.

Group of 5 schools win slightly less than 50% of their games, while Power 5 schools win well more than 50% of their games. This seeming anomaly probably has two causes. First, Power 5 schools tend to have a winning record against Group of 5 schools. Second, both sets of schools are likely to have winning records against schools that do not participate in the College Football Playoff (schools in the Football Championship Subdivision or FCS). The Power 5 schools are likely to dominate FCS schools more than Group of 5 schools, contributing to the differential in winning percentage. Because Power 5 schools are both older and more successful, they also have more total wins. Finally, Power 5 schools are more likely to play on campus than Group of 5 schools, though the vast majority of Group of 5 schools (almost 80%) also play on campus.

While we do not cite city size in Table 1, there appears to be no pattern in the population of the cities with stadiums on or off campus. Schools with off-campus stadium are in small towns, such as Kent, OH (population 28,000), midsize cities, such as Mobile, AL (population 186,000), and large cities, such as Philadelphia (population over one million).

Table 1 Relevant means

Variable	Total	Power 5	Group of 5
NFL team nearby	0.197	0.203	0.190
Stadium capacity	52,491	67,434	37,511
Winning percentage	52.6	55.4	49.8
Total wins	472	647	295
Stadium on campus	0.827	0.859	0.794
Average attendance	42,056	61,785	22,013
Number of observations	127	64	63

[2]Ranking might have a distinct impact from a team's win-loss record if some teams play against other strong teams, while others do not.

4 Results

Table 2 shows four sets of regressions: two using the absolute level of attendance and two using the natural logarithm of attendance. The results show a clear nonlinear relationship between attendance and the explanatory variables, as the semilog specification has more significant coefficients and a much higher adjusted R^2. We therefore focus on the semilog results.

The first set of regressions contains a full set of conference dummies, with Conference USA of the Group of 5 as the default category. These show that most of the Group of 5 conferences do not differ from C-USA in attendance, with only the Mid-America Conference (MAC) differing from zero. In contrast, all the Power 5 conferences show a positive impact, as expected. The impact ranges from less than 40 percentage points for the Pac-12 to over 70 percentage points for the SEC.

The presence of a nearby NFL team does not affect attendance at college football games, which could imply that the two appeal to different audiences or that the two effects described above offset one another.

Most of the remaining control variables have a statistically significant impact on attendance, and those that are significant have the anticipated impact. Increasing stadium capacity by 1000 increases attendance by 0.6 percentage points. While winning percentage in the present season is statistically insignificant, winning percentage in the previous season increases present attendance. This suggests that most attendees purchase their tickets before the season begins. Attendance is also greater for schools with stronger football traditions.

Finally, schools with stadiums on campus do not see any boost in attendance relative to schools with off-campus facilities. The coefficient is small and nowhere close to statistically significant.

The results for the more parsimonious specification are similar. Proximity to an NFL team remains statistically insignificant. The impact of lagged winning percentage is identical, while that of stadium capacity and total wins increases only slightly. Being a member of a Power 5 conference increases attendance by over 38%. Being in the Mid-American Conference reduces attendance relative to other Group of 5 conferences by 27%, while the Southeastern Conference had attendance over 34% higher than other Power 5 conferences.

Once again, the coefficient for having an on-campus stadium was statistically insignificant at any reasonable significance level. The uniform failure of this variable to have any discernable impact on attendance leads us to conclude that having a stadium on campus does not lead to higher attendance.

Table 2 Determinants of attendance

	Linear specification		Semilog specification	
Variable	Full conference dummies	Power 5 dummy	Full conference dummies	Power 5 dummy
NFL team in city	−1259.2 (−0.25)	−2111.7 (−0.43)	0.022 (0.33)	0.015 (0.23)
Stadium capacity (000 s)	293.1 (1.99)	350.5 (2.61)	0.006 (3.48)	0.007 (4.17)
Winning percentage	111.7 (0.10)		0.011 (0.74)	
Lagged winning percentage	1451.4 (1.35)	1434.7 (1.57)	0.031 (2.21)	0.036 (2.95)
Total wins in 2020	32.714 (1.95)	30.676 (2.18)	0.0008 (3.38)	0.0008 (4.31)
Power 5 school		11,216.0 (1.89)		0.384 (4.87)
ACC	8855.7 (0.87)		0.410 (3.04)	
Big 12	16,288.9 (1.47)		0.542 (3.70)	
Big Ten	18,872.5 (1.72)		0.503 (3.45)	
PAC12	4108.9 (0.68)		0.383 (2.77)	
SEC	39,358.9 (3.40)	25,422.5 (3.71)	0.717 (4.67)	0.244 (2.68)
American	452.2 (0.05)		0.093 (0.74)	
MAC	−3444.1 (−0.38)	−3950.3 (−0.57)	−0.234 (−1.96)	−0.272 (−2.92)
Mountain west	−2569.2 (−0.28)		−0.006 (−0.05)	
Sun Belt	4595.3 (0.50)		0.068 (0.56)	
Independent	4108.9 (0.34)		0.096 (0.59)	
On-campus stadium	1272.21 (0.23)	3004.8 (0.57)	0.033 (0.44)	0.041 (0.58)
Constant	−7183.5 (−0.73)	−8572.4 (−1.11)	9.205 (70.49)	9.235 (89.98)
Adjusted R^2	0.5579	0.5758	0.8109	0.8171
Number of observations	127	127	127	127

5 Conclusion

Universities have many reasons for wanting to play games on campus. Reasons range from attracting prospective students, enhancing campus life for present students, and strengthening ties with alumni. Local governments might also have a stake in the location of a school's home stadium. If an on-campus facility attracts more out-of-town fans, the benefits to the local economy might rise as well.

We have shown that one reason for moving games on campus – improving game-day attendance – does not hold. Regardless of our specification of the dependent variable or the combination of explanatory variables we use, the impact of an on-campus stadium does not come close to any reasonable standard of statistical significance.

While this finding undercuts one justification for on-campus stadiums, building a stadium on-campus might still be worthwhile if it stimulates applications and alumni donations. Whether stadium location affects these factors, however, is beyond the scope of this study.

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New Stadiums in North America and Europe: A Comparison and Agenda for Future Research

Stefan Szymanski

1 Introduction

I remember first meeting Rob Baade back in late 1990s at a conference in Europe aimed at getting European and North American economists to exchange ideas about sports. In truth, it was something of a one-way street back then: Americans had already generated a significant research literature, and Europeans were mostly playing catch-up. In this respect, Rob was clearly one of the leaders from whom we all had to learn. This was an especially pleasant task, given that Rob was always friendly and approachable. Like many others who have contributed to this volume, no doubt, I learned a good deal from Rob. It is thus a pleasure and an honor to contribute to this volume. Alas, for my subject I have taken an area of sports economics where researchers (from Europe or elsewhere), at least in my view, still have much work to do. However, I think the opportunities are exciting, not least in the sense that they will enable many of us to build on Rob's pathbreaking work.

2 New Stadiums in North America

Rob Baade is a pioneer in research on the economic impact of stadiums. It's also fair to say that his conclusions have been somewhat skeptical about the significance of the wider economic impact and therefore the justification for public subsidies. Indeed, his work was critical in establishing this as a consensus among economic

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Table 1 New stadiums/arenas of major league franchises to 2022

League	No. of teams	Opened since 1990	Opened since 2000
MLB	30	23	16
NFL	32	26	19
NBA	30	29	12
NHL	32	29	11
Total	124	107	58
Percentage	100%	86%	47%

Source: Wikipedia

researchers. It is therefore a somewhat sobering thought that since his first review published by the Heartland Institute in 1987 ("Is there an economic rationale for subsidizing sports stadiums?"), only 15 franchises in the four US major leagues are still playing in the same location – the remaining 109 franchises are all in new facilities opened since that date – usually with the aid of significant taxpayer financial support.

The 1990s was a decade of large-scale stadium investment, as can be seen from Table 1. About 40% of the facilities in which major league teams presently play were built in this decade, while almost half of all franchises play in facilities that have been built since 2000.

It is therefore not surprising that this investment spree prompted a significant degree of scrutiny from sports economists. Where Baade led, many have followed. This research interest can be divided into a number of different areas. First, there is documentation. A useful summary on the economic history of stadium investment is Long (2012), although this is already in danger of becoming out of date.

There are broadly two principle areas of economic research around stadiums:

1. The determinants of stadium attendance demand
2. The economic impact of new stadiums on the local/national economy

Research on the first of these topics goes back a long way. As far as I have been able to ascertain, the first statistical analysis of attendance in US major league sports was Noll's chapter on "Attendance and Price Setting" in his edited book, *Government and the Sports Business*, published in 1974. The first statistical analysis of attendance in soccer was the paper by Hart et al. (1975). This study, employing a rather different methodology, was written independently, and neither paper refers to the other.[1]

[1] In January 2023, I exchanged a number of emails with Bob Hart and Trevor Sharot who explained the background to their research and confirmed that they were unaware of Noll's work. The problem they were interested in concerned the effect of distance on the decision to attend a game and was thus connected to the gravity models of trade that were evolving at the time. The three authors worked at the University of Aberdeen, which Peter Sloane had only recently left, and they were certainly influenced by his work. When the paper was published, a journalist from a local newspaper visited them and asked to see the "stadium model" that they had constructed, only to discover that

Borland and MacDonald (2003) in their review cite 57 attendance demand studies. Of these, 24 concern North American sports (primarily baseball), and 21 concern soccer (of which two thirds are about English soccer). Schreyer and Ansari (2021), reviewing 195 papers published on sports attendance demand up until 2020, found that over half (107) focused on soccer, primarily European soccer (English soccer accounted for 38 of the papers). So, as far as attendance demand studies are concerned, interest in the USA has been matched in the UK and Europe.

When we consider economic impact studies, however, the focus generally seems much more North American. Since Baade's pathbreaking work (e.g., Baade and Dye (1988) and Baade (1996)), there have been numerous studies assessing the impact of specific stadiums, including several books (e.g., Noll and Zimbalist (1997) and deMause and Cagan (2008)). Important contributions to this literature include Crompton (1995), Coates and Humphreys (1999, 2003), Johnson et al. (2001), and Baade et al. (2008). A good summary of the economic debate is provided by Humphreys (2019) and Matheson (2019), and a recent survey of the literature is provided by Bradbury et al. (2022). There are numerous studies that focus on specific investments, often arising out of expert witness testimony in court cases (e.g., Dehring et al. (2007) and Propheter (2019)).

Outside of North America, economic impact studies have largely been focused on the investments surrounding mega events, notably the Olympics (e.g., Baade and Matheson 2002, 2016; Preuss 2004; Billings and Holladay 2012), the FIFA men's World Cup (e.g., Baade and Matheson 2002; Allmers and Maennig 2009; Peeters et al. 2014; Baade et al. 2021), or both (e.g., Fourie and Santana-Gallego (2011)). One difficulty presented by this approach is disentangling the impact of the event itself from the effect of facilities built in order to host the event. In Europe and elsewhere, sports organizations such as governing bodies, leagues, and clubs have tended to view a mega event as a means to obtain public funding for stadium investment Buttner et al. (2007), Feddersen et al. (2009), Feddersen and Maennig (2012). Szymanski and Drut (2020) show that not only does league attendance increase at the stadiums after hosting games in an international competition, but this can be the case even at stadiums which did not host events. Notably, they found evidence of increased attendance in English stadiums following the 1966 FIFA men's World Cup and 1996 UEFA men's European Championship, even though no new stadiums were built for those events.

Studies of new stadium economic impacts outside of North America are almost unknown. The principal exception is Feddersen et al. (2009) who examine the impact of new stadiums in the German Bundesliga between 1963 and 2004. It seems likely that one reason for this relative neglect is the difference between political processes. In North America, the most likely scenario is that the team owner will seek a public subsidy for stadium construction, and this subsidy will be paid out of local taxes. Some local taxpayers are likely to challenge the case for

the model was not a physical construct but an econometric equation. Trevor Sharot did get an invitation to attend the 1978 World Cup in Argentina where he presented the paper.

subsidy, which might lead to legal disputes, a referendum, or both. Whatever the case, this process will generate a lot public interest, a lot of published reports supporting competing economic claims, and a significant demand for the research skills of economists. Economists, in turn, are likely to use this opportunity to obtain data in order to generate publishable research.

Outside of the USA, the process is likely to be different. In many cases, investment is pursued by authoritarian governments as in the examples of 2008 Summer Olympics in Beijing or the Russian 2018 FIFA men's World Cup. In each case, central government devoted what appeared to be very large sums of public money to these events, without any transparent or reliable accounting, leaving economists with little to do other than to speculate. Even in the democracies, where public finance tends to be much more transparent, the way in which investment is funded often limits opportunities for analysis and research. For example, in most European countries, the central government tends to control a good deal of regional finance with the aim of equalizing resources across the country. The result of this is that local citizens may contribute little directly to the funding of a stadium, which in a sense becomes a national project. This in turn leads to less local pressure for scrutiny and accounting and therefore limited opportunities to conduct impact analyses.

This is not to say that research on issues related to sports stadiums in Europe has been completely absent. In addition to the papers cited above, there are papers such as Feddersen and Maennig (2009), Ahlfedlt and Maennig (2010a, b), and Cabral and Silva (2013) dealing with aspects such as the impact of stadiums on land values, fan preferences, and financing options. Some demand studies have also included stadium age variables, e.g., Storm et al. (2018) and Nielsen et al. (2019), but these effects have not been a major focus of research.

3 New Stadiums in Europe

While less researched compared to the USA, there appears to have been a boom in European stadium construction since 1990. Wikipedia lists 307 stadiums in Europe with capacity in excess of 25,000.[2] Table 2 lists the date of construction by decade.

Of the 307 construction dates, 141 (46%) are after 1990. This is a somewhat lower percentage compared to Table 1 but still suggests a considerable amount of new stadium construction. A large fraction of stadiums are concentrated in a small number of European countries. Table 3 lists the ten countries with the largest number of stadiums with 25,000 capacity or greater, and they account for over three quarters of the list. Once again, 46% of these stadiums have been since 1990.

[2] https://en.wikipedia.org/wiki/List_of_European_stadiums_by_capacity. The definition of Europe for these purposes includes UEFA countries and hence extends to countries such as Azerbaijan and Kazakhstan, which are not usually included in conventional definitions of Europe.

Table 2 Date of construction by decade of European sports stadiums

Decade beginning	Number
Before 1900	26
1900	6
1910	10
1920	27
1930	22
1940	10
1950	28
1960	17
1970	15
1980	5
1990	23
2000	55
2010	59
2020	4
Grand total	307

Source: Wikipedia

Table 3 Stadium construction by country

Country	Built before 1990	Built 1990–2019	Total
England	27	18	45
Germany	22	13	35
Russia	9	17	26
Italy	18	8	26
Turkey	2	20	22
Spain	15	8	23
France	12	9	21
Republic of Ireland	13	1	14
Portugal	2	9	11
Ukraine	5	5	10
Grand Total	125	108	233

Source: Wikipedia

In several of these countries, new stadiums have been associated with hosting a mega event such as the FIFA men's World Cup (Germany 2006 and Russia 2018) or the UEFA Euros (Portugal 2004, Ukraine 2012, and France 2016). While England hosted the Euros in 1996 and also hosted a significant number of games in 2021 (postponed from 2020 due to Covid), this did not involve any new stadium construction. Likewise, Italy, who hosted the 1990 World Cup, did not undertake large-scale new building, even though existing stadiums were often substantially renovated.

The pattern of stadium construction over time is strikingly similar comparing Europe to the North American major leagues. Table 4 shows the number of new builds by decade, and Fig. 1 graphs the data. From the beginning of the twentieth

Table 4 New stadiums built in 1900–2009

Decade beginning	Europe	US major leagues
1900	6	9
1910	10	11
1920	27	17
1930	22	9
1940	10	4
1950	28	11
1960	17	28
1970	15	27
1980	5	14
1990	23	55
2000	55	44
Total	218	229

Source: Europe, Wikipedia; Major Leagues, Long (2012)

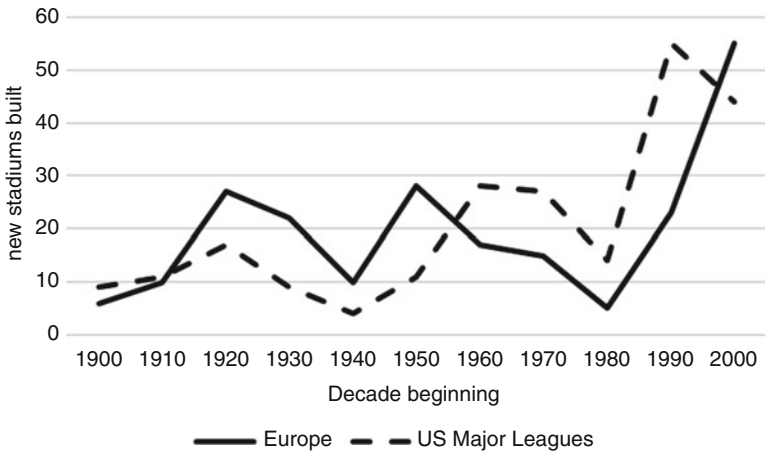

Fig. 1 New stadiums built in 1900–2009. (Source: Europe, Wikipedia; Major Leagues, Long (2012))

century, stadium construction is increasing until the end of the "roaring twenties," as spectator sports establish themselves as a mainstream activity. Then in the 1930s and 1940s, there is a downturn which is likely associated with the Great Depression and World War II. Then there is the postwar boom, although this peters out faster in Europe, followed by significant decline in the 1980s which is mostly likely associated with the slow growth of the 1970s and the global economic downturn of the early 1980s.

The start of the modern boom in stadium construction starts a little earlier in the USA – in the early 1990s, but by the first decade of the new millennium, European construction is at comparable to US levels. Thus, despite noticeably different sporting cultures, Europe and North American stadium investment appears to have

followed similar patterns. This is perhaps not surprising, given that the same global economic trends are likely to influence the availability of funds that finance leisure pursuits.

4 Directions for Future Research

Given that thus far research on new stadiums in Europe has been limited, there is a case to be made that research opportunities exist. These are likely to follow the lines of previous research. Seeking to identify potential wider economic impacts is one obvious path, although, as mentioned above, this is likely to be hamstrung by problems associated with political structures. Comparable information on small economic areas is also much more difficult to assemble given the differences in administrative systems across the continent.

A more fruitful area for research is likely to be the impact of new stadiums on attendance. Attendance figures are widely available for most European soccer leagues, and it should be possible to replicate studies from North America. This could be useful in highlighting the effect of structural differences between European and North American leagues. In particular, the impact of the promotion and relegation system is likely to be important, both in determining the attractiveness of new stadium investment and in determining the effects of these investments. It would also be interesting to examine the construction of stadiums for college sports in North America, which in some ways often appear more similar to European sports leagues than do the major leagues.

It is also possible that financial effects of investments on the teams could be more reliably inferred in a European context. Reliable financial data is notoriously difficult to find for North American leagues – audited financial statements are not published, and estimates of revenues and costs by third parties cannot be reliably verified. By contrast, many European sports organizations publish comprehensive, audited financial statements which can be used to measure financial impacts.

While previous studies have looked at macroeconomic drivers of attendance at professional sports teams, there has yet been no attempt to examine macroeconomic forces behind stadium investment. Given the long history and known chronology of stadium construction across the two continents, it should be feasible to construct an analysis to identify common economic trends.

Finally, the distinction between new build and renovation presents a problem in analyzing stadium investment. In many cases, a renovation can be almost as comprehensive as a new build. It could also be argued that there is a difference between tearing down a stadium and building a new one on the same site, compared to building a new stadium in a new location. Here there are likely to be significant differences between Europe and North America. In North America, teams that were originally located in a downtown area have moved to the edge of town in order to be easier to reach by road and because downtowns were seen as unattractive and even unsafe. European teams were likewise positioned in the heart of town and cities in

the earliest years but are less likely to migrate. This may reflect a number of considerations – greater use of public transport and active discouragement of independent car use, greater commitment to maintaining viable inner cities, limited land availability, greater commitment to tradition, and political authorities that are less sympathetic to redevelopment plans. This is a topic which could clearly benefit from further research.

This paper has focused on the contrast between North America and Europe, arguably the two most developed markets for professional sports, but it should also be mentioned that there has been a boom in stadium construction in the rest of the world. Developments in those countries also present significant research opportunities, along similar lines to those described here.

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Financing Professional Sports Facilities: An Update

Victor A. Matheson

1 Introduction

In a 2012 book chapter, Victor Matheson and Robert Baade noted that the professional sports infrastructure had undergone a massive transformation since 1990 (Baade and Matheson 2012). This chapter updates this previous work by examining trends in stadium and arena construction over the past decade. The data clearly show that the pace of stadium construction, the absolute size of stadium subsidies, and the percentage of construction costs have gone through two distinct stages since the early 1990s.

It is not unreasonable to suggest that the opening of Camden Yards in Baltimore in 1992 marked the beginning of a stadium boom in the United States. The stadium was the first baseball-specific stadium built to replace a multipurpose "cookie-cutter" stadium from the generation of such stadiums built in the 1950s, 1960s, and 1970s. The stadium was also well-designed and vastly improved the fan experience. More satisfied fans meant better attendances and the ability to charge higher prices, both of which helped the owner's bottom line. The stadium also included additional ways to separate fans from their dollars including increased premium seating and more luxury boxes as well as expanded concession options. Finally, the stadium was explicitly sold to the public as not simply something that would help the team or its fans but also improve the local economy of Baltimore's otherwise downtrodden Inner Harbor neighborhood by serving as an anchor for economic redevelopment in the area. While the work of Robert Baade and subsequent researchers showed that

Note: Tables 2–6 in this paper first appeared in Baade and Matheson (2012). They have been updated to reflect new stadium construction over the past 15 years.

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the economic benefits of sports stadiums are dubious at best, these arguments were enough to convince local government officials to pledge $100 million in public funding toward the $110 million price tag for the new stadium (a price tag that seems quaint in the modern era of billion dollar stadiums!)

When other team owners in baseball (and even in other sports) visited the new Camden Yards, they were impressed both by the stadium's aesthetics and its revenue potential. There is no doubt that the beautiful new stadium gave other owners a severe case of "stadium envy," and they also learned that local governments could be easily coerced into providing significant taxpayer funding for stadium projects in the guise of "economic impact."

2 The Data

What followed Camden Yards was 30 years of unprecedented change in the professional sports infrastructure in the North America. In the United States and Canada, by 2023, 133 of the 153 teams in the five largest professional sports leagues, the National Football League (NFL), Major League Baseball (MLB), National Basketball Association (NBA), Major League Soccer (MLS), and National Hockey League (NHL), were playing in stadiums constructed since 1990, and most of the rest played in stadiums that have undergone at least one significant renovation since 1990. This new construction has come at a significant cost, much of which has been borne by taxpayers. Construction costs for major league professional sports facilities have totaled in excess of $50 billion in nominal terms and $75 billion in real terms over the past three decades with $22 billion in nominal terms and $34 billion in real terms paid for by taxpayers. Table 1 summarizes the stadium spending for each of the five leagues. Tables 2, 3, 4, 5 and 6 list newly constructed stadiums in the five major American/Canadian sports leagues. Also included in these tables are at least some of the major renovation projects for these stadiums. In addition, a handful of stadium projects that are underway but not completed are listed, but their costs are only estimates and are not included in the totals. Also, note that stadium naming rights deals are in a constant state of flux, so the stadium names here are accurate as of January 2023 but are sure to change over time.

Table 1 Total stadium construction costs since 1990 ($ millions)

League	Teams in new stadiums	Teams	Costs	Public	Costs (real)	Public real	%	% (real)
MLS	26	29	$4,413	$1,652	$5,476	$2,132	37%	39%
NFL	26	32	$18,958	$8,442	$26,724	$12,926	45%	48%
MLB	23	30	$10,915	$6,203	$16,680	$9,707	57%	58%
NBA	29	30	$10,570	$4,109	$16,035	$6,447	39%	40%
NHL	29	32	$6,704	$1,788	$10,033	$3,017	27%	30%
Total	**133**	**153**	**$51,559**	**$22,193**	**$74,947**	**$34,229**	**43%**	**43%**

Table 2 New and selected renovated NFL stadiums since 1990 (costs in $ millions)

Team	Stadium	Built	Cost	Public cost	Public %	Cost (real)	Public cost (real)
Nashville	Future Stadium	*2026*	*$2,100*	*$1,260*	*60%*	*$2,100*	*$1,260*
Buffalo	Future Stadium	*2026*	*$1,400*	*$850*	*61%*	*$1,400*	*$850*
Las Vegas	Allegiant Stadium	2020	$1,800	$750	42%	$2,073	$864
Los Angeles	SoFi Stadium	2020	$2,660	$0	0%	$3,063	$0
Atlanta	Mercedes Benz Stadium	2017	$1,600	$700	44%	$1,945	$851
Minnesota	US Bank Stadium	2016	$1,061	$498	47%	$1,317	$618
San Francisco	Levi's Stadium	2015	$1,300	$114	9%	$1,634	$143
New Orleans	Caesar's Superdome (rehab)	2011	$505	$490	97%	$669	$649
New York	MetLife Stadium	2010	$1,600	$0	0%	$2,187	$0
Kansas City	GEHA Field (rehab)	2010	$375	$250	67%	$512	$342
Dallas	AT&T Stadium	2009	$1,150	$325	28%	$1,597	$451
Indianapolis	Lukas Oil Stadium	2008	$720	$720	100%	$997	$997
Arizona	State Farm Stadium	2006	$371	$267	72%	$548	$395
Philadelphia	Lincoln Financial Field	2003	$285	$228	80%	$462	$369
Green Bay	Lambeau Field	2003	$295	$251	85%	$478	$406
Chicago	Soldier Field	2003	$600	$450	75%	$972	$729
New England	Gillette Stadium	2002	$325	$33	10%	$538	$54
Houston	NRG Stadium	2002	$300	$225	75%	$497	$373
Detroit	Ford Field	2002	$300	$219	73%	$497	$363
Seattle	Lumen Field	2002	$300	$201	67%	$497	$333
Pittsburgh	Acrisure Stadium	2001	$230	$150	65%	$387	$252
Denver	Empower Field	2001	$365	$274	75%	$614	$461
Cincinnati	Paycor Stadium	2000	$400	$400	100%	$692	$692
Cleveland	FirstEnergy Stadium	1999	$283	$255	90%	$506	$456
Tennessee	Nissan Stadium	1999	$290	$220	76%	$519	$394
Buffalo	Highmark Stadium (rehab)	1999	$63	$63	100%	$113	$113
Baltimore	M&T Bank Stadium	1998	$220	$176	80%	$402	$322
Tampa Bay	Raymond James Stadium	1998	$169	$169	100%	$309	$309
San Diego	Qualcomm Stadium (rehab)	1997	$78	$78	100%	$145	$145
Washington	FedEx Field	1997	$250	$70	28%	$464	$130
Oakland	Oakland Coliseum (rehab)	1996	$200	$200	100%	$380	$380

(continued)

Table 2 (continued)

Team	Stadium	Built	Cost	Public cost	Public %	Cost (real)	Public cost (real)
Carolina	Bank of America Stadium	1996	$248	$52	21%	$471	$99
Jacksonville	TIAA Bank Field	1995	$121	$121	100%	$237	$237
St. Louis	Edward Jones Dome	1995	$280	$280	100%	$548	$548
Atlanta	Georgia Dome	1992	$214	$214	100%	$455	$455
			$18,958	$8442	45%	$26,724	$12,926

Note: Figures for all stadiums opening in 2024 or later are projected costs. History suggests the final construction costs will be higher than projected

Numerous caveats are in order for these data. First, these figures present the best available data about the construction/renovation costs for major stadium and arena projects as reported in the media. At times full information is not available or is not updated between the original cost estimates and the final numbers. In many cases, the construction and lease contracts are wildly complex so that the true public outlay is unclear. Renovation projects are not widely reported in the media, so it is possible that the tables exclude projects that may have included significant levels of public money.

There are other reasons that these figures understate the total level of public subsidies directed toward spectator sports. First, these data exclude subsidies not directly related to stadium construction and renovation such as below market rental rates for the teams or stadium maintenance subsidies. Second, the tables exclude billions of dollars of property tax exemptions that are the norm for major league sports facilities even when the stadiums are privately owned or financed (Baumann et al. 2020). The tables also exclude at least $4.3 billion in lost federal revenue due to the use of tax exempt municipal bonds to finance sports facilities (Drukker et al. 2020). These tables also ignore spending on spectator sports facilities outside the five major leagues such as spending on stadiums that host minor league sports, women's leagues such as the WNBA and NWSL, college sports, and other popular professional sports such as golf, tennis, auto racing, and the Canadian Football League. The tables only include facilities in the United States and Canada, thus excluding massive spending on stadiums and arenas in the rest of the world (see Stefan Szymanski's article in this volume). Finally, the tables exclude spending on mega-events in the United States such as the Super Bowl (Berri et al. 2020).

A closer look at the data suggests that the stadium construction boom can be broken up into two distinct phases demarcated by the Great Recession of 2008–2009. Stadiums opening in 2009 or earlier would have been proposed with construction starting before the widespread collapse in housing prices and subsequent chaos in financial markets led to most severe economic downturn since the Great Depression. Stadiums opening in 2010 and later would have been proposed in a more austere economic environment. It is much more difficult for politicians to

Table 3 New and selected renovated MLB stadiums since 1990 (costs in $ millions)

Team	Stadium	Built	Cost	Public cost	Public %	Cost (real)	Public cost (real)
Texas	Globe Life Field	2020	$1,100	$500	45%	$1,267	$576
Atlanta	Truist Park	2017	$622	$392	63%	$756	$477
Miami	LoanDepot Park	2012	$525	$370	70%	$681	$480
Minnesota	Target Field	2010	$544	$392	72%	$744	$536
NY Mets	Citi Field	2009	$600	$164	27%	$833	$228
NY Yankees	Yankees Stadium	2009	$1,300	$220	17%	$1,806	$306
Kansas City	Kaufmann Stadium (rehab)	2009	$250	$175	70%	$347	$243
Washington	Nationals Park	2008	$611	$611	100%	$845	$845
Cardinals	Busch Stadium	2006	$365	$45	12%	$540	$67
San Diego	Petco Park	2004	$457	$304	66%	$721	$479
Philadelphia	Citizens Bank Park	2004	$346	$174	50%	$546	$274
Cincinnati	Great American Ball Park	2003	$325	$280	86%	$526	$453
Pittsburgh	PNC Park	2001	$262	$262	100%	$441	$441
Milwaukee	American Family Field	2001	$400	$310	78%	$673	$522
Detroit	Comerica Park	2000	$300	$115	38%	$519	$199
Houston	Minute Maid Park	2000	$265	$180	68%	$459	$311
San Francisco	Oracle Park	2000	$357	$15	4%	$618	$26
Seattle	T-Mobile Park	1999	$518	$392	76%	$926	$701
Arizona	Chase Field	1998	$349	$238	68%	$638	$435
LA Angels	Angel Stadium (rehab)	1998	$118	$30	25%	$216	$55
Tampa Bay	Tropicana Field	1997	$208	$208	100%	$386	$386
Atlanta	Turner Field	1997	$235	$165	70%	$436	$305
Oakland	RingCentral Coliseum (rehab)	1996	See NFL table				
Denver	Coors Field	1995	$215	$168	78%	$420	$329
Cleveland	Progressive Field	1994	$175	$91	52%	$352	$183
Texas	Globe Life Park	1994	$191	$135	71%	$384	$271
Baltimore	Camden Yards	1992	$110	$100	91%	$234	$212
Chicago White Sox	U.S. Cellular Field	1991	$167	$167	100%	$365	$365
			$10,915	$6203	57%	$16,680	$9707

give lavish public handouts to millionaire players and billionaire owners while at the same time laying off teachers and firefighters.

The data for the two periods 1990–2009 and 2010–2023 are shown in Table 7. In all leagues except for MLS, which was in a period of rapid league expansion, the

Table 4 New and selected renovated MLS stadiums since 1990 (costs in $ millions)

Team	Stadium	Built	Cost	Public cost	Public %	Cost (real)	Public cost (real)
Miami	Future Stadium	*2025*	*Unknown*				
St. Louis	Citypark	2023	$250	$60	24%	$250	$60
Nashville	Geodis Park	2022	$250	$69	28%	$255	$70
Austin	Q2 Stadium	2021	$200	$0	0%	$220	$0
Columbus	Lower.com Field	2021	$295	$140	47%	$325	$154
Cincinnati	TQL Stadium	2021	$213	$53	25%	$234	$58
Miami	DRV PNK Stadium	2020	$60	$0	0%	$69	$0
Minnesota	Allianz Field	2019	$200	$0	0%	$233	$0
LAFC	BMO Stadium	2018	$350	$0	0%	$415	$0
DC United	Audi Field	2018	$400	$150	38%	$475	$178
Atlanta	Mercedes Benz Stadium	2017	See NFL table				
Toronto	BMO Field – rehab	2017	$150	$10	7%	$182	$12
Orlando	Exploria Stadium	2017	$155	$0	0%	$188	$0
Houston	Shell Energy Stadium	2012	$110	$50	45%	$143	$65
San Jose	PayPal Park	2012	$60	$0	0%	$78	$0
Montreal	Saputo Stadium - expansion	2012	$23	$23	100%	$30	$30
Kansas City	Children's Mercy Park	2011	$160	$80	50%	$212	$106
Portland	Providence Park	2011	$31	$31	100%	$41	$41
Vancouver	BC Place Stadium (rehab)	2011	$514	$514	100%	$681	$681
NY Metrostars	Red Bull Arena	2010	$190	$90	47%	$260	$123
Philadelphia	Subaru Park	2010	$120	$77	64%	$164	$105
NYCFC	Yankee Stadium	2009	See MLB table				
Salt Lake	America First field	2008	$115	$16	14%	$159	$22
Montreal	Saputo Stadium	2008	$17	$0	0%	$24	$0
Colorado	Dick's Sporting Goods Park	2007	$131	$66	50%	$188	$94
Toronto	BMO Field	2007	$63	$45	72%	$90	$65
Chicago	Seat Geek Stadium	2006	$98	$98	100%	$145	$145
Dallas	Toyota Stadium	2005	$80	$80	100%	$122	$122
L.A. Galaxy	Dignity Health Sports Park	2003	$150	$0	0%	$243	$0
Seattle	Lumen Field	2002	See NFL table				
New England	Gillette Stadium	2002	See NFL table				
Columbus	Mapfre Stadium	1999	$29	$0	0%	$51	$0
Charlotte	Bank of America Stadium	1996	See NFL table				
			$4413	$1652	37%	$5476	$2132

Table 5 New and selected renovated NBA arenas since 1990 (costs in $ millions)

Team	Stadium	Built	Cost	Public cost	Public %	Cost (real)	Public cost (real)
LA Clippers	Intuit Dome	*2024*	*$2,000*	*Unknown*			
Golden state	Chase Center	2019	$1,400	$0	0%	$1,632	$0
Atlanta	State Farm Arena (rehab)	2018	$193	$143	74%	$228	$169
Milwaukee	Fiserv Forum	2018	$524	$324	62%	$622	$385
Detroit	Little Caesar's Arena	2017	$733	$285	39%	$891	$346
Sacramento	Golden 1 Center	2016	$558	$255	46%	$693	$317
New York	Madison Sq. Garden (rehab)	2013	$1,070	$0	0%	$1,369	$0
Orlando	Amway Center	2010	$480	$430	90%	$656	$588
Brooklyn nets	Barclays Center	2010	$637	$150	24%	$871	$205
Charlotte	Spectrum Center	2005	$265	$265	100%	$404	$404
Memphis	FedEx forum	2004	$250	$250	100%	$394	$394
Phoenix	Footprint Center (rehab)	2003	$67	$67	100%	$109	$109
Houston	Toyota Center	2003	$235	$192	82%	$381	$311
San Antonio	AT&T Center	2002	$186	$158	85%	$308	$261
Oklahoma City	Paycom Center	2002	$89	$89	100%	$147	$147
Dallas	American Airlines Center	2001	$420	$210	50%	$707	$353
Toronto	Scotiabank Arena	1999	$265	$0	0%	$474	$0
Indianapolis	Gainbridge fieldhouse	1999	$183	$183	100%	$327	$327
Atlanta	State Farm Arena	1999	$214	$63	29%	$382	$112
Denver	Ball Arena	1999	$160	$35	22%	$286	$63
LA Lakers	Crypto.com Arena	1999	$375	$59	16%	$671	$105
New Orleans	Smoothie King Center	1999	$114	$114	100%	$204	$204
Miami	Miami-Dade Arena	1998	$213	$213	100%	$389	$389
Washington	Capital One Arena	1997	$260	$60	23%	$483	$111
Golden state	Oracle Arena (rehab)	1997	$121	$121	100%	$225	$225
Philadelphia	Wells Fargo Center	1996	$206	$0	0%	$391	$0
Boston	TD Garden	1995	$160	$0	0%	$313	$0
Portland	Moda Center	1995	$262	$35	13%	$512	$67
Seattle	Key Arena (rehab)	1995	$75	$75	100%	$146	$146
Cleveland	Rocket Mortgage FH	1994	$152	$152	100%	$306	$306

(continued)

Table 5 (continued)

Team	Stadium	Built	Cost	Public cost	Public %	Cost (real)	Public cost (real)
Chicago	United Center	1994	$175	$0	0%	$352	$0
Phoenix	Footprint Center	1992	$67	$67	100%	$142	$142
NY Knicks	Madison Sq. Garden (rehab)	1991	$200	$0	0%	$438	$0
Salt Lake City	Vivint Arena	1991	$93	$0	0%	$203	$0
Memphis	Memphis Pyramid	1991	$65	$65	100%	$142	$142
Minneapolis	Target Center	1990	$104	$52	50%	$237	$119
			$10,570	$4,109	39%	$16,035	$6,447

pace of stadium construction significantly slowed down after the Great Recession. In addition, in every league except for MLB, the public contributed a lower percentage of the construction costs for new stadiums. Overall, taxpayers went from footing roughly 60% of the bill in the earlier period to half that amount in the later period. However, stadiums became enormously expensive over the past 30 years. Even after adjusting for inflation, every league experienced huge cost increases for stadium construction as stadiums became more elaborate. Gone are the days when a $110 million ($234 million in 2023 dollars) stadium like Camden Yards could make a team the envy of the league. Billion dollar stadiums are now the norm in the NFL and are increasingly common in the NBA and NHL. The massive increase in stadium costs has meant that taxpayers are often now on the hook for higher dollar amounts than in the past despite covering a lower percentage of the total price tag.

3 Looking Ahead

Rob Baade started the fight against stadium subsidies with his seminal work even before Camden Yards kicked the conflict between major league owners and taxpayers into high gear (Baade and Dye 1988a, b). For the first two decades, the anti-stadium movement suffered many losses, but by the 2010s there were signs the tide was turning. As mentioned previously, the percentage of construction costs borne by the public had been cut in half. While privately financed stadiums were a rarity in the 1990s and 2000s, especially in MLB and the NFL, numerous major projects across the country in the 2010s and 2020s relied almost exclusively on private financing. And on a different front, country after country withdrew from bidding for the Olympics due to public disinterest in footing the bill, with Rob again providing ammunition for critics of the International Olympic Committee (Baade and Matheson 2016).

Table 6 New and selected renovated NHL arenas since 1990 (costs in $ millions)

Team	Stadium	Built	Cost	Public cost	Public %	Cost (real)	Public cost (real)
Arizona	Mullett Arena	2022	$134	$0	0%	$136	$0
NY islanders	UBS Arena	2021	$1,100	$0	0%	$1,210	$0
Seattle	Climate Pledge Arena	2021	$930	$0	0%	$1,023	$0
Detroit	Little Caesar's Arena	2017	See NBA table				
Las Vegas	T-Mobile Arena	2016	$375	$0	0%	$466	$0
Edmonton	Rogers Place	2016	$480	$200	42%	$596	$248
New York	Madison Sq. Garden (re)	2013	See NBA table				
Pittsburgh	PPG Paints Arena	2010	$321	$130	40%	$439	$178
New Jersey	Prudential Center	2008	$375	$210	56%	$519	$291
Winnipeg	Canada Life Centre	2004	$134	$41	30%	$211	$64
Phoenix	Jobing.com Arena	2003	$180	$180	100%	$292	$292
Dallas	American Airlines Center	2001	See NBA table				
Columbus	Nationwide Arena	2000	$175	$0	0%	$303	$0
Minnesota	Xcel Energy Center	2000	$130	$130	100%	$225	$225
Toronto	Air Canada Centre	1999	See NBA table				
Atlanta	Philips Arena	1999	See NBA table				
Denver	Ball Arena	1999	See NBA table				
Los Angeles	Crypto.com Arena	1999	See NBA table				
Carolina	PNC Arena	1999	$158	$98	62%	$283	$175
Florida	FLA Live Arena	1998	$212	$185	87%	$388	$338
Washington	Verizon Center	1997	See NBA table				
Nashville	Bridgestone Arena	1997	$144	$144	100%	$267	$267
Philadelphia	Wells Fargo Center	1996	See NBA table				
Ottawa	Canadian Tire Centre	1996	$188	$6	3%	$357	$11
Buffalo	KeyBank Center	1996	$128	$55	43%	$242	$104
Tampa Bay	Amalie Arena	1996	$160	$120	75%	$304	$228
Montreal	Bell Centre	1996	$230	$0	0%	$437	$0
Vancouver	Rogers Arena	1996	$160	$0	0%	$304	$0
Boston	TD Garden	1995	$160	$0	0%	$313	$0
Chicago	United Center	1994	$175	$0	0%	$352	$0
St. Louis	Enterprise Center	1994	$170	$35	20%	$342	$69
Anaheim	Honda Center	1993	$123	$123	100%	$254	$254
San Jose	SAP Pavilion	1993	$163	$133	82%	$335	$273
NY rangers	Madison Sq. Garden (rehab)	1991	$200	$0	0%	$438	$0
			$6,704	$1,788	27%	$10,033	$3,017

Table 7 Trends in stadium construction costs (costs in $ millions)

	1991–2009				2010–2023			
League	Stadiums	Avg. real cost	Public %	Avg. real public cost	Stadiums	Avg. real cost	Public %	Avg. real public cost
NFL	22	$577	70%	$401	5	$2,006	25%	$495
MLB	21	$603	58%	$350	4	$862	60%	$517
MLS	7	$143	45%	$64	16	$223	27%	$60
NBA	22	$357	50%	$180	6	$894	34%	$307
NHL	16	$316	51%	$162	6	$645	11%	$71
Overall	88	$446	59%	$263	37	$710	30%	$210

But stadium subsidies are a perfect example of "zombie economics," or bad ideas that just will not die. Even despite stadium funding proposals across the country failing in multiple ballot measures in 2021, in March 2022, New York state unveiled a $1.4 billion stadium deal for the Buffalo Bills that provided a record (in nominal terms, at least) $850 million in public subsidies. And when economists suggested it was hard to imagine a worse stadium deal than the one in Buffalo, Nashville said, "Hold my beer," and proposed a $2.1 billion stadium with $1.26 billion in public money which was later approved. And Nashville is not alone as team owners across the country, from Oakland to Tampa to Washington, DC, can sense that perhaps battle lines have shifted again in their favor.

Rob Baade couldn't win the war, but he fought the good fight. And he has left a new generation of researchers willing to defend taxpayers and well armed with a lifetime of his research.

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