

Economics, Sports, and the Environment: Incentives and Intersections

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The systematic study of the economics of sport began 60 years ago, with Simon Rottenberg's seminal 1956 *Journal of Political Economy* article, "The Baseball Players' Labor Market." Focusing on the labor market in baseball, Rottenberg tried to define the nature of sports leagues in general, including the competitive and cooperative elements in them, and the distribution of playing strengths across teams (that is, competitive balance). In the 15 years following Rottenberg, there was relatively little activity in this new world of sports economics. Then came the deluge—player free agency, luxurious state-of-the-art sports facilities, and the explosion of revenues in sports, owing principally to television broadcasting—that turned players into millionaires and owners into billionaires. The complementary "shoe" to drop was the application of economics and statistics to the world of sports in terms of personnel decisions, on-field strategies, and sports analytics in general (a field created first by the baseball historian and statistician Bill James and then made popular by Michael Lewis's 2003 book *Moneyball*).

The birth of the modern environmental movement occurred independently of these important factors in the sports world, but it happened concomitantly, starting in the 1960s, with widespread recognition in 1970—the year of the first "Earth Day" celebration and the formation of the U.S. Environmental Protection Agency (EPA). Though the focus of those involved in environmental matters has evolved over time from natural resource scarcity to environmental quality, global climate change, and sustainability, the underlying principles remain constant, and environmental concerns, along with economic considerations, now permeate virtually all aspects of human activity, including sports.

In this chapter we hope to bring together sports and environment—two important pillars of society through the study of economics. We first summarize fundamental economic principles, followed by a primer on the economics of sports. Next, we highlight the basic tenets of environmental economics. Then, we consider the theoretical underpinnings and applications of these principles and extensions into the sporting world. Finally, we offer a summary and suggest an agenda for further research and analyses.

Principles of Economics

Basic tenets of neoclassical economics begin with the premise that scarcity forces individuals, businesses, and governments to make choices, and that those choices involve costs—opportunity costs, or alternatives not chosen, in economic jargon; that there are usually tradeoffs as well as risks involved when choosing one course of action over another.² A complementary assumption is that people "think at the margin," that is, a little bit more versus a little bit less, rather than all-

or-nothing decisions, weighing costs and benefits, responding predictably and purposefully to incentives in their decision-making. These collective decisions form a competitive market, the premise generally favored by economists in order to make the most of society's scarce resources. When an outcome of this market maximizes societal well-being, using the fewest scarce resources, it is considered to be economically efficient.

Disagreements occur in situations where one of the tradeoffs involves what is efficient on the one hand but not perceived as fair on the other; that markets are arguably not competitive and thus firms may have some degree of market power over their customers or their employees; that economic actors are not sufficiently well-informed as they confront decisions, and because of other behavioral factors they may be inconsistent in their choices and act in less predictable ways. Possible causes of these inefficient outcomes (also known as "market failures") include classes of goods such as "externalities" (costs or benefits that spill over onto third parties) and "public goods" (things or activities that can be enjoyed without paying), which leads to so-called free riders that may call for government invention to influence outcomes. In addition, there are healthy debates and research involving whether people are rational (versus irrational) actors, and the extent to which their values can—or should—be shaped and their preferences influenced for some "greater good."

These latter two considerations—imperfect markets and imperfect people, coupled with policies to deal with externalities and public goods—come to the front in the intersection of sports and the environment. In these cases, there may be a legitimate role for the public sector to be involved in improving market outcomes, though reasonable people—and economists—will disagree as to where to draw that line.

In a well-functioning competitive market, firms both influence and are influenced by the preferences of their customers, and as these preferences change, so do production processes and the goods themselves. And thus if environmental considerations such as pollution control, or climate change matter to customers—in this case sports fans—then organizations and teams are likely to pay attention. Since the sports complex, as with any industry, actively seeks to appeal to new customers it would be of considerable interest for them to know if the characteristics of new potential fans assign higher priorities to the environment.

In these conversations, it is important not to confuse motives with outcomes. For example, a business firm may be motivated by profit and self-interest, arguably not particularly ennobling traits. But a market system based in part on self-interest does not automatically translate into it being bad for consumers, workers, the poor, or the environment. Or, conversely, because non-profit organizations are not ostensibly motivated by profit, that does not necessarily imply that their activities are good for everyone—and the Earth. For example, big-time college athletics in the U.S. is largely a non-profit enterprise, yet for all intents and purposes, its strategic decisions and actions mirror quite closely those of its professional counterparts.

Finally, the term "sustainability" is identifiable and largely understood as a concern for the planet, current resource utilization versus extant supplies, or a nation in terms of its activities. On a smaller level, one could argue that a severe drug or alcohol addiction is not sustainable in terms of one's continued employment or health, or that a city's current balance sheet of expenditures

and revenues is not sustainable. But when it comes to a firm, it is less obvious what that term actually means. For example, for a university to be sustainable that largely means solvency—does it have enough revenues from tuition-paying students, sponsored research, and alumni contributions to maintain its activities and academic programs? And the same is largely true when applied to sports franchises: are their current revenues from ticket-buying fans, television broadcasts, sponsorships, and public subventions sufficient to meet their payroll and other financial commitments? One might argue—and test empirically—that scale may matter: sustainability or environmental sustainability may be conceptually more appropriate on a larger, global stage, and thus one manifestation of that has been the Olympic movement, more than other less global sports activities, incorporating that desideratum into its mission.

The Economics of Sports

When it comes to the business of sports, there are several deviations from competitive market ideals when it comes to the basic institutional framework and outcomes. For example, the assumptions that on the output side, the prices consumers pay are approximately equal to firms' production costs, and on the input side, the wages paid to workers approximate their economic worth to their employers, are violated in most sports economics contexts because these markets are not competitive. That is, in sports the prices paid for the various products and activities are likely to be in excess of the costs of production, and wages paid are likely to be less than the economic value of the employees' contributions precisely because the producers—leagues and owners—possess some degree of market power and can exercise it by jointly restricting output, charging higher prices; and because in most cases they represent the only reasonable employment opportunity, they can pay the players lower than competitive wages. In addition, today, as opposed to 100 years ago, there is considerable power on the other side of the labor market because players' associations (i.e., unions) bargain collectively with management over the potential spoils or, in economic jargon, “rents.”³ This power in labor markets could distort efficient allocations of resources as well.

The larger economic picture in sports markets is that on both sides of the table the participants are not subject to the same market factors as in more conventional situations because new firms cannot freely enter and the employees possess specialized skills or attributes that are not easily substitutable, as would be the case in many other activities. So while the sports industry has some incentive to respond to customer tastes or societal preferences, it may be under less market-based pressure to do so. And thus these non-competitive aspects in sports markets may behave differently when it comes to some considerations, such as discrimination and the environment. Furthermore, public policies—regulation, antitrust legislation—are likely to be more accepting of joint decision-making within and across units in the sports world (including college athletics in the US), and this further reduces the pressure to change and conform.

Of course, the personal values of employers and employees, as well as the court of public opinion and thus public-relations reactions and stances, may generate conformity to society's preferences, though it is less likely to be the norm. Therefore, one witnesses at least modest recycling programs and “green” initiatives by virtually every league, franchise, and international sports organization. However, North American sports leagues are heavily dependent upon the public trough when it comes to financing for their facilities—most of which in this country have

been built in large part with public monies directly or indirectly through tax concessions and other subventions—and thus one might expect this industry to be more likely to respond to civic pressure.⁴

In terms of both positive and negative non-environmental externalities and public goods, all municipalities encounter them on a day-to-day basis as well as in both non-sports-related and sports-related “festival” contexts, many of which are nominally free and open to the public.⁵ Local large-scale sports activities may include regularly-scheduled home games for a city’s collegiate or professional league franchises, marathons and shorter running, biking, and triathlon events, some of which have charity themes. In theory, each of these local activities contains public-goods aspects and public benefits, such as community spirit, and represent good public relations for the city and its citizens. But they are also likely to entail some negative externalities in the way of noise, street closures, and congestion. In addition to those latter factors, plus equity considerations—who benefits or who pays, including the political and social ramifications of gentrification in some instances—many of these events or programs will have other implicit or explicit environmental aspects, including larger-than-normal energy draws, waste management concerns, and, in terms of capital expenditures and commitments, what may fall under the generic heading of “infrastructure.” That could include building of a facility for a franchise, ancillary construction (e.g., an athletes’ village, a media center) for the activities, and building or reconfiguring local transportation networks, many of which are contentious from the outset.

In addition, two other factors in the sporting world are conceptually different from other commercial endeavors, or at least more pronounced. First, the world of television and the expansion of broadcasting make this industry dramatically different now than just 50 years ago, and among other things expand the “superstar” effect and the creation and distribution of economic rents. Second, on the one hand sports leagues (and college athletics in the US) tend to be exempt in part from antitrust legislation or regulation that affords them some protections and allows them to make joint price and output decisions that would not be condoned in more normal commercial environments. We discuss two complementary considerations in the subsections that follow.

Marketing Considerations

Do players, franchises, and leagues espouse strong support for environmental causes more than they do for other contemporary social or political issues such as various anti-social behaviors, or through food or clothing drives, or programs to battle breast cancer? And how would one know or measure the relative extent of their commitment? What factors do they take into consideration when backing environmental programs or policies?

In other high-profile industries, firms and figures must weigh the costs and benefits of their convictions. Support for social justice movements—“Black Lives Matter,” for example—or campaigns on behalf of HIV-AIDS’ victims among Hollywood activists may actually increase their box-office appeal, but stars such as George Clooney, Sean Penn, or Angelina Jolie also run the risk of turning off a segment of the movie-going population, and thus their stances are more costly. In athletics it is a never-ending debate as to whether sports stars should be role models.

But in an age of television and social media, the influence of a LeBron James or Peyton Manning can be substantial. The same holds for more polarizing figures such as Tim Tebow.

This may be less of a problem in industries where there are few perceived substitutes for the products or performers, and “economic rent” is the coin of the realm. In more pedestrian situations where competitors abound, a firm or CEO has to be more careful not to antagonize a large chunk of its customer base. Thus not surprisingly, prominent corporations often play their political cards and wallets close to their chests, and are more likely to be followers rather than leaders or trendsetters.

To the extent that in the sporting world there are not as many close substitutes, then there is presumably more latitude in terms of expressing support for a social or environmental cause. For example, across many leagues and individual sports, the matter of gay, lesbian or transgender athletes has taken center stage in recent years. Simultaneously, the National Football League (NFL) has been embarrassed by the evidence and airing of domestic violence cases. Those appear to be easy judgment calls, but even in such instances there must be some line beyond which the team or athlete will not go.

What is the environmental counterpart and line not to be crossed? That is, what programs or policies—mandatory recycling of all cups and wrappers, not selling bottled water, requiring ticket holders to buy a carbon offset—would an organization or team simply dig in its heels? In addition, outward displays of support can be seen as emotionally positive—saluting military personnel at sports events or having a celebrity throw out the ceremonial first pitch at a baseball game—become an easier “sell” than having to couch the action in terms of a sacrifice that must be made or some modification of one’s behavior be required.

Do environmental initiatives entail sacrifices more than would be a program to combat hunger or poverty? The NFL Charities programs, for example, focus on community efforts to address domestic and other violence, the poor, elderly, young children, or sick, and less so efforts to clean up a lake or river, recycle, or reduce energy usage. Players and the league are more likely to associate with food and coat drives, after-school programs, and hospital visitations than valuable but also more controversial ones.

Environmental initiatives do perhaps differ if one considers the return on investment of social or charitable practices. While there are both private and social benefits to community investment and engagement, these environmental initiatives may present additional private returns in the form of reduced energy and water costs, or reduced maintenance costs. While much of this is dependent on the current regulatory and policy climate, it makes little economic sense for any newly constructed building or facility to adopt less than state-of-the-art technology for heating, lighting, water use, and other such features. However, to go above and beyond when it comes to environment (i.e., solar panels, green roofs) requires additional evaluation to any private investor.

Demographic Considerations

In general, whether selling a product or championing a social cause, any firm has to be careful—and lucky—when it comes to endorsements involving an athlete or other celebrity. Think Hertz and O.J. Simpson, Nike and Lance Armstrong, TAG Heuer and Maria Sharapova, or most recently, Speedo, Ralph Lauren, and others and Ryan Lochte, following ill-advised behavior at the Rio Olympic Games. In addition, owing to changing tastes, income, or demographics, demand for a product or activity can come and go over time. Think Christians versus lions, or even Christians versus Christians, in ancient Rome. Or jousting in Medieval times. Or, more recently, something of a long-time national obsession in Spain—bullfighting—has waned as that public spectacle has fallen out of favor. And the use of animals—elephants in circuses, dolphins at SeaWorld—is being phased out.

Boxing, once a thriving sport and television staple in the United States, and a way for members of ethnic immigrant groups to rise out of their relative poverty, and creator of almost national heroes—Rocky Marciano, Muhammad Ali, or even the Hollywood twist, Rocky Balboa—now captures only a fraction of its former audiences as societal wealth increases. The NFL is battling an image and health problem with concerns over concussions. On the other hand, in terms of violence, UFC (Ultimate Fighting Championship) and MMA (Mixed Martial Arts) seem to be leaping into that void, at least among some demographic groups. Across leagues, basketball attracts younger and African-American viewers; soccer draws more Hispanics; baseball followers are more male; followers of golf are more elderly.

The overriding issue here is the extent to which changing income levels, demographic shifts, or societal values affect interests and draw attention. Fans who attend major sporting events, or participate in activities such as marathons, have incomes two and three times that of the general population. As females enter the labor force in numbers comparable to men, and draw commensurate incomes, that demographic shift has altered both the participation rate and interest level on the part of women, something not lost on leagues or advertisers.

Where do environmental issues enter this conversation? First, preferences change, whether it be towards recycling or global climate change. Second, the population segments most concerned about the environment and complementary social agendas have disproportionately high incomes and are better educated. In economic jargon, environmental amenities have high income elasticities.⁶ Thus sports teams and associations have a natural advantage here in that their target audiences are wealthy and are also thus likely to be sensitive to targeted “green” initiatives that they sponsor. And conversely, consumers of sporting events and products could well demand change or even punish in various ways activities of which they disapprove.

Environmental Economics

Environmental economics deals primarily with issues that compromise market competitiveness and efficiency. The most likely sources of market failure are positive or negative externalities, and the presence of public goods. Externalities occur when the full costs or full benefits of an activity are not borne by the decision maker. Pollution, noise, and smoking are the most commonly cited examples of negative externalities, while education, honeybees, research and

development, and vaccinations are thought to provide positive externalities. Public goods generate positive externalities in that the benefits can be shared by all, regardless of the burden of cost, creating problems in overuse or exploitation of such resources.

Within economics, the market is by no means abandoned in such cases. In fact, sources of market failure are generally thought of as good cases for which policy intervention can restore efficient markets. Market forces are particularly powerful in dealing with environmental externalities, most commonly thought to be negative in direction, but also in facilitating the provision of positive externalities in the form of environmental or “ecosystem” services (the benefits provided to humans by nature). In either case, the assignment of property rights (i.e., giving someone the right to create the externality) is crucial in establishing the framework for market forces to internalize externalities. Once property rights have been established, dealing with environmental problems relies on direct intervention either through incentive-based mechanisms like subsidies or rebates, or through more punitive policy measures, such as taxation, regulation, legal protections, or even outright prohibitions through some governmental action. There are many opportunities to deal with externalities privately, but to fully restore market efficiency some type of policy oversight may be required. For public goods like parks, the government might assume ownership or provision to ensure optimal allocation, but in the interest of maintaining private investment in public resources, the usual practice is to adopt some combination of government provision and the establishment of private property rights.⁷

Global environmental problems take on a different challenge and there are limited examples of successful cross-border environmental policies. The challenges in designing global climate accords are well demonstrated and while sports with its global appeal is in a unique position to reach across borders, both private and policy-based solutions to global market failures are difficult.

An important consideration of environmental economics is the identification, measurement, and distribution of costs and benefits of problems and policies. While certain actors may be well positioned to provide environmental benefits like cleaner air, storm water management, or renewable technology research and development, they often lack the incentive to do so, given there may be a diffuse set of beneficiaries unwilling to directly pay for the enhanced outcomes. This raises questions about how to estimate the value of those environmental benefits and also address issues about equity or fairness because costs and benefits may fall more heavily on one group (e.g., rich versus poor individuals or rich versus poor nations or current versus future generations). Furthermore, actors will generally seek to maximize private returns, which in the presence of externalities, will not result in maximizing social benefits. For example, a sports team or event may choose to invest in “green” practices which results in a cost-savings to them (i.e., energy efficiency) but not those which generate additional social benefits with no private return (i.e., carbon mitigation). Clearly, there is overlap in these practices so opportunities exist to encourage further environmental action either through direct policy intervention or the creation of market structures that promote payment for environmental services.

At first blush one might posit a one-size-fits-all theoretical framework and illustrations that would capture the intersection of economics and the environment when it comes to the sporting world, and thus type of activity or location would be invariant. However, this landscape is so

multi-dimensionally heterogeneous that an argument could be made that the scale, type, and setting matter, and as a result, warrant separate considerations. Furthermore, the motivations for investment in environmental practices may differ, which can affect outcomes and the need for incentives. As noted above, private returns on investment certainly exist for practices such as energy efficiency, water conservation, reduction of compliance costs or regulatory fees, or in the form of public relations and being good stewards of the community. Whether or not these private returns on investment are sufficient to generate society's preferred level of environmental protection depends on the presence and size of the externalities.

There is always the possibility that someone within a sports organization or team genuinely and passionately cares about the environment, and as a result receives utility or a warm glow from investing in such practices. There is also the possibility of appealing to new demographics of fans, those who care most about the environment. Whether or not environmental improvements will lead those who are not sports fans to engage in the sports world is a question yet unanswered.

Worldwide events and their sponsoring organizations are arguably different than a country-specific sports league or one team operating in a single city. Appealing to the planet is certainly more likely for global events, while managing storm water can be localized to a few square blocks of a city. Current events can also influence behavior in different levels of sports. Water conservation may be most appealing in the western US, while adoption of biofuels could attract those in the Corn Belt.

Finally, social movements can impact firms and industries. In sports, two come immediately to mind: (1) racial integration, or civil rights, in the US, which changed the literal complexion of players on the fields and courts; and (2) the inclusion and increased participation of women, especially after Title IX of the 1972 Education Amendments, which prohibits discrimination on the basis of sex in any federally-funded education program or activity. A recent White House initiative targets sports to address climate change, creating awareness through federal actions and examples from the sports industry (White House 2016).

Bringing together these three worlds—sports, economics, and the environment—under one roof, we now turn to how motivations and incentives, private returns and social benefits, and public policies have intersected, and are likely to intersect as the 21st century continues to unfold.

Sports, Economics, and the Environment

As outlined above, interactions within sports markets are varied. Consumers (e.g., fans) can engage in many different ways, including in-person attendance at sporting events, media broadcasts, live Internet feeds, and by purchasing the myriad of memorabilia, clothing, and other products related to their favorite player or team. Producers in these industries also vary, starting with the athletes themselves, teams, facility owners, cities, leagues representing many teams and a culminating championship event or events, and large-scale global entities representing athletes and nations. As a result of this diverse mix of consumption and production activities, the types of environmental investments may vary widely as well, from athletes as spokespeople for green

behavior, to facility owners' adoption of green building practices, to league-wide campaigns to promote environmental friendliness of sports teams and their fans.

The reasons for connecting sports and sustainability also vary. In some cases, as in any industry, a passionate individual may feel it is the duty of the organization to be a good steward of the environment. There may be positive returns on environmental investments by organizations, and also motivations related to public relations, community engagement, reputation, and corporate social responsibility. Policy, regulatory or local zoning, and land use laws can also drive environmental behavior either as compliance or through rent-seeking activities. Aside from the altruistic view that someone may possess toward the environment, the other motivations discussed above can be summarized in five distinct but not mutually-exclusive categories:

1. Direct private return. This exists when an investment provides protection and profits for the investor. This return is determined by a payback over time, usually a relatively short time, since returns in the future are discounted. Energy efficiency upgrades, for example, may cost a premium upfront but subsequently lower energy use and associated costs, eventually paying off the investment and turning into profit. The payback period necessarily depends on the price of energy.

2. Indirect private return. Returns on an investment can also come in a form that doesn't directly or immediately affect a bottom line, but could in the future. These include public relations, employee satisfaction, attraction of new customers, lucrative sponsorships, and overall reputation. For public entities such as cities or colleges, indirect benefits from investments could come in the form of community engagement and recognition, increased donations, and attraction and retention of employees or students. Investments with these types of returns include water conservation, where water is priced too low in most parts of the U.S. to result in a significant cost saving, but promote the investor as a good steward of a scarce resource. There are also limited examples for cities as investors in Olympic Games or sports stadiums, if they can negotiate deals to receive private investments in new park space or mass transit for the community.

3. Social benefit. Social benefits, which result from the presence of positive externalities, are benefits that extend to those who do not bear the cost of the investment. These types of investments, like the mitigation of greenhouse gases, which in the U.S. are not yet regulated in any meaningful way and consequently low valued, have clear societal benefits. It is important to note that while most environmental investments will generate both private (direct and indirect) and social returns, individual actors may only consider the private return when making the decision to invest. As a result, one could argue that private actors, on their own, won't generally make enough environmental investments for society's well-being. This leads directly to the next category.

4. Policy and regulatory. Policy and regulatory action can motivate environmental investment to reach the level desired by society. These mechanisms range from command-and-control approaches that mandate certain types of direct or indirect environmental protection through fines and legal action, such as removal of lead in paint or installation of catalytic converters on cars, to more flexible and sometimes voluntary instruments, like taxes (e.g. gas

taxes), subsidies, and grants for cleaner sources of energy, that create incentives for private actors to invest in higher levels of environmental protection than they would otherwise.

5. Rent-seeking. Related to policy measures, rent-seeking exists when powerful private actors use their influence to promote government support of their industry at the taxpayers' expense. Publicly-funded stadiums are the most commonly cited example, though the agreement could come with strings attached to environmental outcomes such as the provision of park space.⁸

We now illustrate environmental investments by diverse sets of sports agents. The examples chosen—Olympics, National Football League, NASCAR, golf and tennis, and college athletics—are not fully inclusive of all types of sports and leagues, but rather represent different type of actors, practices, scale, settings, and global context. The motivations and incentives for investing in environmental practices differ for each, as do the likely outcomes.

The Olympics⁹

As a flag bearer for international relations, human achievement and, historically, racial equality, the Olympics emphasize social causes, including the global environment. At the same time, the International Olympic Committee (IOC) is an organization with more than 100 members whose economies, populations, political contexts, and cultures vary enormously, and thus reaching consensus by all members may be a daunting challenge. Nevertheless, the IOC, with its large global reach, is in a unique position to unite diverse populations around a common theme—sport. This is clear from the institution's charter, which states "Olympism seeks to create a way of life based on the joy found in effort, the educational value of good example and respect for universal fundamental ethical principles."¹⁰ Due to scale, size and global awareness across diverse populations, the Olympics and FIFA's World Cup are the only types of sporting events likely to significantly influence action on a global externality such as climate change.

Although the Olympic movement has long stressed ethnical and socially progressive standards, including a commitment to the environment¹¹, we focus on the present and recent past: the 2012 and 2016 Games,¹² where even before August 2016 Rio had been beset with political problems of political corruption, economic setbacks in terms of high rates of inflation and recessionary conditions, and concerns over water quality for some events and spread of the Zika virus.

As with the quadrennial proclamation at the concluding ceremonies by the IOC president that these were "the Greatest Olympics Ever," "Towards a One Planet Olympics" emerged as a theme for 2012, and many in London promised that with sustainability and carbon neutrality front and center, it would deliver the "greenest Olympics ever." The priority target areas were climate change, biodiversity, waste, inclusion and healthy living. With respect to green energy and technology related to climate change, London pledged that 20% of newly installed capacity in Olympic Park would come from renewable sources. Reductions in water use, a zero-waste plan, low-carbon and recycled building materials, and a "car-free," transportation objective addressed these specific component. In addition, the Olympic Park itself was planned to incorporate wildlife habitats and ~~nature preserves~~ a net gain in publicly accessible green space.

Ex post, given London’s ambitious commitments, there were inevitably shortfalls and tradeoffs. For example, given the sheer scale of the various construction projects and process, ultimately commitments to emissions reductions were met through a portfolio of carbon saving and reduction projects, rather than from specific technologies. And while many local transportation objectives were feasible, factoring in other aspects—the emissions generated from spectators coming to London for the Games, the inconveniences and congestion around the city—the overall result is less clear.

When IOC members voted to award the 2016 Olympics to Rio de Janeiro it was with a sense of both excitement—a vibrant city and the first time South America had served as host for the Games—and trepidation; known corruption and violence, grinding poverty, water pollution, and potential environmental damage—deforestation—was a concern from the outset. Apart from the usual worries over timely completion of facilities and problems with congestion, added tension leading up to the 2016 Games was the IOC’s decision to bar a substantial number of Russian Olympic athletes (and subsequently their entire Paralympic squad) owing to evidence of state-sponsored doping. The stellar, thrilling achievements of the participants in swimming, track and field, and other competitions were often overshadowed by embarrassments over unsold seats, budgetary exigencies that threatened the Paralympic Games component, and the scandal and saga surrounding alleged attack on four members of the U.S. swim team. In addition, midway through the swimming and diving portion, algae-related problems in the diving pool threatened to impart an entirely new twist to the “greenest games ever” mantra.

The Rio bid committee put forth a nine-point Sustainability Management Plan (SMP) and ambitious environmental agenda to address and commit to: water treatment and conservation, environmental awareness, use and management of renewable energy, carbon neutrality, protection of ecosystems and biodiversity, sustainable design and construction, and solid waste management. One of the SMP’s overarching key objectives was to lessen the environmental footprint, and it organized this objective around four themes or areas: transport and logistics, sustainable construction and urban improvement, environmental conservation and clean-up, and waste management. If by hosting the Olympic Games, Rio hastened its path towards development with investments in infrastructure and pollution control, there exists the potential to achieve both private return to local investors and social benefit for others.

In general, evidence suggests that in terms of economic impact and development, a city’s or nation’s having some “Olympic strategy,” either serving as host locale or a financial commitment to increasing the success of its own athletes in these competitions, does not usually constitute a wise economic investment.¹³ While the Olympic games may attract additional private dollars that may have gone to other causes or locations, and may expedite the clearing of political hurdles, there may be efficiency gains in targeting public investment directly towards other independent social or public goods like education, infrastructure, the environment, health care and poverty, rather than indirectly through Olympic games.

The National Football League¹⁴

In terms of audiences, revenues, and franchise values, American football is largely the face of U.S. professional sports, and its environmental practices are generally representative of team-

based athletics in the United States.¹⁵ Most greening efforts in the NFL appear to be led by stadium owners, with each newly constructed or renovated stadium touting statistics for clean energy usage, diversion of waste, and green building certification.¹⁶ Many of these measures emerge from the synergy between green technologies and profit, as new efficient systems, from lighting to ventilation, have proved to be attractive sources of direct private return and corporate sponsorship.¹⁷ External factors likely play a role in this market. Revenue from energy technologies can be unnaturally high due to government subsidies, particularly for solar projects, which can drive investments above and beyond what would be made for motivations only related to direct return. Simultaneously, implementation costs are often low for owners since taxpayer financing for new stadiums is so common. This is also where barriers to market entry create the potential for rent-seeking. Lack of competition lets teams threaten to leave cities without favorable deals, and so we see the average NFL stadium is in its early twenties, while an English Premier League stadium can boast nearly eight decades.¹⁸

However, the question remains as to why a league or individual team or facility owner would invest in large-scale greening efforts where the returns are largely societal and not captured by the individual investor. In part, there are always concerns about the environmental impact of large sporting events and showcasing these efforts, as the NFL does at the Super Bowl, garners the most attention. For any individual team or facility, the sustainability measures demonstrate a commitment to community and modern technology and can attract high-profile events like the Super Bowl. In this fashion, green practices generate additional revenue indirectly through fans. It is easy to see how initiatives such as locally-farmed menus and digital sustainability graphics might appeal to the modern fan's preferences, and allow for higher prices.¹⁹ Furthermore, by aligning its practices with shifting social views towards the environment, the NFL and its teams can attract new fans. Most environmental surveys indicate that female, younger, and wealthier people care most about the environment, all of whom would be most welcome to the NFL as new fans.

One could measure the full economic value of greening efforts to demonstrate that the social value of environmental improvement may be worth the investment, and as a result, a sports team's generation of environmental services is a return on civic investment in stadiums and sports infrastructure. In economic terms, we would question whether the investments are at a level that is optimal for society and if not, should the leagues and teams be encouraged to do more either through additional policy incentives or regulations.

Automobile Racing²⁰

An unlikely sports industry for greening, yet perhaps one with the most opportunity, is automobile racing. NASCAR launched the NASCAR Green program in 2008 as a comprehensive effort to reduce environmental impact of everything from fossil fuel combustion to waste from race day events. The program has a strong focus on the use and promotion of alternative fuels, along with significant fan education programs. To better understand fan attitudes and behaviors related to environment, NASCAR commissioned several surveys of their fans to compare to the general population (NASCAR, personal communication, 2016). In a 2015 study, NASCAR found that their fans are environmentally aware, with the majority expressing an obligation to protect the environment and a personal responsibility toward climate change

mitigation. Four out of five NASCAR fans surveyed were aware of the NASCAR Green program and most of those recognized it as a sign that NASCAR cared about the environment. A significant component of NASCAR Green involves the transition to alternative fuels, mainly ethanol. This appeared to have significant effect on fans, as most supported the use of ethanol blends in NASCAR race cars, as well as their own cars. In addition, NASCAR fans were 35% more likely to recognize ethanol as a renewable fuel than non-fans, likely due to the support and promotion of ethanol by NASCAR.²¹

The direct private return of partnerships in a transition to alternative fuels may be limited in the near term, there are clear social benefits, and sources of indirect private return given fan awareness, involvement, and adoption beyond spectators of the sport. The exposure of new automobile technology to a large and interested fan base will be attractive to corporate sponsors and potentially new groups of fans, both of which contribute to indirect private returns, in addition to social benefits from the conversion to alternative fuels.

Individual Sports and Associations

Although there are many individual sports with their own underlying governing associations, two stand out in terms of global participation by players and interest and income levels of their fans: golf and tennis. While the leagues (i.e., PGA, LPGA, USTA, WTA) and facilities often lead the way in terms of environmental action, athletes compete individually and often obtain sponsorship at an individual level. Unlike league sports, the players can negotiate equipment and clothing contracts individually, as well as succeed or fail in competition individually, drawing fans at the athlete, rather than a team level. While golf and tennis are both individually-played sports, the environmental initiatives often appear motivated at the league or association level. We treat the two sports in turn.

Golf. Golf, as an exclusively outdoor sport dependent on green spaces, is a unique position with respect to environment. While the sport is dependent on the aesthetics of the natural landscape, it has also come under intense criticism for not adhering to the environmental needs of local communities and ecosystems.²² From excessive water use in drought-stricken or desert regions to the destruction of coral reefs from excessive fertilizer use (“Scientists Report,” 2013), golf has taken its hits. At the same time, given the dependence of the sport on natural resource quality and the relatively wealthy fan and participant base, golf is ideally positioned to invest in water conservation, sustainable landscaping, and environmental education.

The Professional Golfers’ Association (PGA), players, and individual venues that host tournaments note that they support more than 3,000 charities, with a combined total giving in 2014, as announced by the PGA, of \$133 million, and more than \$2 billion over the association’s lifetime (which it compared to the NFL’s \$370 million given to charity in the last 40 years). These efforts are divided among several headings: youth, the military, education and leadership, community, volunteerism, health/medical, disaster relief, and the environment. The PGE Tour but notes that it “supports a range of environmental causes,” and that 15 of the Tour’s clubs are certified as “Audubon Cooperative Sanctuaries” and two tournaments, the Waste Management Phoenix Open and the Deutsche Bank Championship, are “devoted to producing green events.”

In 2016, the PGA Championship at the Baltusrol Golf Club in Springfield Township, New Jersey boasted 10 tons of food recovery to keep it from landfill and feed the needy.²³

Beyond the PGA, golf associations are actively involved in understanding and lessening the sport's environmental impact. The World Golf Foundation has established an industry-wide initiative to support environmental responsibility in the design and management of golf courses. The Environmental Institute of Golf (EIFG), founded by the Golf Course Superintendents Association of America (GCSAA), supports research and advocacy toward golf courses as beneficial uses of land, promoting economic and environmental value to communities. The international non-profit Golf Environment Organization (GEO) offers resources for environmental measurement and improvement for golf courses, developments, and professional and amateur tour events, as well as an eco-label for golf courses that achieve environmental targets. Additionally, companies that support landscaping and associated products like turfgrass and fertilizer, compete for lucrative golf course deals and have an interest in promoting their products as environmentally friendly. For golf, it is clear that environmental sustainability is necessary component of a luxurious game.

Tennis. Similar to golf, tennis is an individual sport, yet we see decision making on behalf of the sport at the league level by the Association of Tennis Professionals (ATP) and the Women's Tennis Association (WTA). In the US, the United States Tennis Association (USTA) manages all professional and junior operations, and runs the U.S. Open, one of four major events comprising the Grand Slam (the other three are the Australian Open, the French Open, and Wimbledon). While tennis is comparable to golf with the major events held on different continents, the locations and venues of each event are permanent and have an established history and legacy. The permanency and certainty of the major event venues, along with the large global and relatively higher income fan following of tennis, lends itself well to more significant environmental investments, which require longer payback periods.

The USTA, in conjunction with the NRDC (the Natural Resources Defense Council, a leading environmental advocacy group) and the Green Sports Alliance, appear to have been quite aggressive on the environmental front and activities. As the host for the U.S. Open each year, the USTA engages in recycling and composting programs, suggests that tournament attendees use mass transit, pays attention to food and service ware, encourages fans to lessen their impact on the environment, and engages in a number of environmental outreach efforts. It also participates in carbon-offset programs. It notes "the responsibility of lessening the U.S. Open's environmental footprint and helping to create a sustainable future." The other major events have also invested in sustainability from a 95% waste diversion rate and locally-sources strawberries at Wimbledon, LEED Gold certification of all buildings at Melbourne Park, home of the Australian Open to a promotional video featuring the top tennis players in the world to encourage fans to sort recyclable and compostable waste into the appropriate bins at the French Open at Roland Garros.

College Athletics

It is important to recognize one other major "player" in the world of sports: college athletics in general and big-time college athletics in particular, a uniquely American enterprise. While

technically this involves non-profit bodies—the National Collegiate Athletic Association (NCAA) and member institutions—their behaviors with regard to product development, marketing, and protecting property rights largely mirror other commercial entities. Many of same factors at the professional level are also applicable to campuses, but there are also added dimensions that make college sports unique when it comes to the environment.

First of all, one overarching entity, the NCAA, governs most of what occurs in this “industry,” including its holding both monopoly and monopsonistic controls, power for which it is beholden to the government to maintain. Second, there are arguably more constituencies involved in collegiate sports than their professional counterparts—state and federal governmental units, faculty and administrators, students, alumni, and local communities. Pressures are often exerted on these institutions of higher education externally and internally to respond to, or at least be sensitive to, popular social and environmental matters, including race and ethnicity, gender and gender identity, recycling, energy use and dependence on fossil fuels, and sustainability. Thus, because of these varied constituencies and the underlying non-profit status, one might expect to find more awareness of, and attention paid to, environmental considerations in these academic enclaves than in ranks of professional sports.²⁴ In addition, given the pre-existing “collective” nature of college athletics—students, faculty, administrators are already in one, dense location (that is, the campus)—costs of organizing, or protesting, are lower.

In terms of a “sustainability” agenda and related activities, there is a strong focus in college athletics on waste management, and the adoption of “zero-waste” events or facilities. Given the vast amount of resources required to maintain top-flight facilities, fly their teams around the country, and host contests on campus for fans (e.g., alumni, students, and “townies,” most of which constitute high-profile and very public exposure), recycling and waste diversion programs are the lowest hanging “green” fruit. Further, there is a direct connection to fans and students through recycling or waste management education and implementation. At the same time, these types of fan-engaged activities can be challenging in college or any sports. People attend sporting events to be entertained and are often not focused on separating waste, reducing their environmental footprint, or being educated on anything beyond sports. College sports have a greater opportunity to address these challenges by engaging students and educated alumni, with a vested interest in supporting their educational institutions.

The NCAA and collegiate sports have been extremely active in extending environmental activities to construction of green buildings, energy conservation, and adoption or generation of renewable energy. In August 2013, the NRDC issued a 100-page report—*Collegiate Game Changers: How Campus Sport is Going Green*—to document “case studies of North American sports industry’s most successful greening initiatives²⁵.” This second volume touts advances in energy efficiency and renewable energy, recycling, composting, water conservation, and green building practices, among other activities, includes case studies on 10 campuses, key findings from a survey of collegiate sports departments, and chapters of why greening campus sport matters, the basis for greening sports, and recommendations for implementing successful programs. More and more colleges are adopting sustainability in sports, connecting vital components of institutions’ operations through student actions as athletes, fans, researchers, and stewards of their campuses. Students, as athletes, can strive to reduce environmental impact through competitions across sports teams,²⁶ while fans can engage in game-day events and

challenges, and conduct the associated research to measure landfill diversion, water use reduction, and energy conservation. Colleges and universities have incentives to create awareness through their sustainability actions that could lead to indirect returns in attracting environmentally-minded individuals as students, staff employees, faculty members, and sports fans.

Summary, Conclusions, and Agenda for Further Analyses

During the last 60 years, economics in general, the economics or business of sports in particular, and environmental economics contributions and concerns have come together in various private and public-policy arenas. In broad strokes, the sections in this chapter first lay out some of the principles of neo-classical economics, then provide a primer on the economics of sports, including marketing and demographic considerations. The chapter then moves in parallel fashion through the basic tenets of environmental economics, followed by a more detailed examination of the intersection of these three components—economics, sports, and the environment—into the theoretical underpinnings as well as applications to specific well-known and popular activities, such as the Olympics, selected professional league and individual sports, and, owing to its importance in the United States, college athletics.

At the end of the day—or, in this case, the chapter—what could come next or be added, and how to proceed? We close with some suggestions.

First, one avenue for further research is to investigate the extent to which the embracing of “green” initiatives vary by type of sport, such as whether these activities occur more frequently and with a higher profile in competitions that are more local in nature as opposed to global, that are enjoyed by higher-income spectators, and other dimensions of this heterogeneous landscape.

A second agenda would be a comparison of both the pace and extent of environmental actions, which usually contain some present-versus-future considerations and thus “discounting” may dilute the immediate urgency compared with those that address other contemporary social or political causes such as discrimination by gender or race, inequality, or political system.

A third area to pursue would be a comparison between the inculcation of environmental actions in economies that are more market oriented and have a small governmental footprint with those in which the state plays a larger, controlling role, and in sectors that are more competitive as opposed to those that by practice or statute enjoy more protection. And to the extent that in competitive markets firms must to some extent conform to the preferences of their customers—in this case, sports fans—how much of current and proposed environmental programs appear to have “bottom-up” versus “top-down” origins?

Regardless of the path(s) forward, it is important to emphasize the measurement of environmental outcomes to better assess the progress that is being made, as well as evaluate benefits and costs to make the case for certain environmental actions across sports industries and actors. Finally, much of this begs two overarching questions: From the viewpoint of the franchise, league, or participants, does “being green” or “going green” represent profit-maximizing behavior, or do the benefits largely accrue to society as a whole rather those

immediately involved? And to what extent is the commonly employed term “sustainability” is as applicable to these industries or set of activities?

Whatever the answers to those questions or subsequent approaches, this is a rich field—or pitch, court, or ice rink—ripe for continued study, and will likely remain so for the foreseeable future.

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² Another fundamental economics principle or tradeoff is how individuals, firms, and societies weigh the present, or present value (or present discounted value) of costs and benefits in their decision-making. This has particular applicability in environmental economics.

³ The term “economic rent” denotes difference between the actual payment made to the owner of an input, such as capital, land or labor, and the payment that would ordinarily be required to bring it forth. Economic rent is usually the result of natural or contrived scarcity and occurs when entry can be blocked or there are not good perceived substitutes for the particular product or labor. For example, a closed league in sports prevents another franchise from entering that industry, and a superstar athlete or entertainer arguably has few perceived substitutes.

⁴ An extension of the term “rent” in economics is “rent seeking.” Rent-seeking is a process, usually political, in which a group or firm—in this case, a sports franchise, league, or global sports entity—lobbies some level of government for concessions or subventions that are largely not designed to enhance social benefits or social capital, but to redistribute money from the public—taxpayers—to the organization or team owner itself. This is also known as the “special-interest effect.”

⁵ For example, with respect to the former, the city of Chicago hosts annually its Air and Water Show along the lakefront; Thanksgiving and St. Patrick’s Day parades in the city center, and the Pride Parade on the north side; two festivals in Grant Park, the Taste of Chicago and Lollapalooza, food and music, respectively; and periodic evening concerts, which are held in Soldier Field, Wrigley Field, or on Northerly Island. In addition, there are a plethora of neighborhood activities. Chicago has also been the site for the NATO summit and national political conventions.

⁶ The term “income elasticity” refers to the tendency on the part of consumers to spend money disproportionately on some goods when their incomes rise, and shy away from others. Thus one might suspect that for families, Nordstrom, foreign travel, and elite private higher education have high income elasticities, whereas McDonald’s, Walmart, or cheaper cuts of meat have low income elasticities.

⁷ Over time there have been at least three threads to handling negative externalities. The first is traced back to Cambridge economist A. C. Pigou: Calculate the social or environmental costs of an activity and impose a tax—a “corrective tax”—that reflects that amount of that damage. The second stems from Nobel Laureate Ronald Coase (1960) and his landmark journal article, “The Problem of Social Cost”: If parties can negotiate over the allocation of resources, they may be able to solve externality problems privately. This has become known as “the Coase theorem.” Political economist and also a Nobel laureate Elinor Ostrom addressed these problems through a more bottom-up approach of cooperation based on community standards or values. Nobel laureate Paul A. Samuelson is often credited with the first theoretical definition and explanation of public goods in his 1954 *Review of Economics and Statistics* article: “The Pure Theory of Public Expenditure”: Scholars have debated what constitutes a public good as well as public versus private approaches and solutions to it for decades.

⁸ For the standard argument of the lack of economic return on public financing of stadiums, see the recent research by Gayer, et al. (2016). On the proverbial other hand, Crompton (2004), provides an alternative rationale for public subsidies of major league sports facilities in the form of spillover benefits from community visibility and engagement.

⁹ Our focus in this sub-section is on the Summer Olympics. The 2014 Winter Games in Sochi, Russia, in terms of scope or scale and outlays—more than \$50 billion, by some estimates—were unlike any Winter Games before then, or more to be seen in subsequent years. Pyeongchang, South Korea, will host the 2018 Games, but had won that right before Sochi unrolled. The 2022 Winter Olympics will be held in Beijing, to a large extent because the cost of the 2014 Games scared off most other bidders, including Oslo, Norway. Lillehammer, Norway, host in 1994, is often referred to the first ‘green’ games because of their attention to natural materials, energy conservation, mass transit, and recycling.

Vancouver, British Columbia, was one of the largest cities to serve as host for the Winter Games. In addition, along with a half-dozen U.S. cities, it is arguably one of the most out-front progressive North American cities in terms of social and environmental matters. And the organizing team did not disappoint in its priorities. Best practices in building design and construction techniques, zero waste management and zero net emissions strategies, and a sustainable development legacy were integral parts of Vancouver’s bid and planning. Even the icons – emblem for the Games, the torch, and the mascots – entailed environmental themes.

¹⁰ The Olympics Charter: http://www.olympic.org/Documents/olympic_charter_en.pdf

¹¹ While the IOC lacks a mandatory environmental commitment in Olympic bids, there is dedicated effort to sustainable practices and messaging for the games: <http://www.olympic.org/sustainability>

¹² The first two twenty-first century locations were Sydney in 2000 and Athens in 2004; Athens is generally considered a failure on environmental criteria. The massive scale, including expenditures of the Chinese government of more than \$45 billion and more guarded control, made the 2008 Games in Beijing unrepresentative of others than preceded or followed, as well as simply more difficult to analyze. Tokyo will be the site of the Summer Games in 2020; the 2024 city will be chosen in autumn 2017.

¹³ See Zimbalist (2015) and Baade and Matheson (2016).

¹⁴ The other major North American professional league sports—baseball (MLB), basketball (NBA), and ice hockey (NHL)—all have various, independent green initiatives. Of the four, the NHL, with the smallest fan base, has arguably made the strongest commitment to sustainability initiatives, both by encouraging and supporting team-led initiatives but also through league-wide leadership. The NHL operates NHL Green in partnership with the Green Sports Alliance to inform and engage fans in league-wide greening efforts through information, activities, and player advocacy. Among the league’s many environmental investments are food recovery and food waste reduction, tree plantings, energy-efficient lighting in arenas, and fan-facing programs such as the “Energy Playbook,” which offers tips to fans on how to engage with the NHL’s efforts (NHL, 2015). Further, the NHL is the only professional sports

league in the US to issue an annual Sustainability Report on collective goals and achievements related to energy, water, waste, and other sustainability categories.

¹⁵ The NFL also has an aggressive marketing agenda to expand its footprint into Europe, Mexico, and Asia.

¹⁶ Leadership in Energy and Environmental Design (LEED) is the most commonly used certification for green building and as of October 2015, there were at least 30 LEED-certified sports stadiums in the U.S. Refer to Chapter 15 for more details on environmental building certification.

¹⁷ A prime example is the new home of the San Francisco 49ers and Super Bowl 50, Levi's Stadium in Santa Clara, the first sports stadium to achieve LEED Gold certification, with region-specific features such as drought-tolerant turf, rainwater harvesting and a solar panel "green roof."

¹⁸ Haddock, Jacobi, and Sag compare the North American and British systems in their 2013 paper "League Structure and Rent-Seeking – The Role of Antitrust Revisited."

¹⁹ These measures can be seen in action in Levi's Stadium in Santa Clara, California.

²⁰ There are several categories of auto racing, including Formula One ("Grand Prix"), IndyCar, and NASCAR (National Association for Stock Car Auto Racing). Our discussion is largely limited to this last, family-owned grouping, the most popular North American circuit.

²¹ Also in the world of automobile racing, Formula E is a global, fully-electric racing series, which showcases state-of-the-art electric vehicles in cities around the world. Formula-E publishes an annual sustainability report of all environmental impacts and outline areas in which a transition to electric vehicle can reduce carbon footprints.

²² The environmental impact of luxury golf courses was the subject of the recent documentary film *A Dangerous Game*.

²³ "10 Tons of Food Recovered from 2016 PGE Championship," Green Sports Alliance, August 19, 2016.

²⁴ Although gender discrimination is against the law in the United States and applied across the board, given Title IX of the 1972 Higher Education Act—mentioned above—represents a significant fork in the road for colleges and universities when it comes to college athletics the increased participation of female students in inter- and intra-collegiate sports. This demographic change may well have many implications, including as it relates to, or leads to changes in, environmental policies on college campuses.

²⁵ See the Resources page of the Green Sports Alliance for the full report "Collegiate Game Changers: How Campus Sports are Going Green," August 2013.

²⁶ See Bulldog Sustainability at Yale University for the "Green Team Certification" as an example of competing to green their sports team operations (Yale University, 2015).