WHO PROFITS FROM AMATEURISM? RENT-SHARING IN MODERN COLLEGE SPORTS*

CRAIG GARTHWAITE
NORTHWESTERN UNIVERSITY
AND NBER

JORDAN KEENER
UNIVERSITY OF MICHIGAN

MATTHEW NOTOWIDIGDO
UNIVERSITY OF CHICAGO
BOOTH SCHOOL OF BUSINESS
AND NBER

NICOLE OZMINKOWSKI
NORTHWESTERN UNIVERSITY

First version: July 2020
This version: August 2020

Abstract

Intercollegiate amateur athletics in the US largely bars student-athletes from sharing in any of the profits generated by their participation, which creates substantial economic rents for universities. These rents are primarily generated by men's football and men's basketball programs. We characterize these economic rents using comprehensive revenue and expenses data for college athletic departments between 2006 and 2019, and we estimate rent-sharing elasticities to measure how rents flow to women's sports and other men's sports and lead to increased spending on facilities, coaches' salaries, and other athletic department personnel. Using complete roster data for every student-athlete playing sports at these schools in 2018, we find that the rent-sharing effectively transfers resources away from students who are more likely to be black and more likely to come from poor neighborhoods towards students who are more likely to be white and come from higher-income neighborhoods. To understand the magnitude of the available rents, we calculate a wage structure for college athletes using the collective bargaining agreements in professional sports leagues as a benchmark. We also discuss how our results help understand how universities have responded to recent threats to these rents arising from litigation, legislation, and the global coronavirus pandemic.

* Garthwaite: c-garthwaite@kellogg.northwestern.edu; Keener: jordkeen@umich.edu; Notowidigdo: noto@chicagobooth.edu; Ozminkowski: NicoleOzminkowski2017@u.northwestern.edu. We thank Peter Bergman for sharing high school catchment area data with us, and we are grateful to Erin Buzuvis, Michael McCann, and Raymond Yasser for discussing Title IX regulations with us. We thank David Berri, Patrick Kline, Kory Kroft, Dan Sacks, Carolyn Stein, and Eric Zwick for useful comments. Any opinions expressed in this paper are those of the authors, and do not necessarily reflect any official positions of the University of Chicago, the University of Michigan, or Northwestern University.

I. Introduction

The first intercollegiate football game was a six to four victory by Rutgers over Princeton in 1869. This was followed 30 years later by the first intercollegiate basketball game, when Hamline University lost to the Minnesota State School of Agriculture in 1895 by a score of nine to three. It is likely that few people watching or participating in those early amateur contests understood they were witnessing the birth of what would become a modern economic powerhouse. What began primarily as a series of student activities has grown into a multi-billion-dollar commercial enterprise that continues to grow to this day. In 2006, National Collegiate Athletic Association (NCAA) Division 1 Football Subdivision (FBS) schools earned $4.4 billion in revenue.[1] Over the next decade, these revenues grew to $8.5 billion.

Where does this revenue come from? While FBS schools typically field men's and women's teams in roughly 20 different sports, 58 percent of the total athletic department revenue comes directly from only two sports: men's football and men's basketball.[2] All other sports directly account for only about 15 percent of total revenue. The remaining 27 percent comes from other sources such as the sale of media rights. Even a cursory review of the revenue involved in such contracts demonstrates that most of the value stems from the ability to broadcast football and men's basketball programs (Sanderson and Siegfried 2018). Given this stark difference in revenue, football and men's basketball are often referred to as "revenue sports," with all other sports being referred to as "non-revenue sports" – a convention we will adopt throughout this paper.

Despite the commercial success of these athletic endeavors, they ostensibly remain amateur athletic activities, with the student-athletes largely barred from sharing in the profits generated by their participation. Athlete compensation is strictly limited to academic scholarships that cover the cost of attendance and a modest stipend for living expenses. We estimate that less than 7 percent of football and men's basketball revenue is paid to athletes through these two forms of compensation.[3]

[1] The FBS is the most competitive division of intercollegiate athletics. It was formerly described as "Division 1-A." This division includes 130 teams that are organized in 10 athletic conferences. Teams that are not in the FBS compete in the Football Championship Subdivision (FCS). We do not include data from the FCS schools in our analysis except for Figure 1.

[2] Men's football refers to American football, and we will drop "men's" in the rest of the paper, since the sport is only played competitively by men in the FBS.

[3] Even this number is likely an overestimate, since the value of the scholarships are based on the list price of tuition and not the percentage of the list price paid by the average student, which would likely be a more accurate measure of what the athletes would

To put this number in perspective, under their respective collective bargaining agreements, professional football and men's basketball players in the US receive approximately 50 percent of the revenue generated by their athletic activities as salary (NBA and NBPA 2017; NFL and NFLPA 2020).[4] Because of the strict limits on player compensation, amateur athletes playing football and men's basketball generate substantial economic rents for the athletic departments in FBS schools.[5]

In this paper, we characterize the economic rents in intercollegiate athletics, estimate rent-sharing elasticities using a variety of empirical approaches, and investigate distributional consequences of the existing limits on player compensation. To do this, we collect comprehensive data covering revenue and expenses for FBS schools between 2006 and 2019, and we assemble new data using complete rosters of students matched to neighborhood socioeconomic characteristics.

We begin by characterizing the distinct "business models" across FBS schools. Athletic departments have two primary revenue sources: (1) revenue-generating activities such as ticket sales, apparel licensing, and the selling of media rights, and (2) institutional support from their universities. Using a standard k-means clustering algorithm, we identify two distinct clusters of schools, with the athletic departments in one cluster primarily having low revenues and relying on transfers from the university, and a second cluster of high-revenue schools where the vast majority of athletic department revenue is generated directly by the activities of the athletic department.

Interestingly, this second cluster corresponds exactly to the set of schools in the so-called "Power 5" athletic conferences.[6] The athletic departments in these schools have traditionally operated successful athletic programs, participated in lucrative postseason activities, and negotiated valuable packages with television networks for their media rights. The clustering analysis demonstrates that Power 5 conference schools operate under a largely self-sustaining business model

have paid had they not participated in amateur athletics. Full-time students at public and private non-profit universities on average have a net tuition and fees price that is 40-45 percent of the list price (Urban Institute 2017).

[4] Appendix Section IV contains excerpts of the relevant parts of the collective bargaining agreement for each league.

[5] As we discuss below it is possible to view lavish spending on facilities for intercollegiate athletes as a fringe benefit that should be counted as compensation. That said, such spending is also common for professional football and men's basketball leagues and is paid in addition to the approximately 50 percent of revenue that is paid as salary.

[6] Teams in the FBS are each members of conferences. These conferences are the primary organizing vehicle for schedules, rules, refereeing and other features related to athletic competition. As we discuss below, they also negotiate post-season championship participation, media rights, and other economically meaningful financial issues. Teams play the majority of their games against teams in their conference and for many conferences there is an annual championship There are 10 conferences in total and they are generally grouped in the "Power 5" conferences and the "Group of 5" conferences. The Power 5 conferences, which serve as the basis of our analysis include the Big Ten, Pac 12, Big 12, Southeastern Conference (SEC), and the Athletic Coast Conference (ACC).

that closely represents a commercial enterprise generating economic rents. This model is distinct from the other FBS schools, and therefore the Power 5 conference schools serve as the main sample for our rent-sharing analysis.

While rent-sharing is theoretically possible in any commercial venture, the potential for rent-sharing in college sports is particularly great because of the NCAA rules limiting the amount of compensation athletes can earn. These constraints create a setting where football and men's basketball programs can generate excess rents compared to what would likely occur in equilibrium if athletic departments were required to pay a market wage to one of their most valuable inputs.[7]

What is the ultimate incidence of these economic rents? To study this, we estimate rent-sharing elasticity regressions following the recent literature in labor economics (Lamadon, Mogstad, and Setzler 2019; Kline et al. 2019). We focus on rents flowing to other sports in the athletic department (in the form of higher spending on these other sports), spending on athletic facilities, and salaries for coaches and other allied personnel who (unlike the players) are not subject to any compensation constraints set by the NCAA.

Our main results are based on a series of panel fixed-effects OLS regressions that include school and year fixed effects, and we measure changes in rents using within-school-over-time variation in the total revenue generated from football and men's basketball programs. We find that increases in revenue generated by the football and men's basketball programs are partly reinvested directly into those sports as increased spending, with an estimated own-sport elasticity of 0.82. Since these sports are almost always profitable (with revenue exceeding expenses, often substantially), the fact that the estimated elasticity is below one means that the reinvestment of revenues in these programs is less than dollar-for-dollar – i.e., there is meaningful residual income that is not spent on these two sports. In addition, the income limits for athletes imply that very little of the increased own-sport spending directly flows to the athletes. Instead, we expect that much of this increased spending within the football and men's basketball programs to be on other factors such as facilities spending and coach's salaries.

[7] This potential for meaningful rent-sharing may be further exacerbated by the fact that athletic departments are legal non-profit enterprises that may find it undesirable or unseemly to show large and persistent excess revenue on their balance sheets.

Using the same rent-sharing specification, we find that the rents not reinvested in football and men's basketball programs are instead transferred to other parts of the athletic department. We estimate cross-sport rent-sharing elasticities for all other sports, women's sports, and other men's sports of 0.42, 0.41, and 0.42, respectively.[8] We also estimate rent-sharing elasticities using data covering salaries for all coaches, salaries for football coaches, administrative compensation, and spending on facilities. For each of these outcomes, we also find meaningful rent-sharing elasticities of 0.40, 0.40, 0.45, and 0.86, respectively.

To interpret these estimates as rent-sharing elasticities, we must assume that the within-school-over-time variation in revenue is plausibly exogenous with respect to other determinants of outcomes such as expenses and salaries. Including school and year fixed effects accounts for some of the most obvious threats to the validity of this assumption (such as national trends or shocks affecting all schools), but there is also the possibility of confounding common shocks that affect revenue across an entire athletic department. Without accounting for such common shocks, we might erroneously conclude there is rent-sharing from football and men's basketball to other sports, while in reality our estimates would simply reflect the impact of the common shocks.

We address this challenge in two ways. First, we extend our panel fixed-effects specification and implement the difference-in-differences strategy developed in the rent-sharing analysis in Lamadon et al. (2019). This exercise supports our causal interpretation given the absence of pre-trends in any of the other outcomes leading up to a sharp change in football and men's basketball revenue. Immediately after the increase in revenue from football and men's basketball, we see sharp increase in spending for those sports as well as sharp increases in spending on all other sports, but no clear change in the revenue of other sports. These results support our interpretation that the causal chain runs from the change in economic rents generated by the revenue sports causing changes in spending on both revenue and non-revenue sports. We see a similar pattern for facilities spending and coaches' salaries. The lack of any clear changes in revenue generated by other sports provides evidence against substantial bias arising from school-wide "common shocks" in our main OLS results.

[8] The all other sports category is the sum of women's sports and all other men's sports (excluding football and men's basketball).

Our second approach is to directly address endogeneity concerns by exploiting the fact that "Power 5" schools receive lump-sum payments from their respective athletic conferences. As we discuss in more detail below, variation in these conference payments is largely based on either the athletic success of the football and basketball programs at other schools or changes in conference media payments. We demonstrate this using as a case study the University of Utah moving into a Power-5 athletic conference in 2012. This case study provides clean "event study" visual evidence (comparing Utah to other Power 5 FBS schools), and the estimates from this case study largely mirror the main panel fixed-effects estimates. We then build on this case study by using conference payments as an instrumental variable (IV) for the revenues generated by football and basketball programs, and we find IV estimates that are broadly similar to our panel fixed-effects OLS estimates. We interpret the broad similarity of the results across the different empirical approaches as supporting a clear causal interpretation: greater rents generated by football and men's basketball increase spending on those sports and on the non-revenue sports, facilities, and coaches' salaries. The increased spending does not lead to additional compensation for football and men's basketball players.

We next build on the rent-sharing estimates by studying the distributional consequences of rent-sharing in college sports. One group benefitting from this rent-sharing are athletes playing in non-revenue sports at the school. As a result of the rent-sharing we estimate, these athletes likely benefit on both the intensive and extensive margin. That is, in some cases the very existence of these sports may be dependent on revenues from football and men's basketball (or on transfers from the university), since most other sports consistently operate with losses. In addition, athletes in these sports likely enjoy more generous facilities and other amenities as a result of the increased spending. Rent-sharing in college sports thus creates additional athletic opportunities and increases spending available for sports that do not consistently generate enough revenue to cover their costs.

There are a variety of mechanisms supporting such transfers within athletic departments. Title IX regulations require (among other things) that schools provide equal opportunities for

athletics across genders.[9] This creates an effectively mechanical relationship between spending on scholarships for football and men's basketball and spending on scholarships for women's sports. The relationship for other types of spending on women's sports (e.g., coaches' salaries and facilities) is less mechanical but could also be influenced by Title IX. However, the connection between the spending on other men's sports, coaches' salaries overall, and total spending on athletic facilities is outside of the scope of Title IX, and these results represent rent-sharing that we do not believe to be related to any prevailing regulations. In fact, given the requirements of equality of opportunity across sports by gender it might be reasonable to expect *less* rent-sharing between football and men's basketball and other men' sports, since such rent-sharing uses up resources that could otherwise be used to help meet the requirements of Title IX.[10]

Regardless of the underlying mechanism, rent-sharing across the various parts of the athletic department creates distributional concerns if there are meaningful differences in the economic circumstances of athletes across sports. To examine this question, we gathered complete roster data on the high school and hometown of every athlete at the "Power 5" FBS schools in 2018, and we merge this data with neighborhood socioeconomic characteristics. We estimate that the average football and men's basketball athlete went to a high school with a median family income at the 49th percentile of all high schools, while for other sports the average athlete's high school was at the 60th percentile. In addition, we show that football and men's basketball players come from school districts with a higher fraction of students living in poverty and a higher fraction of students who are black. This is not surprising since roughly half of all athletes in football and men's basketball are black, compared to only 11 percent of athletes in other sports. We thus conclude from these socioeconomic differences that rent-sharing in intercollegiate athletics effectively involves a transfer

[9] Title IX requires athletic departments to provide equal accommodation and opportunities in three broad areas: student interests and abilities, athletic benefits and opportunities, and financial assistance. It does not, however, require an equal number of men's and women's sports or athletes. For financial assistance, it similarly requires reasonable opportunities for proportionate awards of financial aid given the composition of athletes in men's and women's sports, but does not require an equal number of scholarships to be awarded to men and women (U.S. Department of Education 2020).

[10] Based on our roster data, women's sports have an average of 25.7 players per team compared to 22.9 players per team for men's sports other than football or basketball. Along with our main rent-sharing elasticity estimates, the rough similarity of these numbers suggests that while women's sports receive larger transfers from football and men's basketball activities in the aggregate, transfers on a per athlete basis are similar between women's and men's non-revenue sports.

from students who are more likely to be black and more likely to be from poor neighborhoods to students who are more likely to be white and from higher-income neighborhoods.[11]

To understand the scope of available rents in modern sports, we next calculate a potential wage structure for football and men's basketball players. As a benchmark for this analysis we use collective bargaining agreements in professional sports leagues, following the prior work of Berri (2016) and Goff, Kim, and Wilson (2016). We find that such a system would result in substantial payments to these athletes. We estimate that if football and men's basketball players all split the 50 percent of revenue equally, each football player would receive $360,000 per year and each basketball player would earn nearly $500,000 per year.

These averages mask substantial heterogeneity since certain types of players are more valuable to the athletic success of schools than others. Therefore, we also calculate payments across positions in a manner that mirrors the average professional team for each sport. Under such a system, the two highest paid football positions (starting quarterback and wide receiver) would be paid $2.4 and $1.3 million, respectively. Similarly, starting basketball players would earn between $800,000 and $1.2 million per year. The existing compensation to athletes (scholarships plus stipends) would be subtracted from these totals to arrive at the appropriate cash compensation to players, and we calculate this value separately for every school in our sample. We argue that these compensation estimates represent a plausible benchmark of what athletes could negotiate if they could engage in collective bargaining.

We conclude by discussing the recent responses of universities to various threats to the rents that we have characterized in this paper. These threats include recent litigation relating to the constraints on player compensation, recent legislation that removes some of the limits on player compensation, and the ongoing global coronavirus pandemic. We discuss how university responses to all of these threats are consistent with our rent-sharing analysis.

[11] This paper presents the distributional consequences, but does not carry out a normative (welfare) analysis. Such a welfare analysis would need to consider (among other things) the potential economic benefits of the estimated rent-sharing. For example, Stevenson (2007) documents that the Title IX program caused an increase in college attendance and labor force participation for women. To the extent that such an impact is partly related to increased opportunities for college athletes, changes to rent-sharing could have far-reaching implications that we treat as outside of the scope of this paper.

The next section provides background on intercollegiate sports in the US, discusses the related literature, and describes the various potential recipients of rent-sharing. Section 3 describes the data sources used in our empirical analysis. Section 4 reports the rent-sharing elasticity estimates. Section 5 discusses the distributional consequences that we estimate using roster data. Section 6 reports our player compensation benchmarks. Section 7 discusses university responses to recent litigation, legislation, and the global coronavirus pandemic. Section 8 concludes.

II. Background

While intercollegiate sports are often described as student activities undertaken by amateurs, the economic reality is that athletic departments have developed into complex commercial enterprises that look far more like professional sports organizations than extracurricular endeavors. Kahn (2007) and Sanderson and Siegfried (2015) provide comprehensive overviews of the economic development of this enterprise. What is immediately apparent is that these sports represent meaningful economic activity that is on par with a wide variety of other commercial ventures. Kahn (2007) notes that as far back as 1999 the total ticket revenues for college football and men's basketball exceeded the total ticket sales of professional baseball, football, and hockey. Since that time, the commercial activities of athletic departments have continued to expand. In the remainder of this section we describe the economic landscape of intercollegiate sports and provide more information about the specific categories where rent-sharing may be occurring.

II.A. Intercollegiate Sports Business Models

We begin by characterizing the distinct "business models" within the set of FBS schools. In Figure 1, we use data from 2018 to summarize the business model of modern athletics departments across two dimensions: (1) the share of athletic department revenues that comes from the University (as opposed to commercial ventures) and (2) overall athletic department revenues. The figure indicates two clear "clusters" of schools. One cluster of schools has generally low revenues overall and a large fraction of revenue coming in the form of transfers from the University and/or the student body. The other cluster in the lower-right corner contains schools with meaningfully larger

overall athletic department revenues. For these schools, the vast majority of overall revenue is generated by the direct activities of the athletic department.

To formally determine the clusters of schools, we use a standard k-means clustering algorithm, and the dashed line in Figure 1 represents a hyperplane that divides the sample of FBS schools into two distinct clusters based on this algorithm. As discussed above, the schools in the lower-right cluster correspond exactly to the subset of FBS schools that are members of the so-called "Power 5" athletic conferences: the Big Ten, Pac-12, Big 12, Southeastern Conference (SEC), and the Athletic Coast Conference (ACC). Based on the results of the clustering analysis in Figure 1, we focus our empirical analysis on the schools in the Power 5 conferences, since these are the schools where intercollegiate athletics are likely to generate meaningful economic rents.[12]

Athletic conferences serve a variety of functions including scheduling, establishing rules and regulations, organizing officials, etc. Of greatest relevance to the questions in this paper, conferences also serve as an organizing body for various economic activities. Conferences collectively sell broadcast rights for all member schools and receive payments from the NCAA based on the performance of member schools in postseason tournaments (Hobson 2014). These revenues are then generally split evenly between member schools. In 2017, each Power 5 conference had more than $250 million in annual revenue from football and men's basketball postseason tournament disbursements and media rights alone (Sanderson and Siegfried 2018).

To see the importance of conferences to athletic departments, consider the case of the Big 10 athletic conference. In its 2018 fiscal year, the conference earned nearly $760 million in revenue and paid out over $50 million to each of its conference members.[13] This revenue came from many sources but among the largest were television contracts for broadcasting sports and the conference's television network, the Big Ten Network. There is widespread understanding that the value of these contracts is largely driven by the football and men's basketball programs, which can be seen by

[12] This is similar in spirit to the sample restriction that is made in the recent rent-sharing paper by Kline et al. (2019). In that paper, the authors focus primarily on the firms receiving the most valuable patents; similarly, we focus on the most "profitable" athletic departments, which are the ones most likely to engage in substantial rent-sharing.

[13] While the Big Ten was the most financially successful conference in that year, it was not extraordinary within the Power 5 conferences. For example, the Southeastern Conference (SEC) took in $660 million and paid out approximately $44 million in 2018 (Berkowitz 2019).

comparing the value of these contracts based on which sports are covered. In 2012, ESPN signed a 12-year contract to broadcast the three College Football Playoff games and four of the other most popular bowl games for $7.3 billion, an average annual rate of $608 million (Sanderson and Siegfried 2018).[14] Similarly, the CBS network contract for the sole broadcast rights to the NCAA men's basketball tournament was renewed at the annual rate of $1.1 billion in 2017 through the 2032 tournament. By contrast, the 14-year deal that ESPN signed to broadcast NCAA post-season tournaments for 22 other sports as well as the international rights to the men's basketball tournament and other smaller tournaments was worth roughly $500 million, or $36 million annually (Shaw 2011).

The massive growth in the value of television rights and bowl payments can be seen in changes in athletic conference revenues. Based on IRS-990 filings, the combined revenue of Power 5 conferences increased by nearly 260 percent from 2008 to 2018. By comparison, over the same time period revenues for the NFL and NBA grew by approximately 90 and 110 percent, respectively, (albeit from a higher base).[15]

Most of these conference revenues are distributed to the teams in the form of direct transfers, and these transfers make up a meaningful portion of the budgets for the average department. However, individual athletic departments also earn money in other ways such as gate receipts (i.e., ticket revenues) for sporting events, endorsement deals, and merchandise sales. Ticket sales and donations generate the most revenue of the on-campus activities.[16] In 2019, there were 19 schools that reported at least $20 million in ticket revenue from football alone (Berkowitz 2020). In addition to ticket sales, the individual school endorsement deals with apparel manufacturers such as Nike, Adidas, and Under Armour can be quite valuable – with the top teams receiving several millions dollars per year in both cash and merchandise (Kleinman 2019). For example, the contract for Auburn University is the 10th most valuable current contract, with an estimated value of $3.61

[14] Historically, at the end of every season, the top teams across all conferences play in a series of post season games known as Bowl Games. These are generally paid on or around January 1st. In more recent years, teams have also engaged in a four team College Football Playoffs (CFP) that pits the top 4 teams against each other in an attempt to identify a national champion. Both the bowl games and the CFP generate large amounts of revenue for participating schools.
[15] The growth in NBA and NFL revenues comes from the Forbes team valuations for each league.
[16] A large fraction of donations to athletic departments has historically come from programs that require donations to purchase football season tickets, so these donations should largely be thought of analogous to ticket revenue. This pricing system was common because prior to the Tax Cuts and Jobs Act, 80 percent of the price paid in the form of a donation was tax deductible (Berman 2018).

million in cash and $2.25 million in products per year. In our finances data for public Power 5 schools, we find that ticket sales and donations account for roughly 40 percent of total revenue across all schools in 2018, with corporate sponsorships, advertising, and licensing around 10 percent.

Examining athletic department revenue in addition to conference revenue provides a more complete picture of the scale and growth of this commercial enterprise. Based on our data on athletic department finances at public schools in the Power 5 conferences, average athletic department revenue in our sample grew over 60 percent from 2008 to 2018 and now stands at nearly $125 million. Most of this revenue comes from football, men's basketball, and "non-sport revenue" – a category that often includes valuable things such as television contracts and other media rights. As suggestive initial evidence of meaningful rent-sharing, over that time period the net-income from revenue sports has increased as has the spending on all other sports, coach's salaries, and administrative compensation. The increased spending on non-revenue sports caused a 71 percent increase in the losses generated in those sports – losses that (at least in the time series) appear to be funded by the rents generated by the two revenue sports (football and men's basketball).

Despite this growth in the commercial success of modern college athletics, the players are largely prohibited from profiting from their participation. According to NCAA regulations, financial support for players was historically limited to the official costs of tuition, fees, room and board, and books. Estimates of these costs are dictated by the university's financial aid office and apply to all students. Partly driven by the controversy over the lack of payments for college players, in 2015 schools in the Power 5 conferences allowed these aid packages to also include an additional stipend that was meant to cover the "cost of attendance." Again, this amount was dictated by the financial aid office and there was some variation in the value of these packages across the schools. In 2015 the additional stipend at Boston College was $1,400 while at the University of Tennessee the stipend was $5,666.[17] These additional cost of attendance stipends are paid to all scholarship athletes and not just those in football and men's basketball, with athletes in other sports on partial scholarships receiving partial cost-of-attendance stipends.

[17] A recent study on the impact of these cost-of-attendance stipends found that higher additional allowance amounts were positively correlated with average football recruit quality in the year following the rule change (Bradbury and Pitts 2018).

Beyond these stipends and scholarships, athletes are not allowed to profit in any way from their participation in these sports. This includes restrictions on athletes profiting from the use of their image, likeness, or signatures. Several athletes and their schools have been sanctioned by the NCAA for infractions such as selling signatures and memorabilia for relatively small dollar amounts and services such as tattoos (Schlabach 2011). Penalties for schools involve, among other things, the forfeiture of games, returning revenue, bans on future post season play, and the removal of scholarships. In rare circumstances, coaches can be sanctioned with a "show cause" penalty that makes it meaningfully harder for other schools to hire them in the future (Auerbach 2014). Players can also have their eligibility revoked, which means they are unable to play for any NCAA program.

Recently, the potential scope of penalties and enforcement has increased. In 2017, 10 individuals were charged with a variety of federal crimes including bribery and wire fraud for their roles in a system to pay high school and college basketball players to steer them towards particular schools (Staples 2019). During the course of the trial, tape recordings were introduced that either documented or suggested that college coaches were aware of payments goings to these athletes.

II.B. Previous Research Examining Economic Rents in College Athletics

There is some previous research examining related questions about the economic rents generated by college athletes. Of particular relevance to our questions regarding rent-sharing and potential compensation for athletes, a number of studies have attempted to calculate the marginal revenue product (MRP) for each football player. These efforts mostly follow the methods proposed by Scully (1974) and date as far back as Brown (1993), which attempts to calculate the MRP of elite college football players. Using a small sample of schools, this paper finds that each NFL draft pick was associated with $500,000 in extra revenue for a school. Brown (2011) updates this estimate to include more schools and finds that by 2005 an NFL draftee was worth around $1 million for a school on an annual basis. Lane, Nagel, and Netz (2014) take a similar approach in estimating marginal revenue products of men's college basketball players. More recently, a series of papers have used recruiting rankings to estimate the MRP of college football and basketball players (Borghesi 2017; 2018; Bergman and Logan 2020). An advantage of this approach is that it leverages a metric of

skill that is measured prior to an athlete entering college and is available for all players. These studies provide consistent evidence that the estimated MRP for players exceeds the scholarship value for all recruits of the quality that typically attend Power 5 schools – with an even larger gap for the highest-skilled athletes. One difficulty in interpreting these studies is the potential for reverse causality -- that is, do high-revenue schools attract good athletes, or do good athletes increase revenues for schools? Including school fixed effects can address this difficulty if the school-specific factors are time-invariant, but this reduces the estimated MRP by roughly 70 percent (Bergman and Logan 2020). Additionally, there are several time-varying factors such as new coaches or better facilities that could simultaneously increase revenue and attract higher-skilled athletes – which could bias estimates of the athlete's MRP.

An additional difficulty discussed in the literature is that contemporaneous revenue is a function of both current success and past performance (in the form of television revenues). As discussed in Berri, Leeds, and Von Allmen (2015), this means that efforts to calculate the MRP of athletes using their impact on overall revenue will likely underestimate how much they would likely be paid under collective bargaining – since payment is a function of both their MRP and their ability to bargain for a portion of the fixed revenues. For our analysis of player compensation we use the realized outcome of negotiations in the professional sports leagues as a benchmark to guide how much revenue the players would capture in the absence of current constraints. Similarly, we use data on the distribution of salaries in the professional leagues to estimate a potential distribution of salaries for college players. Berri (2016) and Goff, Kim, and Wilson (2016) are some examples of earlier work that takes a similar approach to estimating salaries for college athletes.

Other authors have also attempted to calculate whether certain parts of the college sports value chain are capturing excess rents. These studies primarily focus on a single part of the value chain in isolation and lack the complete financial data that we have gathered in this paper. For example, Leeds, Leeds, and Harris (2018) examines whether coaches capture a greater share the economic rents than would be expected given their on-the-job performance. Similar to our results, they find that coaches capture a portion of the rents that exceed their on-the-job performance.

Finally, other authors have hypothesized that the existing system of rent-sharing results in a shifting of resources between athletes with meaningfully different economic backgrounds. Perhaps the clearest example of this would be Sanderson and Siegfried (2015), who discuss this possibility in their argument for paying college athletes. However, we are not aware of existing research that empirically examines the distributional consequences of the existing rent-sharing system. We are able to directly address this question using our novel athlete-level data matched to neighborhood characteristics.

I.C. Potential Recipients of Rent-Sharing

Our primary goal of the rent-sharing analysis is to determine the ultimate economic incidence of the rents created by football and men's basketball programs. We focus on the following potential recipients: (1) non-revenue sports (i.e., women's sports and other men's spots); (2) salaries for coaches and spending on other administrative personnel in the athletic department; and (3) spending on athletic facilities. We provide background on each of these categories before discussing our data.

II.C.1 "Non-Revenue" Sports

While the financial health of athletic departments is clearly tied to football and men's basketball, these two sports comprise a minority of the intercollegiate sports played at universities. The Power 5 schools in our sample offer 8.2 men's and 10.8 women's sports on average. While each school chooses different sports, the most commonly offered sports for men (other than football and men's basketball) are golf and baseball. For women, the most commonly offered sports are basketball, soccer, and tennis.

Figure 2 shows trends in average net revenue over time for football, men's basketball, women's sports, and other men's sports. Net revenue is defined as revenue minus expenses, and the average that is reported is averaging across the Power 5 schools in our sample. Figure 3 reports various panels that depict histograms of the net revenue by these same categories of sports for the same sample of schools. Profitable activities are largely limited to two sports: football and men's basketball. While the spending for these revenue sports is meaningfully higher, they still generate

large surpluses with an average net income in 2019 of $16.9 million. By contrast, the non-revenue sports have average net incomes that are meaningfully negative with an average net income in 2019 of $-1.4 million.[18]

Non-revenue sports lose money despite the fact that athletes in these sports receive less financial support per athlete than the revenue sports. For each sport there is a maximum number of full scholarship equivalent scholarships that can be awarded at each school. For most sports (i.e. nearly all sports except for the revenue sports), this number is significantly less than the typical roster size and most athletes receiving aid are on partial scholarships. Schools are also limited by a maximum number of athletes than can receive any athletics-related aid per sport. For example, in baseball there is a limit of 11.7 full scholarship equivalents that can be divided among up to 27 athletes. Football, men's basketball, and a few women's sports (basketball, gymnastics, tennis, and volleyball) are what the NCAA call equivalency sports. This means that the number of full scholarship equivalents is equal to the maximum number of athletes that can receive athletics related aid (National Collegiate Athletic Association 2017).

The clear distinction in net income across the categories of sports provides *prima facie* evidence of rent-sharing across these activities. This is particularly true in light of Figure 1, which shows that very little of the support for Power 5 conference athletic department comes from the university. This runs contrary to the belief of many that these sports are largely financed by the university.[19] Given the lack of institutional support, the only way for schools to continue to offer unprofitable sports is through a transfer of the rents generated by the profitable sports.

II.C.2 Salaries for Non-Athletes

[18] These net incomes are adjusted by the imputation procedure to fix misreported revenue values described in Section III and Appendix Section II. The average unadjusted net income of non-revenue sports was $-1.15 million

[19] There are of course questions about whether donations to athletic departments would otherwise go to the University and therefore represent a subsidy from the school to the athletic department. The direction of this effect is unclear. Both Meer and Rosen (2009) and Anderson (2017) demonstrate that athletic success leads to increased donations to the University. Similarly, Tabakovic and Wollmann (2019) find that unexpected athletic success leads to more donations and research productivity for the University. While this does not definitively answer the question of donations would change if schools stopped participating in sports altogether – it does suggest that the story is more complicated than a subsidization of athletics by the University.

The athletes participating in non-revenue sports are not the only likely beneficiaries of rent-sharing in college athletics. Coaching salaries have grown substantially along with athletic department budgets. As an illustrative example, consider the case of football coaches at Texas A&M University. In 1982, Texas A&M attempted to hire famed University of Michigan Coach and Athletic Director Glenn "Bo" Schembechler, for the then-record sum of $3 million over a 10-year period (Henning 2020). Fast forward to 2017, when Texas A&M hired Florida State Coach Jimbo Fisher at a fully guaranteed salary of $75 million over 10 years. In addition, Texas A&M was forced to pay out approximately $10 million to Kevin Sumlin, the coach who was fired to make room for Fisher.[20]

In our data, we find that average salaries of Power 5 football coaching staffs at public schools grew from $4.8 to $9.8 million from 2008 to 2018. Football coaches, however, are not the only coaches enjoying large salary increases. Coaches for all other sports at Power 5 schools have also seen their salaries increase from $7.3 to $12.5 million, which is roughly a 70 percent increase in just a decade. Similarly, there have been corresponding increases in spending on non-coaching administrative salaries as well. From 2008 to 2018 these increased from $12.1 to $22.3 million. Over this same time period, the support for athletes in revenue sports increased from $3.6 million to $5.3 million – an increase of only 47 percent.[21]

II.C.3 Athletic Facilities

The final category of rent-sharing that we examine is spending on athletic facilities. Unable to lure athletes with competitive compensation packages, schools have increasingly invested in lavish athletic facilities containing a variety of amenities. For example, the University of Central Florida built a $25 million facility that included a lazy river (Hobson 2017). Clemson University built a "football-only" facility at a cost of $55 million that includes features such as laser tag and miniature golf (Hobson and Rich 2015). Describing the facility, the athletic department spokesman said, "it'll

[20] There was no language in Sumlin's contract that lowered that buy-out amount if he went on to get another coaching job – which he did as the coach of the University of Arizona (Kirshner 2018).

[21] This support is based on an average aid book value of $36,889 in 2008 and $54,271 in 2018. The increase in this the value of the aid reflects both rising tuition and an increase in the generosity for non-tuition items.

be their home on campus, when they're not in class." In an analysis of 48 schools in the Power 5 conferences, the *Washington Post* found that the schools spend $772 million on athletic facilities, which represents a nearly 90 percent increase in spending from 2004 (Hobson and Rich 2015).

While it could easily be argued that these lavish facilities constitute a meaningful fringe benefit (i.e., compensation through non-wage amenities) – it is worth noting that professional athletes also enjoy access to many luxurious facilities. That said, there has been a meaningful increase in the spending on college facilities in recent years – much of which appears to be an attempt to compete for athletes who cannot be paid a market wage. Describing the spending, a member of the University of Colorado Board of Regents said, "By the time we're done … we'll be right back behind them all again. It's a never-ending arms race to build shiny objects that appeal to 17-year-olds so they'll pick us instead of someone else" (Hobson and Rich 2015).

The largest facility expenditures are certainly for the revenue sports. However, all sports appear to benefit from this spending. Describing the growth of facility spending, the *Washington Post* said that schools "have built baseball stadiums, volleyball courts, soccer fields, golf practice facilities and ice hockey arenas with money largely derived from powerhouse football teams and, to a lesser degree, men's basketball teams" (Hobson and Rich 2015).[22]

III. Data

To fully explore rent-sharing and its distributional consequences, we combine athletic department financial data with roster data matched to neighborhood socioeconomic characteristics.

III.A. Athletic Department Financial Data

Our data on athletic department finances comes from two primary data sources: (1) EADA and (2) the Knight Commission. We discuss each of these in turn.

[22] Beyond the athlete's enjoyment of these facilities, this spending benefits the multitude of architects, construction companies, and other vendors that plan and build these facilities. The construction of numerous indoor training facilities has developed a growing cottage industry of firms catering to this business. Consider the very existence of SportsPLAN – a firm that "provides specialized architectural master planning, programming, design and personal services to architects, universities, colleges, and municipalities." Describing the increase in business over time, Joel Leider a SportsPLAN architect discussed that historically few teams had indoor practice facilities outside of the Midwest. Now, most major schools have indoor practice facilities, and more than 20 firms have entered the design space for such facilities (Hobson and Rich 2015).

III.A.1. Equity in Athletics Data Analysis (EADA)

The EADA data set covers 2003-2019, but we omit all years prior to 2006 from any analysis because of data quality issues.[23] Over this time period, we have data on 64 of the 65 teams in Power 5 conferences for all years, and coverage of all schools for the final 11 years.[24] The EADA contains a complete accounting of revenue for the athletic department. This includes sport-specific data as well as spending that cannot be directly attributed to a sport. However, these data do not provide any information about the nature of spending or revenues within a sport.

Schools are required to contribute to the EADA to receive Title IV funding (which includes Pell Grants and direct federal student loans), but they maintain some discretion in how these data are reported. We observe revenue and expenses separately for each sport, covering the 2005-2006 through 2018-2019 school years. Schools also report additional "non-sport" revenue and expenses that are not allocated to a specific sport, which complicates some of our analysis. Examining the data carefully reveals that schools allocate non-sports revenue using different rules. This is most apparent when it comes to the treatment of revenue received from conferences, which some schools count as entirely non-sport revenue while others allocate either all or in part to specific sports. Such funds include payments for media rights as well as revenue-sharing for post-season activities. The amount of revenue sharing is at the discretion of the conference. For example, revenue sharing in the Big Ten is quite expansive and even includes large portions of each school's football gate receipts (Dochterman 2013). In addition, in some conferences the newer members receive only partial payments, and some members who are banned from postseason play (e.g., for rules violations in previous years) do not partake in revenue sharing over bowl payments (Schlabach 2017).

While schools exhibit variation in how they account for this money, it seems readily apparent that it is primarily attributable in some way to football and men's basketball. This can be verified by looking at school accounting. Using external data on the annual value of conference and TV

[23] Academic years split the calendar year. For ease of discussion, throughout the paper we adopt the convention of referring to years by the end of the academic year, so 2003 refers to the 2002-03 academic year while 2018 refers to the 2017-18 academic year.
[24] Prior to 2009, the University of Maryland does not report EADA or Knight Commission data. Data for Maryland is included when available.

payments, Appendix Table OA.15 shows that fluctuations in these funds are associated with changes in either non-sports revenue or sport specific revenue for football or men's basketball. We find no change in the revenue for the non-revenue sports. We also find evidence that these differences reflect accounting practices rather than substantive differences in sources of revenue. Appendix Table OA.16 shows that identical changes in conference revenue appear almost entirely in football and men's basketball revenue for schools that have low non-sport revenue shares on average, while for schools with high average non-sport shares these revenues appear in the non-sport category. Therefore, when we consider fluctuations in revenue generated by revenue sports, we consider a composite variable that combines football, men's basketball, and non-sport revenue reported in the EADA. This provides the most accurate measure of the economic rents available for sharing.

One concern with the EADA is data quality (Dosh 2017). While recent work finds that the data performs well under simple data quality tests (Jones 2020; Tatos 2019), we find one significant data quality issue that is particularly relevant for our rent-sharing analysis. Close examination of the EADA data reveals numerous school-sport-year observations where the revenue and expenses are exactly equal for non-revenue sports. While it is possible these data reflect actual economic circumstances, we find this explanation highly unlikely for several reasons. Sport-specific spending includes categories such as bills for travel, medical services, and other services that exhibit unpredictable variation across years. In addition, the revenue includes things such as gate receipts – which also vary meaningfully across years in ways that are difficult to exactly forecast. The odds that these variable revenues and expenses will exactly equal each other at the end of the year is unlikely, even in sports that are intended to break even. In addition, observations with zero net income are highly concentrated in particular school-years. Of the 907 total EADA school-year observations, 137 have a sport with zero net income, and 121 of these have eight or more sports with zero net income.

Additionally, Appendix Figure A.3 shows that the mass of the school-sport-year with exactly zero net income lies in the right tail of the overall distribution of school-sport-year observations for these sports. As discussed in Appendix Section II, the zero net income instances occur almost entirely through an increase in revenue (and corresponding increase in net income), with effectively

no change in spending (expenses). Therefore, we interpret a sport-specific observation with zero net income as a likely misreporting of revenue.

To address this problem, we impute revenue for the small subset of observations where the reported net income leads to concerns about data manipulation. More information about the inclusion criteria and the imputation methods are contained in Appendix Section II. Ultimately, our imputation procedure represents an effort to appropriately classify revenue in particular categories. Our procedure leaves school-level total revenue unaffected as we make corresponding changes to the "non-sport" revenue of each school after every sport-level imputation. Overall, revenue is imputed for only 9.6 percent of all school-sport-year observations, and our main rent-sharing elasticity results are robust to either not imputing any data or dropping all imputed observations.

III.A.2. Knight Commission data

The EADA data set has the advantage of wide availability across both school and years, but the data does not have specific accounting variables beyond the aggregate revenue and spending by sport, which limits what we can observe regarding the internal operations of athletic departments. We therefore supplement the EADA financial data with data from the Knight Commission – an organization formed in 1989 with a mission to "strengthen the educational mission of college sports." As part of this mission, the Knight Commission maintains the College Athletics Financial Information (CAFI) database. This database is a compilation of financial information submitted by public universities – which are required to disclose information about their underlying economics. An advantage of these Knight Commission data is that they provide a far more granular view of the revenues and expenditures of modern college athletic departments. However, only public universities are required to disclose the information that underlies the database. For this reason, our Knight Commission data only contain information from 46 of the 65 Power 5 schools that are in the EADA data.[25] These excludes some influential private schools such as Stanford University, the University of Notre Dame, and Northwestern University. These data are available from 2005-2018 and contain 595 total school-year observations.

[25] Data are available from the University of Maryland from 2009-2018.

Despite the limited coverage in terms of the number of schools, the Knight Commission data contain a number of important financial variables that are critical to our analysis, including detailed revenue categories such as ticket sales, donations, sponsorship and advertising, institutional support (student fees and general university/government funds), and a revenue category that includes NCAA and conference disbursements from postseason tournaments and TV contracts. The data on conference disbursements form the basis for our instrumental variables strategy. The Knight data have similarly detailed information on expenditures including total compensation for coaches and administrators, spending on facilities, and total student aid for athletes.

III.B. Student Roster and Demographic Data

Our second main category of data measures the demographics and socioeconomic characteristics of athletes participating in each sport. We obtained complete roster data from each school in our sample by scraping athletic department websites in October 2018. While each school differs in the format of their roster, a consistent and valuable feature is that the hometown and previously-attended school (most often the athlete's high school) are both typically listed. Using the scraped roster data, we match athletes to their respective Census Designated Place (CDP) and county.[26] Our matching procedures for CDP and county matches 93.4 percent of athletes where a U.S. hometown is listed.[27] Appendix Table OA.13 shows sample statistics on the number of athletes observed with each characteristic and the number matched to specific cities/counties and public high schools.

For our distributional analysis, it is also important to match athletes to their specific high school – which for many athletes would provide a better measure of their neighborhood.[28] Due to data constraints, matching high schools for athletes is far more difficult than matching to CDP and county. For example, the "previous school attended" is most often a high school but at times is a

[26] This is done using fuzzy text matching for the hometown listed for the athlete. We also match by hand any listed hometowns that appear in the roster data 10 or more times but are not matched by the algorithm. This solves problems such as matching common alternative names, e.g. this matches all athletes with "Brooklyn, NY" listed as their hometown to the New York, NY CDP.
[27] The fraction not matched is largely consistent with the share of foreign athletes participating in NCAA sports.
[28] High school catchment areas are often geographically smaller than CDP and counties. An obvious exception to this being a better match for family income are athletes that attend private high schools or sports training academies.

previous college. In addition, some students attend preparatory schools, private schools, or training academies – none of which provide accurate information about the family income student to the same degree as a local public school. Therefore, we only attempt to match athletes to the set of public high schools in the county or counties of their hometown. This both improves the match quality and limits our sample to high schools that provide geographic information that is relevant to proxying for family income. Our final analysis sample results in 29,556 athletes matched to a CDP/county, with 16,794 of these athletes matched to a public high school.[29] More discussion of the matching procedure and details on the match rate can be found in Appendix Section I.

We use the matched roster data to compute a variety of socioeconomic statistics from the Census. Except for the constructed variable of mean household income, all variables come from the 2000 Census SF3 and SF1 files, imputed to 2010 census tract geographies.[30] Just 0.7 percent of the observations in the census dataset are missing, which is due to data suppression. We then aggregate this tract-level census data to the school level using a school catchment area to tract crosswalk described below.[31]

We are left with a dataset of 15,184 athlete-sport observations for which all census variables are matched, from an original roster dataset of 35,721 athlete-sport observations. Of the 35,721, 18,927 athlete-sports were not able to be matched to NCES IDs, leaving 16,794 possible matches. Of the possible matches, 1,610 observations are missing from the crosswalk/census file, leaving us with our sample of 15,184. Only 64 unique colleges are represented in the final dataset because Clemson's online roster does not include high school information.

For students whose hometowns are reported in the roster dataset, we also match to city-level demographics. Since doing this does not require matching to NCES ID, the dataset is much larger (27,737 observations); however, matching at the city level rather than school level is coarser and aggregates over the economically meaningful heterogeneity that exists within a city between schools.

[29] Clemson did not have previous school listed on any of the rosters, so the high school sample of schools comes from only 64 colleges.
[30] The mean household income variable is derived by dividing aggregate household income by the number of households, in a calculation done by Social Explorer.
[31] 99.98% of schools have census information for at least one census tract in the catchment area, and 96.9% of schools have census information for all tracts.

We choose school-based matching as our preferred estimates, but the patterns we find are all robust to instead matching based on hometown as shown in Appendix Table OA.7.

III.C. Other Data

Our data on public high schools comes from the Stanford Education Data Archive school directory (Reardon et al. 2018). The crosswalk between census tracts and high schools is created using data on the intersection of census tracts with high school catchment areas in 2017.[32] Data on professional football and basketball salaries from the National Football League (NFL) and National Basketball Association (NBA) come from the website Spotrac. Finally, all data on college athlete race/ethnicity/nationality and graduation rates comes from publicly available data provided by the NCAA. All dollar figures are converted to 2018 USD using the CPI-U.

IV. Rent-Sharing in Intercollegiate Athletics

In order to fully understand the scope of rent-sharing in intercollegiate athletics, we examine the relationship between the revenue earned by football and men's basketball and a variety of economic outcomes. We begin by estimating a series of panel data regressions examining how changes in the revenue generated by football and men's basketball impact non-revenue sport spending, non-athlete salaries, and facility spending. We assess the validity of a causal interpretation of these estimates by examining shocks to football and men's basketball revenue that are plausibly unrelated to other factors that could drive changes in our other economic outcomes of interest.

IV.A. Panel Data Estimates

If other parts of the athletic department are sharing in the economic rents earned by football and men's basketball, then we should observe a systematic relationship between the spending on these other outcomes and the revenue earned by football and men's basketball

[32] These data were provided by Peter Bergman, with the original data coming from Maponics (2017).

A first question is which data represents the revenue generated by football and men's basketball. As described above, schools have a variety of means of accounting for revenues. The most obvious revenue generated by football and men's basketball are those that are directly earned by those sports such as ticket revenues and concessions sales. However, a large fraction of the revenue for modern athletic departments comes from the sale of television rights, merchandise, athletic sponsorships, etc. While some schools account for that revenue under a sport-specific category, others classify this as "non-sport" income. The most logical interpretation is that the revenue from conference payments and television contracts are generated by the revenue sports – which are the assets that largely determine the value of these payments. Therefore, in our panel data specifications we consider football and men's basketball revenue to be the sum of sport-specific revenue (for revenue sports) plus non-sport revenue. Using this as our key right-hand side variable, we estimate the following panel fixed effects regressions:

$$\log(y_{it}) = \gamma_i + \delta_t + \beta \log(\text{FB/MBB revenue + non-sport revenue})_{it} + \varepsilon_{it} \quad (1)$$

where i indexes schools and t indexes years, and γ_i and δ_t are school and year fixed effects, respectively. The outcome variable y_{it} is included in logs so that the key coefficient β can be interpreted as a rent-sharing elasticity. The key assumption for the estimate to represent a causal rent-sharing elasticity is that the error term is uncorrelated with unobserved determinants of y_{it} conditional on school and year fixed effects.

Table 2 reports OLS estimates of equation (1) for a range of different outcomes. Standard errors are clustered at the college level throughout. The first column of Panel A contains the estimated effect on logged football and men's basketball spending. This estimate suggests a relatively large "own-sport" elasticity of 0.82. Columns (2) through (4) provide estimates that help to understand the amount of revenue sharing with other sports. For example, the estimate in column (2) describe the change in logged spending for all other sports and finds an elasticity of 0.416. Breaking out all other sports into women's sports and other (non-revenue) men's sports leads to similar elasticity estimate (columns (3) and (4)).

An immediate concern with interpreting these results causally is that there could be school-level shocks that affect spending in all sports, which has nothing to do with rent-sharing from football and men's basketball to other sports. One way to address this concern is to include conference-by-year fixed effects. This throws away some variation that we may think is plausibly exogenous (such as variation in conference payments over time), but if school-wide shocks are correlated across schools within a conference, then this specification can assess bias from common shocks. Panel B of Table 2 contains the estimates from a specification that also includes conference-year fixed effects, and the results are remarkably similar to those without these additional controls.

Another way to investigate this concern is to estimate the direct relationship between football and men's basketball revenue and the revenue generated by other sports. To do this, we include revenue generated by other sports as the outcome in equation (1). If a confounding factor is increasing revenue across all sports simultaneously, then this analysis will estimate a positive and statistically significant estimate of β. These estimates are reported in Table 4. For both specifications with and without conference-year fixed effects, we find no evidence of a statistically or economically significant relationship between the revenue generated by football and men's basketball and the revenue generated by the other sports in an athletic department. This provides additional evidence that our estimates in Table 2 are not simply reflecting a general economic improvement across sports in the athletic department, but rather genuine rent-sharing within the athletic department.

To further assess the validity of a causal interpretation of our main results, we next implement the difference-in-differences methodology for rent-sharing developed in Lamadon et al. (2019). This procedure provides a clear visual depiction of the variation in the data underlying our panel fixed effects estimates. It does so by exploiting variation in the changes in revenue over time to create treatment and control groups and then presents an event study figure based on averages of these treatment-control comparisons. Specifically, for every year in our data we measure the annual change in the revenue for the summation of football, men's basketball, and non-sport revenue. In any year, schools with an above-median increase in this change are classified as a treatment group and the remaining schools serve as the control group. Using this framework, we estimate an event study regression for each year; i.e., we redefine the treatment and control groups based on each

annual change. This results in a series of event study coefficients. We then graph the average of these coefficients for the four years before and after the "treatment year," i.e. the year in which we calculated the revenue change to assign groups.

The procedure results in a graphical summary of the variation underlying our main rent-sharing results. For example, Figure 4 contains these estimates for rent-sharing between revenue and non-revenue sports. Panel A contains the estimates for the change in revenue for football and men's basketball. As would be expected if the procedure was accurately identifying revenue shocks, the trend in revenue prior to the treatment year is largely flat and then swiftly increases for schools that experience a revenue shock compared to those that do not. For panels B through E, we provide estimates for the same procedure for expenses for football and men's basketball, all other sports, women's sports, and non-revenue men's sports, respectively. To ease interpretation, in each figure we include a dashed line representing the change in revenue from Panel A.[33] Consistent with the results in Table 2, Panel A of Figure 4 shows that the increase in revenue leads to an increase in spending for football and men's basketball. However, as in Table 2, this increase is again not one-for-one. The other panels show there was also a meaningful increase in spending for the non-revenue sports.

Importantly, the estimated event study coefficients for spending on these sports prior to the treatment year were largely flat and very close to zero. The pattern of these estimates combined with the lack of a relationship between revenue from football and men's basketball and the other sports supports a causal interpretation of our panel data estimates rather than simply a continuation of pre-existing trends in spending. Further supporting the causal interpretation are the patterns in Figure 5, which show no similarly-clear increase in revenue for the other categories of sports. Thus, increases in football and men's basketball revenue are not associated with increases in revenue of other sports, and lead to increases in spending on these other sports

The discussion in Section II.C and the descriptive statistics in Appendix Table OA.17 suggest that rent-sharing is not limited to the non-revenue sports but also extends to salaries for all

[33] We follow Lamadon et al. (2019) and do not present confidence intervals in the main figures. Appendix Figure OA.2 reports bootstrapped confidence intervals for Figure 4 based on 1,000 bootstrap iterations, resampling schools with replacement and taking the same simple average across regression models (as described in the main text) in each bootstrap iteration.

coaches, salaries for football coaches, salaries for administrative personnel, and facilities spending. Table 3 reports rent-sharing elasticity estimates for these additional outcomes, and we find meaningful rent-sharing elasticities of 0.40, 0.40, 0.45, and 0.86, respectively. As in Table 2, these results are robust to conference-year fixed effects.[34] Figure 6 contains the estimates from the same Lamadon et al. (2019) difference-in-differences procedure as in Figure 4 for these additional categories. Across all spending categories, the estimated change in spending prior to the increase in football and men's basketball revenue is both flat and close to zero, and there is clear visual evidence of increases in spending on these categories following increases in revenue from these sports. This continues to provide evidence supporting the causal interpretation of our rent-sharing elasticities and indicates additional recipients of rent-sharing within the athletic department.

IV.B. Instrumental Variable Analysis

The supportive visual evidence leads us interpreting our panel fixed effects estimates as valid rent-sharing elasticity estimates. However, to further support the causal interpretation of our panel data estimates, we also report complementary results from an instrumental variables strategy that exploits variation in revenues generated by the substantial transfers from conferences to athletic departments. As detailed above, these revenues primarily accrue from payments to the conference resulting from bowl game participation by all members, NCAA tournament revenue, and revenue from media rights contracts (i.e. television rights). In this way, these revenues are not directly related to the success of any individual school's team – but are clearly the result of that school participating in football and men's basketball.

Consider the case of bowl revenue. Conferences receive substantial payments when football teams qualify for post-season bowl games – and therefore by definition this revenue varies by year.[35] As an example of the sources of variation in these payments consider the case of the Big 10 and Pac 12 conference in 2019. In that year, the Big 10 conference received an additional $6 million in

[34] Note that the sample of schools changes slightly because these measures are not available for all schools, so Appendix Table OA.1, Panel C confirms that the main results in Table 2 continue to hold within the subsample of schools where we can measure these additional outcomes.

[35] College football bowl games are post-season contests that are played primarily by NCAA FBS schools. Bowl games pay the teams for participation, and the money is shared within the conference. Roughly half of all FBS schools play in a bowl game each year.

payments because Ohio State earned a spot in the Fiesta Bowl and an additional $4 million for Penn State's berth in the Cotton bowl (Dosh 2019). These payments were in addition to the annual $40 million the conference receives each year as part of its ongoing contract with the Rose Bowl and its $66 million base payment from the College Football Playoffs (CFP). By contrast, in the same year teams in the Pac 12 had less successful seasons and did not receive invitations for any additional high-revenue bowl games. Therefore, the conference only received its regular $40 million for its contract to take part in the Rose Bowl and its $66 million CFP base payment from the College Football Playoffs. Given that the Big Ten shares all bowl revenue equally, this means each Big Ten athletic department received over $700,000 in additional revenue simply because of the successful seasons of the Ohio State and Penn State football teams. Conferences also receive payouts for participation in the annual "March Madness" men's basketball tournament – with part of the payments being based on the number of teams that qualify for the tournament.[36] In addition to payments related to the success of other teams, schools also receive substantial payments from their conferences for media rights. These payments are not explicitly tied to the decisions of any one school and vary both over time and across conferences. In modern athletics, these media payments have grown substantially in value (Sanderson and Siegfried 2018).

To demonstrate the importance of conferences in the revenue generated by football and men's basketball we begin with a case study of the University of Utah – which moved from the relatively small Mountain West athletic conference to the larger and more financially sophisticated Pac 12 conference in 2012 (the decision was announced in June 2010). Figures 7 and 8 show the changes in revenue and spending from various categories from Utah's athletic department over this time period. For comparison we also provide the average for all other Power 5 teams over this time period. The top-left panel contains Utah's revenue from conference payments and shows a marked increase that begins immediately after its transition into the Pac 12 conference. Similarly, the top-right panel shows a swifter increase in revenue for football and men's basketball after joining the conference. Admittedly, this increase follows an already-increasing trend, but the figure shows clear

[36] Conferences receive payments based on the success of their members in the men's postseason basketball tournament. Conferences earn "units" based on each stage of the tournament that their teams advance to. Each year's payments are based a six-year rolling average of NCAA tournament performance.

"convergence" in football and men's basketball revenue for the University of Utah after joining the Pac 12. This trend reflects Utah's success in these sports, and it was arguably this success that made Utah an attractive target for moving to the Pac 12 in the first place.

All of the spending variables in Figures 7 and 8 follow the pattern established by our panel data estimates – i.e., increases in revenue generated by the activities of the football and men's basketball teams causing higher spending for all of the other sports, higher salaries for coaches and other personnel, and higher spending on facilities. To provide some sense of the magnitude of these changes, Appendix Tables OA.4 and OA.5 report difference-in-differences estimates of the change in revenue and spending before and after the conference transition, and the estimates are similar in magnitude to the OLS estimates in Tables 2 and 3.

While the Utah estimates are only a single case study of a school switching conferences, they provide visual and empirical evidence that supports our main panel data estimates. Additionally, the case study demonstrates the economic importance of conference payments. This motivates our instrumental variables analysis under the assumption that changes in these payments cause an increase in available revenue for an athletic department that is not directly related to other factors that would cause increased spending. Thus, we argue that we can use conference payments directly as an instrumental variable to estimate the following two stage least squares (2SLS) regression model:

$$\log(\text{FB/MBB revenue+non-sport revenue})_{it} = \propto_i + \lambda_t + \pi \log(\text{Conference payments})_{it} + \upsilon_{it} \quad (2)$$

$$\log(y_{it}) = \gamma'_i + \delta'_t + \beta^{IV} \log(\text{FB/MBB revenue+non-sport revenue})_{it} + \varepsilon'_{it} \quad (3)$$

where i indexes schools and t indexes years (as above), and $\log(\text{Conference payments})$ is the excluded instrument that is in the first stage (equation (2)) but not in the second stage (equation (3)). As with the OLS model in equation (1), the outcome variable y_{it} is included in logs so that the key coefficient β^{IV} can be interpreted as a rent-sharing elasticity. In this model, the key assumption is that the excluded instrument is exogenous conditional on the fixed effects and only affects the outcome through its effect on football and men's basketball revenue.

Table 5 reports the 2SLS estimates of equations (2) and (3). Column (1) contains the first stage estimates of equation (2), which demonstrates that conference payments have a strong effect on the revenue generated by football and men's basketball, with an associated first-stage F-statistic of 37.34. While our instrument is strongly correlated with the endogenous right-hand side variable, our instrument bears little relationship to the revenue in other sports as can be seen in Appendix Figure OA.3. The only strong relationship in the data is between conference payments and the revenue for football and men's basketball. This supports our assumption that these conference payments largely reflect factors related specifically to football and men's basketball, rather than a department-wide change in economic prospects.

Columns (2) through (5) of Table 5 report the IV estimates for spending on various sports, analogous to the main results in Table 2.[37] These estimates provide additional evidence of rent-sharing across the sports, and the magnitude of these estimates is similar to our panel data estimates – further supporting the causal interpretation of our main panel data results. Appendix Table OA.2 reports analogous results for non-athlete and facilities spending, which are also broadly similar to the OLS results. Since coaches do not have control over conference payments, the fact that these payments lead to higher coaches' salaries is consistent with our rent-sharing interpretation and rules out simple "pay-for-performance" explanations for panel data estimates.

V. Distributional Consequences of Rent-Sharing

The previous section reported a wide range of rent-sharing elasticities in intercollegiate athletics. We next consider the potential distributional consequences of this rent-sharing. We view this analysis as an important input into any normative analysis of the existing constraints on player compensation.

[37] For completeness, Appendix Table OA.3 reports IV estimates for a specification that includes conference-year fixed effects, to reproduce Panel B of Table 2. The estimates are broadly similar magnitude as the results in the main tables, but we view these estimates as conceptually inappropriate since conference-year fixed effects account for much of the variation in our instrument. Our instrument is ideally capturing conference payments that come from conference-wide factors that are not specific to any one school. Consistent with this interpretation, the first stage F-statistic with conference-year fixed effects is a much smaller in magnitude (F-statistic = 9.19), which creates additional issues interpreting these 2SLS estimates.

Our rent-sharing estimates suggest that one group of beneficiaries is the participants in non-revenue sports, which includes a variety of individuals. For example, our analysis shows meaningful rent-sharing with the coaches of these non-revenue sports – which will be accounted for in the data as spending on that sport. Beyond the coaches, the athletes of these sports also benefit. At a minimum, a large fraction of these athletes receive scholarships that offset some or all of their cost of attending college. In addition, recent events around the "Varsity Blues" college admissions scandal reveals that athletes for these sports can receive preferential admission to colleges they would otherwise not be academically qualified to attend.[38]

To understand the distributional consequences of rent-sharing across sports, we next examine whether there are systematic differences in the economic circumstances of athletes. To do this, we use available roster information matched to athletes' hometowns and high schools to approximate the socioeconomic characteristics of where they grew up and went to school. We begin in Figure 9 by showing the cumulative distribution function of the athletes' median family income (in the school district containing their high school), broken down by whether the athlete participated in a revenue or a non-revenue sport. This figure shows clear visual evidence that athletes in the non-revenue sports attended high schools where the students had higher median family incomes. A Wilcoxon rank-sum test confirms the visual evidence that these distributions are statistically significantly different ($p < 0.001$). Panel B of Figure 9 shows the CDF with the non-revenue sports further broken down into women's sports and non-revenue men's sports. This figure suggests that female athletes come from high schools with slightly higher average incomes than their counterparts in the non-revenue men's sports ($p = 0.009$).

Table 6 contains more detailed data on the economic circumstances of athletes based on their high school. Column (1) contains data for all sports while columns (2) through (5) contain the data for football and men's basketball, all other sports, women's sports, and non-revenue men's sports, respectively. On average, athletes attend high schools with a median family income of

[38] In 2019, the Justice Department uncovered a scheme in which at least 50 people were charged with cheating on standardized tests and paying or accepting bribes in order to help children gain admission to selective colleges, including the University of Southern California which is one of the "Power 5" schools in our main sample. As part of the "Varsity Blues" scheme, wealthy parents paid bribes to coaches to recruit their children who did not play sports so that the children could be evaluated against athlete-specific admission criteria, which often require lower grades and test scores (Medina, Benner, and Taylor 2019).

$67,500 and a mean family income of $112,400. However, as would be expected by the CDF presented in Figure 9, athletes participating in football and men's basketball attended high schools with a median family income, on average, of $58,400 and a mean family income of $99,800. In contrast, the average non-revenue sport athlete attended a high school with a median family income of $80,000 and a mean family income of $116,800. Columns (4) and (5) show that female athletes attended high schools with slightly higher incomes than did male athletes in non-revenue sports – with both groups attending high schools with much higher incomes than football and men's basketball participants. To place these numbers in context, we estimate that the average revenue sport athlete went to a high school with a median family income at the 49th percentile (in our sample of high schools), while the average non-revenue sport athlete went to a high school at the 60th percentile.

We next examine whether these socioeconomic differences vary based on the selectivity of the university. Table 7 contains the average family income at the high schools attended by athletes based on their sport and the selectivity of their University. The university tiers are taken from the Opportunity Insights data (Chetty et al. 2020). These income statistics demonstrate that the gap in estimated family income between athletes in revenue and non-revenue sports is greater for the more selective universities. For example, for both the "Ivy Plus" and "Elite" tiers the gap in income is approximately $30,000 compared to only $20,000 for highly selective and approximately $11,000 for selective schools.

There are other dimensions upon which the athletes in revenue sports appear to systematically differ from those in non-revenue sports. The remaining rows in Table 6 provides information on several other socioeconomic outcomes. For example, the average football and men's basketball players attended high schools where approximately 13 percent of the students were black. By contrast, non-revenue sport athletes attended high schools where only 5 percent of their fellow students were black. Given the distribution of athletes by race across sports, this should not be surprising. Appendix Table OA.11 uses data from the NCAA about athlete demographics at the conference-sport level for schools in the Power 5 conferences. Panel A contains the breakdown of athletes within a sports category by race. It shows that while nearly 50 percent of the athletes

participating in revenues sports are black, only 11 percent of the non-revenue sports athletes are black. Panel B details which sports black athletes within an athletic department play. Nearly 60 percent all black athletes in Power 5 schools take part in revenue sports. By contrast, only 14 percent of white athletes participate in revenue sports while the remainder take part in non-revenue sports.

Taken together, these data provide clear evidence that the rent-sharing across sports we identify in this paper shifts resources from athletes that come from poorer families to those from richer families (as estimated by the average family income of attended high schools). Additionally, the excess rents appear to flow from participants in sports where athletes are disproportionately black to sports where athletes are more likely to be white.

A similar dynamic applies to rent-sharing for coaches and administrators as well – where the majority of beneficiaries of the rents generated by the activities of revenue sport athletes are white. According to the NCAA, in 2019 78 percent of the headed coaches for men's and women's sports were white. For men's sports only 12 percent of the coaches are black and for women's sports this number was only 9 percent. Similarly, 75 percent of University athletic directors are white and only 16 percent are black. This demographic profile is meaningfully different from the athletes participating in revenue sports – which suggests that rent-sharing in the form of non-athlete compensation also involves a transfer from athletes that are poorer and more likely to be black to coaches and administrators that are more likely to be white.

In the case of coaches, the economic benefits are startlingly large. In 2018, the average Power 5 conference football coaching staff was paid approximately $9.6 million. This was a marked increase since 2006, when the average staff earned only $4 million. Some of this increase can be explained by an increase in total athletic department revenue. However, coaching staffs have also captured a large fraction of overall revenue. In 2006, coaches were paid approximately 5.9 percent of revenue. This number steadily increased and by 2018 coaches captured approximately 7.75 percent of overall revenue. To help place this amount in perspective, consider the data in Appendix Table OA.18 which contains the percentage of total revenue captured by the top executives in ExecuComp database. This percentage varies over the years, but the average amount of revenue paid to the top 5 executives in the database was 1.32 percent with a low of 0.43 percent and a high

of 2.9 percent. The large rent-sharing elasticities we estimate for football coaches' salaries are consistent with Leeds et al. (2018). We speculate that the existing limits of player compensation cause excess rents to be transferred to coaches.

VI. Player Compensation Analysis

In order to provide some evidence of the potential magnitude of rents being shared in modern college sports, we next consider what the distribution of rents might looks like under an alternative system where the athletes no longer face restrictions on the compensation for their efforts. There have been several proposals and efforts that would limit such restrictions. Perhaps the most successful has been an attempt to allow players to receive compensation from individuals or firms that would like to use their image (or "likeness") for marketing or endorsement purposes (G. Anderson 2020). Such proposals would effectively allow athletes to earn income based on their athletic success but would not directly give them access to the revenue currently received by their universities. That said, in equilibrium this would likely affect the distribution of rents since athletic departments earn meaningful income from the sale of merchandise – at least part of which is related to the athletes. This has been a particular point of frustration for some college athletes (Hagy 2003).[39]

Another interesting proposal for changing the distribution of rents occurred in 2014 at Northwestern University where the athletes attempted to form a labor union. While this effort was ultimately unsuccessful, it provides an interesting potential scenario for considering a different distribution of the rents generated by revenue sport athletes might look like (Nocera and Strauss

[39] Perhaps one of the most famous discussions of this fact relates to the University of Michigan Basketball team's "Fab Five." This team was the first to start five Freshman players in a championship game and was immensely popular and responsible for a meaningful surge in merchandise sales for the University. The most heralded member of that team, Chris Webber, left college after his sophomore year to play professional basketball. Describing this decision, the *New York Times* wrote, "Michigan collected almost $19 million in royalties from apparel sales when members of the Five ruled the roost. When Webber went pro in '93, the first college sophomore to be the No. 1 pick since his idol Magic Johnson, the decision was a financial one. He said that he could no longer bear witnessing the $75 sale of his No. 4 jersey when he couldn't afford to buy a pizza." It was later alleged that Webber received payments from a booster (i.e. a supporter of the athletic department) totaling nearly $300,000. This was a violation of current NCAA rules that resulted in, among other things, all games Webber played in being forfeited, a ban on postseason play for the basketball team in 2002-03, and the school returning $450,000 to the NCAA. The types of payments received by Webber and other many other athletes would be allowed under a policy where athletes could sell their image and likeness and could affect how much revenue was available for athletic departments.

2016).[40] After all, in the major professional football and basketball leagues in the US (the NFL and NBA), the players are unionized and their collective bargaining agreements dictate (among other things) the percentage of revenue that must be paid as salary to the athletes (Rosen and Sanderson 2001). As described in Berri et al. (2015), in professional sports these percentages reflect not only the direct contributions of players to their team's athletic success but their ability to capture a portion of the fixed revenues earned as a result of television contracts. Such features could be reasonably expected to be present in college athletics if players were able to collectively organize and negotiate their compensation.

As a result, we next consider the implications of athlete compensation if athletes could capture various percentages of the revenue generated by their sports.[41] Berri (2018) outlines a method for estimating college salaries under this framework and finds that the average salary for players on the national champion Duke men's basketball team of 2015 would have been over $1.4 million, with salaries for top players exceeding $3 million. We follow this method and calculate potential salaries for players in all Power 5 conferences assuming some form of revenue sharing between schools using the most recently available revenue data available.

We first calculate this for all Power 5 conferences as a group and then assume conferences share revenue only between member schools individually. While we primarily do this to address issues of how schools report football and basketball revenue, we note that if salaries were to be paid to athletes it is quite reasonable that for equity or parity reasons there would be some degree of revenue sharing between schools.[42] This is particularly likely within conferences, many of which already exhibit a strong preference towards the sharing of revenues from activities such as bowl

[40] In August 2015, the National Labor Relations Board turned down the athlete's petition, citing that due to its novelty the petition would not have promoted "stability in labor relations."

[41] An immediate question is which revenues are generated by the activities of the football and men's basketball athletes. Examining the collective bargaining agreements for professional sports reveals that athletes share in "football-related" and "basketball-related" revenues. The definitions of these categories are quite broad and therefore support using the EADA category of football and men's basketball sport-specific revenue. If anything, this would be a conservative approach, since many schools account for their conference payments in the "non-sports" category. This means that valuable media rights that exist primarily because of the efforts of the revenue sports would not be accounted for in the sport specific revenue category. Such revenues would be considered sport-related revenue under the professional collective bargaining agreements.

[42] Both the NFL and NBA have some form of revenue-sharing between teams. The NFL directly shares more than 60 percent of total revenue, most of which comes from national television contracts (Bloom 2014). The NBA's revenue sharing is smaller and more targeted at transferring revenue from teams in large local media markets to small-market teams, as a large share of NBA media rights revenue is from local rather than national networks (Wertheim 2018). As both leagues have salary caps, the dispersion in player wage bills between teams is even less than dispersion in post-revenue sharing revenues.

participation payments, NCAA tournament revenues, and at times even gate receipts from on-campus events.

Table 8 contains a summary of potential player salaries under various revenue sharing percentages. Panel A contains calculations if every scholarship player received the same salary while Panel B contains estimates if each school designated a set of players that matched the roster sizes of the professional sports. Panel A shows that football players could receive an annual salary of nearly $220,000 if they shared only 30 percent of their sport specific revenue. This salary rises to over $360,000 if they shared 50 percent of revenue, as is currently done in the NFL.[43] Similarly, men's basketball players could earn between $300,000 and $500,000. These estimated salaries are significantly higher than the current average value of full scholarships these athletes are currently receiving, which are shown in Appendix Table OA.12.[44]

If we consider revenue sharing that is within rather than across conferences, there would be meaningful variation in the potential salaries. This reflects that fact that either conferences have varied in their ability to capture the value generated by their revenue sports or in their ability to create value in the first place. For example, the Big Ten conference was a forerunner in creating a television network and has successfully expanded its footprint to increase the value of that offering. By contrast, the Pac-12 has been less successful at negotiating large payouts – a fact that results in meaningfully lower annual payments to its conference members (Wilner 2020). Examining potential conference level salaries for players (and assuming a 50 percent revenue sharing) shows the lowest football salary in the Atlantic Coast Conference (ACC) of nearly $270,000 and the highest salary in the Big Ten at nearly $440,000. For basketball, the lowest salary would be in the Pac-12 at approximately $300,000 and the highest would be in the ACC at just over $600,000.[45]

[43] Interestingly, in August 2020 a coalition of Pac-12 student-athletes threatened to opt out of participating in any practices and games during the COVID-19 pandemic unless a series of demands were guaranteed in writing, including the distribution of 50 percent of conference revenue to the players (Players of the Pac-12 2020).

[44] A similar analysis for women's college basketball players finds that the average salaries with 50 percent revenue sharing would be greater than $80,000 for players in the largest conferences for the 2016 season (D. Berri 2017). This exceeds the estimated value of full scholarships for every Power 5 school in 2019; however, most women's basketball teams currently have negative net income so such salaries would require meaningful restructuring of the current sports-related spending for most women's basketball teams.

[45] The fact that the ACC has the highest basketball and the lowest football salaries should not be surprising. Many teams in that league, such as Duke University and the University of North Carolina operate highly successful basketball programs and relatively less competitive football programs.

Discussion of paying college athletes often moves quickly to whether "third or fourth string" players would receive the same salaries as the more prominent starting players who often go on to play professional football and basketball. One way to proceed is to note that any comparison to the salaries and revenue sharing of professional sports teams would likely need to account for variation in the degree to which players uniquely impact the success of teams. Even a casual perusal of salaries in the NFL and NBA reveals systematic differences in payments across positions. Since all salaries are individually negotiated in these professional sports leagues, these persistent patterns likely reflect the unique contributions of particular positions to the success of teams. These differences by position are far greater in football than in basketball.

To understand how differences in payments across positions would impact potential player salaries for college athletes, we use salary data from professional sports leagues to estimate the distribution of potential salaries in two ways. We first look at the distribution of salaries for each sport assuming the distribution of salaries relative to the average salary matches the professional league. We then calculate average salary shares for starters and backup players at each position and use these percentages to allocate salaries across positions for college athletes while holding total compensation fixed, following the method developed by Goff, Kim, and Wilson (2016).[46] More information on this procedure can be found in Appendix Section III.

Figure 10 shows our estimated distribution of salaries for football and men's basketball using the distribution of relative compensation in the NFL and NBA, respectively. Potential position-based salaries are contained in Table 9. Both sets of distributional results are based on roster sizes that match the average number of players under contract in the professional salary data (66 for football and 13 for basketball), and we assume that athletes share in roughly 50 percent of sport-specific revenue.[47] Under such assumptions, the two highest-paid football positions would be the starting Quarterback and Wide Receiver, who would earn $2.4 and $1.3 million, respectively. Even the lowest-paid players (the backup running back and starting long snapper) would receive

[46] The starters are the players who are chosen to play at the start of the game and are typically the better players on the team; backup players are substitute players who are sometimes used during the game, but do not typically play at the start of the game.
[47] We use a labor share of 48.5 percent for football and a labor share of 51 percent for men's basketball. These are the maximum possible shares in the current collective bargaining agreements for each league. The NFL labor share must fall between 47 and 48.5 percent and the NBA labor share must fall between 49 and 51 percent in each season.

approximately $140,000. The value of tuition and the stipend that students receive would be subtracted from these amounts to calculate additional cash compensation, but even the minimum compensation for backup players is more than double the value of the tuition and other aid that players receive today as their only form of compensation.

These salary estimates provide a plausible benchmark for the amount of surplus conceivably available for salaries for college athletes. That said, there are several important caveats that should be discussed regarding how salaries might evolve under a regime where athletes could be compensated for their efforts. The salaries that would ultimately emerge in equilibrium if the NCAA allowed athletes to be paid would be a function of the relative bargaining weights of the respective parties and the amount of surplus that would be available under such a system. We discuss both issues in the remainder of this section.

While there are many factors that would impact the relative bargaining weights, perhaps the most important is that the salaries which are observed in the NFL and the NBA are the result of a collective bargaining process with athletes part of a formal labor union.[48] Therefore, even if the NCAA removed restrictions on schools paying athletes, it is unlikely they would receive a similar share of revenue in absence of a labor union.

The other issue is whether the economic surplus generated by college sports would be disrupted by a move to pay players. As is discussed in Sanderson and Siegfried (2015) there are a few ways this could occur. For example, uncapped compensation across schools could lead to a competitive imbalance that favors a smaller number of teams. That said, the current system allows schools to pay unlimited amounts to coaches and spend unlimited amounts on facilities – both of which are often described as recruiting tools intended to improve on-field success. Schools with more economic success have a greater ability to spend on such resources – which leads to its own degree of competitive imbalance. Mills and Winfree (2018) argue that enhanced athlete compensation or unionization is unlikely to negatively impact competitive balance in college football or men's basketball.

[48] The history of professional sports suggests that unions have been largely successful in both increasing salaries and improving non-wage job aspects such as working conditions and player mobility (Rosen and Sanderson 2001).

Another potential outcome affecting equilibrium payments is whether demand for college sports is partly a function of the amateur nature of the endeavor. It is unclear whether demand for television rights or in-person attendance would decrease as a result of the athletes being paid. This could result in schools be unable or unwilling to continue participating in these sports. Ultimately, it is an open question of whether even after such a reduction in demand players would be better off under a system where they were paid compared to the current system where compensation is effectively limited to the direct costs of attending college.

Our rent-sharing estimates suggest that one group that would likely be harmed by a movement to pay revenue sport athletes would be the participants in the non-revenue sports. If meaningful funds that are currently dedicated to non-revenue sports are instead used as compensation for athletes, then that could cause schools to either offer fewer non-revenue sports or decrease the amenities offered to participants in those sports. The actual equilibrium outcome is unclear and would be a function of whether and how colleges value these non-revenue sports. In addition, schools would need to navigate the regulatory landscape of Title IX which requires that schools provide equal opportunities to athletes across genders. It is outside the scope of this paper to comment on how Title IX would apply to paying revenue sport athletes. However, our results demonstrate that the efforts of athletes in revenue sports generate meaningful economic rents that in turn contribute to coaches' salaries and spending on other sports. The athletes generating the rents are more likely to be black and come from lower-income neighborhoods, and the rents are shared with a set of athletes and coaches that are more likely to be white.[49]

VII. Discussion

Our estimates provide evidence of rent-sharing in intercollegiate athletics. The recent responses of universities to various threats to the magnitude of available rents further can be understood as a natural consequence of our results. These threats have come in two main forms. First, the increasing commercial success of intercollegiate athletics combined with the lack of

[49] Recent work in political science by Druckman and Sharrow (2019) highlights how the segregated nature of college sports along racial and gender lines has been an impediment to reform, which is consistent with the stark racial differences we see between athletes in revenue sports and the athletes, coaches, and administrators that currently benefit from rent-sharing.

compensation for players has led to a number of efforts to increase the share of the surplus available to athletes, including recent litigation and legislation. Second, the COVID-19 pandemic has largely halted athletic activities as of mid-March 2020 – including the canceling of "March Madness" – the annual postseason tournament for Division 1 men's basketball. In addition, as the pandemic spread throughout the United States, it created uncertainty about whether schools would be able to hold football games in the Fall 2020 – which would result in a loss of both television revenue and gate receipts for these events. The commentary and response of schools to these events provides additional anecdotal evidence supporting our rent-sharing analysis.

Consider first questions about compensating revenue sport athletes. While this question has been debated over many years, recent litigation and legislation has made some form of compensation likely. Perhaps the most well-known and successful litigation was *O'Bannon vs. NCAA* which was a class action lawsuit attempting to allow student athletes to enjoy financial returns from the use of their image and likeness after they graduate. This dispute stemmed from the use of these athletes in a popular video game marketed by EA Sports.[50] During the legal proceedings, the NCAA ended its partnership with the video game manufacturer. The NCAA ultimately lost this case, which paved the way for the increased cost of attendance payments made by Power 5 conferences. In 2019, the NCAA lost an additional case that further increased the ability of schools to provide additional education-related funds to students (Kirshner 2019).

These legal actions have been followed by legislation allowing athletes to earn income based on the sale of their image and likeness. This would include permitting activities such as individual athletes signing endorsements deals, selling memorabilia, and/or being compensated for the sale of merchandise related to the athlete (i.e. a jersey with the athlete's name and number). In 2019, the State of California enacted the "Fair Pay to Play Act," which required college athletes be allowed or receive compensation for their image or likeness – earnings that are currently barred under NCAA regulations. This law is scheduled to go into effect in 2023 and would effectively eliminate restrictions on the ability of student athletes at California schools to engage in commercial activity

[50] In May 2014 the players and EA Sports settled for $40 million dollars, leaving the NCAA as the only party to the class action lawsuit (Farrey 2014).

that is directly related to their participation in intercollegiate athletics (Murphy 2019). Similar legislation is being actively debated in the United States Congress and many state legislatures.

While the equilibrium of such legislation is hard to predict, many involved in the existing business model of rent-sharing have expressed concerns about the impact of such a change. Many of these concerns center on the impact of reduced sponsorship revenue for the athletic department. An article describing the impact of this noted the negative impacts would be felt by "athletic directors, coaches, and those who own stock in the firms that build big locker rooms and athletic training facilities" (Schatz, 2020).

The only Power 5 conference that is directly affected by California's act is the Pac-12 which includes 4 teams located in that state. In a statement reacting to the passage of the law, the conference said "The Pac-12 is disappointed in the passage of SB 206 and believes it will have very negative consequences for our student-athletes and broader universities in California … [it] will likely reduce resources and opportunities for student-athletes in Olympic sports and have negative disparate impact on female student-athletes" (Rollins 2019).[51] Similar sentiments have been expressed by the NCAA and other conferences and likely would be shared about efforts to actually pay players with funds from athletic departments.

Another recent example that illustrates the consequences of the rent-sharing we estimate in this paper comes from the loss of revenues caused by the COVID-19 pandemic. At a minimum, the canceling of the annual men's basketball tournament caused the forfeiture of a large amount of television revenue and as a result the NCAA decreased its aggregate payout to conferences by $375 million. Given our estimates below, this reduction in conference payments should result in fewer resources being transferred to other parts of the athletic department. Such reductions would increase dramatically if schools are unable to play football games in the Fall of 2020 – an activity that generates meaningfully more economic surplus.

Commenting about this possibility, Big 12 commissioner Bob Bowlsby said, "it's a whole new ballgame if we find ourselves not playing football because it affects everything we do. … It

[51] We interpret the "Olympic sports" in the statement to refer to a subset of the non-revenue sports, even though men's basketball is technically an Olympic sport.

affects the largest portion of our TV contract. It was the largest source of campus revenue, which is live gate. Anything I say regarding finances, we have to make the assumption that we're going to be back playing football in the fall. And if that doesn't happen, then the underpinning of what we've known as normal goes away and we'll have major changes to make" (Auerbach 2020).

The response of schools to the current and existing revenue declines has resulted in reductions for each category where we empirically identify rent-sharing: non-revenue sports, facilities, and non-athlete salaries. Schools such as the University of Akron, Appalachian State University, the University of Cincinnati, and Old Dominion University and many other non-Power 5 schools have eliminated non-revenue sports in response to the economic damage from the pandemic (Associated Press 2020). In perhaps the largest such move to date, in July 2020 Stanford University announced they would be cutting 11 non-revenue sports (Scarborough 2020). Discussing the decision Stanford noted that they had long offered far more sports than other schools (36 compared to an average of 20 at other schools) and this had been increasingly difficult over time. The pandemic was cited as a "breaking point" for the economics of their athletic department.

Schools made adjustments along other dimensions where we have identified rent-sharing. For example, Indiana University has deferred any non-essential athletic building and maintenance projects (Blau 2020). At the University of Colorado, the athletic director, football coach, and both head basketball coaches agreed to take 10 percent pay cuts (Schlabach 2020). Similar pay cuts have been announced at schools such as Iowa State, Kansas, Louisville, Michigan, and Missouri (Layberger 2020). All of these responses are consistent with our rent-sharing estimates.

VIII. Conclusion

Intercollegiate amateur athletics in the US bars student-athletes from sharing in any of the profits generated by their participation, which creates substantial economic rents for universities. The economic rents from amateur athletics are primarily generated by men's football and men's basketball programs. In this paper, we characterize the economic rents in intercollegiate athletics, estimate rent-sharing elasticities using a variety of empirical approaches, and investigate additional distributional consequences of the existing limits on player compensation.

We estimate that rent-sharing leads to increased spending on women's sports and other men's sports as well as increased spending on facilities, coaches' salaries, and other athletic department personnel. The player-level analysis reveals that the existing limits on player compensation effectively transfers resources away from students who are more likely to be black and more likely to come from poor neighborhoods towards students who are more likely to be white and come from higher-income neighborhoods.

Our results are based on comprehensive data covering revenue and expenses for FBS schools between 2006 and 2019, and we assemble new data using rosters of students matched to neighborhood socioeconomic characteristics. We have made all of the data in this paper publicly available online at users.nber.org/~notom/research/ncaa.html, and we hope the data is useful for future researchers studying the economics of college sports.

References

Anderson, Greta. 2020. "College Athlete Pay Structure Takes Form." Inside Higher Ed. 2020. https://www.insidehighered.com/news/2020/04/30/ncaa-board-governors-approves-name-image-likeness-guidelines.

Anderson, Michael L. 2017. "The Benefits of College Athletic Success: An Application of the Propensity Score Design." *Review of Economics and Statistics* 99 (1): 119–34. https://doi.org/10.1162/REST_a_00589.

Associated Press. 2020. "List of College Teams Cut Because of Coronavirus Pandemic." *The Washington Post*, July 8, 2020. https://www.washingtonpost.com/sports/colleges/list-of-college-teams-cut-because-of-coronavirus-pandemic/2020/07/08/02ecc450-c158-11ea-8908-68a2b9eae9e0_story.html.

Auerbach, Nicole. 2014. "The Perception and Reality of NCAA Show-Cause Penalties." *USA Today*, May 27, 2014. https://www.usatoday.com/story/sports/college/2014/05/27/ncaa-show-cause-penalty-bruce-pearl-kelvin-sampson/9632273/.

———. 2020. "Cuts to NCAA Revenue Distribution Carry a Ripple Effect for Athletic Departments." The Athletic. 2020. https://theathletic.com/1703417/2020/03/26/ncaa-tournament-revenue-distribution-athletic-departments/.

Bergman, Stephen A., and Trevon D. Logan. 2020. "Revenue per Quality of College Football Recruit." *Journal of Sports Economics* 21 (6): 571–92. https://doi.org/10.1177/1527002520921223.

Berkowitz, Steve. 2019. "Big Ten Conference Had Nearly $759 Million in Revenue in Fiscal 2018, New Records Show." *USA Today*, 2019. https://www.usatoday.com/story/sports/2019/05/15/big-ten-revenue-hit-nearly-759-million-fiscal-2018/3686089002/.

———. 2020. "Major Public College Football Programs Could Lose Billions in Revenue If No Season Is Played." *USA Today*, April 14, 2020. https://www.usatoday.com/story/sports/ncaaf/2020/04/14/college-football-major-programs-could-see-billions-revenue-go-away/2989466001/.

Berman, Jillian. 2018. "Trump's Tax Code Could Hurt Donations to Lucrative College Sports Programs." MarketWatch. 2018. https://www.marketwatch.com/story/trumps-tax-code-could-hurt-donations-to-these-lucrative-college-sports-progams-2018-02-06.

Berri, David. 2017. "Women Are Also Exploited By College Basketball." Forbes. 2017.

https://www.forbes.com/sites/davidberri/2017/11/05/women-are-also-exploited-by-college-basketball/#689e7f167848.

Berri, David J. 2016. "Paying NCAA Athletes." *Marquette Sports Law Review* 26 (2): 480–91.

———. 2018. *Sports Economics*. New York, New York: Worth Publishers/Macmillan Education.

Berri, David J., Michael A. Leeds, and Peter Von Allmen. 2015. "Salary Determination in the Presence of Fixed Revenues." *International Journal of Sport Finance* 10 (1): 5–25.

Blau, Jon. 2020. "IU Shuts off Athletics Facilities Due to COVID-19 Concerns." *Bloomington Herald-Times*, March 17, 2020. https://www.indystar.com/story/sports/college/indiana/2020/03/17/iu-shuts-off-athletics-facilities-due-covid-19-concerns/5073495002/.

Bloom, Howard. 2014. "NFL Revenue-Sharing Model Good for Business." Sporting News. 2014. https://www.sportingnews.com/us/nfl/news/nfl-revenue-sharing-television-contracts-2014-season-business-model-nba-nhl-mlb-comparison-salary-cap/gu0xok7mphu01x3vu875oeaq6.

Borghesi, Richard. 2017. "Pay for Play: The Financial Value of NCAA Football Players." *Applied Economics* 49 (46): 4657–67. https://doi.org/10.1080/00036846.2017.1287865.

———. 2018. "The Financial and Competitive Value of NCAA Basketball Recruits." *Journal of Sports Economics* 19 (1): 31–49. https://doi.org/10.1177/1527002515617510.

Bradbury, John Charles, and Joshua D. Pitts. 2018. "Full Cost-of-Attendance Scholarships and College Choice: Evidence From NCAA Football." *Journal of Sports Economics* 19 (7): 977–89. https://doi.org/10.1177/1527002517696958.

Brown, Robert. 2011. "Research Note: Estimates of College Football Player Rents." *Journal of Sports Economics* 12 (2): 200–212. https://doi.org/10.1177/1527002510378333.

Brown, Robert W. 1993. "An Estimate of the Rent Generated By a Premium College Football Player." *Economic Inquiry* 31 (4): 671–84. https://doi.org/10.1111/j.1465-7295.1993.tb00898.x.

Chetty, Raj, John N. Friedman, Emmanuel Saez, Nicholas Turner, and Danny Yagan. 2020. "Income Segregation and Intergenerational Mobility Across Colleges in the United States." *The Quarterly Journal of Economics* 135 (3): 1567–1633. https://doi.org/10.1093/qje/qjaa005.Advance.

Dochterman, Scott. 2013. "In Big Ten Conference, They Split the Gate." *The Gazette*, October 25, 2013. https://www.thegazette.com/2013/10/25/in-big-ten-conference-they-split-the-gate.

Dosh, Kristi. 2017. "The Biggest Misconceptions About the Finances of College Sports." *Www.Forbes.Com*, 1–7. https://www.forbes.com/sites/kristidosh/2017/06/12/the-biggest-

misconceptions-about-the-finances-of-college-sports/print/.

———. 2019. "College Football Playoff Payouts For 2019 Season." Forbes. 2019. https://www.forbes.com/sites/kristidosh/2019/12/28/college-football-playoff-payouts-for-2019-season.

Druckman, James, and Elizabeth Sharrow. 2019. "How Institutions and Social Identity Affect Policy Change : The Case of College Sports Elizabeth Sharrow." *Northwestern Institute for Policy Research Working Paper Series* WP-19-22. https://www.ipr.northwestern.edu/our-work/working-papers/2019/wp-19-22.html.

Farrey, Tom. 2014. "Players, Game Makers Settle for $40M." ESPN.Com. 2014. https://www.espn.com/espn/otl/story/_/id/11010455/college-athletes-reach-40-million-settlement-ea-sports-ncaa-licensing-arm.

Goff, Brian L., H. Youn Kim, and Dennis P. Wilson. 2016. "Estimating the Market Value of Collegiate Football Players from Professional Factor Shares." *Applied Economics Letters* 24 (4): 233–37. https://doi.org/https://doi.org/10.1080/13504851.2016.1178842.

Hagy, Alyson. 2003. "Webber's World." *The New York Times Magazine*, February 23, 2003. https://www.nytimes.com/2003/02/23/magazine/webber-s-world.html.

Henning, Lynn. 2020. "Behind the Scenes: When Texas A&M Came Calling, Bo Schembechler Chose Michigan over Money." *The Detroit News*, May 6, 2020. https://www.detroitnews.com/story/sports/college/university-michigan/2020/05/06/when-texas-a-m-came-calling-bo-schembechler-chose-michigan-over-money/5174860002/.

Hobson, Will. 2014. "Fund and Games." *The Washington Post*, March 18, 2014. https://www.washingtonpost.com/graphics/sports/ncaa-money/.

———. 2017. "One School's Formula for Athletic Success: Build a Lazy River and (Hope) the Recruits Will Come." *The Washington Post*, March 31, 2017. https://www.washingtonpost.com/sports/colleges/one-schools-formula-for-athletic-success-build-a-lazy-river-and-hope-the-recruits-will-come/2017/03/31/e1b7f5c8-1568-11e7-833c-503e1f6394c9_story.html.

Hobson, Will, and Steven Rich. 2015. "The Latest Extravagances in the College Sports Arms Race? Laser Tag and Mini Golf." *The Washington Post*, December 21, 2015. https://www.washingtonpost.com/sports/colleges/for-college-athletic-departments-building-the-best-is-never-ending-task/2015/12/21/e8384dd4-a558-11e5-9c4e-be37f66848bb_story.html.

Jones, Willis A. 2020. "A Benford Analysis of National Collegiate Athletic Association Division I Finance Data." *Journal of Sports Economics* 21 (3): 234–55. https://doi.org/10.1177/1527002519887430.

Kahn, Lawrence M. 2007. "Markets: Cartel Behavior and Amateurism in College Sports." *Journal of Economic Perspectives* 21 (1): 209–26. https://doi.org/10.1257/jep.21.1.209.

Kirshner, Alex. 2018. "Jimbo Fisher's $75 Million A&M Contract Is Even More Hilariously One-Sided than You Thought." SB Nation. 2018. https://www.sbnation.com/college-football/2018/8/22/17769874/jimbo-fisher-texas-a-m-contract.

———. 2019. "Why the NCAA's Mounting Court Losses Will Only Matter so Much." SB Nation. 2019. https://www.sbnation.com/college-football/2019/3/11/18258562/ncaa-court-case-fallout.

Kleinman, Daniel. 2019. "The Most Valuable College Apparel Deals: UCLA Leads As Gear Companies' New Mindset Thwarts Rivals." Forbes. 2019. https://www.forbes.com/sites/danielkleinman/2019/09/13/ucla-most-valuable-college-apparel-deals/#6b9312236762.

Kline, Patrick, Neviana Petkova, Heidi Williams, and Owen Zidar. 2019. "Who Profits from Patents? Rent-Sharing at Innovative Firms." *The Quarterly Journal of Economics* 134 (3): 1343–1404. https://doi.org/10.1093/qje/qjz011.

Lamadon, Thibaut, Magne Mogstad, and Bradley Setzler. 2019. "Imperfect Competition, Compensating Differentials and Rent Sharing in the U.S. Labor Market." *NBER Working Paper No. 25954*. https://doi.org/10.2139/ssrn.3400197.

Lane, Erin, Juan Nagel, and Janet S. Netz. 2014. "Alternative Approaches to Measuring MRP: Are All Men's College Basketball Players Exploited?" *Journal of Sports Economics* 15 (3): 237–62. https://doi.org/10.1177/1527002512453144.

Layberger, Tom. 2020. "Several College Football Coaches Taking Pay Cuts During Coronavirus Sports Shutdown." Forbes. 2020. https://www.forbes.com/sites/tomlayberger/2020/05/04/several-college-football-coaches-taking-pay-cuts-during-coronavirus-sports-shutdown.

Leeds, Michael A., Eva Marikova Leeds, and Aaron Harris. 2018. "Rent Sharing and the Compensation of Head Coaches in Power Five College Football." *Review of Industrial Organization* 52 (2): 253–67. https://doi.org/10.1007/s11151-017-9604-x.

Maponics. 2017. "Maponics School Boundaries." Pitney Bowes.

Medina, Jennifer, Katie Benner, and Kate Taylor. 2019. "Actresses, Business Leaders and Other Wealthy Parents Charged in U.S. College Entry Fraud." *The New York Times*, March 12, 2019. https://www.nytimes.com/2019/03/12/us/college-admissions-cheating-scandal.html.

Meer, Jonathan, and Harvey S. Rosen. 2009. "The Impact of Athletic Performance on Alumni Giving: An Analysis of Microdata." *Economics of Education Review* 28 (3): 287–94. https://doi.org/10.1016/j.econedurev.2008.06.003.

Mills, Brian, and Jason Winfree. 2018. "Athlete Pay and Competitive Balance in College Athletics." *Review of Industrial Organization* 52 (2): 211–29. https://doi.org/10.1007/s11151-017-9606-8.

Murphy, Dan. 2019. "What California Bill Means for NCAA Image and Likeness Debate." ESPN.Com. 2019. https://www.espn.com/college-football/story/_/id/27585301/what-california-bill-means-ncaa-image-likeness-debate.

National Collegiate Athletic Association. 2017. "Division 1 Manual." http://www.ncaapublications.com/productdownloads/D118.pdf.

NBA and NBPA. 2017. "Collective Bargaining Agreement." https://nbpa.com/cba.

NFL and NFLPA. 2020. "Collective Bargaining Agreement." https://operations.nfl.com/football-ops/2020-nfl-nflpa-cba-need-to-know/.

Nocera, Joe, and Ben Strauss. 2016. "Fate of the Union: How Northwestern Football Union Nearly Came to Be." *Sports Illustrated*, February 2016. https://www.si.com/college/2016/02/24/northwestern-union-case-book-indentured.

Players of the Pac-12. 2020. "#WeAreUnited," August 2, 2020. https://www.theplayerstribune.com/en-us/articles/pac-12-players-covid-19-statement-football-season.

Reardon, Sean F., Andrew D. Ho, Benjamin R. Shear, Erin M. Fahle, Demetra Kalogrides, and Richard DiSalvo. 2018. "Stanford Education Data Archive."

Rollins, Khadrice. 2019. "Pac-12 Claims New California Law 'Will Have Very Significant Negative Consequences.'" Sports Illustrated. 2019. https://www.si.com/college/2019/09/30/pac-12-response-california-fair-pay-to-play-law.

Rosen, Sherwin, and Allen Sanderson. 2001. "Labour Markets in Professional Sports." *The Economic Journal* 111 (469): 47–68. http://www.jstor.org/stable/2667957.

Sanderson, Allen R., and John J. Siegfried. 2015. "The Case for Paying College Athletes." *Journal of Economic Perspectives* 29 (1): 115–38. https://doi.org/10.1257/jep.29.1.115.

———. 2018. "The Role of Broadcasting in National Collegiate Athletic Association Sports." *Review*

of Industrial Organization 52 (2): 305–21. https://doi.org/10.1007/s11151-017-9593-9.

Scarborough, Alex. 2020. "Stanford to Cut 11 Varsity Sports, Cites Pandemic as Breaking Point." ESPN.Com. 2020. https://www.espn.com/college-sports/story/_/id/29429478/stanford-cut-11-varsity-sports-cites-pandemic-breaking-point.

Schlabach, Mark. 2011. "NCAA Sends Message to Ohio State." ESPN.Com. 2011. https://www.espn.com/college-football/story/_/id/7373708/ncaa-sends-message-sanctions-ohio-state-buckeyes.

———. 2017. "NCAA Hits Ole Miss with Additional Year of Bowl Ban, Scholarship Restrictions." ESPN.Com. 2017. https://www.espn.com/college-football/story/_/id/21629060/ole-miss-rebels-get-two-year-bowl-ban-scholarship-reductions-ncaa.

———. 2020. "Colorado Athletic Director, 3 Head Coaches to Take 10% Pay Cuts." ESPN.Com. 2020. https://www.espn.com/college-sports/story/_/id/29088433/colorado-athletic-director-3-head-coaches-take-10-pay-cuts.

Scully, Gerald W. 1974. "Pay and Performance in Major League Baseball." *The American Economic Review* 64 (6): 915–30.

Shaw, Lucas. 2011. "ESPN, NCAA Extend Deal through 2023-24." Reuters. 2011. https://www.reuters.com/article/us-espn-ncaa/espn-ncaa-extend-deal-through-2023-24-idUSTRE7BE2FM20111215.

Staples, Andy. 2019. "What Has the NCAA—or Anyone—Learned From the College Basketball Black Market's Time on Trial?" *Sports Illustrated*, May 2019. https://www.si.com/college/2019/05/09/ncaa-trial-fbi-bribery-corruption-mark-emmert.

Stevenson, Betsey. 2007. "Title IX and the Evolution of High School Sports." *Contemporary Economic Policy* 25 (4): 486–505. https://doi.org/10.1111/j.1465-7287.2007.00080.x.

Tabakovic, Haris, and Thomas G. Wollmann. 2019. "The Impact of Money on Science: Evidence from Unexpected NCAA Football Outcomes." *Journal of Public Economics* 178: 104066. https://doi.org/10.1016/j.jpubeco.2019.104066.

Tatos, Ted. 2019. "An Empirical Evaluation of EADA and NCAA College Sports Financial Data: Applications for Research and Litigation." *Marquette Sports Law Review* 29 (2): 411.

U.S. Department of Education. 2020. "Requirements Under Title IX of the Education Amendments of 1972." https://www2.ed.gov/about/offices/list/ocr/docs/interath.html.

Urban Institute. 2017. "Understanding College Affordability." http://collegeaffordability.urban.org/prices-and-expenses/net-price/.

Wertheim, Jon. 2018. "How Do NBA Franchises Spend Their Revenue? Team Executives Reveal Financial Info." Sports Illustrated. 2018. https://www.si.com/nba/2018/09/21/nba-teams-revenue-spending-breakdown-small-large-market.

Wilner, Jon. 2020. "Pac-12 Revenue Gap: We Ran the Numbers, and the Conference Could Fall so Far behind the SEC and Big Ten That It Can't Catch up." *The Mercury News*, February 4, 2020. https://www.mercurynews.com/2020/02/04/the-pac-12-revenue-gap-we-ran-the-numbers-the-conference-could-fall-so-far-behind-the-sec-and-big-ten-that-it-cant-catch-up/.

Table 1
Descriptive Statistics

	N	Mean	Std. Dev.	10th percentile	50th percentile	90th percentile
	(1)	(2)	(3)	(4)	(5)	(6)
Revenue:						
Total revenue	851	93.714	33.108	55.852	88.615	140.420
Total sport revenue	851	66.535	28.786	35.063	60.948	105.856
Total non-sport revenue	851	27.179	14.568	11.091	25.017	46.512
Men's Football + Men's Basketball revenue	851	59.499	26.685	30.648	53.353	95.565
Women's sports revenue	851	4.028	3.417	0.821	3.011	8.014
Other men's sports revenue	851	3.008	2.439	0.572	2.380	6.697
Expenses:						
Men's Football + Men's Basketball expenses	851	31.623	11.145	19.159	29.956	45.635
Women's sports expenses	851	15.201	5.031	9.036	14.543	22.285
Other men's sports expenses	851	8.029	3.531	4.089	7.550	12.637
Revenue - Expenses (Net Revenue):						
Men's Football + Men's Basektball	851	27.876	19.649	7.126	23.507	55.085
Women's sports	851	-11.173	4.578	-17.342	-10.897	-5.510
Other men's sports	851	-5.021	2.570	-8.367	-4.601	-2.256
Additional spending measures (from Knight commission):						
Salaries paid to all coaches	595	15.808	5.452	9.438	14.944	23.000
Salaries paid to football coaches	595	6.651	2.824	3.535	6.222	10.729
Total administrative compensation	595	16.364	6.881	9.395	15.135	24.980
Facilities spending	595	19.824	9.479	7.882	18.803	32.465
Total revenue from conference, bowls, TV	595	25.747	12.187	11.635	24.918	41.887

Notes: This table reports descriptive statistics for 61 (of the 65) schools in the "Power 5" athletic conferences. The data exclude 4 schools with sport-level accounting data that is not usable for the statistical analysis (Baylor, Boston College, Rutgers, and West Virginia). All values are in millions of (nominal) dollars, and cover years 2006-2019. The school-level revenue and expenses data come from the EADA reports provided by the Department of Education. The salary, compensation, facilities, and conference revenue variables come from reports from the Knight commission, and cover 46 of the 65 Power 5 schools. Variables form the Knight data cover years 2006-2018. See Data Appendix for more details.

Table 2
Rent-Sharing Elasticities Across Sports

Dependent Variable is Total Expenses for:	Football and Men's Basketball	Women's Sports and Other Men's Sports	Women's Sports	Other Men's Sports
	(1)	(2)	(3)	(4)
Panel A: OLS Estimates Including School Fixed Effects and Year Fixed Effects				
Football and Men's Basketball Revenue + Total Non-Sport Revenue	0.820	0.416	0.410	0.424
	(0.093)	(0.074)	(0.080)	(0.099)
R^2	0.893	0.941	0.934	0.933
Panel B: OLS Estimates Including School, Year, and Conference-by-Year Fixed Effects				
Football and Men's Basketball Revenue + Total Non-Sport Revenue	0.839	0.437	0.417	0.471
	(0.102)	(0.083)	(0.091)	(0.101)
R^2	0.903	0.945	0.938	0.939

Notes: N = 851 for all regressions, and the unit of observation is a school-year. All variables are included in logs so that the coefficients can be interpreted as elasticities. The sample covers 61 schools in "Power 5" conferences between 2006 and 2019. The standard errors are clustered by school and are reported in parentehses.

Table 3

Additional Rent-Sharing Elasticities:

Salaries for Coaches, Administrative Compensation, and Facilities Spending

Dependent Variable:	Salaries for All Coaches	Salaries for Football Coaches	Administrative Compensation	Facilities Spending
	(1)	(2)	(3)	(4)
Panel A: OLS Estimates Including School Fixed Effects and Year Fixed Effects				
Football and Men's Basketball Revenue +	0.403	0.397	0.452	0.861
Total Non-Sport Revenue	(0.064)	(0.125)	(0.108)	(0.252)
R^2	0.926	0.764	0.902	0.779
Panel B: OLS Estimates Including School, Year, and Conference-by-Year Fixed Effects				
Football and Men's Basketball Revenue +	0.371	0.322	0.367	0.821
Total Non-Sport Revenue	(0.072)	(0.121)	(0.092)	(0.285)
R^2	0.939	0.795	0.915	0.806

Notes: N = 595 for all regressions, and the unit of observation is a school-year. All variables are included in logs so that the coefficients can be interpreted as elasticities. The sample covers 46 schools in "Power 5" conferences between 2006 and 2018. The standard errors are clustered by school and are reported in parentehses.

Table 4
Testing for Common Shocks Using Revenue for Other Sports

Dependent Variable is Total Revenue for:	Women's Sports and Other Men's Sports	Women's Sports	Other Men's Sports
	(1)	(2)	(3)
Panel A: OLS Estimates Including School Fixed Effects and Year Fixed Effects			
Football and Men's Basketball Revenue + Total Non-Sport Revenue	-0.099	-0.166	0.017
	(0.246)	(0.306)	(0.257)
R^2	0.776	0.740	0.789
Panel B: OLS Estimates Including School, Year, and Conference-by-Year Fixed Effects			
Football and Men's Basketball Revenue + Total Non-Sport Revenue	-0.072	-0.167	0.155
	(0.248)	(0.321)	(0.253)
R^2	0.808	0.766	0.821

Notes: N = 851 for all regressions, and the unit of observation is a school-year. All variables are included in logs so that the coefficients can be interpreted as elasticities. The sample covers 61 schools in "Power 5" conferences between 2006 and 2019. The standard errors are clustered by school and are reported in parentehses.

Table 5
Instrumental Variables Estimates of Rent-Sharing Elasticities Across Sports

Dependent Variable:	[First Stage] Football and Men's Basketball Revenue + Total Non-Sport Revenue	Total Expenses for: Football and Men's Basketball	Women's Sports and Other Men's Sports	Women's Sports	Other Men's Sports
	(1)	(2)	(3)	(4)	(5)
Football and Men's Basketball Revenue + Total Non-Sport Revenue		0.799	0.390	0.432	0.378
		(0.152)	(0.116)	(0.097)	(0.197)
Total revenue from conference payouts, football bowls, and TV contracts	0.239				
	(0.039)				
First Stage F-statistic	37.34				

Notes: N = 595 for all regressions, and the unit of observation is a school-year. All variables are included in logs so that the coefficients can be interpreted as elasticities. The sample covers 46 schools in "Power 5" conferences between 2006 and 2018. Columns (1) reports OLS estimates of the First Stage regression, while columns (2) through (5) report Instrumental Variables estimates using conference/bowls/TV revenue as an instrument. The standard errors are clustered by school and are reported in parentehses.

Table 6
Neighborhood Characteristics for Athletes Using High School Catchment Area

Sample of Athletes:	All Athletes	Football and Men's Basketball	Women's Sports and Other Men's Sports	Women's Sports	Other Men's Sports
Income					
Median Household Income	67,459.02	58,361.24	70,997.70	71,719.43	69,899.15
Mean Household Income	112,355.95	99,786.33	116,736.76	118,139.51	114,265.24
Average High School Catchement Income Percentile	0.57	0.49	0.60	0.61	0.59
Share in 1st Quartile	0.12	0.17	0.11	0.11	0.12
Share in 2nd Quartile	0.22	0.30	0.19	0.19	0.20
Share in 3rd Quartile	0.26	0.26	0.26	0.25	0.27
Share in 4th Quartile	0.39	0.27	0.43	0.45	0.41
Education					
Share with Grad School	0.13	0.10	0.14	0.14	0.13
Share with Bachelor's Degree	0.23	0.20	0.24	0.24	0.23
Share with Some College	0.29	0.29	0.29	0.29	0.29
Share with High School Degree	0.23	0.26	0.23	0.22	0.23
Share with Less than High School	0.12	0.15	0.11	0.11	0.11
Poverty Status					
Share in Poverty	0.08	0.09	0.07	0.07	0.07
Race/Ethnicity					
Share Black	0.07	0.13	0.05	0.05	0.06
Share White	0.84	0.78	0.86	0.86	0.86
Share Hispanic	0.07	0.08	0.07	0.07	0.07
Observations					
Number of Schools	60	60	60	60	60
Number of Athlete-Sports	14,293	3,694	10,599	6,223	4,270

Notes: This table reports various statistics broken down by sport, using athlete-sport level data that combines the athlete's sport to census demographic information. The census information is linked through the athlete's high school's catchement area overlap with census tracts, and is aggregated to the high school level. Students who play multiple sports are represented in multiple rows in the data - once for each sport. Column one reports statistics for all student-sports, while columns two through five report statistics just for Football/Men's Basketball, Non- Football/Men's Basketball Sports, Womens sports, and Men's non-Football/Men's Basketball sports. The first set of statistics reported reflect median and mean household income. The next set of statistics shows the share of students in each quartile of the overall US household income distribution, created from 2000 Census SF3 files. The next set of statistics shows the proportion of the population associated with each high school of various educational attainments and various race/ethnicities. Finally, we report the number of colleges represented in the sample, as well as the number of athlete-sport rows. Income is reported in 2018 dollars.

Table 7
Tract-Matched Mean and Median Household Income for Athletes by Selectivity Tier

Tier	All Athletes	Football and Men's Basketball	Women's Sports and Other Men's Sports	Women's Sports	Other Men's Sports	Number of Schools
Panel A: Tract-Matched Mean Houshold Income						
Ivy Plus	137,043.16	112,379.26	142,820.29	148,293.88	135,375.23	2
Other Elite Schools	129,897.43	107,439.14	137,461.28	138,207.91	134,537.65	9
Highly Selective	115,872.12	101,357.73	121,106.73	122,705.17	118,861.24	15
Selective	104,794.76	96,680.36	107,715.78	109,257.00	105,276.72	33
All	112,272.45	99,752.81	116,676.21	118,085.68	114,160.12	59
Panel B: Tract-Matched Median Houshold Income						
Ivy Plus	84,304.12	60,535.47	89,585.83	92,891.46	82,010.26	2
Other Elite Schools	73,447.48	59,086.44	81,195.74	83,338.04	75,449.43	9
Highly Selective	71,401.94	58,306.26	76,177.89	77,821.28	74,213.99	15
Selective	64,169.22	57,844.47	66,305.47	67,106.04	65,576.76	33
All	67,121.87	58,186.81	70,910.90	71,637.14	69,745.95	59

Notes: This table reports the census tract level median household income from the roster data, broken down by sport type and selectivity tier, where selectivity tier is defined by Opportunity Insights data. Ohio State Unviversity is not accounted for in the Opportunity Insights dataset. Income is reported in 2018 dollars.

Table 8
Estimates of Mean Counterfactual Compensation

	Football			Men's Basketball		
Labor Share of Revenue	30%	40%	50%	30%	40%	50%
Panel A: Professional Roster Sizes (FB=66, MBB=14)						
Overall	289,047	385,396	481,745	327,588	436,784	545,980
ACC	210,287	280,382	350,478	403,810	538,413	673,017
Big 12	315,847	421,129	526,412	303,005	404,007	505,008
Big Ten	355,490	473,987	592,483	399,058	532,078	665,097
Pac-12	225,615	300,820	376,025	215,249	286,999	358,749
SEC	322,682	430,243	537,804	317,825	423,766	529,708
Panel B: Current Scholarhsip Roster Sizes (FB=85, MBB=13)						
Overall	224,436	299,248	374,061	352,787	470,383	587,978
ACC	163,282	217,709	272,136	434,872	579,830	724,787
Big 12	245,246	326,995	408,743	326,313	435,084	543,855
Big Ten	276,028	368,037	460,046	429,755	573,007	716,258
Pac-12	175,183	233,578	291,972	231,807	309,076	386,345
SEC	250,553	334,071	417,589	342,273	456,364	570,455

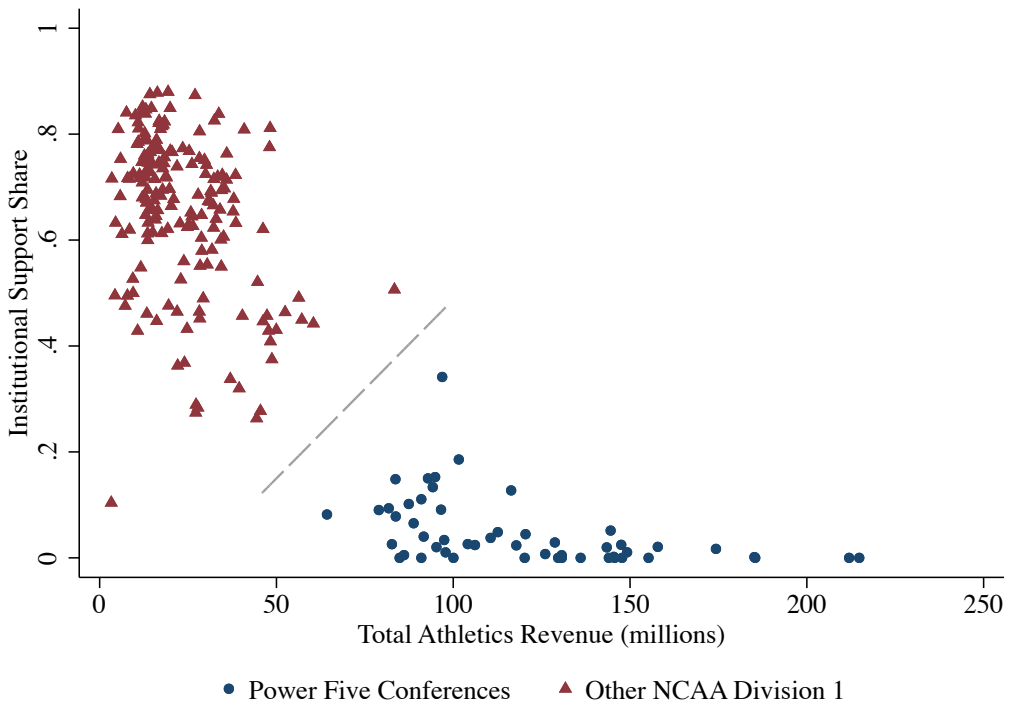
Notes: Table shows the mean compensaton per player for football and men's basketball under the counterfactual that players receive a fixed share of total sport revenue. These estimates are calculated using sport-specific revenue values in the EADA data from the 2018-2019 school year. These estimates assume revenue sharing to equalize player budgets across schools, either by between all schools in the sample ("Overall") or by conference. The sample is the 61 (of the 65) schools in the "Power 5" athletic conferences. The data exclude 4 schools with sport-level accounting data that is not usable for the statistical analysis (Baylor, Boston College, Rutgers, and West Virginia). All numbers reported are 2018 US dollars.

Table 9
Compensation Heterogeneity by Position

	Starter	Reserve
	Panel A: Football	
Quarterback	2,716,070	220,250
Wide Receiver	1,518,866	158,428
Defensive Line	1,291,102	154,294
Offensive Line	1,122,824	138,206
Linebacker	1,110,909	138,151
Defensive Back	1,044,334	151,792
Tight End	943,847	158,053
Running Back	822,036	160,040
Kicker	433,065	-
Punter	323,332	-
Long Snapper	168,670	-
	Panel B: Men's Basketball	
Point Guard	1,211,149	247,107
Small Forward	1,086,771	266,973
Shooting Guard	996,813	249,123
Center	963,601	335,109
Power Forward	819,989	260,034

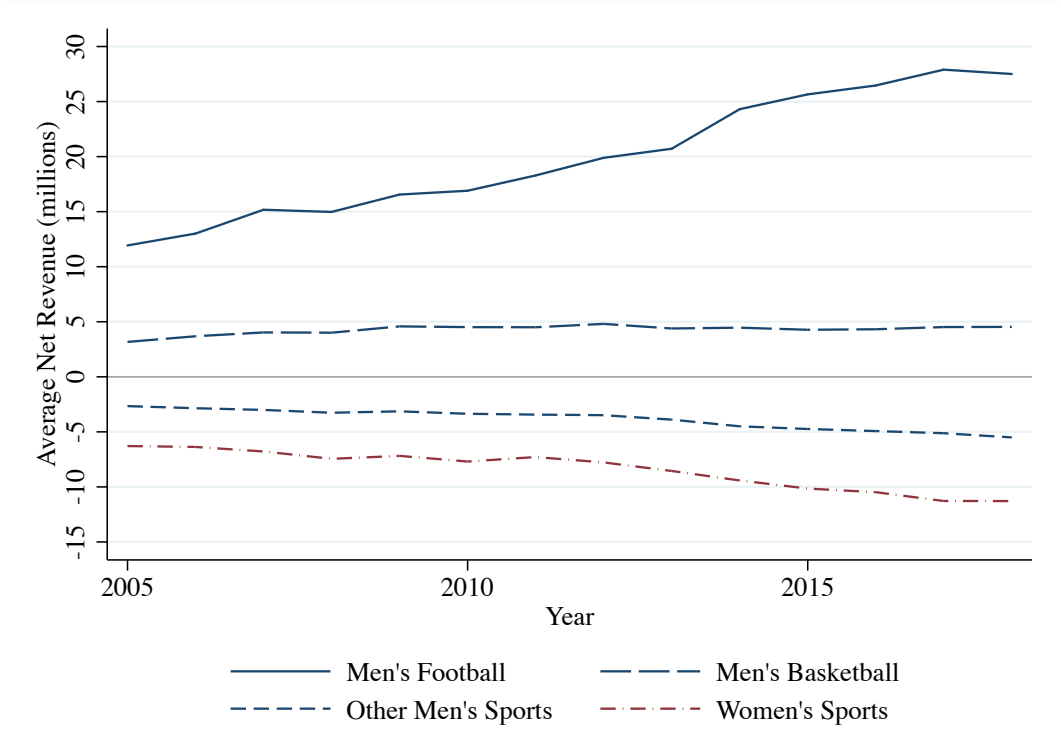
Notes: Table shows the mean compensation per player by position, which is defined as a combination of playing position in each sport and whether or not the player is a starter or reserve. These values are calculated using the Spotrac data on NFL and NBA contracts. We assume that the labor share of revenue and the number of players per team matches that observed in the professional league for each sport, and that the average relative compensation between positions matches that observed in the Spotrac data. The sample for calculating average revenue is the 61 "Power Five" schools used in Table 8. All numbers reported are 2018 US

Figure 1: Athletic Department Financing for NCAA Division 1 Schools, 2018



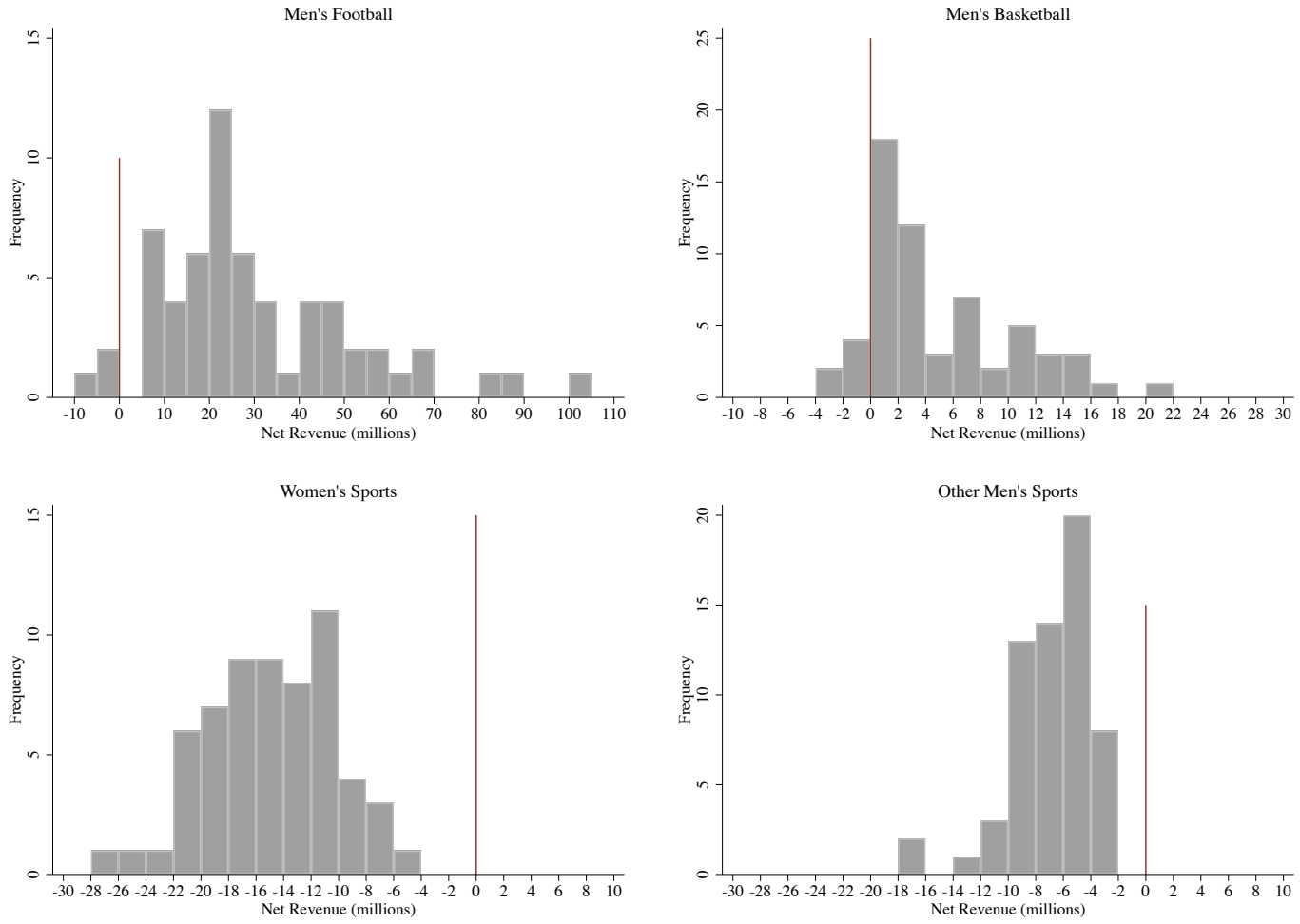
Notes: This figure reports the total athletic department revenue and the share of athletic department revenue that is institutional support – the sum of student fees, state funding, and other general funding from the university. The remainder of the revenue (excluding institutional support) is revenue that is generated directly by the athletic department. The sample is 229 NCAA division 1 universities, which includes 52 (of the 65) universities in the so-called "Power Five" athletic conferences where we have institutional support data; see text for more details. The dashed line shows a hyperplane dividing the sample into the two clusters calculated from a standard k-means clustering algorithm (set to find $k = 2$ clusters). Both variables are standardized before running the algorithm, and the clustering is perfectly correlated with the Power Five definition shown in the figure. Searching for additional clusters ($k = 3, k = 4$) preserves these two clusters and divides the sub-samples into additional clusters (within each sub-sample).

Figure 2: Average Net Revenue for Men's Football, Men's Basketball, Other Men's Sports, and Women's Sports, 2005-2018



Notes: This figure reports the average net revenue (revenue minus expenses) for different college sports (or groups of sports), averaging across 61 universities in the so-called "Power Five" Athletic conferences. For "Other Men's Sports" we exclude Football and Basketball, and we take sum of net revenue across sports within a school and then average across schools; we do analogous calculations for Women's sports, as well.

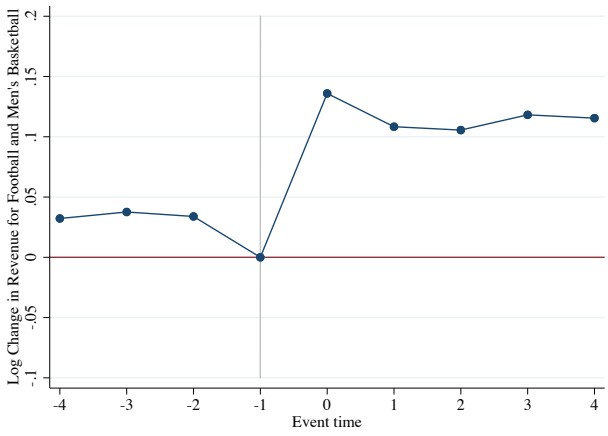
Figure 3: Distribution of Net Revenue for Men's Football, Men's Basketball, Other Men's Sports, and Women's Sports, 2018



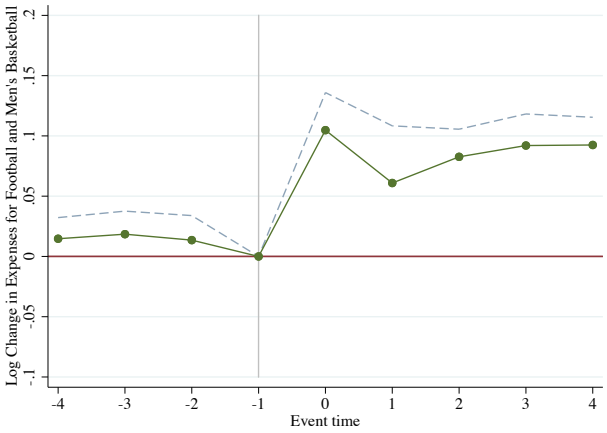
Notes: This figure reports histograms of the average net ragenue (revenue minus expenses) for different college sports (or groups of sports), covering 61 universities in the so-called "Power Five" Athletic conferences. For "Other Men's Sports" we exclude Football and Basketball, and we take sum of net revenue across sports within a school; we do analogous calculations for Women's sports, as well.

Figure 4: Difference-in-difference representation of main rent-sharing elasticity estimates

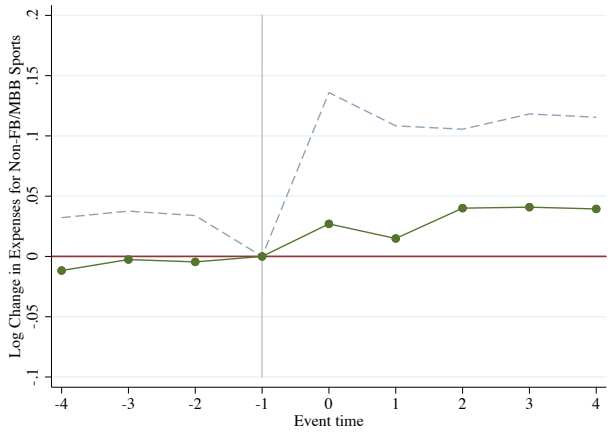
Panel A: Football and Men's Basketball Revenue



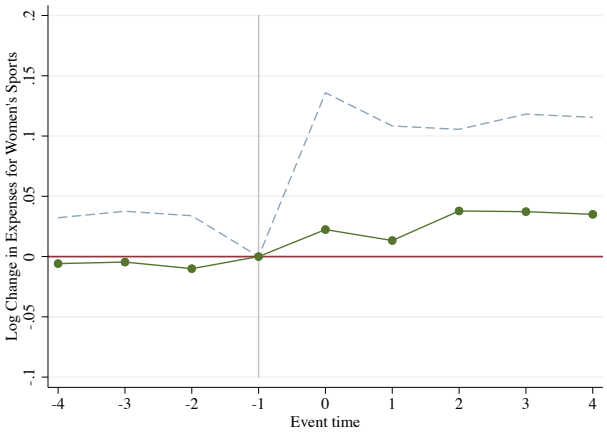
Panel B: Football and Men's Basketball Expenses



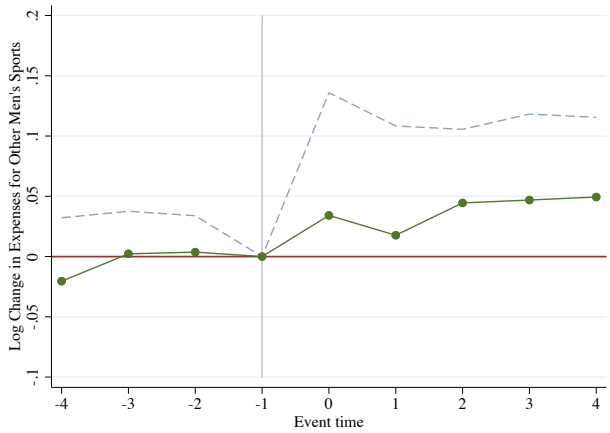
Panel C: Women's and Other Men's Sports Expenses



Panel D: Women's Sports Expenses



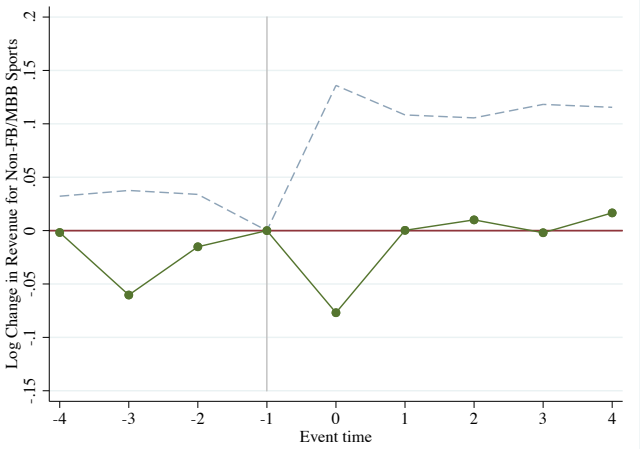
Panel E: Other Men's Sports Expenses



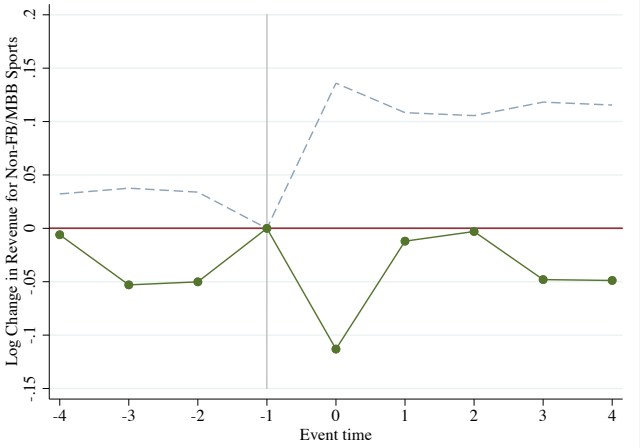
Notes: This figure reports a difference-in-difference representation of the rent-sharing elasticities reported in Table 2. The figure is constructed following the procedure in Lamadon, Mogstad, Setzler (2019). Specifically, for each outcome, the figure displays the mean differences in the log value between schools that receive an above-median versus below-median change in "Football and Men's Basketball Revenue + Non-Sport Revenue". This is the shock to school-level athletic department "rents" that are then passed through to spending on other sports. The ratio of the magnitude of the solid line relative to the dotted line can be interpreted as a rent-sharing elasticity that should correspond to the OLS estimates in Table 2 if the model is specified correctly.

Figure 5: Difference-in-difference representation of revenue for other sports

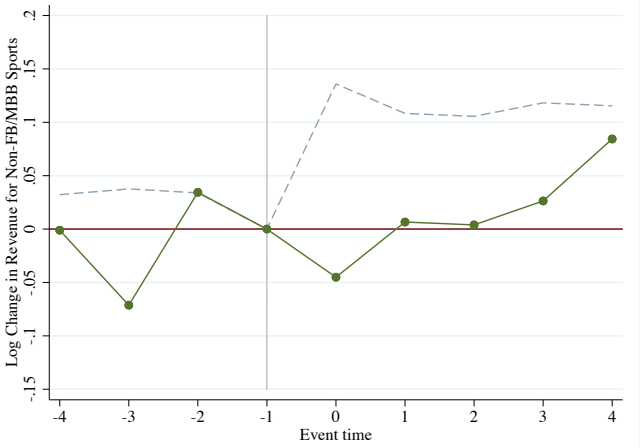
Panel A: Revenue for Women's Sports and Other Men's Sports



Panel B: Revenue for Women's Sports

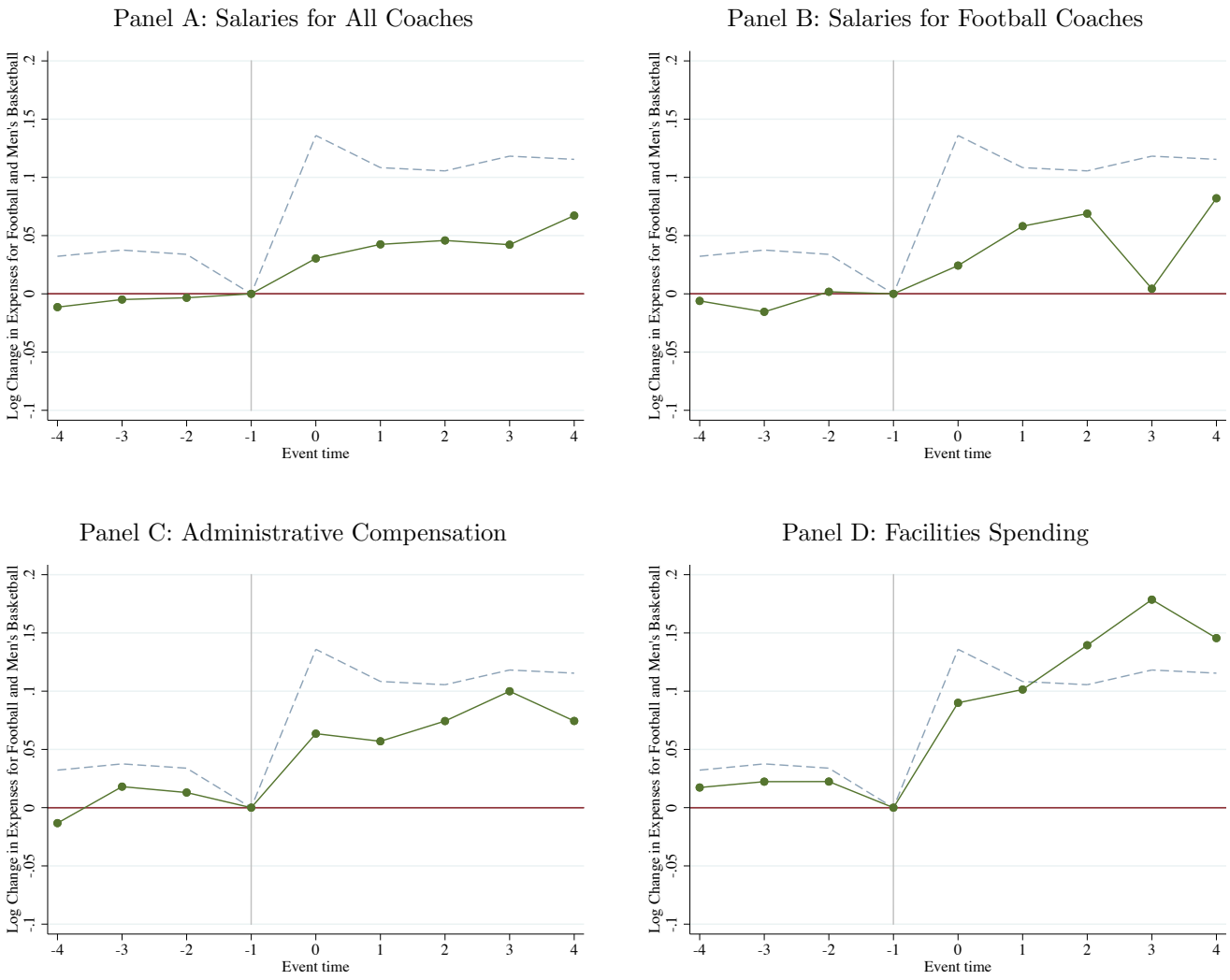


Panel C: Revenue for Other Men's Sports



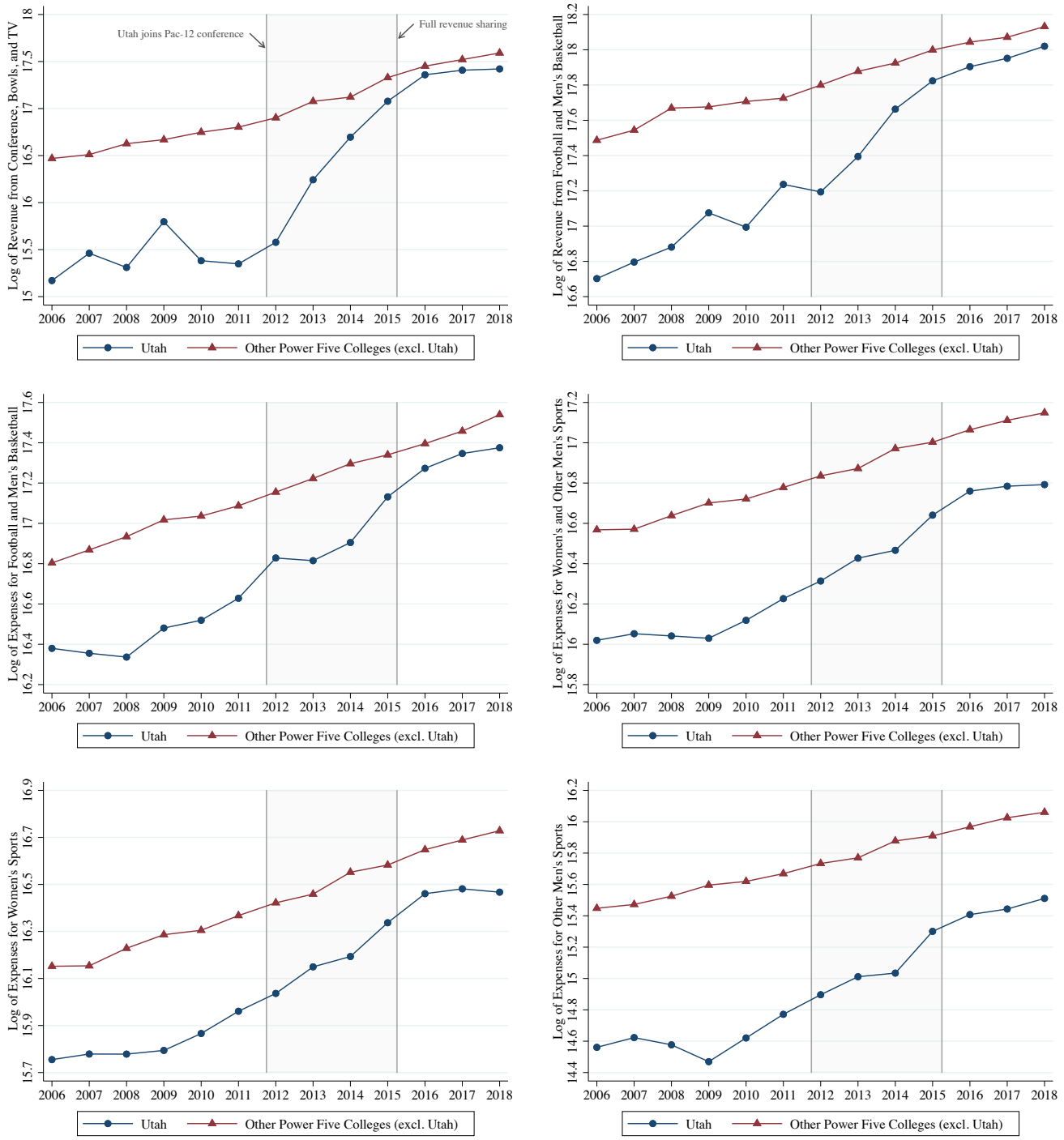
Notes: This figure reports a difference-in-difference representation of the rent-sharing elasticities reported in Table 3. See notes to Figure 4 for more details.

Figure 6: Difference-in-difference representation of additional rent-sharing elasticity estimates



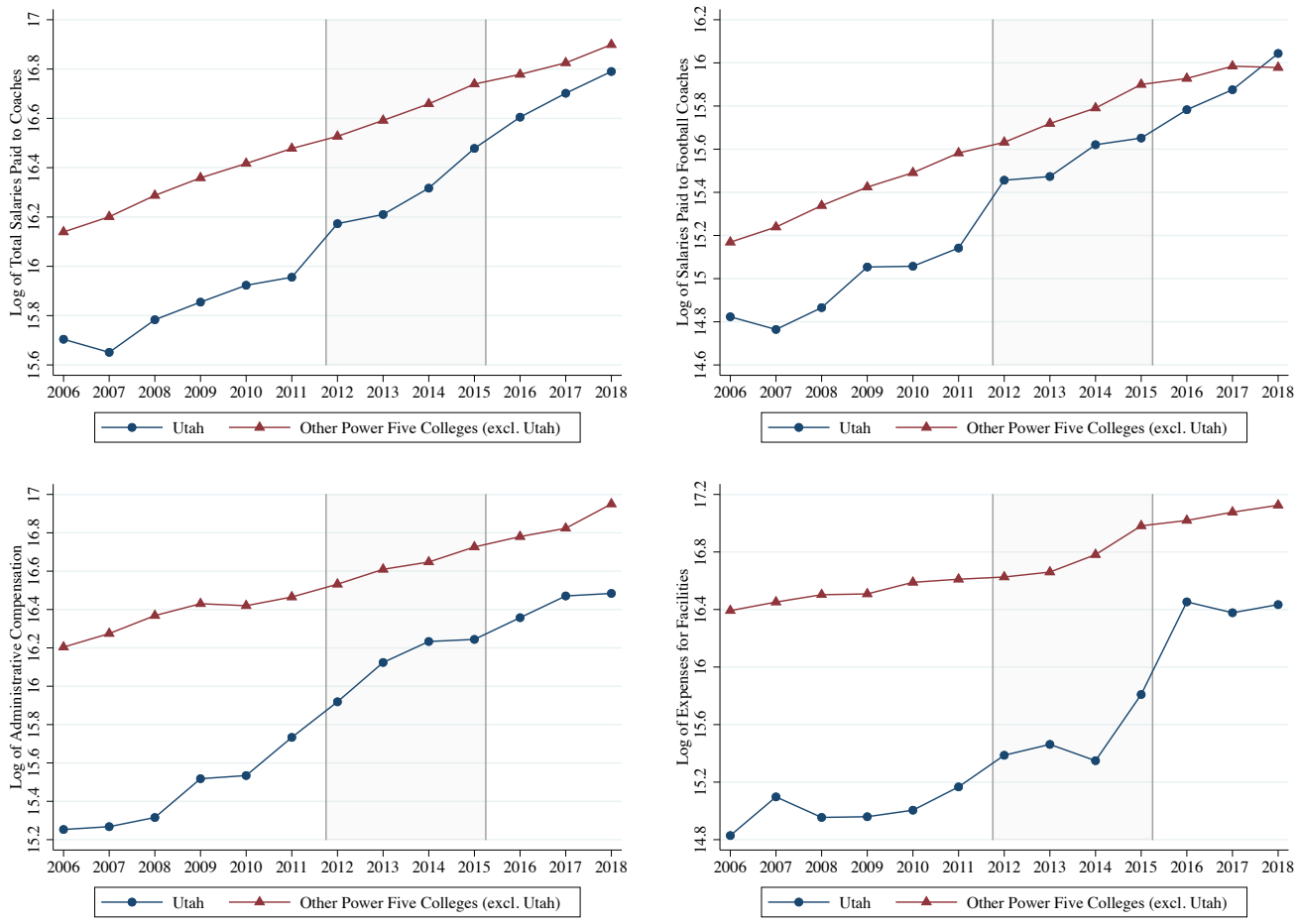
Notes: This figure reports a difference-in-difference representation of the rent-sharing elasticities reported in Table 3. See notes to Figure 4 for more details.

Figure 7: Rent-Sharing in the University of Utah Case Study



Notes: This figure reports raw trends in outcomes comparing the University of Utah to all of the other "Power 5" schools in our analysis. Beginning in 2012, Utah moved from the Western Athletic Conference (not a "Power 5" conference) to the Pac-12 (which is one of the "Power 5" conferences). Over the next 3 years, the conference payments to Utah were "phased in".

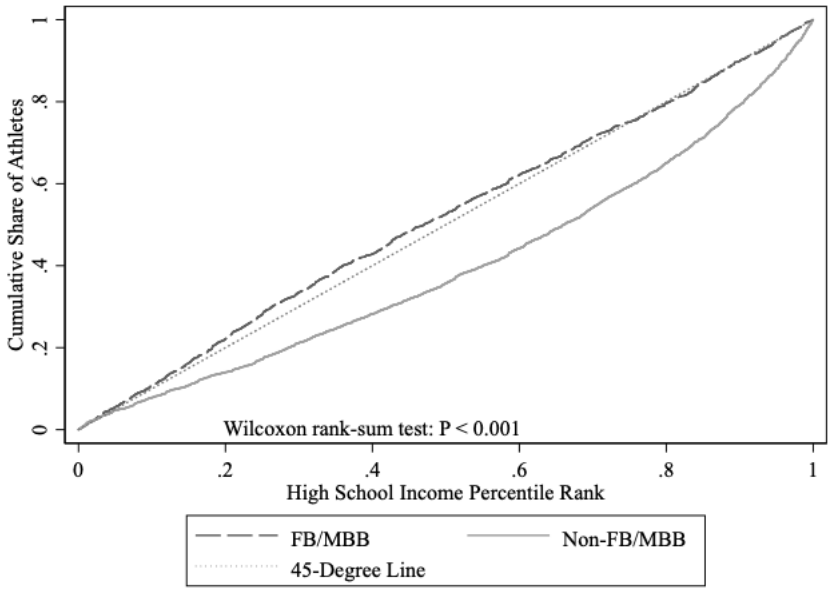
Figure 8: Additional Outcomes for University of Utah Case Study



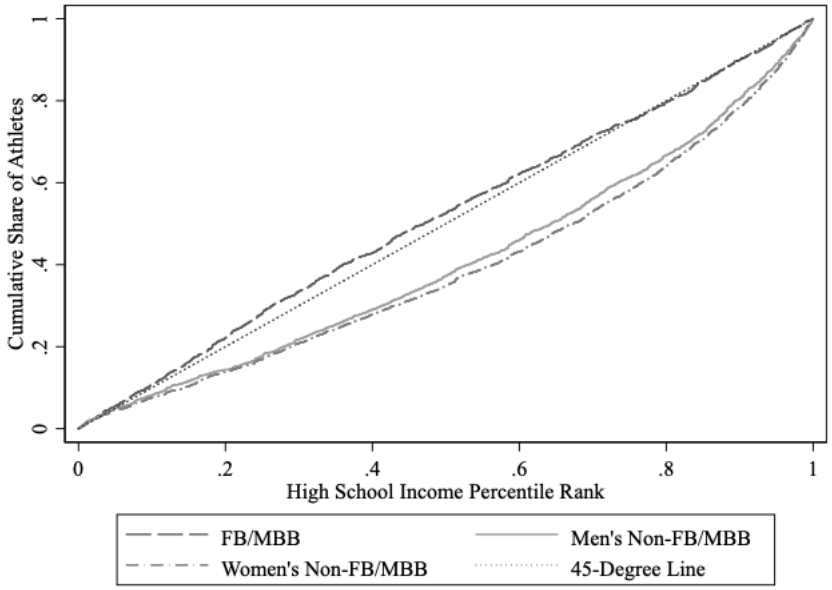
Notes: This figure reports raw trends in outcomes comparing the University of Utah to all of the other "Power 5" schools in our analysis. See notes to Figure 6 for more details on this case study

Figure 9: Distribution of Median Household Income by Sport

Panel A: Football and Men's Basketball versus Other Sports

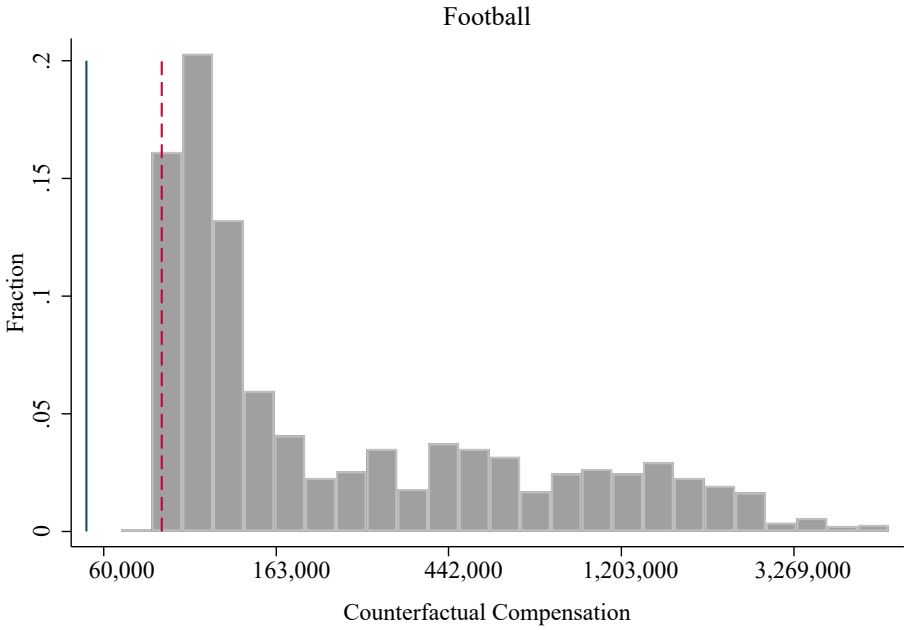


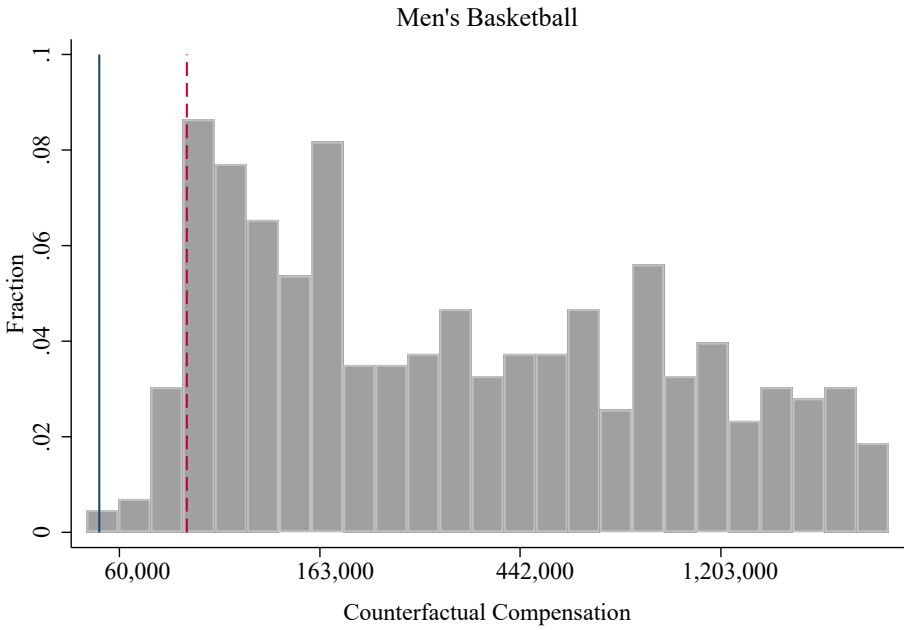
Panel B: Separating Other Sports by Gender



Notes: This plot shows the CDF of each player's high school-matched median household income from the 2000 census SF3 files. Athlete-sport observations are sorted based on matched median household income at the high school level, and players that play multiple sports are counted once per each sport. In Panel A, the CDFs are broken down into two separate categories of sports: Football and Men's Basketball, and everything else. A Wilcoxon rank-sum test comparing the two distributions has a p-value of less than 0.001. In Panel B, the CDFs are broken down into three separate categories of sports: Football and Mens' Basketball, and all other sports broken down by gender. Wilcoxon rank-sum tests are run comparing distributions pairwise. The P-values of the test are less than 0.001 for comparisons of FB/MBB vs Women's sports and FB/MBB vs Men's Non-FB/MBB sports. The P-value for a comparison between Women's and Men's Non-FB/MBB is 0.009.

Figure 10: Estimated Distribution of Athlete Compensation





Notes: This figure plots the distribution of our (logged) counterfactual compensation estimates. We assume the labor share of revenue and number of players per team matches the professional league for each sport, and that the distribution of relative compensation matches the distribution observed in the Spotrac contracts data for each professional league. These estimates are calculated using sport-specific revenue values in the EADA data from the 2018-2019 school year. The sample is the 61 (of the 65) schools in the "Power 5" athletic conferences. The data exclude 4 schools with sport-level accounting data that is not usable for the statistical analysis (Baylor, Boston College, Rutgers, and West Virginia). In each figure the blue solid line marks the average current scholarship value across schools ($54,271) and the red dashed line marks the maximum current scholarship value ($83,960).