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

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First version: July 2020
This version: July 2021

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. We rule out skill-upgrading of coaches as an alternative explanation of our results by focusing on head coach "stayers" using panel data on the identity of each football head coach in our sample. Using complete roster data for every student-athlete playing sports at these colleges 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. Having documented the existence of rent-sharing, we conclude with stylized calculations of 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.

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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) colleges and universities 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 colleges typically field men's and women's teams in approximately 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. Direct revenue is likely an underestimate of the total funds generated by football and men's basketball. The remaining 27 percent of athletic department revenue comes from other sources such as the sale of media rights. Even a cursory review of those contracts demonstrates that most of the value stems from the ability to broadcast football and men's basketball programs (Sanderson and Siegfried 2018a). Given this stark difference in revenue generation, 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.[3]

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.[4] 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

[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 colleges 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] It should be noted that the actual distinction between these two sets of sports is not that "non-revenue" sports actually generate zero revenue for the athletic department directly or the university indirectly, but instead is meant to highlight the economically significant differences in the average level of revenue and ratio of revenue and expenses across these categories of sports. We discuss the reasons for this distinction between "revenue" and "non-revenue" sports extensively in Section II.

[4] Even this number is likely to be 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 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). We discuss this issue in more detail in Section VI below. Additionally, we also discuss the possibility of viewing the lavish spending on athletic facilities for student-athletes as a fringe benefit that should be counted as compensation. We note here that such spending is also common for professional football and men's basketball leagues would not be included in the 50 percent of revenue that is paid as salary.

generated by their athletic activities as salary (NBA and NBPA 2017; NFL and NFLPA 2020).[5] 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 colleges.

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

We begin by characterizing the distinct "business models" across FBS colleges. 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 colleges, 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 colleges 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 colleges in the so-called "Power 5" athletic conferences.[6] The athletic departments in these colleges have traditionally operated successful athletic programs, participated in lucrative postseason activities, and negotiated valuable media rights packages – i.e., the ability of television networks to broadcast athletic contests. The clustering analysis demonstrates that Power 5 conference colleges operate under a largely self-sustaining business model that closely represents a commercial enterprise generating economic rents. This model is distinct from the other FBS colleges, and therefore the Power 5 conference colleges serve as the main sample for our rent-sharing analysis. When we refer to college sports in this paper we are primarily referring to colleges operating under this business model.[7]

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

[5] Appendix Section IV contains excerpts of the relevant parts of the collective bargaining agreement for each league.
[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 Atlantic Coast Conference (ACC).
[7] This means, of course, that our estimates cannot speak to the economics of other intercollegiate athletic programs. That said, attempting to analyze programs with such different underlying economics as a single group conflates important differences in rent-sharing that could have implications for optimal policy in this area.

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.[8]

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 college and year fixed effects, and we measure changes in rents using within-college-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, which corresponds to $0.31 of every dollar brought in by football and men's basketball programs being spent on football and men's basketball. 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 coaches' salaries – a fact we empirically document below.

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.[9] These results imply that for every dollar of football and men's basketball revenue, $0.11, $0.07, $0.04 are spent on all other sports, women's sports, and other men's sports, respectively. We also estimate rent-sharing elasticities using data covering salaries for football coaches, salaries for non-football coaches, administrative compensation, and spending on facilities. For each of these outcomes, we also find meaningful rent-sharing elasticities of 0.40, 0.31, 0.45, and 0.86, respectively. Again, converting to shares, these estimates imply that $0.03, $0.03, $0.09, and $0.20 are spent on each of these outcomes per dollar of football and men's basketball revenue.[10]

[8] 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.
[9] The all other sports category is the sum of women's sports and all other men's sports (excluding football and men's basketball).
[10] When comparing the magnitude of the estimates across football and non-football coaches, it is important to remember that there are a far greater number of non-football coaches in an athletic department. Therefore, the equal spending in aggregate does not reflect the benefit to each individual coach.

In theory, the estimated increase in spending on coaches and administrative staff need not represent rent-sharing. Instead, it could represent "skill upgrading" as colleges use the unexpected increases in revenue to hire higher quality coaches and trainers. We assess this alternative explanation using panel data on the identity of each football head coach in our sample. We find that increases in football and men's basketball revenue does not lead to increased head coach turnover. We also estimate similar rent-sharing elasticities when we identify rent-sharing only for head coach "stayers" (i.e., head coaches who remain at same college). Specifically, we demonstrate robustness to including a full set of college-by-head-coach fixed effects and find similar rent-sharing elasticity estimates as in our main results. We thus conclude that skill upgrading is not the primary explanation for the estimated increase in coaches' salaries and instead primarily represents rent-sharing by these coaches.

Finally, we explore effects on institutional support – the amount of money transferred from the university to the athletic department – and find elasticities very close to zero (ranging from -0.2 to 0.01 depending on the exact specification), which correspond to shares between -$0.01 and $0.01 per dollar of football and men's basketball revenue. This demonstrates that increased revenues are not simply reducing the institutional support from the university, a fact that is not surprising since the Power 5 conferences in our sample are largely self-contained economic enterprises.

To interpret these estimates as rent-sharing elasticities, we must assume that the within-college-over-time variation in revenue is plausibly exogenous with respect to other determinants of outcomes such as expenses and salaries. Including college 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 colleges), 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 college-wide "common shocks" in our main OLS results.

Our second approach is to directly address endogeneity concerns by exploiting the fact that "Power 5" colleges 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 colleges or changes in conference media payments. To demonstrate the importance of conference payments, we present a case study of the University of Utah moving into a Power-5 athletic conference in 2012. This illustrative example is used to motivate an instrumental variables (IV) identification strategy that uses variation in conference payments to instrument for the revenues generated by football and basketball programs. Our IV estimates are broadly similar to our panel fixed-effects OLS estimates, and we interpret this broad similarity of our 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.

To provide broader context for our rent-sharing estimates, we next study 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 college. 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 of these 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 colleges provide equal opportunities for athletics across genders.[11] 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 well 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

[11] 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).

other men' sports, since such rent-sharing "uses up" resources that could otherwise be used to help meet the requirements of Title IX.[12]

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 colleges in 2018, and we merged 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 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.[13]

Having documented rent-sharing and explored its distributional consequences across student-athletes, we conclude the paper with stylized calculations of an alternative wage structure for football and men's basketball players using collective bargaining agreements in professional sports leagues as a benchmark. This follows 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 colleges and universities 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 college in our sample. We argue that these compensation estimates

[12] 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.

[13] 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.

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.

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 threats to rents. 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 colleges. 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 colleges. One cluster of colleges 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 colleges with meaningfully larger overall athletic department revenues. For these colleges, the vast majority of overall revenue is generated by the direct activities of the athletic department.

To formally determine the clusters of colleges, we use a standard *k*-means clustering algorithm, and the dashed line in Figure 1 represents a hyperplane that divides the sample of FBS colleges into two distinct clusters based on this algorithm. As discussed above, the colleges in the lower-right cluster correspond exactly to the subset of FBS colleges that are members of the so-called "Power 5" athletic conferences: Big Ten, Pac-12, Big 12, Southeastern Conference (SEC), and Atlantic Coast Conference (ACC). Based on the results of the clustering analysis in Figure 1, we focus our empirical analysis on the colleges in the Power 5 conferences, since these are the colleges where intercollegiate athletics are likely to generate substantial economic rents.[14]

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 colleges and receive payments from the NCAA based on the performance of member colleges in postseason tournaments (Hobson 2014). These revenues are then generally split evenly between member colleges. 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 2018a).

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.[15] 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 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 2018a).[16] 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).

[14] 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.

[15] 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).

[16] 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 colleges.

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).[17]

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 for sporting events (i.e., ticket revenues), endorsement deals, and merchandise sales. Ticket sales and donations generate the most revenue of the on-campus activities.[18] In 2019, there were 19 colleges that reported at least $20 million in ticket revenue from football alone (Berkowitz 2020). In addition to ticket sales, the individual college 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 million in cash and $2.25 million in products per year. In our finances data for public Power 5 colleges, we find that ticket sales and donations account for roughly 40 percent of total revenue across all colleges in 2018, with corporate sponsorships, advertising, and licensing accounting for 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 colleges and universities 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, coaches' 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

[17] The growth in NBA and NFL revenues comes from the Forbes team valuations for each league.

[18] 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 of 2017, 80 percent of the price paid in the form of a donation was tax deductible (Berman 2018).

students. Partly driven by the controversy over the lack of payments for college players, in 2015 colleges 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 colleges. In 2015 the additional stipend at Boston College was $1,400 while at the University of Tennessee the stipend was $5,666.[19] 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.

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 name, image, or likeness. Several athletes and their universities 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 universities 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 universities 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 colleges (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 colleges, this paper finds that each NFL draft pick was associated with $500,000 in extra revenue for a college. Brown (2011) updates this estimate to include more colleges and finds that by 2005 an NFL draftee was worth around $1 million for a college 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

[19] 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).

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 colleges – 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 colleges attract good athletes, or do good athletes increase revenues for colleges? Including college fixed effects can address this difficulty if the college-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 receive 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 obtain a greater share the economic rents than would be expected given their on-the-job performance. Similar to our results, they find that coaches obtain 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 that matches high schools and hometowns to neighborhood socioeconomic 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. Rent-sharing generally refers to a scenario where profits are shared with workers above and beyond payment of market wages. In our setting, we interpret excess revenue generated by football and men's basketball programs as rents, and we study how these rents are shared within the athletic department. We focus on the following potential recipients: (1) non-revenue sports (i.e., women's sports and other men's sports); (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 small share of the intercollegiate sports played at universities. The Power 5 colleges in our sample offer 8.2 men's and 10.8 women's sports on average. While each college 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 colleges 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 colleges. Profitable activities are largely limited to two sports: football and men's basketball.[20] 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.[21]

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 college. 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. Colleges 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

[20] The results in Figure 3 show that revenues exceed expenses for almost all of the football programs in our sample, which partly reflects the fact that our sample is limited to colleges in the Power 5 conferences. Outside of the Power 5, we expect more football programs to be unprofitable based on the measure in Figure 3. Our results show, however, that the oft-repeated claim that "most college football teams lose money" is not true for colleges in Power 5 conferences.

[21] 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

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.[22] Given the lack of institutional support, the only way for colleges 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

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.[23]

In our data, we find that the average total payments to football coaching staffs at Power 5 public colleges and universities 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 colleges have also seen their total salaries increase from $7.3 to $12.5 million, 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.[24]

[22] There is a question about whether donations to athletic departments would otherwise go to the university and therefore represent a subsidy from the colleges 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 colleges stopped participating in sports altogether – it does suggest that the story is more complicated than a subsidization of athletics by the university.

[23] 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).

[24] 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.

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, colleges 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 be their home on campus, when they're not in class." In an analysis of 48 colleges in the Power 5 conferences, the *Washington Post* found that the colleges 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* noted that colleges "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).[25]

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.

[25] 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 colleges 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.[26] Over this time period, we have data on 64 of the 65 teams in Power 5 conferences for all years, and coverage of all colleges for the final 11 years.[27] 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.

Colleges 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 academic years. Colleges 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 colleges allocate non-sport revenue using different rules. This is most apparent when it comes to the treatment of revenue received from conferences, which some colleges 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 college'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 the revenue sharing over bowl payments (Schlabach 2017).

While colleges 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 the colleges' accounting. Using external data on the annual value of conference and TV payments, Appendix Table OA.19 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.20 shows that identical changes in conference revenue appear almost entirely in football and men's basketball revenue for colleges that have low non-sport revenue shares on average, while for colleges 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

[26] 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.
[27] Prior to 2009, the University of Maryland does not report EADA or Knight Commission data. Data for Maryland is included when available (2009-2019).

combines football revenue, men's basketball revenue, 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 college-sport-year observations where the revenue and expenses are exactly equal for non-revenue sports. While it is possible the 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 college-years. Of the 907 total EADA college-year observations, 137 have a sport with zero net income, and 121 of these have eight or more sports with zero net income.

Given our interest in rent-sharing, the nature of data manipulation is important to understand. Obviously, a sport can achieve zero net income by either an artificial change in revenue or in spending. In Appendix Section II, we present a variety of pieces evidence that support the argument that colleges are inflating revenue rather than deflating costs. Perhaps the most compelling is that we find that instances where a college reports exactly zero net income is associated with a meaningful change in the within-sport revenue for the year. We do not detect a similar relationship with a change in costs. Therefore, we interpret a sport-specific observation with zero net income as a likely misreporting of revenue and not costs.

To address this problem, we impute revenue for the small subset of observations where the reported net income leads to our 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 college-level total revenue unaffected as we make corresponding changes to the "non-sport" revenue of each college after every sport-level imputation. Overall, revenue is imputed for only 9.6 percent of all college-sport-year observations, and we show below that all of our main rent-sharing elasticity estimates 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 college 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 additional information about the budgets of their athletic departments. 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 colleges that are in the EADA data. These excludes some influential private colleges such as Stanford University, the University of Notre Dame, and Northwestern University. These data are available from 2005-2018 and contain 595 total college-year observations.

Despite the limited coverage in terms of the number of colleges, 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, expenditures on athletic facilities and equipment, and total student aid for athletes.

II.A.3 Athletic Department Financial Data Summary Statistics

Summary statistics for variables from both the EADA and Knight Commission datasets are displayed in Table 1. It is clear that football and men's basketball sports bring in far more revenue than all other sports, with an average of about $60 million for football and men's basketball (or $90 million, including non-sport revenue), compared to about $7 million for other sports. Table 2 displays average revenues and expenditures as a share of athletic department revenue. Football, men's basketball, and non-sport revenue account for 92 percent of total athletic department revenue, with about 34 percent of total revenue being spent directly on football and men's basketball. By contrast, women's sports and men's non-revenue sports account for only 7 percent of the athletic department revenue, with 25 percent of the overall revenue being spent on these sports. The fact that non-revenue sports spend far more than they generate in revenue is initial evidence that rent-sharing occurs across sports within athletic departments. Turning to additional measures from the Knight commission, the largest categories of expenditure in the Knight database are on facilities spending, administrative compensation, and coach compensation, which account for 21, 18, and 18 percent of athletic department revenue, respectively.

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 college in our sample by scraping athletic department websites in October 2018. While each college 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. [28] Our matching procedures for CDP and county matches 93.4 percent of athletes where a U.S. hometown is listed.[29] Appendix Table OA.17 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.[30] 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 previous college. In addition, some students attend preparatory schools, private schools, or training academies, which may be less informative about an athlete's family background. 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.[31] 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.[32] 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.[33]

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[28] 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.

[29] The fraction not matched is largely consistent with the share of foreign athletes participating in NCAA sports.

[30] 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.

[31] Clemson did not have previous school listed on any of the rosters, so the high school sample of schools comes from only 64 colleges.

[32] The mean household income variable is derived by dividing aggregate household income by the number of households, in a calculation done by Social Explorer.

[33] 99.98 percent of schools have census information for at least one census tract in the catchment area, and 96.9 percent of schools have census information for all tracts.

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. 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.11.

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.[34] 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

[34] 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, colleges 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 colleges 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.[35] 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 3 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)).

In Table OA.2, we convert elasticities to effective shares of football and men's basketball plus non-sport revenue. To do this, we multiply each elasticity by its respective category's spending as a share of total athletic department revenue. We then divide by the share of total athletic department

[35] One unusual aspect of this specification is that we are estimating a rent-sharing elasticity using gross revenue on the right-hand side, rather than net revenue or value-added. This is somewhat non-standard within the recent labor economics literature on rent-sharing (see, e.g., Kline et al. 2019 and Lamadon et al. 2019), but this specification is necessary given inherent limitations in our data. Specifically, we do not observe school-sport-specific measures of non-labor and other intermediate costs, so we cannot calculate net revenue accurately. This limitation provides another motivation for the instrumental variables analysis, since we can plausibly assume that the instrument isolates variation in gross revenue that is orthogonal to unobserved determinants of non-labor costs. This means that the variation in gross revenue isolated by the instrument reflects variation in rents that can be shared within the athletic department. The similarity between the IV and OLS estimates alleviates concerns about using gross revenue on the right-hand side in our setting.

revenue which is accounted for by football, men's basketball, and non-sport revenue. Using this method, the own-sport elasticity of 0.82 corresponds to $0.31 of each dollar brought in by revenue-generating sports and non-sport revenue being spent on football and men's basketball. Since 92 percent of athletic department revenue is accounted for by football, basketball, and non-sport revenue, the share of total athletic department revenue spent on football and men's basketball is nearly the same: $0.28 of each additional dollar of athletic department revenue is spent on football and men's basketball. About $0.11 of every marginal dollar brought in by revenue-generating sports is spent on non-revenue generating sports.

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 3 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.[36]

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 6. 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.[37] This provides additional evidence that our estimates in Table 3 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

[36] Appendix Table OA.1 reports the robustness of the results in Table 3 to adding college-specific linear time trends, removing non-sport revenue from the main independent variable, and various decisions on imputation and sample inclusion.
[37] We write that the estimates in Table 6 are not economically significant because all of the elasticity estimates are small in absolute magnitude (always less than 0.2), and the estimates are also always at least 60 percent less than the magnitude of the corresponding expenses elasticity estimate in Table 3. The estimates are somewhat imprecise, however, which is one reason why we complement these results with the instrumental variables estimates discussed in the next section.

in the revenue for the summation of football, men's basketball, and non-sport revenue. In any year, colleges with an above-median increase in this change are classified as a treatment group and the remaining colleges 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 colleges 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 solid line representing the change in revenue from Panel A, and dashed lines indicate bootstrapped 95-percent confidence intervals. Consistent with the results in Table 3, 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 3, 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.21 suggest that rent-sharing is not limited to the non-revenue sports but also extends to salaries for salaries for football coaches, salaries for all non-football coaches[38], salaries for administrative personnel, and facilities spending. Table 4 reports rent-sharing elasticity estimates for these additional outcomes, and we find meaningful rent-sharing elasticities of 0.40, 0.31, 0.45, and 0.86, respectively. As in Table 3,

[38] Non-football coach salaries are constructed by subtracting football coach salary spending from total coach salary spending for all colleges in the Knight dataset.

these results are robust to conference-year fixed effects.[39] These elasticities imply that $0.03, $0.03, $0.09, and $0.20 are spent on each of these outcomes per additional dollar of football, men's basketball, and non-sport revenue, as reported in Table OA.3. These marginal spending shares are roughly the same as the average share for facilities spending reported in Table 2, but are smaller than the average spending shares for all other measures.

To explore whether revenue from football and men's basketball affects the university's finances, we also study the rent sharing with total institutional support: the amount of money transferred from the university to the athletic department. There is no evidence that institutional support is impacted by football and men's basketball. The elasticities we estimate change signs based on the specification used, and the associated shares reported in Table OA.3 are small and not significantly different from zero. They range from -$0.01 to $0.01 received per dollar of football, men's basketball, and non-sport revenue. The negligible effect suggests that the additional revenue brought in by football and men's basketball is either spent on other sports, in other years, or is possibly redirected to the university through something other than a change in institutional support. To further demonstrate this point, the final column of Table OA.3 contains an estimate of the change in the athletic department surplus. We find that an increase in revenue from football and men's basketball results in greater surpluses for the department. While the elasticity here is small, it is important to remember that annual changes in revenue are much smaller than the overall athletic department budget so we would not expect large percentage changes in surplus.[40]

Figure 6 contains the estimates from the same Lamadon et al. (2019) difference-in-differences procedure as in Figure 4 for some of 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.

Finally, we also examine the robustness of our rent-sharing estimates to alternative measures of spending. As we note above, there are some concerns with EADA sport-specific financial data where colleges appear to manipulate data to result in exactly zero dollars of net income for many years. There could be a concern that our attempts to correct these data do not fully account for potential manipulation of spending data and therefore may bias our estimates of rent sharing across sports.

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[39] Note that the sample of colleges changes slightly because these measures are not available for all colleges, so Appendix Table OA.1, Panel C confirms that the main results in Table 3 continue to hold within the subsample of colleges where we can measure these additional outcomes.

[40] The expenditure categories in Appendix Table OA.3 come from the Knight dataset and are not collectively exhaustive. Therefore, they should not be added together with the estimated shares in Appendix Table OA.2 using EADA spending categories, which would include spending from these categories and thus should not be expected to sum up to one. It should also be noted that the surplus measure used in Appendix Table OA.3 is the ratio of revenue to expenses (rather than revenue minus expenses) so the variable can be log transformed like the other expenditure categories. This means it should also not be expected to sum up to one with any expenditure categories, even if the individual measures were mutually exclusive and collectively exhaustive.

While we believe our efforts appropriate adjust the data, we supplement our main estimates with alternative measures of spending that do not use the EADA sport-specific spending variables and therefore avoid the concerns over measurement or reporting error associated with these variables.

Results using these alternative spending data are shown in Appendix Table OA.4 alongside our baseline specification from Table 3. The alternative expense measures from the Knight data used as dependent variables are total football spending, non-football spending, and a proxy for other sport spending that subtracts the various categories used in Table 4 from total spending in the Knight data.[41] The measure is intended to approximate the amount of spending on athletes outside of football and can be created without using the EADA data. The estimated elasticity for football spending is 0.69, which is slightly smaller than our baseline specification in Column 1 of Table 3.[42] The elasticities for non-football spending and the proxy for other sport spending are 0.53 and 0.42, respectively. These are very similar to the elasticity reported in Column 2 of Table 3, which measures non-revenue sport spending directly using the EADA data.

IV.B. Rent-Sharing or Skill-Upgrading?

The increase in spending on coaches' salaries and administrative staff need not represent rent-sharing; it could instead represent "skill upgrading" as colleges use unexpected increases in revenue to hire higher quality coaches and trainers. We assess this alternative explanation by collecting panel data on the identity and total compensation of every head football coach in our sample from USAToday.com, and we use this data to estimate whether the greater revenue from football and men's basketball leads to greater head coach turnover. We also report results from alternative specifications that include college-by-head-coach fixed effects, which isolates the change in salaries for the same coaches and therefore eliminates the possibility of skill upgrading. The inclusion of these additional fixed effects means that rent-sharing is more narrowly identified from head coach "stayers" and is similar to the strategy in Lamadon et al. (2019). By conditioning on the football team's head coach not leaving, we identify rent-sharing as increased spending on the head coach and the rest of the football coaching staff that cannot be due to "upgrading" the head coach.[43]

Table 5 reports these additional results. Column (1) of Panel A shows that we find no evidence of increased head coach turnover in response to increases in revenue from football and men's basketball; the point estimate is small and statistically insignificant. The results in columns (2) and (3) show broadly similar results comparing specifications with and without the additional college-by-head-coach fixed effects (comparing Panel B to Panel A). If we take the ratio of the rent-sharing elasticity

[41] Since we do not observe sport-specific expenses in the Knight data for any other sports besides football, this proxy includes men's basketball spending.
[42] This is unsurprising given this measure excludes spending on men's basketball and the relative amount of overall spending between these sports.
[43] When the head coach changes, the rest of the football coaching staff is very likely to change, as well.

estimates for football coaching staff salaries across the two specifications, we find that the estimate in Panel B is 87 percent of the estimate in Panel A, suggesting that skill upgrading can only account for at most 13 percent of the overall rent-sharing elasticity estimate. The results for head coach salaries are much noisier, which makes it hard to assess the importance of skill upgrading using these results, but the ratio of point estimates again implies a relatively small role for skill upgrading (31 percent). When combined with the additional robustness analysis reported in the Online Appendix, we conclude that skill upgrading is unlikely to be the primary explanation for the estimated increase in football coaches' salaries and that our main results largely reflect genuine rent-sharing.[44]

IV.C. 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 college's team – but are clearly the result of that college 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.[45] 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 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

[44] We show robustness of the results in Table 5 in Online Appendix Tables OA.7 (adding conference-by-year fixed effects) and OA.8 (instrumental variables estimates). These results provide no evidence of increased head coach turnover and show broadly similar results with and without college-by-head-coach fixed effects.

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

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.[46] In addition to payments related to the success of other teams, colleges also receive substantial payments from their conferences for media rights. These payments are not explicitly tied to the decisions of any one college and vary both over time and across conferences. In modern athletics, these media payments have grown substantially in value (Sanderson and Siegfried 2018a).

To demonstrate the importance of conferences in the revenue generated by football and men's basketball and to motivate our instrumental variables analysis, 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).[47] 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 "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. While Utah is only a single case study of a college switching conferences, it provides 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. That is, we argue that we can use

[46] 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 on a six-year rolling average of NCAA tournament performance.

[47] We use the Utah case study primarily to illustrate the logic of our instrumental variable. There are other colleges that changed conferences during our sample period (e.g., Rutgers and Maryland joined the Big Ten). In principle, conference changes could be a source of exogenous variation in conference revenue, but implementing this is complicated by the fact that the year colleges change conferences is often not the year that colleges begin receiving the same conference payments as the other colleges in the conference. For the Utah case study, the timing of changes in conference revenue line up with what we were able to learn from published media reports.

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 colleges 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)).[48] 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.[49]

Table 7 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 7 report the IV estimates for spending on various sports, analogous to the main results in Table 3.[50] 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.4 reports analogous results for non-athlete and facilities spending, which are also broadly similar to the OLS

[48] An alternative to using own-college conference payments could be using the leave-me-out average conference payments (averaging across all of the other colleges in my conference). This instrument turns out to be too weak (first stage F-statistic below 10), and it is also not necessarily more likely to satisfy the exclusion restriction given that my own team qualifying for a lucrative bowl leads to larger payments to other teams in the same conference.

[49] The instrumental variable analysis addresses another potential concern with the OLS estimates, which is that the key right-hand side variable is based on gross revenue rather than net revenue, or value-added. As a result, productive investments in a football program that lead to simultaneous increases in revenue and expenses might be spuriously interpreted as rent-sharing within the revenue sports. The timing of changes in revenue and expenses in Figure 4 provides some evidence against this interpretation (since the plausibly exogenous changes in revenue precede the changes in spending), and the instrumental variables estimates further support our preferred interpretation under the assumption that our conference payments instrument is orthogonal to unobserved investments in football and men's basketball programs.

[50] For completeness, Appendix Table OA.9 reports IV estimates for a specification that includes conference-year fixed effects, to reproduce Panel B of Table 3. 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 college. 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.

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.

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. Although preferential admission for athletes is not confined to these sports, 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.[51]

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 8 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,

[51] 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" colleges 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).

respectively. On average, athletes attend high schools with a median family income of $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 9 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 9 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.15 uses data from the NCAA about athlete demographics at the conference-sport level for colleges 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 colleges 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.[52]

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

[52] Harper (2018) provides a detailed analysis of the racial composition of revenue sport athletes compared to non-revenue sports for the Power 5 conferences.

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 head coaches for men's sports and 79 percent of the head coaches for women's sports in the Power 5 conferences were White (National Collegiate Athletic Association 2020). 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 obtained 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 obtained approximately 7.75 percent of overall revenue. To help place this amount in perspective, consider the data in Appendix Table OA.22 which contains the percentage of total revenue obtained by the top five executives in ExecuComp database.[53] This percentage varies over the years, but the average amount of revenue paid to the top executives 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), and this leads us to speculate that the existing limits of player compensation cause excess rents to be transferred to coaches.

VI. Player Compensation Analysis

Having documented the existence of rent-sharing, we now 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

[53] We use the ExecuComp database as an illustrative comparison since we are not able to use salaries for professional coaches (e.g., coaches in the NFL or NBA); those salaries are not publicly available.

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).[54]

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 2016).[55] 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 obtain 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 obtain various percentages of the revenue generated by their sports.[56] 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 colleges 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 colleges individually. While we primarily do this to address issues

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[54] 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 university 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.

[55] 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."

[56] 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 colleges 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.

of how colleges 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 colleges.[57] This is particularly likely within conferences, many of which already exhibit a strong preference towards the sharing of revenues from activities such as bowl participation payments, NCAA tournament revenues, and at times even gate receipts from on-campus events.

Table 10 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 college 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.[58] 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.16.[59] The range of salaries shown in Table 10 under different labor shares can also provide some context for the salaries athletes would receive on average as bargaining power changes relative to the professional leagues, or as cash compensation is offset from the inclusion of non-wage benefits through the bargaining process. This would include the value of academic resources, training, facilities, and other amenities that athletes receive from their athletic departments.[60] With respect to spending on lavish facilities, we take as an extreme upper bound estimate of current football and men's basketball player compensation to be the total spending on athletic facilities, interpreting this spending as a non-wage amenity that is valued by the players at cost.[61] In this case, football and men's basketball players collectively currently receive 21.8 percent of revenue, which could be subtracted from the 50 percent benchmark to calculate appropriate player compensation net of amenities).[62]

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[57] 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.

[58] 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).

[59] 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 college 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.

[60] One indication of athletes in football and men's basketball placing a high value on the training they receive from college programs is that nearly all NFL players and most American NBA players played in college before entering the professional league. The NFL currently requires players to be three years removed from high school before entering the league while the NBA requires players to be one year removed from high school.

[61] Such an upper bound effectively treats all facilities spending as player compensation, whereas in reality some of that spending is more accurately defined as the physical plant and infrastructure investments required for any firm. That said, this upper bound estimate provides useful information about the extent of cash compensation potentially available for players under collective bargaining.

[62] We argue that this is an extreme upper bound because facilities and equipment spending includes amenities that are either shared across sports within the athletic department or used entirely by sports other than football and men's basketball. This measure may also

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.[63]

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).[64] 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 11. 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

imperfectly capture the true amenity value of an athletic department's facilities and equipment stock, since the Knight data reports annual expenditures on debt service and leases for facilities and new purchases of equipment.

[63] 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.

[64] 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.

13 for basketball), and we assume that athletes share in roughly 50 percent of sport-specific revenue.[65] 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 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.

Defining the compensation that athletes receive under the current system as the book value of the scholarship is clearly incomplete in a variety of ways. As a measure of resource costs, this is clearly an overestimate. Even if we consider the opportunity cost to the college of a particular seat in a class, it is unlikely that many athletes would be required to pay the list price of tuition if they were not on scholarship. That said, it is also unclear that absent participation in athletics any particular athlete would gain admission to their respective college. In this way measuring compensation as the book value may be an underestimate of the actual value enjoyed by athletes. A key additional benefit that athletes receive that is not captured with this definition is favorable admission practices for athletes, potentially allowing many athletes to attend more selective universities than they would otherwise be admitted to. Our rent-sharing results imply that the financial incentive to improve athletic performance by relaxing admission standards is particularly large for football and men's basketball, so these athletes could disproportionately benefit from preferential admission. However, athletes may face constraints on major choice, class enrollment, and time that are not faced by most students at these universities (Office of Senator Chris Murphy 2019). Football and men's basketball players also have significantly lower graduation rates than the general student body at Power 5 colleges, as shown in Appendix Table OA.16. In contrast, athletes in non-revenue sports have graduation rates that are more similar to the overall student body – suggesting that the value of preferential admission may be greater for these students. It is also important to consider that the value of preferential admission is not the entire benefits of human capital from a selective university but instead the increase at the margin from attending the more selective school adjusted for decreased ability of revenue sport athletes to take part in the entirety of the educational process. Finally, it is important to consider that there are statutory NCAA limits on minimum admissions standards and therefore the value that can be provided by preferential admission is constrained in a way that is not true for the growth in revenue – which is uncapped and rising rapidly.

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

[65] 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.

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.[66] Therefore, even if the NCAA removed restrictions on colleges 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 colleges could lead to a competitive imbalance that favors a smaller number of teams. That said, the current system allows colleges 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. Colleges 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. Sanderson and Siegfried (2015) also point out that athletic departments may respond to a relaxation of compensation limits by reducing roster sizes, particularly for football. We attempt to reflect the potential for adjustment on this dimension by using different roster size assumptions in Table 10. However, we do not consider the potential spillover effects this could have on athletes currently playing other non-Power 5 colleges.

Another potential outcome affecting equilibrium payments is whether demand for college sports is partly a function of the amateur nature of the endeavor. Sanderson and Siegfried (2018b) hypothesize that if players were to be played, the NCAA might split into a small number of groups that compensate athletes, but only have loose affiliations with colleges. In this case, 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 colleges 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

[66] 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).

that are currently dedicated to non-revenue sports are instead used as compensation for athletes, then that could cause colleges 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, colleges would need to navigate the regulatory landscape of Title IX which requires that colleges 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.[67]

VII. Discussion

Our estimates provide evidence of rent-sharing in intercollegiate athletics. We have primarily focused on rent-sharing across sports within athletic departments, and we have interpreted increased spending on coaches' salaries and athletic facilities as additional recipients of rent-sharing. We acknowledge that some of the estimated effects on coaches' salaries and facilities spending could represent productive investment or skill upgrading, rather than rent-sharing. For example, higher-quality facilities can represent investments in attracting better players, and higher coaches' salaries could represent increased payments to higher quality coaches. We rule out skill upgrading as the primary explanation of our results for coaches' salaries in Section IV.B, but we are not able to rule it out entirely given the limitations of our data. That said, we interpret the similarly-large increases in spending on *non-football* coaches' salaries (as compared to football coaches' salaries) as additional evidence against rent-sharing as the primary explanation for our results. We thus interpret our OLS and IV estimates as establishing a causal chain running from increases in football and men's basketball revenue leading to increased spending on women's sports and other men's sports, athletic facilities, and (football and non-football) coaches' salaries, and we see rent-sharing as the most likely explanation for this pattern of results.

In the remainder of this section, we discuss 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 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

[67] 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.

– 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 colleges 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 colleges 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.[68] 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 colleges 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 colleges to engage in commercial activity 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

[68] 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).

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).[69] 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 colleges 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 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 colleges 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. Colleges such as the University of Akron, Appalachian State University, the University of Cincinnati, and Old Dominion University and many other non-Power 5 colleges 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 colleges (36 compared to an average of 20 at other colleges) and this had been increasingly difficult over time. The pandemic was cited as a "breaking point" for the economics of their athletic department.

Colleges 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 colleges such as Iowa State, Kansas, Louisville, Michigan, and Missouri (Layberger 2020). All of these responses are consistent with our rent-sharing estimates.

[69] 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.

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 colleges 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.

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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 athletic department measures (from Knight commission):						
Salaries paid to all coaches	569	15.808	5.452	9.438	14.944	23.000
Salaries paid to football coaches	569	6.651	2.824	3.535	6.222	10.729
Salaries paid to non-football coaches	569	9.192	3.190	5.485	8.857	13.257
Total administrative compensation	569	16.364	6.881	9.395	15.135	24.980
Facilities spending	569	19.824	9.479	7.882	18.803	32.465
Total revenue from conference, bowls, TV	569	25.747	12.187	11.635	24.918	41.887
Institutional support (e.g., student fees, state funding, general funding from university)	569	5.220	5.571	0.000	3.754	11.874

Notes: This table reports descriptive statistics for 61 (of the 65) colleges in the "Power 5" athletic conferences. The data exclude 4 colleges 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 college-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 colleges and universities. Variables form the Knight data cover years 2006-2018. See Data Appendix for more details.

Table 2

Revenue and Expenses Share of Total Athletic Department Revenue

Panel A: Sport Revenue Share of Total Athletic Department Revenue

	Football and Men's Basketball + Non-Sport Revenue	Women's Sports and Other Men's Sports Revene	Women's Sports Revenue	Other Men's Sports Revenue
Average Share	0.924	0.076	0.044	0.032
Standard Deviation	(0.050)	(0.050)	(0.035)	(0.022)

Panel B: Sport Expenditures Share of Total Athletic Department Revenue

	Football and Men's Basketball Expenses	Women's Sports and Other Men's Sports Expenses	Women's Sports Expenses	Other Men's Sports Expenses	Other Athletic Department Expenses
Average Share	0.344	0.252	0.166	0.086	0.348
Standard Deviation	(0.067)	(0.048)	(0.033)	(0.023)	(0.089)

Panel C: Salaries, Facilities Spending, and Institutional Support Share of EADA Total Revenue

	Salaries for Football Coaches	Salaries for Non-Football Coaches	Administrative Compensation	Facilities Spending	Institutional Support
Average Share	0.073	0.102	0.179	0.218	0.063
Standard Deviation	(0.017)	(0.021)	(0.03)	(0.081)	(0.064)

Notes: This table reports average shares of total athletic departmen revenue (measured in the EADA data). Panel C reports shares constructed by dividing variables from Knight Commission data by total revenue from the EADA reports. Table OA.5 displays alternative shares for those in Panel C which use a measure of total athletic department revenue from the Knight Commission data, and the average shares are very similar.

Table 3
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 College 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 College, 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 college-year. All variables are included in logs so that the coefficients can be interpreted as elasticities. The sample covers 61 colleges in "Power 5" conferences between 2006 and 2019. The standard errors are clustered by college and are reported in parentheses.

Table 4

Additional Rent-Sharing Elasticities:

Salaries for Coaches, Administrative Compensation, Facilities Spending, Institutional Support

Dependent Variable:	Total Salaries for Football Coaching Staff	Total Salaries for Non-Football Coaches	Administrative Compensation	Facilities Spending	Institutional Support
	(1)	(2)	(3)	(4)	(5)
Panel A: OLS Estimates Including College Fixed Effects and Year Fixed Effects					
Football and Men's Basketball Revenue +	0.397	0.311	0.452	0.861	-0.196
Total Non-Sport Revenue	(0.125)	(0.086)	(0.108)	(0.252)	(0.620)
R^2	0.764	0.896	0.902	0.779	0.855
Panel B: OLS Estimates Including College, Year, and Conference-by-Year Fixed Effects					
Football and Men's Basketball Revenue +	0.322	0.310	0.367	0.821	0.092
Total Non-Sport Revenue	(0.121)	(0.104)	(0.092)	(0.285)	(0.627)
R^2	0.795	0.911	0.915	0.806	0.899

Notes: N = 569 for all regressions, and the unit of observation is a college-year. All variables are included in logs so that the coefficients can be interpreted as elasticities. The sample covers 46 colleges in "Power 5" conferences between 2006 and 2018. The standard errors are clustered by college and are reported in parentheses.

Table 5
Distinguishing Rent-Sharing from Skill-Upgrading

Dependent Variable:	Indicator for Change in Football Head Coach	Total Salaries for Football Coaching Staff	Football Head Coach Salary	Total Expenses for Football and Men's Basketball
	(1)	(2)	(3)	(4)
Panel A: OLS Estimates Including College Fixed Effects and Year Fixed Effects				
Football and Men's Basketball Revenue +	-0.140	0.397	0.474	0.862
Total Non-Sport Revenue	(0.125)	(0.125)	(0.219)	(0.115)
R^2	0.068	0.764	0.733	0.890
Panel B: OLS Estimates Including College, Year, and College-by-Head-Coach Fixed Effects				
Football and Men's Basketball Revenue +		0.344	0.327	0.791
Total Non-Sport Revenue		(0.072)	(0.326)	(0.095)
R^2		0.953	0.823	0.934

Notes: N = 569 for all regressions except for column (3) where N = 463 because of some missing head coach salaries. The unit of observation is a college-year. All variables are included in logs so that the coefficients can be interpreted as elasticities. The sample covers 46 colleges in "Power 5" conferences between 2006 and 2018. The standard errors are clustered by college and are reported in parentheses.

Table 6
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 College 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 College, 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 college-year. All variables are included in logs so that the coefficients can be interpreted as elasticities. The sample covers 61 colleges in "Power 5" conferences between 2006 and 2019. The standard errors are clustered by college and are reported in parentheses.

Table 7
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 = 569 for all regressions, and the unit of observation is a college-year. All variables are included in logs so that the coefficients can be interpreted as elasticities. The sample covers 46 colleges 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 college and are reported in parentheses.

Table 8
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 Catchment 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 9

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 Colleges
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 Colleges and Universities	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 Colleges and Universities	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 10
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

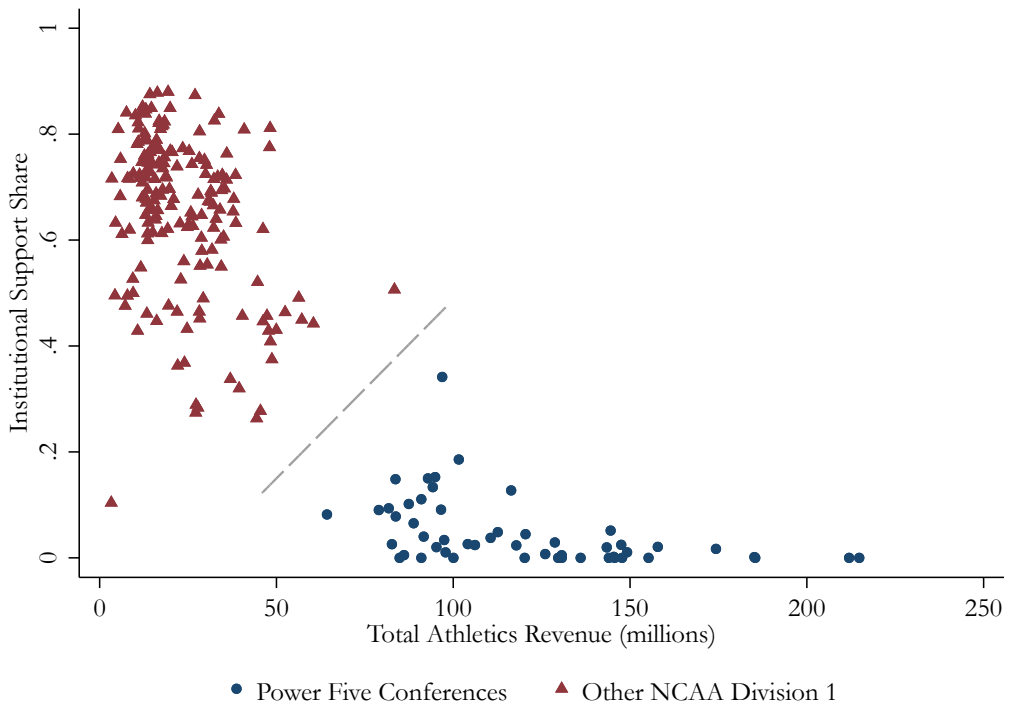
Notes: Table shows the mean compensaton per player for football and men's basketball under the counterfactual that players receive a fixed share of total sport revenue. These estimates are calculated using sport-specific revenue values in the EADA data from the 2018-2019 academic year. These estimates assume revenue sharing to equalize player budgets across colleges, either by between all colleges in the sample ("Overall") or by conference. The sample is the 61 (of the 65) colleges in the "Power 5" athletic conferences. The data exclude 4 colleges 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 11
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

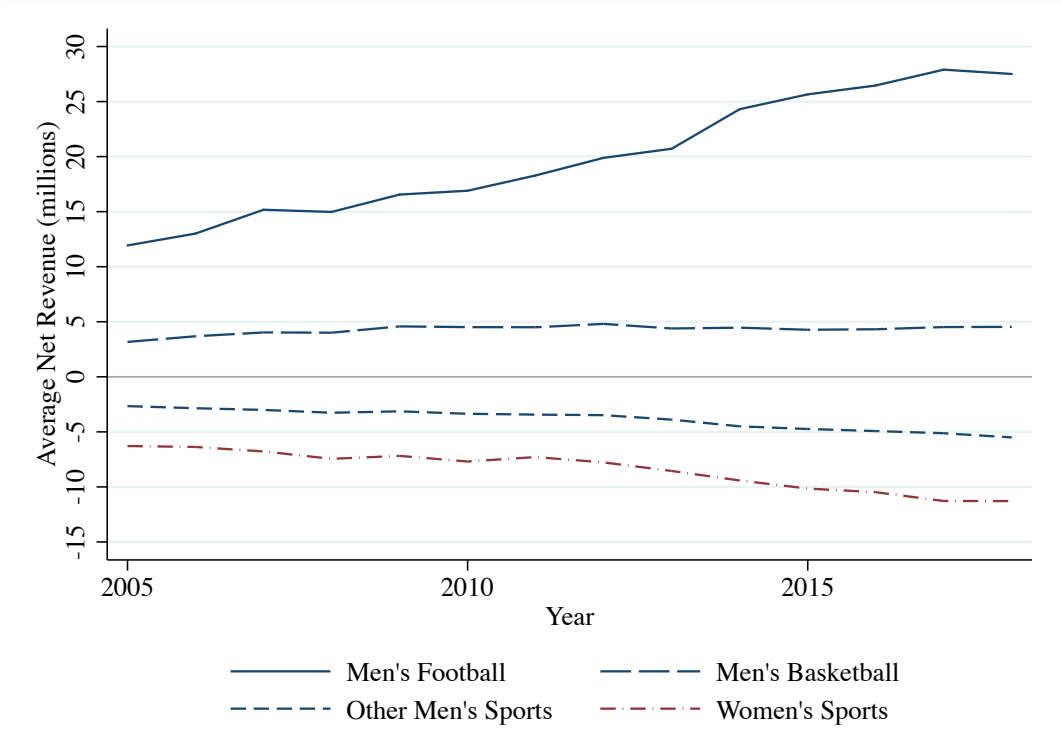
Notes: Table shows the mean compensation per player by position, which is defined as a combination of playing position in each sport and whether or not the player is a starter or reserve. These values are calculated using the Spotrac data on NFL and NBA contracts. We assume that the labor share of revenue 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" colleges used in Table 10. All numbers reported are 2018 US dollars.

Figure 1: Athletic Department Financing for NCAA Division 1 Colleges and Universities, 2018



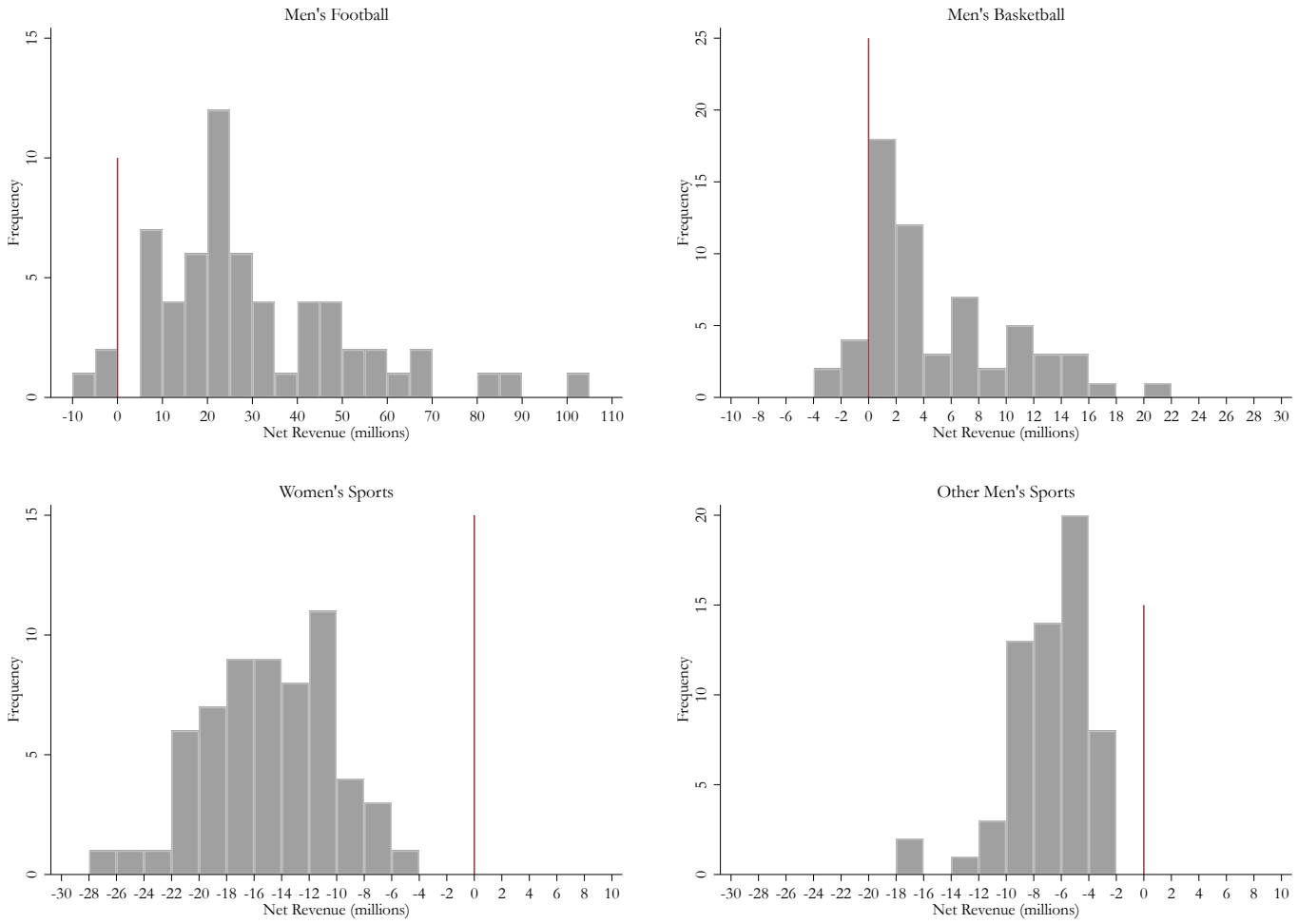
Notes: This figure reports the total athletic department revenue and the share of athletic department revenue that is institutional support – the sum of student fees, state funding, and other general funding from the university. The remainder of the revenue (excluding institutional support) is revenue 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 college and then average across colleges; we do analogous calculations for Women's sports, as well.

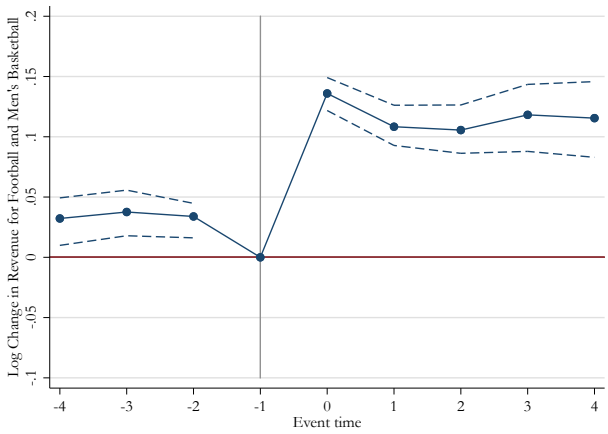
Figure 3: Distribution of Net Revenue for Men's Football, Men's Basketball, Other Men's Sports, and Women's Sports, 2018



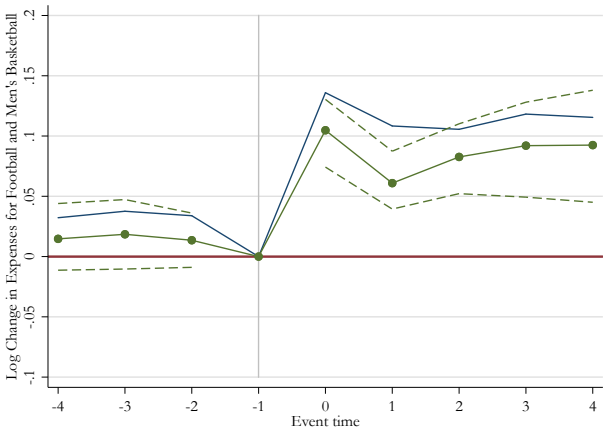
Notes: This figure reports histograms of the average net revenue (revenue minus expenses) for different college sports (or groups of sports), covering 61 universities in the so-called "Power Five" Athletic conferences. For "Other Men's Sports" we exclude Football and Basketball, and we take sum of net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

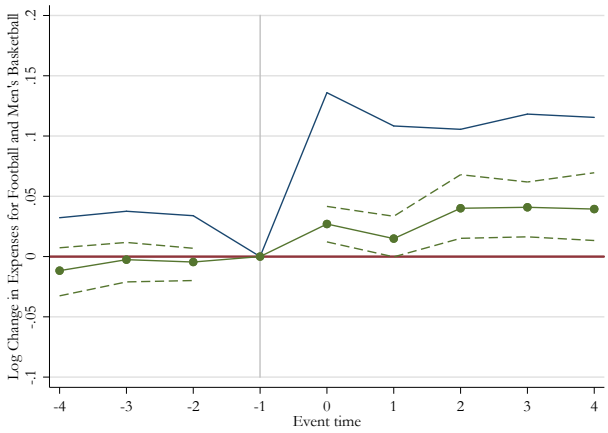
Panel A: Football and Men's Basketball Revenue



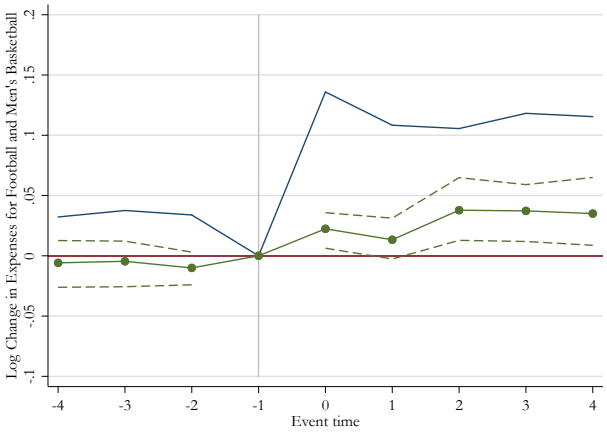
Panel B: Football and Men's Basketball Expenses



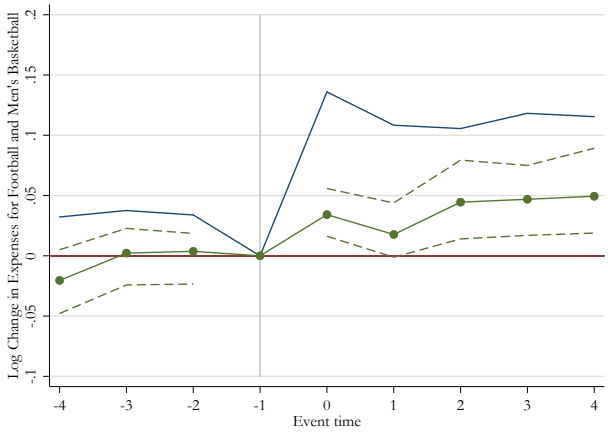
Panel C: Women's and Other Men's Sports Expenses



Panel D: Women's Sports Expenses



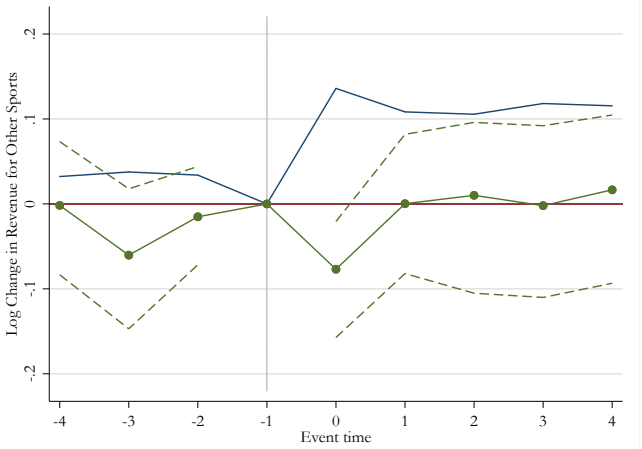
Panel E: Other Men's Sports Expenses



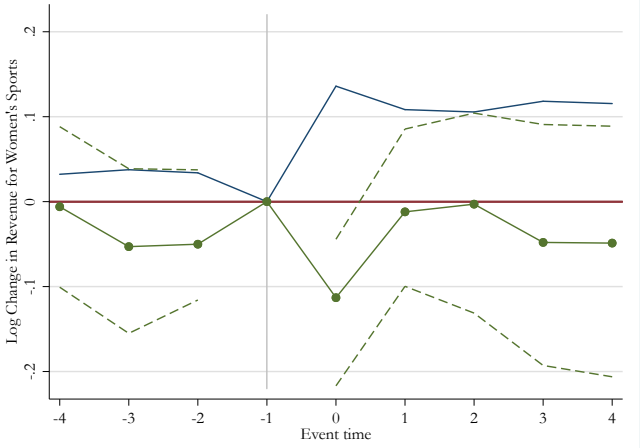
Notes: This figure reports a difference-in-difference representation of the rent-sharing elasticities reported in Table 2. The figure is constructed following the procedure in Lamadon, Mogstad, Setzler (2019). Specifically, for each outcome, the figure displays the mean differences in the log value between colleges that receive an above-median versus below-median change in "Football and Men's Basketball Revenue + Non-Sport Revenue". The ratio of the magnitude of the solid line relative to the dotted line can be interpreted as a rent-sharing elasticity that should be similar to magnitude of the OLS estimates in Table 2 if the model is specified correctly. Each panel includes bootstrapped 95-percent confidence intervals. The bootstrap samples are based on sampling colleges with replacement, and each bootstrap iteration calculates each regression and takes simple average of event study coefficients. See main text for more details.

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

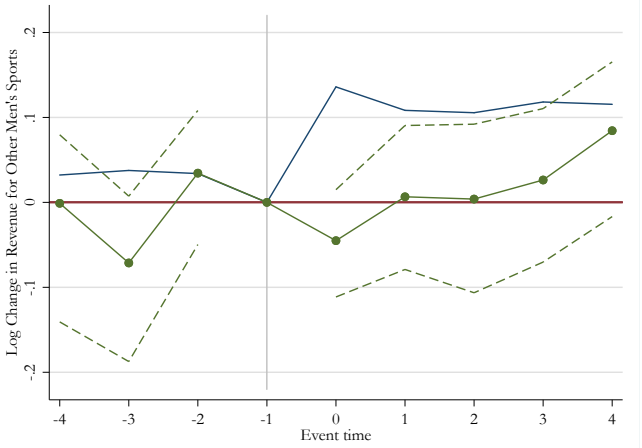
Panel A: Revenue for Women's Sports and Other Men's Sports



Panel B: Revenue for Women's Sports



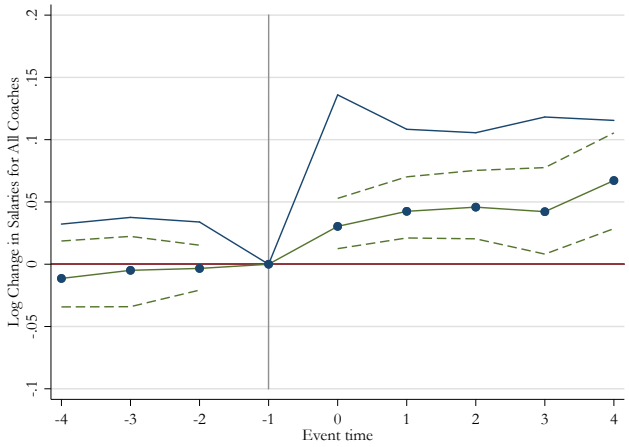
Panel C: Revenue for Other Men's Sports



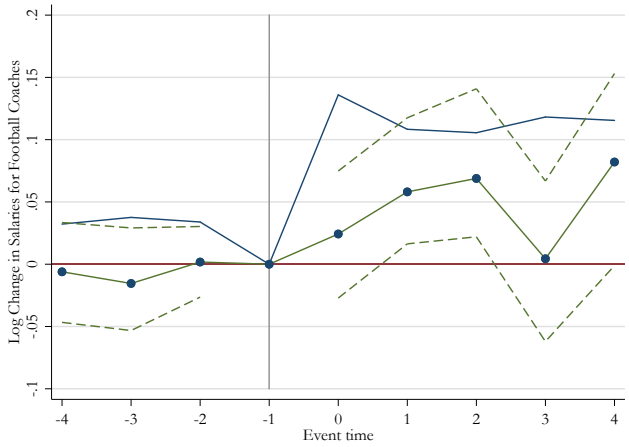
Notes: This figure reports a difference-in-difference representation of the rent-sharing elasticities reported in Table 3. See notes to Figure 4 for more details.

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

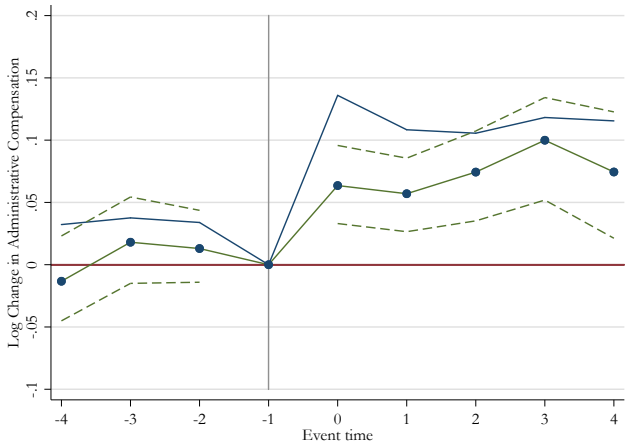
Panel A: Salaries for All Coaches



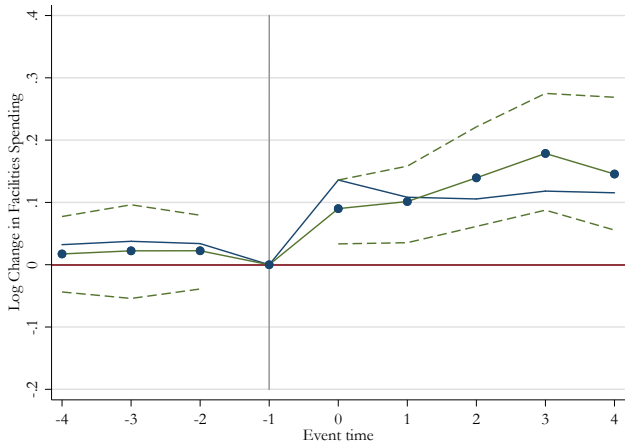
Panel B: Salaries for Football Coaches



Panel C: Administrative Compensation

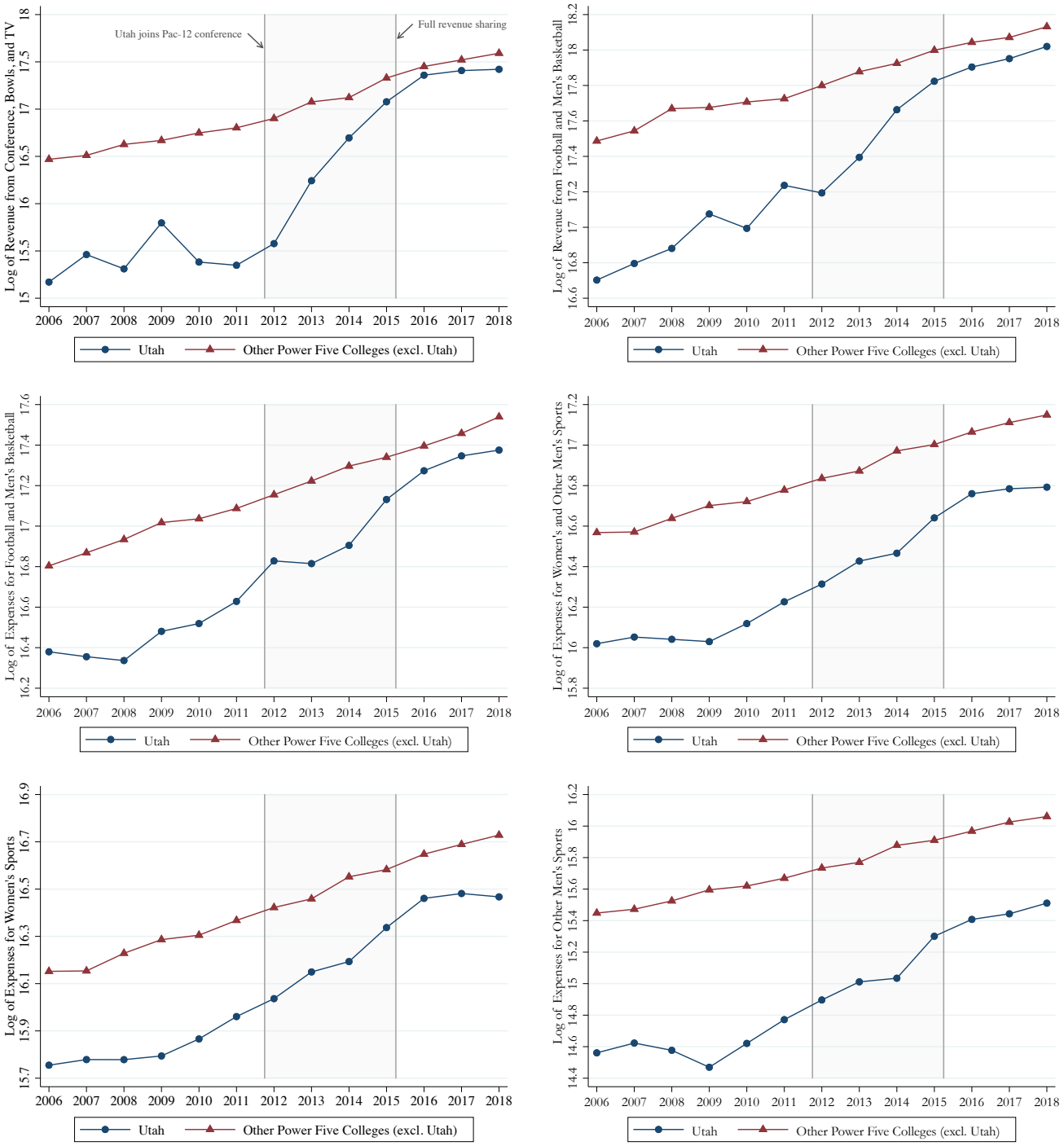


Panel D: Facilities Spending



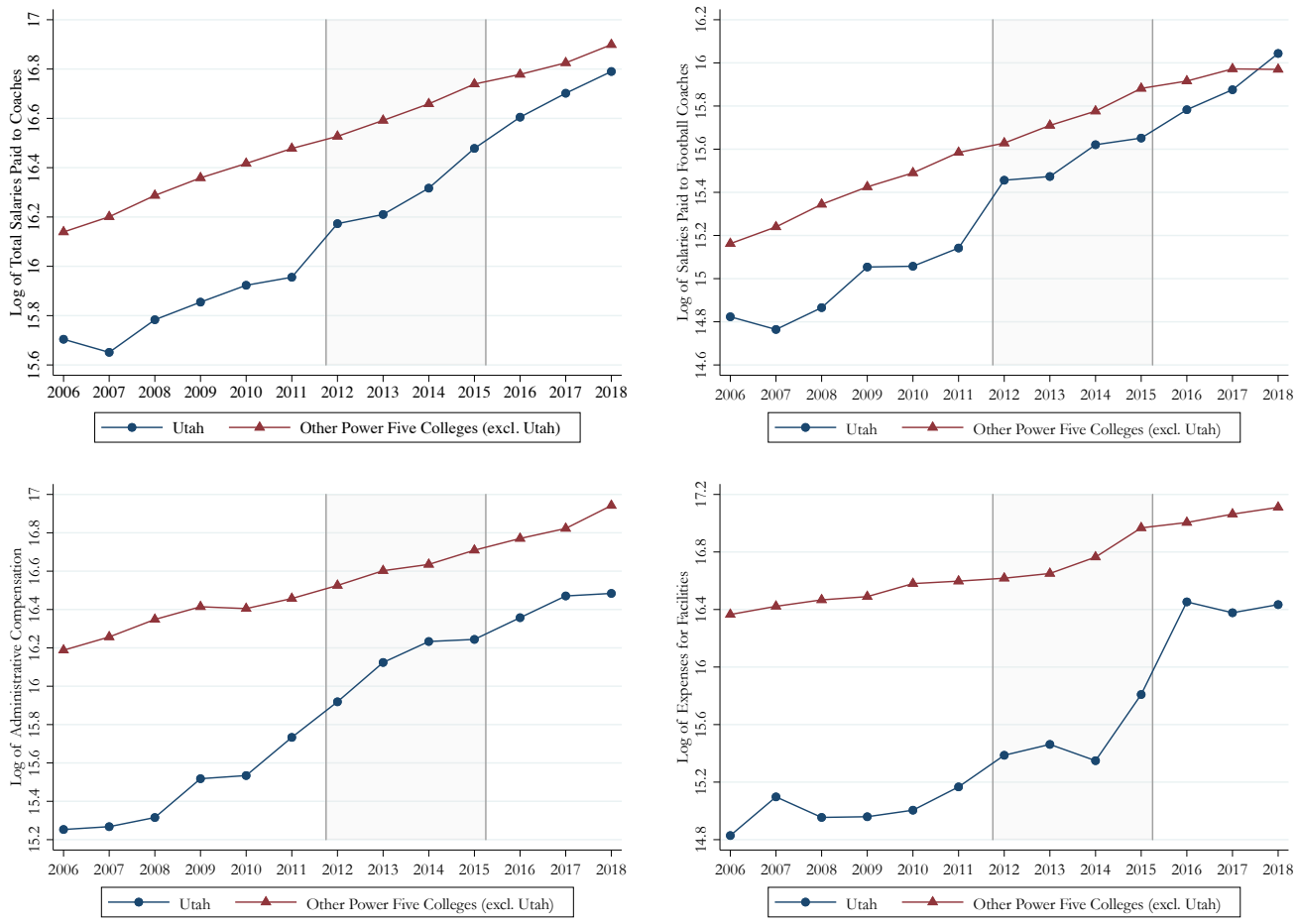
Notes: This figure reports a difference-in-difference representation of the rent-sharing elasticities reported in Table 3. See notes to Figure 4 for more details.

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" colleges 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".

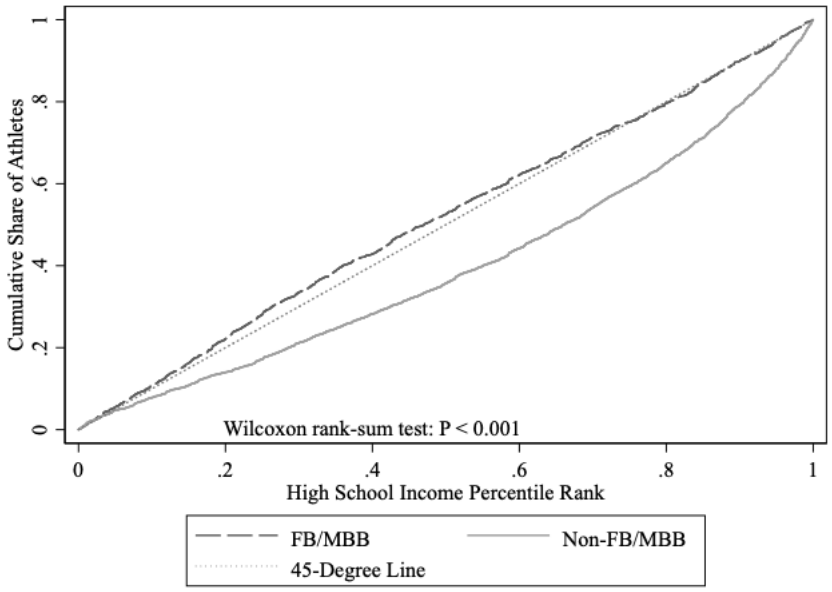
Figure 8: Additional Outcomes for University of Utah Case Study



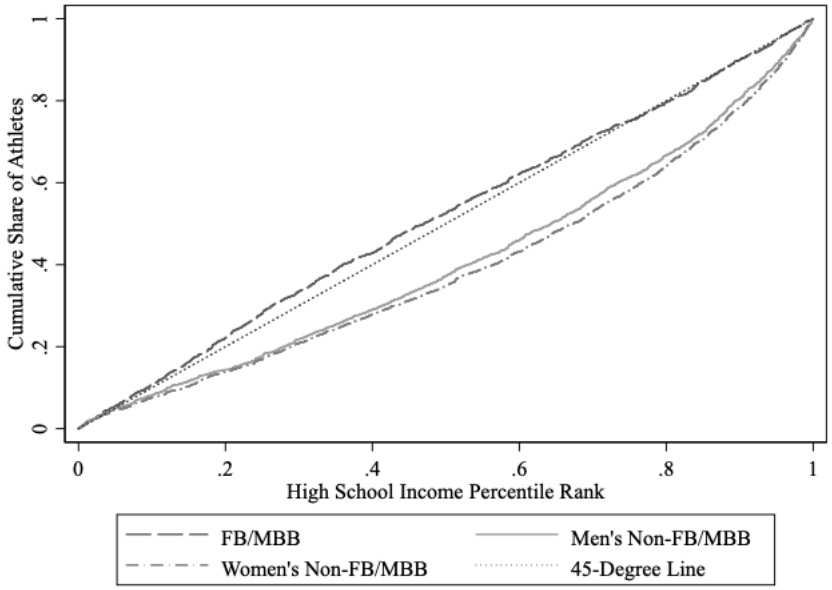
Notes: This figure reports raw trends in outcomes comparing the University of Utah to all of the other "Power 5" colleges in our analysis. See notes to Figure 6 for more details on this case study

Figure 9: Distribution of Median Household Income by Sport

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

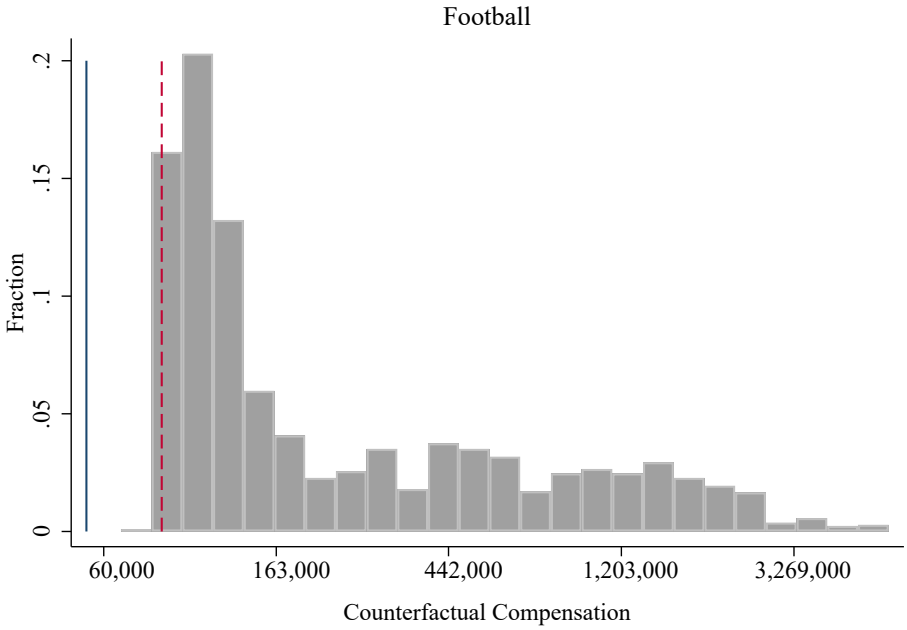


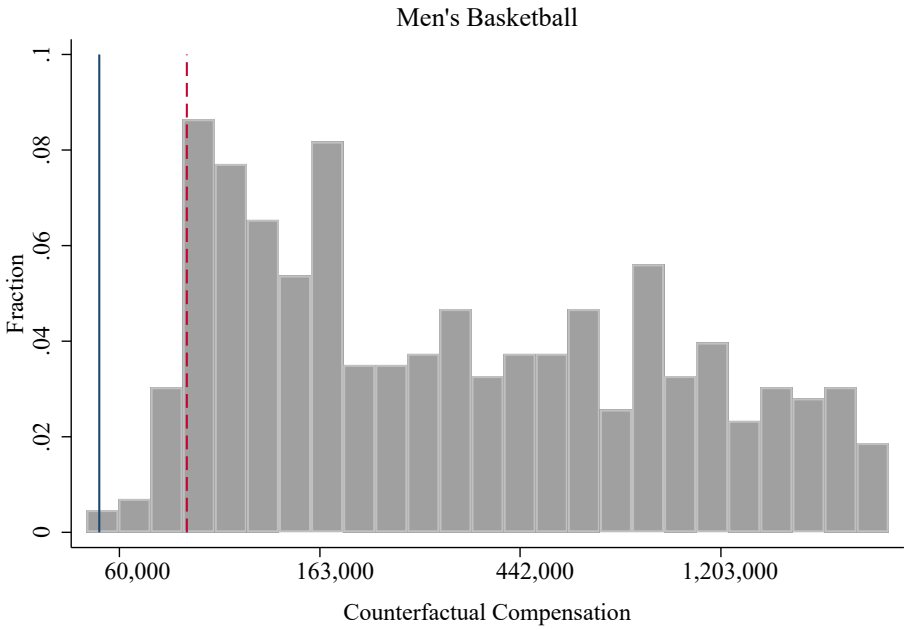
Panel B: Separating Other Sports by Gender



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) colleges in the "Power 5" athletic conferences. The data exclude 4 colleges 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 colleges ($54,271) and the red dashed line marks the maximum current scholarship value ($83,960).