The Impact of Visibility on School Athletic Finances: An Empirical Analysis using Google Trends

Behera, Sarthak and Sadana, Divya

Centre College, University of Wisconsin - Eau Claire

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Sarthak S. Behera* and Divya Sadana†

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Abstract

Many papers in the past literature provide evidence on the impact of athletic performance on various school outcomes. This paper uses the weekly college football poll by the organization Associated Press (AP), to investigate the effect of a college team ranked in top 25 on various school outcomes such as revenues and expenses of school, coaches' salary and enrollment. The college football poll also known as AP poll conducts weekly voting to assign the teams certain points based on which these team are ranked. First, by exploiting the discontinuity arising due to the points of 25th ranked versus 26th ranked team, I verify the visibility of a school using google trends. Secondly, my results provide evidence of the impact of this visibility of being in top 25 on positive school outcomes.

Keywords: College Football; Google Trends; School Finances; Enrollment; Student Quality

JEL Codes: I21, I22, Z20, Z23

*Sarthak S. Behera: Centre College, Economics and Business, 319 Crounse Hall, Danville, KY 40422, sarthak.behera@centre.edu

†Divya Sadana: University of Wisconsin - Eau Claire, Department of Economics, Schneider Social Science Hall 473, Eau Claire, WI 54701, sadanad@uwec.edu

I. INTRODUCTION AND BACKGROUND

Benefits of college football success on overall welfare of a university has always been a subject of conflicting results. On one hand, a set of past literature claims that football success negatively affects the educational performance as the participation may take away time from studying and working. These studies have shown that the success in football is negatively associated with the publications by the economics faculty (Shughart, Tollison and Goff, 1986), school's average graduation rate (Tucker, 1992), and academic performance of nonathletes (Clotfelter, 2011; Lindo, Swensen, and Waddell, 2012). On the other hand, another set of papers provide evidence on the positive spillover effects of the football achievements on school's academic outcomes as this can attract more and better-quality students. For example, being a member of one of the super conferences, or having a successful football or basketball seasons has a positive impact on SAT scores of incoming freshmen (McCormick and Tinsley, 1987; Tucker, 2005), and college applications (Pope and Pope, 2014).

While there is ample evidence on the indirect effects of the football success on school academic outcomes, the empirical evidence on the direct impact on school athletic finances is relatively lacking. The related studies show the effect of college football success on alumni donations (Shulman and Bowen, 2002; Tucker, 2004; Meer and Rosen, 2009). This paper views this gap in literature as important because the achievements in college football is directly associated with athletic finances (Goff, 2000). A more recent paper in this line of research by Tabakovic and Wollman (2019), uses Associated Press (AP) Top 25 Poll to measure the football success by taking the difference between the postseason and preseason vote counts. Exploiting this measure of the football success as the instrumental variable they show that an unexpected athletic outcome has a positive impact on research support of the university faculty (via donations). Following their

implication, in this paper, I use the weekly college football poll by the organization Associated Press (AP), to investigate the effect of a college team being ranked in top 25 on various school financial outcomes such as athletic revenues and expenses, total academic spending, total football spending, and coaches' salary.

The Associated Press Poll (**AP Poll**) provides weekly rankings of the top 25 NCAA teams in Division I college football. The rankings are compiled by polling around 60 voters on an average, from across the nation. Every week, each of these voters individually assign points to the teams and the team with the highest point is ranked first-place, the team with second-highest points is ranked second-place, and so on until twenty-fifth place. At the end of each week, these points for each team by all the voters are added to produce the national ranking. Only these top 25 ranked teams are listed in the news outlet, thereby increasing the visibility/popularity among the public for these teams only. Thus, using the ranking of the top 25 teams I study the effect of visibility on the school financial outcomes.

I use Google Trends Index as the measure of visibility. This index is an unbiased dataset of the google searches, which provides a method to measure the interest of public over a particular topic, from around the world. The focus of this paper on visibility is motivated by the growing use of Google Trends Data in the recent past. Google trends data in the past papers has successfully predicted cinema admissions (Hand and Judge, 2012), business cycles (Chen et al.,2015), and unemployment (Fernandez and Velasco, 2018). Another issue in the field of microeconomics, addressed by a more recent paper, is the impact of COVID-19 lockdown on the mental health using google search index data (Brodeur et al., 2021). Furthermore, Baker and Fradkin (2017) show that as compared to other survey or web-based measures, google search index is available in real-time

and is more geologically precise. I use Google Trends Index to investigate the visibility/popularity of a college team ranked in top 25. Thus, I conduct two analyses in this paper:

1) Verify the visibility/popularity of a college team ranked in top 25 using Google Trends.
2) Investigate the impact of visibility on school athletic finances.

The trends in weekly ranking of college football teams and their weekly google search index, depicted in Figure 1, provide an added motivation for the first part of my study. The three panels in figure 1 show the weekly trends for three different universities in different years[1]. The solid-thick line represents the ranking of the college football teams in each week in a year (measured on the left vertical axis). The dashed-thin line depicts the google trends for that college in the following week in the same year (measured on right vertical axis). The figures show a positive, almost concurrent relationship between the ranking and the google trends in the following week. For example, Panel A of figure 1 shows that the weekly rankings for the year 2016 for the football team of University of Miami matches one-to-one with the google search trends in the following week for the University.

In this paper, I use the weekly college football poll voting as a measure of top 25 teams' ranking. The college football poll also known as AP poll conducts weekly voting to assign the teams certain points based on which only the top 25 teams are ranked at the end of each week. Combining the weekly ranking of these school teams with the weekly google trends data I investigate the visibility of a ranked football team using the Regression Discontinuity Design (RDD) framework.

[1] Panel A, Panel B, and Panel C are for University of Miami in 2016, Oklahoma State University in 2017, and Northwestern University in 2018, respectively.

Particularly, I exploit the discontinuity arising due to the points of 25th versus 26th ranked team to compare the google trends of the universities around this cutoff.

The universities around the cutoff enter my second analysis to investigate the impact of this visibility on certain school outcomes such as athletics revenues and expenses, coaches' salary, academic spending, and enrollment. Since, I have constructed a panel dataset of the institutions, it allows me to include school fixed effects in the regressions of the second analysis. By using google trends information, my results show that the universities just above the threshold are around 10 percent more visible as compared to the universities just below the cutoff. Also, the schools just making into the top 25 because of a marginal difference in points at the threshold have higher athletic revenues by around 3 percent and higher athletic expenses by around 2 percent. In particular, being more visible helps in increasing the donations coming in for these ranked teams by around 6 percent and also helps to increase coaches' compensation by 3.4 percent. I also conduct falsification tests for various covariates to confirm if these controls exhibit a jump at the threshold for my running variable. Ideally, the relation between the covariates and the treatment should be smooth around the threshold. I see no jumps for any of my game characteristics or school characteristics at the threshold in my balancing tests.

This paper provides two main contributions to the existing literature. First, this paper introduces the Google Trends Data as the measure of visibility for a college being ranked in top 25. Prior literature uses only the last weeks' poll data to measure the football success (McCormick and Tinsley, 1987; Tucker, 1992; Tucker, 2005; Pope and Pope, 2014), whereas the google trends data allows me to exploit the weekly variation within one season, arising by the discontinuity of points assigned by voters, using the RDD framework. Second, my paper extends the current literature by providing a new and rich source of data for school athletic finances. A substantial literature in the

past has only focused on the effect of college football success on alumni donations. However, this paper uses the data collected from College Athletics Financial Institutions (CAFI), which provides various detailed sub-categories of athletic revenues (such as, corporate sponsorships, donations, conference sponsorships, ticket sales, institutional contributions, and student fees) and athletic expenses (such as, medical expenses, recruiting expenses, travel expenses, coaches compensation, expenses on facilities, and athletics aid), and data on total academic spending, total football spending, total coaches' salary, and enrollment as well. This dataset is compiled from various sources of government agencies such as, Athletics in Equity Data Analysis (NACA), Integrated Postsecondary Education Data System, and USA Today's NCAA Athletics Finance Database.

The structure of the rest of the paper is as follows: Section II briefly provides details on the background on the AP Polls and describes other data sources and the summary statistics. Section III discusses the conceptual framework and the methodology used to answer my research question. Section IV provides the empirical results, which also reviews certain important robustness analysis. Finally, section V concludes.

II. DATA

A. AP Polls

The Associated Press Poll (**AP Poll**) provides weekly rankings of the top 25 NCAA teams in Division I college football. The AP college football poll's origins go back to the 1930s. While the AP Poll currently lists the Top 25 teams in the nation, from 1936 to 1960 they used to only rank 20 teams. From 1961 to 1967 only 10 teams were recognized. From 1968 to 1988, the AP again resumed its Top 20 before expanding to the current 25 teams in 1989.

The rankings are compiled by polling 59-62 sportswriters and broadcasters from across the nation. These voters rank the teams based on the points assigned by them using the *"Borda Ranking Technique".* According to this technique, each voter provides their own ranking of the top 25 teams every week, by giving a team 25 points for a first-place vote, 24 for a second-place vote, and so on down to 1 point for a twenty-fifth place vote. At the end of each week, these points for each team by all the voters are added to produce the national ranking. Teams are ordered according to total points, such that the team with highest votes is ranked first. The team with second-highest votes is ranked second, and so on. Only these top 25 ranked teams are listed in the news outlet, thereby increasing the visibility/popularity among the public for these teams only. Thus, being ranked as 25th team matters more as compared to the 26th team, because the 25th team will get benefits of being popular, despite both teams receiving similar points.

I obtained the AP poll data from ESPN and AP Poll Archive from 2016-2020. The AP poll data consist of 109 unique universities, and since every week each voter ranks 25 teams, the total number of teams receiving votes is larger than 25, ranging from 34 to 52. This provides us on an average about 40-42 teams with assigned points, every week in a year[2].

B. Google Trends

This paper uses Google Trends data as the measure of *visibility*. Google Trends provides access to a large unfiltered sample of actual search requests made to Google. This allows me to display interest in a particular topic from around the world or down to school-level geography.

There are two samples of Google Trends data that can be accessed:

- *Real-time data* is a sample covering the last seven days.

[2] The number of weeks ranges from 15 to 17 in every season.

- *Non-Realtime data* is a separate sample from real-time data and goes as far back as 2004 for annual and 2016 for weekly data.

I collect the non-real time google trends data from 2016-2020 because for my analysis I need the weekly google data to be combined with weekly AP poll voting.

The Google Trends data is not the direct search quantity over time, it in fact provides an index for search amount by topic over the requested time-period in a certain geographical area. In other words, it is the comparative popularity of a search term, which is calculated by dividing the number of searches for the specified topic by the total number of searches for all the topics in a particular geographical location and time-period. Then the calculated numbers are scaled from a range of 0 to 100 based on a topic's share to all searches on all topics together. A value of 100 indicates the highest popularity for the time-period, and a value of 50 implies that the term is partially as popular. Finally, it is given a value of 0, when there is not enough data for this term.

C. School Outcomes

The data for school outcomes come from various sources. The data for school finances such as athletic revenues (where the money comes from) and expenses (where the money goes), academic spending and coaches' salary is collected from College Athletics Financial Information (CAFI) Database[3]. Athletic revenues and expenses are further subdivided into various categories such as donation, ticket sales etc. under revenues and travel, athletes aid, etc. under expenses. The full definitions for all the categories under revenues and expenses are explained in the data appendix. The academic outcome, enrollment, coaches' salary, and athletic debt come from the US

[3] The data in this database is acquired from the federal government (Equity in Athletics Disclosure Act and the Integrated Postsecondary Education Data System), and USA Today's NCAA Athletics Finance Database.

Department of Education. Other academic variables mainly include school characteristics such as share of students who are female, black, Asian, Hispanic, receiving federal aid, share of full-time faculty, average faculty salary, and cost of tuition. The school outcomes are collected from 2016-2020.

Table 1 provide the summary statistics for all the outcome variables and other school characteristics in our analysis. Column 1 shows the number of observations and columns (2) and (3) provide the mean and the standard deviation of these variables. This table shows the descriptive statistics of the variables only for the schools that enter my RDD framework analysis. The standard deviations for majority of my school outcomes are in the vicinity of their mean values. This also implies that they are right skewed, so, most of my school outcomes in the second analysis uses log transformations of the left-hand side variables.

III. CONCEPTUAL FRAMEWORK AND METHODOLOGY

A. First Analysis – RDD Framework

To estimate the impact of the college team being ranked in top 25 on google trends, I use a Regression Discontinuity Design (RDD) framework. Exploiting the discontinuity arising due to the points of 25th versus 26th ranked team[4], I investigate the visibility of a ranked team by comparing the google trends of the universities that are just above and below this cutoff, using the following equation:

$$\begin{aligned} Google\ Trends_{s,w+1,t} &= \delta_0 + \delta_1 Top25_{s,w,t} + \delta_2 RV_{s,w,t} + \delta_3 (Top25_{s,w,t} * RV_{s,w,t}) + \delta_4 X_{s,w,t} \\ &+ \gamma_w + \mu_t + \epsilon_{s,w,t} \end{aligned} \quad (1)$$

[4] The construction of the running variable due to this discontinuity gives a sharp RD design. Figure 3 shows this case of sharp RD design, where probability of the treatment variable (whether the team is ranked in top 25) goes from zero to one at the threshold of the running variable.

where the outcome $Google\ Trends_{s,w+1,t}$ is the search index ranging from 0 to 100 for school *s* in the following week *w+1* in year *t*. $Top25_{s,w,t}$ is a dummy that takes a value of one if school *s* is ranked in top 25 in week *w* in year *t* and, zero otherwise. $RV_{s,w,t}$ is the running variable for school *s* in week *w* and year *t,* which is constructed using the threshold points of the 25th ranked team. The points assigned to the 25th ranked team in each week is the threshold for constructing the running variable for all the teams. This threshold is then subtracted from the points of other teams in each week. Figure 2 shows the method of construction of this running variable in my analysis. The running variable is set to zero for the 25th ranked team for every week in a year. Vector $X_{s,w,t}$ includes time-varying controls which may be correlated with the ranking and the Google Trends at the same time, for example, game characteristics such as win/loss, bare win, big win, home/away game, bare loss, and big loss in last week[5]. Last week's and following two week's google trends are also included in vector *X*. γ_w stands for week fixed effects; μ_t are year fixed effects; and $\epsilon_{a,c,t}$ is the unobserved error term. In equation (1), δ_1 is the main parameter of interest that provides an estimate to verify the visibility of a college football team being ranked in top 25. This is done by comparing the google trends of the universities just above the threshold with the universities falling below the threshold by a marginal difference. The standard errors in equation (1) are clustered at the *year*week* level.

B. Second Analysis

Now using the universities entering my first analysis through the RDD framework, I investigate the impact of visibility (i.e., being in top 25) on various school outcomes estimating the following equations:

[5] Here, bare win is defined as when a team wins by at most 4 points; big win is considered when a team wins by at least 14 points; and similar thresholds for bare loss and big loss.

$$Revenues_{s,t} = \alpha_0 + \alpha_1 Visibility_{s,t} + \alpha_2 X_{s,t} + \gamma_s + \theta_t + \epsilon_{s,t} \quad (2)$$

$$Expenses_{s,t+1} = \beta_0 + \beta_1 Visibility_{s,t} + \beta_2 X_{s,t} + \gamma_s + \theta_t + \epsilon_{s,t} \quad (3)$$

$$Other\ Financial\ Outcomes_{s,t+1} = \rho_0 + \rho_1 Visibility_{s,t} + \rho_2 X_{s,t} + \gamma_s + \theta_t + \epsilon_{s,t} \quad (4)$$

where $Revenues_{s,t}$ are the athletics revenues earned from the football season for school *s* in year *t*; $Expenses_{s,t+1}$ are the athletic expenses spent in the following year of the football season for school *s;* $Other\ Financial\ Outcomes_{s,t+1}$ includes other school outcomes such as total academic spending, enrollment, and coaches' salary for school *s* in the following year of the football season; $Visibility_{s,t}$ is a measure of college football team visibility for school *s* in year *t*. I use two different variables to measure the *visibility*:

(a) a dummy which takes the value 1 if a school football team has ever been ranked in top 25 in that game season of year *t.*

(b) a continuous variable which is the total number of times the team has been ranked in top 25 in that game season of year *t.*

$X_{s,t}$ includes time-varying school characteristics such as percentage female, percentage black, percentage asian, percentage hispanic, percentage of full-time faculty, average faculty salary, and tuition; γ_s are the school fixed effects, which controls for any unobserved time-invariant variables; and θ_t are the year fixed effects. In equations (2), (3), and (4), the main parameter of interests are α_1, β_1, and ρ_1, respectively. These provides an estimate of the effect of visibility on different school outcomes, using the above two different variables. The standard errors in all the three equations above (2, 3 and 4) are clustered at the school level.

IV. EMPIRICAL RESULTS

A. First Analysis - RDD Results

Table 2 provides the estimates from the RDD framework used to investigate the impact of college football team ranking on google trends in equation (1). The results show a positive effect of being ranked in top 25, on the google trends. Columns 1, 2 and 3 represent the three different bandwidths of rank between *"21 and 30", "20 and 31", and "19 and 32*", around the cutoff of the 25th ranked team. The results in all the bandwidths provides strong evidence of a significantly positive relationship between ranking and the Google Trends, with a magnitude of estimates ranging from around 5 to 3.5. Relative to the mean value of the google trends of around 44, these estimates in Table 2 suggest that being ranked in top 25 in a week of football season increases the search index by around 10 percent for the universities just above the cutoff.

B. Robustness Checks

The interpretation of the estimates presented in Table 2, which are obtained from equation (1) using RDD framework, mainly relies on two assumptions: (a) of other observables and unobservables are similar on either side of the threshold, and (b) the college football teams cannot manipulate their points such that they can enter top 25 ranked teams. So, as a standard in RDD framework analysis, to validate the first assumption I perform balance checks test (also known as falsification tests) on certain pre-treatment covariates (Imbens and Lemieux, 2008). And, following McCrary (2008), I conduct a density check at different bandwidths, which suggests that there are no manipulations of the points and is thus smooth around the threshold.

The falsification tests are done to test for comparability of units of the covariates around the cutoff. There are two ways in which these tests can be conducted:

(a) Visual test: plot the covariate on the running variable and check for jumps at the threshold
(b) Run the RDD regression using the covariates as the outcome

I use the 1st method of visual tests to conduct the falsification tests for certain game characteristics in the past week such as won/lost, home/away game, ranked in top 25, bare win, big win, bare loss, and big loss. The same tests were also done for past week's google trends and google trends for two weeks after the match as well.

For the above balancing assumption to hold, the relationship between the covariates and the treatment should be smooth around the threshold, i.e., point estimates on the plot for visual tests should not show any significant jumps at the cutoff point. Figure 3 shows the plots for four of the above-mentioned covariates in the past week: won/lost, big win, bare win, and past week's google trends[6]. The dots in these plots are the point estimates and the thicker line is the line fit for the covariates. The thinner lines around the line fit represent the 95 percent confidence intervals. It is evident from the figure that none of the covariates show any signs of significant jump at the threshold.

To conduct the balancing tests for certain school characteristics for the past season, I use the 2nd method of running RDD regression (using covariates as the outcomes) by estimating the following equation:

$$School\ Covariates_{s,t-1} = \delta_0 + \delta_1 Top25_{s,t} + \delta_2 RV_{s,t} + \delta_3 (Top25_{s,t} * RV_{s,t}) + \gamma_s + \mu_t + \epsilon_{s,t} \quad (5)$$

where the outcome, *school covariates* in the past season includes school characteristics such as average faculty salary, tuition, percent female, percent black, percent Hispanic and percent full-time faculty. $Top25_{s,w,t}$ is a dummy that takes a value of one if school *s* is ranked in top 25 in year *t* and, zero otherwise. $RV_{s,t}$ is the running variable for school *s* in the final week of the season in

[6] The falsification tests for the rest of the game covariates are provided in Table A1 of the appendix.

year *t,* which is constructed using the threshold points of the 25th ranked team. The running variable is set to zero for the 25th ranked team for the final week in a year. Here, δ_1 is the main parameter of interest which needs to be insignificant and have zero effect on the covariates thus showing them to be balanced at the threshold.

The results in Table A2 of the appendix, which are obtained from running equation (5) shows similar effects for the school characteristics as it was seen for the game characteristics, i.e., insignificant effect on these covariates. Thus, there is no evidence that the covariates are not balanced at the threshold, for both game characteristics as well as school characteristics.

C. Second Analysis

Table 3 and 4 presents the results obtained from estimating equations (2) and (3) in the second analysis of this paper. Equation (2) estimates the impact of being ranked on total athletic revenues and its sub-categories in the *same* season and equation (3) estimates the effect of being ranked on total athletic expenses and its sub-categories for the *next* season. I have used two different measures for the *visibility* variable in my analysis. Table 3 shows the results from equation (2) and (3) using the 1st measure, i.e., being ranked in the top 25 in at least 1 week of the whole season. And, Table 4 provides the results for these equations using the 2nd measure, i.e., the number of times a team has been ranked in top 25 in the whole season. The schools compared in this analysis have similar ranks and thus, their performances are not very different from each other.

In Panel A of Table 3, I present the estimates of the impact of the being ranked on the athletic revenues and, the same for the athletic expenses in Panel B. The estimates in both the panels suggest that there is a significant and positive correlation on both athletic revenues as well as expenses. All the outcomes for the revenues and spending are reported in their log values. So,

column (1) of Panel A shows that the total athletic revenues in the same game season are increasing by around 3 percent for the institutions just above the cutoff, which is significant at the 5 percent level. Columns (3), (4), and (6) of Panel A provide evidence that the increase in total revenues is mainly coming from increase in corporate sponsorships (increasing by 8 percent, which significant at 5 percent level), donor contributions (increasing by 6.3 percent, which is significant at 5 percent level), and athletic conferences (increasing by 3.5 percent, which is significant at 10 percent level), respectively. Columns (8) and (9) of Panel A indicates that there is no increase in the direct funds coming from from the institution or the student fees. This could imply that being ranked in top 25 is helping the institutions visibility that the athletics program is able to accumulate revenues from other sources like donations or conferences themselves and do not require to raise funds from their own institution.

The estimates from column (1) of Panel B suggests that the total athletic expenses for the following season are increasing by around 2 percent for the institutions just above the cutoff, which is significant at 5 percent level. Under the expenses category, columns (2), (4), (6), and (7) show that the increase in total expenses primarily comes from medical expenses, game and travel expenses, coaches' compensation, and student athletes aid, respectively. Medical expenses for the athletes are increasing by 4 percent, though it is significant at only 10 percent level. However, the coaches' compensation and travel expenses are increasing by 3.5 percent and 6 percent, respectively, which are significant at 1 percent level. The aid available for the athletic students is also increasing (by 1.5 percent) and is significant at 5 percent level, compared to their unranked counterpart teams.

The estimates in Panel A and B of Table 4 also provide similar results of the effect on athletic revenues and expenses but using the 2nd measure of visibility. The total athletic revenues and expenses are significantly increasing for the 2nd measure of the visibility as well, however, the

magnitude of these estimates is smaller as compared to the effect of 1st measure of visibility. Both, total athletic revenues, and expenses increase by around 0.6 percent. The increase in revenues in this case, is mostly coming from donor contributions (increases by around 2 percent, significant at 5 percent level), and conferences (shows an increase of 1 percent, significant at 10 percent level). And, for expenses in this measure, it is essentially from travel expenses, and coaches' compensation (increases by around 1 percent), both of which are significant at 1 percent level.

Table 5 and 6 provides the results obtained from estimating equations (4) in the second analysis of this paper. Equation (4) estimates the impact of being ranked on other outcomes such as, total academic spending, enrollment, total football spending, total coaches' salary, athletic debt, and athletic debt paid, for the *next* season. Here again, I have used two different measures for the *visibility* variable in my analysis. Table 5 shows the results from equation (4) using the 1st measure, and Table 6 provides the results for this equation using the 2nd measure[7].

The estimates from column (1) of Table 5 suggests that there is a significant and positive increase of 1.2 percent in the total academic spending for the schools just making the cutoff of 25th rank as compared to the schools just below this threshold. Column (2) provide evidence of the increase in enrollment by around 194 freshmen for the next semester. Relative to the mean of 21,138 students for enrollment, these results indicate that the enrollment increased significantly in the next semester by around 1 percent. Estimates from columns (3) and (4) show that the total football spending and total coaches' salary increased by around 3 percent and 8 percent respectively for the schools ranked in top 25 in at least 1 week of the season. Lastly, columns (5) and (6) indicate

[7] 1st measure is being ranked in the top 25 in at least 1 week of the whole season, and 2nd measure is the number of times a team has been ranked in top 25 in the whole season.

that there is no significant impact on the total athletic debt owed and athletic debt paid by the athletic department.

The results shown in Table 6 provide similar estimates of the effect on these other outcomes using the 2nd measure of visibility. Here also, columns (1), (2), (3), and (4) show a positive and significant increase in the total academic spending, enrollment, total football spending, and total coaches' salary. However, using the 2nd measure gives smaller magnitudes for the estimates of these other outcomes as well, like the athletic revenues and expenses from Table 4. Total academic spending and enrollment increased by around 0.4 percent and 0.2 percent (relative to the mean), respectively, and total football spending and total coaches' salary show an increase of 0.8 percent and 2 percent, respectively. The estimates from columns (5) and (6), again show no impact on the total athletic debt owed and paid by the athletic department of these schools.

V. CONCLUSION

In this paper, using the weekly college football poll by the organization Associated Press (AP), I empirically analyze the effect of a college team ranked in top 25 on various school outcomes such as revenues and expenses of school, coaches' salary, academic spending, and enrollment. To do that, I use the following two-step procedure: (a) Using RDD framework, investigate the visibility/popularity of a college team ranked in top 25 using Google Trends, and (b) Examine the relation of this visibility on certain school outcomes.

In the results from my first analysis, I find that there is a significant and positive relationship between the measure of visibility and a team being ranked in the top 25 during a football season. Specifically, the estimates suggest that being ranked in top 25 in a week of a football season increases the search index by around 10 percent for the universities just above the threshold of 25th

rank as compared to universities falling just below the threshold due to a marginal difference in points assigned by the voters.

For the second analysis in this paper, I find that being ranked in top 25 for the universities have a highly significant and positive impact on the school outcomes such as athletic revenues and expenses, total academic spending, coaches' salaries, and enrollment of incoming freshmen. Total athletic revenues for the universities just above the threshold of 25^{th} rank, increases by around 3 percent and total athletic expenses increases by around 2 percent. Similar estimates are found for total academic spending, and enrollment, which are increasing by around 1 percent. From the estimation of the subcategories of the revenues, it also implies that being ranked in top 25 is helping the institutions visibility/popularity in the news outlet, because of which the athletics program is able to accumulate revenues from other sources like donations or conferences themselves and do not require to raise funds from their own institution. Thus, my results provide evidence that being in top 25 by a marginal difference is making schools more visible and consequently, these more visible schools have better school outcomes as compared to schools just missing the threshold of being ranked in top 25.

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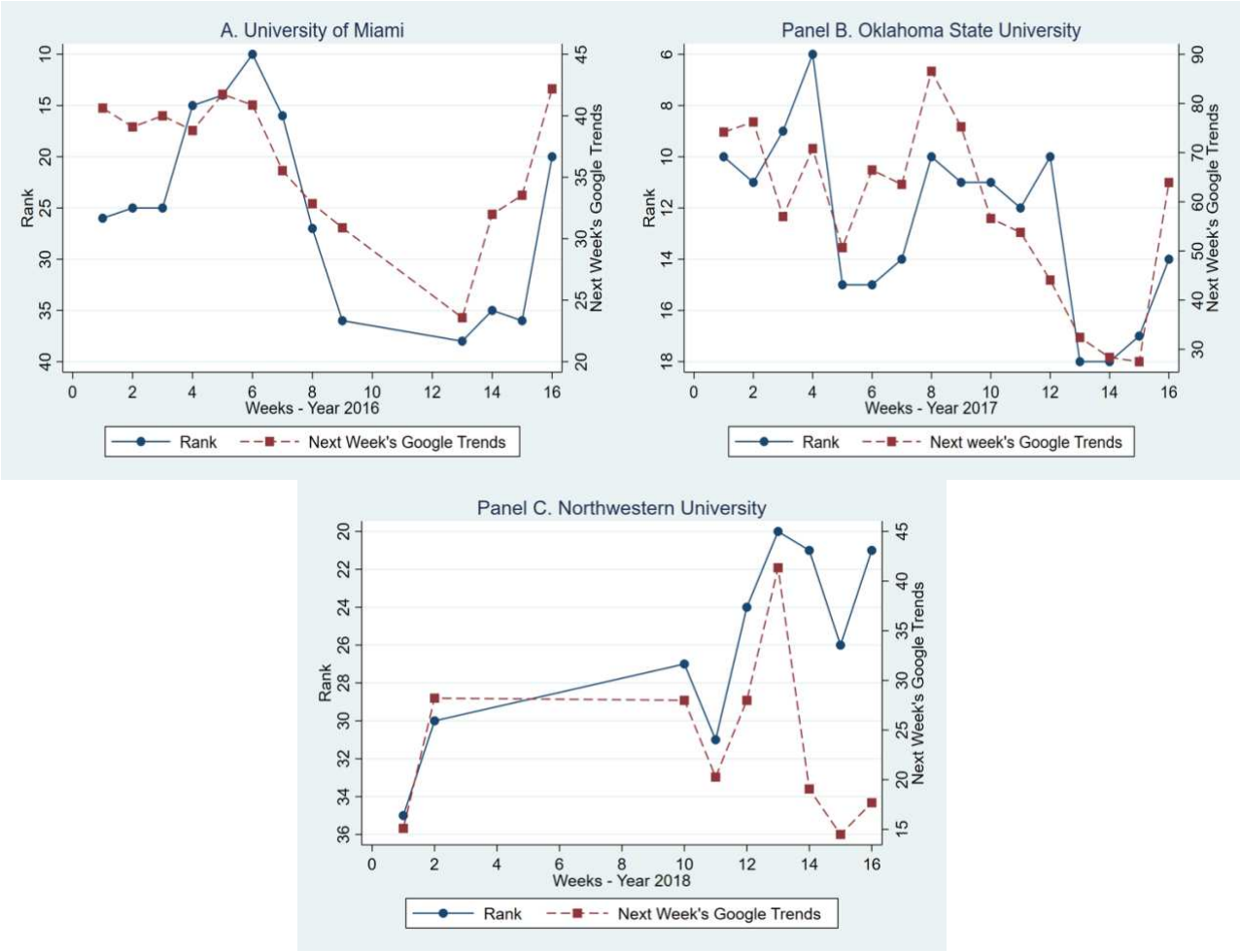
LIST OF FIGURES AND TABLES

FIGURE 1

Weekly Trends in College Football Ranking and Google Search Index



Notes: The weekly ranking of the college football teams are on the left-hand side of all three panels, and the google trends for the following week for these colleges are on the right-hand side of the panels. In panel A, panel B, and panel C, the horizontal axis gives the weeks of the football season for University of Miami in 2016, Oregon State University in 2017, and Northwestern University in 2018. All the panels show an astounding positive relationship between schools' football ranking and their google trends in each year.

FIGURE 2

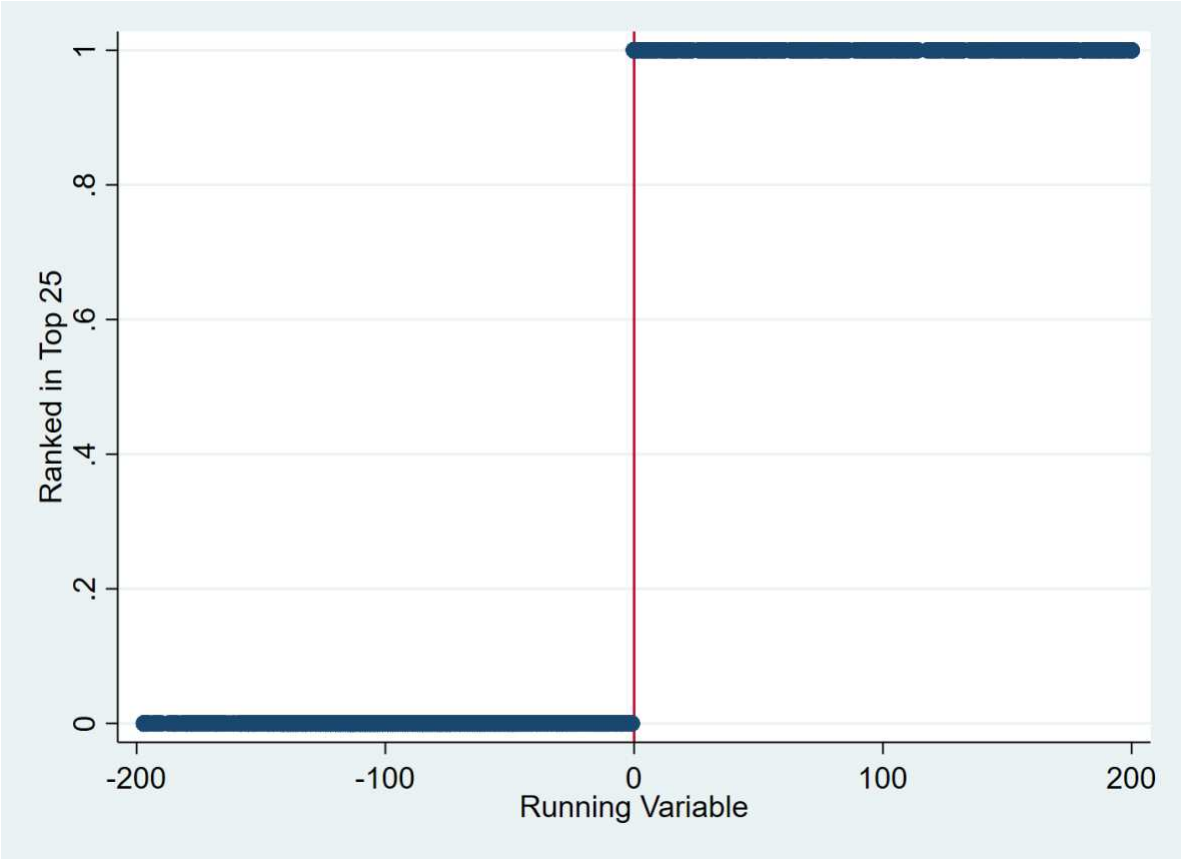
Construction of the Running Variable (RV)

Rank	Team	Year	Week	Points	RV
20	USC	2016	1	344	164
21	Oklahoma State	2016	1	316	136
22	North Carolina	2016	1	283	103
23	Baylor	2016	1	280	100
24	Oregon	2016	1	218	38
25	**Florida**	**2016**	**1**	**180**	**0**
26	Miami (FL)	2016	1	159	-21
27	Texas A&M	2016	1	81	-99
28	Utah	2016	1	74	-106
29	Washington State	2016	1	68	-112
30	Boise State	2016	1	49	-131
20	Texas A&M	2016	2	477	340
21	LSU	2016	2	423	286
22	Oklahoma State	2016	2	409	272
23	Baylor	2016	2	296	159
24	Oregon	2016	2	242	105
25	**Miami (FL)**	**2016**	**2**	**137**	**0**
26	Florida	2016	2	117	-20
27	UCLA	2016	2	62	-75
28	Boise State	2016	2	50	-87
29	Utah	2016	2	43	-94
30	San Diego State	2016	2	37	-100

Notes: This figure shows two weeks from year 2016 as an example to provide the method of construction of the running variable (RV) used in my analysis. The points assigned to the 25th ranked team is taken as the threshold and then subtracted from the points of other teams. For example, in week 1 in 2016, 25th ranked team has 180 points so, RV for the 20th ranked team = 344-180 = 164.

FIGURE 3

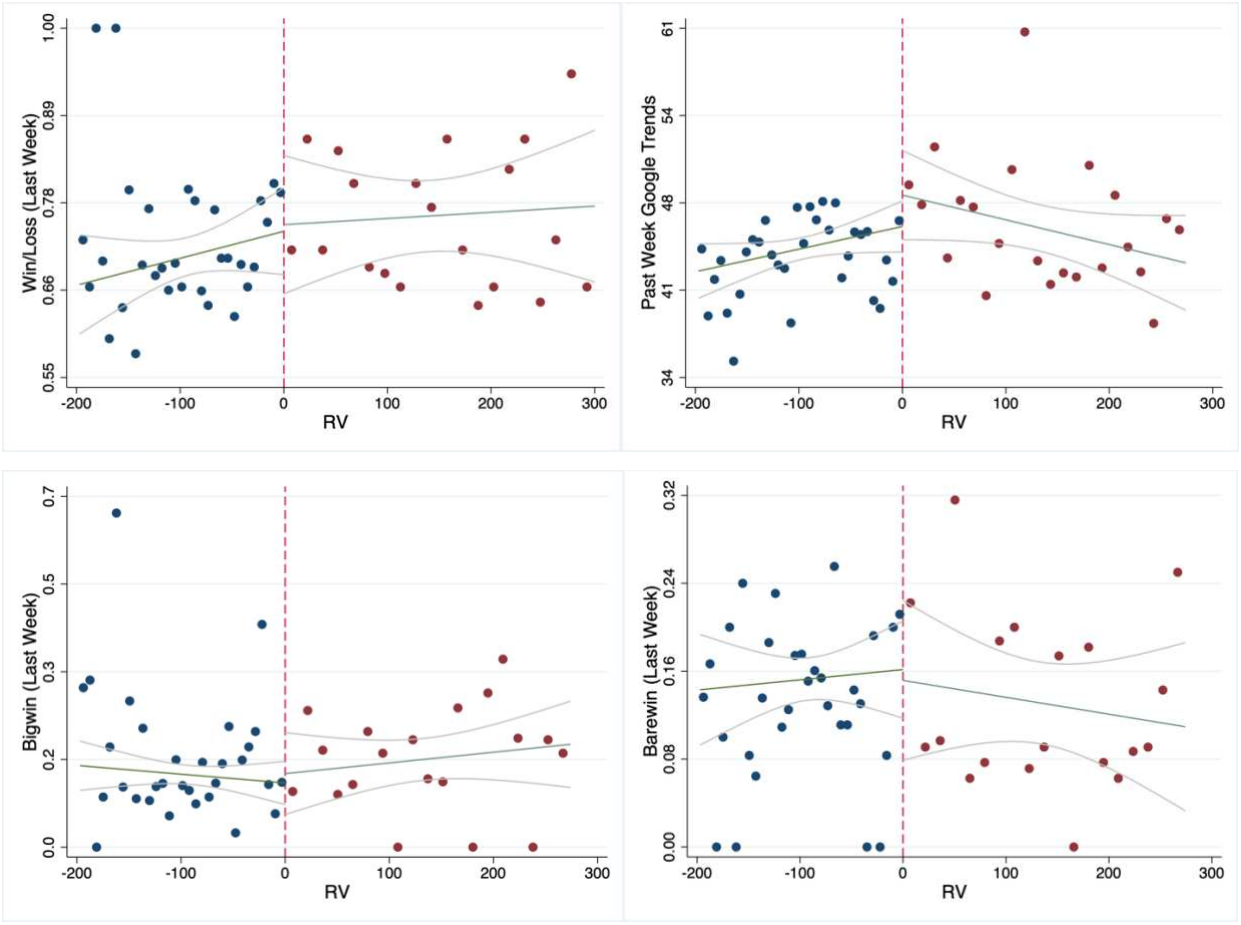
Jump of the Treatment Variable (Ranked in Top 25) at the Running Variable's Cut-off



Notes: The Figure represents the case of sharp RD design, where probability of the treatment variable (whether the team is ranked in top 25) goes from zero to one at the threshold of the running variable.

FIGURE 4

Falsification Tests between Covariates and the Treatment



Notes: To produce the figure, I plotted certain pre-treatment covariates such as win/loss last week, big win last week, bare win last week, and past week's google trends on the treatment to check whether the covariates are balanced at the threshold. The dots present the point estimates for the covariates and the lines are 95 percent confidence intervals.

Table 1: Summary Statistics

VARIABLES	(1) N	(2) Mean	(3) Std. Dev.	(4) Descriptions
(A) Expenses				
Total Expenses	805	70,137	35,824	All expenses for the athletics program plus "Excess Transfers to the Institution".
Medical	805	936.8	563.1	Medical expenses and medical insurance premiums.
Competition Guarantees (Exp)	805	1,914	1,203	Amounts paid to visiting participating institutions, including per diems and/or travel and meals.
Recruiting	805	1,136	604.8	Spending on transportation, lodging, meals, and other personnel and administrative expenses relating to recruitment of prospective student-athletes.
Game Expenses and Travel	805	8,052	4,609	Game expenses relate to competition expenses other than travel. Travel relates to spending on transportation, lodging, meals, and incidentals related to preseason and regular season competition.
Facilities and Equipment	805	14,960	10,490	Facility expenses include debt service, leases, and rental fees for athletic facilities. This includes overhead and administrative expenses. Equipment expenses includes spending for items provided to teams including in-kind equipment.
Coaches Compensation	805	12,433	6,131	Coaches' compensation includes bonuses and benefits, but not severance payments. This category includes direct payment and bonuses to coaches from the institution and from a third party.
Admin Compensation	805	12,302	7,525	Support and administrative staff compensation includes bonuses and benefits paid to all administrative and support staff. This category includes direct payment from the institution and payment from a third party.
Athletic Student Aid	804	9,002	3,444	Total expenses for athletic student aid, including tuition and fees, room and board, books, summer school, tuition discounts, waivers, and cost of attendance, including aid given to student-athletes who have exhausted their eligibility or who are inactive due to medical reasons.
Other Expenses	805	9,179	6,216	Expenses related to the following categories: Sports equipment, uniforms and supplies, fundraising, marketing and promotion, sports camps, spirit groups, membership and dues, student-athlete meals, and other operating expenses.

(B) Revenues				
Total Revenues	805	73,086	39,592	Total revenues for the athletics program minus "Less Transfers to the Institution".
Corporate Sponsorship	805	5,646	5,883	Revenue generated by the institution from royalties, licensing, advertisements, and sponsorships.
Donor Contributions	805	16,659	15,593	Funds contributed from individuals, corporations, associations, foundations, clubs, or other organizations external to the athletics program above the face value for tickets.
Competition Guarantees (Rev)	805	1,021	971.1	Revenue received from participation in away or neutral-site games.
Conference Distributions	805	18,110	14,306	Revenue received from the NCAA (including championships) and athletics conferences, media rights and post-season football bowl games.
Ticket Sales	805	16,796	12,855	Revenue received from ticket sales for all NCAA-sponsored sports at an institution.
Institutional Support	805	5,207	6,317	Revenue received from governments, direct funds from the institution for athletics operations, and costs covered, and services provided by the institution to athletics (and for athletics debt) but not charged to athletics.
Student Fees	792	3,890	4,634	Fees paid by student and allocated for the restricted use of the athletics department.
Other Revenue	805	5,820	4,998	Revenue from the following categories: Compensation and benefits provided by a third party; game program, novelty, parking and concession sales; sports camps and clinics; athletics restricted endowment and investments income; and other operating revenue.
(C) Other Financial Outcomes				
Total Academic Spending	995	1,085	785.9	Total expenditures for the direct role and mission activities of an institution. It includes functional classifications of expenditures for instruction, research, public service, academic support, student services institutional support, operations and maintenance, and scholarships and fellowships.
Total Football Spending	797	18,486	9,798	Total football operating expenses, including the cost of athletics student aid.
Total Coaching Salaries	802	5,192	2,911	Total compensation reported for all football coaches, including salaries,

				benefits and bonuses paid by the university, and contractually guaranteed amounts paid by third parties.
Athletics Related Debt	750	79,097	77,106	Total athletic debt balances owed by the athletic department. NOTE: NCAA definitional changes increased, for some institutions, the amounts reported in this area beginning in 2014-15.
Annual Debt Service	757	6,065	5,498	Payment of principal and interest on athletic facilities debt, leases and rental fees in the reporting year NOTE: NCAA definitional changes increased, for some institutions, the amounts reported in this area beginning in 2014-15.
(D) School and Game Characteristics				
% Black	817	0.0652	0.0613	
% Hispanic	817	0.0887	0.0926	
% Asian	817	0.0686	0.0781	
Tuition	995	11,491	6,985	
Average Faculty Salary	995	9,759	2,232	
% Full-time Faculty	995	0.799	0.124	
% Female	779	0.533	0.0540	
# Times in Top 25	995	1.226	1.676	
Google Trends	942	44.25	18.30	
Ranked	995	0.485	0.500	
Enrollment	995	21137.69	9966.167	

Notes: All the athletic revenues and expenses, total football spending, total coaching salaries, athletic debt, and average faculty salary are reported in thousands of US dollars. Total academic spending is reported in millions of US dollars. There are a maximum of 995 observations for the full panel, however, certain variables are unavailable for certain years and institutions.

Table 2: Effect of College Football Ranking on Google Trends

	(1)	(2)	(3)
	BW = Rank Between		
	21 and 30	20 and 31	19 and 32
	Google Trends		
Top25 [w-1]	**5.270****	**4.556****	**3.406***
	(2.55)	(2.23)	(1.99)
RV [w-1]	-0.093**	-0.055**	-0.026
	(0.05)	(0.03)	(0.02)
Top25 x RV	0.104	0.039	0.015
	(0.07)	(0.04)	(0.02)
Week FEs	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes
Observations	495	683	942

Notes: This table reports the RD design regressions results from the first analysis to show the effect of college football ranking on the following week's google trends to verify the visibility of an institution based on its football team ranking. Top25 is a dummy taking a value of 1 if a team is ranked in top 25 in a week in a season. It includes the lead and lag of google trends and, also the controls for game characteristics like win/loss, bare win, big win, home/away game, bare loss, and big loss in last week. Standard errors are in parentheses and clustered at the year*week level.
* p<0.1 ** p<0.05 *** p<0.01

Table 3: Effect of Being Ranked on Athletic Revenues and Expenses

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Panel A: Athletic Revenues								
	Total Revenue	Other Revenues	Corporations	Donations	Competition	Conference	Ticket Sales	Institutional	Student Fees
Ranked	**0.028****	-0.008	**0.080****	**0.063****	-0.060	**0.035***	0.015	-0.012	0.015
	(0.01)	(0.03)	(0.04)	(0.03)	(0.08)	(0.02)	(0.02)	(0.07)	(0.03)
School Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
School FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	792	801	804	804	793	805	805	638	560
	Panel B: Athletic Expenses								
	Total Expenses	Medical	Recruiting	Travel	Facilities	Coaches	Admin	Athletes Aid	
Ranked [t-1]	**0.021****	**0.042***	-0.009	**0.059*****	0.001	**0.034*****	0.001	**0.015****	
	(0.01)	(0.02)	(0.01)	(0.01)	(0.03)	(0.01)	(0.01)	(0.01)	
School Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
School FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Observations	703	704	704	704	704	704	704	697	

Notes: This table reports the regressions coefficients for the effect of 1st measure of visibility, i.e., being ranked in at least 1 week in a season on athletic revenues of the same season and athletic expenses of the following season. All the outcomes for athletic revenues and expenses are in their log values. It includes the controls for school characteristics like % female, % black, % Asian, % Hispanic, % full-time faculty, average faculty salary, and tuition. Standard errors are in parentheses and clustered at the school level.
* p<0.1 ** p<0.05 *** p<0.01

Table 4: Effect of the Number of Times being Ranked in Top 25 on Athletic Revenues and Expenses

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Panel A: Athletic Revenues								
	Total Revenue	Other Revenues	Corporations	Donations	Competition	Conference	Ticket Sales	Institutional	Student Fees
# Top 25	**0.006***	0.003	0.017	**0.018****	-0.021	**0.009***	0.006	-0.016	-0.004
	(0.00)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.00)	(0.02)	(0.01)
School Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
School FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	792	801	804	804	793	805	805	638	560
	Panel B: Athletic Expenses								
	Total Expenses	Medical	Recruiting	Travel	Facilities	Coaches	Admin	Athletes Aid	
# Top 25 [t-1]	**0.006****	0.007	-0.003	**0.012*****	0.008	**0.008*****	-0.001	0.002	
	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	
School Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
School FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Observations	703	704	704	704	704	704	704	697	

Notes: This table reports the regressions coefficients for the effect of 2nd measure of visibility, i.e., number of times ranked in top 25 in a season on athletic revenues of the same season and athletic expenses of the following season. It includes the controls for school characteristics like % female, % black, % Asian, % Hispanic, % full-time faculty, average faculty salary, and tuition. Standard errors are in parentheses and clustered at the school level.
* p<0.1 ** p<0.05 *** p<0.01

Table 5: Effect of being Ranked on Other School Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)
	Total Academic Spending	Enrollment	Total Football spending	Total Coaches' Salary	Athletic Debt	Athletic Debt Paid
Ranked [t-1]	**0.012***	**193.625***	**0.031***	**0.079*****	0.007	-0.040
	(0.01)	(113.84)	(0.02)	(0.02)	(0.08)	(0.09)
School Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
School FEs	Yes	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Observations	662	635	539	537	473	470

Notes: This table reports the regressions coefficients for the effect of 1st measure of visibility, i.e., being ranked in at least 1 week in a season on other school outcomes of the following season such as total academic spending, enrollment, and total coaches' salary. It includes the controls for school characteristics like % female, % black, % Asian, % Hispanic, % full-time faculty, average faculty salary, and tuition. Standard errors are in parentheses and clustered at the school level.

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

Table 6: Effect of the Number of Times being Ranked in Top 25 on Other School Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)
	Total Academic Spending	Enrollment	Total Football spending	Total Coaches' Salary	Athletic Debt	Athletic Debt Paid
# Top 25 [t-1]	**0.004***	**44.413***	**0.008***	**0.020*****	-0.001	0.000
	(0.00)	(26.39)	(0.00)	(0.00)	(0.02)	(0.02)
School Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
School FEs	Yes	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Observations	662	635	539	537	473	470

Notes: This table reports the regressions coefficients for the effect of 2nd measure of visibility, i.e., number of times ranked in top 25 in a season on other school outcomes of the following season such as total academic spending, enrollment, and total coaches' salary. It includes the controls for school characteristics like % female, % black, % Asian, % Hispanic, % full-time faculty, average faculty salary, and tuition. Standard errors are in parentheses and clustered at the school level.

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

APPENDIX

Data Appendix

ACADEMIC SPENDING:

Definition: Total expenditures for the direct role and mission activities of an institution. It includes functional classifications of expenditures for instruction, research, public service, academic support, student services institutional support, operations and maintenance, and scholarships and fellowships.

ATHLETIC STUDENT AID:

Definition: Total expenses for athletic student aid, including tuition and fees, room and board, books, summer school, tuition discounts, waivers, and cost of attendance, including aid given to student-athletes who have exhausted their eligibility or who are inactive due to medical reasons.

COACHES COMPENSATION:

Definition: Coaches compensation includes bonuses and benefits, but not severance payments. This category includes direct payment and bonuses to coaches from the institution and from a third party.

COMPETITION GUARANTEES (REVENUE):

Definition: Revenue received from participation in away or neutral-site games.

COMPETITION GUARANTEES (EXPENSES):

Definition: Amounts paid to visiting participating institutions, including per diems and/or travel and meals.

CORPORATE SPONSORSHIP, ADVERTISING, LICENSING:

Definition: Revenue generated by the institution from royalties, licensing, advertisements, and sponsorships.

DONOR CONTRIBUTIONS:

Definition: Funds contributed from individuals, corporations, associations, foundations, clubs, or other organizations external to the athletics program above the face value for tickets.

FACILITIES AND EQUIPMENT:

Definition: Facility expenses include debt service, leases, and rental fees for athletic facilities. This includes overhead and administrative expenses. Equipment expenses includes spending for items provided to teams including in-kind equipment.

FOOTBALL COACHING SALARIES:

Definition: Total compensation reported for all football coaches, including salaries, benefits and bonuses paid by the university, and contractually guaranteed amounts paid by third parties.

FOOTBALL SPENDING:

Definition: Total football operating expenses, including the cost of athletics student aid.

GAME EXPENSES AND TRAVEL:

Definition: Game expenses relate to competition expenses other than travel. Travel relates to spending on transportation, lodging, meals, and incidentals related to preseason and regular season competition.

INSTITUTIONAL GOVERNMENT SUPPORT:

Definition: Revenue received from governments, direct funds from the institution for athletics operations, and costs covered, and services provided by the institution to athletics (and for athletics debt) but not charged to athletics.

MEDICAL EXPENSES:

Definition: Medical expenses and medical insurance premiums.

NCAA/CONFERENCE DISTRIBUTIONS, MEDIA RIGHTS, AND POST-SEASON FOOTBALL:

Definition: Revenue received from the NCAA (including championships) and athletics conferences, media rights and post-season football bowl games.

OTHER EXPENSES:

Definition: Expenses related to the following categories: Sports equipment, uniforms and supplies, fundraising, marketing and promotion, sports camps, spirit groups, membership and dues, student-athlete meals, and other operating expenses.

OTHER REVENUE:

Definition: Revenue from the following categories: Compensation and benefits provided by a third party; game program, novelty, parking and concession sales; sports camps and clinics; athletics restricted endowment and investments income; and other operating revenue.

RECRUITING:

Definition: Spending on transportation, lodging, meals, and other personnel and administrative expenses relating to recruitment of prospective student-athletes.

STUDENT FEES:

Definition: Fees paid by student and allocated for the restricted use of the athletics department.

SUPPORT AND ADMINISTRATIVE COMPENSATION WITH SEVERANCE:

Definition: Support and administrative staff compensation includes bonuses and benefits paid to all administrative and support staff. This category includes direct payment from the institution and payment from a third party.

TICKET SALES:

Definition: Revenue received from ticket sales for all NCAA-sponsored sports at an institution.

TOTAL ANNUAL DEBT SERVICE:

Definition: Payment of principal and interest on athletic facilities debt, leases and rental fees in the reporting year NOTE: NCAA definitional changes increased, for some institutions, the amounts reported in this area beginning in 2014-15.

TOTAL ATHLETICS RELATED DEBT:

Definition: Total athletic debt balances owed by the athletic department. NOTE: NCAA definitional changes increased, for some institutions, the amounts reported in this area beginning in 2014-15.

TOTAL ATHLETIC EXPENSES:

Definition: All expenses for the athletics program plus "Excess Transfers to the Institution."

TOTAL ATHLETIC REVENUES:

Definition: Total revenues for the athletics program minus "Less Transfers to the Institution."

Appendix Tables

Table A1: Falsification Tests for Game Characteristics

	(1)	(2)	(3)	(4)	(5)	(6)
	Google Trends (Next Week)	**Home/Away Game**	**Ranked**	**Big Loss**	**Bare Loss**	**Won/Lost**
Top 25 [t+1]	4.131	0.041	0.041	0.029	-0.009	0.075
	(2.68)	(0.09)	(0.09)	(0.02)	(0.04)	(0.07)
RV [t+1]	-0.078**	0.001	0.001	0.001	-0.001	0.001
	(0.04)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Top25 x RV	0.091	-0.002	-0.002	-0.001	0.001	0
	(0.06)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Week FEs	Yes	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Observations	774	601	601	601	601	601

Notes: This table reports the regressions coefficients for the falsification tests for the game characteristics. This table is obtained by estimating the following equation:

$$Game\ Characteristics_{s,w-1,t} = \delta_0 + \delta_1 Top25_{s,w,t} + \delta_2 RV_{s,w,t} + \delta_3 (Top25_{s,w,t} * RV_{s,w,t}) + \gamma_w + \mu_t + \epsilon_{s,w,t}$$

which shows if the treatment has any significant effects on the covariates. Standard errors are in parentheses and clustered at the year*week level.

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

Table A2: Falsification Tests for School Characteristics

	(1)	(2)	(3)	(4)	(5)	(6)
	Tuition	**Avg. Faculty Salary**	**% Female**	**% Full-Time**	**% Black**	**% Hispanic**
Top 25 [t-1]	1380.388	605.86	-0.004	-0.196	1.071	2.331
	(1363.39)	(470.94)	(0.02)	(0.29)	(4.46)	(3.31)
RV [t-1]	-20.637	-10.612**	0	-0.003	-0.011	-0.05
	(12.91)	(4.29)	(0.00)	(0.00)	(0.03)	(0.03)
Top25 x RV	14.212	7.598	0	0.004	0.061	0.09
	(19.16)	(6.37)	(0.00)	(0.00)	(0.06)	(0.05)
School FEs	Yes	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Observations	995	995	779	995	817	817

Notes: This table reports the regressions coefficients for the falsification tests for the school characteristics. This table is obtained by estimating equation (5) in the analysis, which shows if the treatment has any significant effects on the covariates. Standard errors are in parentheses and clustered at the school level.
* p<0.1 ** p<0.05 *** p<0.

Rescaling Google Trends

As the weekly data in one year for each school comes from a separate request to the weekly data in another year, the scaling factors used to calculate the range 0-100 score are not the same in the two periods. Therefore, the two series need to be re-scaled so that they are comparable[8].

Let us denote the weekly google searches for a school *s* on week *i* in year *y,* by $W_{i,s,y}$, year ranging from 2016-2020. This data is obtained for each individual week *i* and takes on values ranging from 0 to 100 for each week in the particular year considered in my analysis. However, the weekly data from one year cannot be compared to the weekly data in another year as their denominator (the maximum number of searches in that year) is not the same. To make it comparable, the weekly data for each year is rescaled by the respective year search interest weights that I calculate using the yearly data which is available continuously over the entire period of five years in my analysis.

The following equations describes the method of calculating the desired rescaled number of weekly google searches for a school in a week over the period of five years, which is denoted by $W_{i,s,y1-y5}$, *y1 and y5* being the year 2016 and 2020, respectively. First, the respective yearly search interest weights are calculated for all the years in our period of analysis. Weekly data from year 2016-2020 is taken and then aggregated to calculate the average yearly searches for a school in year 2016, to get $\overline{W_{i,s,2016}}$. Similar calculation is done for the remaining four years in my analysis[9]. From the yearly data provided over all the years, $\overline{W_{i,s,2016-2020}}$, is also calculated. Using the yearly averages and the average of all the years, following weights are calculated (for all five years from 2016-2020):

[8] I follow the approach of re-scaling used by Brodeur et al., 2021 in their paper for the impact of the COVID-19 lockdown.
[9] This gives us the values for the following:
$\overline{W_{i,s,2017}}$, $\overline{W_{i,s,2018}}$, $\overline{W_{i,s,2019}}$, and $\overline{W_{i,s,2020}}$.

$$wt_{s,2016} = \frac{\overline{W_{i,s,2016-2020}}}{\overline{W_{i,s,2016}}}$$

And similar calculations for other years till:

$$wt_{s,2020} = \frac{\overline{W_{i,s,2016-2020}}}{\overline{W_{i,s,2020}}}$$

Using these yearly search interest weights, the weekly data is rescaled for each year by multiplying the weekly google search value, $W_{i,s,y}$, by the weights calculated for each year:

$$W_{i,s,y1-y5} = W_{i,s,2016} * wt_{s,2016} \text{ in 2016}$$

And, similarly for other years till 2020:

$$W_{i,s,y1-y5} = W_{i,s,2020} * wt_{s,2020} \text{ in 2020}$$

Lastly, the above calculated weekly data is normalized to obtain the values between 0 and 100 for being able to do inter-temporal comparison of the google trends data:

$$W_{i,s}^{r*} = \frac{W_{i,s,y1-y5}}{\max\left(W_{i,s,y1-y5}\right)} * 100$$

This is the final rescaled value of the google trends, that has been used in the first analysis.