The Impact of College Conference TV Networks On College Football Attendance*

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June 30, 2020

Abstract

As sports teams increase the quantity and quality of live-televised events, an obvious question is the extent to which television acts as a substitute for in-stadium attendance. This is especially true at the collegiate level, where ticket sales and other gameday revenues make up a sizeable portion of total revenues. Using a panel dataset from 2003–2019, this paper examines the effect of new conference networks and the increase of televised events on attendance and capacity filled for college football NCAA Division I Football Bowl Subdivision schools. We find that having a conference network, and that increasing the availability and access of the home team on television, has had a positive effect on attendance.

1 Introduction

A more complete introduction is forthcoming. Our paper continues the work done by recent papers including Allan and Ray (2008), Falls and Natke (2014), Solberg and Mehus (2014), and Kringstad, Solberg, and Jakobsen (2018), which, among other things, examine the effect of live broadcasts on stadium attendance.

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2 The Model and Data

Our data covers all home college football games at FBS schools from 2003–2019. More specifically, it covers all non-postseason games at a school's primary home venue. Schools who switched to FBS during the sample are only represented during their seasons in an FBS conference. We test factors of attendance demand at the season level and single-game level, and analyze both attendance and percent-capacity figures. Attendance and capacity data are primarily pulled from ESPN historical box scores, supplemented by data from Wikipedia.

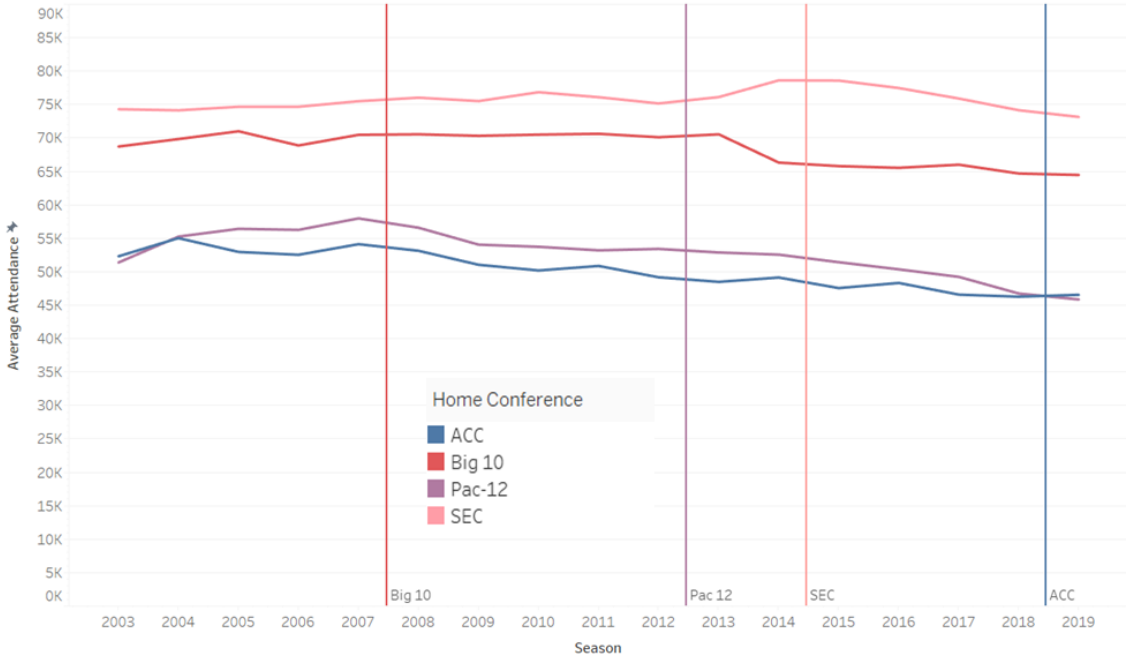
Our first set of models focus on aggregate season-level attendance,

$$Attendance_{iy} = CN_{cy} + TV_{iy} + S_{iy} + E_{iy} + Q_{iy} + S_i + C_c + Y_y + C_c \cdot Y_y + \varepsilon_{iy}. \quad (1)$$

$Attendance_{iy}$ is the average per game attendance or percent capacity filled for school i in season y. CN_{ct} is an indicator if conference c operates or is part of a conference network in season y. Four of the power five (P5) conferences are affiliated with a conference network in the sample period, with the exception being the Big 12.[1] The conference networks have staggered start years, with the Big Ten starting its conference network in 2007, the Pac-12 in 2012, the SEC in 2014, and the ACC in 2019. This is illustrated in Figure 1. The staggered nature of this variable means that it should not be picking up general growth or other trends contained in the season, Y_y, and conference season interaction, $C_c \cdot Y_y$, fixed effects, and instead only capture sustained changes in attendance corresponding with the implementation of the conference network.

[1]The Big 12 did have a conference network from 2008–2014, but it only broadcast college basketball games.

Figure 1: Average Attendance Pre And Post Conference Network



Listed are average attendances for schools in the four power five conferences that have conference networks. Vertical lines represent the introduction of the conference network. The Big Ten was the first to introduce a network in 2007. The Pac-12 was second in 2012. The SEC introduced their conference network in 2014. The ACC Network launched in 2019.

TV_{iy} is the number of times the school appears on national television in a season. These include games on networks available via satellite (Fox, CBS, NBC, ABC), basic cable (ESPN, EPSN2, FS1, NBC Sports, among others), and cable add-ons (ESPNU, FS2, CBSSN, the conference networks, among others). Broadcast data come from ESPN when applicable, and Wikipedia otherwise. We also test various specifications of this variable based on the availability and accessibility of the network, including regional networks, online streaming only, and pay-per-view, in addition to the aforementioned nationally broadcasted categories. Not all games appear on television, especially games earlier in our sample. That being said, as seen in Table 1, a higher percentage of games in the sample are televised, corresponding to a rise in nationally televised games available on add-on sport networks.

S_{iy} includes variables describing the age of the stadium. We include a variable if the stadium is in its first season, as well as stadium age to test for fan preferences for newer facilities and detect any sort of honeymoon effect. E_{iy} includes economic variables including population and personal income, both measured within the school's MSA. These data come from the Bureau of Economic Analysis, but are not yet available for 2019. We include model specifications with and without these variables. Although these variables are not stationary, school fixed effects should capture most of the baseline information related to local population and economic conditions. Q_{iy} controls for the quality of the home team that season, as well as the quality of the opponents the home team is facing at the time of the game. For home team quality, we include season win total as well as indicator variables for if the home team is a reigning conference and/or national champion. For opposing

Table 1: Game Broadcast Breakdown Over Time

Season	Season Games	Not Broadcasted	National Game (Satellite)	National Game (Basic Cable)	National Game (TV Add-Ons)	Other*
2003	513	37.82%	15.20%	24.95%	0.00%	22.03%
2004	490	35.51%	14.90%	25.51%	0.41%	23.67%
2005	492	31.91%	15.45%	25.00%	7.11%	20.53%
2006	548	29.01%	12.04%	24.27%	9.67%	25.00%
2007	548	23.72%	12.96%	22.81%	13.32%	27.19%
2008	557	23.16%	13.46%	22.44%	17.24%	23.70%
2009	557	23.16%	13.11%	20.47%	18.85%	24.42%
2010	558	17.92%	11.83%	22.94%	21.68%	25.63%
2011	556	11.51%	11.69%	28.60%	22.30%	25.90%
2012	590	5.76%	13.39%	27.12%	29.15%	24.58%
2013	625	5.44%	12.32%	27.36%	28.80%	26.08%
2014	644	2.17%	10.40%	26.55%	41.30%	19.57%
2015	659	2.28%	11.23%	27.62%	36.87%	22.00%
2016	656	1.52%	11.28%	23.48%	38.72%	25.00%
2017	669	4.19%	13.00%	24.51%	33.63%	24.66%
2018	660	1.97%	12.88%	24.85%	36.52%	23.79%
2019	671	1.04%	13.56%	25.93%	36.81%	22.65%

*Other includes regional, online stream, and pay-per-view games

Games not broadcasted are games that either were not aired on television or the internet, or are games in which our data sources did not identify a television network. It is possible that some of the games not associated with a broadcast were in fact available to watch. National games on satellite include games broadcasted on Fox, CBS, NBC, or ABC. National games on basic cable include games on networks that are generally included with a basic cable subscription such as ESPN, FS1, NBC Sports, etc. TV add-ons include the remainder of the nationally televised games, generally on networks that a consumer traditionally has to pay extra in order to receive.

team quality, we include a measure for the number of ranked opponents a team played that season. Ranking data come from historical AP polls, and rankings are observed at the start of each game. Finally, fixed effects are used to control for the school (S_i), conference (C_c), season (Y_y), and conference season interaction ($C_c \cdot Y_y$). The inclusion of these fixed effects controls for general time-invariant school characteristics, general time-invariant conference characteristics, general changes in attendance across college football over time, and individual demand shocks within conference that may be caused by realignment, among other things. The stochastic error term in the model, ε_{iy}, is assumed to be independent of the aforementioned covariates, distributed normally with mean zero, and captures random deviations from predicted average per-game attendance.

Our second set of models focus on game-level attendance,

$$Attendance_{gijty} = TV_{gt} + S_{iy} + E_{iy} + Q_{ijt} + W_{gt} + G_g + D_{ij} + S_i + C_c + Y_y + C_c \cdot Y_y + \epsilon_{it}. \tag{2}$$

TV_{gt} is a set of indicator variables if game g on day t is broadcast nationally on a channel available via satellite, nationally on basic cable, nationally on a channel traditionally purchased in addition to basic cable, regionally, online, or pay-per-view. These variables are ordered based on whether their associated networks are available for consumers to purchase, and the extent to which they are accessible, where free access is most accessible and pay-per-view is least accessible. S_{iy} includes aforementioned stadium variables in year y, plus an additional variable that captures if a team is playing in a recently completed renovated stadium after having to play in a temporary facility the year prior to complete renovations. E_{iy} are the aforementioned economic variables for school i's MSA in year y.

Our weather covariates are contained in W_{gt} and include temperature, dew point, humidity, wind speed, wind gust, air pressure, precipitation, and an indicator if the weather included lightning, thunder, or especially heavy rain or snowfall. Hourly weather data were scraped from Weather Underground.[2] Before scraping the data, we identified which weather station was closest to each stadium, and then scraped hourly weather for data at those stations on game days.[3] Our weather variables provide data at the most recent hour prior to kickoff. In most cases, hourly data are listed for the entire or the majority of the day. In some situations, hourly data are only listed for parts of days. In those situations the most recent hour to kickoff may be hours before the game actually begins. Finally, we dropped observations if Weather Underground did not have weather data for that day at all (we only needed to drop eight games).

The remaining covariates look at factors related to the game and matchup. Q_{ijt} capture the quality of home team i and visiting team j at time t. In addition to the aforementioned home team quality measures, we also include whether the visiting team is a reigning conference or national champion, and variables if either or both schools are ranked at the time of the game. G_g examines game characteristics such as local start time and day-of-week. D_{ij} is a variable that measures the straight-line distance between schools. This is measured by taking the manually collected longitude and latitude for the home and visiting school, and using the *purrr* and *geosphere* packages in R to calculate the straight-line distance in miles between the schools. This is meant to be a proxy for the travel costs for visiting

[2]https://www.wunderground.com/

[3]Consistent with other papers that examine the effects of weather on attendance, such as Ge et al. [11], future drafts of this paper will include different time horizons for weather. These may include weather hours before kickoff, previous day's weather, and forecast weather.

Table 2: Per Game Attendance Model Summay Statistics

Variable	N	Mean	St. Dev.	Min	Max
Total Attendance	1,582	318,017.80	183,444.60	21,543	897,431
Average Attendance	1,582	48,676.65	25,350.81	8,694	112,252
Average Percent Capacity Filled	1,566	0.818	0.186	0.144	1.151
National TV Satellite Games	1,591	0.806	1.133	0	9
National TV Basic Cable	1,591	2.394	1.827	0	10
National TV Add-On Networks	1,591	3.939	2.257	0	11
Age of the Stadium	1,591	61.185	28.607	0	111
Temporary Stadium	1,582	0.002	0.044	0	1
New Stadium	1,582	0.006	0.075	0	1
Significant Stadium Renovations	1,582	0.002	0.044	0	1
MSA Population	1,473	1,824,106	3,096,746	30,593	19,345,820
MSA Per Capita Income ($)	1,473	40,744.86	10,871.59	20,851	106,213
Home Games Played	1,591	6.353	0.79	2	11
Home Games Against Conference Champions	1,591	0.094	0.291	0	1
Home Games Against National Champion	1,591	0.011	0.106	0	1
Home Games Against Ranked Opponents	1,591	1.069	1.002	0	5
Total Wins	1,591	6.903	3.087	0	21

All variables listed are measured at the aggregate full season level. MSA population and personal income exclude data from 2019. Observations that do not include attendance or capacity figures are excluded from the final models.

fans. The further away a visiting school, the more expensive it likely is for visiting fans to travel. Also, schools further separated are less likely to consider each other regional rivals. Similar fixed effects to the previous model are included for school, conference, season, and conference season interaction.

Summary statistics for variables included in the season per game average attendance and capacity percentage filled models in Equation 1 are included in Table 2. Summary statistics for variables included in the single-game attendance and capacity percentage filled models Equation 2 are included in Table 3.

Table 3: Single Game Attendance Model Summay Statistics

Variable	N	Mean	St. Dev.	Min	Max
Attendance	9,973	50,165.45	25,866.04	1,111	115,109
Capacity	9,927	58,823.92	21,992.42	15,000	109,901
Percent Stadium Capacity Filled	9,907	0.827	0.203	0.037	1.251
National Game (CBS, FOX, NBC, ABC)	9,993	0.128	0.334	0	1
National Game (Basic Cable)	9,993	0.250	0.433	0	1
National Game (TV Add-Ons)	9,993	0.244	0.429	0	1
Regional Network Game	9,993	0.101	0.302	0	1
Streaming Online Only	9,993	0.122	0.327	0	1
Pay Per View Game Only	9,993	0.016	0.125	0	1
Year of Stadium Built	9,993	1950	28.774	1909	2017
Age of the Stadium	9,993	62.17	28.567	0	111
New Stadium	9,957	0.006	0.074	0	1
Temporary Stadium	9,957	0.002	0.040	0	1
Significant Stadium Renovations	9,957	0.002	0.042	0	1
MSA Population	9,249	1,822,078	3,121,322	30,593	19,345,820
MSA Per Capita Income	9,249	40,826.95	10,801.36	20,851	106,213
Distance Between Opponents	9,094	536.71	443.003	238.799	706.553
Rank of Home Team	2,206	14.35	6.427	1	25
Rank of Away Team	1,688	14.38	6.548	1	25
Conference Champion Home Team	9,993	0.095	0.293	0	1
National Champion Home Team	9,993	0.013	0.112	0	1
Conference Champion Away Team	9,993	0.073	0.261	0	1
National Champion Away Team	9,993	0.007	0.084	0	1
FBS Opponent	9,993	0.735	0.442	0	1
Conference Game	9,993	0.587	0.492	0	1
Home Team Ranked	9,993	0.221	0.415	0	1
Away Team Ranked	9,993	0.169	0.375	0	1
Either Team Ranked	9,993	0.344	0.475	0	1
Both Teams Ranked	9,993	0.046	0.209	0	1
Temperature (degrees F)	9,993	67.147	15.367	0	107
Dew Point (degrees F)	9,993	47.631	16.192	-6	84
Humidity (%)	9,993	54.084	20.226	0	100
Wind Speed (MPH)	9,993	8.672	5.253	0	40
Wind Gust (MPH)	9,993	3.369	8.742	0	53
Pressure (in)	9,993	28.886	1.753	0	30.59
Precipitation (in)	9,993	0.003	0.032	0	1.1
Really Bad Conditions	9,993	0.005	0.068	0	1
Early Kickoff	9,993	0.327	0.469	0	1
Afternoon Kickoff	9,993	0.305	0.460	0	1
Evening Kickoff	9,993	0.367	0.482	0	1
Late Kickoff	9,993	0.001	0.033	0	1

Variables are grouped by category. The single-game attendance models include variables from the aggregate model in addition to weather variables, more granular television variables, game time information, and additional team quality control variables.

3 Results

Results are provided for four different sets of models using the following dependent variables: average per game attendance, average per game percent capacity filled, individual game attendance, and individual game percent capacity filled.

3.1 Aggregate Attendance Models

Table 4 identifies factors of demand related to average per game attendance. Model 1 is our base specification, and includes our television variables of interest, self and opponent quality measures, dummy variables for whether the home team is a defending conference or national champion, an indicator if the team is playing in the first year of a new stadium, and fixed effects for school, conference, season, and the interaction of conference and season. Model 2 excludes the number of nationally televised home games in which the school participated. Model 3 excludes the interaction of conference and season fixed effects. Model 4 also excludes those interacted fixed effects, but includes economic variables at the MSA level.[4] Model 5 is similar to Model 4, but reintroduces the interacted conference season fixed effects. Model 6 adds to the base model an interaction term between the conference and whether the school's conference has a conference network. This is meant to identify if the effects on attendance of being part of a conference network are uniform across the conferences. Models 7 and 8 incorporate stadium age and its quadratic. Model 9 includes all of the aforementioned variables and fixed effects in one specification.

[4]Any model including the economic data drops 2019 from the sample due to the lack of available information at this time.

Table 4: Average Season Per Game Attendance

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Conference Network	6,056.0210**	5,856.5590**	(32.11)	612.23	7,810.8460***	6,056.0210**	5,618.1520**	5,681.9080**	7,454.3300***
	(2786.40)	(2814.25)	(426.21)	(450.53)	(2749.15)	(2786.40)	(2808.71)	(2723.14)	(2773.28)
X ACC						593.03			
						(2574.44)			
X Big Ten						-13,624.6800***			
						(4593.59)			
X Pac-12						(4130.60)			
						(2559.72)			
Nationally Televised Games	613.0798***		383.3964***	394.2264***	638.3764***	613.0798***	622.4510***	630.3310***	642.4680***
	(116.83)		(99.30)	(101.01)	(119.81)	(116.83)	(116.78)	(116.31)	(119.85)
Ranked Opponents	223.48	346.7306**	404.6458***	375.2221***	195.83	223.48	228.36	230.77	208.18
	(147.59)	(147.18)	(140.19)	(143.54)	(150.90)	(147.59)	(147.30)	(146.82)	(150.97)
Team Win Total	618.8086***	679.2944***	617.6901***	598.2607***	605.5635***	618.8086***	622.1375***	618.5702***	605.8586***
	(47.65)	(46.71)	(47.95)	(49.24)	(49.00)	(47.65)	(47.66)	(47.44)	(49.03)
Conference Champion	1,673.1340***	1,888.0670***	1,866.5440***	1,595.2740***	1,385.1670***	1,673.1340***	1,642.2130***	1,647.2260***	1,363.1220***
	(458.30)	(461.07)	(463.43)	(474.68)	(470.32)	(458.30)	(457.54)	(456.59)	(470.40)
National Champion	1494.89	1596.81	1094.98	1451.00	1950.54	1494.89	1541.12	1545.04	1973.93
	(1205.62)	(1217.63)	(1200.75)	(1225.18)	(1228.25)	(1205.62)	(1203.27)	(1201.23)	(1227.58)
New Stadium	2173.88	2494.59	2,986.8080*	2609.65	1757.19	2173.88	521.17		509.71
	(1678.24)	(1694.04)	(1574.38)	(1643.08)	(1708.90)	(1678.24)	(1781.38)		(1834.45)
Stadium Age							-109.2723**	-115.4746***	-84.7307*
							(44.08)	(40.28)	(48.72)
Stadium Age Squared							0.9788*	1.1071**	0.79
							(0.53)	(0.47)	(0.58)
MSA Population				0.00	0.0034***				0.0031***
				(0.00)	(0.00)				(0.00)
MSA Per Capita Personal Income				-0.1296**	(0.05)				(0.06)
				(0.05)	(0.05)				(0.05)
Constant	43,163.8500***	43,710.4000***	37,347.7500***	40,994.5700***	42,553.7500***	43,163.8500***	45,775.9600***	45,955.2200***	45,242.7000***
	(3567.10)	(3601.55)	(3223.47)	(3694.60)	(4061.90)	(3567.10)	(3691.85)	(3639.52)	(4315.08)
School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Conference FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Season FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Conference X Season FE	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes
N	1,573	1,573	1,573	1,455	1,455	1,573	1,573	1,582	1,455
R^2	0.975	0.975	0.971	0.972	0.976	0.975	0.976	0.976	0.976
Adjusted R^2	0.970	0.970	0.969	0.969	0.971	0.970	0.971	0.971	0.971
Residual Std. Error	4,368.2320 (df = 1308)	4,412.2920 (df = 1309)	4,503.5490 (df = 1435)	4,430.1180 (df = 1317)	4,299.8340 (df = 1198)	4,368.2320 (df = 1308)	4,359.1790 (df = 1306)	4,351.9310 (df = 1316)	4,297.1970 (df = 1196)
F Statistic	195.7995*** (df = 264; 1308)	192.5358*** (df = 263; 1309)	353.4820*** (df = 137; 1435)	334.3828*** (df = 137; 1317)	190.7368*** (df = 256; 1198)	195.7995*** (df = 264; 1308)	195.1633*** (df = 266; 1306)	197.4783*** (df = 265; 1316)	189.504*** (df = 258; 1196)

Statistical significance is identified at the *10% level, **5% level, and ***1% level

The variables of interest are related to the broadcast of the game, but we will first start by examining the effects of the other covariates. Ranked opponents captures the number of schools the team plays that are ranked at the time of the game. The coefficients are positive across specifications, although only statistically significant in models where the conference season interaction is excluded (Models 3 and 4) or number of nationally televised games is excluded (Model 2). In seasons when a conference is stronger, most of its members will play more ranked games, likely soaking up some of the effects of number of ranked opponents. As for the statistically significant result in Model 2, most games against ranked opponents are nationally televised, especially in the later years of the sample, so the ranked opponents coefficient is likely soaking up some of those effects.

Team win total is the total number of games the team won in that season, meant to capture the team's overall ability. As expected, the coefficients are positive and statistically significant, with coefficients around 600 fans. Being a reigning conference champion is also positive and statistically significant in all specifications. Being a reigning national champion is not statistically significant, although that fact is explained by the relatively small number of national champions in the sample, plus the idea that most national champions were also conference champions.

The new stadium coefficients are mostly not statistically significant. However, the stadium age and stadium age squared terms are statistically significant in Models 7, 8, and 9. The sign on stadium age is negative as expected, identifying fan preferences for newer stadiums. MSA population and per capita personal income results are inconclusive, showing statistical significance in some specifications but not others.

Two key television variables are included in these specifications. The first is an indicator if the school is part of a conference with a conference network. Coefficients are positive and statistically significant in nearly all of the specifications.

These results support the general conclusion that television does not act as a substitute for live attendance for college football games. The statistical significance of the conference network variable may suggest that the general brand exposure of being on a conference network has a positive effect on fan demand. By controlling for team quality, we are able to conclude that the positive coefficient is likely not being driven by the fact that being part of a conference network leads to more resources for the school to use on recruiting and getting better talent. We are currently working to identify other theories as to what, besides improved brand awareness, is driving the positive effect. We are also still working to identify why excluding the interacted conference season fixed effects in Models 3 and 4 causes the conference network statistical significance to go away.[5] Model 6 includes an interaction effect between the conference network variable and conference to identify if the presence of a conference network has a consistent effect on attendance across the conference. Compared to the excluded SEC, the presence of a conference network seems to have a negative impact on attendance for the Big Ten, but positive effect for the SEC and ACC (the total effect for the Pac-12 is not statistically different from zero). The ACC's conference network began in 2019, so more data are needed to identify the long run effects for the ACC.

The second television variable counts the number of home games the school

[5]This result is especially perplexing. Had the results been flipped—statistical significance in these models but none in the other models—it would be easy to conclude that the conference network variable is picking up the effects of the continuing growth of the Power 5 (excluding the Big 12) relative to the growth of other FBS conferences.

plays that are nationally televised. These include nationally televised games on NBC, Fox, CBS, ABC, ESPN, ESPN2, ESPNU, FS1, NBC Sports, and each of the conference networks. This variable is also statistically significant in all of the specifications. Model 2 excludes the number of games on national television variable to identify any potential multicollinearity effects on the conference network variable. Excluding the variable did not impact the conference network coefficient. One potential explanation for the positive statistically significant coefficients for the nationally televised games variable is that nationally televised games are often heavily advertised, and that increased advertisement from national networks leads to increased consumer demand.

Table 5 is similar to the previous table except with percent capacity filled used as the dependent variable instead of attendance. Most of the covariates, including number of ranked opponents, team win total, and reigning conference and national champions, provide results consistent with the previous set of results. The presence of a new stadium is positive and statistically significant in all of the specifications excluding stadium age, suggesting a nine percentage point increase in percent capacity filled.[6] In the other models, stadium age is still negative and statistically significant, and stadium age squared is positive and statistically significant. Population is positive and statistically significant in each of the three specifications it is in, while income is not statistically significant. Finally, the TV variables provide the same conclusions as they did in the attendance models.

[6]Most new stadiums built during the sample period are larger than their team's preceding stadium, so it is peculiar that percent capacity filled is greater, given the lack of statistical significance in the attendance model.

Table 5: Average Season Per Game Percent-Capacity

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Conference Network	0.1229**	0.1171**	(0.00)	0.00	0.1755***	0.1229**	0.0972*	0.05	0.1507***
	(0.05)	(0.05)	(0.01)	(0.01)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
X ACC						0.02			
						(0.05)			
X Big Ten						-0.2092**			
						(0.09)			
X Pac-12						0.01			
						(0.05)			
Nationally Televised Games	0.0160***		0.0113***	0.0115***	0.0164***	0.0160***	0.0165***	0.0166***	0.0167***
	(0.00)		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Ranked Opponents	0.00	0.0069**	0.0066**	0.0065**	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Team Win Total	0.0123***	0.0138***	0.0126***	0.0120***	0.0116***	0.0123***	0.0125***	0.0125***	0.0116***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Conference Champion	0.0321***	0.0378***	0.0341***	0.0294***	0.0274***	0.0321***	0.0309***	0.0312***	0.0260***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
National Champion	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.01)
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
New Stadium	0.0903***	0.0988***	0.0870***	0.0935***	0.0920***	0.0903***	0.02		0.01
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)		(0.03)
Stadium Age							-0.0051***	-0.0058***	-0.0056***
							(0.00)	(0.00)	(0.00)
Stadium Age Squared							0.00005***	0.0001***	0.0001***
							(0.00)	(0.00)	(0.00)
MSA Population				0.00000004**	0.0000001***				0.00000004**
				(0.00)	(0.00)				(0.00)
MSA Per Capita Personal Income				0.00	0.00				0.00
				(0.00)	(0.00)				(0.00)
Constant	0.7195***	0.7338***	0.6158***	0.5964***	0.6542***	0.7195***	0.8377***	0.8217***	0.8290***
	(0.07)	(0.07)	(0.06)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.08)
School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Conference FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Season FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Conference X Season FE	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes
N	1,557	1,557	1,557	1,441	1,441	1,557	1,557	1,566	1,441
R^2	0.840	0.833	0.819	0.827	0.848	0.840	0.845	0.841	0.854
Adjusted R^2	0.807	0.799	0.802	0.809	0.816	0.807	0.813	0.809	0.822
Residual Std. Error	0.0814 (df = 1293)	0.0831 (df = 1294)	0.0825 (df = 1420)	0.0805 (df = 1304)	0.0792 (df = 1185)	0.0814 (df = 1293)	0.0802 (df = 1291)	0.0811 (df = 1301)	0.0778 (df = 1183)
F Statistic	25.7406*** (df = 263; 1293)	24.6377*** (df = 262; 1294)	47.3165*** (df = 136; 1420)	45.9407*** (df = 136; 1304)	25.9523*** (df = 255; 1185)	25.7406*** (df = 263; 1293)	26.5201*** (df = 265; 1291)	26.0861*** (df = 264; 1301)	26.8352*** (df = 257; 1183)

Statistical significance is identified at the *10% level, **5% level, and ***1% level

3.2 Single Game Attendance

In addition to the per game average attendance and capacity filled models, we consider single-game models to explore some of the trends discovered in the previous section. Table 6 identifies factors of demand that impact single game attendance. In addition to the variables discussed in the previous subsection, these models include game-specific variables such as weather factors, game start time and day-of-the-week, travel distance between schools, rank of the home and visiting schools, and a more granular breakdown of the type of television coverage a game receives. Model 1 is our base model. Models 2 and 3 incorporate MSA population and income data to the base model. Models 3 and 4 include variables related to the stadium. Model 4 is similar to Model 3, but excludes the economic data.

Weather variables include temperature and its quadratic, dew point, humidity, wind speed, wind gust, air pressure, precipitation, and a dummy variable for extremely bad weather.[7] Temperature is positive and statistically significant, and temperature squared is negative and statistically significant—although the effect is positive over the range of realistic temperatures. Dew point, wind speed, and air pressure are not statistically significant. Wind gust is negative and statistically significant, indicating that excessive winds leads to a diminished gameday experience, and thus reduces demand. Humidity is also negative and statistically significant, suggesting that fans prefer less humid days. Finally precipitation is negative and statistically significant, not surprising given we would expect less fans to attend on rainy days. The extremely bad weather indicator did not return statistically significant.

[7]Extremely bad weather includes heavy rain, thunder, or lightening.

Table 6: Single Game Attendance

Variables	Model 1	Model 2	Model 3	Model 4
National Game CBS, FOX, NBC, ABC	5,299.5120*** (301.30)	5,260.2100*** (304.37)	5,230.6660*** (304.77)	5,269.0290*** (301.61)
National Game Basic Cable	3,834.5480*** (263.05)	3,903.4530*** (265.30)	3,884.3080*** (265.66)	3,806.7090*** (263.42)
National Game TV Add-Ons	2,007.4540*** (271.41)	2,082.1710*** (276.00)	2,084.1710*** (276.44)	2,008.8890*** (271.81)
Regional Network	1,281.8870*** (296.34)	1,284.7270*** (297.49)	1,339.0140*** (298.69)	1,328.2440*** (297.45)
Streaming Online Only	(126.30)	(18.27)	(16.40)	(128.44)
	(329.51)	(337.04)	(338.14)	(330.43)
Pay Per View Game Only	1,397.5570** (592.72)	1,483.8780** (589.61)	1,467.7010** (591.61)	1,371.7190** (594.65)
Home Conference Champion	1,901.2440*** (254.76)	1,656.3050*** (262.30)	1,633.2970*** (262.28)	1,884.2990*** (254.57)
Home National Champion	2,705.5000*** (637.48)	2,967.2920*** (652.83)	2,961.2510*** (652.11)	2,711.7640*** (636.75)
Away Conference Champion	435.3845* (245.49)	469.9142* (253.14)	494.1914* (253.52)	460.7131* (245.78)
Away National Champion	1,842.4950** (762.17)	1,788.9430** (778.36)	1,772.0700** (777.61)	1,820.5780** (761.30)
Either Team Ranked	2,510.8430*** (159.27)	2,484.1250*** (163.37)	2,484.1810*** (163.39)	2,511.9200*** (159.24)
Both Teams Ranked	1,724.5960*** (313.28)	1,668.2110*** (319.50)	1,673.6660*** (319.22)	1,731.7430*** (312.95)
Conference Game	-1,171.8120*** (151.21)	-1,231.5080*** (156.02)	-1,235.2980*** (156.16)	-1,172.7940*** (151.30)
Monday Game	3,454.0020** (1,357.37)	3,025.5710** (1,382.34)	3,040.2790** (1,381.02)	3,461.1310** (1,355.87)
Tuesday Game	-5,154.7710*** (1,189.06)	-5,806.8680*** (1,229.30)	-5,828.8280*** (1,228.33)	-5,182.2170*** (1,188.03)
Wednesday Game	-5,028.4360*** (1,305.66)	-5,290.1440*** (1,356.47)	-5,193.4000*** (1,355.03)	-4,955.4330*** (1,304.10)
Thursday Game	-2,077.2450*** (344.40)	-2,084.9850*** (353.19)	-2,087.3780*** (353.48)	-2,096.7340*** (344.59)
Friday Game	-1,499.4350*** (329.29)	-1,680.1520*** (348.26)	-1,631.0810*** (348.36)	-1,456.9570*** (329.27)
Sunday Game	(307.56)	44.62	31.15	(310.83)
	(943.34)	(961.09)	(959.98)	(942.10)
Afternoon Kickoff	(24.31)	49.04	67.88	(4.13)
	(171.07)	(176.21)	(176.63)	(171.43)
Evening Kickoff	977.3204*** (175.51)	999.4909*** (180.79)	1,005.2870*** (180.85)	983.4596*** (175.52)
Late Kickoff	2,219.39 (1,827.71)	2,067.67 (1,816.10)	2,150.58 (1,813.99)	2,321.99 (1,825.30)
Distance Between Schools	-1.3498*** (0.16)	-1.3542*** (0.16)	-1.3642*** (0.16)	-1.3597*** (0.16)
Temperature	94.5721*** (28.42)	94.1519*** (29.00)	91.7254*** (29.06)	92.4094*** (28.46)
Temperature Squared	-0.5243** (0.21)	-0.5138** (0.22)	-0.5042** (0.22)	-0.5170** (0.21)
Dew Point	1.72 (14.02)	(1.22) (14.13)	(0.30) (14.13)	2.88 (14.01)
Humidity	-17.6426** (8.21)	-15.6339* (8.32)	-16.1076* (8.32)	-18.0292** (8.21)
Wind Speed	0.21 (16.26)	(2.62) (16.79)	(3.08) (16.82)	(0.54) (16.28)
Wind Gust	-21.3224** (9.40)	-19.3293** (9.74)	-18.8776* (9.77)	-21.0897** (9.42)
Pressure	10.29 (68.62)	10.26 (68.36)	10.47 (68.32)	9.48 (68.57)
Precipitation	-7,172.0660*** (2,131.34)	-7,425.0790*** (2,145.37)	-7,314.3580*** (2,143.32)	-7,068.9250*** (2,128.88)
Bad Weather Conditions	580.77 (993.38)	96.40 (1,110.71)	12.53 (1,109.51)	516.60 (992.15)
Significant Stadium Renovations			4,768.2290*** (1,663.21)	4,336.6310*** (1,665.40)
New Stadium			1,641.16 (1,050.98)	1,607.12 (1,017.57)
Stadium Age			-52.1333* (28.63)	-55.7573** (25.68)
Stadium Age Squared			0.25 (0.34)	0.22 (0.31)
MSA Population		0.0034*** (0.00)	0.0030*** (0.00)	
MSA Per Capita Personal Income		-0.0681** (0.03)	-0.0708** (0.03)	
Constant	45,205.6000*** (2,710.00)	45,239.3500*** (2,871.02)	47,233.0700*** (3,054.64)	47,035.1600*** (2,830.60)
School FE	Yes	Yes	Yes	Yes
Conference FE	Yes	Yes	Yes	Yes
Season FE	Yes	Yes	Yes	Yes
Conference X Season FE	Yes	Yes	Yes	Yes
N	9,076	8,421	8,386	9,041
R^2	0.950	0.951	0.951	0.950
Adjusted R^2	0.949	0.949	0.949	0.949
Residual Std. Error	5,921.8200 (df = 8785)	5,875.8730 (df = 8138)	5,868.4560 (df = 8099)	5,913.4550 (df = 8746)
F Statistic	578.1533*** (df = 290; 8785)	554.3918*** (df = 282; 8138)	545.6690*** (df = 286; 8099)	569.7549*** (df = 294; 8746)

Statistical significance is identified at the *10% level, **5% level, and ***1% level

Compared to early day starts (traditionally noon or 1pm kickoffs), evening games (start times between 6-9pm) draw statistically significantly more fans. Compared to traditional Saturday games, nearly every day of the week draws worse.[8] Distance, measured as the straight line distance in miles between the two competing schools, is negative and statistically significant. This is not surprising as the further an opponent is, the less opposing fans are likely to travel and the less likely the opponent is to be a regional rival. MSA population has a positive and statistically significant effect, while income has a negative and statistically significant effect on single game attendance.

Having the home team or the visiting team be a reigning conference or national champion leads to higher attendance. Games also see higher attendance when either team is ranked, and even greater attendance when both teams are ranked. Theses results suggest that fans have higher demand to watch good teams. A conference game indicator variable is interacted with home conference to control for the fact that not all conference games are created equal. Conference games seem to draw additional fans in the Big Ten, Pac-12, and SEC, has no statistically significant effect in the Big 12 and Sun Belt, and actually leads to fewer fans in the remaining FBS conferences.

The stadium variables provide expected results. Big renovations is an indicator for whether the home stadium received major renovations and had to close for at least one season prior in order to receive those renovations, essentially making it like a new stadium. Both that variable and the new stadium variable return positive and statistically significant in both specifications. Stadium age is once

[8]The exception is Monday, although the only Monday games you generally see are at the very beginning of the season. Future edits of this paper will include week or month fixed effects.

again negative and statistically significant, again showing fan preferences for newer facilities.

Television coverage is tiered by availability and accessibility. Our first variable, Satellite, includes games that would be available to almost all consumers as games are available on national television with the accessibility of a satellite or other basic coverage. These include games on Fox, CBS, NBC, and ABC. The next category includes games that are nationally televised on networks available in almost any basic cable package. These include games on ESPN, ESPN2, NBC Sports, and FS1 among others. The third category includes games that are nationally televised, but on networks that generally cost a premium to acquire and may not be accessible to all consumers. These include games on the conference networks, ESPNU, FS2, CBSSN, and others. The next category is also the largest category, including all games on regional networks. These games are not televised nationally, but are generally available to those living near the home team. The last two categories include games only available via an online stream or via pay-per-view, respectively.

All results are compared to the excluded variable of no television coverage. Games that appear on multiple networks, and in multiple television categories, get assigned the most accessible category applicable. Besides online stream, all of the television variables are positive and statistically significant, supporting early results that being on television does not serve as a substitute for attending a college football game. It is also noteworthy that there does seem to be a relationship between the size of the coefficient and the general reach and accessibility of the game on television. Games available nationally via satellite draw around 5,000 more fans, games available nationally on basic cable draw approximately 3,700 ad-

ditional fans, games available nationally on a network add-on draw around 2,100 additional fans, games available regionally only draw approximately 1,400 additional fans, and the few pay-per-view games drew approximately 1,700 additional fans. Most of these coefficients are statistically different from one another, indicating a positive relationship between availability and accessibility of the game and fan attendance. This result is consistent with results from the aggregate model section and support the conclusion that appearing on television actually leads to higher attendance figures.

The final set of results in Table 7 examine single game capacity filled percentage instead of attendance. Weather, stadium age, start time, day-of-week, travel distance, economic conditions, home and opponent quality, and television coverage results are all consistent with previous results.

4 Discussion

The results in this paper are consistent with results identified in previous papers that examine the effect of television availability on in-stadium game attendance. Live broadcasts serve as a complement to stadium attendance. This paper gets granular in the type of television coverage a game receives, examining the effect of introducing a college network to attendance, and then examining the effect of availability and accessibility to live broadcast on attendance. The introduction of a college network seemed to have mixed effects for the various leagues that implemented one, benefiting the ACC and SEC, but hurting the Big Ten, and having no statistically significant effect on the Pac-12. Increased availability and accessibility benefits attendance, with games being nationally televised and accessible with a

Table 7: Single Game Percent-Capacity

Variables	Model 1	Model 2	Model 3	Model 4
National Game CBS, FOX, NBC, ABC	0.1006***	0.0998***	0.0996***	0.1004***
	(0.01)	(0.01)	(0.01)	(0.01)
National Game Basic Cable	0.0793***	0.0802***	0.0799***	0.0790***
	(0.01)	(0.01)	(0.01)	(0.01)
National Game TV Add-Ons	0.0502***	0.0513***	0.0516***	0.0506***
	(0.01)	(0.01)	(0.01)	(0.01)
Regional Network Game	0.0260***	0.0271***	0.0288***	0.0273***
	(0.01)	(0.01)	(0.01)	(0.01)
Streaming Online Only	0.00	0.00	0.00	(0.00)
	(0.01)	(0.01)	(0.01)	(0.01)
Pay Per View Game Only	0.0393***	0.0403***	0.0405***	0.0392***
	(0.01)	(0.01)	(0.01)	(0.01)
Home Conference Champion	0.0371***	0.0337***	0.0323***	0.0363***
	(0.01)	(0.01)	(0.01)	(0.01)
Home National Champion	0.01	0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Away Conference Champion	0.0085*	0.0088*	0.0096**	0.0092*
	(0.00)	(0.00)	(0.00)	(0.00)
Away National Champion	0.0253*	0.02	0.02	0.02
	(0.01)	(0.02)	(0.01)	(0.01)
Either Team Ranked	0.0438***	0.0441***	0.0446***	0.0442***
	(0.00)	(0.00)	(0.00)	(0.00)
Both Teams Ranked	0.0235***	0.0227***	0.0223***	0.0233***
	(0.01)	(0.01)	(0.01)	(0.01)
Conference Game	-0.0263***	-0.0275***	-0.0279***	-0.0265***
	(0.00)	(0.00)	(0.00)	(0.00)
Monday Game	0.0476*	0.0531*	0.0526*	0.0473*
	(0.03)	(0.03)	(0.03)	(0.03)
Tuesday Game	-0.0956***	-0.1172***	-0.1213***	-0.0991***
	(0.02)	(0.02)	(0.02)	(0.02)
Wednesday Game	-0.0634**	-0.0673**	-0.0683***	-0.0648**
	(0.03)	(0.03)	(0.03)	(0.03)
Thursday Game	-0.0413***	-0.0421***	-0.0426***	-0.0424***
	(0.01)	(0.01)	(0.01)	(0.01)
Friday Game	-0.0216***	-0.0231***	-0.0226***	-0.0214***
	(0.01)	(0.01)	(0.01)	(0.01)
Sunday Game	(0.02)	(0.01)	(0.01)	(0.02)
	(0.02)	(0.02)	(0.02)	(0.02)
Afternoon Kickoff	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Evening Kickoff	0.0179***	0.0177***	0.0180***	0.0181***
	(0.00)	(0.00)	(0.00)	(0.00)
Late Kickoff	0.05	0.05	0.06	0.0585*
	(0.04)	(0.04)	(0.03)	(0.04)
Distance Between Schools	-0.00003***	-0.00003***	-0.00003***	-0.00003***
	(0.00)	(0.00)	(0.00)	(0.00)
Temperature	0.0017***	0.0019***	0.0019***	0.0017***
	(0.00)	(0.00)	(0.00)	(0.00)
Temperature Squared	(0.00)	-0.00001*	-0.00001*	-0.00001*
	(0.00)	(0.00)	(0.00)	(0.00)
Dew Point	(0.00)	(0.00)	(0.00)	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Humidity	-0.0003*	(0.00)	-0.0003*	-0.0003**
	(0.00)	(0.00)	(0.00)	(0.00)
Wind Speed	(0.00)	(0.00)	(0.00)	(0.00)
	(0.00)	(0.00)	(0.00)	(0.00)
Wind Gust	-0.0004**	-0.0003*	(0.00)	-0.0004**
	(0.00)	(0.00)	(0.00)	(0.00)
Pressure	-0.0023*	-0.0022*	-0.0023*	-0.0024*
	(0.00)	(0.00)	(0.00)	(0.00)
Precipitation	-0.1416***	-0.1584***	-0.1500***	-0.1344***
	(0.04)	(0.04)	(0.04)	(0.04)
Bad Weather Conditions	(0.00)	(0.01)	(0.01)	(0.00)
	(0.02)	(0.02)	(0.02)	(0.02)
Significant Stadium Renovations			0.0959***	0.0838***
			(0.03)	(0.03)
New Stadium			0.0333*	0.0396**
			(0.02)	(0.02)
Stadium Age			-0.0049***	-0.0040***
			(0.00)	(0.00)
Stadium Age Squared			0.00004***	0.00003***
			(0.00)	(0.00)
MSA Population		0.0000001***	0.00000004***	
		0.00	0.00	
MSA Per Capita Personal Income		0.00	0.00	
		(0.00)	(0.00)	
Constant	0.7812***	0.7407***	0.9234***	0.9146***
	(0.05)	(0.06)	(0.06)	(0.05)
School FE	Yes	Yes	Yes	Yes
Conference FE	Yes	Yes	Yes	Yes
Season FE	Yes	Yes	Yes	Yes
Conference X Season FE	Yes	Yes	Yes	Yes
N	9,018	8,373	8,338	8,983
R^2	0.689	0.698	0.704	0.694
Adjusted R^2	0.679	0.687	0.693	0.684
Residual Std. Error	0.1156 (df = 8728)	0.1132 (df = 8091)	0.1120 (df = 8052)	0.1146 (df = 8689)
F Statistic	66.9228*** (df = 289; 8728)	66.4173*** (df = 281; 8091)	67.1298*** (df = 285; 8052)	67.3854*** (df = 293; 8689)

Statistical significance is identified at the *10% level, **5% level, and ***1% level

satellite leading to an increase of approximately 5,000 fans (or increase in percent capacity filled by 9.4 percentage points), with the effect decreasing as games are less accessible or available in fewer homes.

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