

Do College Football Games Pay for Themselves? The Impact of College Football Games on Local Sales Tax Revenue

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Abstract

This paper analyzes the net impacts of college football games on the sales tax revenues and taxable sales of four mid-sized cities in Texas. The paper addresses the question in the title, but also asks whether state policy makers might be justified in encouraging schools in their state to play one another based on the local economic impact those games will have. In general, our evidence suggests the answer to that question is no.

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1 Introduction

Football game day in a college town can be frenetic, especially if the school plays football in Division I, the top echelon of college sports. Thousands of visitors from around the state and region flock to the host city, spending money in bars and restaurants, hotels and motels, and even inside the stadium. All of this commercial activity carries with it sales tax revenues to the state and to the community. Of course, the large crowds lead to more traffic in town, greater congestion in the streets and eating and drinking establishments, and an increased need for police and emergency services relative to non-game days. The important policy question is whether the tax revenues from all the activity pay for the added services or if community budgets are put under pressure to meet these demands.

In this paper, we analyze monthly sales tax data for a period of several years from four small to medium-sized cities in Texas: Austin, College Station, Lubbock, and Waco. Each is home to a university that plays football in the Football Bowl Subdivision (FBS) of NCAA Division I (formerly known as Division I-A). The institutions are the University of Texas at Austin (Austin), Texas Tech University (Lubbock), Baylor University (Waco), and Texas A & M University (College Station). Using these data, our goal is to assess the impact of FBS football games on the sales tax revenues of the host jurisdiction and to assess whether conference games, games against teams from within the state, or games against specific rivals are different from other games.

This project is linked in obvious ways to the literature on the demand for attendance at sporting events. While numerous papers focus on attendance to professional football games, Kaempfer and Pacey (1986), Fizel and Bennett (1989), DeSchriver and Jensen (2002), Price and Sen (2003), and Leonard (2005) all address attendance at college football games. These papers are more directly related to our project than the general attendance literature because attendance at college football games, especially by out-of-town visitors, is presumed to be a source of extra commercial activity that produces a boost in local sales tax collections.

Kaempfer and Pacey (1986) and Fizel and Bennett (1989) focus on the influence of television broadcasts on attendance. The former find that attendance and broadcasts are complements, the latter that complementarity exists for major programs but that overall broadcasting has reduced attendance. Neither study examines the impact of a broadcast on attendance at a specific game but

rather explain how an additional broadcast this season or historically affects season attendance relative to season long availability of seats.

Leonard (2005) focuses on Division I football and the importance of geographic proximity of the two schools whose teams are playing. His approach is not a standard economic one, however, as he adapts the “gravity model of social science” which “posits that there is an attractive force between two places (their “masses” or geographic complementarity) that is mitigated by the cost of interaction between the two places”. The costs of interaction are a function of the distance between the two schools, the proximity of other nearby tourist attractions, the inherent interest in the game, the quality of the opponents, and other reasons for travel to the game location.

Price and Sen (2003) investigate game day attendance to FBS football games in the 1997 season. They find that the quality of both the home and the visiting team, whether or not the teams are traditional rivals, and conference memberships significantly influence attendance. Furthermore, enrollment and the percentage of students living on campus also affect attendance. Finally, they find that a nearby professional football team reduces a college team’s drawing power.

The importance of games against rivals has a policy dimension that does not feature prominently in the evaluation of professional franchises and games. State politicians often express interest that public colleges and universities in their state schedule football games against one another. Consider, for example, an Associated Press story dated February 10, 2005: “It was only a passing reference, but the ovation that interrupted Gov. Joe Manchin’s State of the State address was proof that some of the first-term governor’s agenda had already hit home. Increasing state revenues? Better health care? No. Manchin really wants Marshall and West Virginia universities to resume their in-state football rivalry. The way they reacted, so do a lot of lawmakers.” A second example comes from North Carolina. Two state legislators sponsored a 1995 bill that would have required the University of North Carolina and North Carolina State University to schedule football games against East Carolina University. While the bill was never passed, it wasn’t long before ECU was on the UNC and NCSU schedules. Referring to the arrangement in an interview reported in the *Raleigh News and Observer* on October 20, 2007, North Carolina state Senator Marc Basnight said, “There are no negatives to it. It benefits the economy of Eastern North Carolina and benefits Raleigh. It fills up the stadiums. All I’ve heard in the legislative building this week is ‘Big game, big game.’ Why play some out-of-state

team when you can create this much interest?”

Obviously, Senator Basnight believes that college football games have meaningful economic benefits to the host communities. While there has been little work done specifically on estimating the effects of college sports on local economies, there is a larger literature measuring the effects of holding sporting events of various types.¹ This research is important because policy makers may wish to know how valuable an event might be for their city before they advocate spending money on attempting to recruit the event to their city (see, for example, Baade and Matheson, 2001, 2004a, 2004b; Matheson and Baade, 2005; Coates and Humphreys, 2002; Porter, 1999; and Coates, 2006). The general consensus in the academic literature that analyzes these issues *ex post* is that there is not a large return in terms of permanent jobs or income. However, the literature focusing on the amount of tax revenue generated while the event is taking place, which reflects the immediate net impact of the event on local spending, is less developed.

Baade, Bauman and Matheson (2008) examine how events in the sports world or society more generally impact sales taxes in Florida, focusing specifically on the effects of sports strikes and lock-outs. In their analysis they also control for the effects of hurricanes and the opening of new stadiums or arenas as well as the arrival of expansion franchises in baseball, football, basketball, and hockey. Their intuition is that work stoppages are negative mega-events. Therefore, they test for any negative impact of events *not* being held. Unfortunately, neither work stoppages, the opening of new facilities, nor the arrival of a new team have a statistically significant effect on the host city’s share of state taxable sales. One can infer that because the (missing) events had no effect on taxable sales, the events have no meaningful effect on tax revenue when they are held.

Coates (2006) uses a time series of monthly sales tax revenues for Houston, Texas to estimate the effects on local sales tax revenues of hosting the 2004 NFL Super Bowl and the 2004 Major League Baseball All-Star game. He finds that hosting the Super Bowl may have generated an increase in the sales tax revenues collected in Houston, but that the increment to revenues was possibly smaller than the increased expenditures on security, sanitation, and other public services that the event required. His findings show that sales tax revenues in Houston were smaller in July 2004, the month of the MLB All Star Game, than in a typical July. This is not, of course, consistent with the effect proponents of

¹One example of this work is Baade, Baumann, and Matheson (2007) which focuses explicitly on college football’s effects, finding little impact on host communities.

hosting such events advertise in their promotional materials.

Coates and Depken (2007) is the most similar previous research to the current analysis, but they evaluate the impact of a wide array of professional and amateur, regular season, playoff, and championship sporting events and a national political convention, on sales taxes in twenty-six Texas municipalities. One of the event types investigated is college football games, but they do not control for which teams were playing in any game. This paper focusses on game details. The questions we ask include the broader one addressed by Coates and Depken (2007): whether an FBS football game generates increases in local sales tax revenue. However, we collect more refined game-level data to assess the impact of games against “rivals,” against teams within the conference, and against teams from within Texas. Put differently, we use data from Texas to assess Senator Basnight’s belief about the value to the local economy of games between in-state rivals.

Texas is a natural place to ask this question. First, the four universities located in the cities we investigate all play Division I FBS football, the cities are all moderately sized, though Austin is much larger than the others, and none are home to any major professional sports franchises which might make it more difficult to identify the impact of a college football game on local sales tax revenues. Three of the institutions, the University of Texas at Austin, Texas Tech University, and Texas A & M University, are public, while Baylor University is private and religiously affiliated.

Second, consider that at one time there were 8 teams from Texas within the same conference, the Southwest Conference, but now those same 8 teams are split among 3 conferences.² Naturally, being in different conferences means they play each other less often. If games against other teams from Texas means greater local interest, more intense rivalry, and more out of town visitors, than games against teams from outside of Texas, then having fewer games against the other Texas teams will mean less sales tax revenues from the games. Indeed, during the 1990s, legislators in Texas took positions on the rumored departure of the University of Texas at Austin and Texas A & M University from the Southwest Conference. An Associated Press article dated August 17, 1990, reported that

²The eight institutions include the four mentioned in the text, and the University of Houston, Rice University (Houston), Southern Methodist University (Dallas), and Texas Christian University (Ft. Worth). Previous to 1995, all eight teams played in the Southwest Conference. After 1995, the four we investigate herein joined the Big Eight Conference to form the Big XII Conference. The other four schools were left to find their own conference affiliations. For example, TCU played in the Western Athletic Conference from 1996-2001, then joined Conference USA from 2001-2005, and joined the Mountain West Conference starting in 2005. The conference affiliations of the other teams: Rice (WAC, 1996-2005; Conference USA, 2005-present), Houston (Conference USA, 1996-present), SMU (WAC, 1996-2005; Conference USA, 2005-present).

“Texas House Speaker Gib Lewis says he strongly opposes the University of Texas or Texas A&M University leaving the Southwest Conference. He vowed ‘to do everything in my power to prevent it from happening’ - even slashing appropriations to the two universities. For fiscal 1991, the Legislature appropriated \$233 million to UT and \$183 million to Texas A&M - none of it for athletics.” The article also indicated “[a] common concern is that the smaller schools left in the conference would lose too much income from television revenues and ticket sales without UT and Texas A&M on their schedules.”

The issue did not go away, and in February of 1994, speculation that UT, Texas A&M, Baylor, and Texas Tech were considering offers to enter the Big Eight Conference “prompted several Texas legislators to hold hearings on the SWC’s future and to pledge legislative retaliation if any teams flee the conference.” While these four teams did eventually leave the Southwest Conference and no legislative retaliation occurred, these news accounts emphasize how the scheduling of college football games and the organization of college conferences is an important policy issue for state legislators. Consequently, analysis of the fiscal repercussions of intercollegiate football games is valuable for people interested in effective and efficient government and in local economic development.

In the next section of the paper we describe the data and the empirical approach to assessing the sales tax revenue impacts of college football games. We then turn to a section which describes and interprets the results of estimating the revenue models. The paper ends with a summary of our findings and suggestions for additional work.

2 Data and Empirical Model

In this section we first describe our data then outline the empirical methodology and hypothesis testing.

2.1 Data

Our goal is to estimate the effects of college football games on the tax revenue in the actual cities that host the events. To accomplish this, data on monthly sales tax allocations for 4 Texas cities from January 1984 through February 2008 were obtained from the Texas Comptroller’s Office.

The state of Texas does not have a state income tax and raises a significant portion of the state government’s revenues from a state sales tax, currently set at 6.5%. Local cities can charge up to an additional 2% in sales taxes which can be dedicated to general city funds or to specific projects, including mass transit, street maintenance, and stadium construction. Our data reflect the local jurisdiction’s portion of the overall sales tax collected in the jurisdiction.

A primary concern is the length of the sample period given the nominal measure of sales tax allocations. We convert the monthly sales tax allocations to real 2004 dollars using the monthly Consumer Price Index as reported by the Bureau of Labor Statistics.³

2.2 Empirical Model

We assume a linear relationship between real tax revenues and the college football games played in the city

$$RTax_{it} = \alpha_i + \lambda_i TIME_{it} + \beta EVENTS_{it} + \epsilon_{it}, \quad (1)$$

where i indexes the city, t indexes the month, and ϵ_{it} is a zero-mean error term. The dependent variable, $RTax_{it}$, is real monthly tax revenues for city i in month t , measured in 2004 CPI adjusted dollars. The parameters to be estimated include α_i , a city-specific fixed effect constant over time, λ_i , a city-specific time trend, and β , a vector of parameters that measure the net impact of additional football games, additional conference games, additional games against instate opponents, and games against the other three institutions in our data.

It is important to adequately control for the intra-year variability of tax revenues. A common approach is to first-difference the data, which would measure the one-month change in tax revenues throughout the year. However, for institutional and seasonal reasons, month-to-month differences are unlikely to sufficiently de-trend the data. Rather than impose a seasonal adjustment procedure, such as the Census Bureau’s X-12 seasonal adjustment, we use the twelve-month difference of the model described in equation (1). In this approach the dependent variable is measured as the twelve-month change in real sales tax revenue. The independent variables are also 12-month differenced. One

³Specifically, we used the Consumer Price Index - All Urban Consumers available at www.bls.gov, last accessed April 2008.

advantage of this approach is that the fixed effect for city i in the estimated equation is actually the growth rate for city i , λ_i in equation (1), while the city-specific fixed effects α_i are differenced out of the estimation.⁴

The model after 12-month differencing is:

$$\Delta RTax_{it} = \lambda_i + \beta \Delta EVENTS_{it} + \epsilon_{it}, \quad (2)$$

We further control for seasonality and general macroeconomic trends by including a year time trend and month dummy variables. We recognize that general trends and dummy variables are not ideal for this purpose. However, variables that might better control for temporal changes in local economic conditions are difficult if not impossible to measure at the city level with the same frequency by which the sales tax data are collected.⁵

We estimate a number of specifications in a specific to general approach. Model (1) is a baseline specification wherein the explanatory variables include total games played in city i in month t , the total in-conference opponents that played in city i in month t , and the total number of in-state opponents that played in city i in month t . This model imposes the restrictions that the impact of an additional game, an additional conference game, and an additional game against an in-state opponent have the same impact on sales tax revenues in Austin, College Station, Waco, and Lubbock.

The second specification allows each city's sales tax revenue to be differentially impacted by an additional game against any type opponent, in-state opponents, and in-conference opponents. In other words, Model (2) allows us to test the equality of the impact of an additional game on the sales tax revenues collected in Waco, Lubbock, College Station, and Austin. Model (3) allows us to test for differences in the impact of additional in-state opponents on the tax revenue collected in the four cities in the sample. Model (4) allows us to test for differences in the impact of additional in-conference opponents on the tax revenue collected in the four cities in the sample. Model (5) combines all of these extensions.

⁴This does require an adjustment to the standard errors. Specifically, the fixed effects estimator will calculate the standard errors based on $NT - N - k$ degrees of freedom whereas the correct degrees of freedom are actually $NT - 2N - k$.

⁵For example, population of a tax jurisdiction likely influences the sales tax revenue collected in that jurisdiction. However, population is only available on an annual basis and it is not clear how to interpolate monthly population levels from these annual observations. A similar problem arises when contemplating other potential explanatory variables such as business startups, unemployment levels, or disposable income.

We next estimate specifications that allow us to assess the impact of a visit by any of the four schools represented in the sample on the the sales tax revenues collected in any of the other three cities. In Model (6) we estimate the impact of a UT-Texas A&M game on the tax revenues collected in Austin, the impact on tax revenue in Waco of a Baylor-Texas A&M game played in Waco, and so on. Given the position several Texas legislators held on possible conference realignment and of several North Carolina legislators on the value of games played against in-state opponents, the results of this estimation are of particular interest. We can ask whether there is a material boost in sales tax revenue collected in Waco or Lubbock when UT or Texas A&M visits. Furthermore, we can address whether an increase could justify legislative intrusion into the football schedules of the schools involved. That is, we can evaluate North Carolina Senator Basnight's assertion of the economic benefits of in-state teams playing one another.

Our final generalization, Model (7), introduces variables that enable us to assess whether away games have an impact on local sales tax revenues. One can think of this an analogous to the question asked by Coates and Humphreys (2001) and Baade, Baumann, and Matheson (2006) concerning the impact of strikes and lockouts; does the absence of home games affect the local economy? For example, consider when Baylor plays UT in Austin. Given the proximity of these two institutions, it is conceivable that large numbers of Baylor fans make the trip from Waco to Austin for the game. Leonard's (2005) gravity model, economic theory, and intuition, suggest more travel between cities that are closer together. Therefore, does an exodus of Baylor supporters from Waco reduce sales tax revenues collected in Waco? If the answer is yes, then it may be beneficial to encourage institutions to *not* play games against opponents that are especially close to them.⁶

The descriptive statistics of our data are provided in Table 1. We convert nominal sales tax revenues into 2004 dollars using the monthly Consumer Price Index as reported by the Bureau of Labor Statistics. We gathered the dates and opponents of football games held in Austin, College Station, Lubbock, and Waco from James Howell's historical scores archive.⁷ The upper panel of Table

⁶A similar issue might arise between Texas Christian University, located in Fort Worth, Texas, and Southern Methodist University, located in Dallas; the two institutions are approximately 35 miles apart. In North Carolina, Duke, located in Durham, and UNC-Chapel Hill are within ten miles of each other. Amongst the Division I FBS teams, other proximate dyads include Houston and Rice (6 miles apart), Washington State and Idaho (8 miles apart), Stanford and California - Berkeley (45 miles apart), Southern California and UCLA (14 miles apart), Georgia and Georgia Tech (70 miles apart), Vanderbilt and Middle Tennessee State University (32 miles apart), Miami (FL) and Florida Interactional (7 miles apart), and the University of Central Florida and the University of South Florida (100 miles apart).

⁷Available on the Internet at www.jhowell.net/cf/cfindex.htm, last accessed May 2008.

1 reports descriptive statistics for the entire sample of 1106 observations describing the period from January 1984 through February 2008 whereas the bottom panel reports those observations during which football games were played (August, September, October, November, and December). We report the level of real sales tax revenues and the 12-month difference of sales tax collections.

The upper panel of Table 1 reports the average real monthly sales tax revenue for the entire sample was \$3.305 million, with the greatest monthly average tax revenue being collected in Austin (\$8.15m) and the lowest monthly average tax revenue being collected in College Station (\$0.89m). The lower panel shows that the average sales tax collected during the last four months of the year was slightly (but not statistically significantly) higher at \$3.317 million. Therefore, without controlling for the type or location of the opponent, there is no immediate evidence that NCAA college football games materially impact local sales tax revenues.

The bottom panel of Table 1 reports that the average number of football games (during the months of the football season) was roughly two games per month, of which one of these games was an in-state opponent, and one game was an in-conference opponent (although these groups are not necessarily mutually exclusive). Amongst the four teams in our sample, each team visits one of the other three teams on a home-and-away rotating basis. For example, the University of Texas plays Texas A&M in Austin in even-numbered years and in College Station in odd-numbered years. Therefore, each team visiting one of the other cities represents about twelve percent of the observations during the football season.

Table 2 provides a tabulation of how often each of the teams in our sample visits another team in the sample during the months of the football season. As can be seen, none of the four teams visit each other during the month of August. Primarily, visitors tend to be in-state non-conference rivals and a mix of out-of-state (both in-conference and non-conference) opponents. It is common practice for Division I FBS teams to schedule lower-tiered opponents or exotic out-of-state or out-of-conference teams for early home games (an example of the latter would be the annual Colorado-Colorado State game, which is typically the first game of the year for each team). Of the four teams in the sample, only Baylor and Texas Tech visited one of the other teams during the month of September. Traditionally, neither Baylor nor Texas Tech has been a football power and therefore might be scheduled by Texas or Texas A&M relatively early in the conference schedule as preliminary “warm-up” games before the

larger games on the schedule, for example the annual “Red River Shootout” between UT and the University of Oklahoma, played in Dallas in October.

3 Results and Discussion

Table 3 presents the estimation results for the specifications described in the previous section.⁸ As mentioned, Model (1) is a baseline model that restricts the impact of total games, total in-state opponents, and in-conference opponents to be the same across the four cities in the sample. As we estimate the model using 12-month differences of both the dependent and independent variables, the parameter estimates can be interpreted as the net marginal impact on sales tax collections in the host city (rather than the metropolitan area) in which the home team plays for each i) NCAA football game, and additionally for each ii) in-state opponent and iii) in-conference opponent. By controlling for city specific effects, month-specific and year specific effects, city-specific heteroscedasticity, and city-specific AR(1) error terms, we hope to have accounted for a substantial portion of any unobserved heterogeneity inherent in the frequency of the data. We note that the data only measure sales tax and thus do not include any additional excise or user taxes, such as hotel, car-rental, airport, or liquor taxes charged by the host city but collected by a different agency. In many cases these excise or user taxes are already earmarked for specific projects, for example, to service debt on various public projects, and do not flow into the general funds of the host city. To the extent that the host city incurs marginal costs for an additional game, e.g., extra police or security enforcement, only sales tax revenues to the city’s discretionary spending can be used to offset these marginal costs.

Model (1) indicates that, on average, an additional NCAA football game held in Austin, College Station, Waco or Lubbock, during the sample period reduced local sales tax revenues but the parameter estimate was not statistically different from zero. Thus, any increases in local sales tax revenue caused by visitors and residents contributing new spending to attend the event, seems to be offset, on average, by reductions in local spending in other areas. This reduction in other spending might be caused by what we term the “hunker-down effect,” wherein local residents stay home rather than venture out to spend money. Alternatively, the reduction in spending may be caused by what we term the “skedaddle

⁸Because our data is a long panel, we were concerned about the potential for bias if it is not stationary. We tested for non-stationary data using the Im, Pesharan, and Shin (2003) method and could easily reject the nully hypothesis of unit roots.

effect,” where locals flee town to avoid the game day crowds and therefore spend money in some other jurisdiction. If local spending is crowded out by spending on the event, the net effect on local sales tax revenue could be zero; a result consistent with that found in the baseline model.

While an additional game itself does not influence sales tax revenues, Model (1) suggests that sales tax collections vary depending on whom the opponent is. For instance, a generic football game reduces net tax revenues collected in the host city by approximately \$18,000, however the parameter estimate is only significant at the 10.1% level and an in-state opponent reduces sales tax revenues by an additional \$16,000 ($p = 0.11$). While the individual parameters are not significant at conventional levels, combining them indicates that an in-state opponent reduces sales tax revenues in the host city by approximately \$34,000 ($p = 0.01$). On the other hand, an in-conference opponent increases tax revenues by approximately \$29,000 ($p = 0.02$). Combining all three parameters suggests that an in-state, in-conference opponent essentially has no impact on local sales tax revenues; the point estimate is approximately -\$5,000 with a p -value of 0.502. This suggests that in-conference opponents generally bring sufficient new dollars to offset the reduction in tax revenues incurred by hosting a generic football game against an in-state opponent. In other words, during these games the inflow of new spending more than offsets the reduced spending caused by the “hunker-down effect” and the “skedaddle effect.”

Model (2) differentiates the effects of a game by the city in which it is played, using Waco (home of Baylor University) as the reference category, holding the impact of in-state opponents and in-conference opponents the same across the four cities. The null that these effects are all zero is rejected at the 5% level, ($p = 0.01$). During the sample period, an additional game held in Austin *reduced* sales tax revenues by an average of \$136,000 relative to Waco. Furthermore, an additional game in College Station reduced sales tax revenue by an average of \$31,000 and in Lubbock reduced sales tax revenue by \$67,000, relative to Waco. This suggests that the inflow of new spending in Austin, College Station, and Lubbock, did not offset the reduction in spending caused by any “hunker-down effect” and “skedaddle effect.” The results that in-state opponents had no significant impact on local sales tax revenues but that in-conference games had a positive influence on local sales tax revenues carry over from Model (1).

The null hypothesis that the parameters concerning where games are played are jointly equal to

zero is strongly rejected ($\chi^2_{(3)} = 11.20, p = 0.01$). However, when combining the parameter estimates in various scenarios, we once again find that for Austin and College Station an in-state, in-conference game has no net impact on local sales tax revenues, suggesting that the inflow of new money spent during the event is offset by other reductions in local spending. This is not the case in Lubbock, where an in-state, in-conference game corresponds with an average reduction in sales tax revenues collected in Lubbock of approximately \$37,000 ($p = 0.02$). One explanation is the relative isolation of Lubbock; the city is approximately 350 miles from Dallas, 425 miles from El Paso, and 575 miles from Houston.

Model (3) tests for differences across the host cities in the dimension of in-state opponents, again using Waco as the reference category, holding the impact of additional games and in-conference opponents the same for the four cities in the sample. Testing the null that these separate city effects are all zero is easily rejected ($p = 0.004$). The results suggest that on average, an in-state rival increases tax revenues in Waco but might have no impact or reduce revenues by approximately \$100,000 in Austin ($p = 0.19$), might have no impact or reduce tax revenues by approximately \$17,000 in College Station ($p = 0.11$), but reduces local tax revenues by approximately \$52,000 in Lubbock ($p = 0.006$). These differential impacts might be explained by the transportation network in Texas. Waco is located on Interstate 35, approximately 80 miles south of Dallas and 100 miles north of Austin. Thus, any in-state rivals playing in Waco have a relatively shorter distance to travel and this distance is traveled on interstate highway. Waco's proximity to Austin and Dallas, both of which have relatively large airports (Austin has 25 gates, Dallas-Fort Worth airport has 174 gates), might make it easier for fans from further away (whether in-state or out-of-state residents) to attend a game in Waco. On the other hand, as mentioned above, Lubbock is geographically distant from the majority of the larger population centers in Texas and surrounding states and its airport, with only nine gates, is primarily serviced by regional jet service.

Model (4) tests for differences across the host cities in the dimension of in-conference opponents, again using Waco as the reference category, holding the impact of additional games and additional in-state opponents the same across the four cities in the sample. The joint hypothesis that these coefficients are all zero is rejected ($p = 0.007$). The results suggest that in Waco, an in-conference opponent increases local tax revenues by \$71,000. Combining the parameter estimates shows that in-conference opponents have no additional impact on local sales tax revenues in Austin ($p = 0.64$)

and Lubbock ($p = 0.43$) but there is, on average, an increase in local sales tax revenue in College Station of approximately \$36,000 ($p = 0.01$) during a game between Texas A&M and a conference opponent.

Model (5) introduces all of the city effects for total games, in-state games, and conference games. Only one of these coefficients is individually significant, that of an in-state game in College Station. The nine coefficients are, however, jointly significant ($p = 0.009$). Interestingly, none of the groups, total, conference, or in-state, when tested for joint significance, will reject the null. It is also possible to test the null that the effects for a given city are all zero. For example, one can test the null that the coefficients for total games, conference games and in-state games played in Austin are zero. This hypothesis is rejected ($p = 0.01$). The analogous nulls for Lubbock and for College Station are not rejected.

Model (6) restricts the marginal impacts of additional games, in-state opponents, and in-conference opponents to be equal across the four cities but allows for differences in local sales tax revenues based on which other Texas team visits a particular city. Specifically, we create a series of indicator variables that take a value of one when a particular team, for instance Texas A&M, visits another city, say Waco. Estimates from this model specification are reported in Table 4.⁹ The results suggest that when Texas A&M visits Texas Tech in Lubbock or Baylor University in Waco, there is no significant change in local tax revenues in those two cities. However, when Texas A&M visits Austin, sales tax revenues in Austin fall by approximately \$410,000. This result is somewhat surprising given the heated rivalry between UT and Texas A&M but is robust to various specifications and sub-samples of the four cities investigated here.

Model (6) suggests that when Baylor visits Austin, local sales taxes in Austin fall by approximately \$237,000. However, when Baylor visits College Station, local sales tax revenues increase by approximately \$47,000. What is the difference between the Baylor Bears visiting Austin versus College Station, especially when both cities are essentially equidistant from Waco? Perhaps more people travel to College Station for the game against Baylor because Kyle Field in College Station is a bit larger than Texas Memorial Stadium in Austin, thereby increasing the possibility that a Baylor Bear

⁹The table does not include the coefficients for total games, instate games, or conference games. Both total games and conference games are individually significant with p-values less than 0.05. Coefficients for these two variables are, respectively, -26.38 and 26.18 .

fan might find a ticket to the game. On the other hand, perhaps the difference is due to city size; Austin with a population of over 700,000 is a much larger city than College Station whose population is about 85,000.

The results from Model (6) suggest that when Texas Tech visits Austin and College Station there is no appreciable change in local sales tax revenues. However, when Texas Tech visits Baylor, local sales tax revenues in Waco increase by approximately \$100,000 on average. Finally, when UT-Austin visits Baylor or Texas Tech, there is no change in local sales tax revenues in those cities, but when UT-Austin visits Texas A&M there is a decrease in local sales tax revenues in College Station of approximately \$56,000.

The reciprocal relationship between Texas A&M and UT-Austin is interesting. Whenever that particularly heated rivalry comes to town, local sales tax revenues decrease. Perhaps this is because a sufficiently large number of people come to the game but bring their own tailgating supplies, thereby reducing spending in the city relative to other games played during the season. Perhaps enough fans live close enough to drive to the game on game day and return home that night, thereby reducing the time during which any new spending might occur and reducing the net change in tax revenue relative to other months of the year. Finally, we point out that in 2006 personal income in the Austin-Round Rock MSA was approximately \$55 billion whereas in the College Station-Bryan MSA personal income was approximately \$5.1 billion (Bureau of Economic Analysis, 2007). While the tax revenue data describes the city, not the Metropolitan Statistical Area, if the relative size of College Station proper to the College Station-Bryan MSA is similar to the relative size of Austin proper to the Austin-Round Rock MSA, then the relative impacts of the Texas A&M-UT game are nearly the same in both cities.

The bottom row and the last column of Table 4 report the results of joint hypothesis tests. Consider the last column for the row labeled Austin. The chi-square value is 10.94 for the test of the null that all of the coefficients on the three visiting team variables are zero. This null is rejected, with a p-value of 0.01. In other words, the visiting teams do have a significant impact on sales tax revenues in Austin. Likewise, teams visiting Waco and College Station have statistically significant effects on sales tax revenues in those cities.

The bottom row tests the null hypothesis that a given team has effects on sales tax revenues in the cities it visits. In the column headed UT, for example, the chi-square statistic is 8.66 with a p-value

of 0.03. This means that when the football team from the University of Texas at Austin goes on the road the cities visited experience a change in their sales tax revenues. Reading across this bottom row it is clear that each of the four teams affects revenues in at least some city it visits.

Model (7) is a very general specification including all of the variables included in Models (1)-(5) except for the month dummies.¹⁰ Furthermore, we include variables that indicate the host city of the visiting team. For example, when Baylor visits Texas Tech, we create an indicator variable that takes a value of one for Waco in that month. Our intent is to test whether there are meaningful changes in local sales tax revenues in the host city of a visiting team. We find that when UT visits Texas A&M local tax dollars in Austin fall by approximately \$369,000, which is significantly less than the decline in tax revenues in Austin when Texas A&M visits UT. There are no statistically significant impacts on Austin tax revenues when UT visits Baylor or Texas Tech, although the parameter estimates are negative. The upper portion of Table 5 is analogous to Table 4, the bottom half of Table 5 shows the effects on the home city of the visiting team.

The remainder of the city pairs carry insignificant parameter estimates except for College Station when A&M visits Baylor and Waco when Baylor visits Texas Tech. College Station sales tax revenues fall by about \$60,000 and increase in Waco by about \$79,000. The bottom row reports the test statistics for the null hypothesis that each school visiting a specific other school has a harmful effect on the sales tax revenues of the home city. For example, the last row under Baylor has a test statistic of 8.01 and a p-value of 0.05. These results mean that in Austin, College Station, and Lubbock, sales tax revenues are lower when UT, A&M, or Texas Tech, travel to Waco. This may be because of the relative ease of traveling to Waco from each of the other cities, as Waco is the most centrally located of the four or it may be because Baylor University is an easier place to get tickets for out of town fans, or for some other reason. For whatever reason, it does suggest that when a team goes on the road it may have harmful effects on that team's home city.

The last column in the lower half of Table 5 shows similar results in a different way. This column reports the results of the joint hypothesis test that all of the away games for a specific team have no impact on revenues in the traveling team's home city. Only for Austin can this null hypothesis be rejected. The upshot is that Austin loses sales tax revenues when UT visits A&M, Baylor, or Texas

¹⁰Inclusion of the month dummies with all the game specific dummies generated perfect collinearity among the regressors.

Tech, but it loses even more if UT hosts those teams. The other cities do not generally experience lost revenues when their institutions go on the road.

4 Conclusions and Discussion

This paper focuses on the impact of Division I Football Bowl Series (FBS) games on the local tax revenues of the specific cities that host them. We narrow our focus to four cities in Texas that host a single Division I FBS team, have no other major professional franchises, and play in a Bowl Championship Series Conference: Austin, College Station, Waco, and Lubbock. These four cities host “big-time” college football programs and have played in the same conference during the period we investigate: either the Southwest Conference or the Big Twelve Conference.

Our question is whether there is a meaningful impact on local sales tax revenues when a football game is played in a particular tax jurisdiction. The question is pertinent in at least three areas. First, there is a small but growing literature that investigates the impact of sporting and cultural events on local sales tax revenues in an attempt to test for whether an event has a meaningful immediate impact on the local host economy. Second, there are several institutions of higher learning in the country that are contemplating either starting a football program or upgrading their program to a higher division. To the extent that officials at those schools and in the host towns are concerned about the influence of new or bigger football games on local resources, the results presented herein are potentially valuable. Finally, it has been suggested by at least two state legislatures that in-state games generate considerable economic activity and therefore flagship institutions should try to schedule games with lower-tiered institutions.

Our first contribution is to the wider literature concerning the economic impact of a mega-event on the local host economy. We stress that our data only focus on the specific city that hosts the college football game and not the surrounding area. We do not measure any spatial spill-overs, whether positive or negative; while the question is valid and the results potentially important, it is beyond the scope of the current project and must be addressed in future research. However, the results obtained in this study are consistent with the other studies that focus on the influence of a mega-event on local sales tax revenue, to wit, the effects vary in their magnitude and sign but are likely to be considerably

lower than politicians and local convention bureaus claim. The results here are also consistent with those of Baade, Baumann, and Matheson (2007) that indicate that big time college football appears to have no discernible impact on either employment or income in the cities where those teams play.

Our second contribution is in the arena of the public finance of mega-events. In many cases, big-time football games put increased stress on local security and medical personnel, including fire and rescue, emergency medical technicians, and police. For example, the U.S. Census estimates that College Station, TX, had a resident population of 67,890 in 2000. On a given Saturday afternoon at Kyle field, there might be more than 80,000 people in the stadium and an unmeasured number outside of the stadium during the game. As witnessed by the localized bombing that occurred in Norman, Oklahoma, during the 2005 game between the Oklahoma Sooners and the Kansas State Wildcats (Associated Press, 2005), a cataclysmic event would put considerable strain on first responders and the security-medical infrastructure of a relatively small town. In response, many smaller cities reach out for reciprocity from neighboring towns, for example for additional emergency medical technician teams, and other city and county police officers for traffic and crowd control. Some cities might appeal to the state for additional state patrol officers to assist in traffic and crowd control. To the extent that the host city can export the cost of additional medical, security, and traffic management, the influence of the event on local tax revenues is of lesser concern. However, if the city cannot export all or any of the additional costs incurred by new or larger football games, the net impact on sales tax revenues is important. A net drain on local sales tax revenues requires the host city to determine if any increased exposure of the town, stock of goodwill with current residents, stature with the state legislature, and any other non-monetary benefits of hosting such events, is worth the financial costs involved.

Our final contribution concerns potential legislative interference in college football scheduling. If the results from these four cities in Texas can be generalized to other, similarly sized and geographically situated cities in the country, then they suggest that there is little economic reason for any interference in college football scheduling. While political benefits might accrue to legislators who are able to pressure flagship institutions to visit smaller, more isolated towns, such benefits are notoriously difficult to measure and remain for future research.

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Tale 1: Descriptive Statistics of the Data Sample

Full Sample: All Observations				
Variable	Mean	Std. Dev.	Min	Max
Real Tax Revenue (2004 dollars)	3,305,769.00	3,155,052.00	264,901.00	14,900,000.00
12-month change in real tax revenue (000s)	107.20	431.27	-2365.97	2369.41
Total Football Games	0.47	0.89	0.00	4.00
In-state Opponents	0.25	0.59	0.00	3.00
In-conference Opponents	0.31	0.72	0.00	3.00
UT Visits	0.03	0.17	0.00	1.00
Texas A&M Visits	0.03	0.17	0.00	1.00
Baylor Visits	0.03	0.17	0.00	1.00
Texas Tech Visits	0.03	0.17	0.00	1.00
Observations	1160			
Partial Sample: Includes Only Observations With NCAA Football Games				
Variable	Mean	Std. Dev.	Min	Max
Real Tax Revenue (2004 dollars)	3,317,104.00	3,105,779.00	296,586.30	12,800,000.00
12-month change in real tax revenue (000s)	87.32	443.51	-1959.86	1846.37
Total Football Games	1.87	0.73	1.00	4.00
In-state Opponents	0.97	0.83	0.00	3.00
In-conference Opponents	1.22	0.95	0.00	3.00
UT Visits	0.12	0.33	0.00	1.00
Texas A&M Visits	0.12	0.32	0.00	1.00
Baylor Visits	0.12	0.32	0.00	1.00
Texas Tech Visits	0.12	0.32	0.00	1.00
Observations	294			

Notes: Data describe Austin, Waco, College Station and Lubbock, Texas, from January 1984 through February 2008. Sales tax revenue obtained from the Texas Comptroller's office. Football game dates and opponents collected by the authors.

Table 2: Count of Visits Amongst Four Sample Universities

School	Home Town	August	September	October	November	December	Total
University of Texas	Austin	0	1	6	28	2	37
Texas A&M	College Station	0	0	23	11	2	36
Texas Tech	Lubbock	0	9	17	11	0	37
Baylor University	Waco	0	6	17	12	0	35

Notes: Counts indicate the number of times each university visited one of the other three universities in each month of the college football regular season. For instance, the University of Texas played only one away game in the month of September against Texas A&M, Baylor, or Texas Tech during the sample period.

Table 3: Estimation Results (Dependent Variable 12-month Difference in Real Tax Revenues)

City	Variable	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
	Total Games	-17.94 (11)	12.54 (17.4)	-17.07 (10.8)	-20.85* (10.8)	-0.22 (21.6)
Austin	Total Games ^a		-135.9* (70.6)			-245.1 (152)
Coll. Sta.	Total Games ^a		-30.71* (18.5)			-26.99 (26.1)
Lubbock	Total Games ^a		-67.03*** (22.7)			-30.3 (32.8)
	In-State Opponents	-16.27 (10.3)	-11.99 (10.1)	52.80** (25.1)	-12.87 (10)	47.25 (28.9)
Austin	In-State Opponents ^a			-149.4* (78.1)		-103.4 (104)
Coll. Sta.	In-State Opponents ^a			-70.14*** (26)		-69.87** (31.1)
Lubbock	In-State Opponents ^a			-105.0*** (30.2)		-45.32 (43.1)
	In-conference Opponents	29.07** (12.8)	30.32** (12.8)	31.05** (12.6)	71.05*** (25.4)	22.51 (32.3)
Austin	In-conference Opponents ^a				-110.6 (85.7)	208.4 (186)
Coll. Sta.	In-conference Opponents ^a				-34.98 (24.4)	25.15 (36.3)
Lubbock	In-conference Opponents ^a				-86.00*** (28.4)	-40.68 (42.6)
	Constant	61.84** (25.5)	62.71** (25.8)	62.49** (25.8)	62.90** (25.9)	63.17** (25.9)
	Observations	1160	1160	1160	1160	1160

Notes: ^a Waco is the reference city. All specifications include a time trend and month dummy variables and allow for city-specific heteroscedasticity and AR(1) error terms. Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 4: Model (6) Visiting Effects

City	Visiting University				H_0 : All jointly zero ^b [<i>p</i> - <i>value</i>]
	UT	Texas A&M	Tex. Tech.	Baylor	
Austin		-410.64*** (131.21)	-102.49 (129.99)	-237.04* (128.18)	10.94 [0.01]
College Station	-55.17*** (20.45)		14.18 (21.27)	47.32** (23.07)	17.25 [0.00]
Lubbock	11.82 (45.44)	-52.89 (50.35)		-64.81 (46.53)	2.91 [0.41]
Waco	24.35 (33.40)	20.91 (33.31)	99.54*** (36.18)		8.00 [0.05]
H_0 : All jointly zero ^b [<i>p</i> - <i>value</i>]	8.66 [0.03]	11.23 [0.01]	8.44 [0.04]	11.17 [0.01]	

Notes: ^a The specification includes a time trend, month dummy variables, and total games, in-state games, and conference game variables. ^b The test statistic is distributed Chi-square with three degrees of freedom ($\chi_c^2 = 7.815$ at $\alpha = 0.05$). The analysis allows for city-specific heteroscedasticity and AR(1) error terms. Standard errors in parentheses, p-values in brackets. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 5: Model (7) Visiting and Traveling Effects

City	Visiting University				H_0 : All jointly zero ^b [<i>p</i> - value]
	UT	Texas A&M	Tex. Tech.	Baylor	
Austin		-770.27*** (189.94)	-344.54* (198.28)	-445.28** (195.35)	17.3 [0.00]
College Station	-34.45 (25.09)		26.53 (27.47)	12.34 (36.11)	3.88 [0.28]
Lubbock	31.56 (67.02)	37.32 (85.09)		44.48 (67.9)	0.5 [0.92]
Waco	-28.99 (45.45)	-28.09 (58.85)	78.4* (47.65)		6.48 [0.09]
H_0 : All jointly zero ^b [<i>p</i> - value]	2.51 [0.47]	16.87 [0.00]	6.66 [0.08]	5.74 [0.12]	

City	Visited University				H_0 : All jointly zero ^b [<i>p</i> - value]
	UT	Texas A&M	Tex. Tech.	Baylor	
Austin		-369.15** (175.43)	-79.17 (172.35)	-218.95 (161.39)	7.14 [0.07]
College Station	10.16 (19.58)		15.66 (22.49)	-60.11** (29.61)	5.82 [0.12]
Lubbock	-6.53 (56.29)	-1.86 (62.37)		92.21 (57.53)	2.60 [0.46]
Waco	-28.95 (43.72)	-26.14 (59.81)	79.12* (42.08)		4.17 [0.24]
H_0 : All jointly zero ^b [<i>p</i> - value]	5.27 [0.15]	4.61 [0.20]	4.33 [0.23]	8.01 [0.05]	

Notes: ^a The specification includes a time trend, and total games, in-state games, and conference game variables for each city. ^b The test statistic is distributed Chi-square with three degrees of freedom ($\chi_c^2 = 7.815$ at $\alpha = 0.05$). The analysis allows for city-specific heteroscedasticity and AR(1) error terms. Standard errors in parentheses, p-values in brackets. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$