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THE IMPACT OF PROFESSIONAL SPORTING EVENTS ON FIRM-LEVEL ECONOMIC ACTIVITY

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ABSTRACT

This paper investigates the impact of professional sporting events on the daily revenue of a particular restaurant in Charlotte, NC. The daily data allow us to test for the impact of professional basketball and professional football games on daily revenues. For this particular firm, professional football games are associated with a net increase in daily revenues, regardless of game outcome; professional basketball games are not associated with increases in daily revenues. Using betting markets as a proxy for market expectations of game outcomes, the data suggest that NFL fans in Charlotte spend more after NFL home games regardless of outcome and regardless of expectations but that they spend less after unexpected losses on the road. This suggests that NFL fans reflect celebratory effects of home games and sore-loser effects of unexpected losses. In contrast, NBA fans reflect only sore-loser effects after unexpected losses at home. The mixed impacts of game outcomes on firm-level revenue suggest that mixed results using aggregate data might be partly caused by the outcomes of events.

The Impact of Professional Sporting Events on Firm-Level Economic Activity

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Abstract

This paper investigates the impact of professional sporting events on the daily revenue of a particular restaurant in Charlotte, NC. The daily data allow us to test for the impact of professional basketball and professional football games on daily revenues. For this particular firm, professional football games are associated with a net increase in daily revenues, regardless of game outcome; professional basketball games are not associated with increases in daily revenues. Using betting markets as a proxy for market expectations of game outcomes, the data suggest that NFL fans in Charlotte spend more after NFL home games regardless of outcome and regardless of expectations but that they spend less after unexpected losses on the road. This suggests that NFL fans reflect celebratory effects of home games and sore-loser effects of unexpected losses. In contrast, NBA fans reflect only sore-loser effects after unexpected losses at home. The mixed impacts of game outcomes on firm-level revenue suggest that mixed results using aggregate data might be partly caused by the outcomes of events.

JEL Classifications: L83, Z20

Keywords: sports, economic impacts, sports subsidies, tourism

This is a distilled version of Benjamin Fore's masters thesis while a student at UNC Charlotte. The opinions expressed in this paper do not reflect the opinions of Bank of America. The authors thank participants at the 2016 Western Economic Association annual meetings for helpful comments. All remaining errors are the authors.

1 Introduction

Promoters of sport and stadium subsidies often claim that businesses within close proximity to the venues enjoy increased business before and after events, thereby partly justifying any public subsidies. However optimistic pre-event studies are, most academic studies have found limited evidence supporting the premise that events provide net positive benefits to local economies. The intent of this paper is to build on prior research by investigating the relationship between local sporting events and economic activity at a specific business. Previous studies focus on broad aggregates such as city-level sales tax revenues and, in doing so, reduce the signal while increasing the noise. Recent studies have made strides by using daily data, for instance on tourist activity related to airline arrivals and hotel registrations, to more clearly identify an event's impact. This study uses daily data from a particular firm-location which provides a look at the micro-level impact of local sporting events.

While it would be ideal to have daily firm-level data for several firms in the same city, several firm locations in a single city, or several firm locations across cities, such data have not yet been obtained. Therefore, the focus in this study is on a particular firm location's daily revenue. The data describe a full-service restaurant located in the center city area of Charlotte, North Carolina within walking distance of Time Warner Cable (TWC) Arena and Bank of America (BoA) Stadium. TWC Arena is home to the NBA's Charlotte Hornets (hereafter Bobcats as this was the team's name until the 2014-15 season) and BoA Stadium is home to the NFL's Carolina Panthers. Both venues host additional events throughout the year including college football and basketball games, international soccer matches, concerts, and conventions of various kinds.

Using daily data from a single firm-location for a five year period, we measure how events influence spending on the day before, day of, and day after the event compared to a similar day without an event. Because the data are daily, we avoid measurement problems when events occur at the beginning or end of a month, quarter, or year. We can also test how unexpected wins and losses, as reflected in the odds implied by money lines from well-established gambling markets, influence spending patterns.

While it would be ideal to have additional establishment-level data, the contribution of this paper is to show that not all events have the same impact on daily revenue, that some events have positive and others negative impacts on daily revenue, and that unexpected wins and losses have disparate impacts on this particular firm's daily revenues. If the firm investigated herein is representative of higher-end dining establishments, it is likely that other similar establishments experience similar spending patterns which contribute to the mixed results obtained with aggregated data.

The empirical approach begins by estimating a base model that includes typical economic indicators and environmental factors expected to impact daily revenue. We then extend the empirical model to control for the day before, the day of, and the day after professional football and professional basketball events (separately), whether there was a generic victory for the home team, regardless of where the game was played, and whether there was a home victory for either team. Our final specification differentiates between expected wins and losses, and unexpected wins and losses, for the two professional sports franchises in the city.

The empirical findings suggest that NFL home games tend to have a positive impact on daily revenues the day before and the day of the game but have no impact the day after; NBA games have no discernible impact on revenues the day before, of, or after a game. NFL home games correspond with more spending on game day regardless of the outcome and regardless of market expectations about the outcome. Only unexpected losses on the road correspond with reduced spending, suggesting that NFL fans in Charlotte display a sore-loser spending pattern after an unexpected loss. In contrast, NBA fans display neither sore-loser spending patterns after unexpected losses nor celebratory spending pattern after surprise wins.

These differences might be correlated with the type of fan that is attracted to an NFL game vs. an NBA game in Charlotte, NC. However, timing of the events might contribute to these differences. NFL games tend to be played in early afternoon, ending in late afternoon or early evening, and most often on the weekend. The games end at or near dinner time. On the other hand, NBA games tend to be played more often during the week, starting at seven in the evening and ending long after normal dining hours, and might not start late enough for working professionals to eat and get to the game at start time after the end of the work day.

The empirical results of this case study have three main implications. First, events have different impacts on spending patterns at this particular restaurant and it can be assumed that these spending pattern differences are experienced by other firms. This is in contrast to what is typically claimed by proponents of public subsidies for events, stadiums, or franchises. Second, timing of events might be important to the overall economic impact of events and deserves further investigation in the future. Finally, studies that find no or little impact of events using monthly, quarterly, or annual data might be partly the result of spending patterns after unexpected wins and losses; how event outcomes differ from market expectations have not been investigated in the past.

To the extent that subsidy promoters assert that all events provide positive externalities to firms proximate to stadiums and venues the assumption that spending patterns are not influenced by

expectations, event timing, and the fans attracted to the events would seem misplaced. The results here suggest that NFL home games provide positive externalities for this restaurant win or lose but NBA home games do not.

2 Previous Literature

The majority of economists who investigate the impact of sporting events agree that such events have little to no discernible impact on the local economy as a whole (Coates & Humphreys, 2008). One reason for this is that the net new money spent on most sporting events is very small relative to the local economy and therefore it is difficult to discern any impacts econometrically. Another issue is that the events are often investigated in the context of monthly, quarterly, or annual data. An event that takes place on a given day is then tested for statistically significant impacts on a thirty, sixty, or 365 day aggregation of the local economy, in which case it is unlikely that the event has a discernible impact (Lavoie & Rodriguez, 2005).[1] A third problem is that all that can be estimated with available data are net effects, rather than gross effects. Net and gross effects can differ dramatically if the events dramatically alter the spending patterns of locals. Visitors might be in town for the event but they might substitute for local spending which reduces the net impact of the event.

Lavoie and Rodriguez (2005) find weak evidence of sporting events' impact on monthly hotel occupancy rates in several cities in Canada. The authors investigated "lock-outs" and franchise relocations and find that in some cases lock-outs have significant negative net impacts, however the results are far from robust.

Baade, Baumann, and Matheson (2008) look at monthly taxable income in four Florida metropolitan statistical areas (MSA's) from 1980 to 2005. They find limited significant positive impact stemming from the creation of new stadiums, leagues, franchises, mega-events, strikes, or lock-outs. These results are in line with the general consensus of the literature.

Coates and Depken (2011) use monthly tax revenues in several cities in Texas. Their study is unique in that it includes events that are large relative to the size of the host city, e.g. a college football game in a small town. Their findings are mixed in that college games generally correspond with net increases in taxable activity, professional games correspond with net decreases in activity,

[1] Coates (2008) goes as far as to say "[n]o matter what cities or geographical areas are examined, no matter what estimators are used, no matter what model specifications are used, and no matter what variables are used, articles published in peer reviewed economics journals contain almost no evidence that professional sports franchises and facilities have a measurable economic impact on the economy."

and football mega-events, such as the NFL's Super Bowl, are associated with large net increases in taxable economic activity. The value-added in using high-frequency data is exhibited in this paper. Events that previously showed no statistical significance because they were a "drop in the bucket" of economic activity show significance at a monthly frequency. However, their data suffer from the aforementioned aggregation problem - some events, like the Super Bowl, are multi-week events that cross over months making accurate measurement difficult.

Baumann, Matheson and Muroi (2009) investigate the effect of sporting events in Hawaii on daily incoming airline passengers. Events include the Honolulu and Maui Marathons, NFL Pro Bowl, PGA tournaments, and surfing competitions. The daily frequency allows the authors to track the number of arrivals several days before and up to the day of the event. Their results show that the only sporting events that significantly impact arrivals are the Honolulu Marathon and the NFL Pro Bowl. However, the authors conclude that the millions of dollars spent by the Hawaiian Tourism Association (HTA) in acquiring the rights to the NFL Pro Bowl exceeds the actual value added to the economy. They reach this conclusion by comparing the influx of passengers from the Pro Bowl to that of the Honolulu Marathon, in which the HTA pays virtually zero dollars to attract and retain.

Depken and Stephenson (2016) make use of daily hotel occupancy data in Charlotte, North Carolina to measure tourism traffic during sporting and political events. The work is similar to Baumann, Matheson and Muroi (2009) in that the use of daily data makes it easier to isolate the effect of a specific event on hotel demand in a temporal and spatial context. The study has a distinct advantage over previous research by measuring how long an event attracts and retains visitors before, during, and afterwards. The results are quite robust; many events significantly increase hotel registrations and hotel prices the day before and the day of the event. However, other events have negative spillover effects that represent a crowding-out in the days following the event. Still other events that the local taxes subsidize have no discernible effect on hotel registrations or prices.

3 Motivation and Theory

This study investigates the extent to which NFL games and NBA games influence daily sales at a representative high-end dining establishment. Both types of sporting events are likely to increase the number of people in the center city area and therefore around this particular business location which is within walking distance of both arenas. The events that increase foot traffic near this restaurant are expected to have a positive impact on revenues. Likewise, events that attract visitors to stay at

hotels in Uptown Charlotte are expected to have a positive effect on sales. However, if an event is large enough it may generate a "crowding out" effect in which some visitors or Charlotteans stay away from the Uptown area or otherwise choose not to dine at this particular establishment.

Professional sporting events attract a large number of fans and are thus expected to have the greatest impact on revenues at this business. A sold-out game at BoA Stadium seats over 70,000 and a sold-out game at TWC Arena seats 20,000. A small portion of this crowd could significantly impact sales at this business. Additionally, an event may attract visitors to stay in Charlotte for several days, leading to positive impacts on revenues before and after the event. However, on game days traffic is congested, parking costs increase, and there are intoxicated fans throughout the city. These aspects of game days might create sufficient negative externalities to cause Charlotteans or would-be visitors to stay away from the center city on game day, thereby potentially reducing sales on game day. Professional sporting events and other relatively large events may have a zero-sum or even negative sum effect on economic activity in the presence of a "crowding out" effect.

Professional sports fans are emotionally invested in the outcome of a game involving their favorite team. A satisfied crowd is more likely to spend money and celebrate than a crowd that is upset over a loss. A home team win is expected to generate celebratory spending behavior. Conversely, when the home team loses fans are expected to spend less money. The outcome of a professional home game is likely to impact revenues at this business by different magnitudes, possibly in different directions. However, many game attendees are fans of the visiting team and a home team loss is their preferred outcome. Thus a home team loss may generate celebratory spending by rival fans, but would not be expected to match the level of any celebratory spending by home team fans because generally there are relatively few rival fans in attendance. The net effect of a home team win is thus impacted by how many rival fans are in attendance.

A second consideration is the timing of the events considered in this study. Professional football games in Charlotte, NC, are most often played on Sunday (49 of 57 home NFL games during the sample period) and most often start at 1pm and ending around 5pm. On the other hand, professional basketball games are more evenly split throughout the week with only 11 occurring on Sunday and only three on Thursday. Basketball games almost always start in the evening during the week and occasionally during the afternoon on the weekend. Thus, the timing of NFL games might be more conducive to post-game celebratory (or sore-loser) spending patterns at this restaurant relative to NBA games.

In summary, sporting events are likely to impact revenue at this business but it is not immediately

clear that the impacts of professional sports will always impact daily revenues in a positive manner, as is apparently assumed by most proponents of sports subsidies. The location of the firm makes it a prime candidate to investigate the economic impact of sporting events.

4 Data Description

The dependent variable in this empirical analysis is the daily sales of a full-service restaurant in Charlotte, North Carolina from March 26th 2007 to December 31st 2013 for a total of 2,247 observations.[2] The business was closed for 45 days during this period because of various holidays and renovations; these observations are omitted from the sample because they have zero revenue. Figure 1 provides scatter of the daily revenue normalized by the first day of sales for discretion. There is a slight downturn during the 2008-09 recession, followed by a period of stable revenues with respect to an overall time trend.[3] Figure 2 plots sales by the day of week where Monday is represented by the number 1 through Sunday (number 7). There is clearly a consistent variation in sales over the days of the week. Mondays and Sundays have the lowest revenues and Fridays and Saturdays have the highest. This visual inspection suggests that controls for daily, weekly, and yearly fixed effects are appropriate.

Initial claims have proven a reliable leading indicator of the unemployment rate (Montgomery et al., 1998). Therefore, to account for the business cycle and general economic impacts on the restaurant's revenues, data have been collected on North Carolina initial claims of unemployment. State employment offices collect initial claims for unemployment on a weekly basis thus for a given week the reported number of unemployment claims is attributed to each day of the week. The initial claims series has been converted to the natural log to scale the data and increase the ease of interpretation.[4]

In addition to general economic factors, the firm's revenue may be impacted by weather conditions. Weather information from the Charlotte Douglas International Airport Weather Station was obtained from the National Climatic Data Center (NOAA, 2014). The average high temperature for each day, if snow fell during the day, and whether 10mm or more of rain fell during the day are recorded. These variables are intended to capture any adverse effect weather may have on foot traffic in the Uptown

[2]Revenue remains in nominal terms because the series encompasses only a 7 year period over a relatively low-inflation economy; the month-over-month percent change in the consumer price index averaged only 0.16% over the series (FRED, 2014).

[3]The Augmented Dickey-Fuller (ADF) unit root test (Dickey & Fuller, 1979) indicates that the series is stationary at the one percent level of significance.

[4]The ADF unit root test indicates the series is stationary at the one percent level of significance.

area of Charlotte.[5]

Restaurant-specific factors have also been taken into consideration such as promotions and management turnover. Over the sample period there was a regime change in the form of a new general manager being appointed in July 2012. That manager remained in charge of operations until January 2014. This regime change may impose a structural break within the data. A categorical variable "management change" takes a value of one during the interim manager's tenure and zero otherwise. Two weeks of every winter and summer during the sample period hundreds of restaurants in Charlotte participate in Charlotte Restaurant Week. During this promotional event participating restaurants offer a heavily subsidized menu. These price cuts generally increase revenue by increasing demand amongst traditionally price elastic consumers. The categorical variable "promotion" takes a value of one on days in which these promotions were held and zero otherwise.

Professional sporting events data were collected for the NBA's Charlotte Bobcats (currently renamed "Hornets") and the NFL's Carolina Panthers. Event data include whether or not the team played at home, whether they won or lost, and the betting market's *ex ante* expectations for whether or not they would win or lose using the so-called closing money lines. At first glance, games may seem to have only two outcomes: the home team wins or loses. However, the combination of market expectations and actual outcomes suggests there are four possible outcomes for a game: an expected win and an actual win, an expected loss and an actual loss, an expected loss and an unexpected win, and an expected win and an unexpected loss. These last two possibilities are of the most interest to the study.

Table 1 provides summary statistics of the data used in the study. Summary reports for sales revenue have been intentionally omitted for discretion. The upper panel of Table 1 summarizes the control variables. The average high temperature for the day is 22.68 degrees Celsius (72.8 degrees Fahrenheit). During the six years in the sample there were eight days of snow fall in the Charlotte area. Rain information is recorded using a categorical variable equal to one if at least ten millimeters of rain fell on a given day. There were 205 days of at least mild rainfall, roughly 8% of the sample. The weekly average of North Carolina initial unemployment claims was 13,659 during the sample period; the maximum was 56,647 and the minimum was 4,378.

The second panel of Table 1 summarizes the data describing the NFL Carolina Panthers. The Panther's played a total of 112 games in the 2007-08 season through the 2013-14 season. Of these 112 games, 57 were at home, the Panthers won 53 games in total and won 30 of those games at

[5]The ADF test indicates all weather series are stationary at the one percent level.

home. There were three occurrences in which the Panthers played twice in one week. Of the 53 wins throughout this period, 18 were unexpected wins in that the Panthers were considered an underdog in the betting markets. Of the 59 losses during the sample period, 18 were unexpected losses in that the Panthers were favorites in the betting markets.

The third panel of Table 1 summarizes data describing the NBA Charlotte Bobcats. During the sample period the Charlotte Bobcats played a total of 558 games in the 2007-08 season through the 2013-14 season. Of these 558 games, 256 were at home, the Bobcats won 186 games in total and 53 of those wins were at home. Of the 186 wins throughout this period, 94 were unexpected wins in that the Bobcats were considered an underdog in the betting markets and of the 372 losses there were 45 unexpected losses in that the Bobcats were favorites in the betting markets.

5 Models and Empirical Results

Given that the data are time-series, we use the Newey-West (1987) correction for autocorrelation and heteroskedasticity with seven lags included. Sales in log form follow an autoregressive process up to the 7th order; lags beyond 7 were not statistically significant. This result is in line with expectations given that the data are of daily frequency. That is, on any given day, the sales are likely to be related to the previous seven days of sales. The truncation parameter for the Newey-West correction method is set to seven for every model reported in the following analysis.

5.1 Baseline Model

The base-line model is specified as:

$$\begin{aligned} SALES_t &= \beta_0 + \beta_1 TEMP_t + \beta_2 SNOW_t + \beta_3 RAIN_t + \beta_4 UNEMP_{t-14} + \\ &\quad \beta_5 UNEMP_{t-28} + \beta_6 PROMOTION_t + \beta_7 MANAGER_t + \\ &\quad \delta_1 DOW + \delta_2 WOY + \delta_3 YEAR + \epsilon_t, \end{aligned} \tag{1}$$

where $SALES$ is total daily revenue in log form, the β's are parameters to be estimated, δ_1, δ_2, and δ_3 are vectors of parameters to be estimated, ϵ is a zero-mean error term, and t indexes days beginning on March 26, 2007 and ending December 31, 2013.

The explanatory variables include $TEMP$, the high temperature for a given day t in degrees Celsius; $SNOW$ and $RAIN$,e categorical variables equal to one if there was snow or at least 10

millimeters of rain on a given day; $PROMOTION$, a categorical variable that identifies days during which the restaurant was running a very popular promotion; and $MANAGER$, a categorical variable that identifies the interim manager's tenure during the sample period. The DOW, WOY, and $YEAR$ vectors include day of week, week of year, and year yearly fixed effects.

The estimation results for equation 1 are reported in Table 2. The $TEMP$ and $RAIN$ variables are not statistically significant at conventional levels, yet the $SNOW$ variable is significant at the 5% level and the parameter is negative as expected. The $UNEMP$ variable is included as a two week (14-day) lag and four week (28-day) lag. Both lags of $UNEMP$ are statistically significant at the 10% level and the coefficients are negative as expected. The coefficients for $PROMOTION$ and $MANAGER$ are both positive and statistically significant, as expected.

The baseline model's adjusted R-squared is 54.2%. Given the volatility demonstrated in the graph of daily sales over time (see Figure 1) the baseline model explains a significant portion of variation during the sample period. The next two models will incorporate professional sporting events into the baseline model.

5.2 Impact of Professional Sporting Events

Next we identify whether professional sporting events have any impact on daily sales at this specific business. An immediate benefit to the daily specification is the ability to look at the effect a professional sporting event the day before and after the game in addition to the day of the game. The following model is specified to analyze the effect of professional sporting events:

$$\begin{aligned} SALES_t &= \beta_0 + \sum_{i=-1}^{+1} \theta_{1,i+2} NFLHOME_{t+i} + \beta_1 NFLWIN_t + \beta_2 NFLHOMEWIN_t + \\ &\quad \sum_{i=-1}^{1} \theta_{2,i+2} NBAHOME_{t+i} + \beta_3 NBAWIN_t + \beta_4 NBAHOMEWIN_t + \\ &\quad \phi BASE_t + \epsilon_t, \end{aligned} \tag{2}$$

where theβ's, θ's are parameters to be estimated, ϕ is a vector of parameters to be estimated, and ϵ is a zero-mean error term. $NFLHOME$ is equal to one if there was a Carolina Panthers home game on a given day t, $NFLWIN$ is equal to one if the Panthers won a game, regardless of location, and $NFLHOMEWIN$ is equal to one if the Panthers won a home game on a given day t. The same pattern follows for NBA games: $NBAHOME$ equals one if the Bobcats played at home, $NBAWIN$ equals one if the Bobcasts won regardless of location, and $NBAHOMEWIN$ equals one if the Bobcats

won a game at home. Finally, the vector $BASE$ contains all of the variables outlined in model (1).

The estimation results for the variables of interest in model (2) are presented in Table 3. Panthers home games have a significant effect on revenues at this business. The day before a Panthers home game there is an average increase in revenues of 18.4% compared to similar days without a Panthers home game. The day of a Panthers home game there is an average 58.6% increase in revenues relative to a comparable day without a game. Both of these results are statistically significant at the 1% level. The day after a Panthers home game has no statistically significant effect, although the point estimate is positive. A Panthers win does not have a statistically significant effect. Likewise, a Panthers win at home does not have a statistically significant impact. At first this result may seem counter-intuitive. All other things equal, intuition would suggest that winning at home is positive and would lead to celebratory spending behavior by Panthers fans. However, simply winning might not be enough to elicit such a response by Panthers fans. This suggests further inquiry into winning versus expectations may be warranted.

As for Bobcats games and victories, most of the variables are either statistically insignificant or are weakly significant. The day before a Bobcats home game there is a small, negative impact on sales, significant at the 10% level. A Bobcats win has a positive impact on revenue, regardless of home or away, and is significant at the 10% level.

5.3 The Impact of Unexpected Wins and Losses

The evidence suggests that a Panthers win, regardless of where the win takes place, is associated with an increase in sales on that day. Before the 2015-2016, season, the Carolina Panthers and Charlotte Bobcats did not have the best track record, especially the latter. During the sample period, the Carolina Panthers played in one playoff game at home and the Bobcats played in two playoff games at home. The Panthers averaged 7.5 wins per season (0.473 win percentage) and the Bobcats averaged 26.5 wins per season (0.324 win percentage). The performance of the teams might have molded expectations for each team's game outcomes, which can be tracked through the betting market.[6] For our purposes, we utilize divergence between market expectations and actual outcomes. Figure 3 provides a visual representation of the differentiation of game outcomes and expectations. For example, over the sample period the Panthers (Bobcats) were favorites in 53 (143) games but of these expected wins they actually lost 18 (51); these 18 (51) losses are thus categorized as unexpected losses.

[6]While betting houses offer many types of bets, this study converts closing money lines to determine which team is favored to win (see Sauer, 2008 for more on this conversion).

Similar calculations are made to find instances where the Panthers and Bobcats won when they were underdogs, i.e. an unexpected win.

Differentiating between home and away games in this manner generates eight categories for each Panthers and Bobcats game that occurred during the sample period (see Figure 3): Panthers/Bobcats home/away win and they were expected to win; Panthers/Bobcats home/away loss and they were expected to lose; Panthers/Bobcats home/away win and they were expected to lose (unexpected win); Panthers/Bobcats home/away loss and they were expected to win (unexpected loss). The most interesting cases are the latter two because in these two instances we can test whether fan behavior changes with elation or deflation over the unexpected outcome of a game.[7]

The final model estimated expands model (2) to include the aforementioned eight categories of Panthers and Bobcats games:

$$\begin{aligned} SALES_t &= \beta_0 + \sum_{i=-1}^{+1} \theta_{1,i+2} NFLHOME_{t+i} + \sum_{j=1}^{4} \gamma_{1,j} NFLEXPECTATIONS_t + \\ &\quad \sum_{i=-1}^{1} \theta_{2,i+2} NBAHOME_{t+i} + \sum_{j=1}^{4} \gamma_{2,j} NBAEXPECTATIONS_t + \\ &\quad \phi BASE_t + \epsilon_t, \end{aligned} \tag{3}$$

where the β's, θ's, and γ's, are parameters to be estimated, ϕ is a parameter of vectors to be estimated, and ϵ is a zero-mean error term. The new variables in Model (3) include eight categories of Panthers games according to the betting market's expectations ($NFLEXPECTATIONS$) and the eight categories of Bobcats games according to the betting market's expectations ($NBAEXPECTATONS$). The vector $BASE$ contains all of the control variables included in the baseline model (1). The remaining variables are as defined above.

The estimated γ's are reported in Table 4.[8] The (unreported for brevity) results for day before, day of, and day after a Panthers or Bobcats game are essentially the same as they are in Model (2). However, when differentiating between expected wins and losses, home and away, the results for the Panthers are statistically robust whereas the results for the Bobcats are only weakly significant in some cases. Thus, the evidence suggests that at this particular establishment Panthers games significantly impact sales whereas Bobcats games have less impact.

Panthers home games generate positive, statistically significant increases in revenues to this estab-

[7] Other studies have investigated how unexpected outcomes influence crime (Rees and Schnepel, 2009) and domestic violence (Card and Dahl, 2011).

[8] The full estimation results of all models are available from the authors upon request.

lishment on game day. These increases from Panthers home games occur independent of whether the game resulted in an unexpected win, unexpected loss, expected win, or expected loss, although there is some minor variation in the point estimates for each of these conditional outcomes. However, there is significant overlap in each estimated coefficient's 95% confidence interval. That is, the point estimates are slightly different in magnitude, but are not determined to be statistically different than one another. Regardless of game outcome or expectations, the model finds an average 40-60% increase in revenues on Panthers home game days, relative to similar days without Panthers home games. These results are consistent with a celebratory spending pattern after a Panthers home game.

Unlike Panthers home games, when the Panthers win an away game, regardless of expectations, there is no statistically significant impact on revenues. When the Panthers experience an unexpected loss in an away game there is an average 44.8% decrease in revenues on that day, significant at the 1% level. Lastly, there is an average 17.5% decrease in revenue associated with an expected loss away, although this effect is only significant at the 10% level. These results are consistent with a "sore-loser" spending pattern after away game losses.

The Bobcats variables present contrasting results. Overall, neither Bobcats home games or away games seem to dramatically impact daily revenues at this particular establishment. The point estimates for winning at home are not significant at conventional levels, signifying no support for celebratory spending nor sore-loser spending patterns. The spending patterns associated with Bobcats away games suggest that daily revenues might increase slightly after an unexpected loss away, but the impact is only statistically significant at the 10% level.

Overall the results from Model (3) suggest that NFL fans in Charlotte exhibit celebratory spending patterns on days of home games regardless of game outcome and expectations about game outcome. NFL fans in Charlotte exhibit sore loser spending patterns after away game losses, with greater impacts after unexpected losses. On the other hand, NBA fans in Charlotte show no celebratory or sore-loser spending patterns after unexpected wins and losses, which might be caused by a combination of event timing, when upsets occurred during the week, and the type of fans that are attracted to NBA games relative to NFL games.

6 Conclusions

The purpose of this paper is to explore the relationship between professional sporting events in Charlotte, North Carolina, and economic activity at a particular firm. The motivation to explore this

topic is that city governments are generally proponents of subsidizing sporting events and venues. Policymakers often advocate these subsidies because of the belief that the events generate a net increase in economic activity. A formal inquiry into the effect these events have on economic activity is necessary to evaluate the claimed benefits. This study is unique in that the data are daily revenues for a particular firm. The preceding analysis therefore provides our first look at the micro-level impact local professional sporting events have on a single firm.

In this paper, several econometric models are specified at the daily and weekly frequency to investigate the impact of sporting events on daily revenues for a five year period. The first model provides a baseline by including non-sports related variables. Model two controls for baseline variables and identifies the day before, of, and after a NFL game and a NBA game (separately), whether the home team wins, and whether the home team wins at home. Model three then identifies home and away expected wins and losses, and home and away unexpected wins and losses for both teams to test if unexpected outcomes influence spending patterns.

The regression models show significant increases in sales the day before and the day of NFL Panthers home games but no impact the day after. As for NBA games there is a slight decrease the day before the game but nothing the day of or day after. The results suggest that NFL fans in Charlotte increase their spending patterns at this establishment after a home game, regardless of the outcome of the game and regardless of the outcome relative to market expectations. On the other hand, NFL fans in Charlotte respond to unexpected away-game losses by reducing their spending at this establishment. In contrast, the NBA Bobcats do not have a dramatic impact on the daily revenues of this restaurant regardless of game outcome and game outcome relative to market expectations. The lack of impact associated with NBA home games might be related to the timing of most NBA games (at night, after traditional dining hours, and during the week) relative to NFL games (during the day, before traditional dining hours, and on the weekend).

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Table 1: Descriptive Statistics of the Data

Control Variables	Obs.	Mean	Std. Dev.	Min	Max
High Temperature (tenths degrees Celsius)	2427	22.67	8.71	-2.8	40.0
Snow Day (1=YES)	8	0.003	0.057	0	1
Rainy (1=YES)	205	0.083	0.276	0	1
Unemployment Claims (thousands)	2427	9.516	0.387	8.451	10.945
Promotion (1=YES)	104	0.043	0.203	0	1
Management Change (1=YES)	521	0.215	0.411	0	1
Professional Sports Variables	**#Events**	**Mean**	**Std. Dev.**	**Min**	**Max**
NFL Games					
Home Game	57	0.023	0.151	0	1
Away Game	55	0.022	0.148	0	1
Win	53	0.022	0.146	0	1
Win at Home	30	0.012	0.111	0	1
Expected Win	35	0.014	0.119	0	1
Surprise Win	18	0.007	0.086	0	1
Unexpected Loss	18	0.007	0.086	0	1
Expected Loss	41	0.017	0.129	0	1
Expected Win at Home	24	0.01	0.099	0	1
Unexpected Win at Home	6	0.002	0.05	0	1
Unexpected Loss at Home	13	0.005	0.073	0	1
Expected Loss at Home	14	0.006	0.076	0	1
Expected Win Away	11	0.005	0.067	0	1
Unexpected Win Away	12	0.005	0.070	0	1
Unexpected Loss Away	5	0.002	0.045	0	1
Expected Loss Away	27	0.011	0.105	0	1
NBA Games					
Home Game	256	0.105	0.307	0	1
Away Game	253	0.104	0.305	0	1
Win	186	0.077	0.266	0	1
Win at Home	53	0.022	0.146	0	1
Expected Win	92	0.038	0.191	0	1
Surprise Win	94	0.039	0.193	0	1
Unexpected Loss	51	0.021	0.143	0	1
Expected Loss	272	0.112	0.316	0	1
Expected Win at Home	80	0.033	0.178	0	1
Surprise Win at Home	43	0.018	0.132	0	1
Unexpected Loss at Home	41	0.017	0.129	0	1
Expected Loss at Home	92	0.038	0.191	0	1
Expected Win Away	12	0.005	0.070	0	1
Unexpected Win Away	51	0.021	0.143	0	1
Unexpected Loss Away	10	0.004	0.064	0	1
Expected Loss Away	180	0.074	0.262	0	1

Table 2: Baseline Model (1) Estimation Results

Variable	Coefficient
High Temp	0.002
	(0.002)
Snow Day	-0.364**
	(0.158)
Rainy Day	-0.026
	(0.024)
Unemployment Lag 14 days	-0.085*
	(0.049)
Unemployment Lag 28 days	-0.097*
	(0.054)
Promotion	0.650***
	(0.039)
Management Change	0.108**
	(0.052)
Year 2008	-0.126***
	(0.037)
Year 2009	-0.404***
	(0.049)
Year 2010	-0.427***
	(0.034)
Year 2011	-0.3337***
	(0.031)
Year 2012	-0.394***
	(0.041)
Year 2013	-0.457***
	(0.065)

Parameters interpreted as percentage change in daily revenues. Intercept not reported for discretion purposes. Model includes week and day fixed effects not reported for brevity. Robust standard errors reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Table 3: Expanded Model (2) Estimation Results

Event	Impact	
	Panthers	Bobcats
Day Before Home	0.184***	-0.049*
	(0.030)	(0.028)
Day of Home Game	0.586***	-0.045
	(0.081)	(0.034)
Day after Home	0.086	-0.023
	(0.053)	(0.030)
Win	-0.053	0.060*
	(0.073)	(0.035)
Win at Home	-0.070	-0.048
	(0.124)	(0.056)

Parameters are interpreted as percentage changes in daily revenue. Parameters obtained from a single regression of 2,247 observations that includes all baseline variables in Model (1) Intercept not reported for discretion. Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 4: Expanded Model (3) Estimation Results

Event	Panthers at Home	Bobcats at Home	Panthers Away	Bobcats Away
Expected Win	0.418***	-0.072	-0.132	0.021
	(0.079)	(0.041)	(0.096)	(0.102)
Unexpected Win	0.523***	0.084	-0.033	0.081*
	(0.155)	(0.053)	(0.102)	(0.046)
Expected Loss	0.607***	-0.029	-0.173*	-0.025
	(0.126)	(0.043)	(0.099)	(0.028)
Unexpected Loss	0.509***	-0.083	-0.446***	0.155*
	(0.091)	(0.063)	(0.096)	(0.084)

Parameters interpreted as percentage change in daily revenue. Parameters obtained from a single regression of 2,247 observations that includes all control variables included in Model (2), including baseline variables in Model (1). Intercept term not reported for discretion. Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Figure 1: Normalized Sales by Day
(Daily sales normalized by Day One in the Sample for Discretion)

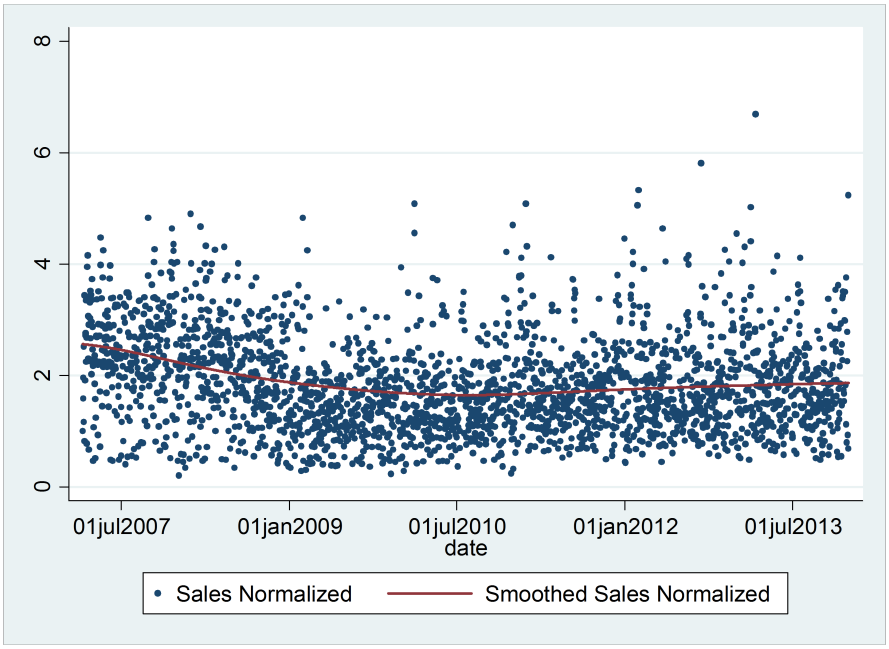

Figure 2: Sales by day of the week

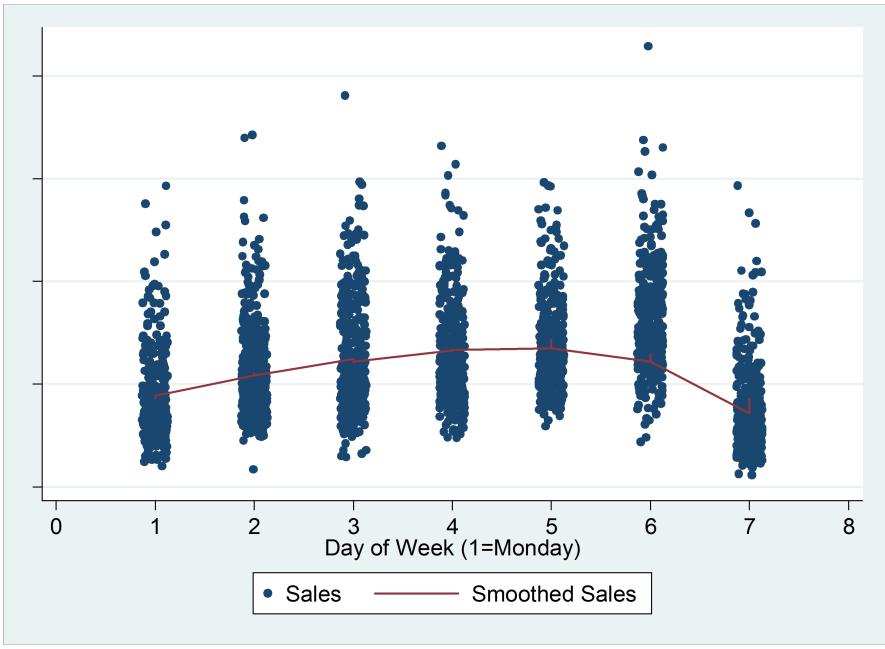

Figure 3: Conditional Outcome Model