Economic Inquiry

HOTEL DEMAND BEFORE, DURING, AND AFTER SPORTS EVENTS: EVIDENCE FROM CHARLOTTE, NORTH CAROLINA

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This paper uses daily hotel occupancy data to examine the effects of a wide variety of political and sporting events on the hotel room market of Charlotte, North Carolina from 2005 to 2014. Two political conventions and NASCAR auto races are associated with large increases in hotel occupancy, prices, and revenue, but many other events have no discernable effect on Charlotte's hotel market. The results also indicate that occupancy effects before or after most events are modest at best. Back-of-the-envelope calculations show incremental hotel-tax receipts fall short of the debt service incurred in constructing and maintaining the city's sports venues. (JEL H71, Z23, Z28)

I. INTRODUCTION

As the academic literature on the economic impact of sports or other events is vast, it is worth calling immediate attention to this paper's contributions. This paper is the first to use daily hotel occupancy data over a long period to investigate the net impacts of political and sporting events on hotel demand, room prices, and total daily hotel room revenue in a large city in the United States. High-frequency data allow for granular estimates of visitor inflows net of any crowding out or displacement effects (Porter 1999).

While the use of high-frequency hotel occupancy data improves upon existing research in several ways, a notable limitation is that hotel occupancy data alone cannot capture any economic impact of visitor spending on food and drink, souvenirs, and other nonhotel goods and services. Such activities might be better captured using sales tax data as the measure of economic activity generated by sports (e.g., Coates and Depken II 2011).

The data facilitate a test of the long-touted but untested claim that major political and sporting events spur tourism spending before and after the event as visitors arrive days before or stay several days after the event. We test whether there are statistically significant impacts on hotel demand, hotel prices, and hotel revenue, during the days leading up to or following the events included in our analysis. This provides insight into the economic effects of sports events and any external benefits or external costs they may generate.

We distinguish between hotels that are close to the Charlotte venues, those that are at an intermediate distance from the Charlotte venues, and those that are at some distance from the Charlotte venues although still within the Charlotte metro area. This last point has economic importance because the metro area's core county has a hotel occupancy tax that is dedicated to debt service associated with a football stadium, a basketball arena, and a sports hall of fame, all in the city of Charlotte. However, many hotels in neighboring counties are within driving distance of the various venues and are not subject to the hotel occupancy tax being used to fund the facilities. Therefore, the geospatial distribution of hotel

ABBREVIATIONS

ACC: Atlantic Coast Conference
CIAA: Central Intercollegiate Athletic Association
CMS: Charlotte Motor Speedway
DNC: Democratic National Convention
NASCAR: National Association for Stock Car Auto Racing
NBA: National Basketball Association
NCAA: National Collegiate Athletic Association
NFL: National Football League
NHL: National Hockey League
SOCON: Southern Conference

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registrations and revenue for various events can influence tax collections in the various counties of the metro area and therefore the ability to service the debt incurred to build and renovate venues in the metro area.

To preview our empirical results, we find the impacts of various sporting and political events differ in terms of magnitude, geospatial distribution, and temporal distribution of hotel registrations, prices, and revenues. The claims that many events draw tourists for multiple days before and after the event are generally not supported; most events draw, at most, a statistically significant, if not overly large number of people, on the day before or after the event. Only large, multiple-day events such as a national political convention or a multiday National Association for Stock Car Auto Racing (NASCAR) event appear to generate significant net increases in hotel rentals in days before and after the event.

II. LITERATURE REVIEW

Studying variations in and factors affecting hotel occupancy is not new. Papers such as Andrew, Cranage, and Lee (1990), Jeffrey and Hubbard (1994), and Jeffrey et al. (2002) are among many examining determinants of hotel occupancy. However, little attention has been paid to analyzing the interaction between hotel room rentals and sporting events, facilities, and franchises. Lavoie and Rodríguez (2005) use monthly hotel occupancy data from eight Canadian cities in the 1990s to study the effects of the 1994–1995 National Hockey League (NHL) lockout. Also included in their analysis are several events which affected some but not all of the eight cities in their study: the 1994 baseball players strike, the 1998 National Basketball Association (NBA) lockout, and the departure or arrival of several NHL and NBA franchises. They find that the NHL lockout is associated with significant drops in hotel occupancy in three of the eight cities affected by the lockout, and in only two of the nine cases are their results for the other labor market disruptions or franchise arrivals or departures consistent with increases in hotel room occupancy. Their results are broadly consistent with the literature summarized in Coates and Humphreys (2008), which concludes that the evidence of large economic benefits from sporting events is weak. Lavoie and Rodriguez's use of monthly hotel data allows for the possibility that their data are not sufficiently granular for detecting real, though perhaps small, effects of sporting events in cities with large volumes of hotel rentals. For example, suppose the Toronto Maple Leafs play four home games in a certain month and that each game causes 500 people to have overnight hotel stays. The monthly total of 2,000 fans attributable to the hockey franchise might be difficult to detect since there may well be more than one million hotel room rentals in Toronto in a given month.

Allmers and Maennig (2009) use monthly hotel occupancy data in their analysis of the 1998 FIFA World Cup, hosted by France, and the 2006 FIFA World Cup, hosted by in Germany. Their results show no net impact on hotel stays arising from either tournament, though their finding that Germany had an increase of 708,000 overnight stays in June 2006 followed by a drop of 738,000 stays in July 2006 suggests that the World Cup may have shifted the timing of tourist visits to Germany.[1]

Similarly, du Plessis and Maennig (2011) study the effect of the 2010 FIFA World Cup in South Africa using a simple comparison of hotel occupancy between June 10 and July 11, 2010 and a comparable period from the preceding year. Their back-of-the-envelope analysis concludes that South Africa's visitors for the World Cup fell well short of ex ante predictions.

Coates (2009) uses monthly hotel tax revenue from South Carolina counties to examine the impact of Clemson University and University of South Carolina football games and NASCAR races at the Darlington track. Hotel tax revenue is a reasonable measure of tourism, but hotel taxes are typically levied as a percentage of room rental rates so hotel tax revenues reflect both any quantity increases and any price increases caused by tourist visits for sporting events. However, to the extent that any price increases accrue to nonlocal businesses rather than local input suppliers, the use of hotel tax revenue as a measure of local economic impacts is somewhat noisy (Baumann, Matheson, and Muroi 2009). Our ability to separately examine the daily number of rooms rented and the average rate charged for those rooms, and subsequently daily revenue, allows us to separate any price and quantity effects associated with various events.

Several studies use measures other than hotel occupancy to assess the economic impacts of

1. The 2006 tournament was played between June 9 and July 9; that the tournament straddles 2 months is another limitation of using monthly data and month dummy variables.

sporting events. A common approach is to use airplane passenger arrivals to isolated destinations that host sporting events. Nishio (2013) uses monthly arrival data to New Zealand from 1983 to 2005 to analyze the effect of that country hosting the 1990 Commonwealth Games, a Cricket World Cup, a Rugby World Cup, two America's Cups, and tours by the British and Irish Lions rugby teams. The only event found to increase inbound traffic overall (i.e., from all countries combined) was the 1990 Commonwealth Games, though increases in inflows from participating countries were also detected for the 2000 America's Cup (Switzerland) and the 2005 British and Irish Lions rugby tour. Again, the limitation of using monthly data is evident, as all events analyzed by Nishio (2013) span two or more months (albeit by just 2 days in a couple of cases). However, Nishio's month dummies for each event are defined to take a value of unity for only a single month for each event (e.g., only June 1983 for the British Lions tour which ran from May 15 to July 16 of that year).

Baumann, Matheson, and Muroi (2009) examine the relationship between daily airline passenger arrivals to Hawaii between January 2004 and May 2008 and sporting events such as the National Football League (NFL) Pro Bowl, two National Collegiate Athletic Association (NCAA) football bowls, various PGA tour events, the Honolulu and Maui Marathons, and the Ironman Triathlon. Only the NFL Pro Bowl and the Honolulu Marathon are associated with significant increases in passenger arrivals. Their empirical strategy explicitly allows for passenger arrivals several days before the actual events and is therefore like our analysis of leading and lagging effects presented below. However, the use of airplane arrivals is less useful for analyzing the economic impact of events held in locations in which tourists do not arrive solely by air.

III. DATA AND EMPIRICAL STRATEGY

The data employed in this study include the daily number of hotel rooms let in the Charlotte metropolitan area, the average daily rate charged for the rooms rented on a given day, and the total revenue generated by hotel room rentals on a given day. The Charlotte metropolitan area is centered around Mecklenburg County (in which the city of Charlotte is located) and includes several nearby counties in North Carolina and South Carolina. In 2015, the metropolitan area had a population of approximately 2.2 million of which one million reside in Charlotte (U.S. Census Bureau 2016).

Charlotte hosts two professional sports franchises, the NBA Charlotte Hornets (formerly Bobcats) and the NFL Carolina Panthers, and therefore hosts regular season (and occasionally postseason) NBA and NFL games. The Charlotte area is also home to the Charlotte Motor Speedway (CMS) (formerly Lowes Motor Speedway) which hosts three major NASCAR races each year. The region also hosts an annual PGA golf tournament, a marathon, several college football games and basketball tournaments every year, and is home to Charlotte-Douglas International Airport which was the 23rd busiest in the world by passenger count in 2013 (Airport Council International 2014). Charlotte is in the rotation to serve as a regional host for the NCAA basketball tournament, and the city hosted two major political events in recent years: the 2012 Democratic National Convention (DNC) and the 2010 National Rifle Association convention (see Table 1 for a complete listing of all events included in this study). Hence, Charlotte provides an interesting area for analyzing the economic impact of sporting and political events using hotel occupancy data.

The hotel data were obtained from STR, a privately held firm that specializes in gathering daily occupancy data from hotels around the world. In addition to aggregate data on hotel rooms let, average daily room rates, and daily hotel revenue for the entire region, we split the data into three subsamples: those hotels located in the city center of Charlotte (ZIP code 28202), those hotels located within Mecklenburg County but outside of ZIP code 28202, and those hotels located within three STR data tracts spanning the Charlotte suburbs lying outside of Mecklenburg County.

Having three geographic subsamples allows us to examine the effect of various events on different parts of the metropolitan area. Events in Charlotte tend to be distributed between the city center, where Bank of America Stadium, Spectrum Center (formerly Time Warner Cable arena), the NASCAR Hall of Fame, and the city's convention center are located, and the suburban city of Concord, located about 15 miles north of the city center, where CMS is located. Hence, events such as the Central Intercollegiate Athletic Association (CIAA) basketball tournament, which draw large crowds to downtown Charlotte,

TABLE 1
Counts of Event Days in Sample

Event	Number of Event Days
NASCAR Hall of Fame[a]	5
NASCAR Event[b,c]	54
NASCAR All-star Race	9
Democratic National Convention[c]	4
NRA Convention[c]	3
NFL Preseason	20
NFL Regular Season	78
NFL Postseason	1
NCAA Bowl Game	8
ACC Football Championship	4
NCAA Basketball Tournament[c]	4
Southern Conf. Basketball Tournament[c]	4
ACC Basketball Tournament[c]	4
CIAA Basketball Tournament[c]	51
NBA Regular Season	288
NBA Postseason	2
Marathon	10
PGA Tournament[c]	40
Tropical Storm	2
Snow Event	12

Notes: Sample period from January 1, 2005 through November 30, 2014. Sample size is 3,617 observations.
[a]Includes the grand opening of the Hall of Fame and annual induction ceremonies.
[b]Includes NASCAR Sprint Cup, Nationwide, and Camping World Truck Series races.
[c]Multiday event.

might have different effects from NASCAR races held at CMS.[2]

Because many events in Charlotte are highly localized in the city center, any estimated effect using the full sample might be biased downward because a preponderance of the impacts of the event is localized. Moreover, a parameter from the full sample might mistakenly suggest that an event has a widespread impact in the metro area when it does not. On the other hand, by including data for the entire metro area we can capture any spatial displacement effects that may be caused by large events in downtown Charlotte. For example, large crowds attending the CIAA tournament might cause some travelers who would stay downtown to choose hotels located outside the city center. Looking only at city center data might lead to the erroneous conclusion some travelers simply abandoned their plans for overnight stays in the Charlotte metro area.

While any event can be associated with hotel rooms rented before, during, and after the event, any empirical analysis should control for what would be considered normal hotel registrations in the region on a given month and day of the week in the absence of an event. Proper accounting for economic impacts of an event focuses on *net* impacts rather than *gross* impacts, so we establish a baseline to which hotel registrations, room prices, and total revenues can be compared. We do this by analyzing a long time series of hotel registrations, daily rates, and daily revenues, controlling for geospatial distribution of hotel activity across various sporting and political events that occurred in the Charlotte region.

With these caveats and warnings in mind, we estimate time series models of the form:

$$
\begin{aligned}
(1)\qquad DEP_{lt} = {} & \beta_0 + \sum_{i=1}^{M} \beta_i EVENT_{it} \\
& + \sum_{j=1}^{L_i} \theta_j EVENT_{it-j} + \sum_{k=1}^{K_i} \phi_k EVENT_{it+k} \\
& + \delta_1 REALGASPRICE_t \\
& + \delta_2 UNEMPLOYMENT_t + \gamma_1 DAY \\
& + \gamma_2 MONTH + \gamma_3 YEAR + \epsilon_t,
\end{aligned}
$$

where DEP_{lt} is one of three dependent variables investigated herein: *DEMAND*, which reflects the actual number of rooms let on a given day, *ADR*, which reflects the average daily rate charged for the rooms let on a given day, and *TR*, which measures the total revenue generated by hotel registrations on a given day (both *ADR* and *TR* are measured in real terms, using November 2014 prices as the base). Each dependent variable is estimated for four distinct geographic areas *l*: Charlotte's city center (ZIP code 28202), Mecklenburg County less Charlotte's city center, suburban Charlotte outside of Mecklenburg County, and the entire Charlotte metropolitan area. The β's, θ's, ϕ's, δ's, and γ's are parameters to be estimated, ϵ is a zero-mean error term, and *t* indexes days from January 1, 2005 through November 30, 2014.

All dependent variables were tested for unit roots using Augmented Dickey–Fuller tests. In all cases, the null hypothesis of a unit root was rejected. In the presence of serial correlation, there are several estimation techniques that can be applied. We choose least squares

2. The CIAA is a NCAA Division II athletic conference currently comprised of 12, mostly historically Black, colleges and universities located in North Carolina and nearby states. Prominent members include Shaw and St. Augustine's Universities located in Raleigh, Johnson C. Smith University located in Charlotte, Fayetteville (NC) State University, Winston-Salem (NC) State University, Virginia State University, and Virginia Union University.

with Newey–West corrected standard errors. The choice of lags, seven in our case, is somewhat arbitrary but it allows for serial correlation over 7 days. Moreover, Wooldridge (2013) recommends a lag structure of $n^{(1/4)}$ which is about 7.75 for a sample of 3,617.

There are M events included in the analysis and for each day on which an event takes place, the associated *EVENT* dummy variable takes a value of one and is zero otherwise.[3] Because the *EVENT* variables are dummies, their estimated coefficients are interpreted as the average effect over all occurrences of the event during the sample period. As noted earlier, the events included in our sample and the number of days during the sample period associated with each event are provided in Table 1. We also indicate those events that are multiple day events such as the 2012 DNC, NASCAR and PGA events, and college basketball tournaments. As can be seen, the most common sporting event to take place in the city of Charlotte is a regular season NBA game, followed by NFL regular season games, NASCAR events, the annual CIAA basketball tournament, and PGA tour tournaments. The rarest events include NFL and NBA postseason games.[4]

Tourism promoters often claim that major events encourage individuals to come to the host city before and stay in the host city after the event has concluded so as to enjoy other tourist attractions in the area. On the other hand, it is also possible that large events deter people who might visit in the days leading up to or immediately following major events. Such effects might occur if a large event creates congested traffic or security concerns or if it takes time to reconfigure arenas, convention centers, or other venues between large events. Thus, Equation (1) includes two leads and two lags of the various events to test for such effects in hotel registrations, average daily rates, and total revenue.[5]

To control for other factors that might affect hotel occupancy, we include the real price of a gallon of gasoline the month during which the event took place (*REALGASPR*), the national unemployment rate the month during which the event took place (*UNEMP*), a vector of day of week dummy variables (*DAY*), where Sunday is the reference category, a vector of month of the year dummy variables (*MONTH*), where January is the reference category, and a vector of year dummy variables (*YEAR*), where 2005 is the reference category.[6] Also included is a dummy variable for days with measurable snowfall in Charlotte. Since the city has a busy airport and lies on two interstate highways, disruptive snow events might also affect hotel demand. Last, a dummy variable taking a value of one for all days after May 1, 2006 is included to control for an increase in Mecklenburg County's hotel occupancy tax beginning on that date.

The descriptive statistics for the three dependent variables and the two continuous explanatory variables are reported in Table 2. During the sample period in the Charlotte metro area, the average number of hotel rooms let was 19,210 with a minimum of 6,876 on December 24, 2008, and a maximum of 31,229 on March 2, 2013. During the sample period, the average daily rate charged per room was $87.92 with a minimum of $56.42 on December 22, 2005 and a maximum of $217.63 on September 2, 2012 (the night before the 2012 DNC).[7] The average daily revenue for the Charlotte metro area is $1.72 million with a minimum of $0.49 million and a maximum of $6.51 million. During the sample period, the average real price of gasoline was $3.25 and the average unemployment rate was just under 7%.

IV. ESTIMATION RESULTS

For brevity, this section presents results for only the day of event effects, with lead and

3. The parameter on any $EVENT_{it}$ reflects a *net* change in hotel demand, average daily rates, or total revenue on a given day relative to the long-term trends and seasonality inherent in hotel occupancy data.

4. There is very little overlap of the events, although some of the basketball tournaments do occur in the same month. An advantage of our using daily rather than monthly data is that we can more clearly identify the actual days on which each event occurs.

5. The choice of two leads and two lags is based on a heuristic that individuals might start their travel for a Sunday football game on Friday or Saturday of that week but would be unlikely to travel on Thursday. We did include up to four lags and four leads and found that only for the DNC convention was there any impact on the third lead. For convenience, we limited the specification to two leads and two lags for all events.

6. Gasoline prices were obtained from the Energy Information Agency and unemployment was obtained from the Bureau of Labor Statistics.

7. The 2012 Democrat National Convention started on September 3 with the highest average daily rate during the sample period. The second day of the National Convention had an average daily rate of $210.48; the third day had an average daily rate of $207.62; the fourth day had an average daily rate of $208.34. The first day after the convention was over the average daily rate was $108.43. The second day after the convention was over the average daily rate was $77.28, consistent with the sample average daily rate. Therefore, on the surface, the convention would appear to have been a windfall for Charlotte hoteliers.

lag effects omitted. Complete estimation results, including lead and lag effects for all events on hotel registrations, average daily rates, and total revenue, are reported in Appendix S1 (Tables A1–A3, Supporting information).[8] We describe the estimation results for the three dependent variables in sequence.

A. *Daily Hotel Registrations*

Table 3 reports the estimation results for daily hotel registrations. The first column reports the results for the subsample of hotels located in the city center, the second column reports the results for the subsample of hotels located in Mecklenburg County but outside of the city center, the third column reports the results for the subsample of suburban hotels located outside Mecklenburg County, and the last column reports the results for the entire Charlotte metro area. Because the total number of hotel rooms let in the entire metro area is the simple sum of the other three subsamples and all four estimated equations have the same explanatory variables, the marginal impact for model (4) in Table 3 is the sum of the marginal impacts for model (1), model (2), and model (3) in Table 3. However, including the three subsamples in addition to the aggregate metro area effect allows us to detect any spatial distribution of any effects associated with various events.

From Table 3, the 2012 DNC and the NASCAR All-star Race had the largest effect on registrations, with more than 7,000 additional rooms per night. Not far behind, the Atlantic Coast Conference (ACC) Championship football game corresponds with approximately 6,800 additional room nights and a regular NASCAR race is associated with just under 6,500 additional room nights for each of the four nights of race week. However, neither the NASCAR Hall of Fame, built with more than $100 million of public funds, nor the special events held at it has any discernable effect on overnight hotel stays. Although it is not well-known outside of North Carolina and nearby states, the CIAA basketball tournament is also a big draw, associated with an increase of more than 5,000 additional rooms for each night of the week-long tournament. Other events such as the college football bowl game, the PGA tournament, and the annual marathon have statistically significant if more modest effects.

Professional team sports receive much attention, and in some cases large subsidies. To the extent that construction and renovation costs are financed with a tax on hotels, it is worth focusing on the impacts of NFL and NBA events on the Charlotte metro area's hotel market. The NFL regular season and postseason games increase hotel room rentals by about 1,700 and 2,500, respectively, but there is no effect associated with NFL preseason games. Since Bank of America Stadium holds more than 70,000 fans for a Panthers game, the additional 1,700 hotel rooms suggest that relatively few fans who attend the game stay overnight in Charlotte hotels. Moreover, NFL teams play only eight regular season home games and occasional playoff games so these modest effects are unlikely to generate an economic impact large enough to justify large stadium subsidies on their own. The effects associated with the NBA regular season and postseason games are both small and statistically insignificant.

The effects for some events vary across the Charlotte metro area. NFL games are played in the city center and about 40% of the increased room rentals associated with the game are in the city center with no impact in the suburbs beyond Mecklenburg County. By contrast, the PGA golf tournament is played south of the city center toward the South Carolina border. The golf event has no effect on hotel rentals in the city center but does increase rentals in the rest of Mecklenburg County and the suburban counties.

As noted earlier, the estimated lead and lag effects are omitted from Table 3 but are reported in Appendix S1 (Table A1). To illustrate the potential relevance of estimating lead and lag effects, we report the complete results for the average NASCAR race in Table 4. Each day of event corresponds with the increase in 6,441 rooms let, which is the same as reported in Table 3. With the leads and lags included, we see that a NASCAR race generates a significant increase in rooms let in the two nights before the races. However, the 2 days after the race are associated with significant decreases in hotel room rentals. Thus, while a NASCAR race has spillover benefits on the days before the event, it also has a "hangover effect" in its aftermath. Appendix S1 indicates there are spillover benefits associated with several events and hangover effects associated with a few events, but there is no clear pattern in these effects. Hence, the results suggest that the effects for different events must be estimated separately and that event promoters

8. Available at https://ssrn.com/abstract=3048628 or from the authors upon request.

TABLE 2
Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max
City Center Rooms	2,439	805	335	3,845
Mecklenburg County Rooms	12,075	2,758	4,418	19,172
Charlotte Suburbs Rooms	4,688	1,168	1,807	8,339
Charlotte Metro Area Rooms	19,202	4,494	6,876	31,229
Charlotte City Daily Rate ($US)	144.70	23.51	86.04	323.62
Mecklenburg County Daily Rate ($US)	80.97	11.63	56.43	217.62
Charlotte Suburbs Daily Rate ($US)	75.67	9.72	58.04	161.92
Charlotte Metro Area Daily Rate ($US)	87.92	11.63	56.42	217.63
City Center Daily Revenue ($US m)	0.36	0.15	0.03	1.18
Mecklenburg County Daily Revenue ($US m)	0.99	0.34	0.29	4.10
Charlotte Suburbs Daily Revenue ($US m)	0.36	0.12	0.11	1.27
Charlotte Metro Area Daily Revenue ($US m)	1.72	0.58	0.49	6.51
Real Gasoline Price ($US)	3.25	0.51	1.89	4.37
U.S. Unemployment Rate	6.96	1.89	4.40	10.00

Notes: Sample period from January 1, 2005 through November 30, 2014. There are 3,621 observations. The Mecklenburg County room, daily rate, and revenue figures do not include the city center.

or civic boosters can neither make blanket claims about spillover benefits nor ignore the possibility of hangover effects.

Last, a brief discussion of the other control variables. On days with measurable snowfall in the Charlotte metro area, there is an increase of approximately 1,200 rooms in Mecklenburg County hotels but no effect in either the city center or the suburban counties. The real price of gasoline, a proxy for the cost of travel, has no discernable impact on hotel registrations but the national unemployment rate, a proxy for the overall health of the economy, is associated with decreased daily hotel registrations; a one point increase in the unemployment rate is associated with 600 fewer daily hotel registrations in the Charlotte metro area. The day of week fixed effects indicates that room demand is highest on Tuesdays and Wednesdays and lowest on Sundays. The month fixed effects indicate that hotel room rentals have an inverse U-shape over the calendar year: the number of rooms let is lowest in January and December and highest from April through October.

B. Average Daily Rates and "Leakages"

Table 5 reports estimation results for the average daily hotel room rate. (For brevity, only the day of event results are included in Table 5, but complete results including leads and lags are included in Table A2.) As before, the first column reports the results for the subsample of hotels located in the city center, the second column reports the results for the subsample of hotels located in Mecklenburg County but outside of the city center, the third column reports the results for the subsample of suburban hotels located outside Mecklenburg County, and the last column reports the results for the entire Charlotte metro area. It is evident that those events associated with increases in hotel registrations are also generally associated with temporary increases in the average daily rate charged. This increase might occur simply because hotels take advantage of the increased demand and any lower price elasticity of those who are attending from outside Charlotte.[9] On the other hand, those who attend the events might choose to stay in more expensive hotels than those who travel on nonevent days, thereby increasing the average price charged on that day.

If increased hotel registrations discussed earlier are manifestations of increased demand rather than statistical artifacts, then the events with the largest price effects should be those that had the largest increases in rooms let as reported in Table 3. This is the case. The events with the largest price effects on the overall market are the DNC ($55 per night), the NASCAR races ($19 per night for the All-star Race and $26 per night for regular races), and the CIAA basketball tournament ($21 per night). Likewise, NFL games have a modest price effect (about $9 per night in the city center and $5 per night in the overall market) consistent with their modest effect on

9. One hotel in Charlotte charged $49.95 for a standard room a week before the 2012 Democratic National Convention and increased the price for the same room to $495 during the convention (although we have no evidence of how many rooms were let at the increased price).

TABLE 3
Day of Event Net Impact on Daily Hotel Registrations

Variables	(1) City Center	(2) Mecklenburg County	(3) Charlotte Suburbs	(4) Charlotte Total
NASCAR Hall of Fame[a]	103.948	431.772	−1.433	534.286
	(218.622)	(314.955)	(158.970)	(457.373)
NASCAR Race[b]	637.759***	4,339.630***	1,463.916***	6,441.305***
	(72.543)	(342.529)	(126.377)	(518.481)
NASCAR All-star Race	922.305***	4,533.051***	1,571.402***	7,026.758***
	(240.696)	(1,015.305)	(324.501)	(1,546.439)
Democratic National Convention[c]	1,208.988**	4,816.070*	1,622.220	7,647.279
	(558.833)	(2,898.562)	(1,269.300)	(4,724.466)
NRA Convention[c]	242.966***	1,569.468***	536.639*	2,349.072***
	(68.124)	(261.886)	(283.018)	(486.666)
NFL Preseason Game	402.636***	−397.247	−156.522	−151.132
	(76.285)	(276.989)	(135.358)	(444.030)
NFL Regular Season Game	674.373***	925.297***	82.026	1,681.696***
	(83.146)	(226.218)	(74.031)	(347.792)
NFL Postseason Game	1,380.177***	2,006.449***	−845.844***	2,540.783***
	(106.199)	(277.536)	(96.641)	(453.799)
College Bowl Game	945.367***	1,252.029**	−152.822	2,044.574**
	(159.942)	(606.019)	(155.711)	(861.530)
ACC Championship Game	1,439.007***	4,803.384***	571.991***	6,814.381***
	(148.121)	(988.223)	(208.985)	(1,244.148)
SOCON Basketball Tournament[c]	380.448***	−36.399	−395.854***	−51.805
	(99.564)	(262.277)	(93.453)	(426.975)
ACC Basketball Tournament[c]	639.963***	2,530.918***	243.797	3,414.678***
	(161.061)	(450.516)	(197.319)	(773.430)
CIAA Basketball Tournament[c]	582.729***	3,338.117***	1,149.668***	5,070.515***
	(73.658)	(354.557)	(146.299)	(531.911)
NCAA Basketball Tournament[c]	568.942***	1,541.599**	434.087	2,544.627**
	(192.155)	(707.635)	(269.954)	(1,137.461)
Marathon	476.690***	559.653	43.963	1,080.306**
	(104.025)	(366.670)	(135.950)	(549.781)
PGA Tournament[c]	−34.810	734.919***	209.844**	909.954**
	(108.643)	(241.762)	(104.579)	(379.406)
NBA Regular Season Game	21.704	−208.981	−90.654*	−277.932
	(48.775)	(138.218)	(48.634)	(220.876)
NBA Postseason Game	−103.821**	215.927	66.291*	178.397
	(46.827)	(134.786)	(37.547)	(173.449)
Hall of Fame Open	−58.957	−80.257	−162.483	−301.697
	(112.690)	(281.070)	(116.126)	(463.267)
Hall of Fame Tax	−153.679	−285.192	−155.871*	−594.742
	(107.009)	(306.804)	(90.387)	(478.595)
Snow Event	−26.219	1,199.913**	0.599	1,174.293
	(166.102)	(482.345)	(145.925)	(745.389)
Real Gasoline Price	63.854	198.547	91.333*	353.734
	(64.606)	(195.807)	(55.381)	(302.525)
Unemployment Rate	1.469	−437.910***	−163.515***	−599.956***
	(47.800)	(135.397)	(42.500)	(214.900)
Constant	1,563.171***	11,502.624***	3,565.660***	16,631.455***
	(298.812)	(841.588)	(278.055)	(1,348.721)
R^2	0.530	0.677	0.770	0.695

Notes: 3,617 observations used in each specification. Dependent variable in levels. Sample period from January 1, 2005 through November 30, 2014. Day of week, month of year, and year fixed effects included but not reported for brevity. Standard errors in parentheses. SOCON, Southern Conference.

[a]Includes grand opening and annual induction ceremony.

[b]Includes Sprint Cup, Nationwide, and Camping World Truck Series events.

[c]Multiday event.

***$p < .01$; **$p < .05$; *$p < .1$.

hotel registrations. NBA games and NASCAR Hall of Fame events had no discernable effect on hotel room rates, just as they had no effect on the number of hotel rooms let.

As with the hotel registrations, one can see different effects across the Charlotte metro area. The CIAA basketball tournament held downtown increases city center hotel rates by nearly $50 per night but only increases suburban rates by about $8 per night. On the other hand, NASCAR races held in suburban Concord increase suburban rates by $40 per night but increase city center rates by about $23 per night.

Besides using estimated price effects to confirm demand increases, they can be used for back-of-the-envelope calculations of the

TABLE 4
NASCAR Race Lead, Day-of-Event, and Lag Effects on Daily Hotel Registration

Variables		(1) City Center	(2) Mecklenburg County	(3) Charlotte Suburbs	(4) Charlotte Total
NASCAR Race[a]	Two leads	140.576**	931.165***	303.842***	1,375.582***
		(62.534)	(161.012)	(61.212)	(255.492)
	One lead	418.118***	2,142.737***	501.187***	3,062.041***
		(80.308)	(230.948)	(76.466)	(321.716)
	Day of event	637.759***	4,339.630***	1,463.916***	6,441.305***
		(72.543)	(342.529)	(126.377)	(518.481)
	One lag	−388.554*	−1,235.734*	−521.407**	−2,145.694*
		(202.979)	(675.473)	(238.741)	(1,095.974)
	Two lags	−161.619	−849.306**	−303.587**	−1,314.512**
		(135.375)	(389.897)	(125.528)	(632.438)

Notes: 3,617 observations used in each specification. Dependent variable in levels. Sample period from January 1, 2005 through November 30, 2014. Leads and lags for all other events and all other variables listed in Table 3 are also included but not reported for brevity. Standard errors in parentheses.

[a]Includes Sprint Cup, Nationwide, and Camping World Truck Series events.

***$p < .01$; **$p < .05$; * $p < .1$.

potential leakages associated with various events. As noted by Baumann, Matheson, and Muroi (2009), one reason that traditional economic impact forecasts are often overstated is that revenue gains from price increases often flow to out-of-town business owners rather than recirculating locally. Here, we use our price and total revenue estimates to illustrate this point. NASCAR races are associated with average daily rate increases of about $26 and daily hotel revenue increases of about $1.2 million. Multiplying the $26 price increase by the mean number of rooms rented each day (about 19,200) yields approximately $500,000, a figure which is roughly 41% of the $1.20 million increase in revenue. To the extent that hotel owners are not Charlotte residents, any multiplier effects assumed to accompany the $1.2 million increase in hotel revenue would be overstated because some revenue "leaks" from the Charlotte region.

C. Real Daily Hotel Revenue and Hotel Tax Revenue

Table 6 reports estimation results with real total revenue (measured in millions of dollars) as the dependent variable.[10] Once again, the first column reports the results for the subsample of hotels located in the city center, the second column reports the results for the subsample of hotels located in Mecklenburg County but outside of the city center, the third column reports the results for the subsample of suburban hotels located outside Mecklenburg County, and the last column reports the results for the entire Charlotte metro area.

10. Table 6 omits lead and lag effects for brevity but complete results are in Table A3 of Appendix S1.

Given the room rental and price effect results already discussed, it is not surprising that the DNC, the two NASCAR race events, and the CIAA are the events that generate the largest increases in daily hotel revenue. These events bring Charlotte area hotels nearly $1 million per day in additional revenue. More modest effects are associated with NFL games, college events such as NCAA basketball tournament regional play, the college football bowl game, and the marathon. NBA games have no effect on revenue either in the city center area where the team's arena is located or across the entire metro region.

In addition to helping understand the economic impact of various events, the hotel revenue results are useful in the debate over public subsidies toward the tourism sector. As the city of Charlotte has an *ad valorem* tax of 8% on hotel rooms, the impact of events on total hotel revenues provide the opportunity to calculate an estimated impact of these events on tax revenues to the city of Charlotte and other cities in Mecklenburg County.[11] For example, NFL games generate about $436,000 of additional hotel revenue per game ($216,000 on the night before a game and $220,000 on game day). Thus, each home game generates about $35,000 in additional hotel tax revenue for Charlotte and Mecklenburg County ($436,000x0.08). NFL teams play eight regular season home games so each season yields about $280,000 in additional hotel tax revenue.

11. The 8% lodging tax is allocated as follows: 3 percentage points are directed to the city of Charlotte for convention center facilities, 3 percentage points are distributed to various other cities in the Mecklenburg County for tourism-related expenditures, and 2 percentage points allocated to servicing the debt incurred to build the NASCAR Hall of Fame.

TABLE 5
Day of Event Net Impact on Average Daily Rates ($US)

Variables	(1) City Center	(2) Mecklenburg County	(3) Charlotte Suburbs	(4) Charlotte Total
NASCAR Hall of Fame[a]	5.287***	1.318	2.002	1.869
	(1.647)	(1.651)	(1.605)	(1.619)
NASCAR Race[b]	22.983***	22.361***	40.087***	26.443***
	(4.455)	(3.261)	(3.071)	(3.154)
NASCAR All-star Race	25.023***	14.221***	26.676***	19.004***
	(6.346)	(4.453)	(5.301)	(4.906)
Democratic National Convention[c]	78.282***	56.973***	30.917**	54.946***
	(26.899)	(21.685)	(13.500)	(20.176)
NRA Convention[c]	22.638***	1.873	−0.818	3.536***
	(0.601)	(1.178)	(1.465)	(0.499)
NFL Preseason Game	−2.473	−3.158***	−2.674***	−1.863**
	(2.630)	(0.724)	(0.658)	(0.829)
NFL Regular Season Game	8.778***	1.964***	0.642	4.855***
	(2.060)	(0.617)	(0.522)	(0.829)
NFL Postseason Game	37.469***	5.317***	−7.675***	11.827***
	(2.575)	(1.072)	(1.023)	(1.254)
College Bowl Game	45.356***	3.121	−0.852	10.966***
	(9.357)	(3.042)	(1.380)	(3.258)
ACC Championship Game	65.935***	10.026***	2.323*	17.809***
	(7.328)	(2.681)	(1.296)	(2.675)
SOCON Basketball Tournament[c]	9.261**	−0.828	0.412	2.361**
	(3.752)	(0.867)	(1.000)	(1.073)
ACC Basketball Tournament[c]	50.489***	11.731***	2.036**	15.086***
	(5.970)	(2.030)	(0.969)	(2.420)
CIAA Basketball Tournament[c]	48.543***	20.984***	7.762***	20.983***
	(6.770)	(3.285)	(1.734)	(3.129)
NCAA Basketball Tournament[c]	13.102***	4.798	−0.280	5.342*
	(4.250)	(3.639)	(1.817)	(2.856)
Marathon	8.287**	2.896***	0.632	4.189***
	(3.408)	(1.081)	(0.863)	(1.243)
PGA Tournament[c]	−3.956**	0.147	0.154	−1.086
	(1.996)	(0.456)	(0.810)	(0.664)
NBA Regular Season Game	−0.455	−0.870**	−0.695*	−0.605
	(1.115)	(0.438)	(0.375)	(0.520)
NBA Postseason Game	−4.789***	−0.136	−0.759	−2.090***
	(1.300)	(0.457)	(0.687)	(0.579)
Hall of Fame Open	−2.136	−2.113**	−9.020***	−3.951***
	(2.425)	(0.981)	(1.050)	(1.230)
Hall of Fame Tax	2.223	1.229	2.497***	1.343
	(2.754)	(1.039)	(0.654)	(1.237)
Snow Event	0.173	0.936	−1.395	−0.173
	(3.783)	(0.949)	(0.919)	(1.276)
Real Gasoline Price	−1.733	−1.972***	0.945	−1.240
	(1.684)	(0.765)	(0.593)	(0.890)
Unemployment Rate	−5.171***	−2.271***	0.929**	−1.601**
	(1.226)	(0.547)	(0.440)	(0.629)
Constant	161.569***	89.201***	56.876***	89.117***
	(7.513)	(3.185)	(2.870)	(3.694)
R^2	0.642	0.742	0.752	0.691

Notes: 3,617 observations used in each specification. Dependent variable in levels. Sample period from January 1, 2005 through November 30, 2014. Day of week, month of year, and year fixed effects included but not reported for brevity. Standard errors in parentheses. SOCON, Southern Conference.

[a]Includes grand opening and annual induction ceremony.

[b]Includes Sprint Cup, Nationwide, and Camping World Truck Series events.

[c]Multiday event.

***$p < .01$; **$p < .05$; *$p < .1$.

The same type of calculations can be done for the other events held in Charlotte.

However, the additional tax revenue generated by these various events falls far short of the annual debt service for building and renovating venues in Charlotte, which was approximately $33.4 million in fiscal year 2016 (City of Charlotte 2017). Furthermore, while the special events such as the DNC generate significant net hotel tax revenue, the additional revenue might not surpass the considerable costs of hosting the events. For example, Charlotte spent approximately

TABLE 6
Day of Event Net Impact on Real Daily Hotel Total Revenue ($ Millions)

Variables	(1) City Center	(2) Mecklenburg County	(3) Charlotte Suburbs	(4) Charlotte Total
NASCAR Hall of Fame[a]	0.023	0.053	0.008	0.084
	(0.032)	(0.043)	(0.018)	(0.066)
NASCAR Race[b]	0.147***	0.696***	0.361***	1.204***
	(0.020)	(0.078)	(0.025)	(0.116)
NASCAR All-star Race	0.193***	0.555***	0.289***	1.037***
	(0.048)	(0.131)	(0.052)	(0.223)
Democratic National Convention[c]	0.590***	1.757***	0.421**	2.768***
	(0.160)	(0.631)	(0.208)	(0.999)
NRA Convention[c]	0.083***	0.145***	0.038	0.266***
	(0.010)	(0.031)	(0.029)	(0.053)
NFL Preseason Game	0.040***	−0.074***	−0.025**	−0.060
	(0.013)	(0.025)	(0.011)	(0.045)
NFL Regular Season Game	0.114***	0.096***	0.010	0.220***
	(0.016)	(0.024)	(0.007)	(0.042)
NFL Postseason Game	0.296***	0.214***	−0.092***	0.417***
	(0.019)	(0.031)	(0.010)	(0.056)
College Bowl Game	0.237***	0.122	−0.019	0.340***
	(0.038)	(0.075)	(0.014)	(0.120)
ACC Championship Game	0.389***	0.463***	0.042**	0.894***
	(0.040)	(0.108)	(0.020)	(0.160)
SOCON Basketball Tournament[c]	0.070***	−0.004	−0.029***	0.037
	(0.020)	(0.028)	(0.011)	(0.055)
ACC Basketball Tournament[c]	0.235***	0.381***	0.028	0.645***
	(0.044)	(0.073)	(0.020)	(0.131)
CIAA Basketball Tournament[c]	0.241***	0.615***	0.139***	0.995***
	(0.031)	(0.076)	(0.023)	(0.126)
NCAA Basketball Tournament[c]	0.117***	0.196**	0.027	0.340**
	(0.034)	(0.098)	(0.030)	(0.154)
Marathon	0.082***	0.071**	−0.001	0.152**
	(0.020)	(0.032)	(0.013)	(0.060)
PGA Tournament[c]	−0.019	0.055**	0.016	0.052
	(0.018)	(0.022)	(0.011)	(0.039)
NBA Regular Season Game	0.000	−0.029*	−0.011**	−0.040
	(0.009)	(0.015)	(0.005)	(0.027)
NBA Postseason Game	−0.023*	0.025*	0.004	0.006
	(0.013)	(0.015)	(0.007)	(0.024)
Hall of Fame Open	−0.014	−0.038	−0.059***	−0.110*
	(0.021)	(0.033)	(0.013)	(0.060)
Hall of Fame Tax	−0.016	−0.005	−0.001	−0.023
	(0.020)	(0.035)	(0.009)	(0.061)
Snow Event	0.011	0.106**	−0.008	0.109
	(0.029)	(0.044)	(0.011)	(0.079)
Real Gasoline Price	0.007	−0.001	0.011*	0.016
	(0.012)	(0.023)	(0.006)	(0.039)
Unemployment Rate	−0.013	−0.064***	−0.009*	−0.085***
	(0.009)	(0.016)	(0.005)	(0.028)
Constant	0.273***	1.032***	0.197***	1.501***
	(0.054)	(0.094)	(0.030)	(0.169)
R^2	0.567	0.698	0.753	0.685

Notes: 3,617 observations used in each specification. Dependent variable in levels. Sample period from January 1, 2005 through November 30, 2014. Day of week, month of year, and year fixed effects included but not reported for brevity. Standard errors in parentheses. SOCON, Southern Conference.

[a]Includes grand opening and annual induction ceremony.

[b]Includes Sprint Cup, Nationwide, and Camping World Truck Series events.

[c]Multiday event.

***$p < .01$; **$p < .05$; *$p < .1$.

$330,000 for public safety during the 2017 PGA Championship (City of Charlotte 2017).

There is also a regional public finance aspect to using hotel taxation to finance facilities or events. Events such as the CIAA basketball tournament and the ACC football championship game are played in Charlotte but generate significant increases in hotel revenue in suburban areas outside of Mecklenburg County. Therefore, counties beyond Mecklenburg benefit from events subsidized by Charlotte and Mecklenburg taxpayers but their revenue gains are not subject

to taxes used to partly offset the subsides. Conversely, the NASCAR races are held in Cabarrus County but generate large hotel revenue increases and hotel tax collections in Mecklenburg County. That such externalities exist points to the difficulty of aligning the taxes used to subsidize facilities with the benefits associated with the events held in those facilities.

V. CONCLUSION

Tourism promoters, sports franchise owners, and local political officials often claim that sporting and political events increase tourism before, during, and after the event. In the past, such claims were hard to confirm or refute because of a paucity of appropriate data. This paper provides the first study of daily hotel registrations, average daily rates charged, and daily hotel revenue over a substantial period. Focusing on Charlotte, North Carolina and its surrounding suburbs, we estimate the impact of various sporting and political events in the city to the measures of hotel demand.

We differentiate between hotels located in the city center, near the two major venues in the city (Spectrum Center and Bank of America Stadium), the rest of Mecklenburg county, the Charlotte suburbs (located outside of Mecklenburg county), and the entire region. We further differentiate between 2 days before, 1 day before, day of, day after, and 2 days after each event in our analysis. This allows us to test whether and to what extent events have any greater tourism draw than the event itself.

The estimation results show that several events, particularly NASCAR races, the annual CIAA college basketball tournament, and the DNC, had substantial effects on the number of rooms let, the average daily rate charged, and the total revenue generated in the hotel industry. This, in turn, suggests that these events provide substantial net increases in hotel room tax revenue generated for Mecklenburg County and partly used to service public debt incurred to build and renovate various venues within the city of Charlotte. These events all share a common trait: they are multiple-day events for which a substantial number of people come from out of town and stay for multiple nights during the event.

Other events, such as college bowl games and NFL games, have a day before and day of effect on hotel rooms and hotel revenues but do not exhibit any net impact 2 days before or 2 days after the events. Still other events, such as NBA regular season games, are not associated with a net increase in hotel registrations or hotel revenues the days before, the day of, or the days after the event.

The rhetoric of event promoters often implies that all events are expected to encourage visitors to come days before the event or stay for days after the event. The estimation results for Charlotte show that there is no common theme to the temporal or geographic impact of events on hotel registrations and hotel revenues. Some events have positive tourism effects, some have negative "crowding out" effects, and still others have no net impact on hotel registrations even during the event. Thus, the evidence suggests that increased tourism, and associated increased tourism-related tax revenue, is a rather tenuous reason to justify public subsidies of venues and events.

We can identify hotel registrations, average daily rates, and hotel revenues across tax jurisdictions within the Charlotte region. Events within Mecklenburg County that generate net increases in hotel registrations, average daily rates, and hotel revenues in counties other than Mecklenburg, represent a loss in hotel tax revenue within Mecklenburg County. Events held outside of Mecklenburg County, such as NASCAR races held at CMS, can generate net increases in hotel registrations and hotel revenues within Mecklenburg County, leading to net increases in hotel room tax revenue for Mecklenburg County. These cross-jurisdiction effects highlight the difficulty in aligning the taxes used to subsidize venues and events with the benefits generated by those venues and events.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Appendix S1 Online Appendix