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Article

The Impact of Conventions on Hotel Demand: Evidence from Indianapolis Using Daily Hotel Occupancy Data

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Abstract: This paper uses daily hotel occupancy data for the Indianapolis metro area from STR to estimate the effect of multi-day conventions on hotel demand. In addition to multi-day conventions, we hand collect data on other major events such as the Indy 500 and major sporting events. Hotel demand is an important part of the economic activity generated by multi-day events because hotel rooms are largely occupied by out-of-town guests and represent new local economic activity. We look at the effect of conventions and other large events in Indianapolis on average daily room rates, revenue per room, demand, occupancy, and total revenue. We find large and statistically significant effects for multi-day conventions on hotel demand with very little evidence of crowding out. A single day of a multi-day convention brings in approximately \$928,000 in additional hotel revenue. Our findings contribute to the literature on the economic impact of large events such as conventions and sporting events that attract out-of-town visitors.

Keywords: tourism; hotel demand; conventions; football; sports economics; visitors

JEL Classification: R58; Z20; Z32

1. Introduction

Major events can bring attention to areas and, more importantly, generate economic benefits to local businesses and communities that host travelers. Regular streams of out-of-town tourists can play a significant role in local economies by increasing employment and, subsequently, local tax revenues. Indianapolis has made a concerted effort to attract both sports teams and conventions with the construction of multiple sports facilities and a major convention center. The city also hosts the Indianapolis 500, which is one of the more notable events in automotive racing.

The Indiana Convention Center has become a significant force for attracting tourism by hosting a variety of trade shows, conventions, and conferences over the last decade. With growing attendance figures at conventions like Gen Con, the claimed value of this event has gone up to \$70 million in recent estimates from the Indianapolis tourism organization Visit Indy (Shuey 2020). It would seem natural to extend some interest into these claims, as there is a long history of overprediction of economic impacts from major events, most notably major sporting events (Coates and Humphreys 2008). For our purposes the question will be focused on the effects of convention events designed to attract tourists on hotel revenue.

Large scale events and conventions are likely to draw visitors to the city but measuring the true net economic effect of such an event can prove to be a tricky endeavor. There is the potential for leakages from the local economy from locals and others traveling for other reasons (Crompton et al. 2001). Heller et al. (2018) also note that it is problematic if visitor spending occurs at national chains (which would include hotels) that sees the revenue generated being repatriated to stakeholders outside the region with the event, thus mitigating the regional impact of these events.

The focus of this study will be on a sub-group of tourism-related events that are routinely held at the Indiana Convention Center located in downtown Indianapolis, Indiana. This sub-group includes the Fire Department Instructor's Conference, Gen Con, Indy PopCon, The National Future Farmers of America (FFA) convention, and the National Rifle Association (NRA) annual meeting and exhibits (which occurred twice over our sample period). There are also numerous events, and types of events, that can allow for us to examine the difference between impacts from sports and conventions.

This research will seek to build on the growing literature that uses changes in hotel demand to estimate part of the economic impact of sports (Depken and Stephenson 2018), same-sex marriage legalization (Earhart and Stephenson 2018), and political conventions (Heller et al. 2018). Depken and Stephenson (2018) use daily hotel data on the Charlotte market from 2005 to 2014 to look at how different types of events change hotel demand before, during, and after the event. They find that political conventions such as the Democratic National Convention and National Association for Stock Car Auto Racing (NASCAR) events are associated with large increases in hotel demand. National Basketball Association (NBA) games, however, have no impact on hotel demand and therefore prices. The results of Depken and Stephenson (2018) are consistent with the rest of the literature that the effects of an event on hotel demand depend on the type of event and its potential to draw in visitors from outside while not crowding out other sources of hotel demand. Crowding out occurs when other demanders of hotel rooms change their plans to avoid the higher prices or congestion associated with an event. For example, if business travelers who otherwise would have flown into Indianapolis on 5 February 2012 delayed or canceled their trip because of the Super Bowl, that is crowding out.

For example, Earhart and Stephenson (2018) look at the effect of same-sex marriage legalization on Savannah Georgia and Charleston South Carolina. These cities were chosen because they are popular cities for destination weddings. Earhart and Stephenson (2018) find that the legalization of same-sex marriage had no discernible impact on hotel demand in either city, except perhaps for the first few months after legalization in Savannah. In contrast, and consistent with the positive findings of Depken and Stephenson (2018), Heller et al. (2018) find that the 2008 and 2012 Democratic and Republican national conventions led to higher hotel occupancy and prices.

This paper tests for economic impacts associated with these conventions by examining daily hotel occupancy data on the Indianapolis metropolitan area. Additionally, estimates of hotel demand impacts for sporting events in Indianapolis are estimated to give insight as to the relative magnitude of conventions to sporting events. The nature of the data will increase our ability to detect the impact of events and any effects that occur in the days immediately before and after the event in question.

The usage of daily data in the economic impact literature is growing, though relatively uncommon. In addition to the studies cited earlier, Baumann et al. (2009) use daily airline passenger arrivals to examine the economic impact for sporting events held in Hawaii and daily bridge crossing data has been used by Mills and Rosentraub (2014) to estimate Canadian fans visiting Buffalo, New York for NHL games. Baumann et al. (2009) find that the only two events that increase visitors to Hawaii are the Honolulu Marathon and the NFL's Pro Bowl. Mills and Rosentraub (2014) estimate that 15 percent of Buffalo Sabre game attendees are Canadians, although the percentage varies by who Buffalo is playing. While these examples examine the effects of sporting events, there is little reason to believe that multi-day convention impacts cannot be similarly estimated.

2. Data and Empirical Approach

This study used nightly hotel data for the Indianapolis metropolitan area for the time period running from period 1 January 2010 to 31 December 2019. The data were obtained from STR, a firm that compiles hotel occupancy data from the U.S. and other countries (Recent papers using STR data include [Lee et al. \(2019\)](#); [Bonneau and Hall \(2020\)](#); [Sheehan and Stephenson \(2020\)](#)).¹ These daily data for the entire market were then matched with a schedule of events compiled from news reports and official statements regarding the dates. For professional sporting events (Indianapolis Colts and Indiana Pacers were the only major sporting teams considered), the schedules are taken from ESPN’s historical game records. These are not the only comparison events that we have. We also have the schedules for a set of major events that occur annually as well as those events that rotate through Indianapolis. These includes the Indy 500, Brickyard 400, Big Ten Football Championship, Super Bowl XLVI, National Collegiate Athletic Association (NCAA) Men’s Big Ten Basketball Championship, NCAA Men’s Basketball Tournament Games, Final Four, an International Champions Cup match, and the PGA (Professional Golfers Association) BMW Championship. Table 1 lists all the events in our sample along with the number of days the event occurred over our sample period.

Table 1. Events in the sample along with frequency.

Event	Days	Events	Days
Gen Con	41	Pacers Postseason Game	38
FDCI	53	Super Bowl XLVI	1
FFA	31	International Champions Cup	1
NRA	6	Indy 500	10
Pop Con	18	NFL Combine	66
Colts Preseason Game	20	BOA Super Regionals	10
Colts Regular Season Game	80	BOA Grand Nationals	10
Colts Post Season Game	5	NCAA Men’s Final Four	6
Big 10 Football Championship	9	NCAA Men’s Tournament Games	9
PGA Event (BMW Championship)	8	Big Ten Basketball Tournament	45
Pacers Regular Season Game	406	Brickyard 400	10

Our variables of interest were occupancy, average daily room rate (ADR), demand, revenue per available room (RevPar), and total revenue. We did not consider supply as a dependent variable because while we had daily supply data, it did not change much over our sample. In a typical year in our sample, supply increased by 0.7 percentage points. Supply appeared to change in response to overall market conditions, not specific events. Occupancy represents the percentage of available rooms that were occupied, ADR was calculated by dividing the total revenue by the number rooms sold, and revenue per available room was found by dividing the total revenue by the number of available rooms. Summary statistics for our dependent variables can be found in Table 2.

Table 2. Summary statistics, full sample.

Variable	Mean	St. Dev.	Min	Max
Supply	31,248.32	714.3806	29,245.52	33,392
Demand	19,481.74	4929.223	6206.183	31,322.85
Average Daily Room Rate	95.9627	19.4613	54.54709	305.74
Revenue (\$1000’s)	1936.136	815.7454	358.1772	8846.37
Occupancy (%)	62.33535	15.68172	20.6302	97.12163

Note: N = 3652.

¹ Data was provided at the market level, not the individual hotel, as part of the agreement with firms participating in the survey.

The summary statistics showed that, on average, 62% of hotel rooms were full. The mean price of a room per night was approximately \$96, which led to an average daily revenue of \$1,936,000. The range for revenue was large as the maximum revenue over the sample was \$8,846,000, but this is not surprising since this occurred during the lead up to Super Bowl XLVI which was in the sample. For comparison, we can look at the summary statistic for days with conventions as compared to days without conventions. This comparison of sample statistics should help us gauge whether there seemed to be a difference in variables between the full sample and sub-samples of interest (in this case all days compared to convention days and non-convention days). Table 3 shows the summary statistics for convention days.

Table 3. Summary statistics, conventions.

Statistic	Mean	St. Dev.	Min	Max
Supply	31,376.3	767.1458	30,380	33,141.48
Demand	25,066.14	4548.419	13,566.11	30,635.5
Average Daily Room Rate	117.9962	22.50684	76.72408	158.6652
Revenue (\$1000's)	3022.209	978.6521	1141.275	4767.191
Occupancy(%)	79.92269	14.5472	44.4139	97.12163

Note: N = 146.

Even without removing other events from the sample the summary statistics showed a very clear increase for each variable of interest. Once we ran a more formal model we can see if our early optimism was justified, or if other factors made this jump a consequence of noise with a weak signal.

For a simplistic comparison between the convention days and sporting events we can examine Table 4 which contains the summary statistics for Indianapolis Colts regular season home games. Comparing Tables 3 and 4, there seemed to be a reduction in the daily hotel rate while revenue was lower. This does not imply that Colts games decreased hotel demand, but the simple comparison may suggest anemic impacts of local sports games which is not surprising in light of the findings of Depken and Stephenson (2018).

Table 4. Summary statistics, Colts games.

Statistic	Mean	St. Dev.	Min	Max
Supply	31,308.79	709.8949	30,290	33,392
Demand	14,300.85	3831.652	7879.519	25,073.94
Average Daily Room Rate	89.58263	15.49133	62.13816	124.9054
Revenue (\$1000's)	1327.531	552.5412	489.6188	2797.599
Occupancy(%)	45.7207	12.47737	25.54056	81.00388

Note: N = 80.

The next step involved the estimation of an intervention analysis of the form:

$$\begin{aligned}
 Outcome_t = & \beta_0 + \sum_{i=1}^N \beta_{1i} Event_{it} + \sum_{i=1}^N \beta_{2i} Event_{it-j} + \sum_{i=1}^N \beta_{3i} Event_{it+k} \\
 & + \sum_{g=1}^7 \delta_{1g} Day_g + \sum_{m=1}^{12} \delta_{2m} month_m + \sum_{p=2010}^{2019} \delta_{3p} Year_p
 \end{aligned}
 \tag{1}$$

where *Outcome* refers to one of our five outcome variables: hotel demand, average daily rate, total revenue (in thousands), revenue per available room, and occupancy. Each specification included controls for the day of the week, month of the year, and year fixed effects that should aid in capturing trends that might be present in the data. Mega-events, such as the Indy 500 and Super Bowl XLVI were estimated with increased lead-lag (β_2 and β_3) length to account for the scale of the event. For the purpose of our study, 'lead' refers to days before the event and 'lag' refers to days after the event. For example, the Super Bowl occurs on Sundays and thus our binary variable for the day of

the event was a Sunday hotel night. A lead would be if Super Bowl attendees stayed in the hotel the Saturday before the game. A lag would be if they also stayed over Monday night.

The convention sub-group, Colts games, NASCAR’s Brickyard 400, College-level Tournaments, and College-level Championship games, NFL Draft Combine, PGA tournament event (BMW Championship) are given a lead-lag length of two. Also included are the date of the International Champions Cup soccer game between Chelsea and Inter Milan, which was given a single lead-lag. Following Depken and Stephenson (2018) the leads and lags for certain sporting events, such as basketball, tended to have no significance and were thus omitted after observing a similar lack of evidence for effect and significance.

Each specification controlled for the day of the week, month of the year, and year fixed effects that should aid in capturing the underlying trends that might be present in the data. We will begin with analyzing the main results, then we will consider each Convention alone, as there might be some events that overshadow others, and some might occur with more regularity. We also included all other major events in Indianapolis over 2010–2019 where data on event dates were available. This will allow for some comparison of scale as there are multiple types of events with varying scale that impact Indianapolis hotel demand.

3. Empirical Results

3.1. Baseline Convention Results

The first main set of results are presented in Table 5. Here we can see the impacts of conventions on the five variables of interest: average daily rate (ADR), revenue (in thousands of US dollars), demand, occupancy, and revenue per available room (RevPar) in US dollars. The main independent variable of interest is the convention sub-group, and we control for all events mentioned before alongside day of the week, month, and year fixed effects.

Table 5. The impact of Indianapolis area conventions on the hotel industry.

Dependent Variable	ADR	Revenue	Demand	Occupancy	RevPar
Mean	95.96	1936.13	19,481.74	62.33	61.91
Convention Lead 4	−2.071488 (1.677906)	−86.85407 (80.09942)	−414.3097 (505.4712)	−1.298588 (1.618474)	−2.734644 (2.553558)
Convention Lead 3	−2.087847 (1.663952)	−73.16581 (79.43327)	−325.2886 (501.2674)	−1.107163 (1.605014)	−2.432208 (2.532321)
Convention Lead 2	0.9527782 (1.658038)	66.4875 (79.15096)	440.0117 (499.4859)	1.332625 (1.59931)	2.007509 (2.523321)
Convention Lead 1	11.35632 *** (1.659526)	528.0011 *** (79.22198)	2558.492 *** (499.9341)	8.128957 *** (1.600745)	16.74419 *** (2.525585)
Convention Day	19.9283 *** (0.851067)	928.0586 *** (40.628)	4120.522 *** (256.3849)	13.10639 *** (0.8209218)	29.50204 *** (1.295215)
Convention Lag 1	0.7899806 (1.669393)	3.33088 (79.693)	−177.1549 (502.9065)	−0.6158839 (1.610262)	0.0026099 (2.540601)
Convention Lag 2	−0.2886109 (1.670165)	−31.18114 (79.72989)	−189.9052 (503.1392)	−0.6908739 (1.611007)	−1.128831 (2.541777)
Convention Lag 3	−1.419888 (1.66135)	−69.35231 (79.30905)	−380.0457 (500.4835)	−1.260098 (1.602504)	−2.286733 (2.528361)
Convention Lag 4	−1.221638 (1.658229)	−68.60329 (79.16008)	−389.93 (499.5435)	−1.257852 (1.599494)	−2.196667 (2.523612)
R-squared	0.765	0.6951	0.667	0.6626	0.6936

Notes: N = 3652 in all specifications. Standard errors in parentheses. *** corresponds to 1% significance level. The regression includes day of week, month, and year fixed effects. Controls for other majors tourist events such as sporting events are included but not reported for space.

The results showed that on convention days, ADR increased by around \$19.93. This represented an increase of 20.7% of the mean average daily rate for the full sample. These effects occurred in the day preceding the convention, as ADR increased by around \$11.36, or around 11.84% of the full sample mean. These were both statistically and economically significant. What is also interesting is that there seemed to be little persistence, as there was no statistically significant evidence for ADR being higher or lower after the event.

The revenue increases were also present and significant on convention day and the day preceding the conventions start. Revenue increased by approximately \$928,000 per convention day and there was a boost in revenue of around \$528,000 the day before the convention started. So for a convention day revenue increased by around 48% as compared to the full sample mean, which is impressive. This was reflected by the similar changes in revenue per available room. The gains on convention days might have been offset by dips in revenue directly after the convention, but there was no significant drop in revenue after the convention ended.

The demand data suggested the surge in demand from conventions was non-negligible and significant; thus, it was not shocking to see that occupancy increased during and immediately before a convention. Occupancy went up around 13.1 percentage points, and occupancy rate increased by approximately 21% on convention days. The day before occupancy increased 8.13 percentage points, or a 13% increase. In general, the results seemed to confirm that for most of the sup-group in question, the effects were positive on the major variables of interest for convention events. This suggests that it might not be necessary to look much beyond the two days before the start and end of a convention.

3.2. Specific Convention Results

The previous regression treated all conventions as the same. In this section we re-run our analysis with different conventions identified by their own binary variables. Each specification controls for day, month, and year fixed effects as well as all the major events listed in Table 1. The coefficients for the other events are not reported here in order to focus on the convention results. However, Tables 6–13 present the estimated coefficients for these other events (This is why the R-squared is the same in Tables 6–13).

Table 6 breaks down the large convention group by individual convention results. There were not statistically significant leads and lags beyond one day. The Indy PopCon was insignificant in effect for all variables of interest. Since Pop-Con is a relatively new convention (it began in 2014) the lackluster and imprecise estimates may be due to a small attendance figure, or large but very local attendance. This convention was more of an exception but might be emblematic of a set of conventions that had decent attendance and support, but did not have much of an impact on local hotel demand.

For Gen Con, Fire Department Instructors Conference (FDIC) International, and the National Future Farmers of America (FFA) convention the stories are very similar. The NRA convention is significant, but the magnitude is less pronounced than for estimates of the group. For example, the revenue impact for the NRA National convention is approximately \$596,000 compared to the \$1,025,000 of FDIC International convention and the \$1,044,000 for FFA. Gen Con generated approximately \$1,189,000 in additional revenue per night, or an increase of around 61% over the full sample mean and the highest for conventions tested. ADR (in US dollars) increased by 25.86, 23.37, and 20.26 for Gen Con, FDIC, and FFA respectively. This was compared to NRA national which only had an ADR increase of 12.44. All these were significant, but the disparities between the top three conventions the NRA still raises an eye. Demand for rooms seems to be similar among Gen Con, FDIC, and FFA, the numbers for the conventions were 5157, 4436, and 4779 respectively and were significant at the 0.1% level. Gen Con and FFA saw increased demand the day before, while FDIC saw a jump two days before but nothing the day before. The NRA saw a statistically significant rise of 3136 the day of the event, but a marginally significant 3377 the day before.

Table 6. The impact of specific conventions on the hotel industry.

Dependent Variable	ADR	Revenue	Demand	Occupancy	RevPar
Mean	95.96	1936.13	19,481.74	62.33	61.91
Gen Con Lead 1	19.93212 *** (3.009981)	1014.161 *** (143.816)	4495.034 *** (917.3684)	14.26682 *** (2.93775)	32.12174 *** (4.585966)
Gen Con	25.85273 *** (1.56028)	1189.259 *** (74.54975)	5153.217 *** (475.5352)	16.47858 *** (1.522838)	37.93722 *** (2.377222)
Gen Con Lag 1	−0.4965269 (3.027713)	4.22537 (144.6633)	220.3695 (922.7727)	0.7077307 (2.955056)	0.1421531 (4.612982)
FDIC Lead 1	7.680364 ** (3.201597)	135.6616 (152.9714)	771.9869 (975.7683)	2.426061 (3.124767)	4.275765 (4.877909)
FDIC	23.45961 *** (1.405768)	1025.979 *** (67.16718)	4465.268 *** (428.4435)	14.24632 *** (1.372033)	32.72856 *** (2.141808)
FDIC Lag 1	1.890507 (3.171015)	56.24763 (151.5102)	4.695669 (966.4476)	0.1161921 (3.094919)	1.928917 (4.831315)
FFA Lead 1	14.49092 *** (3.447839)	716.5532 *** (164.7368)	3300.62 *** (1050.817)	10.47997 *** (3.365101)	22.76896 *** (5.253081)
FFA	20.37701 *** (1.807461)	1050.2 *** (86.35997)	4815.592 *** (550.8698)	15.10954 *** (1.764087)	33.02146 *** (2.753823)
FFA Lag	4.863424 (3.441825)	116.5565 (164.4494)	−149.3992 (1048.984)	−0.7437471 (3.359231)	3.243625 (5.243918)
NRA Lead 1	12.4213 ** (6.83244)	611.6662 ** (326.4521)	3341.589 (2082.36)	10.52728 (6.66848)	18.99787 ** (10.40981)
NRA	12.0505 *** (3.967203)	596.4454 *** (189.5519)	3084.571 ** (1209.106)	9.882845 ** (3.872001)	18.71856 *** (6.044377)
NRA Lag 1	−2.647314 (6.876991)	−124.5252 (328.5807)	−9.978247 (2095.938)	0.2322793 (6.711962)	−3.574101 (10.47769)
PopCon Lead 1	−1.71318 (3.851518)	10.44159 (184.0245)	524.2348 (1173.848)	1.704747 (3.759092)	0.3772034 (5.86812)
PopCon	−1.881763 (2.239256)	−85.14619 (106.991)	−323.8198 (682.4704)	−1.037717 (2.18552)	−2.716552 (3.4117)
PopCon Lag 1	−1.284142 (3.842956)	−117.3521 (183.6154)	−742.8955 (1171.239)	−2.482855 (3.750735)	−3.931786 (5.855075)
R-squared	0.773	0.7051	0.6714	0.667	0.7034

Notes: N = 3652 in all specifications. Standard errors in parentheses. ** and *** correspond to 5%, and 1% significance levels. The regression includes day of week, month, and year fixed effects. Controls for other majors tourist events such as sporting events are included but not reported for space in this table but are instead presented in later tables.

These conventions seemed to generate a lot of revenue and led to noticeably higher rates. The occupancy story was also present. Occupancy jumped by 16 percentage points during the event, and considering the mean of 62% occupancy, this could push overall metro hotel occupancy to nearly 89%. Though from the sample we know that Gen Con conventions had days where metro occupancy was recorded at 97%, which occurred during Gen Con 2013.

Interestingly, for Gen Con, FDIC, and the FFA events, there was little to no evidence of reduced revenue or demand following the shock of the convention event. ADR and Revenue did not plummet past the trend, and for all five conventions, there was no statistical or economic significant changes to note. This is a startling lack of evidence of crowding out for these multi-day events (in hotel demand at the least). There do appear to be negative effects for the NRA convention; however, the estimates were imprecise and insignificant. The increases in the occupancy rate could raise concern of crowding out along a spatial dimension as Indianapolis has a large network of hotels connected to the convention center. So if occupancy is nearing the 90% range, there might be some crowding in certain downtown locations.

3.3. Comparison with Sporting Events

Sporting events vary drastically as local sporting events seem to have very low impact when compared to the conventions and larger less-local events, but this is to be expected. In this subsection we focus on specific sporting events to compare to conventions. Due to the number of events simultaneously estimated we report the results in groupings, although they all come from the same regression.

The results for Indianapolis Colts games appear in Table 7 and show that these games generated approximately 1934 additional room nights and \$284,000 dollars in revenue, with a slight increase of \$6.5 in the nightly room rate. This was in line with the rather anemic estimates found in Depken and Stephenson (2018) for Carolina Panthers home games, suggesting that NFL Games were not major drivers of hotel demand. This was also similar to the impact of West Virginia University home football games Bonneau and Hall (2020). So, hotel taxes were likely going to be generated from convention traffic.

Table 7. The impact of Indianapolis Colts games on the hotel industry.

Dependent Variable	ADR	Revenue	Demand	Occupancy	RevPar
Mean	95.96	1936.13	19,481.74	62.33	61.91
Colts Preseason	−3.227 (2.149)	−175.6 (102.7)	−1191.7 (654.9)	−3.842 (2.097)	−5.652 (3.274)
Colts Game Lead 1	2.406 * (1.171)	87.08 (55.96)	499.0 (357.0)	1.584 (1.143)	2.770 (1.784)
Colts Regular Season	6.508 *** (1.164)	284.4 *** (55.61)	1934.0 *** (354.7)	6.295 *** (1.136)	9.228*** (1.773)
Colts Post Lead 1	5.433 (4.200)	21.52 (200.7)	−868.0 (1280.0)	−2.568 (4.099)	0.808 (6.399)
Colts Post Season	10.63 * (4.200)	401.8 * (200.7)	1908.5 (1280.2)	6.262 (4.100)	12.94 * (6.400)
R-squared	0.773	0.7051	0.6714	0.667	0.7034

Notes: N = 3652 in all specifications. Standard errors in parentheses. * and *** correspond to 10% and 1% significance levels. All statistically significant leads and lags reported. The regression includes day of week, month, and year fixed effects. Controls for other majors tourist events such as sporting events are included but not reported for space in this table but are instead presented in later tables.

Pacers games had no statistically significant results for the day of or for leads or lags and thus were not reported. This was true for regular season games as well as postseason games. This lack of a result mirrors the lack of result in Depken and Stephenson (2018) for Charlotte Bobcat games. It is for these reasons, that while we excluded several other local sports, there was little reason to believe that there would be a result for Minor League Baseball if the NBA drew such meagre impact. Likely the only impact that NBA teams generate from visitors outside the area is for the traveling teams, beat reporters, and the occasional crew for an NBA prime time game. Much the same could be said for the Women’s National Basketball Association, Minor League Baseball, and Major League Soccer.

The bigger and one-off events seemed to be an interesting comparison group for conventions, as the local sports teams would be lucky to equal an amount of impact over one season as just one day of Gen Con. The Big Ten college football championship results are presented in Table 8, which Indianapolis has hosted since its inception, generated an additional \$2,000,000 in hotel revenue, and 10,000 hotel stays. This was only a one-day event, but it generated around \$1,047,000 in revenue the night before, \$437,000 the day after the game, and \$587,000 the second day after the game.

Table 8. The impact of Big 10 football championship and basketball tournament games on the hotel industry.

Dependent Variable	ADR	Revenue	Demand	Occupancy	RevPar
Mean	95.96	1936.13	19,481.74	62.33	61.91
Big 10 Football Championship Lead 2	10.46 *** (3.155)	369.3 * (150.8)	2704.2 ** (961.6)	8.535 ** (3.079)	11.66 * (4.807)
Big 10 Football Championship Lead 1	34.54 *** (3.173)	1047.2 *** (151.6)	4687.5 *** (966.9)	14.80 *** (3.096)	33.27 *** (4.834)
Big 10 Football Championship	45.98 *** (3.180)	2028.9 *** (151.9)	10,173.9 *** (969.1)	32.40 *** (3.103)	64.58 *** (4.845)
Big 10 Football Championship Lag 1	12.69 *** (3.182)	437.4 ** (152.0)	3073.1 ** (969.7)	9.881 ** (3.105)	14.03 ** (4.848)
Big 10 Football Championship Lag 2	12.80 *** (3.184)	587.7 *** (152.1)	4822.1 *** (970.3)	15.37 *** (3.107)	18.70 *** (4.850)
R-squared	0.773	0.7051	0.6714	0.667	0.7034

Notes: N = 3652 in all specifications. Standard errors in parentheses. *, **, and *** correspond to 10%, 5%, and 1% significance levels. All statistically significant leads and lags reported. The regression includes day of week, month, and year fixed effects. Controls for other majors tourist events such as sporting events are included but not reported for space in this table but are instead presented in later tables.

This effect was similar in scale to the impacts seen for the Indy 500, shown in Table 9. The Indy 500 effects started to become significant 2 days before the race, with rates in the Indianapolis Area going up by 52.56 two days before and was approximately \$64 dollars more the day before race day and race day. This led to a drop in ADR for up to 4 days afterwards. The revenue story showed \$1.4 million two days before, \$2.5 million the day before, and roughly \$2.3 million the day of.

Table 9. The impact of the Indy 500 and the Brickyard 400 on the hotel industry.

Dependent Variable	ADR	Revenue	Demand	Occupancy	RevPar
Mean	95.96	1936.13	19,481.74	62.33	61.91
Indy 500 Lead 2	52.56 *** (3.024)	1404.1 *** (144.5)	1350.4 (921.6)	4.331 (2.951)	44.94 *** (4.607)
Indy 500 Lead 1	64.57 *** (3.025)	2512.3 *** (144.5)	6329.5 *** (921.9)	20.20 *** (2.952)	80.23 *** (4.608)
Indy 500	64.95 *** (3.024)	2313.9 *** (144.5)	8898.5 *** (921.6)	28.47 *** (2.951)	74.00 *** (4.607)
Indy 500 Lag 1	-17.55 *** (3.026)	-1114.9 *** (144.6)	-9196.1 *** (922.2)	-29.37 *** (2.953)	-35.57 *** (4.610)
Indy 500 Lag 2	-14.05 *** (3.014)	-885.5 *** (144.0)	-6380.2 *** (918.5)	-20.37 *** (2.941)	-28.24 *** (4.592)
Indy 500 Lag 3	-9.678 ** (3.014)	-638.1 *** (144.0)	-4327.5 *** (918.6)	-13.80 *** (2.942)	-20.30 *** (4.592)
Indy 500 Lag 4	-7.591 * (3.009)	-487.8 *** (143.8)	-3272.1 *** (917.2)	-10.44 *** (2.937)	-15.53 *** (4.585)
Brickyard 400 Lead 2	15.17 *** (2.994)	516.6 *** (143.1)	1738.0 (912.6)	5.719 (2.922)	16.80 *** (4.562)
Brickyard 400 Lead 1	18.88 *** (2.995)	804.5 *** (143.1)	3584.8 *** (912.7)	11.59 *** (2.923)	25.98 *** (4.562)
Brickyard 400	14.46 *** (2.995)	533.6 *** (143.1)	3144.7 *** (912.7)	10.18 *** (2.923)	17.23 *** (4.563)
R-squared	0.773	0.7051	0.6714	0.667	0.7034

Notes: N = 3652 in all specifications. Standard errors in parentheses. *, **, and *** correspond to 10%, 5%, and 1% significance levels. All statistically significant leads and lags reported. The regression includes day of week, month, and year fixed effects. Controls for other majors tourist events such as sporting events are included but not reported for space in this table but are instead presented in later tables.

This did appear to have an offset as revenues were lower up to 4 days after the Indy 500. This is not consistent with the Big 10 Football game effects at all. Though the scope of the 500 was massive, it had noticeable local effects. The Brickyard 400 was more consistent with the conventions but had a lead in that was significant 2 days before the event, though no negative shocks to revenue or ADR occurred.

Table 10. The impact of NCAA Basketball Final 4, NCAA Tournament, and Big Ten Basketball Tournament on the hotel industry.

Dependent Variable	ADR	Revenue	Demand	Occupancy	RevPar
Mean	95.9627	1936.136	19,481.74	62.33535	61.91022
NCAA Final 4 Lead 2	23.62 *** (6.608)	478.4 (315.7)	550.3 (2014.1)	1.695 (6.450)	15.50 (10.07)
NCAA Final 4 Lead 1	70.51 *** (6.624)	2357.7 *** (316.5)	5930.3 ** (2018.8)	19.38 ** (6.465)	77.04 *** (10.09)
NCAA Final 4	84.98 *** (3.862)	3087.1 *** (184.5)	9902.4 *** (1177.2)	32.06 *** (3.770)	100.5 *** (5.885)
NCAA Tournament	7.760 * (3.176)	325.3 * (151.7)	1354.2 (967.9)	4.408 (3.100)	10.52 * (4.839)
Big Ten Basketball Tournament	7.274 *** (1.522)	311.4 *** (72.71)	1627.0 *** (463.8)	5.226 *** (1.485)	9.984 *** (2.319)
R-squared	0.773	0.7051	0.6714	0.667	0.7034

Notes: N = 3652 in all specifications. Standard errors in parentheses. *, **, and *** correspond to 10%, 5%, and 1% significance levels. All statistically significant leads and lags reported. The regression includes day of week, month, and year fixed effects. Controls for other majors tourist events such as sporting events are included but not reported for space in this table but are instead presented in later tables.

NCAA Tournament Games (excluding the Final Four) generated around \$325,000 per day of the Tournament and had no significant effects the day before or after, but the day of event effects were mildly significant. These results are presented in Table 10. The Big Ten basketball tournament was almost identical in coefficients to the NCAA normal tournament games.

The NCAA and Indianapolis have a cozy connection and as a result the NCAA Final Four has rotated twice through the city, and two more are scheduled in 2021 and 2026. The ADR increased by \$23.62 two days before the first Final Four Game, and the day before the first game the ADR was \$70.51 more than it would be otherwise. During the Final Four, the ADR was \$84.98 more (so room-rates were almost double the sample mean). This was reflected in the revenue, as revenue went from an imprecise \$478,000 2 days before tipoff. The day before, revenue went up \$2,357,000 and peaked during the tournament at \$3,087,000. The Final Four had no impact after the event though for any lag length. ADR returned to normal, and revenue was slightly negative, but hardly precise and not significant.

An event which has some elements of events that occur in the convention center, but utilize Lucas Oil Stadium, was included. Bands of America (BOA) Grand Nationals, which is a multi-day National High School Marching Band competition, was estimated to have brought in \$751,000 per day, and a little over \$440,000 for the day before and two days before. These results appear in Table 11. This event occurred annually and was not on the same weekend every year.

Another event we included was an International Champions Cup Association Football match between Inter Milan and Chelsea. These are games played in exhibition and could conceivably be a draw for audiences that might be willing to travel to see their favorite teams in Europe. However, in the case of the one game in our sample, there was no significant effects and ADR was unchanged implying that there was little fanfare, though this only one event from 2013. These results are not reported for space.

Table 11. The impact of Bands of America (BOA) Super Regionals and Grand Nationals on the hotel industry.

Dependent Variable	ADR	Revenue	Demand	Occupancy	RevPar
Mean	95.9627	1936.136	19,481.74	62.33535	61.91022
BOA Super Regionals	3.950 (2.482)	312.4 ** (118.6)	2312.6 ** (756.5)	7.259 ** (2.423)	9.825 ** (3.782)
BOA Grand Nationals Lead 2	8.595 ** (3.019)	442.3 ** (144.2)	2889.5 ** (918.6)	9.142 ** (2.942)	13.99 ** (4.599)
BOA Grand Nationals Lead 1	8.475 ** (3.016)	456.1 ** (144.1)	3362.8 *** (917.7)	10.72 *** (2.939)	14.52 ** (4.595)
BOA Grand Nationals	14.00 *** (1.655)	751.3 *** (79.07)	5226.3 *** (503.6)	16.76 *** (1.613)	24.04 *** (2.521)
BOA Grand Nationals Lag 1	7.565 * (3.051)	258.9 (145.8)	1758.1 (928.3)	5.646 (2.973)	8.316 (4.648)
BOA Grand Nationals Lag 2	9.648 ** (3.058)	477.0 ** (146.1)	3691.9 *** (930.6)	11.80 *** (2.980)	15.25 ** (4.659)
R-squared	0.773	0.7051	0.6714	0.667	0.7034

Notes: N = 3652 in all specifications. Standard errors in parentheses. *, **, and *** correspond to 10%, 5%, and 1% significance levels. All statistically significant leads and lags reported. The regression includes day of week, month, and year fixed effects. Controls for other majors tourist events such as sporting events are included but not reported for space in this table but are instead presented in later tables.

We present the NFL Combine results in Table 12. The NFL Combine though does register an uptick of ADR by \$6.4 the day before anything occurs, and over the course of the multi-day scouting event ADR is \$11.68 higher and stays up by \$9.50 the day after the combine. Revenues are up over \$359,000 during the event and the day after as well. Occupancy is up 11 percentage points the during the event and 12.46 percentage points the day after the event.

Table 12. The impact of the NFL Combine on the hotel industry.

Dependent Variable	ADR	Revenue	Demand	Occupancy	RevPar
Mean	95.9627	1936.136	19,481.74	62.33535	61.91022
NFL Combine Lead 1	6.438 * (3.022)	196.2 (144.4)	1150.8 (921.0)	3.766 (2.950)	6.370 (4.604)
NFL Combine	11.68 *** (1.247)	359.6 *** (59.56)	1571.9 *** (379.9)	5.275 *** (1.217)	11.77 *** (1.899)
NFL Combine Lag 1	9.538 ** (2.997)	388.7 ** (143.2)	1710.0 (913.5)	5.545 (2.925)	12.46 ** (4.566)
R-squared	0.773	0.7051	0.6714	0.667	0.7034

Notes: N = 3652 in all specifications. Standard errors in parentheses. *, **, and *** correspond to 10%, 5%, and 1% significance levels. All statistically significant leads and lags reported. The regression includes day of week, month, and year fixed effects. Controls for other majors tourist events such as sporting events are included but not reported for space in this table but are instead presented in later tables.

Finally, we present Super Bowl XLVI in Table 13. Super Bowl XLVI saw ADR rise by around \$30 5 days before the game, but as the game approached ADR increased by almost \$180 and peaked at \$235 on Super Bowl Sunday. Revenue rose \$988,000 5 days before, going to around \$5,779,000 more 3 days out, and Super Bowl Sunday hotel revenue increased by approximately \$8,230,000. Occupancy during the 3 days leading to and including Super Bowl XLVI and Final Four Game Days were very similar and pushed hotel occupancy by around 34 percentage points putting occupancy around 95%. These mega events saw no noticeable decrease in ADR or Revenue after the event which is interesting

considering the changes after the Indy 500. Demand was down but there was no real significance to the estimates for either event as soon as one day after.

Table 13. The impact of Super Bowl XLVI on the hotel industry.

Dependent Variable	ADR	Revenue	Demand	Occupancy	RevPar
Mean	95.96	1936.13	19,481.74	62.33	61.91
Super Bowl Lead 5	30.19 ** (9.319)	987.9 * (445.2)	4440.6 (2840.1)	13.46 (9.095)	30.77 * (14.20)
Super Bowl Lead 4	34.98 *** (9.316)	851.3 (445.1)	1915.9 (2839.4)	7.548 (9.093)	28.87 * (14.19)
Super Bowl Lead 3	179.9 *** (9.315)	5779.6 *** (445.1)	10,392.0 *** (2839.1)	35.24 *** (9.092)	190.2 *** (14.19)
Super Bowl Lead 2	205.4 *** (9.317)	6600.4 *** (445.2)	9766.3 *** (2839.6)	33.32 *** (9.093)	217.2 *** (14.20)
Super Bowl Lead 1	222.3 *** (9.324)	7297.1 *** (445.5)	10,104.3 *** (2841.7)	34.48 *** (9.100)	240.1 *** (14.21)
Super Bowl XLVI	235.4 *** (9.317)	8238.8 *** (445.2)	18,304.8 *** (2839.5)	60.68 *** (9.093)	270.2 *** (14.20)
R-squared	0.773	0.7051	0.6714	0.667	0.7034

Notes: N = 3652 in all specifications. Standard errors in parentheses. *, **, and *** correspond to 10%, 5%, and 1% significance levels. All statistically significant leads and lags reported. Controls for other majors tourist events such as sporting events are included but not reported for space in this table but are instead presented in later tables.

The larger events that Indianapolis hosts seemed to increase revenue with few events having decreased revenue following the event. The Indy 500 had a large impact but seemed to involve some crowding out and shifting that dampens the value that the event brings. The Big Ten Football championship was a massive draw, with regularity for a one-day event. The constant stream of tidy revenue streams from College basketball were interesting, although the more interesting story was the revenue from conventions. Gen Con running for its usual 4 days would generate over \$4,000,000 in additional hotel revenue during the event.

3.4. Placebo Test

In order to ensure that are results were not spurious, we conducted a placebo test. To mimic the multiday nature, we selected 40 groupings of 4 days to test whether the observation of increased hotel demand on convention days occurred by chance. This ensured that the placebo convention had a similar grouping to the actual conventions that occurred. To mimic the estimation of conventions, we included two leads and two lags for the placebo convention days. The choice of two was taken from the lack of results past the 2-day threshold from the start and end of the event.

Table 14 shows the results from using the placebo conventions to estimate our variables of interest. There was no significance in any variable, or any lead, lag, or event day for the placebo conventions. This supports the conclusion that conventions have a significant ability to impact hotel demand for Indianapolis.

Table 14. Placebo test on convention results.

Dependent Variable	ADR	Revenue	Demand	Occupancy	RevPar
Mean	95.9627	1936.136	19,482	62.33535	61.91022
Placebo Lead 2	0.112 (1.503)	30.88 (71.81)	274.0 (457.9)	0.621 (1.467)	0.687 (2.290)
Placebo Lead 1	1.480 (1.481)	79.02 (70.76)	533.3 (451.2)	1.487 (1.445)	2.249 (2.256)
Placebo Convention	0.927 (0.761)	50.00 (36.36)	445.4 (231.9)	1.262 (0.743)	1.434 (1.160)
Placebo Lag 1	-1.161 (1.474)	-24.66 (70.41)	61.40 (449.0)	0.0496 (1.438)	-0.959 (2.245)
Placebo Lag 2	-0.311 (1.472)	9.985 (70.32)	163.2 (448.4)	0.295 (1.436)	0.0421 (2.243)
R-squared	0.7729	0.7049	0.671	0.6669	0.7032

Notes: N = 3648 in all specifications. Standard errors in parentheses. The regression includes day of week, month, and year fixed effects. All other events are included but not reported for space.

4. Conclusions

This paper has examined the impact of conventions, and mega-events, on hotel demand and revenue for the city of Indianapolis, Indiana. This is aimed at attempting to uncover the impact of conventions to a major US city, by examining the effectiveness of conventions to bring in external tourism revenue. As such, it is a contribution to the literature on the promise of mega events (Jago et al. 2010) as well as the accumulated evidence of their effects on hotel revenue, and consequently hotel taxes (Bonneau and Hall 2020; Chikish et al. 2019; Depken and Stephenson 2018).

The impacts of these events tend to be positive and significant for the conventions in our sample. The effects of these conventions do not appear to crowd out hotel demand in the days afterwards, though larger events such as the Indy 500, Big Ten Football championship, and the NCAA Final Four might have such effects. For example, the Indy 500 generates around \$6,200,000 in hotel revenue a year, but over \$4,000,000 is lost over the next 4 days negating most of the increases in revenue with a dry spell afterwards.

The hotel tax rate in Indianapolis is 17%. This implies that each day of Gen Con generates \$202,130 in hotel tax revenue, FDCI generates \$174,250 in tax revenue, and FFA generates \$178,500. Considering the multiday nature, these events seem to be decent sources of tax revenue. Using the available dates for the 5 conventions studied, the 146 convention days generated \$135,488,000 over ten years. Using the 17% hotel tax rate, the convention days generated \$23,032,960 in tax revenue over the decade. It should be noted that this does not include other, much smaller conventions.

While this is a lot of tax revenue, it is important to remember that the convention center is not privately financed. The construction of Lucas Oil Stadium in 2008 and the \$275 million expansion of the convention center in 2011 received public support. The Indiana General Assembly financed both projects through hotel, car rental, and restaurant taxes (Associate Press 2011). The fact that the convention center expansion was tied up with the construction of Lucas Oil stadium and the demolition of the RCA Dome makes a full cost-benefit analysis outside the scope of this paper, but costs of the convention center must be acknowledged when evaluating the benefits.

Complicating issues for recouping the cost of the convention center expansion is the nationwide expansion of Airbnb in 2011. While we do not have direct data on Airbnb rentals, there is some evidence that Airbnb is used extensively in Indianapolis (Sisson 2019). While our fixed effects deal with the expansion of Airbnb over our sample, the existence of Airbnb certainly lessens the estimated effect of these events on hotel demand.

Another limitation of our study is that our data do not go back prior to 2010. The expansion of the convention center in 2011 may have represented a fundamental shift in the types of events

that Indianapolis could have attracted. As such, it would have been beneficial to have more years pre-expansion.

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Abbreviations

The following abbreviations are used in this manuscript:

ADR	Average Daily Rate
BOA	Bands of America
FDIC	Fire Department Instructors Conference
FFA	Future Farmers of America
NASCAR	National Association for Stock Car Auto Racing
NBA	National Basketball Association
NCAA	National Collegiate Athletic Association
NFL	National Football League
NRA	National Rifle Association
PGA	Professional Golfers Association
RevPar	Revenue Per Available Room
WNBA	Women's National Basketball Association

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