# ANALYSIS ON EMPLOYMENT IN THE CHARLOTTE METRO AREA BEFORE AND AFTER THE OPENING OF THE CHARLOTTE BOBCATS ARENA

By

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# ABSTRACT

BENITO LOPEZ. Analysis on employment in the Charlotte metro area before and after the opening of the Charlotte Bobcats Arena. (Under the direction of DR. CRAIG DEPKEN II)

This paper uses nonfarm employment data from the Charlotte-Concord-Gastonia, NC-SC MSA and the Raleigh-Cary NC MSA to measure the treatment effect on employment after the opening of Charlotte Bobcats Arena in Charlotte's center city district in 2005. Additionally, we measure the treatment effect on employment after the departure of the Charlotte Hornets NBA basketball team following the 2002 NBA season. The results show that opening new the arena in the center city district of Charlotte, North Carolina is associated with a positive effect on employment, and that not having an NBA basketball team (from 2002 to 2004) is also associated with a positive effect on employment. The results indicate that the positive effect on employment after the opening of Charlotte Bobcats Arena is not the result of Charlotte hosting an NBA expansion team the previous year, because the analysis shows that losing an NBA basketball team (not gaining one) is associated with a positive treatment effect on employment.

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# INTRODUCTION

Sports economists are interested in recent trends of public funds being used to finance professional sports facilities. Since the 1990s there has been a "construction boom" in new stadium construction, and it is estimated that between 1997 and 2015 an average of 56 percent of funding for new NFL stadiums were from public sources (Alakshendra 2016). The interest in public financing leads to the discussion of professional sports teams receiving subsidies to build or renovate stadiums or arenas. Proponents of public financing of sports stadiums and arenas would argue that the community will receive a benefit they had not received before. An intangible benefit the citizens in a community where a professional sports team resides might include "civic pride". Citizens might feel they are better off because their hometown demonstrates the qualities of a "world class" town due to the presence of professional sports. It is true that all cities cannot have professional sports teams due to the supply. Sports economists are interested in the possibility that professional sports teams use their monopolistic influence to receive public funding to build or renovate stadiums and arenas, and are concerned that these are not the best investments of public funds.

There is an opportunity cost for a sports team owner to receive public funding to build a stadium or arena for his or her team to play. That is money not being allocated or invested into other community projects. But in addition to the efficiency argument about where public funding ought to be invested, it is not widely accepted by academic economists that public financing of professional sports stadiums or arenas return an economic benefit that justifies the investment.

Following the 2001-2002 NBA basketball season, the Charlotte Hornets had departed its host city, Charlotte, North Carolina, to play in New Orleans, Louisiana. Only a short period later, in 2004, the city of Charlotte would be the host of an NBA basketball team once again. The Charlotte Bobcats were the new NBA expansion basketball team, and Charlotte was their home. The Bobcats had played their first season in the Hornets' old arena, the Charlotte Coliseum. By their second season, however, the Charlotte Bobcats had a new permanent home at the Charlotte Bobcats Arena (now Spectrum Center) in the center city district in Charlotte, North Carolina.

In this paper I will analyze economic net benefits in the labor market. I measure differences in employment in the Charlotte area from before and after the opening of the Charlotte Bobcats Arena. I will also measure the differences in employment in the Charlotte area from before and after the departure of the Charlotte Hornets NBA basketball team for New Orleans, Louisiana. I will use a differences-in-differences methodology with regression and I will control for macroeconomic activity using the GDP growth rate in the estimated equations. The Charlotte metropolitan statistical area (MSA) will be the treatment population for the analysis, and the Raleigh MSA will be the control population for the analysis.

I want to show that in the particular case for Charlotte, North Carolina, holding all other things constant, employment had increased following the opening of the new basketball arena in the center city district. There exists a supporting literature that a city does not receive significant economic benefits simply for having a professional sports team, however it is suggested that with a comprehensive plan for economic growth or revitalization, some cities have shown positive net economic benefits from a new stadium

or arena; particularly in their downtown areas, as opposed to the city's perimeter or suburban areas. We examine before and after the departure of the Hornets from Charlotte to test for negative impacts on employment. A negative impact on employment in the period where Charlotte did not have an NBA basketball team will support the argument that a city having a team can achieve net economic gains after receiving a professional sports team, but a positive impact on employment will do the opposite.

In this paper I will discuss the unique story of Charlotte's NBA basketball teams: the Charlotte Hornets, and the Charlotte Bobcats. Additionally, I will examine the literature describing different methods of measuring economic benefits to a community as the communities in question relate to hosting professional sports teams. Subsequent sections in this paper describe the data, methods, results and conclusions of our research on this topic.

# THE CHARLOTTE HORNETS

The Charlotte Hornets NBA basketball team is a story of two franchises. In 1988, the original Hornets began their tenure in Charlotte, North Carolina, playing at the Charlotte Coliseum. While Charlotte is home to the Carolina Panthers NFL football team, the Hornets were the City's first major professional sports team. Basketball fans in Charlotte immediately connected with the new team, and the team was well received over time. On the night of the Hornet's first game in the Charlotte Coliseum, the team lost by forty points (a very large margin in professional basketball), but still received a standing ovation from the fans in attendance. The team had gone on to sell out 364 consecutive games at the Charlotte Coliseum, which included every game for seven consecutive seasons. The success and attention of the Charlotte Hornets had provided enough interest in the town to host the 1994 NCAA Final Four college basketball tournament at the Charlotte Coliseum. This event was certainly an achievement for the city, and it had earned extraordinary positive attention to the extent that then president Bill Clinton was in attendance to witness his favorite college basketball team, the Arkansas Razorbacks win the national championship game against North Carolina's own Duke University.

In later years the fans and the Charlotte community, however, had a public falling out with the owner of the team, George Shinn, over a series of public scandals, and the team had lost a good share of its popularity. In 2002, unable to reach a deal with the City of Charlotte over a replacement arena, Shinn moved the team to New Orleans, Louisiana. Charlotte was left without an NBA basketball team.

In 2004 Charlotte had received a new NBA expansion team, the Charlotte Bobcats. The Bobcats played their first season, 2004-2005, in the Charlotte Coliseum, where the Hornets had previously called home. The following season the Charlotte Bobcats had moved into their new permanent home, the Charlotte Bobcats Arena. The Charlotte Bobcats Arena was built in the center city district of Charlotte, and is known today as the Spectrum Center. In 2007 the Charlotte Coliseum was demolished.

In 2013, the New Orleans Hornets had changed their names to the New Orleans Pelicans. In 2014, the Charlotte Bobcats officially change their name to the Charlotte Hornets. The same year, the Charlotte Hornets restored the history and statistics of the original Charlotte Hornets team from when they played in the Charlotte Coliseum, along with the franchise's history as the Charlotte Bobcats.

# LITURATURE REVIEW

In this section I review research done on this topic. Some sports economists have taken to various methods of valuating professional sports franchises, stadiums, or arenas. Others are interested in the economic implications associated with teams and stadiums or arenas entering and exiting a community. While this paper analyzes the treatment effect of a sports arena opening in the center city district of a major city, Charlotte, North Carolina, other methods of sports team valuation and analysis of marginal changes were reviewed. In this section, I visit various methods researchers have used to measure changes in local economies following the announcement or development of a professional sports stadium or arena. I also review the literature in order to understand the potential economic impacts the community receives from the franchise and cash inflows due to tourism associated with professional sports teams, stadiums and arenas, and major sporting events.

One reason to consider sports team franchise or stadium/arena valuation is to evaluate whether or not publicly sourced subsidies are necessary or an appropriate means of distributing public funds. That is, does the public ultimately receive a greater economic benefit when compared to the cost of subsidizing the stakeholders of sports franchises or facilities (Bade-Dye 1990; Coates-Humphreys 2000; Alexander-Kern-Neill 2000; Siegfried-Zimbalist 2006; Coats 2007; Dehring-Depken-Ward 2007; Yates 2009; Santo 2016; Depken-Stephenson 2018)? Other research evaluates the methods of valuating a franchise or stadium/arena; calling into questions the methods, the data, and the underlying assumptions (Késenne 2006; Walker-Enz 2006).

Yates (2009) focuses interest on the revitalization of downtown areas of cities. The author argues that building a new sports facility is often part of a comprehensive redevelopment plan, and continues that the facility is integral in attracting visitors from outside the area. Increased spending in the downtown districts, in particular, benefit a city's hospitality industry overall. In the paper Yates suggests that the presence of a professional sports team in a city "qualifies it [the city] as 'major league'"; supporting the argument that in some capacity, public financing of sports franchises and/or their facilities is an appropriate investment into the community because of increased revenues, and potentially an increase in the number of jobs in the area.

The author does not provide an econometric approach to the discussion of publicly funding or subsidizing a sports franchise or facility, but does analyze claims of successful and unsuccessful publicly financed investments in sports teams. The paper cites a claim by the Tampa Bay Rays Major League Baseball (MLB) franchise, arguing that building a new baseball stadium in St. Petersburg, FL will "pump" $1 billion into the economy and will create 2,500 permanent jobs, namely retail and office. The author does address concerns from opponents that claim sports' stadiums and/or arenas will not produce additional income to an economy, but instead will divert spending from other local entertainment. An unsuccessful example provided references the development of the AT&T Center, home of the NBA basketball team, the San Antonio Spurs, where the surrounding area has not experienced measurable economic change. The paper explains that the community didn't benefit from the AT&T Center economically, because the arena was not built in the downtown area with a comprehensive revitalization plan.

Coates and Humphreys (2000) addresses the fact that much of the expense of a professional sports facility is funded by taxpayers. When a professional sports team moves to a new city, or renews a contract and stays in a city, taxpayers often pay for the new stadium or arena, renovations to an existing facility, and also pay for infrastructure that support the arena. Sports franchise owners often leverage the monopoly power of the team to influence political stakeholders and business owners to support public financing of the facilities. Proponents of stadium and arena subsidies often hire consultants that estimate economic benefits in dollars and jobs that a community will receive should the local government invest in sports franchises and their facilities. While there are measurable increases in employment, there is some disagreement between consultants and academic economists whether or not incomes increase. It is common that consultants who provide these "advocacy studies" are almost always commissioned by proponents of publicly financed projects and stakeholders of stadiums and arenas.

The paper discusses faults in the methods employed in advocacy studies. It is suggested that parameters used in multiplier effects are often misrepresented by the consultants. Critics of this method argue that by estimating the total revenue generated by additional inflows is recirculated continually, as inflows recirculate in the economy, but often these estimates lack certain controls such as tax rates and the substitution effect; where money spent at a new stadium would have been spent elsewhere in the community. Another argument is that advocacy studies do not consider other possible investment opportunities. Public funds spent on professional sports teams and facilities are not spent in other places the community can benefit like infrastructure or public education. Additionally, advocacy studies put value on "civic pride". Like Yates (2008), the notion

of the community being proud of their sports team may hold intrinsic value, but is hard to measure in economic terms.

The authors of the paper describe two econometric approaches to quantify the effects of a new stadium in a community. The first method analyzes city specific factors over time in metropolitan areas to estimate income and income growth. The second method applies an event study to analyze the effect on income in a local economy. The results indicate that: the professional sports environment had no measurable impact on the growth rate of income in the areas sampled; and the professional sports environment has a negative impact on level income in the areas sampled.

Coates (2007) discusses the recent trend (since 1990) of new stadium and arena construction. While the paper focuses on subsidies received by the professional sports franchise owner, it also discusses different methods that have been used to measure economic impacts a new stadium or arena have on a community. The author cites an extensive list of literature that apply econometric methods to this research topic. The paper references the works of Tu (2005), and Carlino and Coulson (2004) who have used hedonic regression to estimate the value of stadiums and professional sports teams. Tu analyzed property values surrounding FedEx Field near Washington DC, and found that the price discount on properties near the stadium was smaller after the development of the stadium compared to before. Tu's results support the argument that the closer a property is to the stadium, the higher the property value. Coates points out, however, that Tu did not include confounding detail regarding nearby arena, U.S. Airways Arena, and suggests the results may be biased.

Carlino and Coulson (2004) analyzed wages and rents in cities hosting NFL football teams in regression models. Regarding wages, the researchers did not find conclusive results. The coefficient in the estimated model representing the presence of an NFL football team did not prove to be statistically significant at a reasonable level. Regarding rents, the researchers found a positive association for properties in central cities of metropolitan areas, but had weaker results for broader geographic areas. Coates, Humphreys, and Zimbalist (2006), however, show that omitted data relating to low rent properties provides evidence of bias in Carlino and Coulson (2004), and criticizes the methods as being "unreliable".

Coates (2007) discusses an alternative to hedonic regression, namely contingent valuation. Contingent valuation uses nonmarket determined data to value a stadium or arena. One approach utilizes a survey of individuals' willingness to pay for attendance. Once survey data is collected, the researcher will attempt to construct an inverse demand curve, and the demand curves are used to estimate consumer surplus. Coates (2007) applies contingent valuation models to various NFL football teams, and NHL hockey teams, and finds consumer surplus exceeds the cost of construction of the stadiums and arenas.

Alexander, Kern, and Neill (2000) evaluates the subsidies a professional sports team receives in stadium construction costs against justifying the level of public spending in contrast to other potentially publicly financed projects. The authors note that many academic economists have investigated net gains in communities following large public investments in local professional sports stadiums, and have found that benefits to income and employment are negligible. The authors do, however, argue that while net economic

benefit isn't distributed throughout the community, sports fans receive consumer surplus while attending games, and that when a local professional sports team is doing well, the community receives an externality, and civic pride becomes a public good. The paper describes calculating consumer surplus from historical ticket prices and attendance records. While the paper did not attempt to calculate a demand curve (or inverse demand curve), different levels of consumer surplus depend on different price elasticities of demand. The paper described a range of public funding vs. consumer surplus scenarios to justify public funding for various NFL football, NHL hockey, NBA basketball, and MLB baseball stadiums and arenas. The authors found it, overall, not beneficial for a city to invest public funding into subsidizing the construction of a professional sports stadium on the basis of consumer surplus to the fans attending the sporting event.

Dehring, Depken and Ward (2007) analyzes the impacts on housing prices following five announcements of future locations for stadiums to host the Dallas Cowboys NFL football team. The paper explains that initial expenditures into a community are often difficult to measure, but positive externalities that result from such expenditures become public goods that are represented in the cost of admission into a community. That is, individuals are willing to pay more on average to live in a community with certain desirable public goods, and this is ultimately reflected in housing costs. The paper describes an area having a professional sports team as an overall city amenity which has a positive impact on housing prices, an increase in taxes on residents to fund a new or renovated stadium has a negative impact on housing prices, and proximity to the arena or stadium has an ambiguous effect.

In 2004 the Dallas Cowboys NFL football team had announced that they would likely be moving the team from Irving, Texas, just outside of Dallas to downtown Dallas. Less than two months after the initial announcement the franchise had announced they would not be hosting the Dallas Cowboys NFL football team in the previously announced location. Other subsequent announcements followed regarding the new announced location, Arlington, Texas. The authors apply a differences-in-differences analysis to measure the treatment effects on property prices in and around the Dallas and Arlington areas following the franchise announcements on where the team will reside. To control for other known pricing factors, the authors specify the regression model in the differences-in-differences analysis using a hedonic regression functional form.

Results from the analysis show after the first announcement, Dallas Cowboys NFL football team moving from Irving to downtown Dallas, show property values in Dallas had increased, while property values in the remaining Dallas County had decreased in value. Following the second announcement, Dallas Cowboys NFL football team is not moving to downtown Dallas, property values in Dallas and remaining Dallas County had returned to their original values (values prior to the first announcement). Following the remaining announcements about moving the team to Arlington, Texas, average property values in Arlington had dropped by $1,700 on average, approximately the same amount of the discounted tax burden per resident. The results in Arlington suggest there is no added amenity for Arlington residents as a result of the Dallas Cowboys NFL football team moving to Arlington, Texas.

Depken and Stephenson (2018) analyzes impacts of political conventions and sporting events in Charlotte, North Carolina; and not the impact of a particular team or

facility. The authors use high-frequency hotel occupancy data to measure impacts on the days surrounding the events. The econometric method for evaluating net impacts on hotel attributes is a time-series model which estimates hotel room demand, daily rates charged, and the hotel's total revenue. The model includes confounders to control for seasonality and macroeconomic conditions. Additionally, the dependent variable is estimated over four geographic boundaries in order to measure net impacts on hotels in different parts of the Charlotte metropolitan statistical area.

The results of Depken and Stephenson (2018) show that multi-day events, particularly those where visitors come in from outside the area, had a substantial effect on the number of rooms, average daily rates, and total revenue. Single day events such as bowl games and NFL games had a positive impact on the number of rooms, and total hotel revenues; but not for two days before the event or two days after the event. Other events such as NBA regular season basketball games were not associated with impacts to number of rooms, average daily rates charged, or total hotel revenue.

# DATA AND METHODS

My goal is to measure whether or not there is any difference in employment levels in the Charlotte metropolitan statistical area, between the time before the Charlotte Bobcats Arena was open for business and after. I consider the Charlotte MSA as receiving the treatment, opening a new stadium in the center city district. I examine the Raleigh MSA as a control for comparison, and apply a differences-in-differences analysis. I use Ordinary Least Squares (OLS) Regression to estimate the differences before and after October, 2005, the month Bobcats' Arena was open to the public. My dependent variable in the analysis is total nonfarm employment at the MSA level. I collected total nonfarm employment figures from the Federal Reserve Economic Data (FRED) repository provided by the Federal Reserve Bank of St. Louis. The employment figures are represented monthly from January, 1990 to December 2018. I will describe the methods in more detail towards the end of this section.

I will apply an additional differences-in-differences analysis with the same two MSA's as a treatment and control to test for a negative treatment effect on employment in the Charlotte MSA following the departure of the original Charlotte Hornets NBA basketball team. I want to differentiate the effects of the arena opening in the center city district from any subsequent effects the new NBA expansion basketball team, the Charlotte Bobcats, have on employment in the Charlotte MSA. A negative treatment effect following the exit of the Hornets to play in New Orleans would suggest that a treatment effect on employment is related to the population gaining or losing an NBA basketball team. However, a positive treatment effect or no measurable effect on

employment in the Charlotte population following the exit of the Hornets suggests that a new NBA basketball team is not associated with a positive change in employment. This will provide support that the arena, itself being the treatment, precedes an increase in employment on average, and is not because of the acquisition of an NBA basketball team. For this second differences-in-differences analysis the before time period is from January, 1990 to May, 2002[1]; and the after time-period is from June, 2002 to September 2004, the time period where Charlotte, NC did not have an NBA basketball team.

Charlotte and Raleigh are the two largest cities in North Carolina with populations 872,498 and 469,298, respectively. The two cities are amongst the fastest growing in North Carolina. From 2016 to 2017, Charlotte had grown 1.8 percent, while Raleigh had grown 1.2 percent over the same time period.[2] Tables 1-3 describe additional demographic similarities between Mecklenburg County, NC and Wake County, NC; homes to Charlotte and Raleigh, respectively. Information from Tables 1-3 are 2018 estimates provided by the U.S. Census Bureau. I will address similar characteristics between the two communities that suggest the Raleigh MSA is an appropriate control population in a differences-in-differences analysis against the Charlotte MSA.

[1] The Charlotte Hornets were defeated in the NBA Playoffs in May 2002 by the New Jersey Nets, ending their final season in Charlotte, NC.

[2] For more information on this see "Majority of North Carolina Cities Have Grown Since 2010", by the North Carolina Office of State Budget and Management, available at: https://files.nc.gov/ncosbm/documents/files/NC_PlaceEst2017.pdf

Table 1 - Mecklenburg County and Wake County Race and Hispanic Origin Comparison

| | Mecklenburg County, NC | Wake County, NC |
|---|---|---|
| White Alone | 57.5% | 68.1% |
| Black and African American Alone | 32.9% | 21.0% |
| American Indian and Alaska Native Alone | 0.8% | 0.8% |
| Asian Alone | 6.4% | 7.5% |
| Native Hawaiian and Other Pacific Islander Alone | 0.1% | 0.1% |
| Two or More Races | 2.4% | 2.5% |
| Hispanic or Latino | 13.6% | 10.3% |
| White Alone, Not Hispanic or Latino | 46.4% | 59.8% |

Table 1 describes similar racial and Hispanic origin population distributions between the two counties in which Charlotte and Raleigh reside; Mecklenburg County, NC, and Wake County, NC. The number of people identifying as 'White Alone' between the two counties are different by about 10 percent, with Wake County having the larger percentage of white citizens. The number of people identifying as 'Black and African American Alone' differ by about 12 percent between Mecklenburg County and Wake County. Mecklenburg County has a higher percentage of black and African American citizens. The two counties share more similar percentages of other racial and Hispanic origin groups: 'American Indian and Alaskan Native Alone' rates are 0.8% and 0.8%, 'Asian Alone' are 6.4% and 7.5%, 'Native Hawaiian and Other Pacific Islander Alone'

are 0.1% and 0.1%, 'Two or More Races' are 2.4% and 2.5%, 'Hispanic and Latino' are 13.6% and 10.3%, and 'White Alone, Not Hispanic or Latino' are 46.4% and 59.8% for Mecklenburg County and Wake County, respectively[3].

Table 2 - Mecklenburg County and Wake County Housing Comparison

| | Mecklenburg County, NC | Wake County, NC |
|---|---|---|
| Owner-Occupied Housing Rate | 56.5% | 63.9% |
| Median Value of Owner-Occupied Housing | $219,800 | $265,800 |
| Median Selected Monthly Owner Costs (with a Mortgage) | $1,462 | $1,612 |
| Median Gross Rent | $1,099 | $1,102 |

Table 2 illustrates statistics describing the characteristics of housing in Mecklenburg County and Wake County. Owner-occupancy is where the purchaser of a residential property lives in the property versus the alternative, purchasing the property as an investment. Owner-occupancy describes home ownership in a community. Owner-occupancy rates for Mecklenburg County and Wake County are 56.5 percent and 63.9 percent, respectively; approximately a 7 percent difference. Median value of owner-occupied homes are in the two hundred thousands in Mecklenburg County and Wake County, $219,800 and $265,800 respectively. Median selected monthly owner costs are $1,462 in Mecklenburg County and $1,612 in Wake County. Finally, median gross rent

[3] Racial demographic segments have persons reporting only one race or persons reporting two or more races. Hispanic can refer to a person of any race and are also counted in other race categories.

in Mecklenburg County is $1,099 and $1,102 in Wake County. Median monthly owner costs are $1,558, and median gross rent is $1,023 nationally.

Table 3 - Mecklenburg County and Wake County Education Comparison

| | Mecklenburg County, NC | Wake County, NC |
|---|---|---|
| High School Graduate or Higher (persons age 25+) | 90.1% | 92.7% |
| Bachelor's Degree or Higher (persons age 25+) | 44.8% | 51.8% |

Table 3 describes education rates for the two counties. For high school graduate or higher, the Mecklenburg County is at 90.1% and Wake County is at 92.7% of their respective populations. Similarly, 44.8% of Mecklenburg County residents have bachelor's degrees or higher, while 51.8% of Wake County residents have bachelor's degrees or higher. Nationally, the high school graduate or higher rate is 87.7%, and the bachelor's degrees or higher rate is 31.5%.

I collected employment data from the Federal Reserve Economic Data (FRED) series. I analyze total nonfarm employment from the Charlotte MSA, and from the Raleigh MSA. The employment data are seasonally adjusted, and are reported in thousands of persons. The frequency of the employment data is monthly, and represents the period between January, 1990, and December 2018. In this paper, I analyze two treatments the Charlotte Metro area had received: the opening of Bobcats Arena in 2005, and the departure of the Hornets NBA basketball team from Charlotte. Additionally, I

control for confounding macroeconomic activity by including the national GDP growth rate in our analysis. Table 4 below describes the time periods for the two parts of the analyses.

Table 4 - Treatment 1 and Treatment 2 Date Ranges

| | Treatment 1: Bobcats Arena Opens | Treatment 2: Hornets Leave Charlotte |
|---|---|---|
| Before Begins | Jan 1990 | Jan 1990 |
| Before Ends | Sep 2005 | May 2002 |
| After Begins | Oct 2005 | June 2002 |
| After Ends | Dec 2018 | Sep 2004 |

To identify differences in employment before and after the opening of Charlotte Bobcats Arena, we apply a differences-in-differences analysis. For the analysis, I assign the Charlotte MSA as the city receiving the treatment, opening an arena in the center city district of Charlotte, and I assign the Raleigh MSA as the control city. Table 5 below describes the summary statistics of the total employment data and national production data we use in our analysis for our first treatment.

Table 5 - MSA Employment and National GDP Growth Rate Before and After Opening the Charlotte Bobcats Arena

| | Before Bobcats Arena | After Bobcats Arena | Difference |
|---|---|---|---|
| Charlotte MSA Employment | 826.3<br>(97.3) | 1,049.1<br>(81.8) | 222.8 |
| Raleigh MSA Employment | 385.7<br>(57.6) | 544.6<br>(46.8) | 158.9 |
| Difference | 440.6 | 504.5 | 63.9 |
| National GDP Growth Rate | 0.77%<br>(0.54%) | 0.43%<br>(0.60%) | -0.34% |

The period represented in the data before Charlotte Bobcats Arena was opened to the public is from January, 1990 to September, 2005. The period represented in the data after Charlotte Bobcats Arena was opened is from October, 2005 to December, 2018. For the period before the opening of the arena, the mean employment level for the Charlotte MSA is 826.3 thousand people, with a standard deviation of 97.3. For the period after, the mean employment level for the Charlotte MSA is 1,049.1 thousand people, with a standard deviation of 81.8. For the period before the arena was opened, the mean employment level for the Raleigh MSA is 385.7 thousand people, with a standard deviation of 57.6 people. For the period after, the mean employment level for the Raleigh MSA is 544.6, with a standard deviation of 46.8. For the period before the arena was opened, the mean GDP growth rate in the U.S. is 0.77% with a standard deviation of 0.54%. For the period after the arena, the mean GDP growth rate in the U.S. is 0.43%, with a 0.6% standard deviation. The mean GDP growth rate in the U.S. is 0.34% lower in the second period compared to the first.

After the opening of the arena, Charlotte MSA mean employment is 222.8 thousand higher than the mean before the arena. After the opening of Bobcats Arena in Charlotte, Raleigh MSA mean employment is 158.9 thousand higher than the mean before the arena. Before the opening of Bobcats' Arena in Charlotte, Charlotte MSA mean employment is 440.6 thousand higher than Raleigh MSA mean employment. After the opening of Bobcats' Arena in Charlotte, Charlotte MSA mean employment is 504.6 thousand higher than Raleigh MSA mean employment. The difference-in-differences of the means gives us the unconditional treatment effect of 63.9 thousand persons employed. That is, by only comparing the changes in the unconditional mean employment levels, in the period after Bobcats' Arena opened to the public, the community that received the treatment (Charlotte MSA) experienced an increase in total employment by 63.9 thousand persons. I will evaluate the conditional treatment effect of the opening of Bobcats' Arena in Charlotte on employment using regression while controlling for changes in the national GDP growth rate in the next section.

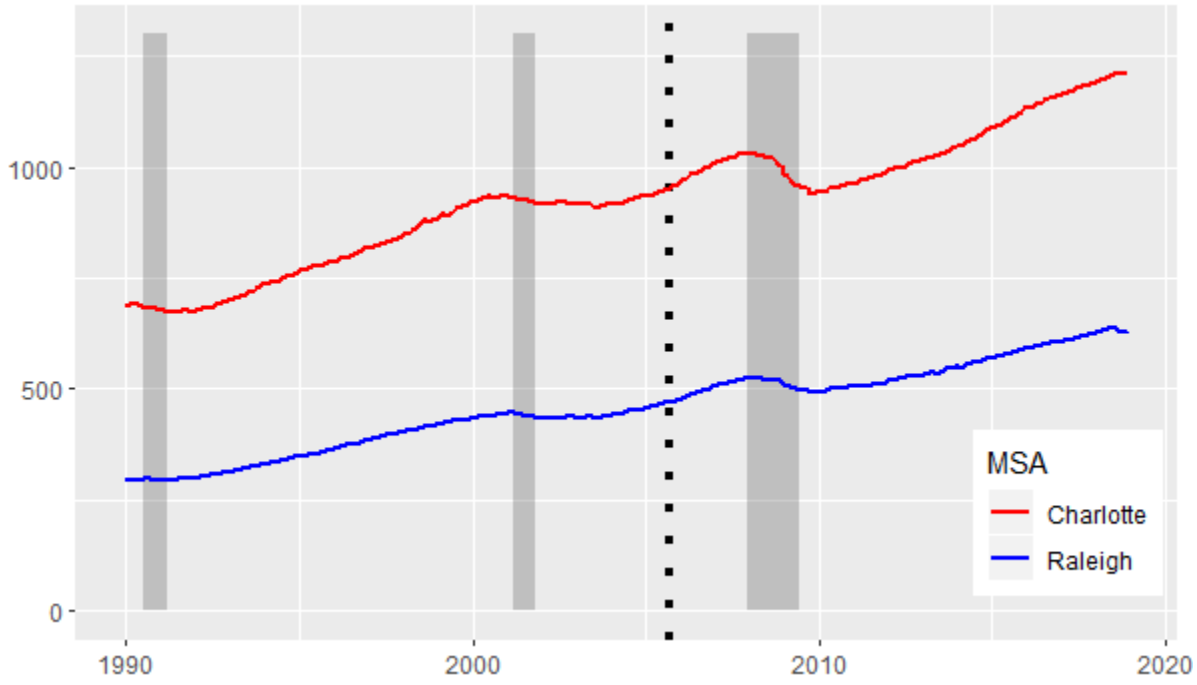


Figure 1 - MSA Employment in Charlotte and Raleigh (Jan 1990 – Dec 2018)

Figure 1 illustrates employment levels in the Charlotte and Raleigh MSAs from January 1990 to December 2018, the periods sampled before and after the opening of Bobcats Arena. GDP growth rates are represented as recessionary periods in gray. The two series have different levels but follow similar trends (described by a visual representation). It appears that in the period leading up to the opening of the area in Charlotte's center city district, both the Charlotte MSA and the Raleigh MSA levels share a similar trend. Recessionary periods impact both time-series, but visually it appears that the Charlotte MSA is more sensitive than the Raleigh MSA is to decreased production.

Table 6 - MSA Employment and National GDP Growth Rate Before and After the Charlotte Hornets Leave Charlotte

| | Before Hornets Leave Charlotte | After Hornets Leave Charlotte | Difference |
|---|---|---|---|
| Charlotte MSA Employment | 799.7<br>(93.0) | 918.8<br>(5.5) | 119.0 |
| Raleigh MSA Employment | 369.3<br>(53.9) | 440.6<br>(5.9) | 71.4 |
| Difference | 430.5 | 478.1 | 47.6 |
| National GDP Growth Rate | 0.76%<br>(0.57%) | 0.79%<br>(0.42%) | 0.03% |

The period represented in the data before the Hornets leave Charlotte, the mean employment level for the Charlotte MSA is 799.6 thousand people, with a standard deviation of 93.0. For the period after the Hornets leave Charlotte, the mean employment level for the Charlotte MSA is 918.8 thousand people, with a standard deviation of 5.5. for the period before the Hornets leave Charlotte, the mean employment level for the Raleigh MSA is 369.3 thousand people, with a standard deviation of 53.9. For the period after the Hornets leave Charlotte, the mean employment level for the Raleigh MSA is 440.6 thousand people, with a standard deviation of 5.9. For the period before the Hornets leave Charlotte, the mean GDP growth rate in the U.S. is 0.76% with a standard deviation of 0.57%. For the period after the Hornets leave Charlotte, the mean GDP growth rate in the U.S. is 0.79% with a standard deviation of 0.42%. The mean GDP growth rate in the U.S. is 0.03% higher in the second period compared to the first.

After the Hornets leave Charlotte, Charlotte MSA mean employment is 119.0 thousand higher than the mean before their departure. After the Hornets leave Charlotte, Raleigh MSA mean employment is 71.4 thousand higher than the mean in the period before. Before the Hornets leave Charlotte, Charlotte MSA mean employment is 430.5 thousand higher than Raleigh MSA mean employment. After the Hornets leave Charlotte, Charlotte MSA mean employment is 478.1 thousand higher than Raleigh MSA mean employment. The differences-in-differences of the means gives us the unconditional treatment effect of 47.6 thousand total employed. That is, by only comparing the changes in the unconditional mean employment levels, in the period before the Hornets left Charlotte, the community that received the treatment (Charlotte MSA) experienced an increase in total employment by 47.6 thousand persons. We will evaluate the conditional treatment effect of the Hornets leaving Charlotte on employment using regression while controlling for changes in the national GDP growth rate in the next section.

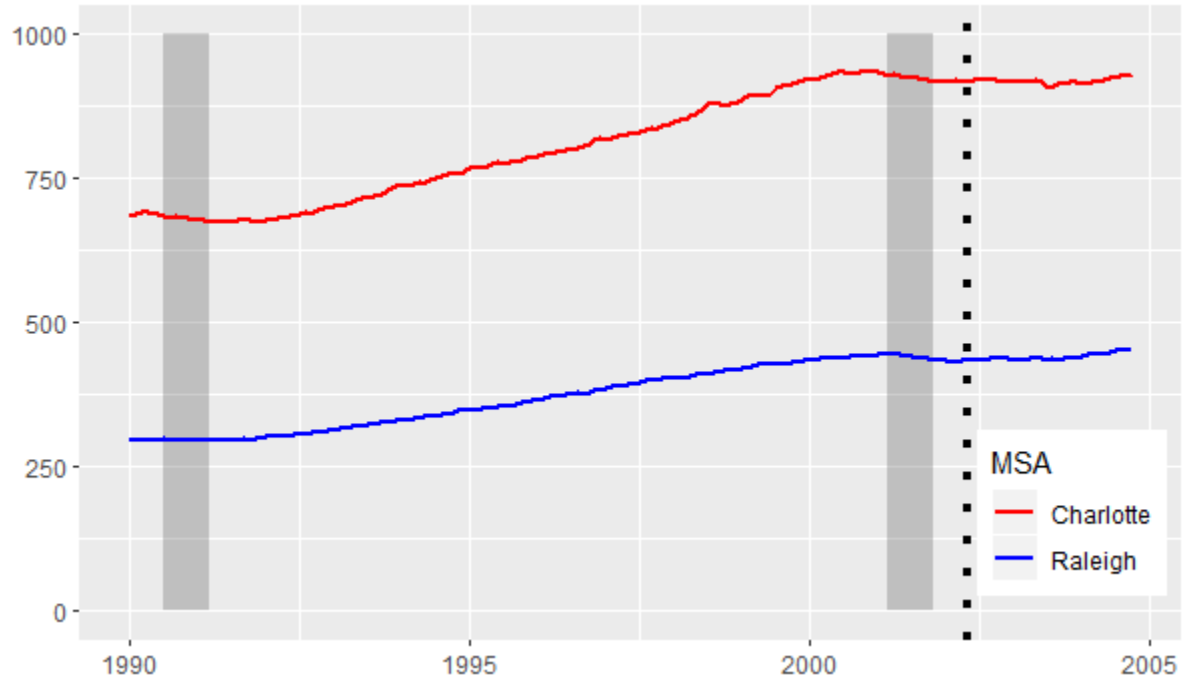


Figure 2 - MSA Employment in Charlotte and Raleigh (Jan 1990 – Sep 2004)

Figure 2 depicts a subset of data from Figure 1. Figure 2 illustrates employment levels in the Charlotte and Raleigh MSAs from January 1990 to Sep 2004, the periods sampled before and after the Hornets leave Charlotte. Also like in Figure 1, GDP growth rates are represented as recessionary periods in gray. The two series have different levels, but follow similar trends and appear to exhibit similar responses to recessionary periods.

Because I have shown that Charlotte and Raleigh share similarities in population and demographic information, and that the dependent variable I am measuring, total nonfarm employment, has a similar trend in both populations prior to the treatment being applied, I will analyze the differences-in-differences in these two populations using OLS to estimate the treatment effect. I include national GDP growth rates as a control for

confounding macroeconomic influences. Figure 3 shows the quarterly national GDP growth rate from Q1 1990 through Q4 2018.

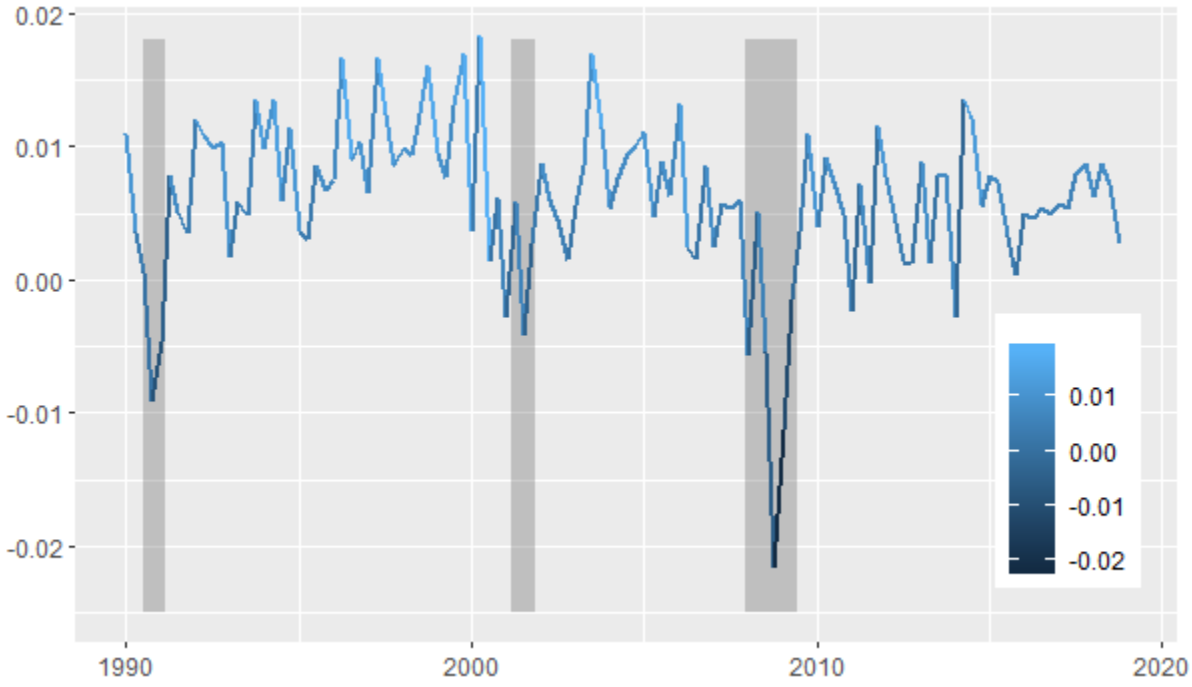


Figure 3 - National GDP Growth Rate

Equation 1 below specifies my first model, where I derive a differences-in-differences figures for analysis. The treatment in this analysis is the opening of Charlotte Bobcats Arena in the Charlotte, North Carolina center city district.

Equation 1 - Total Nonfarm Employment Where the Treatment is Opening Charlotte Bobcats Arena

$$Y_i = \beta_0 + \beta_1 TREAT_1 + \beta_2 AFTER_1 + \beta_3 TREAT_1 * AFTER_1 + \beta_4 GDP\_G_i + u_i$$

Where:

| | | |
|---|---|---|
| $Y_i$ | = | the number employed in the $i^{th}$ month in the study |
| $TREAT_1$ | = | a dummy variable which is assigned a value of 1 for the $i^{th}$ month in the study if the observation represents the Charlotte MSA; and is assigned a value of 0 otherwise |
| $AFTER_1$ | = | a dummy variable which is assigned a value of 1 for the $i^{th}$ month in the study if the observation occurred after Charlotte Bobcats Arena opened in Charlotte; and is assigned a value of 0 otherwise |
| $TREAT_1 * AFTER_1$ | = | the product of the $TREATMENT_1$ and $AFTER_1$ dummy variables, which describes the conditional treatment effect in the model |
| $GDP\_G_i$ | = | the quarterly GDP growth rate in the $i^{th}$ month of the study |
| $u_i$ | = | the stochastic error term |

The data are assembled as panel data. $Y_i$ are monthly total nonfarm employment figures. For each month in the periods between January, 1990 and December, 2018 there

is one observation for the Charlotte MSA, and one observation for the Raleigh MSA. The $TREATMENT_1$ variable indicates the observation is from the Charlotte MSA, the treatment population in the study. The $AFTER_1$ variable indicates the observation is from October, 2005 and later; the period after the arena was opened to the public. $TREATMENT_1 * AFTER_1$ is the product of two variables describing the interaction of the population being the treatment and time-period being after the treatment is applied. $GDP\_G_i$ is a variable that controls for changes in the economy. Rather than include a dummy variable that identifies recessions in the model, I calculated the quarterly GDP growth rate from quarterly real GDP level data. Including the growth rate in the model not only controls for recessionary periods, but also controls for the magnitude of negative output over these periods. $u_i$ is the stochastic error term.

Equation 2 below specifies my second model, where I derive a differences-in-differences figures for analysis. The treatment in this analysis is Charlotte, North Carolina not having an NBA basketball team. This is the period after the Charlotte Hornets moved to New Orleans, Louisiana, and prior to NBA expansion basketball team, the Charlotte Bobcats arrival.

Equation 2 - Total Nonfarm Employment Where the Treatment is the Hornets Leaving Charlotte

$$Y_i = \gamma_0 + \gamma_1 TREAT_2 + \gamma_2 AFTER_2 + \gamma_3 TREAT_2 * AFTER_2 + \gamma_4 GDP\_G_i + u_i$$

Where:

| | | |
|---|---|---|
| $Y_i$ | = | the number employed in the $i^{th}$ month in the study |
| $TREAT_2$ | = | a dummy variable which is assigned a value of 1 for the $i^{th}$ month in the study if the observation represents the Charlotte MSA; and is assigned a value of 0 otherwise |
| $AFTER_2$ | = | a dummy variable which is assigned a value of 1 for the $i^{th}$ month in the study if the observation occurred after the Hornets had left Charlotte to play in New Orleans; and is assigned a value of 0 otherwise |
| $TREAT_2 * AFTER_2$ | = | the product of the $TREATMENT_2$ and $AFTER_2$ dummy variables, which describes the conditional treatment effect in the model |
| $GDP\_G_i$ | = | the quarterly GDP growth rate in the $i^{th}$ month of the study |
| $u_i$ | = | the stochastic error term |

Similar to estimating Equation 1, the data are assembled as panel data. $Y_i$ are monthly total nonfarm employment figures. For each month in the periods between

January, 1990 and September, 2004 there is one observation for the Charlotte MSA, and one observation for the Raleigh MSA. The $TREATMENT_2$ variable indicates the observation is from the Charlotte MSA, the treatment population in the study. The $AFTER_2$ variable indicates the observation is from June, 2002 and later; the period where Charlotte, NC did not have an NBA basketball team. $TREATMENT_2 * AFTER_2$ is the product of two variables describing the interaction of the population being the treatment and time period being after the treatment is applied. $GDP\_G_i$ is a variable that controls for changes in the economy, namely quarterly GDP growth rate. $u_i$ is the stochastic error term.

# DISCUSSION OF RESULTS

Table 7 describes the regression output from the first model, Equation 1, described in the previous section. I use OLS to estimate coefficients using R version 3.5.0 (2018-04-23) for estimating the two models. For the analysis, I call the *sandwich* library to calculate robust standard errors[4] of the model coefficient estimates, and the *lmtest* library to test the specification of the model using the Wald F-Test with Robust Standard Errors.

Table 7 - Estimating Employment Where Treatment is Opening the Charlotte Bobcats Arena

| | Estimate | Robust SE | t-value | p-value |
|---|---|---|---|---|
| Intercept | 370.9 | 5.6 | 66.3 | < 2.2E-16 *** |
| $TREAT_1$ | 440.6 | 8.2 | 54.0 | < 2.2E-16 *** |
| $AFTER_1$ | 165.4 | 5.9 | 27.8 | < 2.2E-16 *** |
| $TREAT_1$*$AFTER_1$ | 64.0 | 11.0 | 5.8 | 9.234E-09 *** |
| GDP_G | 1,921.8 | 437.4 | 4.4 | 1.291E-05 *** |

Significance Codes:

| | |
|---|---|
| 0.000 to 0.001 | *** |
| 0.001 to 0.01 | ** |
| 0.01 to 0.05 | * |
| 0.05 to 0.1 | . |

F-Statistic: 2,221.6 on 4 and 691 DF
p-value < 2.2E-16

R-Squared: 0.9235
Adj R-Squared: 0.9230

[4] Robust standard errors are calculated for hypothesis testing of coefficient estimates to control for heteroskedasticity in the data.

For the estimated model of Equation 1, coefficients for $TREAT_1$, $AFTER_1$, $TREAT_1 * AFTER_1$, and $GDP\_G$ are all statistically significant with significance level less than 0.001. The coefficient estimate of the $TREAT_1$ variable, a dummy variable which assigns a value of 1 for the $i^{th}$ observation if the observation represents the Charlotte MSA, is 440.6. That is, on average and holding all other conditions constant, the Charlotte MSA employs 440.6 thousand more persons than the Raleigh MSA. The coefficient estimate of the $AFTER_1$ variable, a dummy variable which assigns a value of 1 for the $i^{th}$ month occurring after Bobcats Arena opened in Charlotte, is 165.4. That is, on average and holding all other conditions constant, employment after Charlotte Bobcats Arena opened in the center city district in Charlotte is 165.4 thousand higher than the period before. The coefficient estimate of the $TREAT_1 * AFTER_1$ variable, an interaction variable describing the observations representing the Charlotte MSA after the opening of Charlotte Bobcats Arena, is 64.0. That is, on average and holding all other conditions constant, for observations that are both in the Charlotte MSA and after the opening of Charlotte Bobcats Arena, employment is 64 thousand higher than observations that are not both in the Charlotte MSA and after the opening of the arena. The coefficient estimate of the $GDP\_G$ variable, the quarterly GDP growth rate of the $i^{th}$ month in the study is 1,921.8. That is, on average and holding all conditions constant, as the GDP growth rate increases by 1.0%, employment for all observations in the study have increases by 19.2 thousand persons.

The estimated coefficients from the regression output are used to describe the conditional differences-in-differences results, illustrated in Table 8.

Table 8 - Conditional Differences-in-Differences Where Treatment is Opening the Charlotte Bobcats Arena

| | Before Arena | After Arena | Difference |
|---|---|---|---|
| Charlotte MSA | 811.5 | 1,040.9 | 229.3 |
| Raleigh MSA | 370.9 | 536.3 | 165.4 |
| Difference | 440.6 | 504.6 | 64.0 |

While controlling for U.S. GDP growth rate, before the opening of the arena, employment in the Charlotte MSA is 811.5 thousand, and employment in the Raleigh MSA is 370.9 thousand, a difference of 440.6 thousand. After the opening of the arena, employment in the Charlotte MSA is 1,040.9 thousand, and employment in the Raleigh MSA is 536.3 thousand, a difference of 504.6 thousand. Employment in the Charlotte MSA had grown 229.3 thousand, and employment in the Raleigh MSA had grown 165.4 thousand on average after opening the arena. The conditional treatment effect estimated by the model is an increase in employment of 64.0 thousand persons, the same estimate as provided by the unconditional approach in the previous section. The results of the differences-in-differences analysis support that claim that employment did, in fact, increase in the time period after the opening of Bobcat's Arena in the center city district of Charlotte, North Carolina.

Table 9 describes the regression output from our model, Equation 2, described in the previous section.

Table 9 - Estimating Employment Where Treatment is the Hornets Leaving Charlotte

| | Estimate | Robust SE | t-value | p-value |
|---|---|---|---|---|
| Intercept | 355.7 | 7.7 | 46.3 | < 2.2E-16 *** |
| $TREAT_2$ | 430.5 | 8.7 | 49.3 | < 2.2E-16 *** |
| $AFTER_2$ | 70.8 | 4.6 | 15.2 | < 2.2E-16 *** |
| $TREAT_2$*$AFTER_2$ | 47.6 | 9.1 | 5.2 | 2.953E-07 *** |
| GDP_G | 1,784.8 | 756.8 | 2.4 | 1.891E-02 * |

Significance Codes:

| | |
|---|---|
| 0.000 to 0.001 | *** |
| 0.001 to 0.01 | ** |
| 0.01 to 0.05 | * |
| 0.05 to 0.1 | . |

F-Statistic: 9,630.2 on 4 and 335 DF
p-value < 2.2E-16

R-Squared: 0.9130
Adj R-Squared: 0.9120

For the estimated model of Equation 2, coefficients for $TREAT_2$, $AFTER_2$, $TREAT_2 * AFTER_2$, and $GDP\_G$ are all statistically significant with significance level less than 0.05. The coefficient estimate of the $TREAT_2$ variable, a dummy variable which assigns a value of 1 for the $i^{th}$ observation if the observation represents the Charlotte MSA, is 430.5. That is, on average and holding all other conditions constant, the Charlotte MSA employs 430.5 thousand more persons than the Raleigh MSA. The coefficient estimate of the $AFTER_2$ variable, a dummy variable which assigns a value of 1 for the $i^{th}$ month occurring during the time period Charlotte, NC was without an NBA basketball team, is 70.8. That is, on average and holding all other conditions constant, employment in the time between the Charlotte Hornets' last post-season game before departing to New Orleans, Louisiana and the arrival of the Charlotte Bobcats expansion

NBA basketball team (June, 2002 to September, 2005) is 70.8 thousand higher than the period before. The coefficient estimate of the $TREAT_2 * AFTER_2$ variable, an interaction variable describing the observations representing the Charlotte MSA when Charlotte did not have an NBA basketball team, is 47.6. That is, on average and holding all other conditions constant, for observations that are both in the Charlotte MSA and between June, 2002 and September, 2005, employment is 47.6 thousand higher than employment in the Raleigh MSA or when Charlotte did have an NBA basketball team. The coefficient estimate of the $GDP\_G$ variable, the quarterly GDP growth rate of the $i^{th}$ month in the study is 1,784.8. That is, on average and holding all conditions constant, as the GDP growth rate increases by 1.0%, employment for all observations in the study have increases by 17.8 thousand persons.

The estimated coefficients from the regression output are used to describe the conditional differences-in-differences results in Table 10.

Table 10 - Conditional Differences-in-Differences Where Treatment is Hornets Leaving Charlotte

| | Hornets in Charlotte | Hornets in New Orleans | Difference |
|---|---|---|---|
| Charlotte MSA | 786.2 | 904.6 | 118.4 |
| Raleigh MSA | 355.7 | 426.5 | 70.8 |
| Difference | 430.5 | 478.1 | 47.6 |

While controlling for U.S. GDP growth rate, before the Hornets left Charlotte for New Orleans, LA, employment in the Charlotte MSA is 786.2 thousand, and employment

in the Raleigh MSA is 335.7 thousand, a difference of 430.5 thousand. After the Hornets left Charlotte for New Orleans, employment in the Charlotte MSA is 904.6 thousand, and employment in the Raleigh MSA is 426.5 thousand, a difference of 471.1 thousand. Employment in the Charlotte MSA had grown 118.4 thousand, and employment in the Raleigh MSA had grown 70.8 thousand on average after the Hornets' departure. The conditional treatment effect estimated by the model is an increase in employment of 47.6 thousand persons, the same as the unconditional differences-in-differences estimate. The results of the differences-in-differences analysis do not support that claim that employment decreased or was unchanged following the departure of an NBA basketball team.

# CONCLUSIONS

I have applied differences-in-differences analysis using employment data in the Charlotte and Raleigh metro areas for two different treatments. The first treatment, described in Equation 1, corresponds to the opening of the Charlotte Bobcats Arena in the center city district in Charlotte, North Carolina. The arena was open to the public September 2005, and intended to host the Charlotte Bobcats NBA basketball team, an NBA expansion team whose first official season was the 2004-2005 NBA season. The analysis yielded a statistically significant treatment effect of 64 thousand employed while controlling for changes in GDP. That is, on average, an increase of 64 thousand employed persons are associated with the opening of the new arena.

Although some academic economists would disagree that the addition of a sports team, stadium, or arena would contribute to the growth or an increase in net economic benefit of a city by itself, some would argue that in certain circumstances the addition of a stadium or arena in the city's downtown or center city district can have positive economic impacts on the local economy, particularly when the city is engaged in a comprehensive effort to revitalize the area. The results from estimating the treatment effect of the opening of the Charlotte Bobcats Arena provides support for this argument based on empirical observations. The results support the claim that, holding other factors constant, a 64 thousand person increase in employment in the Charlotte metro area is associated with the opening of the new Charlotte Bobcats Arena in 2005.

The second part of my analysis focused on the impact a sports team has on employment in Charlotte, North Carolina; namely the Charlotte Hornets NBA basketball team. The second treatment in this analysis is the Hornets departure from Charlotte, North Carolina to play in New Orleans, Louisiana. This treatment describes the impact of a city losing an NBA basketball team. One of the goals of this analysis is to show that the increase in employment (in the first part of our analysis) in the area are associated with the new arena, and not with the addition of a new NBA expansion basketball team. If it is assumed that the addition of an NBA basketball team has a positive treatment effect on the area's employment levels, then it is expected that the departure of an NBA basketball team would have a negative treatment effect on the area's employment levels. This is not the result I get from the differences-in-differences analysis described using Equation 2. The treatment effect of the Hornets leaving Charlotte is positive, and the coefficient estimates for the model are all statistically significant with significance levels less than 0.05. The results do not support the claim that the loss of an NBA basketball team in Charlotte is associated with a decrease in employment in the area. It follows that, based on empirical evidence, while the Charlotte metro area is associated with increased employment levels following the opening of the Charlotte Bobcats Arena, the addition of a new NBA basketball team playing in the arena does not have a significant confounding impact on employment in the area.

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