The Economic Impact of College Athletics on Local Economies

An Empirical Approach from the U.S.

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Abstract

The popularity college athletics enjoys can be compared to the popularity of professional sports in the U.S. With bigger attendance figures than professional sports, college athletics is able to attract millions of fans and generate millions of dollars annually in revenue. Therefore, college athletics plays an important role for the U.S sporting culture and its local economy. Some research has been done on trying to find a positive linkage between college athletics and the economy (Baade, Baumann, & Matheson, 2011). This has however not been successful, which can be seen as a little surprising, since college athletics brings millions of dollars to the university and contributes to the economic activity in the local economy.

This thesis has researched the economic impact Division I-A college athletics has on the metropolitan and state level economies. This has been done by looking at the impact college athletics has on the metropolitan and state GDP, as well as on the local employment. An ex-post analysis approach has been used by applying different econometrical methods of ordinary least squares, three stage least squares, instrumental variable and general methods of moments to tackle problems of reverse causality and endogeneity. To specifically find the impact college athletics has on GDP and not GDP's impact on college athletics, an instrumental variable approach has been applied with using unexpected success (Olympics medals) as an instrument capturing the effect on college athletics.

The findings of college athletics impact on the economy are twofold. Whereas college athletics does not have a positive impact on the metropolitan economy, college athletics has a positive impact on the state economy. This can be attributed to the fact that many profitable universities are located in the same state but different metropolitan areas. Smaller universities might not be as profitable but can still have an impact on the metropolitan and state economies. Although college athletics fails to have an impact on the metropolitan economy, which can be due to the substitution and crowding out effect, the empirical findings show that college athletics has a positive significant impact on the state GDP. This study is among a handful of studies that have been able to find a positive relationship between college athletics and the state economy.

Contents

1. Introduction

1.1 Motivation

College athletics has enjoyed huge popularity in the last decades and plays an important role in the U.S sporting culture (Chung, 2013). In recent years, there has been an increasing amount of interest to know the finances regarding college athletics and if they are profitable or not from the public and the media. This is due to the millions of dollars being spent on college athletics and millions of dollars circulating in it. Until now, most empirical research within sports economics has focused on the impact professional sports and stadiums have on the economy. Thus, academic research concerning college athletics has garnered much less attention. This can be seen as surprising, bearing in mind the size of college athletics compared to professional sports and the cultural importance it has in the U.S (Beyer & Hannah, 2000). Comparing to professional sports, college athletics is a major player among all sports in the U.S, having higher attendance figures than the four major pro leagues in the U.S[1]. For instance, in 2013 the average attendance in the Football Bowl Subdivision (FBS) was 45,192 with Michigan having the largest attendance of 111,592[2] (Fulks, 2013). In comparison, the largest attendance an NFL (National Football League) team had in 2013 was Dallas with 88,043[3] (ESPN, 2013). Large attendance figures provide great revenues for the NCAA (National Collegiate Athletic Association) and the schools that are football powerhouses[4]. Millions of dollars circulate in college athletics with football and basketball bringing most of the money to their respective athletic departments. For instance, in 2013 the NCAA had $905,419,498 in revenue from college athletics (NCAA, 2014). As millions of dollars circulate in college athletics, it can be viewed as an important part of the American culture and economy. Considering that a large part of the revenues generated from college sports are from ticket sales and media rights indicates that the society is part of college sports (Chung, 2013). To put the NCAA revenue into perspective and the revenue college athletics generates, Colorado's largest ski resort, Vail Resorts reported in 2013 $1.1 billion in revenue, which was almost the same as NCAA's revenue in 2013 (Vail Resorts Inc., 2013).

[1] The four major pro sports leagues are NHL, NFL, MLB and MLS.
[2] http://fs.ncaa.org/Docs/stats/football_records/Attendance/2013.pdf
[3] http://espn.go.com/nfl/attendance/_/year/2013
[4] See Appendix 1 for explanation of term

Taken this into consideration, this paper explores the economic impact college athletics has on the local economies by using panel data from 96 Division I-A schools between the years of 2005 to 2013. The reason for focusing on Division I-A schools is since it includes the biggest schools when it comes to college athletics and revenue streams. This paper uses different econometric approaches of Ordinary Least Squares, Three State Least Squares, Instrumental Variable and General Methods of Moments in order to determine the impact of college athletics.

1.2 Problem Statement

Based on the previous discussion on why college athletics is a relevant field of study, this thesis will investigate and adresses the following problem statement:

"What economic impact does Division I-A college athletics have on the metropolitan and state economies?"

In order to investigate the problem statement, two hypotheses are constructed to be able to answer, if Division I college athletics has an economic impact on metropolitan and state economies.

Hypothesis I: "College athletics has an economic impact on metropolitan and/or state GDP"

Hypothesis II: "College athletics capital investments has an effect on metropolitan/micropolitan employment"

The two hypotheses presented above are discussed and addressed in more detail in section 5, where the empirical findings of this study are discussed. In the next sub-section 1.3, the background of the NCAA and college athletics are discussed.

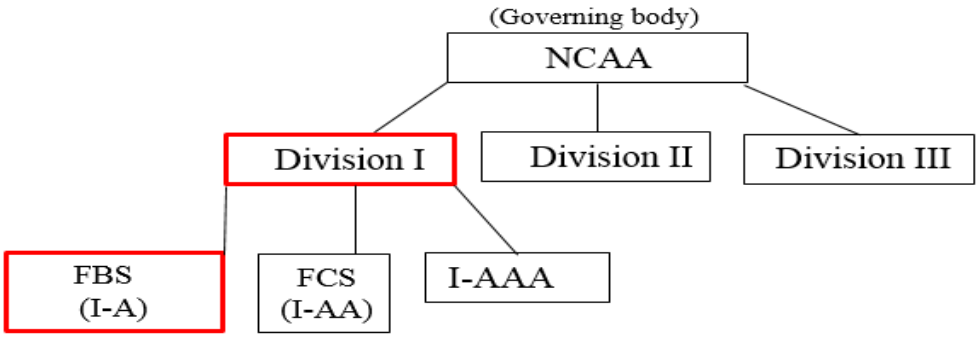
1.3 Background on Division I College Athletics & NCAA

The NCAA (National Collegiate Athletic Association) is the governing body of college athletics in the U.S and Canada for Division I, II and III[5]. The association was formed in 1906 by Theodore Roosevelt and was originally called IAAUS but got its current name in 1910 and serves as a non-profit organization (Smith, 2000). Currently, the NCAA constitutes of over 1,000 membership schools that have to apply to the rules and governance set by the NCAA in order to participate in college athletics. One of the main goals for the NCAA is ensure that the student-athletes meet the academic and amateur criteria's in order to participate in their respective sports (Fulks, 2013).

The NCAA consists of three different sport divisions: Division I, Division II and Division III. Division I is the highest and Division III is the lowest. Out of 1000 membership schools, 325 participate in Division I, 300 in Division II and 450 in Division III. Different rules apply (i.e. different criteria's have to be met) for the different divisions, which the schools have to meet in order to compete in a respective division. One of the biggest differences among the schools competing in the different divisions, lies in the sizes and budgets of the schools. The largest universities and thus the most revenue bringing, compete in Division 1. In order for a school to compete at the highest level, Division I, the following criteria's has to be met (NCAA, 2013)[6].

- The university has to compete in at least 14 different sports
- Meet minimum financial aid awards for their sports
- Play 100% of the minimum required games against fellow Division I schools

[5] NJCAA (community colleges) and NAIA (smaller universities) are the other governing bodies in college athletics.
[6] http://www.ncaa.org/about/who-we-are/membership/divisional-differences-and-history-multidivision-classification



Graph 1. Structure of the NCAA[7].

Division I is further divided into three sub-divisions, FBS (Football Bowl Subdivision, formerly known as I-A), FCS (Football Championship Series, formerly known as I-AA) and D-NF (Division-No football, formerly known as I-AAA, without football) depending on if they have a football[8] team or not[9]. The sub-divisions only apply to football and thus the other varsity sport teams are just simply classified as competing in Division I. The illustration of the NCAA structure and its divisions can be seen in Graph 1. The differences between the sub-divisions are regarding the amount of varsity sports they sponsor, size of the stadium, revenue streams and average football game attendance. The biggest and most revenue bringing schools compete in Division I, FBS. In 2013, there were 124 members in the FBS subdivision and one team that was transitioning to the division. Schools that are part of this subdivision must meet the following criteria's (NCAA, 2013):

- Sponsor at least 16 teams (7 men's and 7 women's)
- Play at least 5 home games against fellow FBS (Football Bowl Subdivision) teams
- Have to have an average game attendance of 15.000 per game
- Have to provide 85 football scholarships

Schools that have at least six wins in a season are also eligible to be invited to the bowl games[10], which guarantees the athletic departments additional bowl participating money from media rights to ticket sales. However, the universities that are part of the FCS (Football Championship Subdivision) are not eligible

[7] Own creation
[8] Football= American Football
[9] Division I consists of 11 different conferences to which the respective schools belong to.
[10] A post season championship game

to take part in the bowl games. One of the major differences between FBS and FCS is that the latter only has to sponsor 14 varsity teams to the 16 teams that FBS has to sponsor. The 124 institutions that are part of the FCS have also fewer football scholarships than those in the FBS (63 to 85) (NCAA, 2013). The last subdivision in Division I, D-NF, does not have football and is mostly focused on the other revenue generating sport, basketball. However, the Ivy League[11] universities that compete in Division I athletics do not offer athletic scholarships to athletes as they are private and are not required to disclose their financial information. For this reason the Ivy League schools are not included in this study as only public universities are taken into consideration. Since there are differences in the subdivisions in Division I, this thesis focuses on the biggest institutions that has the biggest budgets, i.e. universities in the FBS subdivision that are the most comparable with each other. These institutions are the most revenue bringing universities, which in turn could have the largest impact on the state and local economies. Due to this, universities that are participating in the other two subdivisions, FCS and D-NF in Division I, are not included in this study.

1.5 Structure

This thesis is divided into 7 main sections. As previously seen, section 1 gives an introduction and background on college athletics as well as presents the problem statement. Previous research about the impact of professional sports and college athletics is reviewed and discussed in section 2. Following the literature review, the methodology used in the study is described in section 3. Section 4 presents the data used in the study, while section 5 presents the empirical findings and discusses the results. The last two main sections, 6 and 7, will account for possible further research that can be conducted in the future, as well as the conclusion of the study.

[11] These include Harvard, Brown, Princeton, Columbia, Yale, Cornell, Dartmouth and University of Pennsylvania.

2. Literature Review

In this section previous research is presented within the field of sports economics. Research on the economic impact of sporting mega-events, stadiums, professional teams and college athletics are reviewed and discussed. Since this study takes an ex-post analysis approach, previous ex-ante studies are only briefly addressed.

2.1 Sports Economics

There has been a wide range of research done on the economic impact professional sports, stadiums, franchises and mega sporting events[12] have on local economies (Baade & Dye, 1990; Baade & Sanderson, 1997; Matheson & Baade, 2006; Siegfried & Zimbalist, 2000, 2006). However, the specific field of college athletics and the impact college athletics has on the economy has not been widely researched, in contrast to the impact professional sports has on the economy. Most studies about college athletics has focused on the indirect impact college athletics has on universities with regards to tuition fees, applications, donations and graduation rates (Baade & Sundberg, 1996; Mixon & Ressler, 1995; Murphy & Trandel, 1994). There have been only a few studies conducted on the direct economic impact college athletics has on local economies that have been done by prominent sport economists and by universities own economics departments (Coates & Depken, 2008). Thus, as most of these impact studies have only been carried out by the university's economics department and therefore only researched that specific athletic department's economic impact the, overall impact of college athletics has not been addressed that much (Beyers, 2007; Thompson, 2005). Most of these studies have used either an ex-post or an ex-ante approach to carry out the economic impact analysis of college athletics.

2.2 Economic Impact Analysis

Economic impact analysis looks at the impact sports events and teams has on the economy (Blair, 2012) When conducting an economic impact study there are several stages that have to be accounted for, in order to arrive at the total economic impact a sporting event has on an area. In the first stage the total net

[12] The Olympic Games, Super Bowl, Football Bowl Games and FiFa World Cup are among others considered mega sporting events.

spending in the area has to be calculated before an impact multiplier can be applied. However, getting the right net spending amount can be challenging since net spending needs to be adjusted for substitution and displacement effects (Ibid). Substitution effect occurs when for example, a baseball fan decides to go to a game instead of attending a concert. Displacement effect occurs on the other hand when *"out –of town visitors who attend the event cause other would-be visitors to go elsewhere"* (Blair, 2012: 305). However, finding exactly what the substitution and the displacement effect is in an area can be a very challenging task to do (Baade & Dye, 1990). Once all these are accounted for an impact multiplier can be applied in order to arrive at the total economic impact for the area. The reasons why multipliers do not really work when conducting sports economic impact studies are discussed and taken up in the methodology part in section 3. When conducting sports economic impact studies, the impact of stadiums, sport events or a relocation of a sports team are looked into and what effect that has on the economy regarding employment, income or sales tax revenue. Previous studies that have looked into the relationship between sports and economic development have failed to find a positive relationship (Baade, 1996; Siegfried & Zimbalist, 2000).

2.2.1 Ex-Post Analysis

2.2.1.1 Professional Sports Economic Impact

There exists almost 20 years of economic research on the impact of stadiums and professional sports teams on local economy and almost no evidence of positive impact has been found (Coates & Humphreys, 2003). This sub-section focuses on studies done stadiums, teams and mega-events and their impact on the economy.

Stadiums/ Sports Facilities and Teams

Stadium construction and building sports facilities to professional sports teams have gathered a lot of attention in the media and in the field of sports economics (Siegfried & Zimbalist, 2000). One of the main attention it has gained, lies in the short timespans of renewing the facilities. The stadiums that professional sports teams use, have a useful economic life of around 30 years (Noll & Zimbalist, 1997). However, billions of dollars are spent in constructing new high-end stadiums for teams to replace stadiums that only are around 10 years old and thus, still have two thirds left of their lifespan (Siegfried

& Zimbalist, 2000). The reason to the constructions of these new high-end stadiums is to provide more seating capacity for the fans as well as bringing more life to the city center and its surrounding areas. Since, a new stadium requires a high amount of capital, it has been debated, if having a professional sports team in a city and building new stadiums for the teams will improve the economic development of the area or if the investment mostly provides intangible benefits to the area, such as, fan experience and satisfaction. As a lot of money goes into building sports facilities and stadiums (Baade, 1996; Siegfried & Zimbalist, 2000) there is motivation to research the impact sports stadiums have on local economies. To finance the building of stadiums, subsidies are often used and tax revenues are spent to finance those (Siegfried & Zimbalist, 2000). To justify these expenditures, the economic development stadiums and teams bring a local area, such as, increasing the local income and creating new jobs, have been researched. Another justification to the construction of new stadiums to the public, is to keep the professional sports team in the original city thus to avoid a possible relocation of the team to another city where a new stadium is being offered for them (Sandy, Sloane, & Rosentraub, 2004). However, most empirical research about the impact professional sport teams and stadiums have on economic growth and development have failed to find a positive effect. Also, no positive impact have been found that professional sports subsidies would help in providing benefits for the local area (Baade, 1996). This in turn means that these stadium constructions cannot be justified while taking into account these variables.

Baade and Dye (1990) were one of the first ones that looked into the impact professional sports teams and stadiums had on the local economic development. In their paper, Baade and Dye looked at nine different U.S metropolitan areas (Cincinnati, Denver, Detroit, Kansas City, New Orleans, Pittsburgh, San Diego, Seattle and Tampa Bay) that were home to either a football or a baseball team between the years of 1965 to 1983. In the study, Baade and Dye evaluated what impact the teams and stadiums had on the metropolitan aggregate spending, income and development. Baade and Dye failed to find a significant effect of sports teams and stadiums on the metropolitan area income. Instead, the impact of stadiums and professional teams showed to have a negative significant effect on the metropolitan share of regional income indicating that there is no positive impact of teams and stadiums to the local economy. A few years later Baade (1994) conducted a similar study about the economic impact of sports. Using a longer time frame than the previous study of Baade and Dye (1990), Baade looked at 36 metropolitan areas that had a professional sports team in one the four biggest sports (football, basketball, ice hockey or baseball)

or that had a new sports stadium built during the period 1958 to 1987. With including additional 12 MSAs[13] that did not host a professional sports team, Baade found that professional sports had no impact on the personal income per capita in the metropolitan area, even after adjusting for trend. Whereas the previous studies did not implement a multiplier in their studies, Colclough, Daellenbach and Sherony (1994) used a RIMS[14] II multiplier to look at the impact of constructing a minor league baseball stadium and the impact it had on the sales, income and employment in the area. Colclough et al. (1994) failed, as previous studies, to find a positive impact on the economy.

As previous studies had focused on the impact on real capita income, Baade (1996) expanded his study to also look at the impact stadiums and pro teams had on employment, particularly job creation within the amusement, recreation and commercial sports industry. Again, Baade failed to find a positive correlation between job creation and professional sports. Whereas Coates and Humphreys (1999) had previously focused on looking at real income per capita, they conducted another study where they looked at the impact stadiums and teams had on the retail and services sectors earnings and employment. With focusing on two subsectors in the services sector (hotels, amusement and recreation) and retail trade sector (eating and drinking places) between the years of 1969 and 1996, Coates and Humphreys (2003) found a small positive effect on earnings in the amusement and recreation subsector, which Baade (1996) failed to find. However, this was offset by a negative effect in both earnings and employment in the other subsectors, making the overall impact negative. Coates and Humphreys reasoned the overall negative impact to be contributed to the substitution effect, and that sports might create low-paying jobs when comparing to previously created jobs, thus resulting in the reduced level of income. This result was supported by Baade and Sanderson (1997) who found no positive relationship between professional sports and job creation. They even concluded that creating jobs through sports subsidies is inefficient and costly for the city. Although most empirical studies have proved that sports does not have a positive impact on the local area, arguments have still been made that sports and stadiums help generate economic development to the area by bringing additional spending and hence providing economic benefits. Although previous studies have failed to show a positive impact sports facilities and teams have on local

[13] Metropolitan Statistical Area
[14] Regional Input-Output Modeling System

economies (Baade & Dye, 1990; Baade, 1994; Colclough et al., 1994) teams and sports facilities can bring intangible benefits to the community (Feng & Humphreys, 2008).

Recent studies have tried to take another approach by looking at the intangible benefits professional sports bring to the local economy (Feng & Humphreys, 2008; Kavetsos & Szymanski, 2010). Feng and Humphreys (2008) looked at the impact the presence of sports facilities had on the surrounding house values. Feng and Humphreys looked at two sporting facilities, one hosting an NFL[15] team and the other one hosting an MLS[16] team, both located in Columbus, Ohio. They found that the sport facilities had a positive effect on the house values. The impact was largest on the houses that were located closest to the stadiums and showed a decaying effect the further away the properties were located from the stadiums. Kavetsos and Szymanski (2010) also found a positive and significant relationship between hosting a football event and a so called "feel good" factor. However, they failed to find significant results when looking at intangible benefits (happiness) and national athletic success. In contrast, sports facilities and stadiums when combining with other forms of recreation opportunities have shown to have an effect on the local economic activities in the downtown areas they have been located in, thus giving indications that sports teams and facilities help enhance the quality of life in the local area/region (Rosentraub et al., 2004).

Mega-events

The Super Bowl, the World Cup and the Olympics are some of the mega sporting events that attract hundreds of thousands, even millions of people to the events. The economic impact of hosting sporting mega events has been largely discussed and debated in the media, partly due to falsified impact estimations due to flawed methodology, regarding gross and net spending when hosting a mega event (Baade & Matheson, 2004; Matheson, 2006).

It has been argued that a city hosting a sporting mega event will inject money to the local economy as fans come to the city to attend the event and spend money on hotels, restaurants and businesses, which can create new/additional jobs in these sectors (Blair, 2012; Matheson, 2006). In order to host a mega-

[15] National Football League
[16] Major League Soccer

event the host city usually invests in infrastructure by building new stadiums and facilities, which creates jobs in the local economy. Often when cities compete to host a mega sporting event such as, the Super Bowl or the Olympic Games, it is claimed by event promoters and boosters[17] that the mega event will provide economic growth for the local economy as it generates millions of dollars in profit. Most research done by sport economists on mega sporting events and the impact they have on the economy have looked at the effect it has employment, personal income and taxable sales (Baade, Baumann, & Matheson, 2005; Baade & Matheson, 2002; Coates & Humphreys, 2002; Matheson & Baade, 2006).

Two prominent sport economists, Baade and Matheson (2002) looked at the economic impact the Summer Olympics held in Los Angeles in 1984 and in Atlanta in 1996 had on the cities with regards to employment. Using a sample of the 57 largest MSAs[18] by population in the USA between the years of 1969 to 1997, they assessed the changes in the employment in Atlanta and Los Angeles that were attributable to the Summer Olympic Games in 1996 and 1984 respectively. Having the mean rate of employment growth for the MSAs and the city's growth pattern on employment for the previous three years, Baade and Matheson found that the two Summer Olympic Games had different impact on the employment in the two respective cities. They found that the cumulative job growth for the years 1994 to 1996 from the Olympic Games in Atlanta was between 3.500 to 42.448 (full and part-time) jobs. However, the Olympic Games held in Los Angeles only created 5.043 jobs that were transitory for 1984. Baade and Matheson reasoned the difference to that Atlanta invested in infrastructure before the Games, which allowed jobs to be created, whereas Los Angeles did not make any facility constructions prior to the Games.

The first comprehensive econometric study done on the economic impact post season plays have on the economy was carried out by Coates and Humphreys (2002). Coates and Humphreys looked at the impact a team playing in the post season and the impact it had on the real per capita income in the cities the teams were located in. Coates and Humphreys applied the same econometric model from their previous research (1999) to estimate the economic impact of post season play. Including 39 cities that were home to either a football, basketball or baseball franchise between the years of 1969 to 1998 and applying a

[17] See Appendix 1 for definition
[18] Metropolitan Statistical Area

fixed effects model, Coates and Humphreys found a negative effect of professional teams on the local economy. For instance, hosting the Super Bowl had no positive economic impact on the hosting city and a reason for this could have been a crowding out effect. Meaning, the Super Bowl simply replaced the spending of other visitors that did not visit the city due to the Super Bowl. However, Coates and Humphreys found that for a team winning the Super Bowl the winning team's city's real income per capita increased by $140. Humphreys and Coates explained that this could have been due to tangible economic benefits with increasing the productivity of labor in the NFL team's city. Still, the same effect was not seen for the NBA (National Basketball Association) or MLS champions that won the NBA Championship or the World Series. A similar study was done by Baade and Matheson (2006) that looked at the impact hosting a sporting event had, by looking at the income changes in the cities that hosted the Super Bowl in 1970 and 2001. Their sample consisted of 73 metropolitan areas that belonged to the largest ones in the U.S, between the years of 1970 to 2001. The results showed an overall negative impact (-$133.4 million) on the city hosting the Super Bowl and on average, Super Bowls were able to create $92 million in income gains for the cities. Baade and Matheson's results proved that previous claims of the Super Bowl generating between $300 to $400 million dollars to the host cities were largely overestimated by the NFL, sport boosters and promoters and that the actual impact was one fourth of that claim. Baade and Matheson extended this study a few years later by looking at the impact of Pro Bowl and Super Bowl and concluded that the benefits of mega events are at most only a fraction of the benefits claimed by sports boosters doing ex-ante studies (Baumann & Matheson, 2011). While the previous studies focused on the impact mega events have on employment or personal income/ real income per capita on the MSA level, a study that deviated from this and looked on taxable sales on the county level was done by Baade et al., (2005). With using monthly sales tax data on each county in Florida from January 1980 to June 2005 and aggregating the sales tax data into four MSAs (Miami-Fort Lauderdale-West Palm Beach, Tampa- St. Petersburg, Orlando & Jacksonville), the change in the taxable sales where a sporting event took place was analyzed. In order for an event to be included, the event had to be an All-Star Game or a Championship game in one of the four big sports in the U.S (football, baseball, basketball and soccer). As previous studies, Baade et al., failed to find a positive effect for the city hosting a mega sporting event with finding a reduction in taxable sales of $ 34.4 million per event.

Although economic impact studies on mega events have failed to find a positive impact, the benefits of hosting an event might still be there. However, most likely it is hidden and therefore will be hard to capture and find (Blair, 2012).

2.2.1.2 Direct impact of College Athletics

While there is an extensive literature on the impact of hosting sports events, there has been less research on the impact college athletics brings to local economies (Coates & Depken, 2008). This can be seen as surprising, considering the fact that college sports budgets are often larger than that of professional teams (Sandy et al., 2004). Studies about college athletics have looked on the impact it has on employment, personal income and sales tax revenue (Baade, Baumann, & Matheson, 2008; Baade & Matheson, 2009; Coates & Depken, 2008).

One of the first studies that looked at the direct impact college athletics had on the economy was done by Baade and Matheson (2004). Baade and Matheson studied the short-term economic impact the NCAA men's and women's basketball Final Four had on the hosting metropolitan areas. Using historical data between 1970 to 1999 for the men's basketball and data between 1982 to 1999 for women's basketball, Baade and Matheson estimated the impact the Final Four events had on the host metropolitan areas real income. Baade and Matheson found that hosting the NCAA basketball tournament had a reducing effect on real income with an estimated loss of –$44.28 million. While there has not been many studies looking at the economic impact college athletics has as a whole, there have been several studies looking at the impact college football games have on the local economies (Baade et. al., 2008; Coates & Depken, 2006; Coates & Depken, 2008). For example, Coates and Depken (2006) looked at the impact college athletics and professional sporting events had on the host communities. The empirical study compared, if there was a difference in the economic impact in cities hosting regular, post season and championship games in NHL, NBA or MLB and college football games (regular and bowl games). With using monthly sales tax for 126 cities in Texas, it was found that hosting the Super Bowl increased the sales tax revenue the most ($2.5 million for Houston in 2004), while the sales tax revenue only increased for smaller cities that hosted college football games. The regular season games in the NBA and NFL had the opposite effect. Another study by Coates and Depken (2008) used monthly sales tax data for four cities in Texas (Austin,

College Station, Waco and Lubbock) to see what impact college football games had on the local economies. Again, no sizeable or meaningful impact was found in the study.
A study that also failed to confirm sport boosters claims that sports enhances the economic activity was done by Baade, Baumann and Matheson (2011) where it proved out that men's basketball home games had no impact on the sales tax revenue in Florida. Baade et al. (2008) also concluded in their study that college football games do not contribute positively to the local communities and has in fact a negative effect on employment and personal income.

Alike sport boosters and promoters, the economic departments of universities competing in Division I have conducted their own impact studies (Connaughton, 2012; Thompson, 2005). These survey studies usually find a positive impact of number of jobs created and the amount of revenue the athletic program bring to the metropolitan and state area. However, these reports apply the multiplier effect and no empirical research and from an empirical standpoint can be seen as questionable and debatable with regards to validity of the findings.

While most studies done on the impact of sports and college athletics have on local economies have failed to find a positive effect there has been a few studies that have been able to find a positive effect (Baade et al., 2011; Lentz & Laband, 2009). Lentz and Laband (2009) did the first empirical paper that looked into the economic impact college athletics had on local economies. Laband and Lentz looked at the linkage between metropolitan and micropolitan[19] employment in the accommodations and food services industry and the total athletic revenues aggregated together for all colleges in an MSA. Using 915 MSAs in the sample, they found a positive linkage between employment and athletic revenues and was the first empirical paper that was able to find a positive impact that was significant. However, Laband and Lentz pointed out that their model likely suffered from omitted variable bias and endogeneity problems and did not apply a different method to solve it. A few years later Baade et al. (2011) were also able to find a positive impact of college sports. With using 25 years of monthly sales tax data from Florida from the years of 1979 to 2007, they discovered that home football games were significant and had a positive impact on the local economy. For every home football game in Tallahassee, Florida, the taxable

[19] Micropolitan statistical area

sales rose by $2 million per game, supporting the claim that college football games increase the economic activity of a local area. However, the men's basketball games failed to show the same impact. The reason for this could have been the much larger attendance figures there is in college football in contrast to basketball.

While the literature regarding the direct impact of college sports is still waiting to be expanded, the literature regarding the indirect benefits/impact of college athletics is much more explored, which is taken up in the next sub-section.

2.2.1.3 Indirect Impact of College Athletics

As many successful college programs receives millions of dollars in donations also from alumni many have wondered about the benefits college sports might bring to the university. The literature regarding the impact successful college sports have on tuition fees, applications, SAT scores and alumni donations have been somewhat mixed.

Student Quality and Quantity

Having a successful sports team can bring recognition to the university through media attention by attracting more new students to the campus (Chung, 2013). Another indirect benefit that college sports success might have is the increase of financial donations to the university by former athletes, alumni, sports fans and outside people that are not connected directly to the university (Rosentraub et al., 2004). With the help of donations bigger and better facilities can be built for college athletics.

One of the earliest studies about the link between athletic success and enrollment was done by Borlan, Goff and Pulsinelli (1992). By looking at the winning percentage in football and basketball for Western Kentucky University (WKU) as the measure of athletic success, Borlan et al. (1992) found a positive impact between an increase in basketball winning percentage and increase in student enrollment. Same impact was found for post season participation in football. While the time frame was 28 years, which allowed for time trends to be observed, the sample period was limited to only one school (WKU). A more comprehensive study, which contained a data set covering 10 years from 55 different schools was done by Murphy and Trandel (1994). Applying an OLS model with panel data with school-level fixed effects,

Murphy and Trandel noted that schools that had their football perform unusually well on the field and having a better win-loss record resulted in the number of applications the school received to increase. More recently, McEvoy (2005) examined the relationship between Division I-A college athletics team performance and admissions applications for undergraduates from six different conferences. Athletic success was measured as the change in winning percentage from year to year and was used as the independent variable. The four athletic teams (football, volleyball, men's and women's basketball) that receives most media attention and coverage were included in the study. While volleyball and men's and women's basketball winning percentage did not have an impact on university applications, the winning percentage of football did have an impact. A football team that saw an increase of .250 in their winning percentage received more applications than those that were less successful. This was similar to the results of Murphy and Trandel (1994) and showed that college athletics has an impact on the society.

While the previous studies focused on the impact athletic success had on enrollment, there have been several studies that have looked at the link between athletic success and student quality (Anderson, 2012; Litan, Orszag, & Orszarg, 2003; McCormick & Tinsley, 1987; Pope & Pope, 2009; Smith, 2008; Tucker & Amato, 2006). One of the first studies that researched the link between athletic and academic success and showed a positive correlation was by McCormick and Tinsley (1987). Using a cross-sectional model on 150 schools they found that having a major sports program (football) was strongly correlated with higher SAT scores[20]. On the other hand, Litan et al. (2003) looked at the link between football and basketball operating expenditures and the incoming freshmen's SAT scores, as well as the percentage of accepted applicants among Division I schools. They used a more comprehensive data set in contrast to McCormick and Tinsley (1987) but failed to find a positive linkage. A more recent study by Trenkamp (2009) also failed to find a positive link between basketball success and graduation rates, as well as SAT scores. Trenkamp, however, found that having a successful football program increased the graduation rates and the median SAT scores. While, previous studies had used win-lose records as the primary measure of success, Trenkamp used the Associated Press (AP) ranking as measure of success. Smith (2007) also failed to find a link between athletic performance and academic quality with only concentrating on basketball. While Litan et al. (2003) used only SAT scores as the quality measure, Smith

[20] SAT is the standardized college admission test

applied a more comprehensive quality measure that included GPA[21], SAT scores and National Merit Scholars. Using a 12 year unbalanced panel data on all Division I basketball schools and running a fixed effects OLS model, Smith failed to find an impact between basketball success and student quality. Tucker and Amato (2006) also researched the link between basketball success and SAT scores with using 10 year data from the years 1993 to 2002. The basketball success variable was measured by the Associated Press (AP) ranking as well as the number of NCAA tournaments played. While previous studies failed to take into account lagged values, Tucker and Amato used 10, 2 and 1- year lags on the relationship between basketball success and the average freshman SAT scores. A short term (1 and 2-year lags) positive relationship was found between the basketball success and average SAT scores for the full time period. Whereas the success measure, AP ranking, was found to be not significant, the number of tournament games played was found to provide better estimates on basketball success and the effect it had on SAT scores, which was also supported by the earlier findings of Mixon and Ressler (1995). Anderson (2012) on the other hand, used a propensity score design method and found that having a winning football team increased the donations, student applications, academic reputation and SAT scores for the university. Anderson also found that the university became more selective with accepting new students when having a successful football team. Lastly, Pope and Pope (2009) looked at the impact a successful Division I or Division I-A football program brings to the university with using a panel of all Division I schools from 1983 to 2002. With using two datasets, one set containing data on athletic success, which was measured by rankings and another dataset containing data on the quantity and quality of student applications that included among others, average SAT scores, number of applications and enrollment size of freshman each year, Pope and Pope found that football and basketball success increased the amount of applications the university received. This in turn allowed the institution to increase their total enrollment size, thus further indicating a positive link between athletic success and student quality and quantity. To sum, it can be seen that football and basketball teams create an impact on the university with attracting more talented students to the campus.

There has also been research done on the impact college sports has on tuition revenues (Alexander & Kern, 2009; Mixon & Ressler, 1995; Tucker & Amato, 2006). It has been argued that having a successful

[21] Grade point average

athletics program will bring benefits to universities with, for instance, attracting more out of state students to the university, which have to pay higher tuition fees than in-state students. This results in the out of state students providing more money to the university and thus increasing the financial resources for the university. While previous studies focused on the impact athletic success had on total enrollment, Mixon and Ressler (1995) looked specifically on the out of state enrollments. Using the number of rounds each university participated in the NCAA basketball Championship tournament between the years of 1978 to 1992 as the athletic success measure, for 156 schools, Mixon and Ressler found that successful basketball programs were able to attract more out of state students than those that were less successful. This result validates the claims that athletic success helps increase tuition revenues the school receives and thus have a direct impact for the university[22].

Donations/Contributions

It has been argued that a successful athletic program can not only have an effect on the quantity and quality of prospective students, but the success can also have an impact on the donations the athletic department and the university receives (Rhoads & Gerking, 2000). The more donations and contributions an athletic department receives, the more possibilities the university has regarding improving and scaling up the athletic facilities and increasing the coaches salaries (Sandy et al., 2004). However, empirical research related on this has had some mixed results. Studies that have come up with a positive relationship between college athletics success and private giving include among others, Baade and Sundberg (1996), Meer and Rosen (2009), Rhoads and Gerking (2000) and Stinson and Howard (2004).

One of the earliest studies that found a positive linkage between athletics success and contributions was done by Baade and Sundberg (1996). Baade and Sundberg (1996) looked at the effect a successful football or a basketball program had on alumni giving[23]. Using data from Council for Aid Education between the years of 1973 to 1990, they looked at private, public and liberal arts colleges. The findings showed that a football bowl appearance had a positive effect on donations for both public and private universities. Also, for public universities whose basketball teams reached the NCAA basketball tournament saw an increase in alumni donations. Another study by Goof (2000) used endowment data

[22] Tuition fees are higher for out of state students than for in-state students.
[23] Alumni giving= alumni donations

from two universities (Northwestern and Georgia Tech) from 1979 to 1996 to see if the more years of major football success resulted in more donations to the school. Although football success at Georgia Tech did not result in an increase of donations, Northwestern's football success had an impact by an increase of $200 million in received donations. Rhoads and Gerkin (2000) also studied the success of football and men's basketball and the effect it had on private donations in U.S universities. With having an unbalanced data set ranging ten years (1986 to 1996) and using a fixed-effects model approach, they found a positive link between the yearly changes in athletic success and alumni donations. This further strengthened the claims that college sports has a significant indirect impact on universities.
There have been several other studies that have applied a fixed-effects model as Rhoads and Gerkin (2000), in order to research the link between athletic success and alumni giving (Litan et al., 2003; Turner, Meserve, & Bowen, 2001). For instance, Turner et al. (2001) looked at the impact football success had on alumni donations for15 private universities between the years of 1988 to 1998. Using the win-loss record of the football team as the measure of success, they found that alumni giving was unaffected by the win-loss record at Division I and Ivy League universities. However, for the smaller private schools competing in Division III, there was a positive and significant link between alumni giving and football success. Turner et al. (2001) contributed this result to the "bonding" effect of athletics where the fraction of athletes in regards to the total student body was higher than in schools that had larger enrollments and thus lower fraction of student-athletes with regards to total enrollment.

Although many studies have been able to find a positive link between athletic success and alumni giving the results are still mixed with studies finding no link between athletic success and donations (Stinson & Howard, 2007). The study by Stinson and Howard (2007) looked at all schools participating in Division I-A football and the effect of win-loss record, bowl appearance, football tradition and bowl wins (success measure) had on both academic and athletic giving. Athletic success had no significant link to academic giving[24], whereas a significant link between athletic success and athletic giving was found.

As can be seen, the empirical research is more evolved regarding professional sports and their impact on local economies as well as the indirect benefits (applications, tuition fees etc.) of college athletics

[24] Academic giving refers to donations given to the universities academics and not the athletic departments

compared to the economic impact college athletics has on local economies. Therefore, this paper will contribute to the slowly growing literature about the economic impact college athletics (on an aggregate level) has on local economies.

3. Methodology

This section begins with the explanation of the ex-ante versus ex-post approach to gain an understanding of the overall method used in this paper. The description of panel data and the specific ordinary least squares, three stage least squares, instrumental variable and general methods of moments models applied in this study are followed.

3.1 Methodological Approaches: Ex-ante Versus Ex-post Approach

When estimating the economic impact stadiums, sporting events and teams have on local economies ex-ante or ex-post approaches are applied. Since, this paper uses the ex-post method to investigate the impact college athletics has on the state and metropolitan level GDP, the ex-ante approach is only touched upon briefly. The ex-post approach is preferred, since this paper tries to find the actual impact college athletics has on local economies by looking at past data and not an estimated impact, which an ex-ante approach will give. Also, ex-post approach relies on better methodology providing more robust results.

The ex-ante approach estimates the economic impact before a new stadium is being built, a sporting event takes place or before a professional sports team move to a new area. This approach generally predicts the number of visitors an event can attract and estimates the direct economic impact it has by assessing the average spending per visitor. In order to arrive at the total economic impact, a multiplier is applied to arrive at the final estimation. The multiplier assesses the direct and indirect expenditures of people attending a sporting event, in order to get the total economic impact. The ex-ante methodology has been heavily criticized from researchers doing economic impact analyses on sports, due to its flaws and theoretical deficiencies (Baumann & Matheson, 2011; Blair, 2012; Matheson & Baade, 2006; Siegfried & Zimbalist, 2006). For instance, ex-ante reports the gross economic impact, which is the spending taking place at a specific sporting event and not the net economic impact, which takes into account the reduced spending taking place outside the event. Due to this, net economic impact gives a truer picture of the actual impact the event or a stadium has on the local economy (Baumann & Matheson, 2011). The theoretical deficiencies and flaws that come into play in the ex-ante methodology are substitution, crowding out and leakages (Baade et al., 2005). For instance, hosting college athletics championships events or other mega events for that matter, can simply shift the spending pattern around

(substitution effect), which does not result in an increase in the local income. The crowding out effect occurs when visitors avoid coming to the area where the sporting event takes place and chooses to go somewhere else (Matheson, 2006). The last theoretical deficiency in ex-ante approach is leakages. Leakages occur when spending not only occurs in the local area but leaks into other areas as well, thus making it difficult to estimate the true impact on the local area (Siegfried & Zimbalist, 2000).

Many times when conducting an ex-ante analysis the incremental spending and visitor estimations are too optimistic and give falsified results. There are also flaws with the multipliers applied to estimate the total economic impact[25]. The multipliers are often too large and thus the economic impact estimation is larger than it is in reality. This in turn gives an overly optimistic estimation of the impact teams and facilities have on the economy. Furthermore, it is very challenging to get a correct estimation of net incremental spending due to the fact that it is hard to control for the substitution effect and to get and isolate the multiplier applied (Blair, 2012). Therefore, the ex-ante approach is not favored by sport researchers and is rarely applied in academic research.

Due to the above mentioned problems with ex-ante studies, this thesis follows an ex-post approach, which will provide a truer estimation of the economic impact college athletics has on the state and metropolitan level economies (Baumann & Matheson, 2006). There have been many researchers that have adopted the ex-post approach when analyzing the impact of mega-events, stadium construction and team relocations (Baade et al., 2008; Baade & Dye, 1990;Baumann & Matheson, 2011; Coates & Humphreys, 2002; Feng & Humphreys, 2008). An ex-post approach usually looks at the impact a sporting event, team relocation or a stadium has on the local economy. Some economic variables employed when using the ex-post approach to investigate the economic impact can be; employment, income per capital, sales tax, sales tax revenues, personal income or number of visitors (Bauman & Matheson, 2011).

Although the ex-post analysis gives a truer and more realistic results on the economic impact of sports there are challenges with it. For instance, estimating the economic impact a sporting event has on a local economy can be challenging, since it is not easy to isolate the sporting event from the local

metropolitan/micropolitan area (Blair, 2012). Also, the economic effect a sporting event has on the local economy can have a big effect in the near period of the event taking place but not have a big effect over the entire year. Due to this reason, Matheson (2006) points out that it is more optimal to use quarterly or monthly data than yearly data and use city, micropolitan or metropolitan level of data in contrast to state or national when studying economic impact of sporting events. However, since this paper looks at the economic impact college athletics has as a whole and does not look into at a specific event like the BCS National Championship Game, using yearly data of college athletics is considered to give sufficient results that are within the scope of the study. Since Division I schools reports only yearly data to the NCAA acquiring monthly data on college finance would require resources that are outside of the scope of the study.

3.2 Panel Data

This paper has used panel data to investigate the economic impact Division I college athletics has on the state and metropolitan level economies. Panel data, also called longitudinal data, is the combination of cross-sectional and time-series data (Baltagi, 2005). In other words, panel data has ***n*** observations of different entities, countries, schools etc. over several time periods, **T**. Panel data can be either balanced or unbalanced. In a balanced data set all the elements are observed for each entity and each time period used in the study. An unbalanced panel data set is, where there is data missing for at least one entity and one period (Stock & Watson, 2012). This study uses a balanced panel dataset, having all variables observed for all the universities over each time period[26]. Whereas time-series and cross-sectional regressions have one subscript ***i*** or ***T*** on their respective variables, panel data has a double subscript. The panel data model takes the form of:

$$Y_{it} = \alpha + X'\beta_{it} + u_{it} \quad i = 1 \dots N \; t = 1, \dots, T \quad \text{(Equation 1)}$$

$$u_{it} = \mu_i + v_{it} \quad \text{(Equation 2)}$$

In Equation 1, ***i*** stands for the cross-section dimension and in this study, ***i*** stands for the universities included in the study. Subscript **t** denotes the time-series dimension which in this study covers 9 years

[26] Having unbalanced panel data is more common in empirical research

from 2005 to 2013 (Baltagi, 2005). Alpha, α, is a constant and the intercept in the equation and $\mathbf{X'_{it}}$ is the independent variable followed by the error term, μ_{it}. The error term $\mathbf{u_{it}}$ can be split into two parts, the unobservable individual-specific effect, $\mathbf{u_i}$ and, $\mathbf{v_{it}}$, the remainder errors, as can be seen from Equation 2.

There are several benefits with using panel data (Baltagi, 2005). Panel data controls for individual heterogeneity, meaning that the countries, states or in this case universities are heterogeneous. In this paper, the panel data controls for the heterogeneity between the universities. Time-series and cross-sectional models that do not control and take this into account can as a result obtain biased estimates. Other benefits with panel data are that it has more variability, information and less collinearity between the variables studied[27] (Ibid.). This in turn provides better parameter estimates and better measuring effects that are not as detectable in cross-sectional and time-series studies, since several time periods are pooled together for every university (Cameron & Trivedi, 2005). Lastly, panel data also allows to construct more complicated models than would be possible with having only time-series or cross-sectional data in a study (Baltagi, 2005).

Apart from having many benefits, panel data also has some limitations. For instance, heteroscedasticity is far more likely to occur when pooling data into a panel. Also, using a short time frame can be a limit when using panel data (Baumann & Matheson, 2011). However, this is not considered an issue in this paper, since a time period of nine years has been applied. Lastly, obtaining the correct t-values and standard errors are more challenging when dealing with panel data[28]. To tackle this issue this paper has used robust standard errors.

[27] Collinearity occurs when two or more variables are highly correlated with each other.
[28] For more disadvantages and advantages see Baltagi (2005) and Cameron and Trivedi (2005).

3.2.1 Ordinary Least Squares

To estimate the economic impact college athletics has on the metropolitan and state economies the study starts with Ordinary Least Squares (OLS) estimations. The following models are estimated:

$$MetroGDP_{it} = \beta_0 + \beta_1 Contributions_{it} + \beta_2 Employment_{it} + \beta_3 Enrollment_{it} + \beta_4 Capital_{it} + \beta_5 MetroProfits_{it} + \mu_{it} \quad \textbf{(Model 1)}$$

$$StateGDP_{it} = \beta_0 + \beta_1 Contributions_{it} + \beta_2 Employment_{it} + \beta_3 Enrollment_{it} + \beta_4 Capital_{it} + \beta_5 StateProfits_{it} + \mu_{it} \quad \textbf{(Model 2)}$$

$$Employment_{it} = \beta_0 + \beta_1 Contributions_{it} + \beta_2 MetroProfits_{it} + \beta_3 Enrollment_{it} + \beta_4 MetroGDP_{it} + \beta_5 Capital_{it} + \mu_{it} \quad \textbf{(Model 3)}$$

In the above models, the cross-section dimension is denoted by subscript *i* and stands for universities whereas the time-series dimension is denoted by subscript *t*. In Model 1, which looks at the metropolitan level, the dependent variable is metropolitan GDP (*MetroGDP)*, β_0 is the intercept followed by the independent variables of athletic profits (*MetroProfits),* employment *(Employment),* enrollment *(Enrollment),* facility investments (*Capital)* and donations (*Contributions),* which is followed by the error term u_{it}. Model 2 applies the state GDP (*StateGDP)* as the economic measure and is the dependent variable. The same independent variables are applied in Model 2 as in Model 1, with the exception of *MetroProfits* being substituted with the state athletics profit (*StateProfits)* as one of the independent variables, since we are looking at the state level impact. The athletic departments' profits are aggregated together both at the state and metropolitan level, for the universities located in the same state and metropolitan areas. These two models are used to answer Hypothesis I "*College athletics has an economic impact on metropolitan and/or state GDP"*. Model 3 is used to answer hypothesis II "*College athletics capital investments impact on the state or metropolitan-level has an effect on employment".* The dependent variable is employment and the independent variables are *Contributions MetroProfits*, *Enrollment*, *MetroGDP*, *Capital* followed by the error term.

However, in this study, Models 1, 2 and 3 might suffer from several issues. First of all, it is very likely that these three models suffer from omitted variable bias. There can be omitted factors that affect the metropolitan GDP, state GDP and employment and the independent variables that are not included in the model, resulting in omitted variable bias. Omitted variable bias can occur, if the omitted variable is correlated with one of the independent variables or, if it is a determinant of the dependent variable (Stock & Watson, 2012). All three models might suffer from bias, due to unobserved factors like ability, making ability part of the error term μ_{it}. The measure of the unobserved ability in these three models would be the abilities of the athletes participating in college athletics. It can be argued, that ability plays a role in how much contributions the universities receive, since one can argue that a university that has more successful athletes receives more contributions for their success. Since contributions is correlated with the error term (ability), the OLS assumption that the error term u_i has a conditional mean of zero can be possible violated and thus provide biased results. Another problem that these three models might have is having the correct standard errors. To solve this problem and in order to make sure that the standard errors are heteroscedasticity consistent at the state and metropolitan level, robust standard errors are applied in this study. The reason for this is that it is common in empirical research to use robust standard errors, as it is viewed as a more conservative approach and usually resulting in larger standard errors than when it is not applied (Cameron & Trivedi, 2005). Lastly, Model 1 and 2 can suffer from reverse causality. It can be the case that the state and metropolitan GDP is impacting college athletics and college athletics not impacting metropolitan and state GDP. In order to account for the omitted variable bias and the reverse causality, an instrumental variable approach is applied in this study.

3.2.2 Instrumental Variable

As previously stated in section 3.2.1, the OLS models might suffer from omitted variable bias and reverse causality, making the OLS estimations inconsistent (Stock & Watson, 2012). To solve these problems an instrumental variable (IV) approach is applied. To conduct an IV approach an instrument needs to be applied to the model. It can be hard to find a good instrument and one should use economic reasoning when choosing a valid instrument. Applying a weak instrument into the model might give falsified results with giving large biased coefficients and therefore it is important to have a strong instrument (Ibid).

In this paper the IV regressions of the contributions variable is treated as an endogenous variable since there are other possible factors affecting GDP and employment. To solve for the endogeneity problem present between the contributions the athletics departments receive and the error term (ability), an instrument is selected. The instrument applied to the contributions variable is the total number of Olympic medals a university's athlete/athletes have earned from the 2008 and 2012 Summer Olympic Games. In order for the instrument to be valid, it cannot be correlated with the error term and must be correlated with the contributions variable. It can be argued that winning an Olympic medal will affect the donations a university receives, since success at the Olympics will give incentives for people to contribute more to the athletic departments, to further support possible success in the future. Also, it can be claimed that the total medals variable is correlated with ability and hence this way correlated to the error term. However, it can be argued that the total medals achieved in the Olympics is an exogenous variation of success and therefore can be included as an instrument and thus being uncorrelated with the error term. This means that achieving an Olympic medal can be seen as random success, since one cannot predict, if an athlete will achieve an Olympic medal. To further justify the choice of the instrument, it can be noted from the data that University of Alabama, which is a football powerhouse[29] and receives significant amounts in contributions for their athletic success, actually saw a decrease in their contributions following the 2008 Olympic Games where the university was unable to achieve a medal. On the contrary, Rutgers University, a less prominent football school, which has not enjoyed the same amount of success as University of Alabama, was able to achieve an Olympic Medal in the 2008 Games. Following this unexpected success, Rutgers University saw an increase in its contributions the following year. This validates that the number of Olympic medals are an exogenous variation that affects the endogenous variable (*Contributions*) and therefore can be used as an instrument. Furthermore, applying this instrument solves for the reverse causality problem that was encountered in the OLS models. This is due to the fact that the Olympic medals captures the impact that is coming from college athletics and not the state or metropolitan GDP.

To perform the regressions, a two-stage least square estimation (2SLS) is used. Two-stage least square estimation uses two stages where the IV regression breaks the *Contributions* variable into two separate

[29] A school that has a successful football team contributing significantly to the revenue stream of the athletic department.

parts. The first part is where it is correlated with the error term u_i (ability) and the second part is where it is not correlated with the error term. As noted in the previous section 3.2.1, robust standard errors are used to make sure that the errors will have the same variance. Breaking the *Contributions* variable into two separate parts allows us to get an estimate of β_1. The 1st stage of the models looks like this:

$$Contributions_{it} = \pi_0 + \pi_1 TotalMedals_i + w_1 Metroprofits_{it} + w_2 Employment_{it} + w_3 Enrollment_{it} + w_4 Capital_{it} + \mu_{it} \quad \textbf{(Model 4)}$$

$$Contributions_{it} = \pi_0 + \pi_1 TotalMedals_i + w_1 Stateprofits_{it} + w_2 Employment_{it} + w_3 Enrollment_{it} + w_4 Capital_{it} + \mu_{it} \quad \textbf{(Model 5)}$$

$$Contributions_{it} = \pi_0 + \pi_1 TotalMedals_i + w_1 Metroprofits_{it} + w_2 MetroGDP + w_3 Enrollment_{it} + w_4 Capital_{it} + \mu_{it} \quad \textbf{(Model 6)}$$

In Model 4, 5 and 6, the instrumental variable *TotalMedals* and the exogenous independent variables are regressed on the dependent variable *Contributions*, $\boldsymbol{\pi_0}$ is the intercept, $\boldsymbol{\pi_1}$ is the slope and $\boldsymbol{\mu_{it}}$ is the error term. The condition that the instrument is not correlated with the error term (ability) cannot be tested and confirmed. However, in order to test the instrument validity one can test if the *Contributions* variable is correlated with the *TotalMedals* variable. This can be done by testing if $\pi 1=0$ in Model 4, 5 and 6 above. The results from the first stage regression shows that the *TotalMedals* variable is significant in the models and therefore we can reject that $\pi 1=0$. This means that the covariance between *TotalMedals* and *Contributions* is different from zero and therefore the *Contributions* variable is correlated with variable *TotalMedals* in all the models. The first stage F-statistic is used to check if the instrument is strong in the models. An instrument is considered strong, if the first-stage F-test is over 10 (Stock & Watson, 2012). The first stage results show that the F-value is higher than 10 and thus the instrument is consider sufficiently strong in the models[30]. In the first stage the endogenous variable (*Contributions*) is regressed on the instrument in order to get predicted estimations of $\hat{X}_i$. Doing this will isolate the variation we have in the exogenous instrument (*TotalMedals*), which is uncorrelated with μ_i (Cameron & Trivedi, 2005)[31].

[30] Please see Appendix 4 for the first stage F-test results.
[31] Please see Appendix 3 for the endogeneity tests.

Following the first stage regression where the endogenous variable (*Contributions*) is regressed on the instrument the 2nd stage takes the following form:

$$MetroGDP_{it} = \beta_0 + \beta'_1 \widehat{Contributions}_{it} + \beta_2 Employment_{it} + \beta_3 Enrollment_{it} + \beta_4 Capital_{it} + \beta_5 MetroProfits_{it} + \mu_{it} \quad \textbf{(Model 7)}$$

$$StateGDP_{it} = \beta_0 + \beta'_1 \widehat{Contributions}_{it} + \beta_2 Employment_{it} + \beta_3 Enrollment_{it} + \beta_4 Capital_{it} + \beta_5 StateProfits_{it} + \mu_{it} \quad \textbf{(Model 8)}$$

$$Employment_{it} = \beta_0 + \beta'_1 \widehat{Contributions}_{it} + \beta_2 MetroProfits + \beta_3 Enrollment_{it} + \beta_4 Capital_{it} + \beta_5 MetroGDP_{it} + \mu_{it} \quad \textbf{(Model 9)}$$

In the 2nd stage the predicted value of $\widehat{Contributions}_{it}$ replaces the original *Contributions*$_{it}$ (Model 4, 5 and 6). This gives an estimator of $\hat{\beta}_i$ known as the two stage least squares estimator shown in Models 7, 8 and 9 respectively. In order to estimate the coefficients with IV regression they need to be either identified or over identified. If the coefficients are over identified then there are more instruments than there are endogenous variables. When there are equal amount of instruments as well as endogenous variables the coefficients are said to be identified. If the coefficients are under identified (instruments < endogenous regressors) then they cannot be estimated by IV regression (Stock & Watson, 2012). The Hansen J statistic is used to validate that the coefficients are exactly identified and confirms that the coefficients can be estimated. To test for under identification the Kleibergen-Paap statistic is used and shows that under identification can be rejected and that the model is identified. In this study the three models are exactly identified, since the endogenous variable (*Contributions*) is instrumented with one instrument (*TotalMedals*).

3.2.2.1 Three Stage Least Square

Since two stage least squares (2SLS) method does not exploit the correlation of the disturbances (error terms) across the equations, the three stage least square (3SLS) estimation of simultaneous equation is

performed for Model 1 and Model 2. This is done, since there are cross-correlation between the two models. Meaning, both equations are related to each other through the error term (ability), with the only difference in the models being that one model looks at the state level and the other at the metro level impact. All the same variables are used in both models, except *Stateprofits/Metroprofits* and *StateGDP/MetroGDP*. To perform the three stage least square of simultaneous estimation, Model 1 and Model 2 are estimated together simultaneously. In doing so, more efficient estimations of the parameters are achieved since it uses more information than a single equation estimator (Baltagi, 2005).
However, since there is still endogeneity issue in the independent variables, the results from three stage least squares can be misleading and should be treated with caution.

3.2.3 Generalized Methods of Moments

To solve the endogeneity issues present in models 7, 8 and 9, a Generalized Methods of Moments (GMM) approach is applied. The following models are estimated:

$$MetroGDP_{it} = \beta_0 + \beta_1 L.MetroGDP_{it} + \beta_2 Employment_{it} + \beta_3 Enrollment_{it} + \beta_4 Capital_{it} + \beta_5 MetroProfits_{it} + \beta_6 Contributions + \mu_{it} \quad \textbf{(Model 10)}$$

$$StateGDP_{it} = \beta_0 + \beta_1 L.StateGDP_{it} + \beta_2 Employment_{it} + \beta_3 Enrollment_{it} + \beta_4 Capital_{it} + \beta_5 StateProfits_{it} + \beta_6 Contributions_{it} + \mu_{it} \quad \textbf{(Model 11)}$$

$$Employment_{it} = \beta_0 + \beta_1 L.Employment_{it} + \beta_2 MetroProfits + \beta_3 Enrollment_{it} + \beta_4 Capital_{it} + \beta_5 MetroGDP + \beta_6 Contributions_{it} + \mu_{it} \quad \textbf{(Model 12)}$$

Models 10, 11 and 11 use the same variables as in the OLS estimations expect for adding the lagged values of the dependent variables of *MetroGDP*, *StateGDP* and *Employment* into the model.
The GMM approach applies a semiparametric model, which means that the model is only partly specified. Thus, in cases where maximum likelihood is not a sufficient method or is difficult to conduct, a GMM approach can be used instead, since the model only needs to be partly specified (Cameron & Trivedi, 2005). The GMM estimation relies on the orthogonality condition with assuming uncorrelation

with the dependent and independent variables. This condition must exist between the lagged dependent variable Y_{it} and the error term μ_{it} (Baltagi, 2005). GMM solves the endogeneity issues present in the models as it makes the independent variables exogenous and consequently makes the assumptions that the variables are random. In this way consistent parameter estimates can be obtained. In this paper, GMM moment conditions uses the lag of the dependent variables of *MetroGDP, StateGDP* and *Employment* as one of the independent variables. An advantage of using the GMM method is that an instrument does not need to be found. The models 10, 11 and 12 use the first differences of the independent variables as instruments, which are already implemented in the model.

When applying the GMM framework there are several estimators to choose from. Baumann and Matheson (2011) discuss three of them that can be applied when estimating a sport economic impact. The different GMM estimators that Baumann and Matheson discuss are Anderson and Hsiao (1982), Blundell and Bond (1998) and Arellano and Bond (1991). All these three estimators use the first differences of the independent variable as well as the lag of the dependent variable as instruments. In contrast, the IV approach requires one to find a good and a relevant instrument. The advantage of the GMM method is, that the instruments are already included in the model and uses the existing independent variables as instruments. Also, the instrumental variable approach might cause downward-biased errors and an advantage of using the Arellano and Bond estimator is that it corrects for it. Therefore, the estimator chosen for this study is the Arellano and Bond estimator. The reason for choosing this estimator is that it allows as many lags to be used as the data allows in the model. This makes the model over identified as well as being a more efficient estimator than Anderson-Hsiao with having corrections for downward biased error caused by the IV approach (Baumann & Matheson, 2011). For this paper, one lags were used for the dependent variables (*MetroGDP, StateGDP and Employment*). Different lags were tried but using one lagged dependent variable gave the most consistent parameter estimates.

3.3 Limitations

There are some limitations in relation to the data of this paper. Firstly, it would be ideal to have more than 9 years of data included in the analysis in order to get an extensive comprehension of the impact college athletics has on the economies and that way get more robust results. However, the data collection

by the NCAA was subject to major reporting changes in 2004, due to large accounting discrepancies between the universities. For this reason, data from 2004 and before is not comparable with data from 2005 and onwards[32](Fulks, 2013). Even though the NCAA has made improvements in the data reporting requirements, there are still universities that interpret some numbers differently. Therefore, a complete accounting transparency between the universities is lacking in the data used in this study. Also, it would have been ideal to include all the private universities that participate in the Football Bowl Subdivision (FBS), but since these schools are not required to report their finances, it would require immense resources that are outside of the scope of this study. Lastly, there has not been made any distinction between part-time and full-time employment in this study, which could have been used to compare if college athletics has a bigger effect on part-time jobs than on full-time jobs and might have a negative or insignificant impact on the economy. However, this is something future research can take into account.

[32] NCAA Revenues and Expenses of Division I Intercollegiate Athletics Programs Report, http://www.ncaapublications.com/productdownloads/2012RevExp.pdf

4. Data Analysis

This section describes and presents the data and the variables used in this study. It begins with explaining the data and the variables before moving onto to the summary statistics.

4.1 Data Description

This paper uses data from the period of 2005 to 2013 from 96 public Division I schools that take part in the Football Bowl Subdivision (FBS)[33]. In total, 39 states and 87 cities with FBS universities are included, while private universities and the service academies (Navy, Air Force and Army) that are part of the FBS are excluded. The reason for excluding private universities in the FBS is that they are not by law required to report their finances to the NCAA like public universities. The service academies are excluded as well, as they are government funded. Also, universities that were in the transitioning period to the FBS after 2005 were not taken into account, as the author wanted to ensure to get complete data from the universities included in the study for all the years[34].

Three primary data sources were used to conduct the data analysis. Firstly, the Bureau of Economic Analysis[35] was used to gather data on employment and GDP for the different states and metropolitan areas the universities where located in. Secondly, the data on the athletics total revenues, total expenses and total university enrollment, was retrieved from the Equity in Athletics (EADA) database was used[36]. The EADA database contains all finances of the universities which are required to report their finances according to the Equity in Athletics disclosure Act. However, EADA does not provide very detailed information about the sources of operating revenue and expense allocation. Therefore, data from USA Today's NCAA database was used,[37] in order to get a better view of which specific sources contributed to the revenues and expenses for the athletic departments. As mentioned before, all public universities taking part in Division I college athletics are required to report their finances to the NCAA. However, the NCAA does not release the data publicly and therefore analysts at USA Today collects and gathers

[33] See Appendix 2 for list of all the schools included in the study.
[34] The transitioning period is four years for a team wanting to make a transition to another division or FBS.
[35] http://www.bea.gov/
[36] http://ope.ed.gov/athletics/
[37] http://sports.usatoday.com/ncaa/finances/

the information from the public records submitted to the NCAA. Data about the donations/contributions the athletic departments received was taken from the USA Today database. Also, the total costs the athletic departments spent on facilities/ grounds (capital investments) were also taken from USA Today. Moreover, the United States Olympic Committee (USOC) website was used to get information on which U.S athletes have taken part in the Olympic Games, and thus was used to collect data on the athletes taking part in the 2008 and the 2012 Summer Olympic Games that won at least a medal in one of the Games. Information of the university they represented was also taken from the USOC website that was facilitated with the universities included in the study[38]. This data was used for the instrumental variable. The databases are considered valid since previous researchers have used the same databases in their studies (Lentz & Laband, 2009; Litan et. al., 2003; Orszag & Orszag, 2005; Turner et. al., 2001).

4.2 Variables

This study has followed a model that has used nine different variables. Table 1 below gives a short description of the variables chosen for this study, which is followed by discussion and motivation of the variables.

Variable	Description
StateGDP	State GDP for 2005-2013 of the 39 states included in the study
StateProfits	Athletic departments profits for all sports (aggregated), state level for 2005-2013
Employment	Employment in the metropolitan and micropolitan areas where the universities are located for 2005-2013
Enrollment	Total university enrollment for the years 2005-2013
Capital	Athletic departments capital investments for 2005-2013
MetroGDP	Metropolitan GDP for 2005-2013
MetroProfits	Athletic departments profits for all sports (aggregated), metropolitan level for 2005-2013
Contributions	Amount the athletic departments have received in direct donations from alumni, private persons, corporations between 2005-2013
TotalMedals	Total medals the universities student-athletes achieved from the 2008 and/or the 2012 Summer Olympic Games. Dummy variable[39]

Table 1: Description of the variables used in the study.

[38] http://www.teamusa.org/

[39] A variable that takes the value of 0 if the school has not gotten an Olympic medal and the value of 1 if the school has gotten an Olympic medal.

StateGDP: This variable portrays the yearly Gross Domestic Product of all the 39 states that are included in the study for the years of 2005 to 2013. When looking at the economic impact college athletics has on the state level this variable is chosen as a proxy to measure the economic impact college athletics has on the state economy. As mentioned before, the data on state GDP was taken from the Bureau of Economic Analysis.

StateProfits: This variable denotes the yearly profits of the athletic departments for 2005 to 2013. All universities that are located in the same state are aggregated together in order to get the total statewide profits of the athletic departments. The motivation of including this variable lies in the assumption that the more profitable the athletic departments are on the state level, the more impact it has on the state GDP. This variable serves as one of the independent variables and the variable's impact on state GDP is examined. The yearly athletic department profits has been calculated as shown in Equation 1 below:

$$Total\ Revenue\ (from\ all\ sports) - Total\ Expenses\ (from\ all\ sports) = Profits \quad \textbf{(Equation 1)}$$

Data on total revenue and total expenses was obtained from the EADA database. Profits of all the universities located in the same state were added together to arrive at the state level profits as shown above.

Employment: This variable represents the yearly employment for the metropolitan and micropolitan areas where the universities are located in for the years 2005 to 2013. In the analysis this variable is a control variable measuring the impact college athletics has on the economy. Economic reasoning would indicate that the more unemployed people there are in a state or a metropolitan area the lower the GDP is going to be. In Model 3, this variable is used as the economic impact measure with regards to college athletics capital investments.

Enrollment: This variable represents the total student enrollment at the universities. The motivation to use this variable is to account for the economic impact college athletics has on the economy. Usually the bigger the university (larger student enrollment) the bigger their athletics departments are (i.e. indicating larger student-athlete body and more teams). This in turn also means that when more people are employed

by the university and the athletic departments, the more they contribute to the employment rate of the economy. The size of the universities, also has an impact on the size of the fan base and stadiums. This in turn results in more revenue for the athletic departments, hence bringing more people and businesses to the local community. For these reasons, the enrollment variable is included in the analysis.

Capital: This variable represents the total capital investments made by the athletic departments regarding athletic facilities and stadiums. Since investments in facilities and buildings do not take into account the capital stock, the amount that gets invested in facilities and stadiums (capital) needs to be depreciated, in order for this to be accounted for. Equation 2 below shows the method that has been used to depreciate the capital investments made by the athletic departments.

$$K_{t+1} = I + (1 - \delta) * K_0 \qquad \textbf{(Equation 2)}$$

In the above equation, $\boldsymbol{K_0}$ is the capital in current period, $\boldsymbol{I}$ is the initial investment, $\boldsymbol{\delta}$ is the capital depreciation rate and $\mathbf{K_{t+1}}$ is the capital in the next period. The depreciation rate that has been applied in depreciating the capital stock is 2.5% and has been assumed to be the same for all the universities. The reason why 2.5% has been used as the depreciation rate is that this rate has been used in previous papers when depreciating college athletics facilities (Winston, 2000; Orszag & Orszag, 2005). The motivation to include this variable lies in the fact that investment in infrastructure is assumed to have an impact on the economy (GDP) as it creates more jobs, bigger seating capacity and makes the surrounding areas more appealing.

MetroGDP: This variable represents the yearly GDP of the metropolitan areas[40] the universities are located in from the years 2005 to 2013. The MetroGDP variable is used as the dependent variable when looking at what impact college athletics has on the economy at the metropolitan area. The data was taken from the Bureau of Economic Analysis.

[40] A metropolitan area is a densely populated urban area with a population of over 50.000.

MetroProfits: This variable represents the yearly aggregate profits the athletic departments generated from 2005 to 2013. The profits of those universities located in the same metropolitan area were added together, in order to get a comprehensive understanding of the profits college athletics generates at the metropolitan level. This variable serves as one of the independent variables when looking at the economic impact college athletics has on the metropolitan level. The reason to include this variable lies in the assumption that the more profitable the athletic departments are at the metropolitan level the more impact it has on the metropolitan GDP. This can be due to people spending more on college athletics (i.e. tickets, merchandise, restaurants etc.)

Contributions: This variable represents the amount that has been donated to the athletics department by alumni, private people, firms and alike. The more successful an athletic program is, the more likely it is that will receive bigger donations from, for example, alumni and organizations, which has been proven by several studies (Baade & Sundberg, 1996; Rhoads & Gerkin, 2000; Stinson & Howard, 2004). Getting more donations brings more opportunities for the athletic departments to build new, better and bigger facilities and stadiums for their athletes and fans. This in turn can help them attract talented athletes in the future as well as other prospective students to attend the university. Taking this into account, it can be argued that this will have an indirect effect on the local economy as it results in more donations. This in turns, allows more high-end and bigger facilities to being built on campus. For this reason, the contributions variable has been used as one of the independent variables in the study.

TotalMedals: This variable is an instrumental variable. It is a dummy variable[41] that takes the value of 1, if a school has had an athlete earning a medal in either the 2008 Summer Olympics or the 2012 Summer Olympics and the value of 0, if they have not had an athlete attain an Olympic medal. This variable represents the total amount of medals a university has received from the 2008 Summer Olympic Games and/or 2012 Summer Olympic Games. The total Olympic medals the universities have won are used as an instrumental variable for the Contributions variable. This variable is a "success" variable meaning that unexpected success for a school (more medals) will bring more donations to the university since the athletes are able to bring more attention and recognition to their respective institutions.

[41] A dummy variable is a variable that has the value 1 or 0.

4.3 Summary Statistics

In this sub-section the summary statistics of all the variables included in the study are analyzed. Table 2 contains the mean, standard deviation, minimum and maximum values, as well as, the number of observations of all of the variables.

Table 2 Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
StateGDP (in thousands $)	864	4.53e+08	4.73e+08	2.78e+07	2.20e+09
MetroGDP (in thousands $)	864	8.69e+07	1.78e+08	1.725.000	1.47e+09
Capital ($)	864	2.94e+07	3.77e+07	0	1.96e+08
Employment	864	905.990	1.650.973	20.535	1.18e+07
Enrollment	864	19.968	8.054	4.949	50.995
TotalMedals	864	0, 252	1, 27	0	14
MetroProfits ($)	864	3.277.970	6.206.658	-7.887.610	4.40e+07
StateProfits ($)	864	1.02e+07	1.19e+07	-5.611.921	4.76e+07
Contributions ($)	864	1.09e+07	1.24e+07	0	2.11e+08

Table 2. Summary statistics of the variables[42].

As can be seen from Table 2 above, all the variables included in the study have the same amount of observations of 864, which confirms that the study has a balanced panel data set. The StateGDP and MetroGDP is reported in thousands of dollars, which should be kept in mind when reading the numbers of metropolitan and state GDP.

The mean state GDP is 4.53e+08 (thousands of dollars) with the minimum state GDP being 2.78e+07 (thousands of dollars) in Wyoming in 2005. The maximum state GDP of 2.20+e09 (thousands of dollars) was accounted for in California in 2013. The standard deviation is 4.73e+08, which shows that there is a huge deviation in GDP between the states depending on their size and population. This can result in that some universities located in bigger states, even though profitable, can have a smaller impact on the

[42] Please note that state and metro GDP are in thousands of dollars. Capital, MetroProfits, StateProfits are in dollars while Employment, Enrollment and TotalMedals are in units.

economy than those universities located in smaller states. The same applies when looking at the MetroGDP variable. The mean metropolitan GDP is 8.69e+07 (thousands of dollars), with the minimum metropolitan GDP being $1.725.000 (in thousands) for the Lewiston-Idaho metropolitan area. The maximum metro GDP is 1.47e+09 (thousands of dollars) for the New York City metropolitan area and a standard deviation of $1.78e+08 (in thousands) indicates a quite large deviation in the metropolitan GDP. This shows the high likelihood for the universities located in bigger metropolitan areas to have an insignificant impact on the economy, since college athletics constitute only a fraction of the metropolitan areas economy. In contrast, universities located in smaller metropolitan areas are more likely to have a bigger impact on the economy, since it can constitute a bigger fraction of the economy.

As for the athletic departments capital investments, the average amount spent on capital was 29 million dollars. The maximum amount spent on capital investments equaled $196 million. It is important to note that some universities did not spend anything (minimum being 0) on building new facilities or facility constructions, while some university football powerhouses spent several millions of dollars on their facilities and stadiums, therefore resulting in a large standard deviation of $37.700.000. However, this is not surprising since the top FBS schools have a huge budget compared to lower FBS schools and can thus, invest more money in facilities. Nevertheless, this shows on average that college athletics invests quite significant amounts of money in facilities and stadiums, which can have an effect on the local economy by creating jobs, increasing stadium seating capacity and increasing the economic activity in the area.

When looking at employment one can see that the mean of employment in the different metropolitan/micropolitan areas is 905.990 and the minimum is 20.535 for Lewiston and maximum employment is 11.800.000 for New-York-New Jersey metropolitan area. This shows that the metropolitan and micropolitan areas where the universities are located in, have quite a large population. However, it is important to note here that there is a huge gap between the area that has the smallest employment (Lewiston, Idaho) and the area that has the highest employment (New York-New Jersey). This is expected, since the standard deviation of 1.650.973 indicates that employment is hugely dispersed among the university cities included in the study. Due to this, it can be expected that college athletics might have a bigger impact on the smaller cities, as they can contribute more to the overall economy.

The average number of student enrollment of the universities is 19.968 with a minimum student enrollment of 4.949 and maximum student enrollment of 50.995. The standard deviation of 8.054 confirms that there are large differences between schools taking part in the FBS with regards to student population and university size. One can assume that the larger the university is, the bigger the impact is on the economy as well as on employment, fan base, size of athletics department and contributions received. However, the overall size of the metropolitan area plays a role in the impact it has.

As for the athletic department's metropolitan level profits and state level profits, one can see that there are some athletic departments that are profit powerhouses, whereas others struggle and have deficits. The mean profit for the athletic department profits at the metropolitan level is $3.277.970 with the minimum being $-7.887.610 (San Francisco, Berkeley) and the maximum being $44.000.000 million (Tuscaloosa, University of Alabama). This seems reasonable, since the universities included in this study are the ones that generate most revenue from athletics (University of Alabama in Tuscaloosa being one of them). However, it is surprising that a football powerhouse such as Berkeley has the largest deficit, as it could be assumed that a less established athletics school would suffer a higher deficit. Nevertheless, a simple explanation of this can be that they spent and invested more in athletics (facilities, coach's salaries etc.) than other less prominent schools. Nevertheless, it also seems that these universities such as Berkeley, were not able to generate enough revenue to support this. The standard deviation of 6.206.658 confirms that the metropolitan profits are quite dispersed among the athletic departments but supports the fact that there are huge differences between the universities and their ability to be profitable. However, considering the mean metropolitan GDP, the mean net revenue generated by college athletics is a very small fraction of it and will most likely not have a significant impact on the local economy, at least in the largest metropolitan areas.

The state level profits of the athletic departments show a similar trend with the most profitable universities located in the state Texas. The universities located in Texas had an aggregate profit of $47.572.083, whereas the least profitable state (California) had a deficit of $-5.611.21. Texas being the home to three big football powerhouses (University of Texas, Texas A&M and Texas Tech) it is not surprising that the athletic departments are the most profitable in this state. California is a big football state and it can be noted that it is surprising that the universities are spending more than they are earning.

This can partly be explained by the huge deficit University of California-Berkeley had in 2005 (which was probably one of the biggest reasons), as the other universities located in California did not earn high profits. Another reason can be that the state of California has many profitable private universities that are not included in this study. The mean metropolitan profits of college athletics amount to $3.277.970 million indicating that on average college sports are profitable. However, it is also important to note that the standard deviation is $13.500.000 million, which indicates that the athletic departments profits are widely dispersed among the different states. Lastly, it should be noted that, since there are accounting discrepancies between the schools, the profit numbers can be a bit misleading as many schools do their accounting in a way that their revenues are balanced off with their expenses.

The summary statistics also showcases how the contributions to the athletic departments averaged $10.9 million with the largest contributions being $ 211 million. The Oklahoma State athletic department received the largest contribution in 2006. The minimum contributions to the athletic departments amounted to zero. This seems reasonable, since donations the athletic departments receive fluctuates from year to year, due to changes in the amount of the yearly donations, like Oklahoma State in 2006. It can be argued that athletic success has an impact on the donations the athletic department receives and the more successful a university is, the more donations are paid by people who want to support the athletic department. There are therefore large discrepancies between the contributions received by the athletic departments. This is confirmed when looking at the standard deviation of $12.400.000 million. However, it can be concluded that contributions received by the athletic department plays a big part in college athletics and shows that people are willing to contribute to college athletics, in order to build better and bigger facilities and support college athletics.

Lastly, the total medals variable has an average of 0.25 indicating that less than half of the schools included had an athlete/ athletes achieve a medal in the 2008 and/or 2012 Olympic Games. The maximum medals a university achieved was 14 and the lowest was 0.

5. Empirical Findings

The empirical results of the impact college athletics have on the state and metropolitan GDP are presented by discussing the OLS, IV, 3SLS and GMM test results. This is followed by the results of the impact college athletics capital investments have on the metropolitan employment by using OLS, IV and GMM tests. The first focus is put on the wider impact, the state GDP, and thereafter the economic impact on the metropolitan GDP is investigated. The reasoning is that if there is an impact on the state economy it might also have an impact on the metropolitan area, since it constitutes a smaller economy. To the author's best knowledge there has not been any published studies looking at the impact Division I-A college athletics (aggregated) has on the economy of a state[43] and there has only been a few published studies on the metropolitan/local economy (Baade et al, 2011; Baade et al, 2008; Baade et al, 2007, Coates & Depken, 2008).

5.1 College athletics impact on state and metropolitan GDP

5.1.1 Ordinary Least Squares

To be able to answer Hypothesis I, the study starts with an OLS estimation, as it will give an indication of the impact with using a simple econometrical model. All of the variables included in the model (*Employment, Enrollment, Capital, Contributions, StateProfits*) are significant and the results are shown in Table 3, column 2 (p.44), (the three stage least squares (3SLS) are taken up later in the text). The aggregated state profits of college athletics is positive and significant at the one percent level. The coefficient of 9.47 implies that by for every dollar college athletics earns in profits, the state GDP will rise by 0.00947 dollars[44]. This result supports that college athletics has an economic impact on the state level. This can be due to the so called "football states" where many schools that are revenue powerhouses are located in the same state. Smaller states might not host many profitable college athletics programs, since those states are smaller, the impact of the few schools located there might still further contribute to the positive impact. Capital investments and contributions show a negative but significant linkage to state

[43] Reports made by universities economic departments have studied the impact college athletics has on the state and the local economy (Thompson, 2005; Beyers, 2007).
[44] The GDP variable has been scaled by 1000, hence the interpretation of the coefficient.

GDP. The negative linkage of capital and GDP can be argued to be due to the fact that capital investments are not able to generate enough output/ new jobs in the economy and that way positively impact the state GDP. This can also be due to the crowding out effect when people actually avoid coming to the area where college athletics takes places and rather chooses to go somewhere else. However, this can be different when looking at the metropolitan economy. The contributions college athletics receive being also negative makes sense, since it can be reasoned that even if the state economy is doing well/poorly the contributions do not have to necessarily reflect that. Also, as the total monetary contributions are mostly invested in facilities, one can assume that it will have a similar impact as capital has. Employment and university size show that both variables have a positive relationship with state GDP. This can be expected, since the more employed and educated people there are, the bigger the impact it will have on the economy state wide, as it will provide greater output into the economy. Although the variables are significant and results indicate that there is an impact of college athletics, the R-squared is quite low, as well as the adjusted R^2 (0.25)[45]. The R^2 shows that the variables only explains 25% of the variation in the state GDP, indicating that there might be omitted variables that affect the GDP that is not accounted for in the model. This can lead the results to be biased and inconsistent and therefore the OLS results obtained should be taken with caution. Also, this model might suffer from reverse causality, where the positive findings can be due to the state GDP having an impact on college athletics and not college athletics having an impact on state GDP. However, the OLS model does indicate that there is a positive impact of college athletics with regards to the aggregated profits they are able to generate at the state level.

To look at the impact at a lower scale (metropolitan area), an OLS estimation looking at the metropolitan GDP has been conducted. As can be seen in the table above table, college athletics profits is significant at the ten percent level but has a negative impact on the metropolitan economy, which is the opposite from the state level. This can be seen as the coefficient of -1.06 indicates that a dollar increase in college athletics profits leads to -0.00106 dollars decrease in the metropolitan GDP. This can be due to college sports only constituting a small part of the economy in many of the metropolitan areas. Even though some athletic departments are able to be profitable, it is still not big enough to have an impact on the metropolitan economy.

[45] Adjusted R^2 accounts and penalizes when more independent variables are added in to a model, which the R^2 does not account for. Therefore, there can be cases where these two can differ from each other.

TABLE 3	OLS		3SLS	
	Dependent Variable	Dependent Variable	Dependent	Dependent
	(1)	(2)	(3)	(4)
	MetroGDP	StateGDP	MetroGDP	StateGDP
StateProfits	---	9.47***	----	9.50***
		(1.23)		(1.20)
MetroProfits	-1.06*	---	-0.71	---
	(0.62)		(0.79)	
Capital	-0.00	-1.26***	-0.02	-1.26***
	(0.18)	(0.37)	(0.15)	(0.48)
Employment	74.61***	92.68***	74.76***	92.69***
	(7.32)	(16.25)	(2.64)	(8.74)
Enrollment	1766.24***	14611.15***	1743.31***	14607.85***
	(556.34)	(1820.56)	(572.08)	(1897.01)
Contributions	-1.39	-3.25**	-1.43***	-3.25**
	(0.87)	(1.38)	(0.45)	(1.44)
Constant	2.64e+06	5.30e+07*	-2.80e+06	5.28e+07
	(8.89e+06)	(2.84e+07)	(1.12e+07)	(3.80e+08)
R-squared	0.52	0 .25	0.52	0.25
N	864	864	864	864

Note: Standard errors are reported in parenthesis under the coefficients.

Significant levels. * 0.10, ** 0.05, *** 0.01

N equals the number of observations.

Table 3. OLS and 3SLS estimation results for state and metropolitan GDP.

Since most of the universities are not located in the same metropolitan area, those that are located in bigger cities can fail to have a big role in the economy whereas those located in the smaller metropolitan areas can have a bigger role. However, their role is not big enough to have an aggregate metropolitan impact. This is supported when looking at the summary statistics in section 4 where the average profit a college athletics department generated was $3.2 million dollars. This amount is very small when comparing it to the average metropolitan area GDP. Furthermore, the athletic departments capital investments on facilities as well as contributions received by the athletics departments' are not significant and have a negative relationship with regards to the metropolitan GDP. Even though the impact of college athletics is narrowed down to a smaller economy, it fails to have a positive impact similar to the state level. This can be due to that building and renovating athletic facilities only create low paying part-time jobs in the local economy, which in turn will result in a decrease of metropolitan GDP and are not able

to create enough output into the economy. This can also be explained by the crowding out effect as was the case at the state level. It can simply just be that the economic impact of college athletics crowds out the potential spending of people not coming to the area due to college athletics games. As expected the control variable in this model, *Employment*, is positive and significant at the one percent level. This can be explained by that the lower the unemployment rate is in an area, the higher the GDP. To add on, *Enrollment* (university size) is also significant and has a positive impact on the metropolitan economy. This can be reasoned with that the larger the university is, the bigger effect it is going to have on the metropolitan economy, since it brings more economic activity to the local economy and area such as, more jobs and businesses. Furthermore, looking at how well the variables fit the model, the adjusted- R^2 is 0.52 and the R^2 is 0.52, which means that 52% of the variance of the metropolitan GDP is explained by all the independent variables. This shows that there are more factors that contribute to the metropolitan GDP, which are not explained by the model. As the OLS results show, college athletics does not have a significant impact on the metropolitan economies. However, it is important to note that the R^2 increased significantly from the state level where it only was 25% and thus this model explains better the factors that has an impact on the metropolitan GDP.

As discussed in section 3.2.1 this model might suffer from omitted variable bias since there are factors affecting the metropolitan GDP, which are not counted for in the model, as well as, reverse causality. One of these unaccounted factors is unobserved ability, which leads to endogeneity problem as it is correlated with the contributions the athletic departments receive.

5.1.2 Instrumental Variable

The results from the instrumental variable (IV) regression for the state and metropolitan level is shown in Column 1 and 2, in Table 4 (p.47). The GMM results shown in the same table is taken up in section 5.1.3.

As can be seen in Column 2, the IV results have slightly changed from the OLS estimations as can be expected. Looking at the college athletics variables (*StateProfits, Capital* and *Contributions*) only *StateProfits* has remained significant, indicating that the profits college athletics make on the state level

still has an impact on the state economy. This can be explained with many profitable schools being located in the same state (Texas, Oklahoma, Alabama etc.) and when aggregating these schools together, a positive impact is found. The capital variable shows a negative relationship with the state GDP. This seems reasonable, since building new athletic facilities is more likely to have an effect on the local economy as it can create jobs and businesses in the region, which in turn might not be extended to the state level.

In this model, the amount of contributions the athletic departments receive, has been instrumented with the total Olympic medals the university athletes achieved in the 2008 and 2012 Olympic Games. The instrument is a dummy variable that takes the value of 1, if a university has had an athlete(s) winning a medal(s) from 2008 and/or 2012 Olympic Games and the value of 0 if not having achieved a medal. It is assumed that the instrument of Olympic medals is not related to the error term, since it represents unexpected success with relation to the unobserved ability in the model and hence can be considered a valid instrument. Thus, this instrument captures the effect unexpected success has on the contributions athletics departments receive. The instrument solves the reverse causality problem that was present in the OLS model showing the impact that is coming from college athletics and not the state GDP. Nonetheless, as with the OLS results, the results should be interpreted with caution as some endogeneity issues are still observed in the model. The contributions variable has changed sign, which is expected since it suffered from endogeneity in the OLS model. Although the results show a positive linkage to the state GDP, it fails to be significant. Also, employment is still positive and significant as can be expected. However, university enrollment shows a negative relationship with the state GDP and is not significant. This seems valid, as university enrollment has more impact on the local level with regards to city size and contribution of jobs and businesses in the local area, which is not extended into the state wide economy.

Looking at the metropolitan level, all of the variables except employment are insignificant and do not differ significantly from the OLS results, as can be seen in Column 1, Table 4. This implies that although college athletics is huge in the U.S, there are no implications that it has a direct positive effect on the local economy. Nevertheless, looking more closely at the results, it can be noted that both capital and metropolitan profit variables are negative with having coefficients of -2.66 and -0.60.

TABLE 4	IV		GMM	
	Dependent variable	Dependent variable	Dependent variable	Dependent variable
	(1)	(2)	(3)	(4)
	MetroGDP	StateGDP	MetroGDP	StateGDP
L.StateGDP			----	0.87***
				(0.02)
L.MetroGDP			0.85***	----
			(0.03)	
StateProfits	-----	7.73**	----	0.58***
		(3.13)		(0.11)
MetroProfits	-2.66	-----	0.05	----
	(4.72)		(0.06)	----
Capital	-0.60	-22.22	0.03*	0.20***
	(1.74)	(16.61)	(0.02)	(0.06)
Contributions	2.38	108.39	0.04*	0.05
	(10.98)	(88.09)	(0.02)	(0.04)
Employment	75.09***	127.30***	0.60**	0.44
	(7.39)	(36.35)	(0.26)	(1.42)
Enrollment	1089.64	-9692.85	1011.79***	2675.42***
	(2000.04)	(19252.83)	(334.56)	(965.47)
Constant	-2.63e+06	-7.83e+07	-6.08e+06	7.98e+06
	(1.81e+07)	(1.35e+08)	(6.22e+06)	(2.07e+07)
N	864	864	672	672

Note: Robust standard errors are reported in the parenthesis. Significance levels: * 0.10, ** 0.05, *** 0.01

N equals number of observations

Table 4. IV and GMM results for state and metropolitan level.

Meaning, for every dollar spent on athletic facilities (capital investments) there is a negative impact on the metropolitan GDP, with it going down by -0.0006 dollars. However, since the capital variable is not significant, capital does not have an impact on the metropolitan economy as it did not have on the state economy either. Therefore, it can be argued that investing in athletic facilities does not have a direct impact on the economy. Also, the metropolitan GDP decreases by 0.00266 for every dollar the metropolitan profits of college athletics increases.

As discussed above, the negative relationship between metropolitan GDP and college athletics capital investments can be a result of college athletics not bringing more/new employment or money into the economy and to the crowding out effect. It can also be that there is an impact on the "downtown area" level but this impact is not captured on the metropolitan level. Hence, this could be looked more into detail in future research. Furthermore, the negative relationship between metropolitan profits of college

athletics and metropolitan GDP can have several reasons. For instance, many of the athletic departments that are profitable like the University of Texas, are part of a big metropolitan area and thus the economic impact college athletics bring to those communities can be very slight, since the total economic activities in those areas are big. It can also be that the substitution effect contributes to college athletics not being able to have an impact on the metropolitan level, since it just shifts spending in the area. Also, those universities that are located in smaller metropolitan areas and therefore could be bigger contributors to the local economies might not be profitable and therefore not have a positive impact on the local economy.

To sum up, the IV results shows that there is a positive but insignificant impact of the contributions athletic departments receive, which is the opposite from the OLS results. The change of coefficient signs in the variable was expected, since in the OLS model this variable suffered from endogeneity. The positive relationship between contributions and metropolitan GDP can be explained by the fact that the more contributions college athletics gets, the more possibilities of creating bigger stadiums and developing the campus area there are.

5.1.2.1 Three Stage Least Square

To get further validation of the OLS and IV results, a Three Stage Least Square (3SLS) simultaneous equation of metropolitan and state GDP has been performed. The three stage least squares allows to get joint estimates of the impact college athletics on both the state and metro GDP with estimating all the coefficients simultaneously. This is done, since it can be assumed that the metropolitan and state equations are related through the error term (ability).

The results shown in Columns 3 and 4 in Table 3 (p.44) indicate that both state and metropolitan level estimations are consistent with the OLS results with only minor differences. The profits of college athletics continues to show an impact on the state economy and capital investments continues to show a negative linkage to state GDP. The results show, that the contributions athletic departments receive has a negative relationship with the state economy and is significant at the five percent level, as in the OLS results. As previously stated the results make sense, since it can be argued that contributions are spent on

capital (facilities), which in turn has a more significant impact on the local economy than on the state economy. It can also be noted that enrollment and employment has the same coefficient and significant levels as in the OLS estimation.

Moving on to the metropolitan level, the 3SLS estimation coefficients are similar to the OLS estimation with the exception of the significance levels. The negative coefficient of metropolitan profits has decreased slightly and has become insignificant. The capital investments have also become more negative and has stayed insignificant. The contributions the athletics departments receive continues to show a negative and significant relationship to metropolitan GDP. These results validates the previous ones gotten at the metropolitan level where college athletics fails to have an aggregate positive impact on the economy. The remaining variables (*Employment* and *Enrollment*) have the same coefficients as in the OLS estimation and have remained significant. As previously discussed, the OLS, 3SLS and IV model estimations suffer from endogeneity problems and thus the results should be interpreted with caution and care since they might be biased and inconsistent. However, it can also be argued that these results can still help in giving valuable information when arriving to a final conclusion.

5.1.3 Generalized Methods of Moments

As previously stated, GMM is a semiparametric model which is usually applied when a model suffers from endogeneity issues. With applying as instruments the first differences of the independent and the lagged variables of the dependent variable the GMM model is able to give consistent estimates with tackling the endogeneity issues. The endogeneity issue is tackled with making all the variables exogenous and eliminating any endogeneity present in the model. The reason for applying this technique is, since it is hard to find a valid exogenous instrument and therefore it can be argued that the instrument applied is not necessarily exogenous and thus the model might still suffer from endogeneity and a better instrument could be used which is exogenous. This is solved by using exogenous instruments that are already present in the model in the GMM approach and thus the instrument used here is in fact exogenous and valid.

The results from the GMM approach for the state and metropolitan level is presented in Table 4, seen in the previous section. The results might be different from the previous models, since all the variables are

made exogenous to address the endogeneity issue. As in the previous cases, the profits of college athletics at the state level is positive and significant. The coefficient of 0.58 indicates that for every dollar college athletics earns in profit, the state GDP increases by 0.00058 dollars. This result is consistent with the previous results obtained. College athletics capital investments show to have a positive and significant impact (at a one percent level) on the state economy. The contributions to college athletics has still a positive linkage to GDP but the coefficient has decreased significantly and fails to be significant. University enrollment has become significant and positive, whereas employment still has a positive relationship to state GDP but has become insignificant. The lagged state GDP is significant and positive. This result makes sense, since it can be argued that if the economy is doing well it is going to reflect over to the following year and contribute positively to the next year's GDP.

The metropolitan level GMM results differ quite a lot from the previous IV and OLS results presented in Table 3. It exhibits that college athletics has an impact on the metropolitan GDP and aligns with the state wide results. All variables show a positive relationship with metropolitan GDP. The lagged metropolitan GDP variable is 0.85 and is significant at the one percent level. This means that a one dollar increase in the previous year's GDP results in an increase of 0.85 dollars in the following year's metropolitan GDP. This can be considered to be reasonable, since if an economy is doing well the impact is reflected/extended into the following period/year. The results show a small positive relationship between the profits college athletics generates at the metropolitan level and the metropolitan GDP, however it fails to be significant. Also, looking at employment (significant at the five percent level) and university size results (significant at the one percent level) show that they have a positive and significant impact in relation to the metropolitan GDP. This makes sense, since the larger the university is, the more people it will employ and bring businesses to the surrounding areas. Thus contributing to the economic development in the metropolitan area. Whereas capital investments on sport facilities was in the previous results negative and insignificant, the GMM results in Table 4 not only indicates that college athletics capital investments has a positive effect but that it has also a significant impact on the metropolitan economy. The capital variable has a coefficient of 0.03 and is significant at the ten percent level. Thus, every dollar college athletics spends on facilities results in an increase of 0.00003 dollars in the metropolitan GDP. This is reasonable, as the more capital stock (i.e. athletic facilities) college athletics have, the bigger the impact it is going to have on the local economy by developing the area and creating

local jobs. Lastly, monetary contributions to college athletics has a positive and significant (10% level) impact on the metropolitan economy. One could argue that contributions and capital goes hand in hand, since the more contributions athletic departments receive, the more opportunities they have in building new and bigger facilities and attracting top athletes to the university. Hence, the result is consistent with this.

The above results helps to answer the first hypothesis *"College athletics has an economic impact on metropolitan and/or state GDP"* presented in section 1.2. It can be concluded from the results that college athletics fails to have a significant economic impact on the metropolitan GDP but has an impact on the state GDP with using OLS, 3SLS and IV estimation techniques. However, it can be noted that since these models might suffer from omitted variable bias and endogeneity problems that the results can be biased and thus not reflect the true impact. The endogeneity problem cannot only be solved with the IV approach since it can be argued that the so called unexpected success at the Olympics does not have a direct impact on the contributions the athletic departments receive. Therefore, a GMM approach is applied, which shows that although the economic impact is not big at the metropolitan level, it is significant. Also, the impact of college athletics at the state level remains to be significant and positive throughout all the econometric models. Thus, the economic impact college athletics has is mixed. It can also be noted that there might be some non-economic/ indirect benefits of college athletics on the state or metropolitan GDP, which is not observed by the model.

5.2 College athletics capital investments effect on metropolitan/micropolitan employment

This section will present the results of the possible effect college athletics has on the metropolitan/micropolitan[46] employment. This section will use the same methods as the previous section, starting with an OLS regression, continuing with instrumental variable and finally testing with GMM. These multiple methods will provide with the estimation of the possible impact college sport facilities have on the local employment. To solve the possible biased estimates of the OLS approach, an IV approach has been applied to get more robust and unbiased parameter results.

[46] Micropolitan= A city/urban area with a population of at least 10.000. Metropolitan= A city/urban area with a population of at least 50.000.

5.2.1 Ordinary Least Squares

In order to research the impact capital investments in college athletics has on the employment this section starts with an OLS estimation with the results presented in Table 5, Column 1 (p.53). As can be seen from the table, metropolitan GDP is positive and significant at one per cent level indicating that as the GDP rises so will the employment. Enrollment is positive and significant at the one percent level, indicating that university size has a positive link with metropolitan employment. The enrollment coefficient of 18.58 shows that for every student enrolled, the metropolitan employment is increased by 18.58 people. This result seems quite high and one could argue that this result is biased, since it is unlikely that for every additional student that enrolls at the university will result in 18 additional jobs in the area. The contributions college athletics receives is positive but insignificant, indicating that there is no specific relationship between the donations the athletics receive and employment in the metropolitan area. The positive relationship can be explained by a positive indirect relationship it has with employment through investments made in college sports facilities that in turn can have an impact on the local employment.

The profits that college athletics generate is negative and significant at the five per cent level. Capital is negative and insignificant indicating that there is no positive link between college athletic facilities and the employment in the local metropolitan/micropolitan area. However, the coefficient is -0.00, which demonstrates that the negative effect is very minor and not really observable. The R-squared is 0.52 and the adjusted R^2 is 0.52, which shows that the variation in the local metropolitan employment is explained by 52% with the variables presented in Column 1, in Table 5. As the previous models presented in section 5.1, this model might suffer from omitted variable bias with the model excluding variables that can have an impact on the local employment. Therefore, the results should be interpreted with caution since they can be inconsistent and biased. However, these findings are still very interesting when compared against the other two models.

TABLE 5	OLS	IV	GMM
	(1)	(2)	(3)
L. Employment			-0.19***
			(0.06)
MetroGDP	0.01***	0.01***	0.00
	(0.00)	(0.00)	(0.01)
MetroProfits	-0.01**	-0.04	-0.01
	(0.01)	(0.03)	(0.01)
Capital	-0.00	-0.01	0.00
	(0.00)	(0.01)	(0.00)
Contributions	0.01	0.06	-0.00
	(0.01)	(0.08)	(0.00)
Enrollment	18.58***	7.09	-44.91
	(5.51)	(16.57)	(34.21)
Constant	-45172.65	-1.24e+05	1.87e+06***
	(92494.84)	(139976.62)	(700421.51)
R-squared	0.52	0.41	---
N	864	864	672

Note: Robust standard errors are reported in parenthesis. Employment is the dependent variable.
Significance levels: *0.10, **0.05, ***0.01
N equals number of observations

Table 5. Results of college athletics and metropolitan employment.

5.2.2 Instrumental variable

The results obtained from the IV regression is shown in Column 2, in Table 5 above. As in the OLS results, metropolitan GDP remains significant at the one percent level and shows a positive linkage to metropolitan employment. University enrollment has a positive relationship with employment but is insignificant. However, the coefficient of 7.09 seems more reasonable than the coefficient of 18.58 obtained with OLS, even if it can be argued that the coefficient is still quite high. This is because it seems more reasonable that for every student enrolled will lead to employment increasing by 7.09 than by 18.58 in the local economy. Furthermore, contributions still show a positive but insignificant linkage to employment. The profits college athletics generate on a metropolitan level has an insignificant impact

and negative relationship to employment. The coefficient of -0.04 indicates that for every dollar college athletics makes, the employment goes down by 0.04 dollars. Capital remains negative and insignificant indicating that college athletics does not impact the metropolitan economy with creating jobs in the area. Thus, the results fails to show that investments in college athletics facilities will have a positive impact on the local economy with creating jobs. However, it can be argued that there can be some effect which is not captured by this model, since it might suffer from endogeneity problems and thus giving biased estimates. However, it can be argued that these results are more robust than the OLS and thus give a truer picture of the impact capital investments has on the employment.

5.2.3 Generalized Method of Moments

To get unbiased estimates all variables are assumed and made exogenous with the GMM model. The results obtained from the GMM approach are shown in Column 3, in Table 5 (p.53). The previous period's employment has a negative effect on the following year's employment and is significant at the one percent level. The coefficient of -0.19 indicates that if previous period's employment increased with one person, the next period's employment will decrease by -0.19. This can be explained by that not enough new full-time jobs are being created in the economy. Instead, part-time jobs and substitution contributes to the decrease in employment. Metropolitan GDP has a positive relationship with employment as can be expected, but is insignificant. Metropolitan profits have a negative impact on the employment and is not significant. This means that the more profitable college athletics is, the bigger the negative effect is on the employment in the metropolitan area. A reason for this can be that no new jobs are created with college athletics getting more revenue from, for instance, broadcasting and licensing rights, both of which have no direct impact on the areas of local employment. It can also be argued that the more profitable college athletics is, the more the universities are going to pay the coaches, which will not lead to more output/employment in the economy. The amount athletics receive in donations and the university size are insignificant and fails to have a positive linkage to employment. Both coefficients have changed signs from the OLS and IV results but this can be expected since those estimates suffers from endogeneity. The capital variable is in focus when trying to answer Hypothesis II*: "College athletics capital investments has an effect on metropolitan/micropolitan employment".* Whereas capital showed a negative relationship with micropolitan/metropolitan employment in the OLS and IV results,

the capital coefficient has changed sign to positive but has remained insignificant. It can be noted however, that the coefficient is very small and one can conclude that in the case where college athletics capital investments have an effect on employment, it is very small and does not play a big role for creating employment in the local economy.

Lastly, the overall GMM results indicate that when it comes to the impact of college athletics capital investments has on the economy, there is a positive linkage to employment but capital investments fails to create enough better paying jobs or full-time jobs needed for there to be a big impact in the local economy.

5.3 Discussion of the results

The variables that are looked at to see if there is an impact of college athletics are: the total athletic departments profits (aggregated to metropolitan and state level), athletic departments capital investments and the contributions they receive, while also including other variables that explains GDP (employment and university size).

State level impact

By looking at the wider impact of college athletics, the results show that college athletics has indeed a significant and positive effect on the state wide economy. This result is a little surprising, since if there is an impact at the state level there should also be likely an impact at the metropolitan level, as a smaller economy is investigated. However, there are many possible explanations between the discrepancies at the state and metropolitan level results. Firstly, as this paper looks at the aggregate impact of college athletics, there are many universities located in the same state that can be very profitable whereas there are only a few universities that are located in the same metropolitan area. This in turn can lead to college athletics having a bigger aggregated impact on the state level than on the metropolitan level. Therefore, this result seems reasonable and valid. The OLS estimation shows that the profits college athletics generate at the state level has a positive and significant impact on the economy. This can be contributed to the fact that big football states are hosts to multiple profitable universities where college sports is a big part of the sporting culture. Smaller states might not host any profitable schools or

only have one school participating in Division 1-A athletics. However, since the economy is smaller in those states they can still be able to contribute significantly to the state wide economy. For instance, University of Nebraska-Lincoln enjoys huge popularity throughout the state of Nebraska within its college sports. Taking into account that athletic success/ability can have a big role in the donations athletic departments receive, an instrumental variable model is applied. The results are consistent with the OLS estimations and the variable *Stateprofits* continues to show a positive and significant linkage to the state GDP. The claim that athletic success brings more donations to the athletic departments has been widely researched by sport economists and is supported by the findings of Stinson and Howard (2007) that were able to find that athletic success has an effect on the amount people donate and the total donations an athletic department receives. The findings of Humphreys and Mondello (2005) also strengthens this claim as they were able to find that athletic success, particularly football bowl appearance and basketball success significantly resulted in the increase of the donations athletic departments received. Data used in this study also shows that athletic success has an impact on the donations with Rutgers having an increase in donations after Olympic medals won. This finding is further supported by Rhoads and Gerkin (2000) who discovered that the yearly changes in athletic success in college athletics had a positive relationship with donations received.

A reason why college athletics facilities do not have a state wide impact can be argued to be due to the possible impact only observed at a smaller level. This can be due to the fact that the facilities help boost the local infrastructure and possibly attract more businesses to the area, which is not reflected on a larger scale. It can also be noted that capital investments can be able to contribute to low wage part-time jobs in the economy, which is not going to have a great impact on the economy as a whole. Also, while a direct benefit of athletic facilities is not observed it may well be that it provides indirect benefits to the economy. This claim is supported by the findings of Feng and Humphreys (2008) that found that residential property values increased the more close they were located to a stadium. The indirect benefits of sport stadiums is also supported by Siegfried and Zimbalist (2006) that claim that sport facilities can improve the quality of life in the area. Since capital investments in facilities are not able to have an impact it is not surprising that contributions does not have an impact. The reason for this being that the more contributions given to college athletics the more investments are made in college athletics facilities.

The GMM approach is applied as was done for the metropolitan model. Although the coefficients of capital and state profits are reduced, they show a positive and significant impact on the state economy. This shows that college athletics has an important role in the economy, creating jobs and increasing the economic activity in the area. Thus, the results indicate that college athletics contributes positively to the economy. This is supported by the findings of Baade et al., (2008), which was one of the first ones to find that college athletics (football) had a positive and significant impact on the taxable sales in the economy and thus gave proof that college athletics has an impact on the economy.

Metropolitan level impact

As previously mentioned, college athletics does not have a significant economic impact on the metropolitan economy in the first econometrical approaches. The OLS estimation shows a significant impact of college athletics at the metropolitan level but is negative and might suffer from omitted variable bias and reverse causality. Taken this into account, college athletics still fails to have an impact and shows a negative relationship to metropolitan GDP, with both metropolitan profits and capital being negative. A possible reason for the negative link between college athletics and metropolitan GDP can be that many of the universities that are profitable are located in big metropolitan areas where college sports constitutes only a small fraction of the overall economy and thus is not big enough to have a significant impact on the metropolitan economy. Another possible reason is substitution effect with people spending money on college athletics instead of spending money on something other. This is supported by previous ex-post studies that have studied the impact of college athletics. For instance, Baade and Baumann (2004) and Baade et al. (2008) found college athletics (basketball and football) to have a negative effect on the real personal income on the local economies due to substitution effect associated with the events.

It is interesting to see that after solving for the endogeneity issue the impact of college athletics changes significantly. The results show that both college athletics profit and capital investments have a positive relationship with regards to the metropolitan economy. The capital investments is shown to be significant, which indicates that athletic facilities do have an impact on the local metropolitan economy. This can be due to college athletics being able to attract businesses and fans to the area, hence contributing to the economic activity. To the author's best knowledge this finding is one of the firsts to find this linkage of the direct economic impact of sport facilities. Although previous studies have not

been able to find this link, Feng and Humphreys (2008) findings show that facilities have an indirect impact on the economy and thus this papers has further contributed to the research of positive impact of college sports facilities.

Impact on employment

To specifically look at the impact college facilities have on the local employment, the capital investments of college athletics is looked at to answer Hypothesis II *"College athletics capital investments has an effect on metropolitan/micropolitan employment"*. The results, presented earlier, show that college athletics capital investments does not have a significant impact on the local metropolitan economy with regards to employment. However, it can be argued that the OLS and IV estimations might not reflect the true impact, since they have restrictions and which a model that is less restricted is able to tackle and exploit. Validating this claim is the positive linkage between capital and employment found when making adjustments for the previous models and applying a General Methods of Moments approach. Thus, it can be claimed that college athletics facilities helps with creating jobs in the metropolitan area even though the contribution is not that high. Even though the literature on college athletics is still quite narrow there have been studies that have found that college athletics has a positive impact on the local economies, thus supporting this paper's findings. For example, this study contributes to the previous findings of Lentz and Laband (2009) that found that college athletics had an impact on the employment in the accommodations and services industry. Pointing out that their positive and significant findings might not reflect on the GDP this study shows that college athletics has a positive impact on the GDP.

Overall

To the author's best knowledge there has not been any published empirical study that has looked at the total impact college athletics (total net profit and capital investments) has on both the metropolitan and state GDP. Thus, this paper contributes with new information about the impact college athletics has on the state and metropolitan level. Overall, it can be concluded from the results presented above that the impact of college athletics is mixed. While college athletics does not show a significant impact on the metropolitan economy, the economic impact college athletics has on a state level is significant and positive. The positive findings in this paper are among the only a handful of other empirical studies that have been able to find a positive linkage between college athletics and the local economy. The positive

results obtained in this study are seemed valid and reliable since multiple econometrical methods have been applied in the study to ensure consistent and robust results and has thus shed some new light on the subject at hand.

6. Further Research

Since the impact of college athletics has not yet been extensively researched, there are different approaches and angles one can take to further investigate the economic impact college athletics has. As the data used in this study only covers nine years, it would be interesting to look at the impact college athletics has on the economy with a more extensive time frame to get more robust results. Also, it could be interesting to see, if there is difference between public and private universities when it comes to the impact they have on the economy. However, data availability is needed from the private universities, better resources and more time is required for it to be possible. Furthermore, one could also take a narrower level approach to investigate the impact college athletics has on a city downtown area. It could be interesting to see if there is a difference in the impact of college athletics located in smaller cities versus bigger cities. Regarding college facilities, one could also take the research further to see the impact of college stadiums in cities that have professional teams and those cities that only have college athletics stadiums and see if there is a difference.

Lastly, the results obtained from this study can also be used to carry out research in other fields such as cultural and sociological studies. For example, future research could focus on the economic impact college athletics has on the local societies, with regards to intangible benefits like happiness, sense of belonging (emotional attachment), pride and quality of life. For instance, it would be interesting to see if college athletics is able to increase the productivity of the labor force with making them more happy and satisfied. However, incorporating these factors in a quantitative analysis can be challenging and hard to measure and might require substantial resources in order to be able to carry out the study.

7. Conclusion

Sports economics has in recent years become an expanding field of study (Sandy et al., 2004). Only a handful of empirical research has been done on the direct impact college athletics has on the economy, while much has been written about the benefits and profitability sports brings. This can be seen as surprising, as college athletics generates millions of dollars in revenue, attracts millions of fans and plays a major role in the U.S sporting culture (Chung, 2013). Having this as a motivation, this thesis has investigated the economic impact college athletics has on the state and metropolitan economies by looking at 96 public universities participating in Division I-A college athletics.

To analyze the impact of college athletics, various econometrical methods of Ordinary Least Squares, Instrumental Variable, Three Stage Least Squares and General Methods of Moments has been applied throughout the analysis. This was done to make sure possible econometrical issues were tackled and to ensure robust results. To tackle the issue of omitted variable bias and reverse causality, an instrumental variable approach was used. By using Olympic medals as an instrument for unobserved ability, the model could capture the impact coming specifically from college athletics. However, since it cannot be tested, if the instrument is correlated with the error term it can be argued that the instrument is not exogenous and thus still causing endogeneity problems. This issue was tackled by applying a General Methods of Moments (GMM) approach with making the model random and by using exogenous instruments already implemented in the model.

The results obtained from the econometrical estimations showed that the impact of college athletics is mixed. The economic impact of college athletics at the metropolitan level showed an insignificant impact on the metropolitan GDP. The profits of college athletics, as well as, capital investments indicated a negative relationship towards GDP. It can however be noted, that contributions given to college athletics indicated a positive linkage to metropolitan GDP. It was discussed that the insignificant impact could be due to the profitable universities being located in big metropolitan areas where college athletics is only a small part of the economy. Universities located in smaller metropolitan areas might have an impact on the economy but, since it is only a small part of the total aggregated impact of college athletics it fails to have an overall metropolitan impact. Other possible explanations why college athletics fails to have an

impact was due to the crowding out and substitution effect. However, it was interesting to see that at the state level, college athletics showed to have an impact. Throughout all the models, the profits of college athletics showed to have a positive and significant impact on the state GDP, while contributions had also a positive linkage to GDP. The findings of this paper proves that college athletics matters and has an impact on the economy, which can be due to many profitable schools being located in the same state and have an aggregate impact on the economy.

The positive findings obtained in this study are considered valid and reliable, since multiple econometrical methods has been used to ensure robustness and to tackle econometrical obstacles of endogeneity and reverse causality. This thesis is one of the few studies that have been able to find a positive linkage between college athletics and the economy and thus contributes with its findings to the growing literature of the economic impact college athletics plays in a states economy and the field of sports economics.

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9. Appendix

Appendix 1: List of abbreviations and terms

NCAA= National Collegiate Athletics Association

NBA= National Basketball League

NFL= National Football League

MLB=Major League Baseball

NHL= National Hockey League

Football= American Football

Super Bowl= Championship game in the NFL

Fifa World Cup= World Championship in soccer

Bowl games= Post-season college football games

Football powerhouse= A university that has high revenue generating and highly known football program

FBS= Football Bowl Subdivision

FCS= Football Championship Subdivision

BCS= Bowl Championship Series

Booster= A person who supports/ follows college athletics

GPA= Grade point average

SAT= an entry-examination to get accepted into a university

USOC= United States Olympic Committee

EADA= Equity in Athletics Database

Metropolitan area= A city/urban area with a population of at least 50,000.

Micropolitan area= A city/urban area with a population of at least 10,000

Ivy League= Conference with 8 private institutions consisting of Harvard, Yale, Princeton, Columbia, Cornell, Brown, University of Pennsylvania and Dartmouth

Appendix 2. List of the universities included in the study

	State	City	University
1.	Alabama	Birmingham	University of Alabama at Birmingham
2.	Alabama	Tuscaloosa	The University of Alabama
3.	Alabama	Auburn	Auburn University
4.	Alabama	Montgomery	Troy University
5.	Arizona	Phoenix	Arizona State University
6.	Arizona	Tucson	University of Arizona
7.	Arkansas	Fayetteville	University of Arkansas
8.	Arkansas	Jonesboro	Arkansas State University
9.	California	Fresno	California State University-Fresno
10.	California	San Francisco	University of California-Berkeley
11.	California	Los Angeles	University of California-Los Angeles
12.	California	San Diego	San Diego State University
13.	California	San Jose	San Jose State University
14.	Colorado	Boulder	University of Colorado Boulder
15.	Colorado	Fort Collins	Colorado State University
16.	Connecticut	Hartford	University of Connecticut
17.	Florida	Orlando	University of Central Florida
18.	Florida	Miami	Florida Atlantic University
19.	Florida	Tallahassee	Florida State University
20.	Florida	Gainesville	University of Florida
21.	Florida	Tampa	University of South Florida
22.	Florida	Miami	Florida International University
23.	Georgia	Atlanta	Georgia Institute of Technology
24.	Georgia	Athens	University of Georgia
25.	Hawaii	Urban Honolulu	University of Hawaii
26.	Idaho	Boise City	Boise State University
27.	Idaho	Lewiston	University of Idaho
28.	Illinois	Champaign	University of Illinois at Urbana
29.	Illinois	Chicago	Northern Illinois University
30.	Indiana	Muncie	Ball State University
31.	Indiana	Bloomington	Indiana University
32,	Indiana	Lafayette	Purdue University
33.	Iowa	Ames	Iowa State University
34.	Iowa	Iowa City	University of Iowa
35.	Kansas	Lawrence	University of Kansas
36.	Kansas	Manhattan	Kansas State University
37.	Kentucky	Lexington	University of Kentucky

38.	Kentucky	Louisville	University of Louisville
39.	Louisiana	Baton Rouge	Louisiana State University and Agricultural & Mechanical College (LSU)
40.	Louisiana	Monroe	University of Louisiana
41.	Louisiana	Monroe	Louisiana Tech University
42.	Louisiana	Lafayette	University of Louisiana
43.	Maryland	Washington	University of Maryland
44.	Michigan	Lansing	Central Michigan University
45.	Michigan	Ann Arbor	Eastern Michigan University
46.	Michigan	Kalamazoo	Western Michigan University
47.	Michigan	East Lansing	Michigan State University
48.	Michigan	Ann Arbor	University of Michigan
49.	Minnesota	Minneapolis	University of Minnesota-Twin Cities
50.	Mississippi	Memphis	University of Mississippi
51.	Mississippi	Jackson	Mississippi State University
52.	Mississippi	Hattiesburg	University of Southern Mississippi
53.	Missouri	Columbia	University of Missouri-Columbia
54.	Nebraska	Lincoln	University of Nebraska-Lincoln
55.	Nevada	Las Vegas	University of Nevada-Las Vegas
56.	Nevada	Reno	University of Nevada-Reno
57.	New Jersey	New Jersey	Rutgers University-New Brunswick
58.	New Mexico	Albuquerque	University of New Mexico
58.	New Mexico	Las Cruces	New Mexico State University
60.	New York	Buffalo	University at Buffalo
61.	North Carolina	Greenville, NC	East Carolina University
62.	North Carolina	Chapel Hill	University of North Carolina
63.	North Carolina	Raleigh	North Carolina State University
64.	Ohio	Akron	University of Akron
65.	Ohio	Toledo	Bowling Green State University
66.	Ohio	Cincinnati	University of Cincinnati
67.	Ohio	Columbus	Ohio State University
68.	Ohio	Parkersburg	Ohio University
69.	Ohio	Akron	Kent State University
70.	Ohio	Toledo	University of Toledo
71.	Ohio	Cincinnati	Miami University-Oxford
72.	Oklahoma	Oklahoma City	University of Oklahoma
73.	Oklahoma	Oklahoma City	Oklahoma State University
74.	Oregon	Corvallis	Oregon State University
75.	Oregon	Eugene	University of Oregon
76.	South Carolina	Greenville	Clemson University

77.	South Carolina	Columbia	University of South Carolina
78.	Tennessee	Nashville	Middle Tennessee State University
79.	Tennessee	Knoxville	The University of Tennessee
80.	Tennessee	Memphis	University of Memphis
81.	Texas	Houston	University of Houston
82.	Texas	Dallas	University of North Texas
83.	Texas	College Station	Texas A & M University
84.	Texas	Austin	The University of Texas at Austin
85.	Texas	El Paso	The University of Texas at El Paso
86.	Texas	Lubbock	Texas Tech University
87.	Utah	Logan	Utah State University
88.	Utah	Salt Lake City	University of Utah
89.	Virginia	Blacksburg	Virginia Polytechnic Institute and State University
90.	Virginia	Charlottesville	University of Virginia
91.	Washington	Lewiston	Washington State University
92.	Washington	Seattle	University of Washington
93.	West Virginia	Huntington	Marshall University
94.	West Virginia	Morgantown	West Virginia University
95.	Wisconsin	Madison	University of Wisconsin
96.	Wyoming	Cheyenne	University of Wyoming

Appendix 3. Endogeneity tests

Contributions (Metro level)

```
Tests of endogeneity
Ho: variables are exogenous

Robust score chi2(1)          =  .150502  (p = 0.6981)
Robust regression F(1,857)    =  .145649  (p = 0.7028)
```

Contributions (State level)

```
Tests of endogeneity
Ho: variables are exogenous

Robust score chi2(1)          =  5.19708  (p = 0.0226)
Robust regression F(1,857)    =  11.2804  (p = 0.0008)
```

Contributions (Employment independent variable)

```
Tests of endogeneity
Ho: variables are exogenous

Robust score chi2(1)          =    .3931  (p = 0.5307)
Robust regression F(1,857)    =  .427075  (p = 0.5136)
```

Appendix 4: 1st stage F-tests

Metro level GDP

```
First-stage regression of Contributions:

OLS regression with robust standard errors
```

				Number of obs =	864
				F(5, 858) =	93.78
				Prob > F =	0.0000
Total (centered) SS	=	1.33312e+17		Centered R2 =	0.4319
Total (uncentered) SS	=	2.36301e+17		Uncentered R2 =	0.6795
Residual SS	=	7.57318e+16		Root MSE =	9.4e+06

Contributi~s	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
MetroProfits	.4257541	.0737222	5.78	0.000	.2810571	.5704511
Emp_	-.1549442	.1121942	-1.38	0.168	-.3751515	.065263
capital	.1576231	.0105172	14.99	0.000	.1369806	.1782656
EFTotalCount	178.7757	32.23808	5.55	0.000	115.501	242.0505
TotalMedals	528194.4	258314.8	2.04	0.041	21191.57	1035197
_cons	1327162	660460.2	2.01	0.045	30854.65	2623468

State level GDP

```
First-stage regressions

First-stage regression of Contributions:

OLS regression with robust standard errors
```

				Number of obs =	864
				F(5, 858) =	92.01
				Prob > F =	0.0000
Total (centered) SS	=	1.33312e+17		Centered R2 =	0.3977
Total (uncentered) SS	=	2.36301e+17		Uncentered R2 =	0.6602
Residual SS	=	8.03001e+16		Root MSE =	9.7e+06

Contributi~s	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
StateProfits	.0067361	.0179955	0.37	0.708	-.0285842	.0420564
Emp_	-.3412497	.1307006	-2.61	0.009	-.5977801	-.0847194
capital	.1874962	.010523	17.82	0.000	.1668424	.2081499
EFTotalCount	217.5354	32.82186	6.63	0.000	153.1149	281.956
TotalMedals	491089.7	277223.6	1.77	0.077	-53026.15	1035205
_cons	1178842	690373.8	1.71	0.088	-176177.3	2533861

Metro level employment

First-stage regression of Contributions:

OLS regression with robust standard errors

		Number of obs	864
		F(5, 858)	101.14
		Prob > F	0.0000
Total (centered) SS	1.33312e+17	Centered R2	0.4367
Total (uncentered) SS	2.36301e+17	Uncentered R2	0.6822
Residual SS	7.50991e+16	Root MSE	9.4e+06

Contributi~s	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
MetroGDP	-.0052082	.0009745	-5.34	0.000	-.0071209	-.0032954
MetroProfits	.4082298	.0744538	5.48	0.000	.2620968	.5543628
capital	.1560779	.0104688	14.91	0.000	.1355306	.1766253
EFTotalCount	199.9053	34.03088	5.87	0.000	133.1117	266.6988
TotalMedals	554254.5	248441.1	2.23	0.026	66630.95	1041878
_cons	1313508	655445.7	2.00	0.045	27043.23	2599973