THE ECONOMIC IMPACT OF HOSTING THE OLYMPIC GAMES

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Abstract

The Olympic Games garner worldwide attention. This mega sporting event requires examination in terms of economic impact. The purpose of this study is to determine the effects of hosting the Olympic Games through GDP, employment, and tourism. To assess the economic impact, host nations will not only be analyzed in and of itself, but will also be compared to runner-up nations in the bidding process. Though runner-up nations tend to economically benefit more often than the host nation per Olympiad, host nations are found to benefit intrinsically.

KEYWORDS: (Olympics, GDP, employment, tourism)

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CHAPTER I

INTRODUCTION

The Olympic Games, arguably the most prominent staging of sports competition, is presented to the world in dramatic fashion. The Games bring together nations of friend and foe for over two weeks of the year to compete for the prestigious 'Olympic Gold.' However, perhaps the fiercest competition arises even before the opening ceremony begins. In reality, the Games begin when cities and nations devote generous amounts of time and money in hopes of showcasing their city to the world.

Since 1984, the competition to host the Olympic Games has grown bigger and stronger. There are numerous reasons why cities are so keen and eager to host the event; not only do host regions gain tremendous amounts of global interest, but nations claim the Games are an opportunity to promote economic growth through gains in infrastructure, employment, and tourism. Yet, many economists are wary of these claims, suggesting that hosting such massive sporting events can hinder an economy's growth. Academic economists have come to agree that hosting enormous sporting events, like the Olympic Games or the World Cup of Soccer, actually obstructs economic growth (Kuper, 2013). Furthermore, on the surface, it is not particularly cheap to host and fund this colossal event.

Sochi 2014 spent USD$50 billion to stage the event, while Beijing 2008 cost USD$40 billion (The Economist, 2013). This gigantic price tag is certainly intimidating to nations, yet citizens are excited to endorse the costs, even if this means cuts in public funding (The Economist, 2013). Such events require the scrutiny needed to analyze the effects. It is important to inspect the effects the Olympic Games have on its surroundings simply because of the massive scale. The purpose of this paper will be to look at why cities are so eager to host the Olympic Games from an economic prospective. This query can start to be answered by examining trends in tourism, employment, and gross domestic product (GDP). Using these indicators, we can compare the trends in the host nation to trends in the nation that came second in the bidding process. This approach should make it possible to see how viable hosting the Olympic Games is from an economic standpoint. Results show that hosting the Olympic Games is economically advantageous for the host. Though often the runner-up nation tends to fare better than the host in direct comparison, the host almost always benefits in comparison to itself. The process and results will be discussed throughout the paper. Table 1.1 shows the Summer Games host and runner-up nations.

This paper consists of five sections: a literature review, theory, data and methodology, results and analysis, and a conclusion. The literature review will discuss literature pertaining, but not limited, to the Olympic Games. Following the literature, theories behind the economic effects of hosting the Olympic Games is explored. The section on data and methodology briefly describes the data acquisition and methodology used to run an Ordinary Least Squares (OLS) regression. Lastly, the results are analyzed and conclusions are drawn from the results.

Table 1.1 Summer Olympics Host and Runner-Up (1960-2016)

Games	Year	Host	Runner Up	Session
XVII	1960	Rome, Italy	Lausanne, Switzerland	1955
XVIII	1964	Tokyo, Japan	Detroit, USA	1959
XIX	1968	Mexico City, Mexico	Detroit, USA	1963
XX	1972	Munich, Germany	Madrid, Spain	1966
XXI	1976	Montreal, Canada	Moscow, USSR	1970
XXII	1980	Moscow, Russia	L.A, USA	1974
XXIII	1984	L.A, USA	N/A	1978
XXIV	1988	Seoul, South Korea	Nagoya, Japan	1981
XXV	1992	Barcelona, Spain	Paris, France	1986
XXVI	1996	Atlanta, USA	Athens, Greece	1990
XXVII	2000	Sydney, Australia	Beijing, China	1993
XXVIII	2004	Athens, Greece	Rome, Italy	1997
XXIX	2008	Beijing, China	Toronto, Canada	2001
XXX	2012	London, UK	Paris, France	2005
XXXI	2016	Rio de Janeiro, Brazil	Madrid, Spain	2009

Source: Wikipedia.com

CHAPTER II

LITERATURE REVIEW

The purpose of this chapter is to discuss the literature on hosting the Olympic Games. The procedure of hosting the Olympics and continuing to determine economical outcome is often difficult to analyze. This research will help make the connections between the desire to host the Games and the economic impact of hosting the Games. The first section will discuss the bidding process to host the Olympics, emphasizing the time and effort this development takes. The next section will discuss the revenues and expenditures of the Games, as funding is vital to analyze the substantial costs. Lastly, economic effects of hosting the Olympic Games through important economic indicators will be thoroughly explained. This should provide a thorough understanding of the necessary aspects involved in determining economic practicability of hosting the Games.

Bidding Process

There have been plenty of papers written regarding the bidding process of hosting the Olympic Games. However, many of these studies focus on the political aspect rather than the economic aspect. Much of the bidding process within a nation is the subject of heavy political debate; intense protesting and heavy campaigning are often butting heads on the front line. Nonetheless, there is a very important economic facet of the bidding process that needs to be addressed.

The process to host the Olympic Games often begins nine to eleven years beforehand. This is when the idea is presented and feasibility is examined. However, this process can be prolonged if cities (i.e. Athens, Beijing) are not considered for the desired upcoming Olympic Games, and therefore, must defer to the following Olympic Games. Next, there is the International Olympic Committee (IOC) bid, which takes up to two years, and is split into two stages. The first stage, 'applicant stage,' is used to survey the physical infrastructure of the cities. The IOC appointed Working Group carefully examines the applicants' files, and continues to assess any risk the cities may pose. Any cities that pass stage one move on as potential host candidates. The second stage, 'candidature stage,' is politically entwined and is ended by a secret ballot by the IOC to select the Olympic city (Preuss, 2004). The city then signs the Host City Contract with the IOC and it becomes official. It is important to note, that in stage two, cities are required to submit detailed plans and economic forecasts to the IOC.

Although the actual process seems rather straightforward, the complexity arises when cost-benefit economic analysis reports are submitted to the IOC. Barros, Ibrahimo, and Szymanski emphasize the impact the multiplier effect has on estimating economic benefit for potential host cities (Barros, Ibrahimo, and Szymanski, 2003). They state that an expenditure approach should be taken to estimate the economic impact. This approach begins with first step estimates towards direct expenditures associated with the Games. These estimates are then used to estimate indirect expenditures through the multiplier effect. The problem with this method stems from the accuracy of the first step estimations, or direct expenditure estimates. If these estimates are even slightly off, then the mistakes are accentuated in estimating indirect expenditure, resulting in inaccurate

measures of economic benefit. Barros, Ibrahimo, and Szymanski state that precise estimates at the first step level are vital to generating credible economic impact evaluations (Barros, Ibrahimo, and Szymanski, 2003), and thus accurate reports submitted to the IOC.

This is a significant piece of the bidding process, as the IOC takes time to inspect economic forecasts before voting on candidate cities. Barros, Ibrahimo, and Szymanski describe the process of forecasting economic impacts very well, but to further our understanding, funding the games must be discussed.

Funding the Games

Expenditures. In the backdrop of Olympic sports competition, immense organization and careful planning are on display. These are the kind of expenditures that the Organizing Committee of the Olympic Games (OCOG) face when staging an event of massive magnitude. These are not the only expenditures the OCOG must consider. Other expenditures include sports equipment, sports facilities, opening, closing, and victory ceremonies, personnel costs, and finally infrastructure upgrades[1]. Although all of these expenditures are somehow incurred by the host cities, Preuss states that "it is extremely difficult to compare the expenditures of the different Olympics to each other." (Preuss, 2004: 193) For example, Los Angeles 1984 had very low costs due to the fact that they had Olympic ready facilities through schools such as UCLA and USC (Edds, 2012). Nonetheless, expenditures to some degree are experienced at every Olympic Games.

[1] Infrastructure improvements are costs incurred by the host city rather than the OCOG

With the exception of Los Angeles 1984, sports facilities are often one of the largest expenditures of the Games. Moreover, sports facilities and the construction of sports facilities is a complicated discussion between the OCOG and the host city. The construction of the facilities are either permanent or temporary, based on post-Olympic demand and the 'Games-related' status for such facilities (Preuss, 2004). However, OCOGs are sometimes burdened with the cost of certain facilities rather than the host city. According to Preuss,

> A direct example of this is seen in the many problems that arise for potential host cities when an Olympic hall or stadium does not exist and there is no post-Olympic demand for such a facility within the city. In this situation, an OCOG would be forced to erect the facility as a temporary structure, thereby risking the possibility of quickly surpassing the financial limits of an OCOG. (Preuss, 2004: 198)

This demonstrates some of the complexity that goes into budgeting Olympic facilities. Quite often, host cities aim to build economically safe facilities that are temporary or that have multipurpose use in the Olympic Legacy period[2] (Preuss, 2004). Calgary 1988 transformed the Olympic Village to university dorm rooms, for example. This, however, is not always the case. Beijing 2008 produced one of the most marvelous sporting stadiums in the world, the Beijing National Stadium; or more commonly known as the Bird's Nest. The Olympic Legacy period for this 'nest' was not very kind. China struggled to find ways to fund the annual operating costs. This goes to show the importance of sustainable structures during the post-Olympics period.

[2] The Olympic Legacy period is defined as 10 years after the Olympic Games, as stated by Preuss.

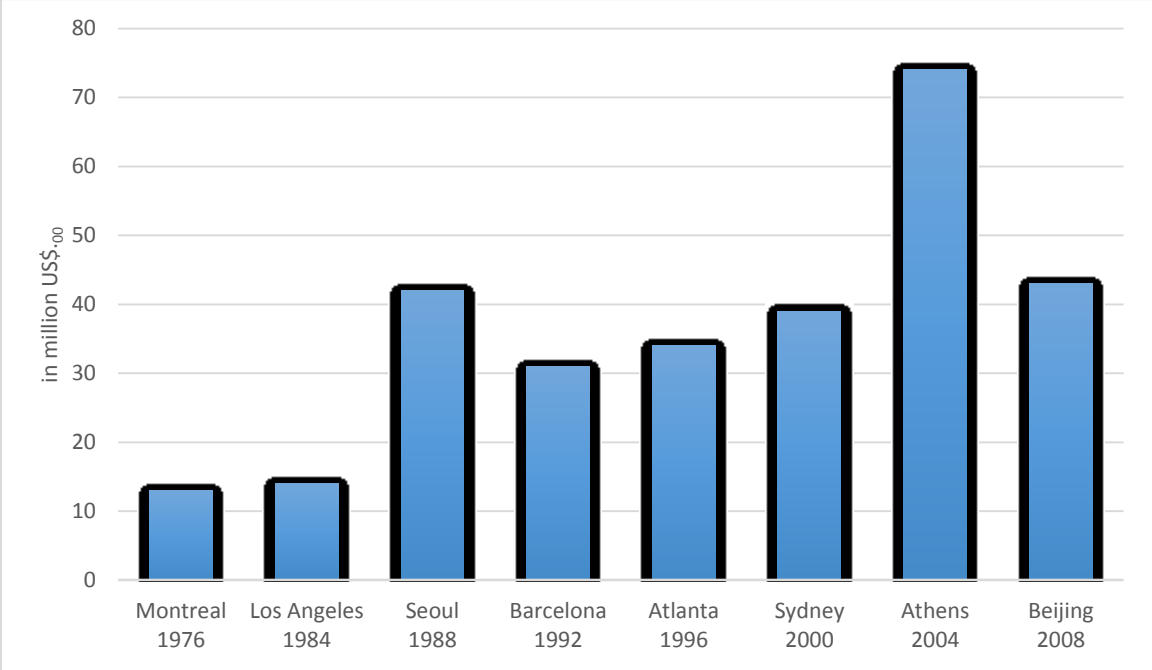
The expenditure of sports equipment can be surprisingly large. This not only includes any sports equipment needed, but sport-specific installations as well, such as volleyball net installations or pole vault facilities. Although this expenditure may not necessarily increase, each OCOG incurs this cost because every Olympic Games require the newest equipment (Preuss, 2004). Modern technology is extremely important for a functioning mega-event as well; precise timing technology is necessary to record accurate times and avoid any controversy. Moreover, technology is used in communications, security, and in the information management system used by Olympic organizers. Preuss writes, "Without using up-to-date technology, it would be impossible to organize the Olympic Games of today." He goes on to say, "Technology ensures the quality of the Olympics by providing an adequate level of services for spectators, media representatives, sponsors and one's own organization." (Preuss, 2004: 216) Clearly the cost of technology is an important expenditure of the OCOG.

Another major expenditure of the Olympic Games is personnel costs. These costs vary from country to country as different factors are involved. "The costs for the organizational and staffing of the competition sector…depend upon the wage levels and the willingness of the population to work as volunteers," writes Preuss (Preuss, 2004: 200). Personnel may include volunteers, organizers, and even security. Security is a vitally important division of Olympic personnel, as the image of the Games rests rather heavily on safety. There have been many Olympic Games in which security concerns are brought into question. Munich 1972 was overshadowed by the massacre that resulted in the deaths of 11 Israeli Olympians. Damaged Olympic images proved evident again in Seoul 1988, as the nation worried about a North Korean invasion, 1992 Barcelona feared

ETA bomb attacks, and Atlanta 1996 had the highest crime rate in the USA as well as the infamous bombing at Centennial Olympic Park. (Preuss, 2004). The OCOG has plenty to combat when assessing security measures. “Growing public interest in the Olympic Games only serves to motivate [criminal groups],” Preuss writes (Preuss, 2004: 225). These costs are an expenditure that cannot be overlooked or underfunded by the OCOG or the government.

The last large expenditure incurred by the OCOG is the opening and closing ceremonies. Figure 2.1 shows the overall expenditures of the ceremonies of the Olympic Games from Montreal 1876 to Beijing 2008. With the eyes of the world focused on one event, the performance has to be perfect. Host cities take this valuable opportunity to present its culture to the entire world, invoking plenty of national pride within. For many nations it is an opportunity to flex their muscles and capture the attention of the world. For these reasons, the cost of the ceremonies continues to increase with each Olympic Games. Nations feel the need to out preform the ceremonies of the previous Olympics. “In the end, it is the organizers’ effort to make their ceremonies more lavish than the previous ones that has led to high costs,” states Preuss (Preuss, 2004: 204). However, there is some validity to doing so. A fabulously preformed ceremony can create a positive image in the eyes of the viewer, which turns out to be much of the world, for years to come.

Figure 2.1 Overall expenditures of the ceremonies of the Olympic Games from Montreal 1976 to Beijing 2008



Source: Preuss (2004, 207)

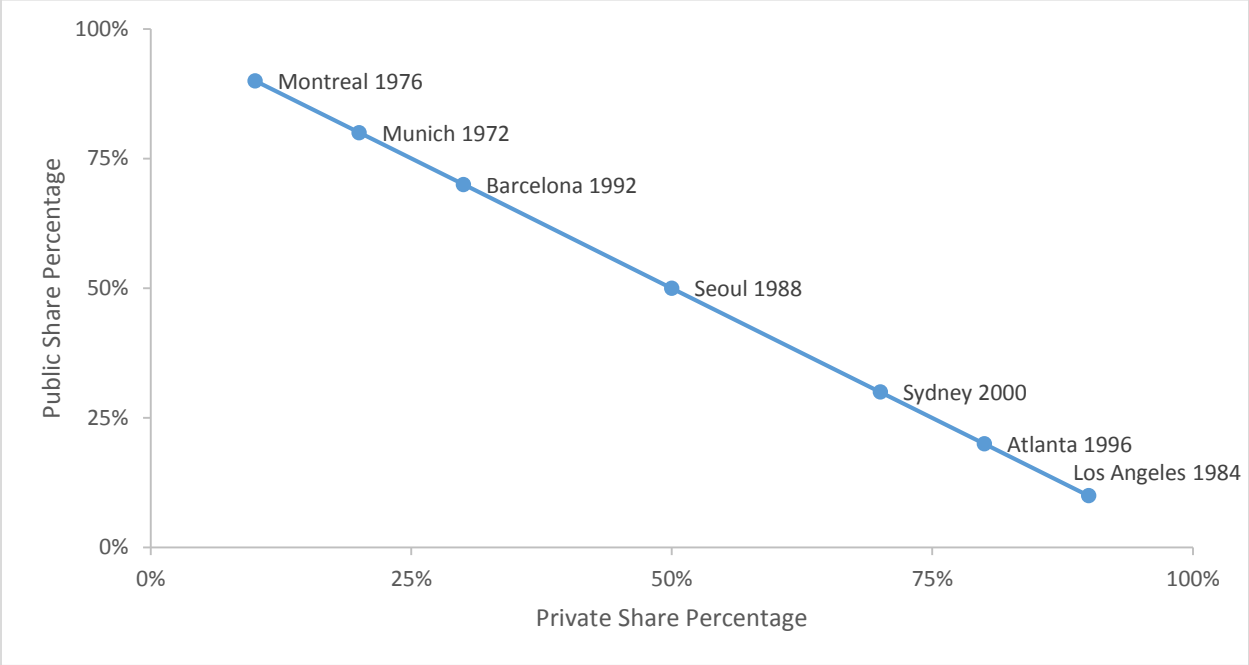
Expenditures for victory ceremonies are also incurred. These ceremonies prove to be very significant, due to the fact that they are broadcast all over the world and provoke strong emotions for the viewers (Preuss, 2004). Medals, national anthems, national flags, costumes, and decorations must all be considered during presentation. “The formal appearance of the ceremony and the emotions of the winner decisively influence the image of the Olympic Games,” Preuss points out (Preuss, 2004: 200).

Olympic expenditures are a substantial portion of organizing the Games. They are no doubt very high, but nonetheless, they are very important. Without these costs, the Olympics would become obsolete. The money to complement these expenditures does not simply appear out of thin air, however. Funding the Olympic Games is perhaps more important than anything.

Funding. The necessary means of funding the Olympic Games are very demanding. Without the Olympic Charter, maintaining accountability between the IOC & OCOG and the host city would be very difficult. The Olympic Charter became essential for the IOC to secure financial guarantees from the organizers, thus preserving its influence on the Olympic Movement (Preuss, 2004). Legally binding the IOC and the host city to all financial relations, is the Host City Contract. The money involved in these contracts and charters come from an array of sources. However, to generalize the financing of the Olympic Games, Public and Private funding will only be touched upon.

Many of the Olympic Games over the years have been financed through a combination of public and private funding. On the two extremes, nonetheless, lie the Games of Montreal 1976 and Los Angeles 1984. Montreal 1976 was almost exclusively funded through the public sector, while Los Angeles 1984 through private shares. Montreal 1976 proved to be a disaster financially, creating massive debt for the city of Montreal, only to be paid off thirty years later in 2006 (Preuss, 2004). Due to this crisis, cities were very reluctant to bid on the 1984 Olympic Games, thus allowing Los Angeles to capture the moment while incurring little cost. This allowed the Games of 1984 to be profitable, and opened up the realization of the benefits of private funding. Figure 2.2 reveals where other Olympic cities between Munich 1972 and Sydney 2000 lie in terms of private and public funding. Data after 2000 is not available.

Figure 2.2 Financing models of the Games from Munich 1972 to Sydney 2000



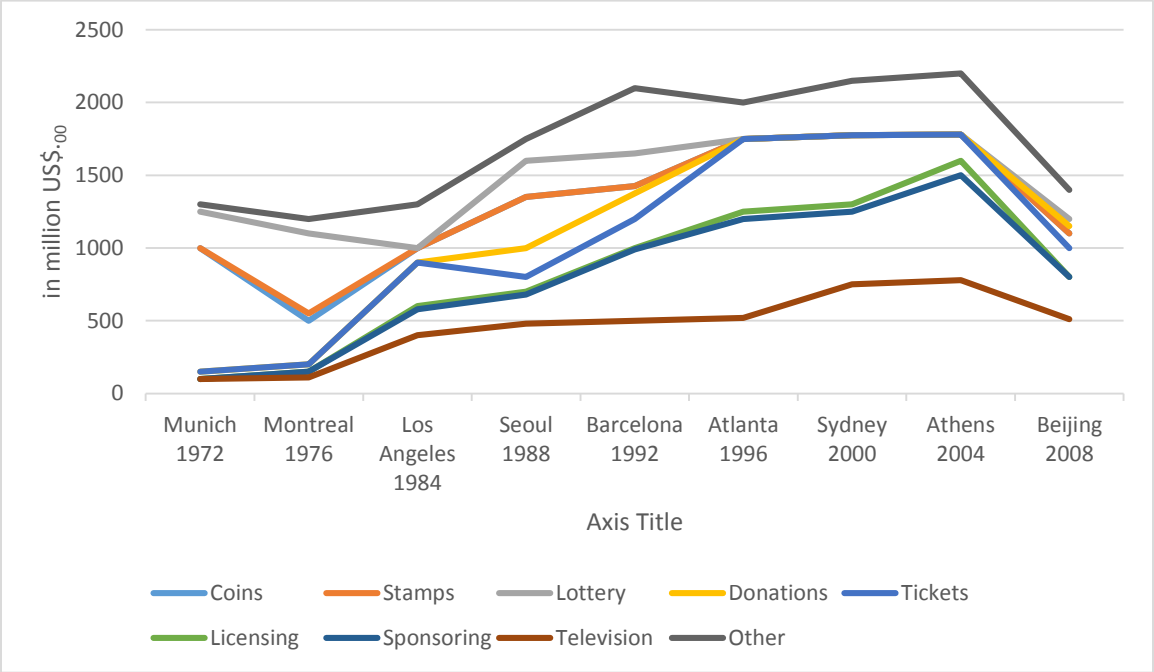
Source: Preuss (2004: 19)

This revenue that helps fund the Olympic Games is generated from a variety of sources. By understanding what these sources are, the Olympic picture starts to become more complete.

Revenues. With plenty of organizing involved in planning the Olympic Games, this task lies within the hands of the OCOG. In its relatively short gathering, the OCOG aims to cover the expenditures to host the Olympic Games, and at its very best, manage a surplus (Preuss, 2004). OCOGs gain revenue through tickets, licensing, sponsorships, television rights, donations, coins, stamps, and lotteries. Figure 2.3 displays overall revenues and the share of financing sources. Although these sources of revenue help fund the Games to this day, the revenue structure has changed drastically since 1984 Los Angeles (Preuss, 2004). Prior to the Games of 1984, much of the revenue stemmed from

public financing sources such as coins, stamps, and lotteries. Most notably, this included the 1972 Munich Games and the 1976 Montreal Games. However, the Games of 1984 in Los Angeles started a new trend of private financing sources such as television rights, sponsorships, and tickets. Although initially revenues did not increase, over time there is fairly steady positive growth (Preuss, 2004). One of the major reasons for this trend in growth is the selling of television rights.

Figure 2.3 Revenues of OCOGs from Munich 1972 to Beijing 2008



Source: Preuss (2004: 96)

Since the financing sources of the Olympics became heavily private based with the 1984 Los Angeles Games, television rights have provided a solid financial base. Toohey and Veal write, “The value of the broadcasting rights for the Olympic Games has grown rapidly from around a million (US) dollars for the Rome 1960 Games, to some

US$1700 million for the Beijing 2008 Games." (Toohey & Veal, 2007: 126) Broadcasting companies are willing to pay large sums of money due to the fact that the Olympics have become emotional, evoking feelings of national pride and self-importance. Regardless the amount of money broadcasting companies spend on obtaining the Olympic rights, the coverage will generate audience and attract advertisers and sponsors.

Sponsorship within the Olympic Games can be a complicated issue, yet it generates significant revenue. The Olympic Partners programme (TOP) was established in 1985 and works by selling to sponsors worldwide rights to use the Olympic logo in their advertising and promotion for the period of an Olympiad. (Toohey & Veal, 2007) Support from sponsors is not always in the form of cash, but often in goods and services, such as timing equipment, ticket payment systems, and computer equipment. Some of the complications arise when sponsors try to garner public attention. There is no advertising permitted within Olympic venues, as well as no naming rights for the Games, creating blockades for sponsors. (Toohey & Veal, 2007) Therefore, finding ways to advertise their product is important but can be a costly endeavor for the sponsor.

Tickets are yet another source of revenue for the Olympic Games. Although ticket revenue has decreased over the years, it is still the third most relevant source of revenue behind broadcasting rights, and marketing/sponsors. (Preuss, 2004) The most significant ticket revenue comes from the opening ceremony. These ticket prices have an upward trend since Munich 1972, with the highest priced tickets increasing drastically. For example, highest priced tickets in Sydney 2000 for the opening ceremonies were $1194 USD, compared to $698 USD four years earlier in Atlanta. (Preuss, 2004) The OCOGs

have realized the low price elasticity of the ceremonies, and thus pounced on the opportunity to maximize profit. (Preuss, 2004) The price differentiation between high priced tickets and low priced tickets are justified by the OCOG because they offer tickets to every social class.

Economic Effects of Hosting the Olympic Games

The purpose of this section is to cover the literature regarding the important economic indicators that will also be investigated later in the paper; tourism, employment, GDP. These form the basis of the research involved regarding the desire to host the Olympic Games.

Tourism. Although Olympic tourism changes from Games to Games, the industry has the potential to be significant for the region. Olympic tourism can be defined as 'tourism behavior motivated or generated by Olympic-related activities.' (Weed, 2008: 22) This includes direct expenditure from foreign tourists attending the Games, but also includes indirect expenditure that may arise from tourism induced through worldwide exposure of the host city/country. These are some of the benefits of hosting the Olympic Games. As Preuss says, "[tourism] has the potential to be a 'giant' because it can attract huge amounts of autonomous money to a region or country." (Preuss, 2004: 46)

Olympic tourism can be split into three different periods: Pre-Olympic, Olympic, and post-Olympic. Pre-Olympic tourism does not always result in a large increase in tourists. Often pre-Olympic events, or test events, bring in athletes and coaches for pre-Olympic training, which is likely the highest pre-Olympic tourist upsurge. For example, in Sydney the pre-Olympic training of more than 127 teams from 39 countries brought

US$43.2 million into the state of New South Wales. (Preuss, 2004) Olympic tourism often depends on the attractiveness of the region and the political & economic conditions of the region. This explains why the Summer Games experience better numbers, as they are frequently hosted in large, warm, well-known regions that are typically bigger than Winter Games host regions. However, the Games also carry a crowd out effect. Preuss states it best, saying, "Non-Olympic tourists and residents avoided the Olympic trouble that, in turn, led to a loss of money that would have otherwise been spent on the host city." (Preuss, 2004: 51) This may be true, but long term benefits have the ability to outweigh this damage. Post-Olympic tourism is very much positive. "The media coverage increases the desire of potential tourists to visit the country after the Games due to a change in perception," explains Preuss. (Preuss, 2004: 59) Host regions rely on tourists sharing positive experiences once they return home, which can trigger a multiplying effect of visitors. This is an important reason why the image and presentation of the Olympic Games must be exceptional.

Employment. There is no doubt that the Olympic Games create employment opportunity. However, the issue becomes to what extent these jobs offer sustainability. The argument then becomes, Olympic Games only create short-term employment with very little benefit to the population. (Preuss, 2004) The duration of jobs can be explained throughout four phases of organizing and hosting the Games. The first phase, during the initial bid, creates work leading up to the Games, and further increased during the preparatory phase. During the Olympics, most of the work must be done, and thus job creation spikes. After the Games, the work effort drops sharply. (Preuss, 2004) Although

this is true, the Games also indirectly create longer lasting jobs in the fourth phase, through infrastructure change, tourism, and leisure industry.

If it is assumed that underemployment prevails in the host country, as in most cases, then employment effects are seen as positive, by providing opportunity to those that are unemployed. However, in the case of full employment, in which people leave their job to pursue Olympic related employment, one must consider the utility or prosperity level of these people. Moreover, there is the consideration that without the Olympics, other projects may in fact create more, longer lasting employment.

Gross Domestic Product. There is very little literature on the effects of the Olympic Games and GDP of the host region. This may be due to the fact that it is very hard to analyze changes in GDP on account of only hosting the Olympics. Although GDP changes may be hard to determine as a result of hosting the Olympics, the theory behind the analysis makes sense. Consumption, investment, government spending, exports, and imports all factor into GDP, and more importantly, all of these components are affected by hosting the Games.

Conclusion

This chapter briefly explained the economic aspects involved with hosting the Games. More often than not, hosting the Olympic Games seems to be a wise choice. As stated earlier, many economists still claim hosting 'mega-events' would be economically detrimental. However, in the last two decades there has been increasing number of cities bidding to host the Games as well as increasing funds invested in Olympic bids, resulting in increased interest on the impact of the Olympics on the host city. (Malfas, Theodoraki

& Houlihan, 2009) The purpose of this study is to compare economic indicators between the host region and the region coming second in the bidding process, hoping to find any differences through tourism, employment and GDP, to determine if hosting the Games was in fact economically practical. The following chapter will investigate the theory behind the impact of hosting the Games.

CHAPTER III

THEORY

The purpose of this chapter is to discuss the theories behind the impact of hosting the Olympic Games. The chapter will be structured in two parts. The beginning of the chapter will concentrate on the previous models and variables that are speculated by this paper to have an impact on the host city. The variables include many world development indicators such as education and life expectancy. The rest of the chapter will focus on the theories behind the empirical regression analysis that will be further explored in chapter IV: Data and Methodology.

The World Bank accurately tracks global development data for over 200 countries and territories. The world development indicator (WDI) database is the primary World Bank collection of development indicators. These indicators can help to determine the economic state of a region or country through numerical data collection. Although there are hundreds of different indicators, the data used for this paper falls into three categories; GDP, employment, and tourism. GDP is measured in current US dollars, employment is measured as the country's unemployment rate, and tourism is determined by GDP in $US billion that is generated through the tourism industry.

The model used for this paper builds off of many models and theories, including Hamburg's model, for one, which pertains to employment and hosting the Olympics

(Hamburg, 2013). Ultimately Hamburg's model served as the base model in which all three of the models in this paper are formatted around. The equation (3.1) that Hamburg used to explain the effect hosting the Olympics has on national employment rates is:

$$\text{Employment} = \beta_0 \text{ constant} + \beta_1 \text{ year} + \beta_2 \text{ Japan} + \beta_3 \text{ Austria} + \beta_4 \text{ France} + \beta_5 \text{ Canada} + \beta_6 \text{ United States} + \beta_7 \text{ Republic of Korea} + \beta_8 \text{ Spain} + \beta_9 \text{ Norway} + \beta_{10} \text{ Australia} + \beta_{11} \text{ Italy} + \beta_{12} \text{ Summer} + \beta_{13} \text{ Pre} + \beta_{14} \text{ Olympic} + \beta_{15} \text{ Legacy} + \beta_{16} \text{ logGDP} + \beta_{17} \text{ Birth Rate} + \beta_{18} \text{ Death Rate} + \beta_{19} \text{ CPI} + \beta_{20} \text{ Schooling} + e \quad (3.1)$$

Where, employment is measured as a percentage of the country's population,

Summer is the dummy variable for the type of Olympics,

Pre is the dummy variable for the Pre-Olympic Period,

Olympic is the dummy variable for the year the Olympics were held,

Legacy is the dummy variable for the ten-year period following the Olympics,

logGDP is the log of Real GDP per capita in the host nation,

Birth rate is the crude birth rate per 1000 people,

Death rate is the crude death rate per 1000 people,

CPI is for Consumer Price Index in the host nation,

Schooling is the average number of years of education completed by people over the age of 15,

e is the error term.

Hamburg expected to see employment rates increase during the Olympic period due to job opportunities that open up due to hosting the Olympics. This is a very sensible hypothesis, however the results found that hosting the Olympics had very little impact on the employment rate in that nation (Hamburg, 2013).

The format of Hamburg's model is something the models in this paper look to improve upon. For example, the model in this paper aims to improve measurements in

education. Post-secondary education replaces Hamburg's schooling term as a baseline for years of schooling. Population is introduced into this paper's model, as this aims to account for the size of a nation for comparison purposes. Overall, the models in this paper hope to reveal the benefits of hosting the Olympics as a whole, rather than employment specifically. This is precisely why other models need be accounted for as well. Another model that this paper expands upon is Edds' model (Edds, 2012). Edds' model is focused on three Olympiads, 1992 Barcelona, 1996 Atlanta, and 2000 Sydney. Here, however, she looks at three different effects per Olympiad, construction, tourism, and financial services, through same country state/region comparisons. Edds' model triggered the idea to compare Olympics from host nation to runner-up nation, as to put cost and benefits into prospective.

Lastly, the theory that Preuss (2004) uses is taken into great consideration when developing this paper's model. Preuss emphasizes certain aspects more than others that economically affect the Olympic Games. Preuss' points on these key aspects of hosting the Olympic Games are greatly considered when introducing the independent variables used in the model.

As stated, this paper consists of three models to explain the economic effects of hosting the Olympic Games. Although the models are measuring different economic effects, they are all very similar in nature, especially in terms of the explanatory variables. In fact, there is only one differing explanatory variable used in the tourism model; change in net tourists. Change in net tourists is used in this model because it is expected that this should have a positive effect on GDP generated through tourism. However, there may be some cases in which people depart the country because of the

commotion of the Olympic Games. Yet GDP generated through tourism may still grow due to the fact that tourists may spend more while attending the Games than if they were visiting the same nation while no Olympics were being held. (Weed, 2008)

The other explanatory variables used throughout all three models are the log of the population, post-secondary education, life expectancy, pre-Olympic, Olympic & Olympic legacy time periods, whether the country was a host or a runner up, and lastly the country. Further detail of these variables will be discussed in Chapter IV: Methodology and Data. Nonetheless, by incorporating the log of the population and including more countries, this model expands Hamburg's model to achieve further insight into the effects of hosting the Olympic Games.

The collected data will be modeled using the Ordinary Least Squares (OLS) regression approach. This approach will not only make it possible to interpret the data set more clearly, but make it possible to compare the host nation to the runner-up nation which is the basis of the hypothesis of hosting the Olympics is beneficial. OLS will test the null hypothesis that hosting the Olympic Games has a positive effect on GDP, a positive effect on unemployment (lower unemployment rates), and a positive effect on GDP generated through tourism.

Conclusion

This chapter details the theory that will be used to explain the effects of hosting the Olympic Games. Further detail of the explanatory and dependent variables, as well as the precise model used in this paper, will be discussed in the next chapter. The explanatory variables will include the log of the population, post-secondary education,

life expectancy, pre-Olympic, Olympic and Olympic legacy time periods, host, runner-up, and country, with change in net tourists introduced in the tourism model. These determinants will be used to estimate effects on the change in GDP, the change in unemployment, and the change in GDP generated through tourism, ultimately determining if the host country fared better than the runner-up nation by hosting the Olympic Games. Also, the regression will help determine the benefits of the host nation in and of itself.

CHAPTER IV

DATA & METHODOLOGY

This chapter will explain two important aspects of this paper. First, the data will be explained. This includes where the data was compiled from, and more specifically why this data is relevant and important to the hypothesis. The chapter will go into detail about why each variable was chosen for the model and the expected effect it will have on the ordinary least squares regression. The second part of the chapter will explain the methodology used and go into depth regarding the structure of the model. This part of the chapter will complement the data explanation.

Data

A considerable amount of the data was pulled from the World Bank, while the remaining data is from the World Travel and Tourism Council. The majority of data points are part of the World Bank's world development indicator (WDI) database. Data from the World Travel and Tourism Council does not have the same history as the World Bank due to the fact that countries did not start tracking tourism information until a later point in time. Much of the data accurately dates back to 1960, however as a result of either political issues within the nation or certain indicators only being recorded at later dates, some of the data points start after 1960. Nonetheless, data is recorded up to 2012 as information from 2013 is not yet readily available. GDP, population, and life expectancy begin in 1960, aside from the Russian Federation and Germany. By reason of political

issues within these countries, GDP is not available until 1989 and 1970, respectively. A gap in GDP data also exists from 1970-1979 in Switzerland. Post-secondary education data points generally begin in 1970, but again because of nationwide circumstances these vary from country to country by about five years. The remaining explanatory variables are dummy variables and include the entire data set.

Variables

The variables used in the model are no doubt advantageous in explaining the hypothesis, however understanding why they are included in the model is important. As previously stated, the three models used in the paper have the same structure in terms of independent variables, only change in net tourism differs in the tourism model.

Population. Population is an explanatory variable used to control for the size of a nation. Population and the state of an economy are often closely tied together. For example, a country with a high population would theoretically have more people competing for jobs, thus affecting employment. Furthermore, a nation with fewer people might experience a higher per capita availability of natural resources, in turn affecting the nations GDP (howmany.org, 2010). Here the log of the population is used to pick up any percent changes that might affect the dependent variable.

Post-Secondary Education. Post-secondary education is used to gauge the general education levels within a nation. This is an important factor within an economy. Nations with very high population levels, such as China, have an extremely high labor supply. This puts ample pressure on worker wages as well as the worker to find a job in a competitive economy. Therefore, people with college degrees will tend to have an

advantage in employment opportunities and essentially achieve a higher wage rate. Another point to consider is globalization and international trade. Countries will carry a comparative advantage with more educated and trained people due to their competitive advantage.

Life Expectancy. The purpose of the life expectancy variable is used to capture a nation's general health and poverty condition. This is included as life expectancy could have a substantial effect on the tourism industry, employment within a nation, as well as the nation's GDP.

Change in Net Tourists. The change in net tourism certainly has an effect on the GDP generated through tourism. However, this term is included to account for the amount of tourists contributing towards the GDP in the Olympic years. Tourists visiting the Olympics may spend more than in years the nation is not hosting the Olympics.

Remaining Explanatory Variables. The remaining independent variables include country (Australia, Brazil, Canada, China, Germany, Spain, France, Greece, Italy, Japan, Republic of Korea, Mexico, Russia, Switzerland, and United Kingdom), pre-Olympic, Olympic, & Olympic legacy, host and runner-up. These are all dummy variables. United States of America (USA) is not included in the country variable list because this is the base country in which results are being compared to. Pre-Olympic, Olympic, and Olympic legacy are dummy variables used to indicate which years fall under each category. Pre-Olympic is the time period leading up to the year of the Olympics. This is determined by when the nation was chosen to host the Olympic Games and range from five to seven years beforehand. Intuitively, the Olympic period is the year

the Games take place, where the Olympic Legacy period is ten years following the games. The host and runner-up variables simply indicate whether the nation was the host or the runner-up to the Olympic Games.

The expected effects of these variables vary between models (Table 4.1). The expected effects of the variables are mostly positive. Hosting the Olympics, for example, is expected to have a positive impact for all three models, where as being the runner-up is expected to have negative impacts compared to hosting. In the Olympic period, positive effects should theoretically be evident. Although most of the variables are expected to have a positive impact, tourism in the Olympic legacy period and population in the tourism model are expected to be negative.

Table 4.1 Summary of Independent Variables Predictions

Variable	Olympic GDP Model	Olympic Employment Model	Olympic Tourism Model
Log Population	+	+	-
Post-Secondary	+	+	+
Life Expectancy	+	+	+
Change in Net Tourists	N/A	N/A	+
Host	+	+	+
Runner-Up	-	-	-
Pre	+	+	No Change
Olympic	+	+	+
Legacy	+	No Change	-

The three dependent variables individually pertain to each model and have previously been discussed. Change in GDP, change in unemployment, and GDP generated through tourism are quite self-explanatory and the independent variables will help to explain any trends. Table 4.2 shows the summary statistics displaying the number of observations, mean, standard deviation, minimum and maximum for each variable.

Table 4.2 Summary Statistics

Variable	Obs.	Mean	Std.	Min.	Max.
changeingdp	783	6.12e+10	2.07e+11	-3.42e+12	1.39e+12
changeinunemploymentrate	448	0.093304	1.093912	-3.4	6.7
changeingdpgeneratedfromtourism	384	8.372188	21.47009	-123.5	120.86
logpopulation	848	7.772288	0.524945	6.73	9.13
postsecondary	561	38.46118	23.95081	0.13	101.76
lifeexpectancy	832	72.84948	6.19034	43.47	82.93
pre	848	0.1875	0.390543	0	1
olympic	848	0.03184	0.175677	0	1
legacy	848	0.25	0.433268	0	1
host	848	0.016509	0.127499	0	1
runnerup	848	0.01533	0.122935	0	1
australia	848	0.625	0.242204	0	1
brazil	848	0.625	0.242204	0	1
canada	848	0.625	0.242204	0	1
china	848	0.625	0.242204	0	1
germany	848	0.625	0.242204	0	1
spain	848	0.625	0.242204	0	1
france	848	0.625	0.242204	0	1
greece	848	0.625	0.242204	0	1
italy	848	0.625	0.242204	0	1
japan	848	0.625	0.242204	0	1
southkorea	848	0.625	0.242204	0	1
mexico	848	0.625	0.242204	0	1
russia	848	0.625	0.242204	0	1
switzerland	848	0.625	0.242204	0	1
unitedkingdom	848	0.625	0.242204	0	1
changeinnettourists	227	-125714	2664161	-1.27e+07	1.50e+07

Source: Author's Calculations

The models used in this paper take an ad hoc approach, as briefly explained in the previous chapter. These models improve on these previous models and strengthen or question previous findings. That being said, the approach of this paper is relatively different in terms of the hypothesis. The goal is to compare Olympic host and runner-up to determine if hosting the Games is in fact beneficial to a nation. Through GDP, employment, and tourism, the paper will determine the benefit of hosting the Games.

An ordinary least squares regression will be used in order to determine the benefit to a nation. The three equations (4.1, 4.2, and 4.3) to be modeled by OLS regression are as follows:

$$\text{Change in GDP} = \beta_0\,\text{Constant} + \beta_1\,\text{Log Population} + \beta_2\,\text{Post-Secondary} + \beta_3\,\text{Life Expectancy} + \beta_4\,\text{Pre} + \beta_5\,\text{Olympic} + \beta_6\,\text{Legacy} + \beta_7\,\text{Host} + \beta_8\,\text{Runner-Up} + \beta_9\,\text{Australia} + \beta_{10}\,\text{Brazil} + \beta_{11}\,\text{Canada} + \beta_{12}\,\text{China} + \beta_{13}\,\text{Germany} + \beta_{14}\,\text{Spain} + \beta_{15}\,\text{France} + \beta_{16}\,\text{Greece} + \beta_{17}\,\text{Italy} + \beta_{18}\,\text{Japan} + \beta_{19}\,\text{Rep. of Korea} + \beta_{20}\,\text{Mexico} + \beta_{21}\,\text{Russia} + \beta_{22}\,\text{Switzerland} + \beta_{23}\,\text{United Kingdom} + e \quad (4.1)$$

$$\text{Change in Unemployment Rate} = \beta_0\,\text{Constant} + \beta_1\,\text{Log Population} + \beta_2\,\text{Post-Secondary} + \beta_3\,\text{Life Expectancy} + \beta_4\,\text{Pre} + \beta_5\,\text{Olympic} + \beta_6\,\text{Legacy} + \beta_7\,\text{Host} + \beta_8\,\text{Runner-Up} + \beta_9\,\text{Australia} + \beta_{10}\,\text{Brazil} + \beta_{11}\,\text{Canada} + \beta_{12}\,\text{China} + \beta_{13}\,\text{Germany} + \beta_{14}\,\text{Spain} + \beta_{15}\,\text{France} + \beta_{16}\,\text{Greece} + \beta_{17}\,\text{Italy} + \beta_{18}\,\text{Japan} + \beta_{19}\,\text{Rep. of Korea} + \beta_{20}\,\text{Mexico} + \beta_{21}\,\text{Russia} + \beta_{22}\,\text{Switzerland} + \beta_{23}\,\text{United Kingdom} + e \quad (4.2)$$

$$\text{Change in GDP Generated from Tourism} = \beta_0\,\text{Constant} + \beta_1\,\text{Log Population} + \beta_2\,\text{Life Expectancy} + \beta_3\,\text{Pre} + \beta_4\,\text{Olympic} + \beta_5\,\text{Legacy} + \beta_6\,\text{Host} + \beta_7\,\text{Runner-Up} + \beta_8\,\text{Australia} + \beta_9\,\text{Brazil} + \beta_{10}\,\text{Canada} + \beta_{11}\,\text{China} + \beta_{12}\,\text{Germany} + \beta_{13}\,\text{Greece} + \beta_{14}\,\text{Spain} + \beta_{15}\,\text{France} + \beta_{16}\,\text{Italy} + \beta_{17}\,\text{Japan} + \beta_{18}\,\text{Rep. of Korea} + \beta_{19}\,\text{Mexico} + \beta_{20}\,\text{Russia} + \beta_{21}\,\text{Switzerland} + \beta_{22}\,\text{United Kingdom} + \beta_{23}\,\text{Change in Net Tourists} + e \quad (4.3)$$

Where, change in GDP is current year GDP minus previous year GDP,

Change in unemployment rate is current year unemployment rate minus previous year unemployment rate,

Change in GDP generated from tourism is current year GDP generated from tourism minus previous year GDP generated from tourism,

Log population is the log of the country's population,

Post-secondary is percentage of population enrolled in higher education,

Life expectancy is the number of years expected to live at birth,

Pre is the dummy variable for the years between being chosen to host the Olympics and the Olympics,

Olympic is the dummy variable for the Olympic year,

Legacy is the dummy variable for ten years following the Olympic Games,

Host is the dummy variable for hosting the Olympics,

Runner-up is the dummy variable for being runner-up to host the Olympics,

Country is the dummy variable for each country,

Change in net tourists is arrivals minus departures compared yearly,

e is the error term.

These equations (4.1, 4.2 and 4.3) expand upon Hamburg's model in order to strengthen the theory that hosting the Olympic Games has a beneficial impact. These models improve upon Hamburg's model by including more countries, adding a population variable, and using life expectancy rather than birth rate and death rate.

Conclusion

This chapter explains the data and methodology used within the models. The importance of the variables will translate over in the results chapter, whereas the models are outlined above, and the effects will be analyzed through an ordinary least squares regression. Further detail of the results will be discussed in the next chapter.

CHAPTER V

RESULTS & ANALYSIS

The purpose of this chapter is to present the results found after running the Ordinary Least Squares (OLS) Regression. The goal is to determine the effects that hosting the Olympic Games has on a country. Each independent variable will be estimated and the statistical significance determined. To properly address the hypothesis, a comparison of host city against runner-up city for each Olympiad will take place. The results of each model will be addressed individually, followed by an overall results analysis. Additionally, three diagnostic tests will be conducted to assess the models accuracy.

Olympic GDP Model

Model 5.1 shows the GDP equation used to determine the effects that hosting the Olympic Games has on a country's gross domestic product. The runner-up variable was omitted due to its collinearity with the host variable.

$$\text{Change in GDP} = \beta_0 \text{ Constant} + \beta_1 \text{ Log Population} + \beta_2 \text{ Post-Secondary} + \beta_3 \text{ Life Expectancy} + \beta_4 \text{ Pre} + \beta_5 \text{ Olympic} + \beta_6 \text{ Legacy} + \beta_7 \text{ Host} + \beta_8 \text{ Australia} + \beta_9 \text{ Brazil} + \beta_{10} \text{ Canada} + \beta_{11} \text{ China} + \beta_{12} \text{ Germany} + \beta_{13} \text{ Spain} + \beta_{14} \text{ France} + \beta_{15} \text{ Greece} + \beta_{16} \text{ Italy} + \beta_{17} \text{ Japan} + \beta_{18} \text{ Rep. of Korea} + \beta_{19} \text{ Mexico} + \beta_{20} \text{ Russia} + \beta_{21} \text{ Switzerland} + \beta_{22} \text{ United Kingdom} + e \quad (5.1)$$

Diagnostic tests were run to confirm the validity and accuracy of the model. The tests performed checked for heteroskedasticity, normality, and multicollinearity.

GDP Diagnostic Tests. Heteroskedasticity arises when the variance of the error term differs across observations. When the variance of error terms do not differ, homoscedasticity is present and OLS provides accurate and unbiased estimates. Although heteroskedasticity will not result in a biased OLS estimator, it will be inefficient. Therefore, homoscedasticity is ideal, though there are ways to correct heteroskedastic results. First, testing for heteroskedasticity must be performed before moving forward. Figure 5.1 shows the results of the test.

Figure 5.2 Breusch-Pagan / Cook-Weisberg Test for Heteroskedasticity GDP

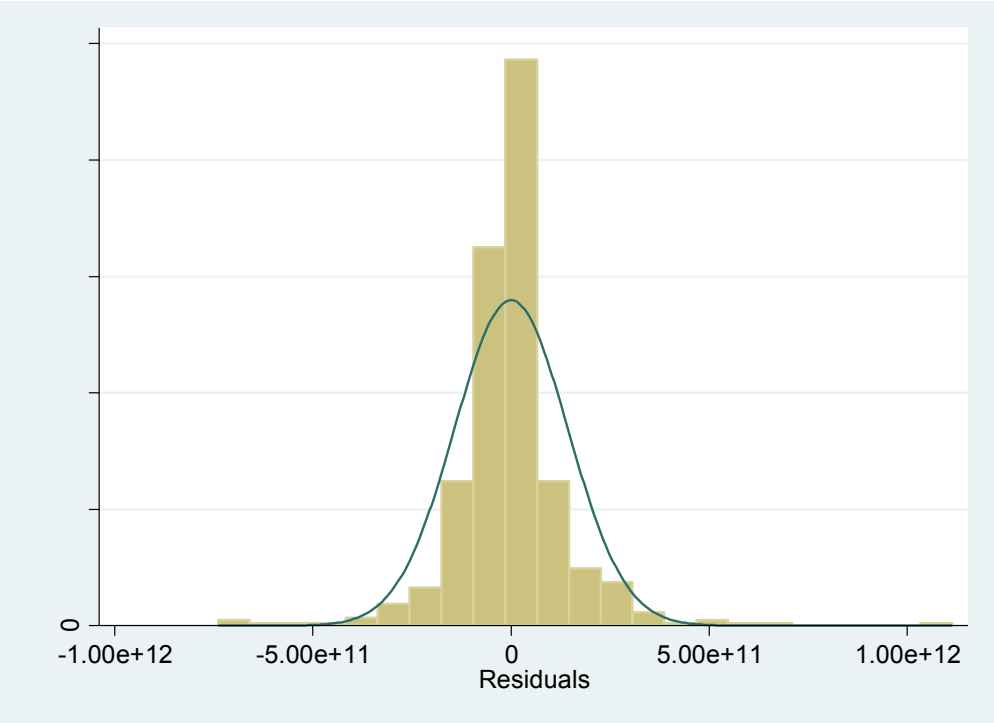
$chi^2(1)$ = 143.67
Probability > chi^2 = 0.0000

The results of the heteroskedasticity test are not surprising. OLS estimates are highly sensitive to outliers, which coincides with the Olympic data set, and can trigger heteroskedasticity. To fix this problem, an OLS regression with robust standard errors is used to correct the potential problem of heteroskedasticity.

Normality is the next diagnostic test to be performed. Non-normality will be found in a skewed distribution of error terms. Typically a Jarque-Bera test is performed to check for skewness and kurtosis, however these tests produced no useable results. Nonetheless, a visual representation of the residuals can be used to check for normality. Figure 5.3 shows the histogram of the residuals in model 5.1. This graph shows that the histogram is essentially normally distributed with leptokurtic kurtosis. This is not a

problem however, as the residuals are centered around the mean while showing a bell curve distribution. Simply put, a leptokurtic distribution means that small changes happen less frequently because historical values have clustered by the mean. However, this also means that large fluctuations are more likely within the fat tails. (Investopedia, 2014)

Figure 5.3 Histogram of Residuals for Olympic GDP Model



Source: Author's Calculations

The last diagnostic test to be performed is a check for multicollinearity. Multicollinearity occurs when two or more variables are closely related. A consequence of multicollinearity is less reliable t-statistics for independent variables. Essentially two independent variables are measuring the same thing, thus driving the t-statistics downward. In this study, there are some variables that have obvious correlation. Post-

secondary and life expectancy, for example, have some correlation. This may be due to the fact education is directly related to a countries well-being, measured by life expectancy. Table 5.1 shows the correlation matrix for the GDP model.

Table 5.1 Correlation Matrix for Olympic GDP Model

	Log population	**Post-secondary**	**Life expectancy**
Log population	1		
Post-secondary	-0.088	1	
Life expectancy	-0.3418	0.5570	1

Source: Author's Calculations

Values over 0.5 tend to be correlated. From table 5.1 it is proven that post-secondary and life expectancy have a value over 0.5 but since both variables contribute to the model, this will be ignored. Furthermore, this study is more interested in the effects of the Olympic periods.

Finally, results can be drawn after completion of the diagnostic tests. Table 5.2 shows the regression results for the GDP model.

Table 5.2 Robust Olympic GDP OLS Results

Variable	Coefficient	T-score
logpopulation	6.60e+11	(2.23)**
postsecondary	2.21e+08	(-0.38)
lifeexpectancy	3.15e+09	(0.52)
pre	-1.55 e+10	(-0.78)
olympic	7.01 e+10	(1.2)
legacy	3.75 e+10	(1.65)*
host	5.90 e+10	(0.56)
australia	-7.30 e+10	(-1.4)
brazil	4.71 e+11	(1.35)
canada	3.12 e+11	(1.12)
china	-5.64 e+11	(-2.54)***
germany	9.74 e+10	(0.59)
spain	2.20 e+11	(0.9)
france	1.52 e+11	(0.8)
greece	5.94 e+11	(1.44)
italy	1.46 e+11	(0.76)
japan	2.85 e+10	(0.27)
southkorea	2.21 e+11	(1.08)
mexico	1.33 e+10	(0.11)
russia	-9.86 e+10	(-1.65)*
unitedkingdom	1.56 e+11	(0.84)
switzerland	7.11 e+11	(1.5)
Observations		531
R-sq. Value		0.3421
F-Statistic		8.26

Note: *p-value<0.1 **p-value<0.05 ***p-value<0.01

Source: Author's Calculations

GDP Results. The regression results show significant findings. The R-squared value indicates the accuracy of the model overall. However, an examination of the F-statistic can provide a significant statistic regarding the model. Here the F-statistic proves that there is a relationship between the dependent variable and the independent variables at the 99.999% confidence level. T-statistics can provide further insight into the results. Countries aside, logpopulation is positive and significant. Population, therefore, plays a

significant role in determining the change in a country's GDP, while other independent variables showed no signs of significance.

The purpose of the study was to determine if the host country fared better than the runner-up from hosting the Olympic Games. The results show that countries hosting the Olympics tend to benefit more than the runner-up. The host variable is not significant, but when comparing by Olympiad between runner-up and host nations, the host benefits ten times out of fourteen. Table 5.3 shows the country that saw better benefits in bold.

Table 5.3 GDP Comparison per Olympiad

Olympic Year	Host	Runner-Up
1960	Italy	**Switzerland**
1964	**Japan**	USA
1968	**Mexico**	USA
1972	Germany	**Spain**
1976	**Canada**	Russia
1980	Russia	**USA**
1984	**USA**	N/A
1988	**Rep. of Korea**	Japan
1992	**Spain**	France
1996	USA	**Greece**
2000	**Australia**	China
2004	**Greece**	Italy
2008	China	**Canada**
2012	**United Kingdom**	France
2016	**Brazil**	Spain

Note: Country that saw greater benefits in comparison per Olympiad is bolded

Source: Author's Calculations

It is surprising to see that the Olympic time periods have very little effect on the change in GDP. The most significant time period is the Olympic legacy period, while the pre-Olympic time period is insignificant and negative, showing decreasing GDP. However, during the Olympic period, changes in GDP are most dramatic.

Olympic Employment Model

Model 5.4 shows the employment equation used to determine the effects that hosting the Olympic Games has on a nation's unemployment rate. The host variable was omitted due to its collinearity with the runner-up variable.

$$\text{Change in Unemployment Rate} = \beta_0 \text{ Constant} + \beta_1 \text{ Log Population} + \beta_2 \text{ Post-Secondary} + \beta_3 \text{ Life Expectancy} + \beta_4 \text{ Pre} + \beta_5 \text{ Olympic} + \beta_6 \text{ Legacy} + \beta_7 \text{ Runner-Up} + \beta_8 \text{ Australia} + \beta_9 \text{ Brazil} + \beta_{10} \text{ Canada} + \beta_{11} \text{ China} + \beta_{12} \text{ Germany} + \beta_{13} \text{ Spain} + \beta_{14} \text{ France} + \beta_{15} \text{ Greece} + \beta_{16} \text{ Italy} + \beta_{17} \text{ Japan} + \beta_{18} \text{ Rep. of Korea} + \beta_{19} \text{ Mexico} + \beta_{20} \text{ Russia} + \beta_{21} \text{ Switzerland} + \beta_{22} \text{ United Kingdom} + e \quad (5.4)$$

Diagnostic tests must be performed to confirm the validity and accuracy of the model. Again, the tests performed checked for heteroskedasticity, normality, and multicollinearity.

Employment Diagnostic Tests. Much like the Olympic GDP Model, testing for heteroskedasticity pertaining to the Olympic Employment Model proved to be high as shown in Figure 5.5. Without question, heteroskedasticity is present in this model as well. Again, by using OLS with robust standard errors, heteroskedasticity can be resolved.

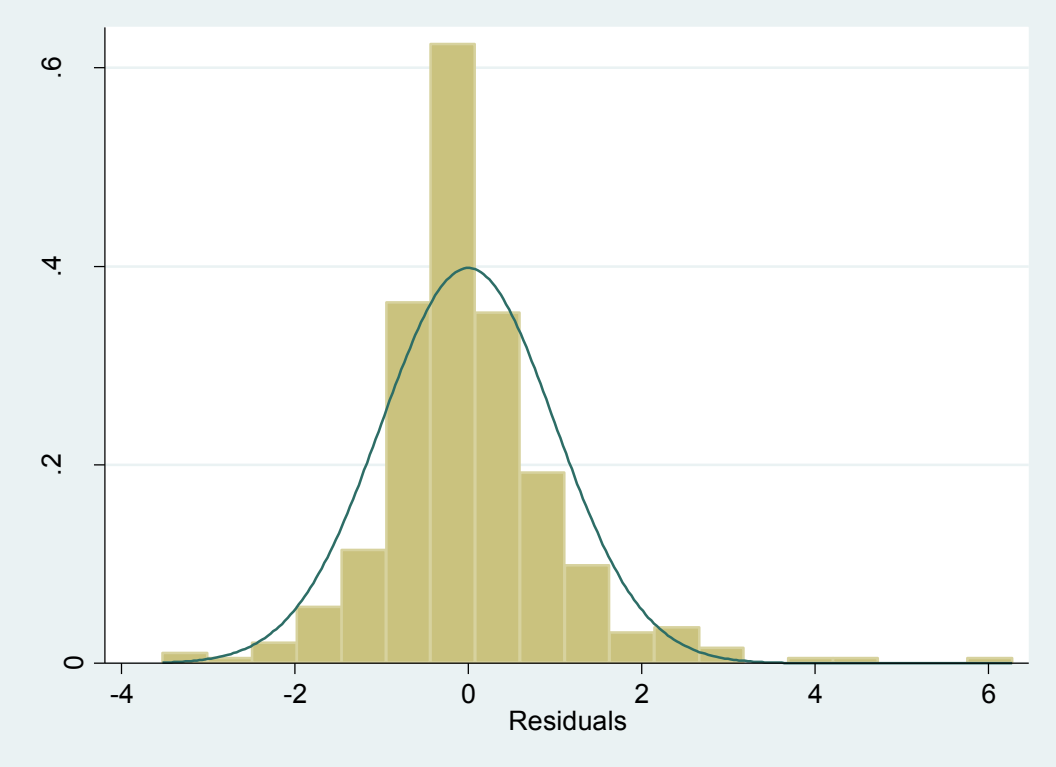
Figure 5.5 Breusch-Pagan / Cook-Weisberg Test for Heteroskedasticity Employment

$\text{chi}^2(1) = 44.38$
$\text{Probability} > \text{chi}^2 = 0.0000$

The next test is for normality, to ensure that the residuals are normally distributed. The Jarque-Bera test is used to check for normality, yet much like the Olympic GDP Model, the results proved to be insufficient. Therefore, a visual inspection is needed to check for normalcy in the data set. Figure 5.6 shows the histogram of the residuals in the

Olympic Employment Model. Here, the visual representation shows a normal distributed bell curve with slight leptokurtic kurtosis. This should not be a problem, as the residuals are centered around the mean.

Figure 5.6 Histogram of Residuals for Olympic Employment Model



Source: Author's Calculations

The multicollinearity issues seen within the Olympic Employment Model are exactly similar to the Olympic GDP Model. Again we see a direct correlation between life expectancy and post-secondary variables (Table 5.4). This is due to the same reasons previously stated, and similarly since both variables contribute to the model, this will be ignored.

Table 5.4 Correlation Matrix for Olympic Employment Model

	Log Population	Post-Secondary	Life Expectancy
Log Population	1		
Post-Secondary	-0.088	1	
Life Expectancy	-0.3418	0.557	1

Source: Author's Calculations

The results can be analyzed now that the diagnostic tests have been performed.

Table 5.5 Robust Olympic Employment OLS Results

Variable	Coefficient	T-score
logpopulation	4.780075	(1.23)
postsecondary	-0.0145071	(-2.37)***
lifeexpectancy	0.0430812	(0.76)
pre	-0.0116395	(-0.09)
olympic	-0.1716648	(-0.33)
legacy	-0.1631287	(-1.02)
runnerup	0.0686347	(0.11)
australia	0.8038002	(1.07)
brazil	5.035019	(1.1)
canada	4.340989	(1.15)
china	-3.959866	(-1.47)
germany	2.222446	(1.1)
spain	3.660408	(1.1)
france	2.498291	(0.96)
greece	6.295646	(1.14)
italy	2.517114	(0.93)
japan	0.8659564	(0.58)
southkorea	3.415087	(1.17)
mexico	1.119527	(0.73)
russia	1.469504	(1.89)*
unitedkingdom	2.338637	(1.07)
switzerland	6.686092	(0.9)
Observations		373
R-sq. Value		0.0409
F-Statistic		0.77

Note: *p-value<0.1 **p-value<0.05 ***p-value<0.01

Source: Author's Calculations

Employment Results. The results show plenty of notable findings. The most significant finding is the R-squared value, 0.04. This is an extremely low number, proving that the independent variables are not explaining much of the variation in the dependent variable. Furthermore, the F-statistics shows that the relationship between the dependent variable and the independent variables is not statistically significant. Nonetheless, the only significant independent variable is post-secondary. To no surprise, the coefficient for post-secondary is negative, proving that when more people are enrolled in post-secondary education, unemployment rates will be lower. Similarly, although not statistically significant, coefficients on the pre, Olympic, and legacy variables are all negative as well. These time periods prove to be beneficial to a country's employment levels. Lastly, the coefficient on the runner-up variable is positive, proving that runner-up nations experience higher rates of unemployment.

Although the model shows that runner-up nations tend to have a higher unemployment rate, nation-to-nation comparison by Olympiad shows that nine times out of fifteen the runner-up had less dramatic change in unemployment than the host nation overall (Table 5.6). This could be due to the countries specifically involved per Olympiad. For example, the United States was runner-up three times to host the Games, yet historically the unemployment rate in the U.S has been relatively low until only recently. Only one country, China, had decreasing unemployment rates in comparison to the USA.

Table 5.6 Employment Comparison per Olympiad

	Host	Runner-Up
1960	**Italy**	Switzerland
1964	Japan	**USA**
1968	Mexico	**USA**
1972	**Germany**	Spain
1976	Canada	**Russia**
1980	Russia	**USA**
1984	**USA**	N/A
1988	Rep. of Korea	**Japan**
1992	Spain	**France**
1996	**USA**	Greece
2000	Australia	**China**
2004	Greece	**Italy**
2008	**China**	Canada
2012	**United Kingdom**	France
2016	Brazil	**Spain**

Note: Country that saw greater benefits in comparison per Olympiad is bolded

Source: Author's Calculations

Olympic Tourism Model

Model 5.7 shows the tourism equation used to determine the effects that hosting the Olympic Games has on a country's tourism industry. The runner-up variable was omitted due to its collinearity with the host variable, as well as the Greece variable due to insufficient data.

$$\text{Change in GDP Generated from Tourism} = \beta_0 \text{ Constant} + \beta_1 \text{ Log Population} + \beta_2 \text{ Life Expectancy} + \beta_3 \text{ Pre} + \beta_4 \text{ Olympic} + \beta_5 \text{ Legacy} + \beta_6 \text{ Host} + \beta_7 \text{ Australia} + \beta_8 \text{ Brazil} + \beta_9 \text{ Canada} + \beta_{10} \text{ China} + \beta_{11} \text{ Germany} + \beta_{12} \text{ Spain} + \beta_{13} \text{ France} + \beta_{14} \text{ Italy} + \beta_{15} \text{ Japan} + \beta_{16} \text{ Rep. of Korea} + \beta_{17} \text{ Mexico} + \beta_{18} \text{ Russia} + \beta_{19} \text{ Switzerland} + \beta_{20} \text{ United Kingdom} + \beta_{21} \text{ Change in Net Tourists} + e \quad (5.7)$$

Diagnostic tests must be performed to confirm the validity and accuracy of the model. Again, the tests performed checked for heteroskedasticity, normality, and multicollinearity.

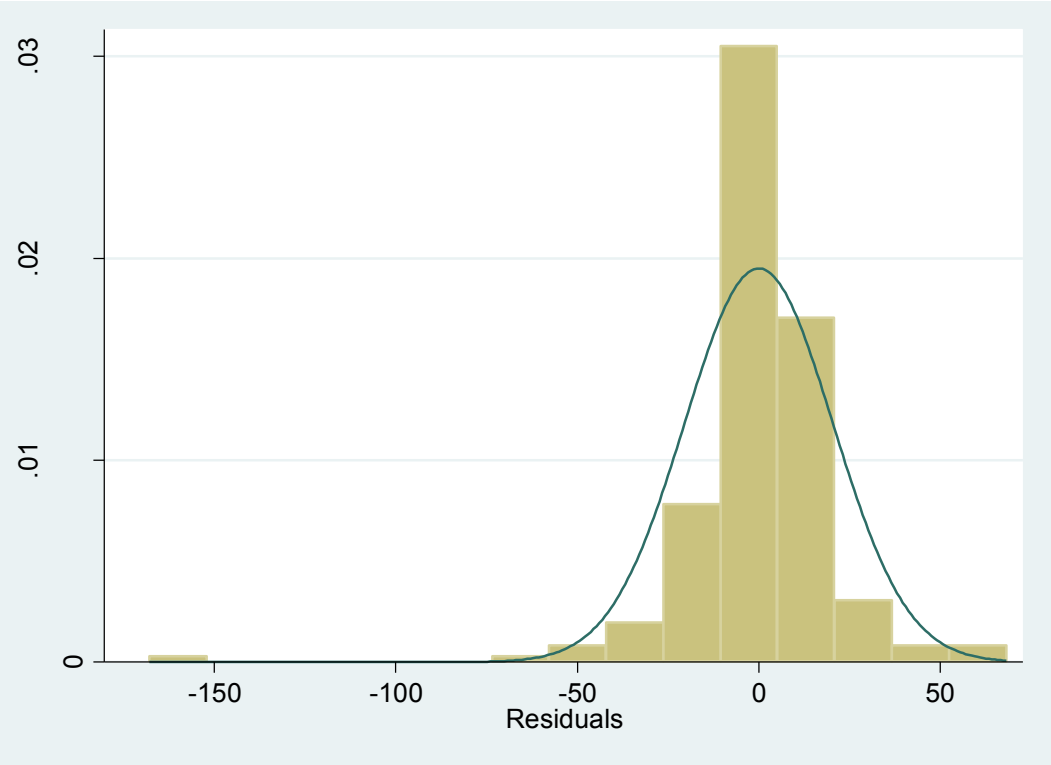
Tourism Diagnostic Tests. For the third time, heteroskedasticity is a problem within the Olympic Tourism Model. The heteroskedasticity test showed a high Chi-squared number indicating positive heteroskedasticity. Once again, using an OLS regression with robust standard errors will correct this problem.

Figure 5.8 Breusch-Pagan / Cook-Weisberg Test for Heteroskedasticity Tourism

$chi^2(1) = 253.75$
Probability > $chi^2 = 0.0000$

Checking for normality will have to be done visually for the Olympic Tourism Model, as results for the Jarque-Bera test were deemed insufficient. Figure 5.9 shows the histogram of residuals. Again, the graph shows a normal bell curve with slight leptokurtic kurtosis. This should not be a problem, as the residuals are centered around the mean much like in the first two models.

Figure 5.9 Histogram for Residuals in Olympic Tourism Model



Source: Author's Calculations

Multicollinearity differs slightly in this model than in the previous two models. Table 5.7 shows the correlation matrix for the Olympic Tourism Model. The only two variables that appear to be related are logpopulation and life expectancy, showing an absolute value of 0.51. This may be due to life expectancy having a significant impact on a nation's population. Nonetheless, both variables are important to the model and so no changes will be made.

Table 5.7 Correlation Matrix for Olympic Tourism Model

	Log Population	Life Expectancy	Change in Net Tourists
Log Population	1		
Life Expectancy	-0.5131	1	
Change in Net Tourists	-0.0986	0.0731	1

Source: Author's Calculations

The results can be analyzed now that the diagnostic tests have been performed. Table 5.8 shows the regression results for the Tourism model.

Table 5.8 Robust Olympic Tourism OLS Results

Variable	Coefficient	T-score
logpopulation	-82.36567	(-0.54)
lifeexpectancy	3.518091	(2.2)**
changeinnettourists	-7.09E-07	(-0.97)
pre	-7.403254	(-1.25)
olympic	-7.393258	(-0.65)
legacy	-1.133374	(-0.16)
host	25.51038	(1.77)*
australia	-30.08398	(-1.62)
brazil	-141.4004	(-0.81)
canada	-124.7628	(-0.88)
china	65.66756	(0.59)
germany	-92.13385	(-1.23)
spain	-110.0363	(-0.89)
france	-97.25602	(-0.99)
italy	-101.9745	(-0.99)
japan	-83.03803	(-1.61)
southkorea	-107.12	(-0.97)
mexico	-64.34708	(-1.21)
russia	-25.70959	(-1.02)
switzerland	-184.4809	(-0.78)
unitedkingdom	-95.98147	(-0.99)
Observations		227
R-sq. Value		0.3045
F-Statistic		4.28

Note: *p-value<0.1 **p-value<0.05 ***p-value<0.01

Source: Author's Calculations

Tourism Results. The R-squared value seen in this model is 0.30. This value shows that the independent variables do a poor job describing the change in GDP generated through tourism. However, the F-statistic proves that there is a relationship between the dependent variable and the independent variables at the 99.99% confidence level. There is some important conclusions that can be drawn from this regression, most notably the significance of the life expectancy variable. Life expectancy is used as a measure of well-being, therefore it is not surprising that nations with high life expectancy attract more tourists.

Although not statistically significant, the pre, Olympic, and legacy variables all have negative coefficients indicating that GDP generated through tourism declines during these periods. Host countries and runner-up countries are included in these categories however, which may indicate that runner-up nations are overwhelmingly experiencing declines in the tourism industry. This is backed up by the fact that host countries see positive gains in tourism, according to the results.

While the results state that the host country sees benefits in terms of GDP generated through tourism, again we see runner-up nations with greater benefits (or less loss) than the host country (Table 5.9). This may also be due to the nations involved in the selection process per Olympiad, specifically host and runner-up. Some countries naturally experience high tourism rates regardless of hosting the Olympic Games, and can still outperform a nation hosting the Olympics. For example, countries like Italy, Spain, and France are popular tourist destinations and are also runner-ups in many cases.

Table 5.9 Tourism Comparison per Olympiad

Olympic Year	Host	Runner-Up
1960	**Italy**	Switzerland
1964	Japan	**USA**
1968	Mexico	**USA**
1972	**Germany**	Spain
1976	Canada	**Russia**
1980	Russia	**USA**
1984	**USA**	N/A
1988	Rep. of Korea	**Japan**
1992	Spain	**France**
1996	**USA**	Greece
2000	Australia	**China**
2004	Greece	**Italy**
2008	**China**	Canada
2012	**United Kingdom**	France
2016	Brazil	**Spain**

Note: Country that saw greater benefits in comparison per Olympiad is bolded

Source: Author's Calculations

The overall results from the regression analysis can be difficult to interpret. The findings differ from model to model as expected. Results show that host countries see greater positive change in GDP than runner-up nations per Olympiad, runner-up nations see greater benefits in the change in unemployment than host nations per Olympiad, and runner-up nations see greater gains in change in GDP generated through tourism than host nations per Olympiad. However, the Olympiad comparisons can be misleading. If the direct Olympiad comparison of nations is excluded, host nations see economic benefit in and of itself. Therefore, though difficult, conclusions can be drawn that the Olympic Games is in fact beneficial to the host nation.

Conclusion

This chapter presented and discussed the results found through the three regression equations. Significant findings were recorded and analyzed, however a formal interpretation of the results will be discussed in the next chapter. Along with a formal interpretation, the next chapter will also include practical applications, further study, as well as limitations this thesis may have encountered.

CHAPTER VI

CONCLUSION

This chapter will provide a brief summary of the research performed in this paper, outlining the objectives and results. Additionally, limitations, contributions to current research, practical applications, and future study will also be discussed.

Summary

The objective of this study was to determine the economic effects of hosting the Olympic Games. The thesis aimed to determine if hosting the Olympics was more beneficial than not in a comparison between host nation and runner-up nation, as well as the benefits in and of itself. Previous studies have looked at specific areas of hosting the Olympics, such as employment, however the purpose of this study was to determine a broader set of benefits of hosting a mega sporting event.

To answer this inquiry, data was taken from the World Bank dating back to 1960. A qualitative analysis was performed with data from nations that hosted the Games, as well as nations that were runner-up in the Olympic selection process. Three specific areas were examined; GDP, employment, and tourism.

For the GDP model, twenty-two variables were used for the most accurate model to describe change in gross domestic product. After analysis, the Natural Log of the

Population was the only variable that turned out to be statistically significant. Hosting the Olympic Games proved to be positively correlated to change in GDP, however it was not statistically significant. In this model, it was more beneficial to host the Olympic Games than to be the runner-up nation in terms of a positive change in GDP. The results from the GDP model are not surprising. The biggest positive change in GDP occurred during the Olympic year, while legacy effects were quite modest and pre-Olympic effects were negatively changed. GDP is expected to rise during the Olympic year because of the inevitable spike in consumption and these effects slowly recede during the legacy years. This coincides with Preuss' findings (2004). The multiplier effect is an important underlying cause of the positive change in GDP.

For the Employment model, twenty-two variables were also used to accurately describe change in the unemployment rate. After analysis, the R-squared value and F-statistic proved the model was not significantly significant. Post-Secondary Education was the only statistically significant variable. During the pre, Olympic, and legacy time periods, all nations experienced a drop in the unemployment rate, although these were not statistically significant. The runner-up nation tends to fare better than the Olympiad host, in terms of change in unemployment rates. With post-secondary education being the only significant variable in the model, inferring that hosting the Olympics has a positive impact on the change in unemployment rate would be thoughtless. Nations may see improvements in the change in unemployment rates during the Olympic periods, but this may be due to circumstances that are not taken into account of the model.

For the Tourism model, twenty-one variables were used to describe the dependent variable, GDP generated through tourism. After analysis, the only statistically significant

variable was life expectancy. This implies that nations with higher life expectancies experienced higher GDP generated through tourism. The host nation also experienced positive gains in GDP through tourism, though not quite statistically significant. Although host nations saw increases in GDP generated through tourism, during the pre, Olympic, and legacy years, there was decline. This indicates that the Olympics would have a negative effect on generating GDP through tourism, however with very little statistically significance, this cannot be stated without some ambiguity.

The model shows that Olympic Games was beneficial to the host nation. This conclusion was drawn from the analysis of the results. Although in some cases, (employment and tourism) runner-up nations fared better than the host nation per Olympiad, nations hosting the Olympics in and of itself saw economic improvements. The demand for high tech buildings and improved infrastructure that comes with hosting the Games, can often be a positive boost to an economy.

Limitations

There are limitations involved with the research performed in this paper. The first involves the data. Data was only available back to 1960, and in some cases (unemployment rates, post-secondary education enrollees, GDP generated through tourism), data only dates back to 1980 at the earliest. Furthermore, data for the Russian Federation (old USSR), and Germany was incomplete due to internal conflicts within the nations. Switzerland also saw a gap in data points due to unknown circumstances.

Another limitation to the models, was the use of only Summer Olympic Games. Though Winter Olympic Games are often miniscule in comparison to the Summer

Games, the models would be improved if the Winter Games were introduced into the model. Including data from the Winter Olympics would provide a larger data set thus improving accuracy of the models.

The biggest limitation to the study are the effects that pertained to the models. The study looked at the Olympic nations and not the Olympic cities directly. The effects would likely be drastically different had data from cities been used. However, data for individual cities is not available. Controlling for effects solely caused by hosting the Olympic Games is hard to do. For example, unemployment may decrease in a nation but not necessarily due to the Olympic Games. Elsewhere in the country there may be other significant factors contributing to that number. For example, the state of Washington may not have seen any real effects from the 1996 Atlanta Olympic Games.

Lastly, limitations due to heteroskedasticity, normality, and multicorrelation may have affected the statistical results to some extent.

Practical Applications

The Olympic Committee has a difficult job in selecting a host nation for the Olympic Games. Though they might not specifically look at this study for reference, it can be applied to show that nations benefit regardless. Change in GDP tends to increase for host nations, change in unemployment rates tend to decrease, and change in GDP generated tend to increase for host nations. Furthermore, Olympic Organizing Committees in candidate cities can use this information to validate their bid to host the Olympic Games.

Future Study

This study will provide further insight on the economic effects of hosting the Olympic Games. Studies in the future can certainly build off the foundation of this research. By focusing on some of the limitations mentioned, the models in this paper can be improved to strengthen the results.

Mega events, such as the Olympic Games, rightfully deserve mega attention. These colossal events capture the attention of much of the world, which is why analyzing the effects of these events is imperative. Not only are the contributions brought by this paper important to the field, but further research as well. The Olympic Games spark immense amounts of national pride, which can often overshadow the true effects of hosting such a large event. Based on the results presented in the paper, hosting the Olympic Games has positive economic effects on the host nation.

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