

Should Countries Host the Olympics?

The Impact on Host Countries' Economy, Poverty, and Inequality

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Abstract

This paper researches the effect of hosting the Olympics on the host country's economy, poverty levels, and inequality levels in the ten years after hosting the event. The research is conducted using difference-in-differences and matching methods comparing host countries to countries who bid to host the games but were not selected. The results show that there is no statistically significant impact on economic measures such as Gross Domestic Product (GDP) per capita, Foreign Direct Investment or trade in the ten years after the games. In addition, the research also finds that there is a statistically significant negative impact in the GDP growth rate ten years after hosting. In regard to social implications, the matching results show a statistically significant impact in rising inequality levels of the host countries compared to bid countries, as well as an increase in the poverty gap. The paper concludes by addressing some policy recommendations in order to ensure hosting the Olympics does not lead to an increased inequality.

Keywords: Olympics, economy, inequality, poverty

I. Introduction

Once every two years, the sporting world turns its eyes to the major sporting event that is the Olympics. Alternating between winter and summer events, the Olympics aspire to promote social development, among other principles, through sport.¹ The financial implications of hosting the Olympics are enormous and can be seen as an investment risk. This has been demonstrated through the most recent events of the Covid-19 pandemic delaying the estimated \$12.6 billion (USD) Tokyo Olympics to 2021 and adding \$2.7 billion (USD) to the cost.^{2,3} Notwithstanding this considerable financial risk, countries continue to submit bids to host the games citing both the direct and indirect economic benefits the Olympics will bring. Pairing this economic question with the aspired ideal of the games, the research question for this paper is, "Does hosting the Olympics affect the economy, inequality, and poverty of the host country?"

In 2015 the United Nations introduced their Agenda 2030, and with this agenda, the 17 Sustainable

Development Goals (SDGs).⁴ These 17 SDGs are a way for countries to focus on various aspects of sustainable development by incorporating clear targets set for each goal.⁵ This particular research question directly examines the impacts of the Olympics on SDG 1: No Poverty, SDG 8: Decent Work and Economic Growth, as well as SDG 10: Reduce Inequalities.⁶ As the Olympics state that their values include social development, and countries seek to host the games primarily for the perceived economic growth, it is important to verify if growth does occur and if it does, who in the country is benefitting. SDG 17 is Partnerships for the Goals, which targets utilizing the synergies between the goals while minimizing the negative impact, or "trade-offs."⁷ It is, therefore, important to investigate the impacts of the games on poverty and inequalities for social and sustainable development. These questions are important to investigate for countries that seek to further their development through hosting the games and may not understand the social and economic implications.

2. Research Argument

¹ International Olympic Committee, "Olympic Values & Ideals - Olympism In Action", International Olympic Committee, 2020, <https://www.olympic.org/the-ioc/promote-olympism>.

² International Olympic Committee, "Joint Statement From The International Olympic Committee And The Tokyo 2020 Organising Committee - Olympic News", International Olympic Committee, 2020, <https://www.olympic.org/news/joint-statement-from-the-international-olympic-committee-and-the-tokyo-2020-organising-committee>.

³ Mike Ozanian, "Postponement Of Tokyo Olympics Expected To Increase Games' Cost By \$2.7 Billion", Forbes, 2020, <https://www.forbes.com/sites/mikeozanian/2020/03/25/postponement-of-tokyo-olympics-expected-to-increase-its-cost-by-27-billion/#1af904091b7c>.

⁴ United Nations, "Transforming Our World: The 2030 Agenda For Sustainable Development .. Sustainable Development Knowledge Platform", Sustainable Development Knowledge Platform, 2015, <https://sustainabledevelopment.un.org/post2015/transformingourworld>.

⁵ United Nations, <https://sustainabledevelopment.un.org/post2015/transformingourworld>.

⁶ United Nations, <https://sustainabledevelopment.un.org/post2015/transformingourworld>.

⁷ United Nations, <https://sustainabledevelopment.un.org/post2015/transformingourworld>.

The Olympics have long been subject to debate about whether or not the financial risk and investments do, in fact, pay-off in the future. Previous research has been divided on this argument, with various studies taking different stances.

A paper by Overmyer (2017) concludes that there are overall positive economic impacts on hosting the Olympics through increased foreign investment.⁸ This paper was limited in scope; however, only focusing on the summer Olympic games from 1996 in Atlanta to 2012 in London.⁹ The paper "The Olympic Effect" by Rose and Spiegel (2009) also notes the positive effect of the games, particularly in the area of trade and trade openness.¹⁰ Rose and Spiegel (2009) argue, however, that this increase of trade openness is also shown in countries that bid to host the games but do not win the bid.¹¹ The authors feel that this may be due to the signal this bid sends to the rest of the world about their openness for trade opportunities.¹² Research conducted by Brückner and Pappa (2013) also notes that most of the positive economic impacts occur between two to five years before hosting the games.¹³

8 Michael P. Overmyer, "Economic Impact Analysis On Olympic Host-Cities", Honors Projects 647 (2017), <http://scholarworks.gvsu.edu/honorsprojects/647>.

9 Overmyer, <http://scholarworks.gvsu.edu/honorsprojects/647>

10 Andrew K. Rose and Mark M. Spiegel, "The Olympic Effect", *The Economic Journal* 121, no. 553 (2009): 652-677, doi:10.1111/j.1468-0297.2010.02407.x.

11 Rose and Spiegel, 652-677

12 Rose and Spiegel, 652-677

13 Markus Brückner and Evi Pappa, "News Shocks In The Data: Olympic Games And Their Macroeconomic Effects", *Journal Of Money, Credit And Banking* 47, no. 7 (2013): 1339-1367, doi:10.1111/jmcb.12247.

The findings mentioned above contrast those in a paper conducted by Billings and Holladay (2012), which notes that "regression results provide no long-term impacts of hosting an Olympics on two measures of population, real Gross Domestic Product per capita."¹⁴

Based on the conflicting results from the literature cited above, this research paper hypothesizes that hosting the Olympics will positively impact the economic measures of the host country. This argument is due to the level of competition that surrounds hosting the Olympics, and the literature that has shown positive results, especially in terms of trade openness and foreign direct investment. The hypothesis that hosting the Olympics will positively impact the economic measures of the host country opposes the study by Billings and Holladay (2012) that showed no long-term effects on GDP or population at a city level.¹⁵ This research paper will also aim to fill some of the gaps of previous work by widening the scope to investigate both the Summer and Winter Olympic games from 1950-2008. Additionally, this paper hypothesizes that the inequality and poverty levels of the host country will be negatively affected as any benefits that are observed would be observed by businesses and investors in the country and would, therefore, raise inequality and effect the poverty levels of the country.

3. Research Design

14 STEPHEN B. BILLINGS and J. SCOTT HOLLADAY, "SHOULD CITIES GO FOR THE GOLD? THE LONG-TERM IMPACTS OF HOSTING THE OLYMPICS", *Economic Inquiry* 50, no. 3 (2012): 754-772, doi:10.1111/j.1465-7295.2011.00373.x.

15 Billings and Holladay, 754-772

In order to determine if hosting the Olympics affects the economy, inequality, and poverty of the host countries, a series of tests will be conducted utilizing difference-in-differences methodology as well as matching. Data for the research will be analyzed for years 1950-2018, encompassing sixteen different Olympic games (Figure 1).

Utilizing the difference-in-differences method, the effect of hosting the Olympic games will be compared between a control group and a test group. The control group for the research will be comprised of countries that submitted a bid to host the Olympics but were not successful. The test group for this research will be comprised of the host countries for the Olympics. Data on the host countries and bid countries was compiled from both the Olympic Games website and a Game Bids website.^{16,17}

The bidding process generally begins around ten years before the games, subsequently, data will be analyzed from ten years before each Olympic event, to ten years post the event.¹⁸ Data from 1950-2018 will be included in the analysis, standardizing the time for each event so that they can be compared.

For example, for the games held in 1968, the year 1958 will be given the value of -10, 1968 will be given the value of 0, and 1978 will be given the value of +10. The decision to begin the analysis for the 1968 games

16 International Olympic Committee, "Olympic Games | Winter Summer Past And Future Olympics", International Olympic Committee, 2020, <https://www.olympic.org/olympic-games>.

17 "Past Bid Results | Gamesbids.Com", Gamesbids.Com, 2020, <https://gamesbids.com/eng/past-bid-results/>.

18 Billings and Holladay, 754-772

was due to the uncertainty of the data surrounding World War II and the years that followed.

The following equation (1) was utilized for the difference-in-differences method regression, derived in the Annual Review of Public Health by Wing et al. (2018), and modified for this study.¹⁹ The variable Y_{gt} is the interested outcome for the country (g) and time period (t).

$$Y_{gt} = \beta_0 + \beta_1 H_g + \beta_2 T_t + \beta_3 (H_g \times T_t) + \beta_4 P_{gt} + \epsilon_{gt} \quad (1)$$

The outcome variables tested will include the GDP per capita, the growth rate of GDP as a percentage, the amount of trade as a percent of the GDP, foreign direct investment, the Gini coefficient for inequality, and the poverty gap. The data for each of these variables will be obtained from the Quality of Government Institute.²⁰

The variable H in equation (1) represents a dummy variable for whether or not the country is a host country, and the variable T indicates the treatment period or years from +1 to +10. The coefficient β_3 is the value in question, as this will determine the

19 Coady Wing, Kosali Simon and Ricardo A. Bello-Gomez, "Designing Difference In Difference Studies: Best Practices For Public Health Policy Research", Annual Review Of Public Health 39, no. 1 (2018): 453-469, doi:10.1146/annurev-publhealth-040617-013507.

20 "Qog Standard Data - QOG, University Of Gothenburg, Sweden", Göteborgs Universitet, 2020, <https://qog.pol.gu.se/data/datadownloads/qogstandarddata>.

difference-in-differences effect of the host country and treatment time on the outcomes tested.

Population was added as a control as the population of a country can impact the GDP growth

In equation (1) a control variable was added, P_{gt} which represents the population of the host country.

Table 1: Olympic Bid Countries and Host Countries Analyzed ^{21,22}

| Year of the Olympics | Bid Countries | Host Country |
|----------------------|---|--------------|
| 1960 Summer | Belgium Hungary Switzerland | Italy |
| 1960 Winter | Germany Pakistan | USA |
| 1964 Summer | Belgium | Japan |
| 1964 Winter | Canada Finland | Austria |
| 1968 Summer | Argentina | Mexico |
| 1968 Winter | Canada Finland Norway | France |
| 1972 Summer | Canada Spain | Germany |
| 1972 Winter | Finland | Japan |
| 1976 Summer | | Canada |
| 1976 Winter | Finland Switzerland | USA |
| 1984 Winter | Japan Sweden | |
| 1988 Summer | Japan | Canada |
| 1988 Winter | Italy Sweden | South Korea |
| 1992 Summer | Netherlands United Kingdom | Spain |
| 1992 Winter | Bulgaria Italy Sweden West Germany | France |
| 1994 Winter | Bulgaria | Norway |

21 International Olympic Committee, <https://www.olympic.org/olympic-games>

22 "Past Bid Results | Gamesbids.Com", Gamesbids.Com, 2020, <https://gamesbids.com/eng/past-bid-results/>.

| | | |
|-------------|---------------------|-----------|
| | Sweden | |
| 1996 Summer | United Kingdom | USA |
| 1998 Winter | Sweden | Japan |
| 2000 Summer | Brazil | Australia |
| | Germany | |
| | Turkey | |
| | United Kingdom | |
| | Uzbekistan | |
| 2002 Winter | Austria | USA |
| | Russia | |
| | Slovakia | |
| | Spain | |
| | Sweden | |
| | Switzerland | |
| 2004 Summer | Argentina | Greece |
| | Brazil | |
| | France | |
| | Russia | |
| | South Africa | |
| | Spain | |
| | Sweden | |
| | Turkey | |
| 2006 Winter | Austria | Italy |
| | Poland | |
| | Slovakia | |
| | Switzerland | |
| 2008 Summer | Cuba | China |
| | France | |
| | Japan | |
| | Malaysia | |
| | Spain | |
| | Thailand | |
| | Turkey | |
| 2010 Winter | Austria | Canada |
| | Bosnia- Herzegovina | |
| | South Korea | |
| | Spain | |
| | Switzerland | |

rate, poverty, and inequality of a country, but hosting the Olympics has not proven to have an impact on

population or population growth.²³ Lastly, the term ϵ_{gt} represents omitted variable error in the equation.

Utilizing this difference-in-differences method, regressions will be run for each of the outcomes in question. Additional regressions will then be run with an added dummy variable, as shown in equation (2).

The term S_g is an additional dummy variable where 1 indicates Summer Olympic events and 0 Winter Olympic events.

Table 2: Variables

These tests will be run to determine if there is a significant difference in the outcome when data is segregated between winter and summer events.

$$Y_{gt} = \beta_0 + \beta_1 H_g + \beta_2 T_t + \beta_3 (H_g \times T_t) + \beta_4 P_{gt} + \beta_5 S_g + \epsilon_{gt} \quad (2)$$

A second methodology, matching, will also be utilized for this research. Data from the control group will be matched with data from the test group, based upon the matching criteria of country population, and country GDP ten years before the Olympics.

| Name | Definition | Source |
|------------------------------|--|---------------------------------------|
| Dependent Variables | | |
| wdi_gdpcapcon2010 | GDP per capita in 2010 USD <small>University Of Gothenburg,</small> | QoG Standard Data, 2020 ²⁴ |
| wdi_gdpgr | GDP growth rate, annual % <small>2020, wnloads/qogstandarddata.</small> | QoG Standard Data, 2020 |
| wdi_trade | Trade as a % of GDP | QoG Standard Data, 2020 |
| wdi_fdiin | Foreign direct investment, net inflow as % of GDP | QoG Standard Data, 2020 |
| wdi_gini | Gini Coefficient <small>ls.Com",</small> | QoG Standard Data, 2020 |
| wdi_povgap190 | Poverty gap at \$1.90 USD a day (PPP) % <small>Reverty/</small> | QoG Standard Data, 2020 |
| Independent Variables | | |
| wdi_pop | Total population | QoG Standard Data, 2020 |
| Host | Dummy variable 1 if host, 0 if bid city | Past Bid Results, 2020 ²⁵ |
| time | Standardized time in years from the Olympic event | Past Bid Results, 2020 |
| Summer.Olympics | Dummy variable 1 if summer, 0 if winter event | Past Bid Results, 2020 |

Matching will result in sixteen pairs, as the test group contains sixteen host countries, whereas the control group contains fifty-three bid countries. Matching will be completed using the “nearest” method in order to match pairs with the closest propensity scores.²⁶ Based on these propensity scores, denoted as distance, the top pairs will then be captured in a separate data set based on their pair number. Regression tests will then be completed on the countries that matched in these top pairs, applying the data from the entire treatment time period, once again utilizing the difference-in-differences method to determine if there is an effect of hosting the Olympics on the outcomes in question. The equation for this regression is the same as equation (1) shown previously.

Due to the several factors that may impact economic growth, inequality, and poverty as well as if a country is to host the Olympics, there is some concern regarding omitted variable bias. One example of this could be the corruption levels in the country. Corruption could impact both economic growth and corruption could impact if a city was to host the Olympics or not, although omitted variable bias cannot be eliminated by utilizing propensity score matching (PSM) methodology assists in balancing any bias between the control and treatment groups.^{27 28} The PSM

addresses endogeneity by matching control and test groups with similar variables such as the original GDP and country population. This can help balance some of the bias in the system, although there is still a risk of unobserved omitted variable bias.^{29 30} In addition to matching, this research will also conduct regression tests with the top matched pairs based upon their differences in propensity score, which again should aid in endogeneity and offer an indication of robustness.³¹

4. Results

As outlined in the Research Design section, the first set of tests were conducted using all of the data for host and bid countries and employing the difference-in-differences method. OLS regressions were then run for each of the dependent variables listed in Table 2. While this section will highlight the main results from the study, results for the OLS regressions run can be found in Appendix A.

The OLS regression demonstrated that hosting the Olympics had a statistically significant negative impact on the annual growth rate of GDP, with a p-value of 0.005. In contrast, the regression results for all other dependent variables did not show a statistically significant difference for countries that hosted the Olympics versus those who only placed bids.

26 Simon Ejdeymyr, "R Tutorial 8: Propensity Score Matching", Sejdemyr.Github.Io, accessed 7 April 2020, <https://sejdemyr.github.io/r-tutorials/statistics/tutorial8.html#executing-a-matching-algorithm>.

27 Laurence Ball, "The Performance Of Alternative Monetary Regimes", Handbook Of Monetary Economics, 2010, 1303-1343, doi:10.1016/b978-0-444-53454-5.00011-6.

28 Michael R. Roberts and Toni M. Whited, "Endogeneity In Empirical Corporate Finance1", Handbook Of The Economics Of Finance, 2013, 493-572, doi:10.1016/b978-0-44-453594-8.00007-0.

29 Ball, 1303-1343

30 Roberts and Whited, 493-572

31 Ball, 1303-1343

32 Roberts and Whited, 493-572

Figure 1 illustrates the increase in GDP over time for both host and bid countries. As mentioned above, the regression results did not indicate a statistically significant difference in the trend of the host countries versus the bid countries. Looking at the figure, it can also be noted that host countries tend to have a higher GDP than bid countries. In all figures, “TRUE” denotes the trend for host countries, and “FALSE” denotes the trend for bid countries.

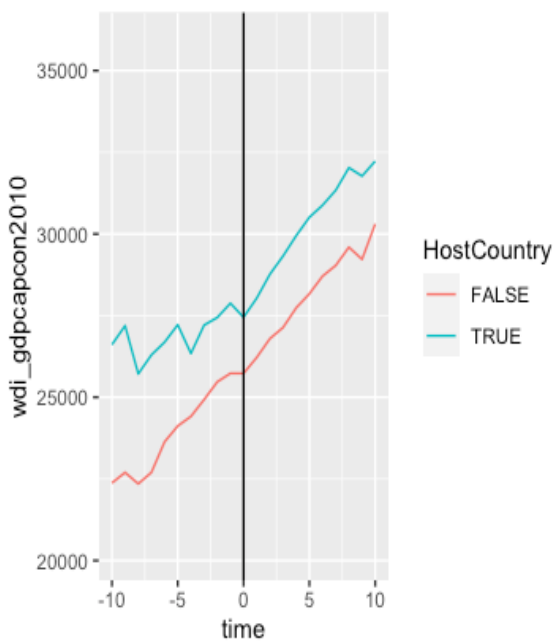


Figure 1: GDP per capita

The regression results show there is a statistically significant relationship between hosting the Olympics and the GDP growth rate. This relationship is negative. It is interesting to note that while bid countries' growth rate fluctuated between 2.5 and 4 percent, after year 0 the Olympic event, host countries fluctuated from 5 to below 2.5, with an overall negative slope.

The next step in the research was to investigate the difference in effect, if any, when segregating the data

into Summer and Winter Olympics. The results for these regressions did not change any of the conclusions, and there was little variation between the results for Summer and Winter Olympic games, in regard to the growth rate of GDP.

A second method applied during this research was matching. Host countries and bid countries were matched using their population and GDP at year -10, or when the bid was placed. Figure 2 shows the resulting propensity scores from the matching analysis for the eleven pairs that matched the closest. A table of matched results for all sixteen pairs can be found in Appendix B. The pairs shown in Figure 2 alternate by color, with the host country on the left, and it has paired bid country on the right. For example, the first pair is host country South Korea '88 and bid country Finland '76.

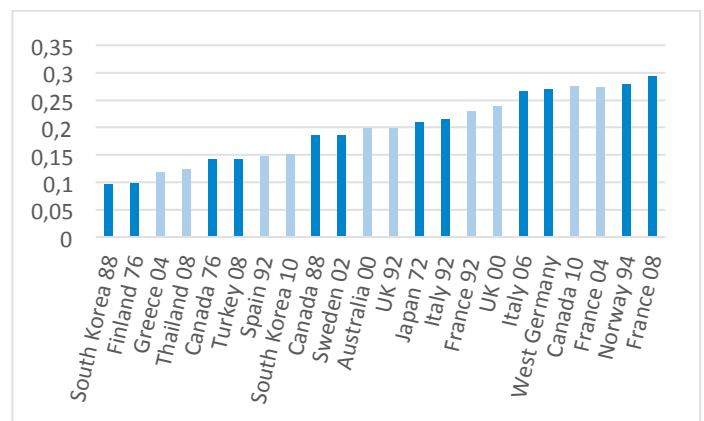


Figure 2: PSM Paired Host Countries and Bid Countries

These matched pairs were then entered into an OLS regression, applying the difference-in-differences method. The matched results for the economic variables remained consistent with the original conclusions from utilizing the entire dataset. The GDP annual growth rate returned statistically significant results, while for the other economic variables, GDP

per capita, trade, and foreign direct investment, no statistically significant relationships were found.

Figures 3 and 4 illustrate the trends in host countries and bid countries for GDP per capita and GDP growth rate using the matched data.

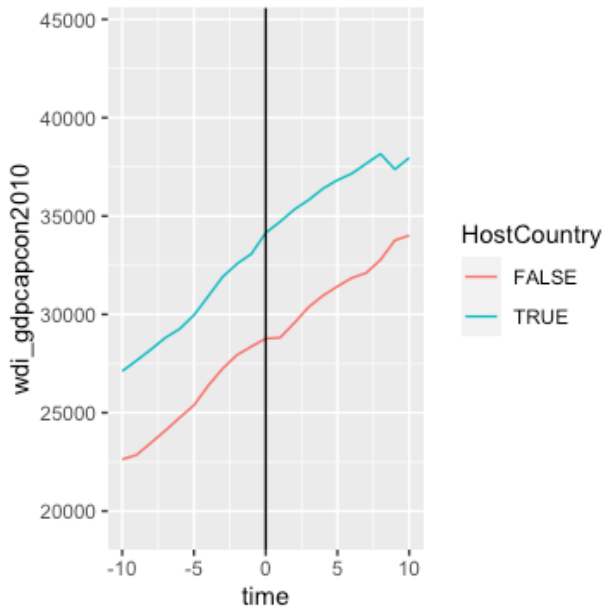


Figure 3: Matching - GDP per capita

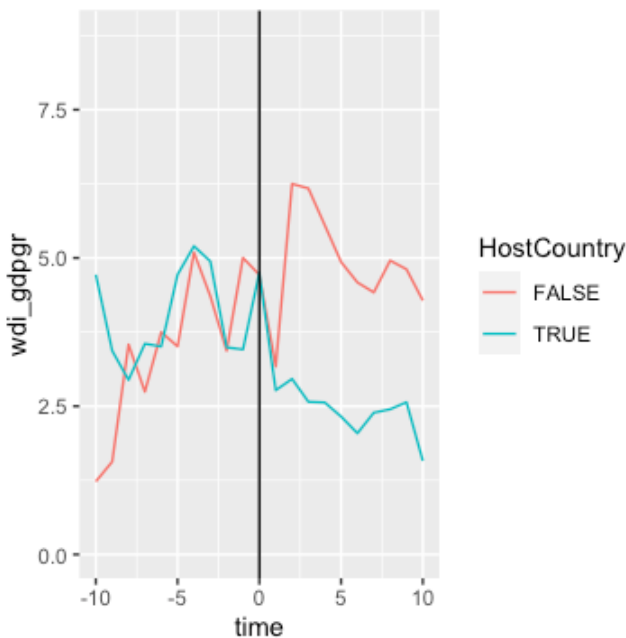


Figure 4: Matching- GDP growth rate %

As shown in Figure 4, the growth rate for bid countries had a positive trend in the years following the Olympic event, whereas for host countries, the percent growth of GDP decreased. The regression results indicate that this trend is statistically significant. The regression results for GDP per capita, however, did not show statistically significant results.

The results for the economic variables demonstrate findings that go against the research hypothesis. The economy of a host country does not appear to be statistically significantly impacted in the ten years after hosting the Olympics, compared to countries that placed bids to host the Olympics but were unsuccessful in their bids and negative impacts were observed in the GDP growth rate. This aligns with the work completed by Billings and Holladay, however, their study was completed at the city level and not the country level, and the growth rate of GDP was not discussed.³³

Utilizing only the difference-in-differences method without matching, there were no statistically significant results found for the measures of inequality and poverty; however, when matching is applied, this is no longer the case. The regression results show the significant findings for the Gini Coefficient of host countries versus bid countries.

These results indicate a positive relationship between hosting the Olympics and the Gini Coefficient, with a p-value of 0.01. The higher the Gini Coefficient, however, the greater the inequality. It can, therefore, be inferred from these results that in the ten years after hosting the Olympics, the inequality in the host country increases a statistically significant amount more than

33 Billings and Holladay, 754-772

the inequality in bid countries. Figure 5 below shows that the fluctuation in inequality for host countries varies from 32 to 36 in the ten years following the Olympics, while the bid countries fluctuate from approximately 30-35.

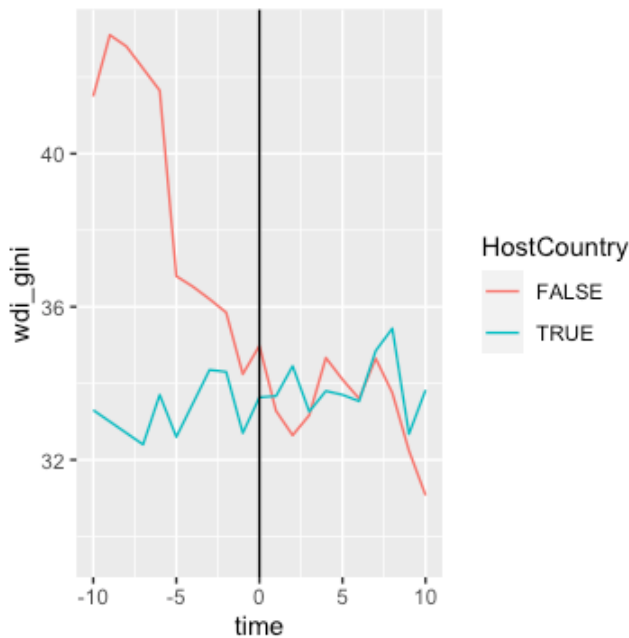


Figure 5: Matching- Gini Coefficient

Additionally, when applying the matching methodology, the difference-in-differences OLS regression results for the poverty gap return statistically significant results.

The p-value of the regression above is 0.005, indicating statistical significance, which in Figure 6 translates to less than one percent difference. The coefficient also denotes a positive relationship, which in this case indicates an increase in the poverty gap in host countries.

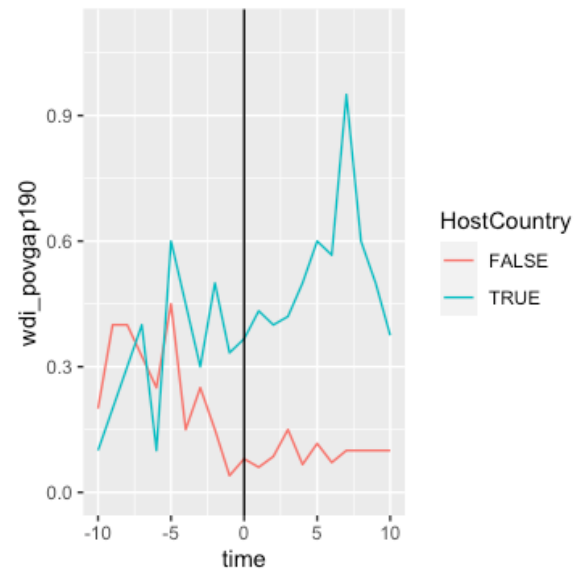


Figure 6: Matching- Poverty Gap

The results for the inequality and poverty variables agree with the hypothesis that the Olympics negatively affect inequality and poverty in the host country. However, the hypothesis predicted that this was due to the economic impact of the games only affecting the wealthy in the country. Based on the conclusion that hosting the Olympics does not appear to have positive long-term impacts, and the growth rate of GDP is lower than those that did not host, other reasons need to be considered for why poverty and inequality would be negatively affected. Reasons for this could be; the GDP growth is lower than what it was before the Olympics, or it could be due to the allocation of funds by the government of these countries. Often when hosting the Olympics, significant investments need to be made into infrastructure, which may take away from funding for social programs.³⁴

5. Policy Recommendations and Conclusion

³⁴ Rose and Spiegel, 652-677

Research has shown mixed reviews as to whether hosting the Olympics garners economic growth for the host country. The results of this research conclude that long-term economic impacts are not statistically significant in terms of GDP per capita, trade, and foreign direct investment. It was demonstrated, however, through matching and difference-in-differences methods that the GDP annual growth rate is negatively impacted by hosting the Olympics in the ten years after the games. This is a compelling finding as the economic benefits are often cited for the reason that countries leap to invest in such a mega-event.

The Olympic committee also states that their values include promoting social development through the avenue of sport.³⁵ This research study focused on social development through indicators of inequality and poverty. Through the matching and difference-in-differences techniques employed to study this data, the results showed statistical significance in the impact of hosting the Olympics on the Gini coefficient and poverty gap. In the ten years succeeding the games, the Gini coefficient was shown to rise significantly compared with the bid countries, which indicates greater inequality in the country. Similarly, the poverty gap was observed to increase on a statistically significant level for host countries as opposed to bid countries. These again are interesting findings as they contradict the ideal set forth by the Olympic organization.

The hypothesis for this research predicted that equality in the host countries would be negatively impacted due to economic gains, but the previous

35 International Olympic Committee, <https://www.olympic.org/the-ioc/promote-olympism>.

conclusion regarding economic factors displays that this is not the case. The reason behind this increased level of inequality and poverty may be due to the number of resources allocated to hosting the games, and how governments decide where this money comes from, and if social programs are the victim. An article in the Economist implies that this may have been the case for the London 2012 Olympics, stating that there were “cuts to public services.”³⁶ The government of Brazil also received much criticism for spending so much money on the Olympics while their schools and hospitals were in disrepair contrasting the ideal of social development through sport.^{37 38} Moving forward, these are important things to consider from a policy perspective. If a country wishes to host the Olympics as a way to further development they will need to adopt policies that promote the games without sacrificing the budget for social programs. It is the recommendation of this paper that host country governments and the International Olympic Committee seek to reform the bidding process of the games in a way that is more sustainable. In being more sustainable through means such as the encouragement of reusing existing facilities, the cost of the games could be reduced, lessening the economic burden of host countries which in the past have taken money from social services funding. It is

36 T, W., "Why Would Anyone Want To Host The Olympics?", The Economist, 2013, <https://www.economist.com/the-economist-explains/2013/09/08/why-would-anyone-want-to-host-the-olympics>.

37 International Olympic Committee, <https://www.olympic.org/the-ioc/promote-olympism>.

38 Michael Powell, "Officials Spent Big On Olympics, But Rio Natives Are Paying The Price", Nytimes.Com, 2016, <https://www.nytimes.com/2016/08/15/sports/olympics/rio-favelas-brazil-poor-price-too-high.html>.

also the recommended that both the Olympic Committee and host country governments seek to form partnerships with various corporations, charities, and social impact organizations. These partnerships can bring publicity to the social development agenda through the games, while also assisting corporations with their marketing and alleviating funding concerns for both the social impact organizations and host countries.

The limitations of this study are surrounding the complicated relationship that hosting the Olympics has to many aspects of the economy and the government. Additionally, data regarding inequality and poverty has also been relatively recently collected, and so there is limited data in these areas as opposed to economic data. In order to improve this study, moving forward matching could also be applied to cities within the same country as the Olympic host to determine if there are varied effects within the country. This research could also be expanded upon by investigating government corruption levels, transparency, and media freedom in relation to Olympic host countries. This study could provide some enlightenment if countries have alternative motives for hosting the games, and the impact of the games on the freedom of the press. In the future, it could also be beneficial to expand this study to more social development factors such as impacts on gender equality in a country to see if the games positively influenced women and young girls in the country to engage in sport.

Bibliography

Ball, Laurence. "The Performance Of Alternative Monetary Regimes". *Handbook Of Monetary Economics*, 2010, 1303-1343.
doi:10.1016/b978-0-444-53454-5.00011-6.

BILLINGS, STEPHEN B., and J. SCOTT HOLLADAY. "SHOULD CITIES GO FOR THE GOLD? THE LONG-TERM IMPACTS OF HOSTING THE OLYMPICS". *Economic Inquiry* 50, no. 3 (2012): 754-772.
doi:10.1111/j.1465-7295.2011.00373.x.

Brückner, Markus, and Evi Pappa. "News Shocks In The Data: Olympic Games And Their Macroeconomic Effects". *Journal Of Money, Credit And Banking* 47, no. 7 (2013): 1339-1367. doi:10.1111/jmcb.12247.

Ejdemyr, Simon. "R Tutorial 8: Propensity Score Matching". *Sejdemyr.Github.Io*. Accessed 7 April 2020. <https://sejdemyr.github.io/r-tutorials/statistics/tutorial8.html#executing-a-matching-algorithm>.

International Olympic Committee. "Joint Statement From The International Olympic Committee And The Tokyo 2020 Organising Committee - Olympic News". International Olympic Committee, 2020.
<https://www.olympic.org/news/joint-statement-from-the-international-olympic-committee-and-the-tokyo-2020-organising-committee>.

International Olympic Committee. "Olympic Games | Winter Summer Past And Future Olympics". International Olympic Committee, 2020.
<https://www.olympic.org/olympic-games>.

International Olympic Committee. "Olympic Values & Ideals - Olympism In Action". International

- Olympic Committee, 2020.
<https://www.olympic.org/the-ioc/promote-olympism>.
- Overmyer, Michael P. "Economic Impact Analysis On Olympic Host-Cities". Honors Projects 647 (2017).
<http://scholarworks.gvsu.edu/honorsprojects/647>.
- Ozanian, Mike. "Postponement Of Tokyo Olympics Expected To Increase Games' Cost By \$2.7 Billion". Forbes, 2020.
<https://www.forbes.com/sites/mikeozanian/2020/03/25/postponement-of-tokyo-olympics-expected-to-increase-its-cost-by-27-billion/#1af904091b7c>.
- "Past Bid Results | Gamesbids.Com". Gamesbids.Com, 2020. <https://gamesbids.com/eng/past-bid-results/>.
- Powell, Michael. "Officials Spent Big On Olympics, But Rio Natives Are Paying The Price". Nytimes.Com, 2016.
<https://www.nytimes.com/2016/08/15/sports/olympics/rio-favelas-brazil-poor-price-too-high.html>.
- "Qog Standard Data - QOG, University Of Gothenburg, Sweden". Göteborgs Universitet, 2020.
<https://qog.pol.gu.se/data/datadownloads/qogstandarddata>.
- Roberts, Michael R., and Toni M. Whited. "Endogeneity In Empirical Corporate Finance1". Handbook Of The Economics Of Finance, 2013, 493-572. doi:10.1016/b978-0-44-453594-8.00007-0.
- Rose, Andrew K., and Mark M. Spiegel. "The Olympic Effect". The Economic Journal 121, no. 553 (2009): 652-677. doi:10.1111/j.1468-0297.2010.02407.x.
- United Nations. "Transforming Our World: The 2030 Agenda For Sustainable Development :. Sustainable Development Knowledge Platform". Sustainable Development Knowledge Platform, 2015.
<https://sustainabledevelopment.un.org/post2015/transformingourworld>.
- W., T "Why Would Anyone Want To Host The Olympics?". The Economist, 2013.
<https://www.economist.com/the-economist-explains/2013/09/08/why-would-anyone-want-to-host-the-olympics>.
- Wing, Coady, Kosali Simon, and Ricardo A. Bello-Gomez. "Designing Difference In Difference Studies: Best Practices For Public Health Policy Research". Annual Review Of Public Health 39, no. 1 (2018): 453-469. doi:10.1146/annurev-publhealth-040617-013507.

Appendix A: Regression Results

OLS Regression Results: Difference-in-differences Effect of Hosting on GDP Growth

Call:

```
lm(formula = wdi_gdpgr ~ Host + treatment_time + did + wdi_pop,
    data = mydata_a)
```

Residuals:

| Min | 1Q | Median | 3Q | Max |
|----------|---------|---------|--------|---------|
| -17.9768 | -1.6483 | -0.0985 | 1.5214 | 30.3754 |

Coefficients:

| | Estimate | Std. Error | t value | Pr(> t) | |
|----------------|------------|------------|---------|----------|-----|
| (Intercept) | 2.889e+00 | 1.520e-01 | 19.007 | < 2e-16 | *** |
| Host | 1.016e+00 | 3.172e-01 | 3.204 | 0.00138 | ** |
| treatment_time | 1.822e-01 | 2.132e-01 | 0.854 | 0.39299 | |
| did | -1.197e+00 | 4.290e-01 | -2.791 | 0.00531 | ** |
| wdi_pop | 3.747e-09 | 6.394e-10 | 5.860 | 5.53e-09 | *** |

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 3.842 on 1722 degrees of freedom

Multiple R-squared: 0.03128, Adjusted R-squared: 0.02903

F-statistic: 13.9 on 4 and 1722 DF, p-value: 3.654e-11

OLS Regression Results: Difference-in-differences Effect of Hosting on GDP per Capita

Call:

```
lm(formula = wdi_gdpcapcon2010 ~ Host + treatment_time + did +
    wdi_pop, data = mydata_b)
```

Residuals:

| Min | 1Q | Median | 3Q | Max |
|--------|--------|--------|-------|-------|
| -27888 | -14578 | 569 | 11623 | 53120 |

Coefficients:

| | Estimate | Std. Error | t value | Pr(> t) | |
|----------------|------------|------------|---------|----------|-----|
| (Intercept) | 2.505e+04 | 6.601e+02 | 37.948 | < 2e-16 | *** |
| Host | 5.198e+03 | 1.362e+03 | 3.816 | 0.00014 | *** |
| treatment_time | 4.218e+03 | 9.258e+02 | 4.556 | 5.58e-06 | *** |
| did | -6.582e+02 | 1.858e+03 | -0.354 | 0.72313 | |
| wdi_pop | -2.312e-05 | 2.795e-06 | -8.270 | 2.61e-16 | *** |

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 16820 on 1752 degrees of freedom
 Multiple R-squared: 0.05487, Adjusted R-squared: 0.05271
 F-statistic: 25.43 on 4 and 1752 DF, p-value: < 2.2e-16

OLS Regression Results: Difference-in-differences Effect of Hosting on Trade

Call:

```
lm(formula = wdi_trade ~ Host + treatment_time + did + wdi_pop,
    data = mydata_e)
```

Residuals:

| Min | 1Q | Median | 3Q | Max |
|---------|---------|--------|--------|---------|
| -57.754 | -19.092 | -6.077 | 14.230 | 159.133 |

Coefficients:

| | Estimate | Std. Error | t value | Pr(> t) | |
|----------------|------------|------------|---------|----------|-----|
| (Intercept) | 6.194e+01 | 1.154e+00 | 53.661 | < 2e-16 | *** |
| Host | -1.981e+01 | 2.371e+00 | -8.356 | < 2e-16 | *** |
| treatment_time | 6.837e+00 | 1.615e+00 | 4.233 | 2.43e-05 | *** |
| did | -5.193e+00 | 3.232e+00 | -1.607 | 0.108 | |
| wdi_pop | -2.881e-08 | 4.859e-09 | -5.929 | 3.67e-09 | *** |

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 29.23 on 1742 degrees of freedom
 Multiple R-squared: 0.146, Adjusted R-squared: 0.144
 F-statistic: 74.46 on 4 and 1742 DF, p-value: < 2.2e-16

OLS Regression Results: Difference-in-differences Effect of Hosting on Foreign Investment

Call:

```
lm(formula = wdi_fdiin ~ Host + treatment_time + did + wdi_pop,
    data = mydata_f)
```

Residuals:

| Min | 1Q | Median | 3Q | Max |
|----------|---------|---------|--------|---------|
| -12.2327 | -1.6899 | -0.6612 | 0.7123 | 23.4068 |

Coefficients:

| | Estimate | Std. Error | t value | Pr(> t) | |
|----------------|------------|------------|---------|----------|-----|
| (Intercept) | 2.316e+00 | 1.268e-01 | 18.256 | < 2e-16 | *** |
| Host | -1.069e+00 | 2.715e-01 | -3.937 | 8.62e-05 | *** |
| treatment_time | 3.205e-01 | 1.738e-01 | 1.845 | 0.0653 | . |
| did | -2.463e-01 | 3.614e-01 | -0.681 | 0.4957 | |
| wdi_pop | 4.334e-10 | 4.950e-10 | 0.876 | 0.3814 | |

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 2.94 on 1488 degrees of freedom
 (1 observation deleted due to missingness)
 Multiple R-squared: 0.02909, Adjusted R-squared: 0.02648
 F-statistic: 11.14 on 4 and 1488 DF, p-value: 6.568e-09

OLS Regression Results: Difference-in-differences Effect of Hosting on Gini Coefficient

Call:

```
lm(formula = wdi_gini ~ Host + treatment_time + did + wdi_pop,
    data = mydata_c)
```

Residuals:

| Min | 1Q | Median | 3Q | Max |
|---------|--------|--------|-------|--------|
| -13.107 | -5.707 | -1.296 | 3.414 | 29.548 |

Coefficients:

| | Estimate | Std. Error | t value | Pr(> t) | |
|----------------|------------|------------|---------|----------|-----|
| (Intercept) | 3.801e+01 | 6.640e-01 | 57.243 | < 2e-16 | *** |
| Host | -6.115e+00 | 1.830e+00 | -3.341 | 0.000899 | *** |
| treatment_time | -3.439e+00 | 8.005e-01 | -4.296 | 2.1e-05 | *** |
| did | 3.728e+00 | 2.155e+00 | 1.730 | 0.084339 | . |
| wdi_pop | 1.424e-08 | 2.030e-09 | 7.013 | 7.7e-12 | *** |

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 7.852 on 494 degrees of freedom
 Multiple R-squared: 0.1244, Adjusted R-squared: 0.1173
 F-statistic: 17.55 on 4 and 494 DF, p-value: 1.765e-13

OLS Regression Results: Difference-in-differences Effect of Hosting on Poverty Gap

Call:

```
lm(formula = wdi_povgap190 ~ Host + treatment_time + did + wdi_pop,
    data = mydata_d)
```

Residuals:

| Min | 1Q | Median | 3Q | Max |
|---------|---------|---------|--------|---------|
| -3.7583 | -0.8609 | -0.4533 | 0.0247 | 21.6638 |

Coefficients:

| | Estimate | Std. Error | t value | Pr(> t) | |
|----------------|------------|------------|---------|----------|-----|
| (Intercept) | 1.363e+00 | 2.008e-01 | 6.788 | 3.27e-11 | *** |
| Host | -5.928e-01 | 5.536e-01 | -1.071 | 0.284782 | |
| treatment_time | -9.259e-01 | 2.421e-01 | -3.825 | 0.000148 | *** |
| did | 5.406e-02 | 6.519e-01 | 0.083 | 0.933942 | |
| wdi_pop | 2.961e-09 | 6.140e-10 | 4.822 | 1.90e-06 | *** |

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 2.375 on 494 degrees of freedom
 Multiple R-squared: 0.07883, Adjusted R-squared: 0.07137
 F-statistic: 10.57 on 4 and 494 DF, p-value: 3.187e-08

OLS Regression Results: Effect of Hosting Summer Olympics on GDP Growth

Call:

```
lm(formula = wdi_gdpgr ~ Host + treatment_time + Summer.Olympics +
    did + wdi_pop, data = mydata_a)
```

Residuals:

| Min | 1Q | Median | 3Q | Max |
|----------|---------|---------|--------|---------|
| -17.8392 | -1.5849 | -0.0937 | 1.5334 | 30.5016 |

Coefficients:

| | Estimate | Std. Error | t value | Pr(> t) | |
|-----------------|------------|------------|---------|----------|-----|
| (Intercept) | 2.776e+00 | 1.728e-01 | 16.064 | < 2e-16 | *** |
| Host | 1.036e+00 | 3.175e-01 | 3.264 | 0.00112 | ** |
| treatment_time | 1.812e-01 | 2.132e-01 | 0.850 | 0.39536 | |
| Summer.Olympics | 2.585e-01 | 1.886e-01 | 1.370 | 0.17086 | |
| did | -1.204e+00 | 4.289e-01 | -2.807 | 0.00506 | ** |
| wdi_pop | 3.580e-09 | 6.508e-10 | 5.501 | 4.35e-08 | *** |

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 3.841 on 1721 degrees of freedom
 Multiple R-squared: 0.03234, Adjusted R-squared: 0.02952
 F-statistic: 11.5 on 5 and 1721 DF, p-value: 6.062e-11

OLS Regression Results: Effect of Hosting Winter Olympics on GDP Growth

Call:

```
lm(formula = wdi_gdpgr ~ Host + treatment_time + winter.Olympics +
    did + wdi_pop, data = mydata_a)
```

Residuals:

| | Min | 1Q | Median | 3Q | Max |
|--|----------|---------|---------|--------|---------|
| | -17.8730 | -1.6081 | -0.0932 | 1.5145 | 30.4701 |

Coefficients:

| | Estimate | Std. Error | t value | Pr(> t) |
|-----------------|------------|------------|---------|--------------|
| (Intercept) | 3.005e+00 | 1.876e-01 | 16.023 | < 2e-16 *** |
| Host | 1.029e+00 | 3.174e-01 | 3.241 | 0.00122 ** |
| treatment_time | 1.813e-01 | 2.132e-01 | 0.850 | 0.39543 |
| winter.Olympics | -2.007e-01 | 1.892e-01 | -1.060 | 0.28912 |
| did | -1.202e+00 | 4.290e-01 | -2.802 | 0.00513 ** |
| wdi_pop | 3.615e-09 | 6.515e-10 | 5.549 | 3.32e-08 *** |

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 3.842 on 1721 degrees of freedom

Multiple R-squared: 0.03191, Adjusted R-squared: 0.0291

F-statistic: 11.35 on 5 and 1721 DF, p-value: 8.662e-11

OLS Regression Results: Matching- Effect on GDP Growth

Call:

```
lm(formula = wdi_gdpgr ~ Host + treatment_time + did + wdi_pop,
    data = match_a)
```

Residuals:

| | Min | 1Q | Median | 3Q | Max |
|--|----------|---------|---------|--------|---------|
| | -11.6353 | -2.6197 | -0.5309 | 1.4801 | 28.7286 |

Coefficients:

| | Estimate | Std. Error | t value | Pr(> t) |
|----------------|------------|------------|---------|-------------|
| (Intercept) | 1.216e+00 | 6.532e-01 | 1.861 | 0.06334 . |
| Host | 1.179e+00 | 6.543e-01 | 1.802 | 0.07221 . |
| treatment_time | 1.240e+00 | 6.604e-01 | 1.877 | 0.06118 . |
| did | -3.036e+00 | 9.331e-01 | -3.253 | 0.00123 ** |
| wdi_pop | 4.523e-08 | 9.155e-09 | 4.941 | 1.1e-06 *** |

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 4.984 on 453 degrees of freedom

Multiple R-squared: 0.07862, Adjusted R-squared: 0.07048

F-statistic: 9.663 on 4 and 453 DF, p-value: 1.659e-07

OLS Regression Results: Matching- Effect of Hosting on GDP Growth Rate

Call:

```
lm(formula = wdi_gdpgr ~ Host + treatment_time + did + wdi_pop,
    data = match_a)
```

Residuals:

| | Min | 1Q | Median | 3Q | Max |
|--|----------|---------|---------|--------|---------|
| | -11.6353 | -2.6197 | -0.5309 | 1.4801 | 28.7286 |

Coefficients:

| | Estimate | Std. Error | t value | Pr(> t) |
|----------------|-----------|------------|---------|-----------|
| (Intercept) | 1.216e+00 | 6.532e-01 | 1.861 | 0.06334 . |
| Host | 1.179e+00 | 6.543e-01 | 1.802 | 0.07221 . |
| treatment_time | 1.240e+00 | 6.604e-01 | 1.877 | 0.06118 . |

```

did          -3.036e+00  9.331e-01  -3.253  0.00123 **
wdi_pop      4.523e-08  9.155e-09   4.941  1.1e-06 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 4.984 on 453 degrees of freedom
Multiple R-squared:  0.07862, Adjusted R-squared:  0.07048
F-statistic: 9.663 on 4 and 453 DF,  p-value: 1.659e-07

```

OLS Regression Results: Matching- Effect of Hosting on GDP per capita

```

Call:
lm(formula = wdi_gdpcapcon2010 ~ Host + treatment_time + did +
    wdi_pop, data = match_b)

```

```

Residuals:
    Min       1Q   Median       3Q      Max
-28534 -10836   1897   9938  42821

```

```

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  3.605e+04  1.755e+03  20.536 < 2e-16 ***
Host         1.776e+03  1.758e+03   1.010  0.313033
treatment_time 6.528e+03  1.775e+03   3.678  0.000263 ***
did          5.780e+02  2.508e+03   0.230  0.817815
wdi_pop      -2.029e-04  2.460e-05  -8.245  1.8e-15 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

Residual standard error: 13400 on 453 degrees of freedom
Multiple R-squared:  0.192, Adjusted R-squared:  0.1848
F-statistic: 26.91 on 4 and 453 DF,  p-value: < 2.2e-16

```

OLS Regression Results: Matching- Effect of Hosting on Trade

```

Call:
lm(formula = wdi_trade ~ Host + treatment_time + did + wdi_pop,
    data = match_e)

```

```

Residuals:
    Min       1Q   Median       3Q      Max
-30.159 -12.350  -4.488   7.181  85.066

```

```

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  6.945e+01  2.515e+00  27.618 < 2e-16 ***
Host        -1.407e+01  2.519e+00  -5.585  4.04e-08 ***
treatment_time 7.912e+00  2.542e+00   3.112  0.00198 **
did         -2.544e+00  3.592e+00  -0.708  0.47915
wdi_pop      -2.116e-07  3.524e-08  -6.003  3.97e-09 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

Residual standard error: 19.19 on 453 degrees of freedom
Multiple R-squared:  0.1721, Adjusted R-squared:  0.1648
F-statistic: 23.55 on 4 and 453 DF,  p-value: < 2.2e-16

```

OLS Regression Results: Matching- Effect of Hosting on Foreign Direct Investment

```

Call:
lm(formula = wdi_fdiin ~ Host + treatment_time + did + wdi_pop,
    data = match_f)

```

Residuals:

| Min | 1Q | Median | 3Q | Max |
|---------|---------|---------|--------|---------|
| -5.5375 | -1.2425 | -0.4877 | 0.6486 | 19.6698 |

Coefficients:

| | Estimate | Std. Error | t value | Pr(> t) |
|----------------|------------|------------|---------|--------------|
| (Intercept) | 2.787e+00 | 3.121e-01 | 8.930 | < 2e-16 *** |
| Host | -1.115e+00 | 3.030e-01 | -3.679 | 0.000264 *** |
| treatment_time | -6.348e-03 | 2.839e-01 | -0.022 | 0.982172 |
| did | 4.830e-01 | 4.095e-01 | 1.179 | 0.238866 |
| wdi_pop | -1.131e-08 | 4.575e-09 | -2.472 | 0.013838 * |

 Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 2.127 on 429 degrees of freedom
 Multiple R-squared: 0.04089, Adjusted R-squared: 0.03194
 F-statistic: 4.572 on 4 and 429 DF, p-value: 0.001262

OLS Regression Results: Matching- Effect of Hosting on Gini Coefficient

Call:

```
lm(formula = wdi_gini ~ Host + treatment_time + did + wdi_pop,
    data = match_c)
```

Residuals:

| Min | 1Q | Median | 3Q | Max |
|--------|--------|--------|-------|-------|
| -9.006 | -1.879 | -0.306 | 2.450 | 7.694 |

Coefficients:

| | Estimate | Std. Error | t value | Pr(> t) |
|----------------|------------|------------|---------|--------------|
| (Intercept) | 3.105e+01 | 1.235e+00 | 25.134 | < 2e-16 *** |
| Host | -7.736e-01 | 1.297e+00 | -0.596 | 0.552021 |
| treatment_time | -2.867e+00 | 8.399e-01 | -3.413 | 0.000865 *** |
| did | 3.767e+00 | 1.445e+00 | 2.606 | 0.010271 * |
| wdi_pop | 8.943e-08 | 1.607e-08 | 5.565 | 1.52e-07 *** |

 Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 3.586 on 125 degrees of freedom
 Multiple R-squared: 0.2798, Adjusted R-squared: 0.2568
 F-statistic: 12.14 on 4 and 125 DF, p-value: 2.272e-08

OLS Regression Results: Matching- Effect of Hosting on Poverty Gap

Call:

```
lm(formula = wdi_povgap190 ~ Host + treatment_time + did + wdi_pop,
    data = match_d)
```

Residuals:

| Min | 1Q | Median | 3Q | Max |
|----------|----------|----------|---------|---------|
| -0.43207 | -0.09096 | -0.07578 | 0.11036 | 0.91248 |

Coefficients:

| | Estimate | Std. Error | t value | Pr(> t) |
|----------------|------------|------------|---------|------------|
| (Intercept) | 2.247e-01 | 7.644e-02 | 2.939 | 0.00392 ** |
| Host | 1.414e-01 | 8.027e-02 | 1.761 | 0.08062 . |
| treatment_time | -8.349e-02 | 5.197e-02 | -1.606 | 0.11069 |
| did | 2.531e-01 | 8.944e-02 | 2.830 | 0.00542 ** |
| wdi_pop | -7.933e-10 | 9.944e-10 | -0.798 | 0.42653 |

 Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.2219 on 125 degrees of freedom
 Multiple R-squared: 0.3862, Adjusted R-squared: 0.3666

F-statistic: 19.66 on 4 and 125 DF, p-value: 1.415e-12

Appendix B: Matching Results

| Pair Number | Countries | Year of Olympics | Distance |
|-------------|--------------------|------------------|----------|
| 1 | South Korea (H) | 1988 | 0.096492 |
| | Finland (B) | 1976 | 0.097492 |
| 2 | Greece (H) | 2004 | 0.117834 |
| | Thailand (B) | 2008 | 0.123553 |
| 3 | Canada (H) | 1976 | 0.141464 |
| | Turkey (B) | 2008 | 0.142438 |
| 4 | Spain (H) | 1992 | 0.146335 |
| | South Korea (B) | 2010 | 0.150016 |
| 5 | Canada (H) | 1988 | 0.184927 |
| | Sweden (B) | 2002 | 0.185503 |
| 6 | Australia (H) | 2000 | 0.1991 |
| | United Kingdom (B) | 1992 | 0.198666 |
| 7 | Japan (H) | 1972 | 0.209628 |
| | Italy (B) | 1992 | 0.213787 |
| 8 | France (H) | 1992 | 0.228524 |
| | United Kingdom (B) | 2000 | 0.237608 |
| 9 | Italy (H) | 2006 | 0.266199 |
| | West Germany (B) | 1992 | 0.268793 |
| 10 | Canada (H) | 2010 | 0.274561 |
| | France (B) | 2004 | 0.272523 |
| 11 | Norway (H) | 1994 | 0.279384 |
| | France (B) | 2008 | 0.293061 |
| 12 Excluded | Japan (H) | 1998 | 0.45316 |
| | Brazil (B) | 2004 | 0.344845 |
| 13 Excluded | USA (H) | 1976 | 0.561574 |
| | Japan (B) | 1988 | 0.346711 |

| | | | |
|-------------|----------------------------|--------------|----------------------|
| 14 Excluded | USA (H) Switzerland (B) | 1996 2002 | 0.755101 0.346745 |
| 15 Excluded | USA (H) Switzerland (B) | 2002 2010 | 0.806955 0.390732 |
| 16 Excluded | China (H) Japan (B) | 2008 2008 | 0.999993 0.517477 |