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To cite this article: Stephen Pettigrew & Danyel Reiche (2016) Hosting the Olympic Games: an Overstated Advantage in Sports History, *The International Journal of the History of Sport*, 33:6-7, 635-647, DOI: [10.1080/09523367.2015.1132201](https://doi.org/10.1080/09523367.2015.1132201)

To link to this article: <http://dx.doi.org/10.1080/09523367.2015.1132201>



Published online: 01 Feb 2016.



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Hosting the Olympic Games: An Overstated Advantage in Sports History

Stephen Pettigrew^a and Danyel Reiche^b

^aDepartment of Government, Harvard University, Cambridge, MA, USA; ^bDepartment of Political Studies and Public Administration, American University of Beirut, Beirut, Lebanon

ABSTRACT

Previous research on the home advantage in the history of the Olympic Games has found initial evidence that host nations have won more medals than non-hosts. In this paper, we argue that these findings are a myth of sports history, providing poor estimates of the home advantage in the Olympics. We argue that selection bias accounts for the findings in previous work, which uses an empirical strategy of comparing host nations to all non-hosts and to historical performances of host countries with much smaller delegations. When we correct for this bias the evidence in favour of a hosting advantage disappears. Additionally, we argue that the existing literature has largely neglected the rules about athlete qualification for host countries. To the extent that a small home advantage does exist, it is almost entirely driven by increased participation rates.

KEYWORDS

Olympic Games; Summer Olympics; Winter Olympics; home advantage; International Olympic Committee

Introduction

In the academic literature about Olympic success, one factor is most often taken for granted: the home advantage. At the 2012 Summer Games in London, Great Britain won 65 medals and ranked third in the medal count, a substantial increase from the 2008 Beijing Games (47). The same happened when Russia hosted the 2014 Winter Games. The country won 33 medals in Sochi and ended up being the most successful nation-state in the medal ranking; just four years earlier in Vancouver, the country only won 15 medals and was eleventh in the medal ranking.

Academic studies have found some empirical evidence for the home advantage in the history of the Olympic Games.¹ However, prior work on this topic has two major shortcomings. First, these studies fail to define an appropriate comparison or control group for estimating the impact of hosting the Games. Most of the studies estimate the home advantage by comparing host countries to all others.² In other words, the research estimates the home advantage by comparing host countries like Great Britain to non-hosts like Djibouti.³ Other studies compare hosts only to their previous success, but do so by pooling across many years.⁴ Such research compares Great Britain's medal count when they

hosted in 2012 to their medal count in 1896, when they did not. Our analysis improves upon the previous research by comparing the medal count of a host nation to that same country's medal count in recent Games.

Second, previous work largely neglects the fact that the qualification rules for athletes from host countries are significantly less strict, resulting in more medal opportunities for the host country. For example, Great Britain had 530 athletes competing at the London Games in 2012, compared to 304 in Beijing in 2008. A total of 215 athletes in Sochi represented Russia in 2014, compared to 175 in Vancouver four years earlier.

Our work is original research that contributes to new scientific knowledge by accounting for these two shortcomings of the empirical literature. We find weak to no evidence of a hosting advantage in the history of the Olympic Games. In particular, there is not a statistically significant increase in the number of total medals or gold medals won by a country when they host. We do find huge increases in the number of athletes for host countries. When we account for increased participation by looking at the ratio of medals to athlete, we find that the home advantage decays to almost zero.

This paper examines the history of the Olympic Games after World War II. We started with the 1952 Summer Games in Helsinki (Finland) and the Winter Games in the same year in Oslo (Norway), and included all 16 Summer Games through 2012 in London and all 17 Winter Games until Sochi in 2014 in our analysis.⁵ Our data comes from *Sports Reference*, which maintains a comprehensive and exhaustive database of Olympic data gleaned from the work of historians and statisticians from the International Society of Olympic Historians.⁶

The paper proceeds as follows. We first discuss the academic literature on the home advantage and explain how the findings in this paper improve our understanding of the topic. We then discuss participation rates among athletes in host nations and show that there is a significant increase in the size of Olympic teams when a country hosts. Then, we present our statistical results, first estimating the home advantage in terms of medal counts and then estimating it in terms of medals per athlete. In each case, we fail to find evidence of a home advantage in the Olympics. We conclude with remarks about what our findings mean for our understanding of the home advantage and the implications of our research for countries interested in hosting the Games.

Mixed Evidence about Home Advantage in the Olympics

Research on home advantage in sports has found evidence of the phenomenon in numerous sports across many countries.⁷ The academic literature that focuses on explaining success in the Olympic Games has largely focused on factors other than home advantage such as GDP, population size, and the presence of a command economy. Although the home advantage is rarely the centrepiece of these studies, several authors have put forth hypotheses for why a home advantage may exist. Johnson and Ali assert that, 'there are undeniable advantages to being the hosting nation',⁸ and find that host nations win, on average, 24.87 more medals than non-host nations. They argue that lower transportation costs and climatic advantages explain at least part of this increase for hosts. Lui and Suen suggest that climate may explain part of the home advantage.⁹

Bernard and Busse point to other economic factors as explaining the Olympic home advantage.¹⁰ They find that host countries win an additional 1.8% of medals and attribute this increase to minimized costs of attendance, tailored facilities, crowd effects on judging, and increased motivation by the athletes themselves. Rathke and Woitek argue that, 'hosting

the Olympic Games considerably increases the public support for (and therefore the money and effort invested in) sports in the years before the Games.¹¹ For example, after London's successful bid to host the 2012 Summer Games, an extra £200 million of public money was provided for elite sport development leading up to 2012.¹² Prior to the 1988 Games in Calgary, the Canadian government invested \$C25 million in its Olympic training facilities, including the country's first multi-sport training centre.¹³

Kuper and Sterken find evidence of a hosting advantage not just in the year that a country hosts the Games, but also in the Olympics four years prior. They suggest that this is evidence for their time-to-build argument: 'It takes long run planning to create a group of optimal performing athletes.'¹⁴ This argument implies that hosting the Games creates a training infrastructure that exists prior to the hosting year, and it may persist after they host.

Most studies analyze the home advantage by looking at aggregate medal counts across all sports; Balmer, Nevill, and Williams take a different approach by analyzing individual events. In their analysis, they group together events based on whether medals are determined by objective criteria (e.g. 100-metre race, downhill ski) or by subjective judging (figure skating, gymnastics).¹⁵ In separate analyses of the Summer and Winter Games, they do not find evidence of a home advantage in objectively measured events, but do find it in subjectively judged competitions. They speculate that, much like research on other sports has shown,¹⁶ the difference is attributable to judge responsiveness to crowd noise, rather than the crowd motivating the athletes themselves.

To our knowledge, our research is the first attempt to directly measure the size of the home advantage in the Olympics at the country level. Although most of the studies described above include a control variable for the host country, none of that research was primarily concerned with estimating how hosting impacts the overall medal count. We believe that these control variables provide biased estimates of the home advantage because of two major flaws, one methodological and one substantive, in their empirical strategies.

Our methodological concern relates to how the existing literature defines their sample and how that decision impacts the estimation of the home advantage. If we are to employ language commonly used to describe experiments, the previous studies consider the Olympic hosts as the 'treated' group, while the 'control' group is made up of all other countries that participated in the Olympics. The size of the home advantage is estimated by comparing medal counts between the treated and the control groups. In other words, these studies compare host countries like the United States or Great Britain to all non-host countries like Djibouti and the Bahamas.

Using all non-host countries as the comparison group introduces selection bias into our estimate of the home advantage, since there are countless factors, both measurable and unmeasurable, which make those two sets of countries different. The existing literature does provide us with an unbiased estimate of the difference in medal count between an *average* host country and an *average* non-host country, but this is not the way we typically conceptualize the home advantage. More commonly, we think of it as the average change in the medal count if the hosting privilege was given to a viable non-host. While it may be interesting to discuss the impact that hosting would have on the medal count of Djibouti or the Bahamas, we have no empirical evidence upon which to base our expectations since no comparable countries have ever played host. Including such countries in the 'control' category of our analysis thus biases our estimate, since the counterfactual world in which the Bahamas hosts the Olympics would likely be different in countless ways other than just their hosting the Games.¹⁷

Additionally, prior literature often pools together data across long time periods.¹⁸ Certainly there are many things that make the Great Britain team that won 65 medals in 2012 fundamentally different from the British team that won seven medals in the 1896 Athens Olympics. Many of these differences, like GDP or investment in athletics, are predictive of a country's medal count, making them confounders and thus biasing the estimates of the home advantage.

In order to avoid these biases, we employ a new empirical strategy for estimating the home advantage. Rather than comparing hosts to all other countries, we compare the medal counts of Olympic hosts to their own medal count in the previous Olympics four years earlier.¹⁹ In other words, we use exact matching to pair each host country in year t with that same country in year $t - 4$. By using a linear model with fixed effects for each pair of prior-to-hosting and hosting-year medal results, we significantly cut down on the number of potential confounding variables. In a four-year window, the within-country variation in factors like GDP, population and number of athletic facilities will be substantially less than their between-country variation. Also, our strategy eliminates any bias from time-invariant confounders. Although we do not claim that we are estimating the causal effect of hosting the Olympics, our approach does cut down on the sources of bias that contaminate previous estimates of the home advantage.

Participation Numbers Increase Dramatically for Olympic Hosts

The substantive concern is that the current literature largely ignores the importance of participation rates in explaining the home advantage. Figure 1 shows that the size of the host country's team grows significantly in the year that they host. 20 Of the set of 33 Summer and Winter Games after World War II, there is only one instance²⁰ – USA in the 1980 Winter Games – of a country decreasing its number of participants in the year that it hosted, compared to the previous Games. In Summer Games, on average, the host country's team is 162.2 athletes larger than in the previous Summer Games ($p = 0.0013$). In Winter Games, the difference is 28.1 athletes ($p = 0.0073$). These values represent a 241% increase in the Summer Games and a 21% increase for the Winter Games.

The main reason that host nations have larger teams is that the qualification standards for the host country are substantially easier. For team events, the host countries do not have to participate in qualification tournaments. For example, South Korea's men's and women's ice hockey teams will make their Olympic debuts in 2018 when Pyeongchang is the host city.²¹ Great Britain's men's and women's handball teams made their Olympic debut in London in 2012, 76 years after the sport was introduced at the Olympics.²²

Automatic qualification also applies to individual sports. In the triathlon, for example, 55 men and 55 women could qualify for the Summer Olympics 2012, with a maximum of three starters per country. The United Kingdom had one guaranteed starter in both competitions, with the option of further participants depending on the British results in the qualification events.²³

The importance of automatic qualification rules is clear. While the German men and women's soccer teams were towards the top of the FIFA rankings, neither team qualified to participate at the London 2012 Olympics.²⁴ Great Britain participated in soccer for the first time since 1960, despite both of their teams being outranked by Germany. Similarly, Germany has had tremendous success in handball in recent years, with regular victories at European club competitions and a world championship in 2007, but it did not qualify for handball events in London. Great Britain qualified despite having never participated in the event at previous Games.

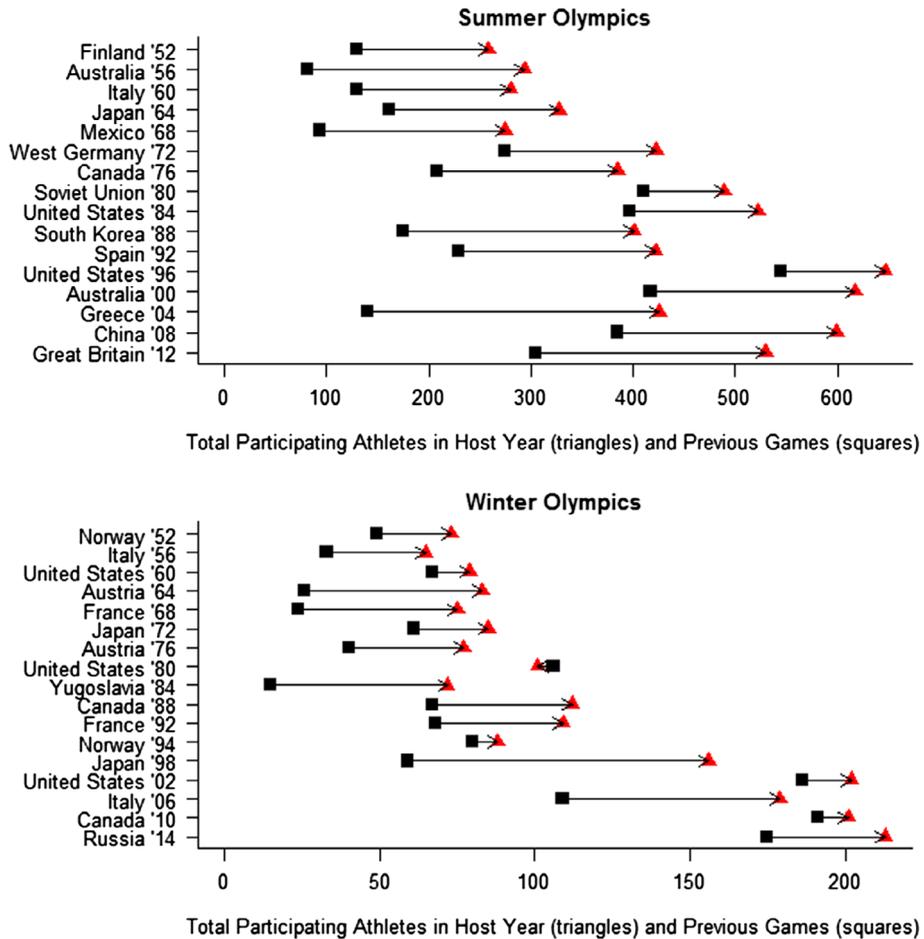


Figure 1. Participation of host countries at the Olympic Games.

Automatic qualification therefore increases the opportunities to win medals for the host country. In 2012, Great Britain had a team that was 74% larger than it was in 2008 (304 athletes in 2008, 530 in 2012). While some of the additional athletes (such as the British men's and women's handball teams that lost all their matches) were not successful, the increase in participation turned into 18 additional medals for team Great Britain (47 in 2008; 65 in 2012). Our understanding of the home advantage described by previous research is, at best, incomplete because of its neglect of this essential piece of the medal-count puzzle. In fact, we will demonstrate in the next section that not only is the home advantage small and not statistically significant when it is measured in terms of medal counts, it disappears entirely when success is measured in terms of medals per athlete.

Accounting for Selection Bias Yields Weak Evidence of an Olympic Home Advantage

Figure 2 displays the number of gold medals won by each host country in the Games that they hosted (triangles) and in the previous Games (squares). This metric is the official

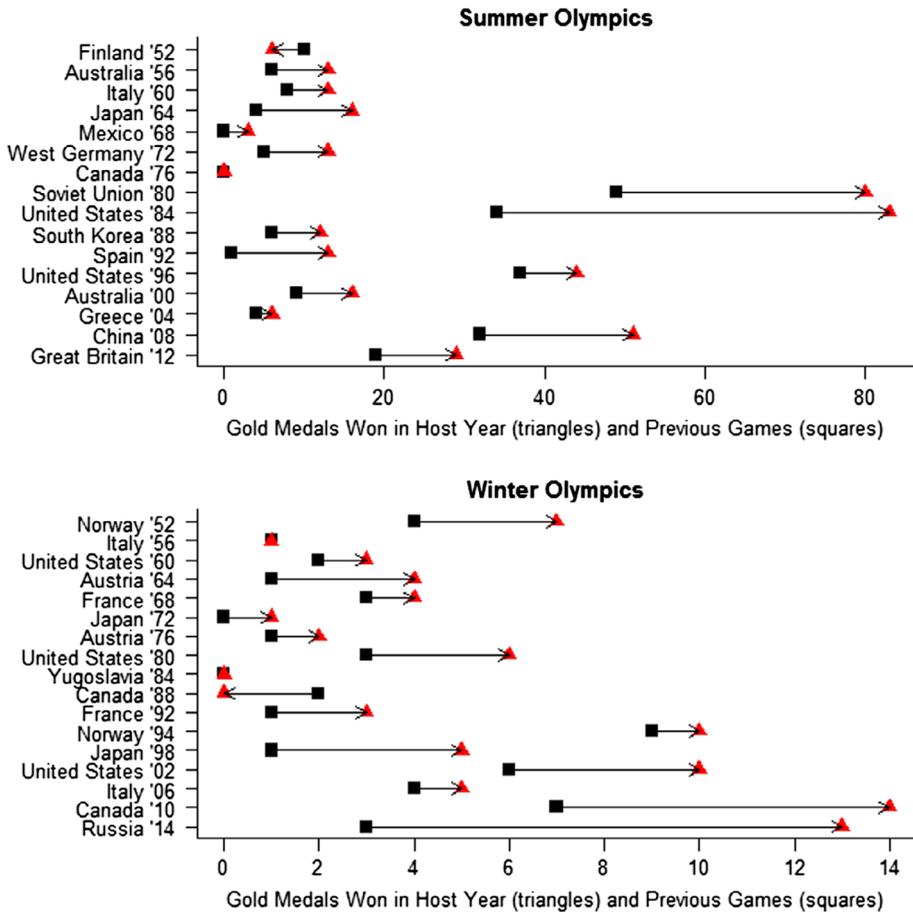


Figure 2. Gold medals by host countries at the Olympics.

ranking method of the International Olympic Committee (IOC) and is used in most countries. If country A wins overall zero gold and 20 silver medals and country B wins one gold and zero silver medals, country B is ranked above country A in the IOC ranking.

As Figure 2 shows, most countries increased their gold medal count when they hosted. However, there are a handful of exceptions to this trend: Finland (10 golds in Summer 1948, six in 1952); Italy (two golds in Summer 1952 and 1956); Canada (zero in Summer 1972 and 1976; two golds in Winter 1984, zero in 1988); and Yugoslavia (zero in Winter 1980 and 1984). In all other Olympics between 1952 and 2014, the host countries were able to increase the number of golds won from the previous Games. So the question then is whether this provides sufficient evidence of an Olympic home advantage.

To estimate the size of the home advantage, we use a linear regression of gold medal count on a dummy variable for ‘host’ and fixed effects for each of the prior to hosting and hosting year medal results.²⁵ The fixed effects can be thought of as capturing the number of golds we would expect a country to win if they did not host, and the coefficient for ‘host’ captures how many additional gold medals they are expected to win by virtue of hosting.²⁶ When we pool together the Summer and Winter results, we

find that host countries tend to increase their number of gold medals by 4.4 (se: 3.71), although this result is not statistically significant ($p = 0.24$) and we cannot reject the null hypothesis of there being no home advantage. The story is similar if we subset the analysis by season. Summer hosts increase their gold medal count by 7.2 (se: 7.7; $p = 0.37$) and Winter hosts have an increase of 1.9 golds (se: 1.2; $p = 0.11$), although neither of the results are statistically significant at conventional levels.

It may also be the case that the build-up in Olympic infrastructure for a host nation begins earlier than the four years before they host, since the candidature process is launched a decade before the Games and lasts for a period of approximately three years.²⁷ As host countries build up training and other facilities, their athletes may be able to benefit from them in the Olympics prior to when they host, potentially explaining the null result in the host advantage. We tested for each of these possibilities and, in each case, the null result of no home advantage remains. Comparing hosting year gold medal counts to those in the Olympics eight years prior yields a statistically non-significant effect ($p = 0.75$ for Summer Games and $p = 0.78$ for Winter Games) for the hosting year.²⁸

Similarly, a build-up of facilities could also have an impact on athlete performance in the Games after a country hosts. Great Britain is aiming to take home at least 66 medals from Rio 2016, one more than British athletes won in London 2012.²⁹ Since the number of British participants will most likely significantly decrease, this would be a remarkable achievement. However, when we compare the performance of countries at the Olympics just before and just after the Games that a country hosts, we find little evidence of such a post-host legacy effect (Summer: $p = 0.34$; Winter: 0.23). This is evidence against the possibility of a long-lasting impact of Olympic hosting on medal counts.

We also considered total number of medals as another way to measure the home advantage. The Associated Press ranks teams based on this metric, weighting gold, silver and bronze medals equally. According to the AP method, if country A wins 20 bronze medals and country B 19 gold medals, country A is still ranked above country B.

Figure 3 displays the shifts in total medal count for countries when they host. Using this criterion, just three out of 33 hosts (Finland Summer 1952, USA Summer 1996, and Italy Winter 2006) performed worse in the year that they hosted compared to the previous Olympics. As before, we used a linear fixed-effects model to estimate the size of the home advantage, this time in terms of total medals won. Host countries increase the number of total medals they win by 7.4 (SE: 8.1), but this result is not statistically significant ($p = 0.37$). The Summer host bump is 11.6 (SE: 17.0; $p = 0.51$) and Winter hosts increase their medal count by 3.8 (SE: 2.6; $p = 0.17$).

The results we have presented provide at best modest evidence in favour of a home advantage in the Olympics. So far though, we have not accounted for the fact that Olympic hosts typically have significantly more participants than they would otherwise have, resulting in more opportunities to win medals. Including this into the analysis allows us to test whether an increase in medals for a host country is a result of crowd effects or any of the other factors identified by prior research, or whether the increased medal count is simply a consequence of more opportunities to win medals because of increased participation. To account for this, we model the ratio of gold (or total) medals won by a given country to the number of athletes on that country's Olympic team.³⁰

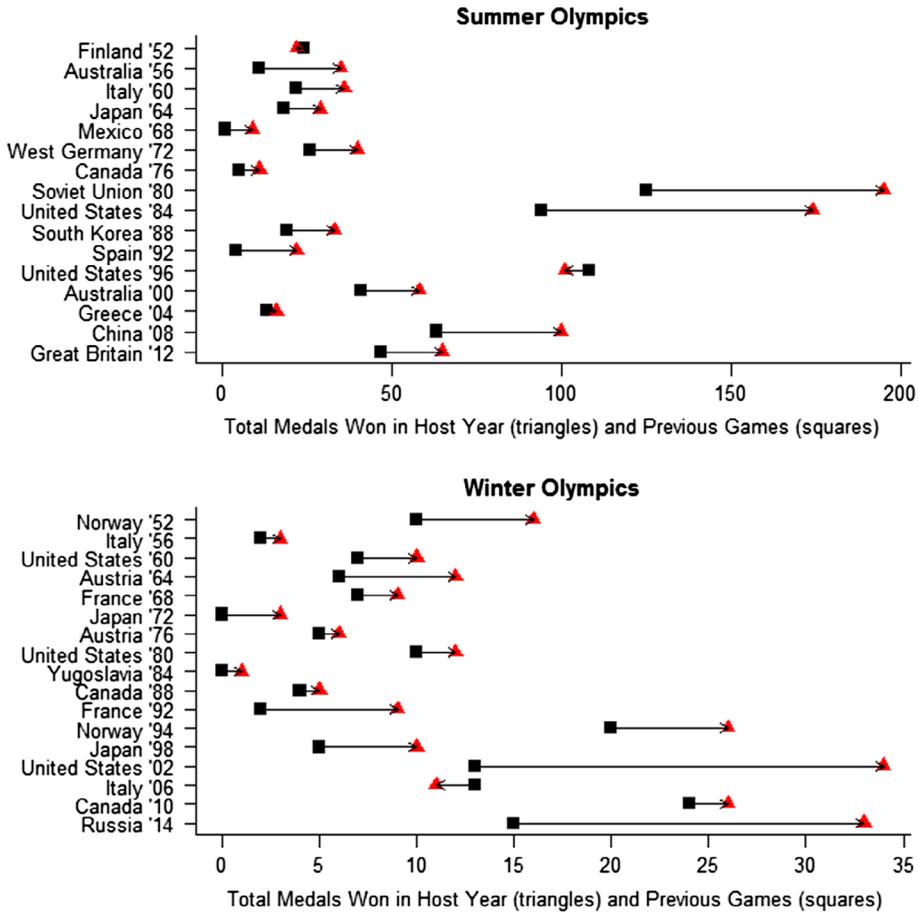


Figure 3. Total medals by host countries at the Olympic Games.

Figure 4 shows how the number of gold medals per athlete changes when a country hosts the Games. Compared to Figure 2, which seemed to have a clearer pattern of increased gold medal counts for Olympic hosts, Figure 4 is much more of a mixed bag. Only 18 of the 33 Olympic hosts increased their fraction of golds per participant in the year that they hosted. When we estimate the size of the home advantage, we find that hosts win 0.003 (0.010) more golds per athlete than they did in the prior Games ($p = 0.75$). Interestingly, we also find that Summer hosts actually win fewer golds per athlete (-0.00008 , se: 0.015, $p = 0.99$) and Winter hosts win slightly more (0.006, se: 0.012, $p = 0.64$). Similar to the results in the previous section, none of these results are statistically significant, so we do not find compelling evidence of a home advantage in the Olympics.

Considering total medals per athlete tells the same story. Roughly half of host countries (17 of 33) saw a decrease in this statistic (Figure 5). We estimate the hosting effect to be more of a disadvantage than an advantage, with host countries winning 0.007 (se: 0.02, $p = 0.73$) fewer medals per athlete than in the prior Games. Just as before, we do not find a significant increase in either the Summer (-0.02 , se: 0.03, $p = 0.61$) or Winter Games (0.001, se: 0.03, $p = 0.97$).

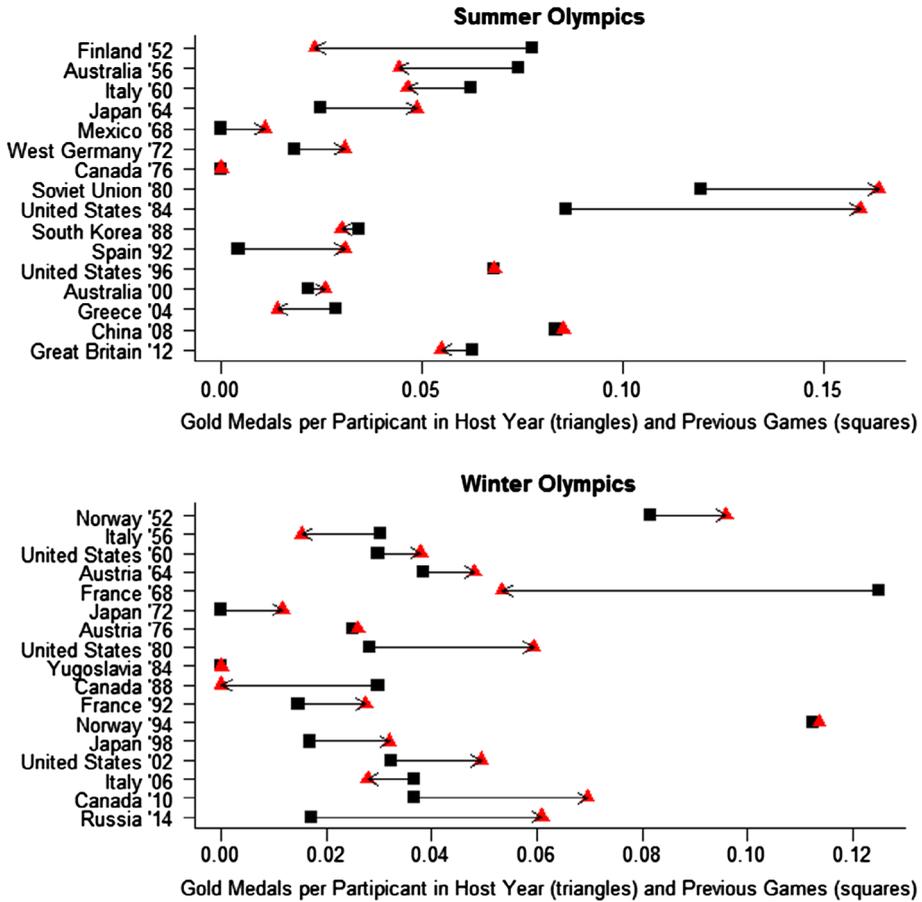


Figure 4. Gold medals per athlete.

Discussion

Regardless of how we specify our statistical model, we fail to find strong evidence of a home advantage in the history of the Olympics. While the results are not statistically significant at any conventional level, this could be a consequence of a small sample size and a lack of statistical power. There are only 33 host and 33 non-host observations in our data-set, and even including additional non-host observations from the Olympics eight years prior to hosting does not change our findings. The reason is that the standard error of the host coefficient is a function of the variance of medals won by hosts and the variance of medals won by non-hosts. Including additional years might provide us a more precise estimate of the average medals won by non-hosts (at the potential cost of introducing selection bias), but only the passage of a long period of time will improve our estimate of the average medals by hosts.

It is also worth pointing out that even if our results were statistically significant, the findings here still contribute to our understanding of the home advantage in the history of the Olympics. Our point estimates of the home advantage are substantially different from

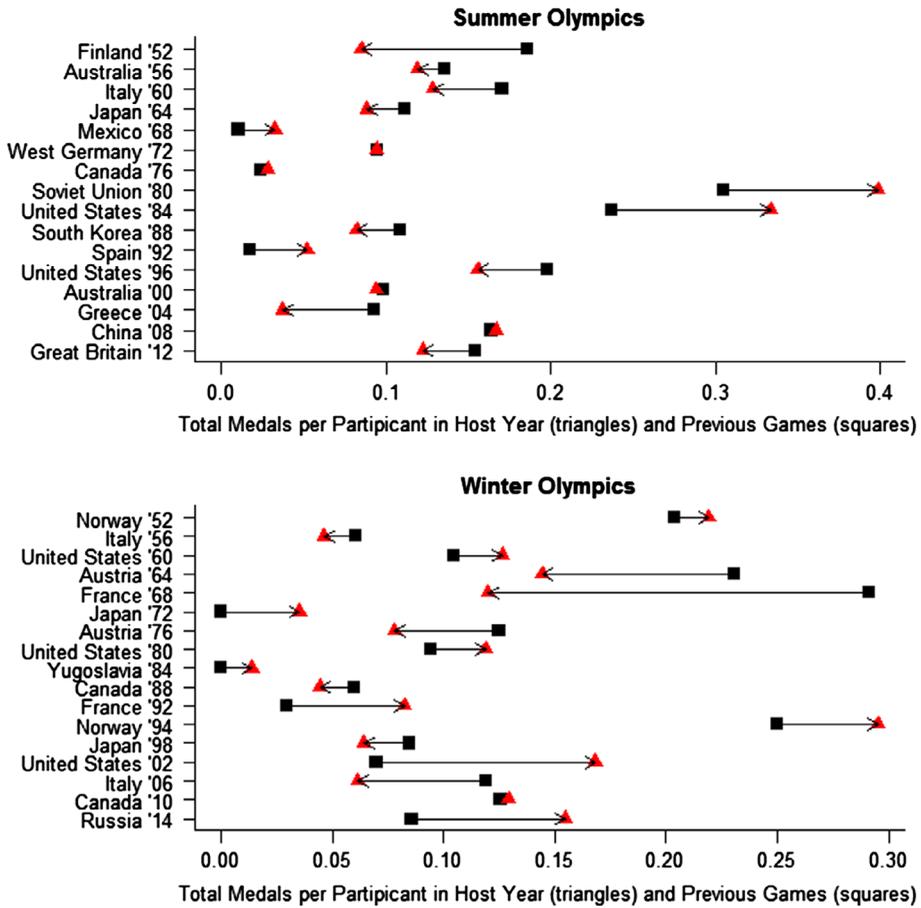


Figure 5. Medals per athlete.

those estimated in prior work. This supports our claim that these prior estimates are biased and our estimates should be preferred.

This finding is especially important given the politics of the bidding process for the Olympics. Only 23 countries have ever hosted a Summer or Winter Olympics in the entire history of the Games (1896–2014). The remaining 182 National Olympic Committees that were recognized by the IOC in July 2015 have never hosted the Olympics. While some emerging countries such as South Africa and India might be hosts in the future, a vast majority of countries will never be able to host the Games due to economic, geographic, climate or other factors. From the perspective of these small or less developed countries, our findings should be encouraging. We cannot say whether they would receive a hosting bump in their medal count, since we have no data upon which to base that prediction. We can say, however, that large, economically prosperous countries, by virtue of hosting the Games, are not receiving a large hosting boost in their medal count which small countries are precluded from receiving.

Our research has focused on countries that actually hosted the Olympic Games. An interesting question to investigate would be whether just the participation in bidding

processes is influencing the Olympic success of a country (by initiating processes to better support elite athletes). Rio de Janeiro will stage the 2016 Summer Olympics, becoming the 24th Olympic host country. However, the country was already bidding for the 2004 Games (that were awarded to Athens). Interestingly, since the 1996 Games in Atlanta (when the country was in the middle of the 2004 bidding process), Brazil has increased its medal count compared to before 1996.

While host nations have a significantly larger Olympic team than in years when they are not hosting, they do not do a good job of winning additional medals with those extra athletes. This is perhaps largely a consequence of the fact that these extra participants will tend to be of lower quality, given that the qualification rules are more lax for host nations. Future research could address the question why host countries tend to spend more money for their Olympic teams: Is this mainly to bring up the additional athletes to the Olympic level or is there a general improvement of the (elite) sport infrastructure? While our research has proven that there is no significant home advantage at the Olympic Games in general, future work may further explore whether there has been a home advantage in the history of specific events. For example, at the Sochi Winter Olympics in 2014, Russian figure skater Adelina Sotnikova surprisingly won the gold medal over South Korean Yuna Kim. Many experts heavily criticized the result from the competition in Sochi and argued that it was the result of the judges being influenced by the home crowd.³¹ Future research on the home advantage could focus more on single events at the Olympics, particularly those where judges are involved, while still correcting for the selection biases identified in this research.

Our research questions one of the main motives stated for hosting Olympic Games: becoming more successful in sports. However, there are plenty of other potentially legitimate reasons for hosting the greatest sporting event in the world apart from the FIFA World Cup,³² such as national pride, international prestige, gaining soft power and, particularly relevant for emerging countries, using sport as a development tool.³³ Whether these motivations are more valid than increased sporting success needs to be addressed in future research.

Notes

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20. The data and code to replicate our analyses can be found at: Stephen Pettigrew and Danyel Reiche, 2015, "Replication Data for: Hosting the Olympic Games: An Overstated Advantage in Sports History (Pettigrew & Reiche 2016)", <http://dx.doi.org/10.7910/DVN/P0AEHQ>, Harvard Dataverse, V2.
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25. In other words, Russia's results from the 2014 Winter Games (when they hosted) and their results from the 2010 Winter Games each receive a common fixed-effect intercept.
26. For all the statistical tests presented in the paper, we also estimated the linear regression model without the fixed effects. This approach is identical to a difference-in-means *t*-test. Our statistical significance and substantive conclusions do not change when we use this approach.
27. Official Website of the Olympic Movement: All about the candidature process, available at <http://www.olympic.org/all-about-the-candidature-process>.
28. This pattern also holds for the remainder of analyses in this section. When analyzing host years to the Games eight years prior, there is no instance of a statistically significant home advantage effect when considering in total medals, gold medals, total medals per athlete or golds per athlete.
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Acknowledgements

Stephen Pettigrew and Danyel Reiche worked on this article while Prof. Reiche was a Visiting Scholar at Harvard in fall 2014/2015 and summer 2015. Prof. Reiche would like to thank the American University of Beirut, which granted him for the fall term 2014/2015 a research leave, and the American University of Beirut's Prince Alwaleed Bin Talal Bin Abdulaziz Alsaud Center for American Studies and Research (CASAR) which granted him in summer 2015 a research travel grant. Prof. Reiche would also like to thank Harvard University's Institute for Quantitative Social Science (IQSS) for inviting him in fall 2014/2015 and summer 2015 as Visiting Scholar.

Notes on contributors

Stephen Pettigrew is a PhD candidate in the Harvard University Department of Government. His political science research interests include American politics, elections and political methodology. He has written about sports analytics for the Wall Street Journal, FiveThirtyEight and Deadspin. His work has been published in *Electoral Studies* and the *Journal of Quantitative Analysis of Sports*.

Danyel Reiche (dr09@aub.edu.lb) is an associate professor for comparative politics at the American University of Beirut and a Visiting Scholar at the Harvard University Institute for Quantitative Social Science (IQSS). He has also worked as a visiting assistant professor at the School of Foreign Services, Georgetown University, in the US, and as postdoc at the Freie Universität Berlin in Germany. He is author of numerous peer-reviewed articles, most recently in *European Sports Management Quarterly*, *International Journal of Sport Policy and Politics*, *Journal of Energy Policy*, *Sport in Society*, *Soccer & Society* and *Third World Quarterly*. Currently, Reiche is working on a book "Success and Failure of Nation at the Olympics".