

Does a home advantage effect exist in international track and field athletics?

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Does a home advantage effect exist in international track and field athletics?

Abstract

Purpose: This paper investigates home advantage in the context of the IAAF World Championships and the IAAF World Indoor Championships.

Design: Our study includes 31 editions of these competitions held between 1987 and 2018. Using three key performance indicators (KPIs) we analysed how host nations had performed when competing at home compared with how they performed in the editions immediately before and after hosting.

Findings: In the case of the IAAF World Indoor Championships, we found a statistically significant home advantage effect for all the KPIs examined ($p < 0.05$). No significant home advantage effect was evident in the IAAF World Championships in terms of two KPIs ($p > 0.10$), although a close to statistically significant home advantage effect was observed for one KPI ($p = 0.060$).

Practical implications: Host nations should be cognisant of such variations in advance of bidding to host these IAAF competitions, particularly if enhancing performance at home is strategically important to them.

Research contribution: A key learning point from our study is that the way in which researchers define performance may well have a bearing on the extent to which a home advantage in individual sports that are scored objectively such as athletics is apparent.

Keywords: home advantage; game location; performance; individual sports; athletics; IAAF

Introduction

Home advantage is commonly defined as the consistent finding that home teams in sports competitions win over half of the games played under a balanced home and away schedule (Courneya & Carron, 1992). The prevalence of home advantage is documented widely in professional team sports that are played on a balanced home and away basis (Pollard & Pollard, 2005). By contrast, the evidence of home advantage in individual sports is far less conclusive. An inherent feature of individual sports is that they rarely, if ever, play balanced home and away schedules. Therefore the definition of home advantage offered by Courneya and Carron (1992) is not applicable to competitions featuring individual sports. With reference to individual sports, Koning (2005) provides a more appropriate definition of home advantage as "the performance advantage of an athlete, team or country when they compete at a home ground compared to their performance under similar conditions at an away ground" (p.19). According to a review by Jones (2013), home advantage is not a major factor in individual sports, with the exception of subjectively evaluated sports (i.e. those which involve subjective decisions and scoring by officials such as in boxing and gymnastics), and its role in individual sports is less prominent in comparison with team sports. However, this conclusion was made on the basis of sparse and scattered literature. We test this assertion in our paper by investigating the extent to which home advantage is prevalent in track and field athletics. In order to do this we have examined the performance of nations in two elite athletics competitions sanctioned by the International Association of Athletics Federations (IAAF), the international governing body for the sport. The two competitions are the IAAF World Championships and the IAAF World Indoor Championships.

Staging these marquee events necessitates a substantial amount of investment by host countries which they would not otherwise incur if the events were to take place elsewhere. For example, the overall costs associated with hosting the 2017 IAAF World Championships

in London was reported to be £45 million (Hart, 2011), with UK Sport, the national agency in charge of elite sport and major events, investing £7m of public funding (UK Sport, 2016). Government investment in elite sport to underwrite the costs of hosting major sports events is often justified in terms of the wider consequences that they are perceived to deliver for different beneficiaries. A range of potential event impacts and legacies have been identified in the literature. For instance the International Olympic Committee (IOC, 2012) categorizes the proposed benefits from hosting the Olympic Games under five broad dimensions - 'economic', 'sporting', 'urban' 'social' and 'environmental'. An outcome related to 'sporting' dimension is the extent to which nations that are awarded the right to host an event receive a return on their investment in terms of benefitting from success in elite sport through a quantifiable home advantage or host nation effect.

As evidenced later in this paper, there have only been a few disparate efforts to investigate home advantage in athletics, which were primarily set in the context of the Olympic and Paralympic Games (Balmer, Neville, & Williams, 2003; Wilson & Ramchandani, 2017a, 2018), with mixed results. Our study is organised to allow a like-for-like assessment to be made of the prevalence and size of any home advantage effect in the two marquee IAAF competitions separately. Our study design also facilitates a comparison of home advantage between the IAAF World Championships and the IAAF World Indoor Championships.

The rest of the paper is structured in the following order. We first consider the main conceptual models that have been developed to guide understanding of the occurrence of home advantage in sport. We then review empirical evidence relating to home advantage in individual sports, including both sports that are objectively judged and those that are subjectively scored by officials, based on which the key research questions are formulated.

The details of the methods used are then presented followed by the results obtained. In the final section, the key findings, implications and limitations of our study are discussed and direction for future research is proposed.

Theoretical Background

The most comprehensive and well-researched conceptual model that attempts to explain the home advantage phenomenon was developed by Carron and colleagues. Their model had two iterations. The original framework proposed by Courneya and Carron (1992) incorporated five major components: (1) game location; (2) game location factors; (3) critical psychological states; (4) critical behavioural states; and, (5) performance outcomes.

'Game location' is either home or away depending on where the competition takes place. There are four 'game location factors' that differentially impact on athletes and teams competing at home or away from home, namely: (1) the support of the home crowd; (2) familiarity with the home venue; (3) travel fatigue of the away team; and, (4) competition rules in certain sports that may favour the home team. Courneya and Carron (1992) theorised that these four factors contribute to the 'psychological states' of competitors, coaches and officials that in turn contribute to the 'behavioural states' (responses) of these individuals, which ultimately tend to favour home athletes and teams. In short, different types of 'performance outcomes' are potentially influenced by game location, game location factors, critical psychological states and critical behavioural states.

Courneya and Carron's (1992) model was refined by Carron, Loughhead and Bray (2005). A comparison of the original framework and its revised iteration is shown in Table 1. There are two key differences between the original and revised models. First, 'officials' were excluded from the latter, not because they do not potentially contribute to home advantage but as, unlike competitors and coaches, they do not have a designated home or visitor status.

Second, the revised model incorporated the 'critical physiological states' of competitors and coaches that are associated with game location. The rationale for the inclusion of physiological states in Carron et al.'s (2005) revised home advantage model (see Table 1) was informed by the work of Neave and Wolfson (2003) who proposed that the competitive context of organised sport invokes the natural protective response to territorial intrusion in human beings, combined with the evidence provided by other researchers on the adverse effect of jet lag on athletic performance (Jehue, Street, & Huizenga, 1993; Recht, Lew, & Schwartz, 1995).

<TABLE 1 HERE>

Studies of territoriality in some team sports have shown that testosterone concentrations of players were considerably higher before home games compared with before away games (Neave & Wolfson, 2003; Carré, Muir, Belanger, & Putnam, 2006). Rises in testosterone are thought to benefit athletic performance because they coincide with greater physical aggression and motivation to compete (Wood & Stanton, 2012). In contrast, more recent research involving samples of elite and semi-professional football players found that no significant effects were observed for testosterone responses in relation to home and away venues (Fothergill, Wolfson, & Neave, 2017). Another hormone that changes in response to game location is cortisol (Allen & Jones, 2014) and there is research showing that cortisol levels are elevated prior to competing at home venues (Carré, Muir, Belanger, & Putnam, 2006; Fothergill et al., 2017), which is indicative of a higher level of stress before home games. Feeling stressed or under pressure to perform in front of home fans could in turn have a detrimental effect on athletic performance such that home advantage is diluted or even reversed. This is the premise for another conceptual model, according to which the pressure

of performing in front of a supportive audience can in certain situations trigger a 'choking' response among home athletes and teams, resulting in a home disadvantage. This notion was introduced by Baumeister and Steinhilber (1984). Butler and Baumeister (1998) found that participants in laboratory experiments performed less well when performing for supportive versus unsupportive audiences.

There is also some archival research that supports the purported home choke effect in different sports including baseball and basketball (Baumeister & Steinhilber, 1984), ice hockey (Wright & Voyer, 1995) as well as golf (Wright & Jackson, 1991) and biathlon (Harb-Wu & Krumer, 2017). Wallace, Baumeister and Vohs (2005) contend that the mechanism through which performance pressure induces choking is by changing performers' attentional focus to avoid failure rather than seek success during the most critical moments of sporting contests. It has also been suggested that performers are not aware of the debilitating effects of supportive audiences (Butler & Baumeister, 1998) and that a friendly environment induces individuals to choke when performing skill-based tasks (Harb-Wu & Krumer, 2017). Even though there is some corroborating evidence for the home disadvantage theory, it is clearly not as prevalent in comparison with the home advantage effect.

Empirical Evidence

The academic literature on home advantage in individual sports is sparse (Jones, 2013) and studies concerning home advantage in individual sports are rarely cited, or analysed as a separate category, in previous literature reviews (see Carron, Loughhead, & Bray, 2005; Courneya & Carron, 1992; Nevill & Holder, 1999). The limited research on home advantage in individual sports can be grouped into two broad categories. First, studies that feature sports that are scored objectively where officials are less likely to influence or determine the outcome of sporting contests (e.g. athletics, alpine skiing, tennis and golf). Second, studies

concerning sports that require a certain amount of subjective decision making and scoring by officials (e.g. combat sports and gymnastics). We now consider the empirical evidence relating to the objectively scored and subjectively scored categories in turn below.

Objectively scored sports

The evidence of home advantage in objectively scored sports is inconclusive and has been shown to vary between sports as well as within sports in different competitions. Alpine skiing is one sport where separate studies have found consistent evidence of a home advantage effect in World Cups (Bray & Carron, 1993), the Winter Olympic Games (Balmer, Neville, & Williams, 2001) and the Winter Paralympic Games (Wilson & Ramchandani, 2017b, 2018). Koning (2005) examined elite speed skating data from World Cups, World Championships and the Winter Olympic Games from 1986 to 2003 and found that a competitor skated faster at home than in another country, although the magnitude of the home advantage was very small. Bullock, Hopkins, Martin and Marino (2009) document the existence of a substantial home advantage for women and a trivial home advantage for men in the Winter Olympic sport of skeleton.

Evidence in favour of a statistically significant home advantage effect has also been reported in Olympic archery (Wilson & Ramchandani, 2018) and in Paralympic athletics and table tennis (Wilson & Ramchandani, 2017a, 2018). By contrast, no significant home advantage or disadvantage has been observed in Olympic athletics, cycling, shooting, swimming, table tennis or weightlifting (Balmer et al., 2003; Wilson & Ramchandani, 2018). A similar insignificant effect was found by Wilson and Ramchandani (2017a) in Paralympic archery, cycling, shooting and swimming.

Nevill, Holder, Bardsley, Calvert and Jones (1997) analysed the four tennis 'grand slams' and the four golf 'major' tournaments in 1993 using current world rankings as a control

on player quality. Overall, they found little evidence of home advantage in these sports. The only possible evidence of home advantage occurred in the 1993 Wimbledon tennis tournament and the 1993 US Open golf championships. A subsequent study by Koning (2011) tested for the existence of home advantage in professional tennis and documented that a 'significant and quantitatively important' home advantage effect exists for men but not for women.

In support of Baumeister and Steinhilber's (1984) home disadvantage theory, Wright and Jackson (1991) found that the scores of British players competing in the British Open Golf Championship deteriorated more from the first to the last round than those of players from overseas. More recently, Harb-Wu and Krumer (2017) examined the task of shooting in sprint competitions of professional biathlon events and found that high-profile biathletes miss significantly more shots when competing in front of a supportive audience.

Subjectively scored sports

A number of studies lend support to the notion that home advantage is more prevalent in individual sports that involve subjective decision-making by officials. Previous research on home advantage in the Winter Olympic Games (Balmer et al., 2001) and the Summer Olympic Games (Balmer et al., 2003) has shown that subjectively judged events (figure skating, freestyle skiing, boxing and gymnastics) enjoy significantly greater home advantage than events with little officiating input. Home advantage in subjectively assessed events has also been shown to exist in the Commonwealth Games (Ramchandani & Wilson, 2011, 2012). Furthermore, Balmer, Nevill and Lane (2005) found that in European championship boxing bouts ending in points decisions had a significantly higher proportion of home wins than those decided by a knockout. More recently, Franchini and Takito (2016) provided evidence for the home advantage effect in five combat sports - boxing, fencing, judo,

taekwondo and wrestling - contested during the Summer Olympic Games between 1996 and 2012 for total number of medals, gold and silver medals. They contended that the home crowd support and its effects on refereeing decisions was the main explanation for the home advantage effect in these sports.

Research Questions

The review of the empirical evidence illustrates two key points. First, there is scant home advantage research in relation to individual sports, particularly those that are scored objectively. Second, the limited research that exists provides mixed evidence of the prevalence and size of the home advantage effect in track and field athletics. Home advantage in athletics has been shown to exist in the Paralympic Games (Wilson & Ramchandani, 2017a) but not in the Olympic Games (Balmer et al., 2003; Wilson & Ramchandani, 2018). To date, home advantage in athletics has been examined exclusively in the context of track and field events contested within the Olympic and Paralympic Games. We extend this line of enquiry by investigating the home advantage phenomenon in the specific context of the sport using performance data for nations that have hosted the IAAF World Championships or the IAAF World Indoor Championships. The two research questions (RQs) that our study attempted to address are outlined below.

RQ1: Do nations that have hosted the IAAF World Championships or the IAAF Indoor World Championships experience a home advantage (or disadvantage) effect?

RQ2: Is the size of any observed home advantage (or disadvantage) effect associated with hosting the IAAF World Championships significantly different compared with the IAAF Indoor World Championships, among nations that have hosted both these competitions?

Methods

Research scope and data sources

Our study incorporates 14 editions of IAAF World Championships (held between 1991 and 2017) and 17 editions of the IAAF World Indoor Championships (from 1987 to 2018). The host nations of each competition in this time frame and the number of events contested in each edition are presented in Table 2.

<TABLE 2 HERE>

Some nations have hosted more than one edition of these competitions. Between 1991 and 2017, Japan (1991 and 2007) and Germany (1993 and 2009) hosted the IAAF World Championships twice. The United States (1987 and 2016), Hungary (1989 and 2004) and Great Britain (2003 and 2018) hosted the IAAF World Indoor Championships twice, while Spain (1991, 1995 and 2008) hosted the competition on three separate occasions. As per the data presented in Table 2, the programme of the IAAF World Championships has ranged between 43-48 events, whereas between 24-31 events have been contested in the IAAF World Indoor Championships.

The results of each edition of the two IAAF competitions were sourced from the official IAAF website (<https://www.iaaf.org>). The data was recorded, processed and analysed in SPSS (version 24).

Performance criteria

The IAAF recognises the performance of nations formally in its World Championships and World Indoor Championships in two ways. First, the IAAF produces a 'medal table' in which nations are ranked according to the number of gold medals won, then silver medals won, and

then bronze medals won. Second, the IAAF 'placing table' ranks nations according to the total number of points accumulated by them, by virtue of being in the top eight places in each event. For the purpose of the placing table the IAAF uses the following points system: each gold medal is worth eight points; silver is worth seven; bronze is worth six; fourth place is worth five; fifth place is worth four; sixth place is worth three; seventh place is worth two; and, eighth place is worth one point. Fundamentally this points system is the inverse of the placings such that the difference in the number of points between places is commensurate with the absolute gap between places. For example, the gap between first place and eighth place is exactly equal to the difference between the points allocated to these placings (i.e. a difference of seven places/points).

Based on the criteria used by the IAAF to measure how nations perform in its competitions, we have developed three key performance indicators (KPIs) for the purpose of our study. These KPIs have been standardised to control for fluctuations in the number of events contested (and therefore the number of medals and places on offer) in each edition of the two competitions over time (see Table 2). Given the importance attached to gold medals when ranking nations in the medal table, we first simply calculated the percentage share of gold medals won by all nations in each edition of the IAAF World Championships and the IAAF World Indoor Championships.

The second KPI was medal points' share. This KPI was calculated by converting the number and type of medals won by each nation in a given edition into points (gold = 3, silver = 2 and bronze = 1) and then expressing those points as a proportion of the total number of medal points won by all competing nations in that edition. For example, in the 2015 IAAF World Championships, the host nation China won 1 gold medal (equivalent to 3 points), 7 silver medals (14 points), and 1 bronze medal (1 point). Hence, the total number of medal points won by China at home in 2015 was 18. The total number of medal points awarded in

that edition taking into account the number of events contested and medals awarded to all nations was 287. This means that China's overall home edition medal points' share in 2015 was 6.27%.

Similarly, we also calculated the placing points' share for each nation by dividing their total number of top eight placing points (as per IAAF criteria where a gold medal equals eight points and eighth place equals one point) by the total number of placing points' achieved by all nations. For example, in 2015 China won 94 placing points out of 1,713 at home, equivalent to 5.49%. The process of calculating KPIs to measure the relative performance of nations in sporting competitions is not new. Computing shares of medals or points is regarded by some researchers as a more robust performance indicator relative to conventional measures of success such as the absolute number of medals won, particularly when diagnosing the performance of nations' at different points in time (see De Bosscher, Knop, Bottenburg, Shibli, & Bingham, 2009; Ramchandani & Wilson, 2010, 2011, 2012; Shibli & Bingham, 2008; Truyens, De Bosscher, & Heyndels, 2016; Wilson & Ramchandani, 2017a, 2017b).

Home advantage calculation

The approach used to calculate home advantage in individual sports is fundamentally different to the way in which it is calculated in major team sports, because of the discrepancy between the number of home and away observations. The three KPIs were derived for all nations listed in Table 2 that had hosted the IAAF World Championships or the IAAF World Indoor Championships.

In order to obtain a reliable estimate of home advantage in each competition we compared each nation's home KPIs with its own average KPIs in the editions immediately before hosting (pre-home) and immediately after hosting (post-home). Preliminary analysis

of the data showed that there were no statistically significant differences between host nations' pre-home and post-home performances in both the IAAF competitions and across all KPIs ($p > 0.10$). For example, China's medal points' share in the 2013 (pre-home) and the 2017 (post-home) editions of the IAAF World Championships was 1.77% and 4.84% respectively - an average of 3.31%. Therefore, on this KPI China performed almost three percentage points better at home in 2015 (6.27%) than its average pre/post-home performance (3.31%). A similar approach was used to compute home advantage scores for each host nation for the other KPIs.

In a few instances where there was no valid pre-home or post-home data for host nations in the time frame under review (pre 1991 for Japan and post 2017 for Great Britain in the IAAF World Championships, and pre 1987 and post 2018 for USA in the IAAF World Indoor Championships), only the available away (pre or post) data point was utilised for comparison with their respective home performances in the home advantage calculation. For those nations that hosted the IAAF competitions on more than one occasion in the time frame under review, we computed an average home advantage effect score per nation in each competition. Therefore, we ultimately derived 12 home advantage scores for the IAAF World Championships and 12 home advantage scores the IAAF World Indoor Championships (i.e. one per host nation in each competition).

Analytical approach and statistical tests

Once home advantage values were calculated for each host nation in each competition, a one sample Wilcoxon signed ranked test was used to determine whether there was a genuine difference in nations' performance under host and non-host conditions in the IAAF World Championships and the IAAF World Indoor Championship separately. This analysis was

based on 12 different nations for the IAAF World Championships and 12 different nations that have hosted the IAAF World Indoor Championships.

We then compared the size of the host nation effect between the two IAAF competitions and tested for significant differences using a Wilcoxon signed ranked test for related samples. In order to ensure that a proper assessment of home advantage can be made, this comparative analysis was based on a sub-sample of six nations that have hosted both these IAAF competitions in the time frame under review (Canada, France, Great Britain, Japan, Russia and Spain). Non-parametric statistical tests were preferred owing to the small number of observations and to avoid the influence of outliers.

Results

IAAF World Championships

The differences between the home and away performances for the 12 nations that hosted the IAAF World Championships between 1991 and 2017 are presented in Table 3. Overall in terms of gold medals share, five nations exhibited improved performances at home (positive scores), six others had better performances away from home (negative scores), whereas for one nation no difference between home and away performances were observed. Similarly, for total medals share, four nations performed better when competing on home soil, seven performed better away from home, whereas one had the same level of success at home and away. For both these KPIs, a one-sample Wilcoxon signed rank test confirmed that the observed median difference between home and away scores in our sample was not significantly different from zero ($p > 0.10$).

<TABLE 3 HERE>

For the placing points' share KPI, there was evidence of a close to statistically significant home advantage effect ($p = 0.060$), with nine of the 12 nations performing better when hosting the competition and only three performing better away from home.

IAAF World Indoor Championships

Table 4 shows the differences between the home and away performances for the 12 nations that hosted the IAAF World Indoor Championships between 1987 and 2018. In this competition, six nations were found to perform better at home in terms of gold medals' share, nine performed better at home in terms of total medals' share and all 12 had better home performance in terms of placing points' share. By contrast, only three host nations had negative scores for any of the KPIs (one for gold medals' share and two for total medals' share).

<TABLE 4 HERE>

Evidence of a statistically significant home advantage effect in our sample was found across all three KPIs - gold medals' share ($p = 0.043$), medals points' share ($p = 0.010$) and placing points' share ($p = 0.002$).

Comparative analysis

For the six nations in our sample that had hosted both the IAAF World Championships and the IAAF World Indoor Championships in the time frame under review, Figure 1 provides a comparison of the median home advantage values for each KPI in the two competitions. The observed difference in the size of the home advantage effect between the two competitions was not significant for either gold medals' share or medal points' share ($p > 0.10$), as

determined by a Wilcoxon signed rank test for related samples. However, a statistically significant difference between the IAAF World Championships and IAAF World Indoor Championships did emerge in the case of the placing points' share KPI ($p = 0.046$).

<FIGURE 1 HERE>

Discussion

In comparison with team sports, for which there is a general consensus that teams perform better when competing at home than they do away from home (Pollard & Pollard, 2005), academic literature on home advantage in individual sports is relatively sparse (Jones, 2013). The 'jury is still out' about whether a genuine home advantage exists in the context of events that feature individual sports that are scored objectively. Hence, it is not clear whether the investment required to host major sporting competitions that feature individual sports provides host nations with a return in terms of improved sporting performance. Our study was therefore concerned with investigating the influence of game location on performance in two such competitions featuring track and field athletics, namely the IAAF World Championships and IAAF World Indoor Championships, using three separate KPIs.

Home advantage or disadvantage?

Our first research question (RQ1) was concerned with examining whether nations perform better (or worse) when competing at home in the IAAF World Championships or the IAAF Indoor World Championships. When performance in the IAAF World Championships was measured narrowly in terms of the share of gold medals and medal points no systematic pattern of a home advantage (or disadvantage) effect was evident among the sample of nations included in the study, as illustrated by the data presented in Table 3. This finding

resonates with previous research by Balmer et al. (2003), who reported no evidence of home advantage in track and field athletics events contested in the Summer Olympic Games between 1896 and 1996. Research involving events that feature some other individual sports that are also objectively scored including professional golf and tennis tournaments (Nevill et al., 1997), Olympic cycling, shooting, swimming, table tennis and weightlifting (Balmer et al., 2003; Wilson & Ramchandani, 2018) as well as Paralympic archery, cycling, shooting and swimming (Wilson & Ramchandani, 2017a) has also provided little or no evidence of home advantage.

However, when the definition of performance in our study was broadened to include top eight positions (placing points' share), a close to statistically significant home advantage effect was observed in the IAAF World Championships. Furthermore, in the case of the IAAF World Indoor Championships, we found a consistent and statistically significant home advantage effect for all the KPIs examined (see Table 4). These findings corroborate the evidence from previous studies of selected sports such as elite alpine skiing and speed skating (Bray & Carron, 1993; Balmer et al., 2001; Koning, 2005), Olympic archery (Wilson & Ramchandani, 2018), and Paralympic athletics and table tennis (Wilson & Ramchandani, 2017a, 2018).

In response to our second research question (RQ2), for nations that had hosted both the IAAF World Championships and the IAAF World Indoor Championships we found that there was a statistically significant difference in the sizes of the home advantage effect between the two competitions as far as the placing points' share KPI was concerned, but no such significant effect emerged for the other two performance indicators examined. A key learning point from our study is that the way in which researchers define and measure performance may well have a bearing on the extent to which a home advantage in individual sports that are scored objectively is apparent and also whether the effect differs between

competitions. The IAAF World Championships is a bigger event compared to the IAAF World Indoor Championships not only in terms of the number of events contested, but also in terms of the number of athletes competing and countries represented. It could be that the consistent prevalence of home advantage observed in the case of the IAAF World Indoor Championships across all KPIs is in some way related to the smaller scale and arguably the lower perceived appeal of this competition relative to the IAAF World Championships.

Conceptual models revisited

While our results confirm that home advantage is prevalent in the IAAF World Indoor Championships and tentatively for one KPI in the IAAF World Championships, they do not explain why such an effect is seen to occur. Based on conceptual models of home advantage in sport (Courneya and Carron, 1992; Carron et al. 2005; Neave and Wolfson, 2003), the most likely factors that contribute to the occurrence of home advantage in these competitions in our view include the support of the home crowd, greater familiarity of home athletes with the home environment (e.g. the climate and venues), travel fatigue of the away competitors, coupled with a sense of territoriality (rises in testosterone) among home competitors. Because we did not find any evidence of a significant home disadvantage in either competition, we contend that the theory that performance pressure induces choking in certain situations (Baumeister and Steinhilber, 1984) is not proven to exist in the context of our study.

From a strategic point of view, financial support for elite sport is one of the fundamental 'pillars', which can be influenced by policy, through which international sporting success can be produced (De Bosscher, De Knop, van Bottenburg, & Shibli, 2006). It is plausible that taking a strategic approach to elite sport development by host nations in the build up to the two IAAF competitions may contribute to some of the observed home advantage identified in our study. If this assertion is correct, then it means that home

advantage can be 'managed' to some extent by nations that are awarded the right to host these competitions.

Management implications

Countries that are awarded the right to host high-profile events like the IAAF World Championships and the IAAF World Indoor Championships invest substantial sums of money to secure and stage them. The rationale for these investments are the potential benefits that events of this scale can allegedly deliver for host countries such as economic, urban regeneration, national pride/feel-good factor, increased participation in physical activity and sport, and international prestige and 'soft power' (Grix, Brannagan, Wood, & Wynne, 2017). However, evidence on the extent to which hosting these types of events actually provides such benefits is scarce.

From an elite sport perspective, our study has shown that hosting the IAAF World Indoor Championships does appear to provide a performance boost to host nations through a quantifiable home advantage effect, but there is no conclusive evidence of such an effect existing in the IAAF World Championships. Even in the case of the IAAF World Indoor Championships, there have been a few isolated instances of nations not performing better at home on some performance measures (France, Hungary and Japan - see Table 4).

Host countries should be cognisant of such variations in advance of bidding to host these IAAF competitions, particularly if enhancing performance at home is strategically important to them. Equally, understanding both the scope for enhancing performance through hosting and the performance measures where an elevated level of success at home might be more visible in these competitions is essential for managing the expectations of potential host countries and allows them to set achievable performance targets based on empirical evidence.

Limitations and future research

Our study utilises the IAAF's official points system as the basis for measuring performance in its competitions, which ultimately informs the calculation of home advantage. There is some merit in relying on the points system used by the IAAF, which recognises the importance that it places to performances in its competitions. At the same time, the points' value assigned to performances using this approach is predetermined. In other words, finishing in first place is worth eight points and finishing in eighth place is worth one point regardless of the actual margin (e.g. distance, time etc.) between each position. Therefore, it might be worth developing a more tailored approach to value performances that accounts for the closeness of sporting contests.

Beyond this, there are three main limitations of our study, which also provide potential avenues for researchers to consider in the future. First, we have investigated the home advantage phenomenon at an overall nation level in the two IAAF competitions and our study stopped short of measuring whether this effect was evident in events contested by men and women separately or in track events and field events separately. Variations in the prevalence and size of home advantage between men and women have been shown to exist in some sports (Bullock et al., 2009; Koning, 2011). Therefore, further empirical research is required to understand whether such differences also exist within athletics.

Second, further research is also required to empirically test the relative influence of game location factors such as home crowd support and international travel across time zones as well as elite sport policy factors such as funding contribute to the occurrence of home advantage in athletics. Third, as is the case with most home advantage research, our findings are based entirely on analysis of archival quantitative data. In other words, no contextual or qualitative information was gathered from competitors or coaches to support our conclusions. It is our view that the study of home advantage in athletics, and in sport more generally,

would benefit from undertaking this exercise in order to better understand whether these individuals are cognisant of a home advantage effect (or an away disadvantage) under host and non-host conditions and what they perceive to be the underlying mechanisms.

Conclusion

We found some evidence of home advantage (and no evidence of home disadvantage) in the context of two international competitions that feature track and field athletics. Among the small sub-sample of nations that hosted both competitions, we found some evidence of the size of the home advantage effect between the competitions being quantitatively different.

Disclosure statement

There is no potential conflict of interest.

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Table 1. Home advantage conceptual framework comparison

Component		Original model^a	Revised model^b
Game location	Home	✓	✓
	Away	✓	✓
Game location factors	Crowd	✓	✓
	Learning/Familiarity	✓	✓
	Travel	✓	✓
	Rules	✓	✓
Critical psychological states	Competitors	✓	✓
	Coaches	✓	✓
	Officials	✓	✗
Critical physiological states	Competitors	✗	✓
	Coaches	✗	✓
Critical behavioural states	Competitors	✓	✓
	Coaches	✓	✓
	Officials	✓	✗
Performance outcomes	Primary	✓	✓
	Secondary	✓	✓
	Tertiary	✓	✓

^a Courneya and Carron (1992)

^b Carron et al. (2005)

Table 2. Host nations and number of events contested in the IAAF World Championships 1991-2017 and IAAF World Indoor Championships 1987-2018

World Championships			World Indoor Championships		
Year	Host Nation	Events	Year	Host Nation	Events
1991	Japan	43	1987	United States	24
1993	Germany	44	1989	Hungary	24
1995	Sweden	44	1991	Spain	27
1997	Greece	44	1993	Canada	31
1999	Spain	46	1995	Spain (2)	27
2001	Canada	46	1997	France	28
2003	France	46	1999	Japan	28
2005	Finland	47	2001	Portugal	28
2007	Japan (2)	47	2003	Great Britain	28
2009	Germany (2)	47	2004	Hungary (2)	28
2011	Korea	47	2006	Russia	26
2013	Russia	47	2008	Spain (3)	26
2015	China	47	2010	Qatar	26
2017	Great Britain	48	2012	Turkey	26
			2014	Poland	26
			2016	United States (2)	26
			2018	Great Britain (2)	26

Table 3. Home advantage (positive scores) and disadvantage (negative scores) in the IAAF World Championships (n = 12)

Host	Gold Medals Share	Medal Points Share	Placing Points Share
Canada	-1.09%	-1.44%	-0.54%
China	0.04%	2.97%	1.84%
Finland	-1.06%	-0.18%	0.67%
France	4.39%	3.12%	1.07%
Germany	-2.33%	-1.35%	-0.19%
Great Britain	-4.34%	-1.08%	0.65%
Greece	-2.17%	-1.03%	0.35%
Japan	0.03%	-0.05%	0.31%
Korea	0.00%	0.00%	0.48%
Russia	6.38%	5.13%	3.51%
Spain	3.21%	0.46%	-0.51%
Sweden	-1.14%	-0.57%	0.13%
MEDIAN	-0.53%	-0.11%	0.41%

Table 4. Home advantage (positive scores) and disadvantage (negative scores) in the IAAF World Indoor Championships (n = 12)

Host	Gold Medals Share	Medal Points Share	Placing Points Share
Canada	5.04%	2.78%	2.09%
France	-3.64%	0.25%	0.88%
Great Britain	5.63%	4.93%	3.84%
Hungary	0.00%	-0.17%	0.77%
Japan	0.00%	-0.30%	1.15%
Poland	3.70%	2.83%	4.19%
Portugal	3.57%	2.37%	1.77%
Qatar	0.00%	0.00%	0.11%
Russia	4.95%	5.39%	5.50%
Spain	0.00%	1.06%	2.06%
Turkey	0.00%	1.26%	0.49%
USA	15.99%	7.86%	5.18%
MEDIAN	1.79%	1.81%	1.91%

Figure 1. Median home advantage effect among nations hosting both IAAF competitions
(n=6)

