Original Article

REVISTA BRASILEIRA DE FUTEBOL
The Brazilian Journal of Soccer Science

Home advantage in football in Brazil: differences between teams and the effects of distance traveled

Vantagem em casa no futebol no Brasil: diferenças entre clubes e efeitos de distância de viagem

Pollard R[1], Silva CD[2], Medeiros NC[2]

1- California Polytechnic State University – California/USA

2- Universidade Federal de Viçosa – MG/Brazil

Abstract

Objective: The objective of the study was to quantify home advantage in football in Brazil by focusing on differences between teams, and on the effect of distance traveled.

Sample: The sample data comprised the results of all 2326 games played between teams of the First Division (series A) of the Brazilian national league for the five seasons between 2003 and 2007.

Methods: Home advantage was quantified after controlling for team ability and then compared between teams making use of standard parametric statistical methods. An ordinal logistic regression analysis was used to assess and quantify the effect of distance traveled by the away team on the result of a game.

Results: Paysandu from Belém was found to have the highest home advantage with 75% of its total points being won from home games compared with the league average of 65% ($p < .05$). Mean home advantage for teams from the north, north-east and south of Brazil were higher than from the central region ($p < .05$). Distance traveled by the away team had a small but significant effect on the result of a game ($p < .01$) amounting to an expected .115 of a goal in favor of the home team per 1000km traveled.

Conclusion: It was concluded that team differences in home advantage exist in Brazil with teams in the north and south generally having increased home advantage. Travel effects, and possibly climatic conditions, are plausible explanations that need further research.

Key Words: Home advantage; Soccer; Brazilian Championship; Distance traveled.

Correspondence to:
Richard Pollard
2401 Cloverfield Boulevard
Santa Monica, CA 90405, U.S.A.
Telephone: +1 310 396 6715
E-mail: richwpollard@yahoo.com

Original Article

Resumo

Objetivo: O objetivo desse estudo foi quantificar a vantagem em casa no futebol do Brasil focalizando as diferenças entre times e no efeito de distância viajada.

Amostra: A amostra foi constituída dos resultados de todos os 2326 jogos entre times da primeira divisão (série A) brasileira para as cinco temporadas de 2003 à 2007.

Métodos: A vantagem em casa foi quantificada depois de controlar a habilidade dos times para então compará-los com métodos estatísticos paramétricos. Análise de regressão logística ordinal foi usada para avaliar e quantificar o efeito de distância viajada pelo time visitante no resultado do jogo.

Resultados: Paysandu Sport Clube de Belém demonstrou ter a vantagem em casa mais alta com 75% de aproveitamento de seus pontos totais jogando em casa comparados com a média da liga de 65% ($p < .05$). A vantagem em casa para os times do norte, nordeste e sul do Brasil foram mais alto que da região central ($p < .05$). Distância viajada pelo time visitante teve um efeito pequeno, mas significante no resultado do jogo ($p < .01$) correspondendo a 115 de gol a favor do time da casa para cada 1000km viajados pelo visitante.

Conclusão: Concluí-se que há diferenças de vantagem de casa entre os times no Brasil com times do norte e sul tendo maiores vantagem em casa. Efeitos de viagem, e possivelmente condições climáticas, são plausíveis explicações plausíveis que necessitam ser pesquisados.

Palavras-chave: Vantagem em Casa; Futebol; Campeonato Brasileiro; Distância de viagens.

Introduction

Home advantage has always been known to be an important factor in determining the result of games at football, but it was not until the 1980s that the phenomenon began to be studied in detail[1,2]. Since then home advantage has been much researched by sports scientists and updated reviews of the magnitude and causes of home advantage in football have recently been published[3,4]. Most research has focused on data from the Football League in England, but a study of 72 leagues covering all six continents has established that home advantage exists worldwide[5]. There were, however, some interesting regional variations, with national leagues in the Balkan countries of south-east Europe and the Andean nations of South America having especially high home advantage. These findings were based on the years 1998 – 2003 and found that for the Brazilian national league, 64.4% of all points were gained by the home team. This figure was above the overall average for the national leagues of Europe (61%). Compared with other countries in South America, it was below Bolivia, Peru and Ecuador (all above 70%), but higher than in Argentina, Paraguay and Uruguay (all below 58%). In a more recent study covering the years 2003 – 2007, home advantage in Brazil was found to be 64.9%, very similar to its previous level and significantly higher than in the national leagues of England, Germany, Italy, Portugal and Spain, as well as Argentina[6]. It was also higher than in France, but the difference was not significant. Comparing these results with those found in Pollard's worldwide survey[5], there was evidence of a decline in home advantage for the six major leagues of Europe (on average from 63.6% to 61.2%), but not for Brazil or Argentina, both of which had a small increase. The analysis of long term trends in home advantage in

England has also suggested a general decline[7,8].

Many possible explanations for the existence of home advantage in football have been suggested and it is surprising that no clear conclusions have been reached. The possible causes of home advantage can be classified under the general headings of crowd support, travel fatigue, familiarity, territoriality, referee bias, special tactics and psychological factors. The evidence for and against these causes have been discussed and a model proposed for the way in which they might interact with each other[2,3]. Da Silva and Moreira[6] have reviewed these causes from a Brazilian perspective. Among their conclusions was the suggestion that the effects of travel might be more important in Brazil than in other countries due to its larger size and to differences in climate between the north and the south, especially in the winter months.

Objectives

Against this background, the purpose of the present study was to examine home advantage in Brazil as a function of the distance between the two teams taking part in a game, the hypothesis being that the greater this distance, the greater the advantage derived by the home team. A second related objective was to ascertain if differences in home advantage existed between the teams. In this case, the hypothesis was that games involving teams from the north or south of Brazil would be more affected by travel and climatic factors and that this would be reflected by increased home advantage for these teams. It should be noted that the term 'home advantage' incorporates the combined effects of the advantage obtained by a home team and the disadvantage for the away team.

Methods

Sample

The sample consisted of all games played in the Brazilian National Championship (series A) for the five seasons from 2003 to 2007. For a study of home advantage over a season it is desirable that the league operates under a balanced playing schedule, that is, each team plays each other twice, once at home and once away. Prior to 2003 this was not the case in Brazil, hence the choice of 2003 as the starting point for the study. The data is available at www.soccerway.com, a website which provides the results of each individual game, as well as final tables giving home and away records. This site has been used in previous studies on home advantage in football[5,6].

Comparison of individual teams

Home advantage for individual teams over a season was calculated by expressing the number of points won at home as a percentage of the total number of points gained. For example if a team gained 50 points at home and 30 points away, home advantage would be calculated as 50/ (50 + 30) = .625 = 62.5%. However, this method does not take into account team ability which will affect the calculation of home advantage. This is because the difference in ability between two teams will often outweigh home advantage which will be masked if home advantage is based on points won and hence the result, rather than the score, of the game. For example, a strong team will win most of its games both at home and away and a high home advantage value will be impossible to achieve. Thus in order to compare teams using the above method of calculating home advantage it is necessary to adjust for team ability. In order to do this, the procedure developed in a similar

situation in basketball in Spain was followed[9]. The ability of a particular team was first quantified as the average number of points per game obtained over the whole season. Total points in a season would have been easier to use, but the number of games played each season in Brazil was not the same during the five years of the study. Next, a linear regression analysis was done with home advantage as the dependent variable and ability as the explanatory variable. The home advantage for each team in each season was the observational unit, 110 team-seasons in all. As expected a significant negative linear relationship was found to exist, thus confirming the need to adjust for ability. This was achieved by returning to the linear regression and calculating the residual value for each team each season. This represented the amount by which the team differed from what would be expected of a team of that ability. For example, a value of -3.68 would indicate that home advantage for that team was 3.68 percentage points below the mean for a team of that ability. Finally, to calculate a team's adjusted home advantage, its mean residual value for its seasons in the league between 2003 and 2007 was either added or subtracted from the league overall home advantage figure of 65.24%. To compare individual teams or groups of teams (for example teams in the different regions of Brazil), a standard t-test or one-way analysis of variance was used as appropriate with a Tukey post hoc multiple comparisons test if necessary.

Effect of distance traveled

The purpose of this part of the analysis was to assess the effect of distance traveled on the home advantage in individual games, after allowing for differences in ability between the two teams. Distance traveled was quantified as the distance between the home grounds of the two teams. Difference in ability was expressed as the difference in average points per game for the two teams over the whole season. The statistical analysis followed the procedure adopted in a previous study of home advantage in football in Turkey[10]. An ordinal logistic regression was carried out with the result of each game as the dependent variable (win, draw, lose) and with distance and the difference in team ability as the two explanatory variable. This allowed the effect of distance to be assessed after controlling for difference in team abilities. A total of 2326 games took place during the five years of the study, but two contained missing data and were omitted.

Statistical analysis

The level of significance was set at $p < .05$. The statistical package Minitab 15® (Minitab Inc., State College, PA, USA) was used for all analyses.

Results

Comparison of individual teams

Thirty one different teams participated in the Brazilian National League during the seasons 2003 to 2007. A global one way of analysis of variance established that the mean annual home advantages of these teams were not all the same ($p = .009$). To further investigate these differences, Table 1 shows the adjusted home advantage values for the 22 teams that took part in at least three of the seasons.

When compared with the rest of the teams in Brazil, the home advantage for Paysandu is significantly greater ($p = .042$). This result is consistent with a hypothesis of higher home advantage in the remoter parts of the country. The more general hypothesis that teams in the north and south of the country would have

Table 1. Adjusted home advantage (HA) of teams with three or more seasons in the Brazilian Championship from 2003 – 2007.

Team	Seasons	Adjusted HA
Paysandu/PA	3	74.92%
Atlético/PR	5	69.26%
Juventude/RS	5	68.76%
Grêmio/RS	4	67.87%
Goiás/GO	5	66.83%
Figueirense/SC	5	66.51%
Internacional/RS	5	66.00%
Santos/SP	5	65.87%
Paraná/PR	5	65.77%
Flamengo/RJ	5	65.75%
Botafogo/RJ	4	65.42%
Cruzeiro/MG	5	64.87%
São Paulo/SP	5	64.64%
Vasco/RJ	5	64.62%
Palmeiras/SP	4	64.14%
Coritiba/PR	3	63.83%
Fortaleza/CE	3	62.72%
Fluminense/RJ	5	62.07%
São Caetano/SP	4	61.89%
Ponte Preta/SP	4	61.54%
Corinthians/SP	5	58.36%
Atlético/MG	4	57.49%

increased home advantage was tested by first classifying each team into one of three groups as follows: North group (all teams in the north and north-east region), South group (all teams in the south region), Central (all other teams). For the teams in the study, the states involved were: North (PA, BA, CE, PE, RN), South (PR, RS, SC), Central (DF, GO, MG, RJ, SP). A one way analysis of variance confirmed that the home advantage means of the three groups were not all the same ($p = .018$), with a post hoc comparison of means analysis establishing that both the north and south had significantly greater home advantage than the central region (both $p < .05$), but that they did not differ from each other ($p > .50$). The adjusted home advantage values for the three regions were North (67.86%), South (67.39%), Central (63.54%).

Effect of distance traveled

The results of the ordinal logistic regression showed that, after controlling for difference in team ability, the effect of distance traveled on the result of a game was significant ($p = .007$). For a more specific interpretation of this finding, the analysis was repeated as a multiple regression with difference in goals, rather than the result of the game, as the dependent variable. For example, if the result of the game was 1x3 (an away win), then the value of the dependent variable was 1 – 3 = -2. The coefficient for distance traveled in the resulting regression equation was 0.000115, indicating that for each 1000km of traveling distance, the goal difference was expected to increase by 0.115 of a goal. Thus although the influence of distance was significant, its actual effect was small, a consequence of a calculation from a very large sample (2324 games) only needing a small difference for a result to be statistically significant. Put another way, for the greatest distance traveled between two teams in Brazil (4172km), the effect on the goal difference between the two teams would be expected to be 4172 x 0.000115 = 0.479, or about half a goal.

Discussion

For the five seasons 2003 – 2007 home advantage in Brazil averaged 65%. This is higher than in the major leagues of Europe, although unlike in Europe, it has not declined over the last 15 years. There are several characteristics of Brazil that might contributing to this higher home advantage. One is its larger size and thus possible increased adverse effects of travel for the away team. In addition, the climate of Brazil shows marked contrasts between the hot, tropical north and north-east and the temperate south, especially during the winter months. In order to shed light on these possible influences on home advantage, this study looked at differences in home advantage between teams, between regions within Brazil and also the direct affect on distance traveled on the result of a game.

At the team level, the results clearly suggest that differences in home advantage between the teams do exist. This was established after controlling for the confounding variable of team ability, and carrying out the analyses using the resulting 'adjusted home advantage' figures. After ranking the teams in order of this adjusted home advantage (Table 1), it was seen that Paysandu had by far the greatest home advantage, a finding that was conformed as statistically significant. At 75%, home advantage for Paysandu was fully 10 percentage points above average. Belém, home to Paysandu, is the remotest location of any of the teams in Brazil, being over 1000km from its nearest neighbour, Forteleza. Since it is also a location with an especially hot and humid climate, this result lends support to home advantage being influenced by the effects of travel and/or climatic factors.

One previous study has looked specifically at home advantage in remote locations within individual countries[10]. This was carried out in Turkey and in the countries in the Balkan region of Europe where home advantage in football is unusually high. Several remote locations were identified with teams experiencing high home advantage. These included teams from Van in Turkey, Xanthi in Greece and Korçë in Albania. Tetevo in Macedonia, Smolyan in Bulgaria and the Montenegro region when it was part of Serbia were other examples, but in addition to being remote, these regions have large ethnically distinct populations that could also be contributing to the cause of high home advantage. In England in the 1980s it was found that out of 94 teams, the team with the greatest home advantage, Plymouth Argyle, was also one of the remotest[11].

Although ethnic identity can probably be excluded as a factor in Brazil, in addition to remoteness, climatic conditions could be an alternative explanation for the high home advantage for Paysandu. Belém is the only city represented in the national league with an average daily high temperature of over 30^{O}C throughout the year. This, coupled with high humidity, could certainly have an adverse effect on visiting teams, especially those from the south of Brazil in winter. There are no studies relating home advantage in football to climate. An investigation of the effect of climate on home advantage in rugby football in South Africa found no association[12]. The possible effects of travel and climate on home advantage is further supported by the regional finding that teams in the southern region and in the north and north-east regions of Brazil had mean home advantage figures significantly higher than for teams in the central region.

The southern region has characteristics that distinguish it from elsewhere in Brazil. The dominant climate is subtropical and frosts are frequent. This could give teams in the south an added advantage playing at home, especially during the third of the season which

takes place during the winter months. This would apply especially to the three teams from the southernmost state, Rio Grande do Sul, where the effects of distance traveled and climatic conditions would be most felt by opposing teams. In fact these three teams were among the six teams with the highest home advantage in Brazil (Table 1). Rio Grande do Sul is also a state with its own specific ethnic characteristics, based on the influence of immigrants from Europe and reinforced by its proximity to Uruguay and Argentina with the same influences. These cultural bonds could lead to a strong sense of Gaúcho tradition. Applied to the football field, it could be suggested that the region has developed its own distinctive style which has been reflected in the success of its teams both at a national and continental level. A heightened sense of protecting one's territory is possible for teams in the south and this concept of territoriality has been suggested as a contributing factor to home advantage in football[13]. This, together with physical preparation and specific tactics to confront a hostile climate, coupled with the difficulties that opposing teams might have coping with extra travel and unfamiliar weather, are all plausible reasons why home advantage is higher for teams in the south.

When comparing the home advantage of different teams and regions, use was made of a measure of home advantage which assesses performance at home in comparison with performance away from home; the greater the difference between home and away performance, the greater the measure of home advantage. Thus for Paysandu, the high value for home advantage is due both to the advantage the team derives from playing games in Belém, as well as the disadvantage it experiences when playing away from Belém. Both of these factors might be due to longer travel and/or changes in climatic conditions but at present it is not possible to separate out the contributions of the various factors. Another possible consideration is that Paysandu count on a large following of fans and this could have a significant impact when playing in their cramped stadium Leônidas Castro, known locally as "Curuzu".

The second part of the study involved an analysis of individual games rather than overall home and away records. The purpose was to better assess and to quantify the effects of travel. The results established that distance traveled did have a statistically significant effect on the result of a game after controlling for differences in ability between the teams. However, the effect was not large, amounting to about 0.1 of a goal for each 1000km traveled. Previous studies on travel distance in football have not produced any clear conclusions. In England, Pollard[2] found that for league teams based in London, the distance traveled for games outside London did not have an effect on home advantage. In a more detailed analysis of the results of over 20,000 games in England in the 1980s, Clarke and Norman[11] found a significant relationship between distance traveled and home advantage. In Turkey, a recent analysis also found a significant relationship between the result of games in the Turkish league and the distance between the teams[10]. Since distances in Brazil (maximum over 4000km between teams) are much larger than either in England (maximum about 600km) and Turkey (maximum about 1200km), it is perhaps surprising that a more definite relationship between distance traveled and home advantage could not be established.

This study suggests the need for further research into home advantage in Brazil, the effect of which has been shown to be stronger than in other countries, as well as having interesting regional

variations. Future work can be undertaken not only at the national level, but also making use of data from the many state leagues in Brazil. Although differences between the home advantage of teams can shed light on the many underlying causes of home advantage, we have only attempted to interpret these differences in terms of travel and climatic effects. To date much research worldwide on home advantage in football has raised more questions than answers[14]. There is no shortage of match data from Brazil to design projects that could investigate the hypothesized explanations for home advantage. In addition to travel, these include crowd effects, familiarity with local playing conditions, referee bias, territoriality and little understood psychological effects.

Conclusion

Home advantage in Brazil is currently greater than in the other major national leagues in the world. After controlling for team ability, it is especially high for Paysandu, a team that plays its home games in hot and humid conditions in the comparatively remote northern city of Belém. Home advantage is generally greater for teams playing in the north, north-east and south of Brazil and lower for teams in the central region. This suggests that travel distance and climatic conditions might be contributing factors. An analysis of the results of individual games showed that distance traveled had a small, but significant effect.

Acknowledgments

CAPES

References

1. Dowie J. Why Spain Should Win the World Cup? New Scientist. 1982;94(10):693-95.

2. Pollard R. Home advantage in soccer: a retrospective analysis. J Sports Sci. 1986;4(3):237-48.

3. Pollard R. Home advantage in soccer: variations in its magnitude and a literature review of the inter-related factors associated with its existence. J Sport Behav. 2006;29(2):169-89.

4. Pollard R, Pollard G. Venteja de ser el equipo local en fútbol: una reseña de su existencia y causas. Rev Int Fútbol Ciencia. 2005;3(1): 31-44.

5. Pollard R. Worldwide regional variations in home advantage in association football. J Sports Sci. 2006;24(3):231-40.

6. Silva CD, Moreira DG. A vantagem em casa no futebol: comparação entre o Campeonato Brasileiro e as principais ligas nacionais do mundo. Rev Bras Cineantropom Desempenho Hum. 2008;10(2):184-8.

7. Pollard R, Pollard G. Long-term trends in home advantage in professional team sports in North America and England (1876-2003). J Sports Sci. 2005;23(4):337-50.

8. Jacklin PB. Temporal changes in home advantage in English football since the Second World War: what explains improved away performance? J Sports Sci. 2005;23(7):669-79.

9. Pollard R, Gómez M. Home advantage analysis in different basketball leagues according to team ability. Iberian Congress on Basketball Research; 2007; 4: 61-64.

10. Pollard R, Seckin A. Why is home advantage in South-east Europe the highest in the world? In: Theodorakis Y, Goudas M, Papaioannou A (eds), Book of long papers, 12th European Congress of Sport Psychology; 2007, p.53-56. Halkidiki, Greece: Fepsac.

11. Clarke S, Norman JM. Home ground advantage of individual clubs in English soccer. The Statistician. 1995;44(4):509-21.

12. Pretorius B, Litvine IN, Nevill AM, Pearce MW. The possible effect of climate and altitude on home advantage and game performance of South African rugby teams. S Afr J Res Sport Phys Ed Rec. 2000;22(2):37-48.

13. Neave N, Wolfson S. Testosterone, territoriality, and the 'home advantage'. Physiol Behav. 2003;78(2):269-75.

14. Pollard R. Home advantage in football: a current review of an unsolved puzzle. Open Sports Sci J. 2008; 1: 12-14.