EDUCATION SCIENCE and SPORTS
ISSN:3023-8668

Education Science and Sports
7(1): 41-48, 2025.
doi:10.70053/esas.1641098

ARAŞTIRMA MAKALESİ / *RESEARCH ARTICLE*

The relationship between home advantage and match results: the role of crowd size

Abdullah Yiğit Güngör [1]
[1]*Res. Asst., Atatürk University, Oltu Faculty of Social Sciences and Humanities, Erzurum, Türkiye, E-mail: yigit.gungor@atauni.edu.tr*

Received: 17.02.2025
Accepted: 18.03.2025
Published: 25.03.2025

Keywords

Crowd effect crowd size, home advantage, game location, match result.

Abstract

This study aims to investigate the relationship between home advantage and match results. In line with this purpose; the relationship of crowd size with the number of wins, draws, losses, and goals was examined. Additionally, the mediator role of goals scored was tested for the effect of crowd size on wins to validate the game location framework. The research design of the study is cross-sectional, correlational, and causal among quantitative research designs. First, the relationship between variables was investigated. For this purpose, descriptive statistics and correlation were used. Then, the mediation effect of the number of goals scored was tested via the General Linear Model (GLM). The sample of study includes Premier League (England), La Liga (Spain), Serie A (Italy), Bundesliga (Germany), Ligue 1 (France), Primeira Liga (Portugal), Eredivisie (Netherlands), and Süper Lig (Türkiye) for the season of 2023-2024. Pearson's correlation analysis shows that crowd size has a significant relationship with the number of wins, draws, losses, goals scored, and goals conceded. GLM mediation analysis shows that crowd size increases the number of wins via number of goals scored in partial. This study supports the game location framework in the most valuable soccer leagues in Europe. As a consequence, crowd size is an important determinant of home advantage in soccer that affects the match results.

Ev sahibi avantajı ve maç sonuçları arasındaki ilişki: seyirci büyüklüğünün rolü

Corresponding author

Abdullah Yiğit Güngör
(yigit.gungor@atauni.edu.tr)

Anahtar Kelimeler

Seyirci etkisi, seyirci büyüklüğü, ev sahibi avantajı, maç lokasyonu, maç sonucu.

Özet

Bu çalışma ev sahibi avantajı ile maç sonuçları arasındaki ilişkiyi araştırmayı amaçlamaktadır. Bu amaç doğrultusunda; seyirci büyüklüğünün galibiyet, beraberlik, mağlubiyet ve gol sayıları ile ilişkisi incelenmiştir. Ayrıca, maç lokasyonu çerçevesini doğrulamak için seyirci büyüklüğünün galibiyetler üzerindeki etkisinde atılan gollerin aracılık rolü test edilmiştir. Çalışmanın araştırma tasarımı, nicel araştırma tasarımları arasından kesitsel, ilişkisel ve nedenseldir. İlk olarak, değişkenler arasındaki ilişki araştırılmıştır. Bu amaçla tanımlayıcı istatistikler ve korelasyon kullanılmıştır. Ardından, atılan gol sayısının aracı etkisi Genel Doğrusal Model ile test edilmiştir. Çalışmanın örneklemi 2023-2024 sezonu için Premier Lig (İngiltere), La Liga (İspanya), Serie A (İtalya), Bundesliga (Almanya), Ligue 1 (Fransa), Primeira Liga (Portekiz), Eredivisie (Hollanda) ve Süper Lig (Türkiye) takımlarından oluşmaktadır. Pearson korelasyon analizi, seyirci sayısının galibiyet, beraberlik, mağlubiyet, atılan gol ve yenilen gol sayısı ile anlamlı bir ilişkisi olduğunu göstermektedir. GLM aracılık analizi, seyirci büyüklüğünün kısmi olarak atılan gol sayısı yoluyla galibiyet sayısını artırdığını göstermektedir. Bu çalışma, Avrupa'nın en değerli futbol liglerinde maç lokasyonu çerçevesini desteklemektedir. Sonuç olarak, seyirci büyüklüğü futbolda maç sonuçlarını etkileyen ev sahibi avantajının önemli bir belirleyicisidir.

How to cite: Güngör, A. Y. (2025). The relationship between home advantage and match results: The role of crowd size. *Education, Science and Sport, 7* (1), 41-48.

CC BY 4.0 This is an open access paper distributed under the terms and conditions of the Creative Commons Attribution-NonCommercial 4.0 International License.

INTRODUCTION

Soccer is one of the fastest-growing markets in the world. The total market size of European soccer has reached €39.1 billion in 2024 with a %42 increase from €27.5 billion in 2020 (Deloitte, 2024). Asian and American soccer markets follow Europe with a $9.1 and $8.8 billion market size in 2024. The global market size of soccer is expected to hit over $66 billion by 2029 (Statista, 2024). These stats show the importance of the soccer market.

When the financial share of the soccer market is considered globally, it is ordinary to expect that soccer clubs tend to improve their performance and get higher revenues. In this context, match results play a key role (e.g. Ahola, 2016; Frick and Semmelroth, 2021). One of the main determinants of match results in the literature is home advantage (Pollard, 2008; Schwartz and Barsky, 1977). There is a game location framework in the literature developed by Courneya and Carron (1992) to unveil the process of home advantage. Within this scope, one of the game location factors is the crowd which expresses the spectators watching the competition from the real game area such as stadiums. According to the conceptual framework, the size or density of spectators influences psychological states and then behaviors of the actors (players, coaches, and officials), finally, this process would be determinant for match results.

There are several studies in the literature that investigate the effect of home advantage in soccer. In this context, some studies used the opportunity of the COVID-19 period and compared the ghost games (without stadium spectators) with crowd games (with stadium spectators). During the COVID-19 pandemic, home advantage reduced significantly (e.g. Correia-Oliveira and Andrade-Souza, 2022; Han et al., 2022; Lee et al., 2022; Wang and Quin, 2023). On the other hand, some studies indicated that home advantage decreased for the 1st divisions, while there was not any significant difference for the divisions below 1 (e.g. Fischer and Haucap, 2021; Macedo-Rego, 2022).

Except for the COVID-19 period, studies can also be categorized according to the leagues or competitions they investigated. Within this scope, home advantage is effective in international competitions such as the World Cup and its qualifications (Pollard and Armatas, 2017), the UEFA Champions League (Goumas, 2017), the Europa League (Goumas, 2012), and also in domestic competitions such as Australian (Goumas, 2014), Chinese (Liu et al., 2019), Greek (Armatas and Pollard, 2014), Iranian (Talab and Mehrsafar, 2016), Portuguese (Almeida and Volossovitch, 2017) soccer leagues. Additionally, some studies focused on major soccer leagues in Europe to analyze the effect of home advantage (İnan, 2018), compare them with each other (Leite, 2017), determine the predictors of crowd density as a home advantage factor (Gövdeli and Güngör, 2022).

When the literature is reviewed, it is seen that COVID-19 studies compared the match results of teams according to the presence or absence of spectators. Therefore, most of them used independent samples (e.g. Ghahfarokhi, Soroush and Hasanbeigi, 2022; McCarrick et al., 2021; Tilp and Thaller, 2020). On the other hand, studies conducted before COVID-19 focused on different aspects such as the percentage of points obtained in home games compared to away (Almeida and Volossovitch, 2017; Seçkin and Pollar, 2008), travel distance (Van Damme and Baert, 2019), referee bias (Boyko, Boyko and Boyko, 2007), crowd noise (Unkelbach and Memmert, 2010).

Apart from the studies abovementioned, this study focused on the crowd effect, as one of the home advantage factors, from the perspective of crowd size rather than crowd density (e.g. Errico et al., 2024). Moreover, a club based on seasonal indicators (number of wins, draws, losses, goals scored and conceded) approach was adopted and the most valuable soccer leagues according to Statista (2024) were incorporated. Hence, the distinctness of the study was tried to be enhanced. In light of this information, the research questions of the study were determined as "What is the relationship between crowd size and match results?" and "Does the number of goals scored mediate the effect of crowd size on the number of wins?.

METHOD

Research Model

The research design of the study is cross-sectional, correlational, and causal among quantitative research designs. First, the relationship between variables was investigated in this non-experimental study rather than the causality effect. For this purpose, descriptive statistics and correlation were used. Then, the meditation effect of the number of goals scored was tested as the causal effect. The hypotheses of the study are presented below.

H_1: There is a significant relationship between crowd size and the number of wins.

H_2: There is a significant relationship between crowd size and the number of draws.

H_3: There is a significant relationship between crowd size and the number of losses.

H_4: There is a significant relationship between crowd size and number of goals scored.

H_5: There is a significant relationship between crowd size and number of goals conceded.

H_6: The number of goals scored has a mediation role in the effect of crowd size on number of wins.

Population and Sample

The population of the study is the most valuable soccer leagues according to player value in May of 2024 (Statista, 2024). In this context, the population study includes Premier League (England), La Liga (Spain), Serie A (Italy), Bundesliga (Germany), Ligue 1 (France), EFL Championship (England), Primeira Liga (Portugal), Brasileirão (Brazil), Eredivisie (Netherlands), Süper Lig (Türkiye). The season of 2023-2024 is considered for each league. However, crowd size statistics could not be found for Brasileirão. In addition, the EFL Championship is a 2nd tier for England. Therefore, these two leagues were excluded from the study. Hence, the sample of the study is composed of the remaining 8 leagues as in Table 1 below.

Table 1.
Sample of the study

League	Country	*Number of Clubs*	*Season*
Premier League	England	20	2023-2024
La Liga	Spain	20	2023-2024
Serie A	Italy	20	2023-2024
Bundesliga	Germany	18	2023-2024
Ligue 1	France	20	2023-2024
Primeira Liga	Portugal	18	2023-2024
Eredivisie	Netherlands	18	2023-2024
Süper Lig	Türkiye	20	2023-2024

Data Collection Tools

The study was designed on a club base therefore the variables were seasonal (e.g. Peeters and van Ours, 2021). Within this framework, the variables of study were crowd size, number of wins, draws, losses, goals scored, and goals conceded in home games (see Table 2). For this purpose, each club's crowd size was collected from Transfermarkt (www.transfermarkt.com). The number of wins, draws, losses, goals scored and goals conceded in home games were collected from Sports Reference (fbref.com). In this context, 71.293.271soccer fans watched the games from the stadium, with 1.195wins, 714 draws, and 837 losses taken. In total, 4.425 goals were scored and 3.573 goals were conceded in home games.

Table 2.
Variables of the study

League	Crowd Size	Wins	Draws	Losses	Goals Scored	Goals Conceded
Premier League	14.651.758	175	82	123	684	562
La Liga	11.048.904	167	107	106	564	441
Serie A	11.748.187	159	112	109	545	447
Bundesliga	12.089.058	134	81	91	553	432
Ligue 1	8.187.990	120	81	105	443	383
Primeira Liga	3.707.290	133	75	98	485	392
Eredivisie	5.631.781	134	76	98	552	453
Süper Lig	4.228.303	173	100	107	599	463
Total	**71.293.271**	**1.195**	**714**	**837**	**4.425**	**3.573**

Analysis of the Data

Descriptive analysis among inferential statistics was used in this study to indicate the number of observations, means, and standard deviation. Additionally, Skewness and Kurtosis values were obtained to test the normality of the variables. First, Pearson's correlation analysis was performed to test the first 5 hypotheses of the study. For this purpose, the International Business Machines Statistical Package for Social Sciences (IBM SPSS) version 25 was used. Then General Linear Model (GLM) Mediation Model was performed on the Jamovi program.

FINDINGS

The descriptive of the variables are shown in Table 3 below. The number of observations for each variable is 152. Mean values are 469034,68 for crowd size; 7,86 for the number of wins; 4,70 for the number of draws; 5,51 for the number of losses; 29,11 for the number of goals scored; 23,51 for the number of goals conceded in home games. Skewness and Kurtosis values are between -1,5 and +1,5 which means that the data is distributed normally (Tabachnick and Fidell, 2013).

Table 3.
Descriptive of the variables

Variable	*n*	*M*	*SD*	*Skewness*	*Kurtosis*
Crowd size	152	469034.68	350087.479	.881	.048
Wins	152	7.86	3.745	.509	-.207
Draws	152	4.70	2.097	.168	-.126
Losses	152	5.51	3.045	.342	-.039
Goals scored	152	29.11	10.431	.848	.084
Goals conceded	152	23.51	7.949	.645	1.433

After the normality test was performed, Pearson's correlation analysis was implemented which is one of the parametric tests for correlation analysis (see Table 4). Pearson's correlation analysis shows that crowd size has significant relationships with the number of wins, draws, losses, goals scored, and goals conceded. The relationships of the crowd size with the number of wins and goals scored are positive and strong. Additionally, the relationships with losses and goals conceded are negative and moderate, while it is weak for the number of draws.

Table 4.
Correlation analysis result

Variable	*n*	*1*	*2*	*3*	*4*	*5*	*6*
1. Crowd size	152	-	.556**	-.231**	-.478**	.537**	-.332**
2. Wins	152	.556**	-	-.527**	-.817**	.862**	-.693**
3 .Draws	152	-.231**	-.527**	-	.017	-.443**	.096
4. Losses	152	-.478**	-.817**	.017	-	-.725**	.808**
5. Goals scored	152	.537**	.862**	-.443**	-.725**	-	-.439**
6. Goals conceded	152	-.332**	-.693**	.096	.808**	-.439**	-

GLM mediation analysis was performed to whether the number of goals scored has a mediation role in the effect of crowd size on the number of wins (see Table 5). Results show that the indirect effect is significant ($p < .001$, $\beta = 0.425$) and the confidence interval does not include zero. This supports the number of goals scored partially but significantly mediates the effect of crowd size on the number of wins. In other words, crowd size increases the number of wins via the number of goals scored in partial.

Table 5.
GLM mediation model

Type	Effect	Estimate	*SE*	%95 CI		R^2	β	*p*
				LL	*UL*			
Indirect	Crowd size ⇒ Goals scored ⇒ Wins	4.55e-6	6.09e-7	3.41e-6	5.80e-6	-	0.425	< .001
Component	Crowd size ⇒ Goals scored	1.60e-5	1.98e-6	1.22e-5	2.02e-5	0.288	0.537	< .001
	Goals scored ⇒ Wins	0.284	0.0163	0.252	0.315	0.743	0.792	< .001
Direct	Crowd size ⇒ Wins	1.40e-6	4.65e-7	4.59e-7	2.32e-6	0.309	0.131	0.003
Total	Crowd size ⇒ Wins	5.94e-6	7.24e-7	4.53e-6	7.36e-6	0.755	0.556	< .001

CI = confidence interval, LL = lower limit, UL = upper limit
Note: Confidence intervals computed with method: Bias corrected bootstrap
Note: Betas are completely standardized effect sizes

DISCUSSION and CONCLUSION

This study considered crowd size as one of the home advantage factors. First, its relationship with the number of wins, draws, losses, goals scored and goals conceded were investigated. This means crowd size, number of wins, and goals scored increase together. On the other hand, when crowd size increases, the number of draws, losses, and goals conceded decreases. These relationships are significant and do not refer to causal effects. Second, the effect of crowd size on number of wins was examined. Additionally, the mediation role of goals scored was tested. The findings confirmed the partial mediation role of goals scored for this causal effect.

This study has congruent outcomes with the literature. For instance, studies investigated home advantage during COVID-19 (e.g. Correia-Oliveira and Andrade-Souza, 2022; Han et al., 2022; Lee et al., 2022; Wang and Quin, 2023) found that the effect of home advantage decreased in the ghost games. In parallel with these studies, the current study showed that when the number of spectators declined, home advantage diminished. The only difference between them is that games played without spectators during COVID-19 while in the current study, some games played with a few spectators rather than none. Apart from the COVID-19 period, this study is consistent with previous studies that showed the significance of home advantage on goals scored (e.g. Goumas, 2017; Liu et al., 2019; Talab and Mehrsafar, 2016) and wins (Goumas, 2014; Pollard and Armatas, 2017).

The result of this study supports the game location framework developed by Courneya and Carron (1992). This framework categorized the match outcomes as primary, secondary, and tertiary. Goals scored and goals conceded are secondary outcomes for soccer games. While win, draw, and loss are tertiary outcomes. According to the framework, crowd size is one of the main factors that affect match outcomes. Therefore, this study affirmed this theoretical framework with the most valuable leagues from Europe.

Apart from theoretical contribution, this study also has some practical implications. In this context clubs, fans, and coaches can develop some strategies to benefit from crowd size. For this purpose, clubs can make some promotions to attract more fans to the stadium (Irwin, Sutton and McCarthy, 2008). For instance, different kinds of discounts can be given for specific groups such as women, students, and elders or some additional services can be provided for high-income supporters. In addition to club incentives, directors of the fan base can also carry on some works to raise the awareness of fans regarding the effect of crowd size. Hence, fans would support their teams even in the hard times. Lastly, coaches can work on various strategies to take advantage of home games such as playing more offensive and establishing a bond with spectators to improve their self-identification because some studies (Kämpe and Paulsson, 2024; Kumar, Srivastava, Thanigan, 2025) showed that fans with higher identifications tend to be more active.

This study contains a number of limitations. For instance, the data includes only the season of 2023-2024 and statistics belonging to the teams are seasonal. Only European soccer leagues were incorporated in the study and the away spectators were not considered. Crowd effect was represented via only crowd size. Psychological factors could not integrated into the research model. Within this scope, future studies can use different soccer leagues from various continents and examine more than one season. Primary performance outcomes such as ball possession, dead balls, passes, and so on can be counted. Different mediators such as team strength, and referee behaviour can be tested as well. Similar studies can be conducted for women's soccer leagues or different sports.

Conflict of Interest

The author declared that there is no conflict of interest.

Acknowledgements
"I would like to thank the reviewers for their valuable contributions to the study".

Ethical Statement
This study does not require any ethical concerns.

Financial support
This study has not received any contribution or support from any organisation or person.

References

Ahola, A. (2016). *The effects of* match *results, investor expectations and stock exchange movement for publicly traded football clubs: The case of Manchester United Football Club.* [Bachelor dissertation, Helsinki Metropolia University of Applied Sciences]. Theseus.

Almeida, C. H., & Volossovitch, A. (2017). Home advantage in Portuguese football: Effects of level of competition and mid-term trends. *International Journal of Performance Analysis in Sport, 17*(3), 244-255.

Armatas, V., & Pollard, R. (2014). Home advantage in Greek football. *European Journal of Sport Science, 14*(2), 116-122.

Boyko, R. H., Boyko, A. R., & Boyko, M. G. (2007). Referee bias contributes to home advantage in English Premiership football. *Journal of Sports Sciences, 25*(11), 1185-1194.

Correia-Oliveira, C. R., & Andrade-Souza, V. A. (2022). Home advantage in soccer after the break due to COVID-19 pandemic: does crowd support matter?. *International journal of sport and exercise psychology, 20*(4), 1245-1256.

Deloitte (2024). Annual Review of Football Finance 2024 (published by Deloitte Sports Business Group). 2024 June.

Errico, L., Ferrari, D., Morabito, L., Mosca, A., & Rondinella, S. (2024). Home advantage, crowding, and gender referee: Evidence from major women's leagues. *Journal of Neuroscience, Psychology, and Economics, 17*(3-4), 145.

Fischer, K., & Haucap, J. (2021). Does crowd support drive the home advantage in professional football? Evidence from German ghost games during the COVID-19 pandemic. *Journal of Sports Economics, 22*(8), 982-1008.

Frick, B., & Semmelroth, D. (2021). The effects of (un) expected match outcomes on stock return: A case study of Borussia Dortmund. *International Journal of Sport Finance, 16*(4), 167-183.

Ghahfarokhi, E. A., Soroush, S., & Hasanbeigi, H. (2022). Investigating the home advantage in the world's prestigious football leagues before and after the outbreak of covid-19. *RBFF-Revista Brasileira de Futsal e Futebol, 14*(57), 119-129.

Goumas, C. (2012). Home advantage and referee bias in European football. *European Journal of Sport Science, 14*(1), 243-249.

Goumas, C. (2014). Home advantage in Australian soccer. *Journal of Science and Medicine in Sport, 17*(1), 119-123.

Goumas, C. (2017). Modelling home advantage for individual teams in UEFA Champions League football. *Journal of Sport and Health Science, 6*(3), 321-326.

Gövdeli, T., & Güngör, A. Y. (2022). Predictors of Crowd Effect in Football: Evidence From Five Major Football Leagues of Europe. *Turkish Journal of Sport and Exercise, 24*(1), 30-37.

Han, B., Yang, L., Pan, P., García-de-Alcaraz, A., Yang, C., & Liu, T. (2022). The influence of removing home advantage on the Chinese Football Super League. *BMC Sports Science, Medicine and Rehabilitation, 14*(1), 208.

İnan, T. (2018). Analyzing the home-field advantage in major european football leagues. *Internatıonal Journal of Environmental & Science Education, 13*(2), 113-124.

Irwin, R. L., Sutton, W. A., & McCarthy, L. M. (2008). *Sport promotion and sales management.* USA: Human Kinetics.

Kämpe, T., & Paulsson, A. (2024). The Unbreakable Bond: A Qualitative Study on the Relationship between Football Fans and Their Clubs. [*Master dissertatiton,* Lund University]. Lund University Libraries.

Krumer, A., Shapir, O. M., & Zou, Y. (2024). The size of the crowd and home advantage in football: Evidence from Chinese Super League. *Asian Journal of Sport and Exercise Psychology, 4*(3), 82-87.

Kumar, C., Srivastava, M., & Thanigan, J. (2025). Influence of fan's sports identification on their intention to watch eFootball live-streaming: evidence from football audience. *Managing Sport and Leisure,* 1-23.

Lee, J., Kim, J., Kim, H., & Lee, J. S. (2022). A Bayesian approach to predict football matches with changed home advantage in spectator-free matches after the COVID-19 break. *Entropy, 24*(3), 366.

Leite, W. S. (2017). Home advantage: Comparison between the major European football leagues. Athens *Journal of Sports, 4*(1), 65-74.

Leite, W., & Zanetti, M. C. (2024). Analysis of the longitudinal effect of home advantage in the Brazilian Football Championship–Série A. *Baltic Journal of Health and Physical Activity, 16*(4), 4.

Leitner, M. C., Daumann, F., Follert, F., & Richlan, F. (2023). The cauldron has cooled down: a systematic literature review on home advantage in football during the COVID-19 pandemic from a socio-economic and psychological perspective. *Management Review Quarterly, 73*(2), 605-633.

Liu, T., García-De-Alcaraz, A., Zhang, L., & Zhang, Y. (2019). Exploring home advantage and quality of opposition interactions in the Chinese Football Super League. *International Journal of Performance Analysis in Sport, 19*(3), 289-301.

Lyhagen, J. (2025). The home advantage and COVID-19: the crowd support effect on the english football premier league and the championship. *Computational Statistics,* 1-14.

Macedo-Rego, R. C. (2022). The effect of crowd support: home advantage in football is reduced during the Coronavirus disease (COVID-19) pandemic. *Behaviour, 159*(10), 941-959.

McCarrick, D., Bilalic, M., Neave, N., & Wolfson, S. (2021). Home advantage during the COVID-19 pandemic: Analyses of European football leagues. *Psychology of Sport and Exercise, 56,* 102013.

Peeters, T., & van Ours, J. C. (2021). Seasonal home advantage in English professional football; 1974–2018. *De Economist, 169*(1), 107-126.

Pollard, R. (2008). Home advantage in football: A current review of an unsolved puzzle. *The Open Sports Sciences Journal, 1,* 1-12.

Pollard, R., & Armatas, V. (2017). Factors affecting home advantage in football World Cup qualification. *International Journal of Performance Analysis in Sport, 17*(1-2), 121-135.

Rosseel, Y. (2019). lavaan: An R Package for Structural Equation Modeling. *Journal of Statistical Software, 48*(2), 1-36.

Schwartz, B., & Barsky, S. F. (1977). The home advantage. *Social Forces, 55*(3), 641-661.

Seckin, A., & Pollard, R. (2008). Home advantage in Turkish professional soccer. *Perceptual and Motor Skills, 107*(1), 51-54.

Tabachnick, B. G., & Fidell, L. S., (2013). *Using multivariate statistics.* Boston, MA: Pearson.

Talab, R. H., & Mehrsafar, A. H. (2016). An analysis of home advantage in Iranian football super league. *International Journal of Sport Exercise and Training Sciences-IJSETS, 2*(4), 137-144.

Tilp, M., & Thaller, S. (2020). Covid-19 has turned home advantage into home disadvantage in the German Soccer Bundesliga. *Frontiers in Sports and Active Living, 2*, 593499.

Unkelbach, C., & Memmert, D. (2010). Crowd noise as a cue in referee decisions contributes to the home advantage. *Journal of Sport and Exercise Psychology, 32*(4), 483-498.

Van Damme, N., & Baert, S. (2019). Home advantage in European international soccer: Which dimension of distance matters?. *Economics, 13*(1), 20190050.

Electronic references

Gallucci, M. (2020). jAMM: jamovi Advanced Mediation Models. [jamovi module]. Retrieved from https://jamovi-amm.github.io/.

IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.

R Core Team (2021). R: A Language and environment for statistical computing. (Version 4.0) [Computer software]. Retrieved from https://cran.r-project.org. (R packages retrieved from MRAN snapshot 2021-04-01).

Soetaert, K. (2019). diagram: Functions for Visualising Simple Graphs (Networks), Plotting Flow Diagrams. [R package]. Retrieved from https://cran.r-project.org/package=diagram.

Sports Reference (2025). Retrieved from https://fbref.com/en/

Statista (2024). Leading soccer leagues worldwide 2024, by combined player value (published by Statista Research Department). 2024 May 23.

The jamovi project (2021). Jamovi. (Version 2.2) [Computer Software]. Retrieved from https://www.jamovi.org.