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|  | Covid-19 Natural Experiment | Country aggregate | Crowd Occupancy | Referee Bias | Crowd size | Team Age | Share of Foreigners | Study Conclusions |
| Boyko, Boyko, & Boyko (2007) | 🗶 | 🗶 | ✓ | ✓ | ✓ | 🗶 | 🗶 | Indivdual referees give significant different responses to crowd noise and have significant different levels of home team bias. |
| Carron & Agnew (1994) | 🗶 | 🗶 | ✓ | ✓ | ✓ | 🗶 | 🗶 | There is a positive relationship with crowd density and home advantage. But the explanatory power of crowd support effects is rather low |
| Courneya & Carron (1992) | 🗶 | ✓ | 🗶 | 🗶 | ✓ | 🗶 | 🗶 | Crowd size is a significant predictor of home advantage |
| Endrich& Gesche (2020) | ✓ | 🗶 | ✓ | ✓ | 🗶 | 🗶 | 🗶 | There is a significant change in punishment for away teams in the situation of “ghost games”. |
| Fischer & Haucap (2020) | ✓ | 🗶 | ✓ | ✓ | ✓ | 🗶 | 🗶 | Crowd occupancy is the main driver of differences in home advantage pre and post covid-19. Referee bias and absolute crowd size appear less important. |
| Mccarick et al(2020) | ✓ | ✓ | ✓ | ✓ | 🗶 | 🗶 | 🗶 | Home advantage decreased significantly after covid-19, points and goals for home teams decreased. Also referee issued significantly fewer sanctions against away teams. |
| Nevill & Holder  (1999) | 🗶 | 🗶 | 🗶 | ✓ | ✓ | 🗶 | 🗶 | Referee bias is the most important component of crowd support effect on team performance |
| Pollard (2006) | 🗶 | ✓ | 🗶 | ✓ | ✓ | 🗶 | 🗶 | Home advantage is a result of many different factors all interacting with each-other. With differeng levels across countries and sports. |
| Pollard (2008) | 🗶 | ✓ | 🗶 | ✓ | ✓ | 🗶 | 🗶 | Home advantage is a result of many different factors all interacting with each-other. |
| Ponzo & Scoppa (2018) | 🗶 | 🗶 | 🗶 | ✓ | 🗶 | 🗶 | 🗶 | Home advantage still persists in derby matches, where familiarity and travel factors are mitigated. Supporting the notion of crowd support influencing home advantage. |
| Schwartz & Barsky (1977) | 🗶 | ✓ | ✓ | 🗶 | ✓ | 🗶 | 🗶 | Home advantage primarily sterns from crowd support. With stronger crowd support(occupancy/size) increasing home advantage |
| Van der Ven (2016) | 🗶 | 🗶 | 🗶 | 🗶 | 🗶 | ✓ | 🗶 | Teams with a higher average age perform better in Away games |
| Tilp & Thaller (2020) | ✓ | 🗶 | 🗶 | ✓ | 🗶 | 🗶 | 🗶 | Covid has turned home advantage into a home disadvantage in case of “ghost games” |
| THIS PAPER | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |  |

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|  | **Mean** | **SD** | **Min** | **Pctl(25)** | **Median** | **Pctl(75)** | **Max** | **N** |
| **Dependent variables** | | | | | | | | |
| Goal Difference | 0.292 | 1.846 | -13.00 | -1.00 | 0.00 | -1.00 | 10.00 | 8,137 |
| Points Difference | 0.365 | 2.571 | -3.00 | -3.00 | 0 | 3 | 3 | 8,137 |
| **Moderators** | | | | | | | | |
| Foreigners Share Difference | 0.001 | 0.213 | -0.752 | -0.139 | -0.001 | 0.139 | 0.752 | 8,137 |
| Age Difference | 0.001 | 1.573 | -5.00 | -1.100 | 0.00 | 1.10 | 5.00 | 8,137 |
| Occupancy Rate | 0.713 | 0.227 | 0.00 | 0.558 | 0.763 | 0.911 | 1 | 8,137 |
| Average Attendance(1000’s) | 24.18 | 18.03 | 0.00 | 10.51 | 19.23 | 35.19 | 81.17 | 8,137 |
| **Mediators** | | | | | | | | |
| Foul Difference | 0.108 | 5.243 | -18.00 | -3.00 | 0.00 | 4.00 | 24.00 | 8,137 |
| Yellow Card Difference | 0.185 | 1.747 | -7.00 | -1.0 | 0.00 | 1.00 | 7.00 | 8,137 |
| Red Card Difference | 0.026 | 0.456 | -3.00 | 0.00 | 0.00 | 0.00 | 3.00 | 8,137 |
| **Control Variables** | | | | | | | | |
| Rating Difference | 0.101 | 15.63 | -58.31 | -9.64 | 0.24 | 9.80 | 62.27 | 8,137 |
| Importance Difference | 1.095 | 32.10 | -100 | -16.78 | 0.10 | 19.48 | 100 | 8,054 |

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| Variable | Operationalization | Source |
| **Dependent variables** |  |  |
| Points Difference | Number of points home team minus number of points away team | Football-data.co.uk |
| Goal difference | Number of goals home team minus number of goals away team | Football-data.co.uk |
| **Moderators** | | |
| Foreigner share difference | Share of foreigners home team minus share of foreigners away team | Transfermarkt.com |
| Age difference | Average age home team minus average age away team | Transfermarkt.com |
| Occupancy rate | Average attendance/stadium capacity | Transfermarkt.com |
| AverageAttendance | Average attendance over season/1000 | Transfermarkt.com |
| **Mediators** | | |
| Yellow card difference | Number of yellow cards away team minus number of yellow cards home team | Football-data.co.uk |
| Foul difference | Number of fouls away team minus number of fouls home team | Football-data.co.uk |
| Red card difference | Number of red cards away team minus number of red cards home team | Football-data.co.uk |
| **Independent variables** | | |
| Covid | 1 = post-covid 0 = pre covid |  |
| **Control variables** | | |
| Rating difference | Home team SPI rating minus away team SPI rating | Projects.fivethirtyeight.com |
| Importance difference | Home team match importance minus away team match importance | Projects.fivethirtyeight.com |
| VAR | 1 if VAR technology available 0 if not | Projects.fivethirtyeight.com |
| Shots Difference | Number of shots home team minus number of shots away team | Football-data.co.uk |
| League | Dummy for each league in the dataset | Football-data.co.uk |

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|  | **Pre-Covid** | **Post-Covid** | **Statistic** | **P-value** |
| Goal Difference | 0.36 | 0.17 | 0.5300 | *p* <.001 \* \* \* |
| Expected goals difference | 0.31 | 0.16 | 0.5364 | *p* <.001 \* \* \* |
| Yellow Card Difference | 0.30 | -0.01 | 0.5518 | *p* <.001 \* \* \* |
| Red Card Difference | 0.03 | 0.01 | 0.5113 | *p* <.001 \* \* \* |
| Foul Difference | 0.29 | -0.21 | 0.5258 | *p* <.001 \* \* \* |

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|  | **Pre-Covid** | **Post-Covid** | **Test Statistic** | **P value** |
| Percentage points Home | 0.58 | 0.53 | 0.5282 | *p* <.001 \* \* \* |
| Points Home | 1.61 | 1.47 | 0.5282 | *p* <.001 \* \* \* |
| Home Goals | 1.58 | 1.47 | 0.5244 | *p* <.001 \* \* \* |
| Percentage home Wins | 0.45 | 0.40 | 74.252^ | *p* <.001 \* \* \* |
| Expected goals Home | 1.57 | 1.46 | 0.5406 | *p* <.001 \* \* \* |
| Home Shots | 13.34 | 12.26 | 0.5605 | *p* <.001 \* \* \* |
| Home Shots on Target | 4.63 | 5.06 | 0.5462 | *p* <.001 \* \* \* |
| Percentage points Away | 0.42 | 0.47 | 0.4718 | *p*  <.001 \* \* \* |
| Points Away | 1.14 | 1.27 | 0.4718 | *p*  <.001 \* \* \* |
| Away Goals | 1.22 | 1.30 | 0.4791 | *p*  <.001 \* \* \* |
| Percentage Away wins | 0.30 | 0.34 | 74.252^ | *p* <.001 \* \* \* |
| Expected goals Away | 1.25 | 1.30 | 0.4846 | *p*  = 0.043\* |
| Away Shots | 10.78 | 10.92 | 0.4918 | *p* = 0.2156 |
| Away Shots on Target | 4.10 | 4.10 | 0.5016 | *p* = 0.8079 |

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|  | **Pre-Covid** | **Post-Covid** | **Test Statistic** | **P value** |
| Yellow Card Home | 1.96 | 2.00 | 0.4915 | *p* = 0.1898 | |
| Red Card Home | 0.09 | 0.10 | 0.4977 | *p* = 0.4763 | |
| Fouls Home | 12.87 | 13.14 | 0.4802 | *p* = 0.003\* \* | |
| Yellow Card Away | 2.26 | 1.98 | 0.5542 | *p* <.001 \* \* \* | |
| Red Card Away | 0.12 | 0.11 | 0.5098 | *p* <.001 \* \* \* | |
| Fouls Away | 13.16 | 12.93 | 0.5128 | *p* = 0.053 | |

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|  | **Actual fit** | **Good fit** | **Pass test** |
| (Chi-square) | .000 | >.05 | No |
| RMSEA | .033 | < .080 | Yes |
| SRMR | .013 | < .080 | Yes |
| CFI | .942 | > .900 | Yes |
| TLI | .876 | > .950 | No |

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| --- | --- | --- | --- |
|  | **Actual fit** | **Good fit** | **Pass test** |
| (Chi-square) | .000 | >,05 | No |
| RMSEA | .033 | <.080 | Yes |
| SRMR | .013 | <.080 | Yes |
| CFI | .931 | >.900 | Yes |
| TLI | .852 | >.950 | No |

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|  | Hypothesis | Accept | Findings |
| Hypothesis 1 | Crowd support positively influences Home Team Performance. | ✓ | The points gap decreased by .538 and the goals gap decreased by .356 because of the absent crowd support. |
| Hypothesis 1b | The effect of crowd support on team performance increases when crowd size increases. | 🗶 | Crowd size does not significantly alter the influence of crowd support on team performance (*β* =.041 , *p* =.538 ) |
| Hypothesis 1c | The effect of crowd support on team performance increases when Stadium occupancy increases. | ✓ | The points gap without crowd support is .398 lower and the goals gap is .317 lower for teams with high occupancy levels compared to teams with low occupancy levels |
| Hypothesis 1d | The effect of crowd support on team performance is weaker for teams with older players. | 🗶 | Player age does not significantly alter the influence of crowd support on team performance (*β* = -.077, *p* = .162) |
| Hypothesis 1e | The effect of crowd support on team performance is weakened when the share of foreigners increases. | 🗶 | The amount of playing time for foreigners does not significantly alter the influence of crowd support on team performance (  *β*= -008, p = .882 ) |
| Hypothesis 2 | The effect of crowd support on team performance is mediated by Referee Bias. | ✓ | The effect of crowd support on team performance is mediated by referee bias, with a 1 unit increase in referee bias decreasing points gap by .023 |
| Hypothesis 2b | The mediating effect of referee Bias on the relationship between crowd support and team performance increases when Stadium Occupancy increases | 🗶 | The occupancy rate does not significantly alter the influence of crowd support on referee bias(*β* = .001 , *p* = .796 ) |
| Hypothesis 2c | The mediating effect of referee Bias on the relationship between crowd support and team performance increases when average Crowd Size increases. | 🗶 | Crowd size does not significantly alter the influence of crowd support on referee bias(  *β* =-.001 , *p* = .570 ) |
| Hypothesis 2d | The mediating effect of referee Bias on the relationship between crowd support and team performance decreases when the share of foreigners increases. | 🗶 | The amount of playing time for foreigners does not significantly alter the influence of crowd support on referee bias(*β* =-.001 ,  *p* = .680) |

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|  | **Points Difference** | **Goal Difference** |
| Total effect Low Occupancy | **-.339\*\***  **(.112)** | **-.197\*\***  **(.082)** |
| Total effect mean Occupancy | **-.538\*\*\***  **(.112)** | **-.356\*\*\***  **(.083)** |
| Total Effect High Occupancy | **-.737\*\*\***  **(.147)** | **-.514\*\*\***  **(.107)** |