



Who chokes on a penalty kick? Social environment and individual performance during Covid-19 times[☆]

Massimiliano Ferraresi, Gianluca Gucciardi^{*}

European Commission, Joint Research Centre (JRC), Ispra, Italy



ARTICLE INFO

Article history:

Received 29 January 2021
 Received in revised form 13 April 2021
 Accepted 15 April 2021
 Available online 20 April 2021

JEL classification:

J24
 D03
 M54
 Z13

Keywords:

Social pressure
 Choking
 Covid-19
 Natural experiment
 Football

ABSTRACT

We use hand-collected data on penalty kicks in the top-level football competitions across France, Germany, Italy, Spain, and the United Kingdom over the 2019/2020 season to analyse how social environment affects the performance of individuals. We exploit the Covid-19 outbreak to induce a plausible source of variation in the supporters' attendance. We find that for home teams the probability of missing a penalty increases when matches are forced to be played behind closed doors, while visiting teams are less likely to choke on a penalty kick, with these effects being more pronounced when the level of attendance (measured before the pandemic) was high. Taken together, these findings indicate that not only a supportive audience, but also the size of the support plays a key role for success of skill tasks.

© 2021 The Author(s). Published by Elsevier B.V. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

1. Introduction

There are many examples of professions in which individuals have to perform in front of an audience, and it is quite intuitive to believe that performing in front of a supportive crowd increases motivation, and thus enhances performance (DeVaro, 2006). Nevertheless, while an audience might increase a performer's will to succeed, the fear of not meeting expectations might conversely become dominant. In this case, it is likely that the higher level of pressure induced by a friendly audience is associated with low performance, leading to the so-called 'choking under pressure' effect. The key question is therefore which of the two prevails. The evidence is mixed. On the one hand, Apesteguia and Palacios-Huerta (2010) and Dohmen (2008), among others, support the theory of choking in football competition. On the other hand, Braga and Guillén (2012) find no effect of pressure on performance by relying on data from the Brazilian Soccer Championships in 2006.

[☆] We thank the editor, Joseph E. Harrington, and one anonymous referee for suggestions that significantly improved the paper. The scientific output expressed does not imply a policy position of the European Commission. Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use which might be made of this publication.

^{*} Corresponding author.

E-mail addresses: massimiliano.ferraresi@ec.europa.eu (M. Ferraresi), gianluca.gucciardi@ec.europa.eu (G. Gucciardi).

Although these studies point to test the social support against the choking hypothesis, evidence of a causal relationship in real tournament settings is quite scarce (Böheim et al., 2019; Harb-Wu and Krumer, 2019). Therefore, they call for more causal evidence in different environments, which may shed additional light on the relationship between a supportive audience and absolute performance.

We complement the existing literature on the social support vs the choking under pressure effect by employing a novel identification strategy on a sample of teams from the major European football leagues, which allows a credible and reliable causal effect to be estimated.¹ Specifically, we rely on hand-collected information on all penalty kicks in the top-level football competitions across France (Ligue 1), Germany (Bundesliga), Italy (Serie A), Spain (Liga), and the United Kingdom (Premier League) over the 2019/2020 season to study whether and to what extent supporters influence the individual performance. To do so, we take advantage of an unusual opportunity provided by the Covid-19 lockdown, which forced all matches to take place behind

¹ While there is a growing literature exploiting the closed doors effects in football induced by the Covid-19 pandemic on several outcomes, and on leagues in multiple countries, all these papers are focused on the 'home advantage' rather than on the 'choking' effect (see among others Bryson et al., 2020; Endrich and Gesche, 2020; Ferraresi and Gucciardi, 2020; Reade et al., 2020; Scoppa, 2021).

closed doors. Such an exogenous change allows us to compare the probability of failing to score on a penalty kick by teams playing at home and teams competing away before Covid-19, when supporters could attend any match, with the same difference after the lockdown, when all matches took place behind closed doors.

The evidence suggests that the social environment has an impact on the performance of individuals. In particular, we find that before the lockdown, for high level of attendance, players of the home team are positively affected by public expectations, while players of the away team are more likely to choke. Conversely, after the lockdown – when playing behind closed doors – the probability a player misses a penalty kick is higher for home as compared to away teams, but only for high levels of pre-Covid stadium attendance.

The remainder of this work is structured as follows. Section 2 describes the institutional context and illustrates the data. Section 3 develops the empirical framework, while Section 4 discussed the results. The last Section summarises and concludes.

2. Football setting and data

We engaged an extensive hand-collection of penalty kicks awarded to home and visit teams (and the scored ones) in the main five leagues of Europe (France, Germany, Italy, Spain, and the United Kingdom) for the 2019/2020 season. To gather this data by single match and team, we leveraged on the website *Whoscored.com*. We used the same source to control for the defensive attitude of opponent teams causing the penalty by hand-collecting information on tackles by match and team. Lastly, we also collected team-level data on the average stadium attendance for the matches played with open doors in the same season from *Transfermarkt.com*.² The final sample is thus composed by 545 penalty kicks observations (295 awarded to home teams), of which 148 are related to games played behind closed doors (27%).³

As our main variable of interest, similarly to [Dohmen \(2008\)](#), we adopt the probability that a player misses a penalty kick, which is a dummy variable that takes on the value of one if the penalty is missed, and zero otherwise.

[Fig. 1](#) plots the relationship between our outcome variable and the attendance size, before the lockdown. As for the home team (Panel A), it turns out that the probability of missing a penalty decreases as the size of the attendance increases. On the contrary, the performance of away teams is negatively affected by the crowd, as the probability of missing a penalty increases with the size of a (hostile) audience (Panel B).

What [Fig. 1](#) seems to indicate is that – under regular circumstances – players are more likely to choke on a penalty kick when they play away, while home teams are positively influenced by the encouragement expressed by a friendly audience.

However, how does this attitude change when players are forced to kick the penalties in empty stadiums? Intuition based on

[Fig. 1](#) would suggest that, if the social support hypothesis holds, we should expect home teams have a lower scoring rate than the visiting teams when performing in front of a neutral one (that is, when playing at home behind closed doors, after the Covid-19 outbreak). In addition, this effect should be more pronounced when the audience size is high, as the supporters of the home teams typically represent the larger fraction of the crowd and can thus express their support more strongly. The opposite should hold for away teams.

3. Empirical strategy

Since we are interested in analysing the role of supporters in explaining the player's performance at the time when the penalty kick is taken, we exploit the staggered time in the countries' decision to permit football events to take place behind closed doors. This exogenous change allows us to compare the probability of missing a penalty for a given level of attendance before the pandemic, when supporters could attend any match, with the same probability after the Covid-19 outbreak, when football matches took place behind closed doors.

The model estimated is the following:

$$Y_{ir} = \alpha + \gamma \text{Closed-doors}_{ir} + \lambda \text{Closed-doors}_{ir} \times \text{Audience}_{ir} + f_t + u_t, \quad (1)$$

where Y_{ir} is the outcome variable which equals 1 if the observed penalty i in round r is an unsuccessful attempt and zero otherwise; Closed-doors_{ir} is a binary variable that is equal to one for penalties that were kicked behind closed doors, and zero otherwise; Audience_{ir} is the (average) number of spectators in the stadium where the penalty kick is taken; f_t are team fixed effects that control for unobserved heterogeneity in the capacity of success in the score of a penalty, such as the quality of the penalty kicker chosen by the team; and u_t is the error term, clustered at the team level.⁴

It is important to note at the outset that in this framework, the estimated impact is measured by $\gamma + \lambda \text{Audience}_{ir}$, which varies according to the size of audience. More precisely, it accounts for the differential effect of playing behind closed doors in stadiums that, before the lockdown, used to have a given size of attendance. In practice, within a team, we compare the probability of missing a penalty in a situation where the player kicks the penalty in a crowded stadium, say, of 75,000 supporters, to the situation in which the penalty kick is taken in the same stadium (or in a similar one in terms of size), but when it is empty.⁵

A few more empirical choices merit further explanation. First, the absence of the crowd might have had an impact not only on players' performance, but also on the referee's decisions ([Scoppa, 2021](#)). Within this framework, were the rate of penalty kicks awarded affected by the change of the behaviour of the referee (because of the absence of the crowd), any comparison of penalty kicks between home and away teams before (with supporters)

⁴ While in principle the penalty kicker might change from match to match, it is reasonable to assume that he does not vary within team, as he is usually chosen at the beginning of the season. Were this the case, the inclusion of team fixed effects should account for it. Instead, in the case the penalty kicker had to change from match to match, for instance due to injuries or to penalties awarded after the substitution of the selected penalty-kicker, in another set of regressions we further include round fixed effects that should mitigate such a concern.

⁵ The most suitable way to conduct the analysis would be to compare the probability of missing a penalty taking in the same fixture pre (open-doors) and post (closed-doors) pandemic. This approach would reduce the sample size of around 35%. Nevertheless, in the spirit of reinforcing our analysis, we replicate our results by relying only on teams for which one penalty is kicked in the pre-pandemic scenario and the other in the post pandemic one in the same pitch. Results are shown in Tables A5 of the Online Appendix and, reassuringly, confirm our main findings.

² Summary statistics are shown in Table A1 of the Online Appendix.

³ Since the spread of Covid-19, many matches have been rescheduled. The French leagues resumed on April 28th 2020. Conversely, the Spanish league was suspended at the 27th round (in March), resumed in June, and eventually concluded in July. Analogously, after it was suspended in the 26th round, the German league resumed in May and ended at the end of June. In Italy, four matches of the 25th round taking place in February were postponed for reasons unrelated to Covid-19 and were played right after the league resumed. Based on a last-minute decision, many matches of the 26th round were played behind closed doors. The competition was then interrupted, resumed in June, and was completed at the beginning of August. Finally, the UK Premier League was stopped after the 29th round and resumed in mid-June, running until late July. At the same time, a few (3) matches of the 28th round were postponed due to reasons unrelated to Covid, and were the first ones played after the re-opening in June.

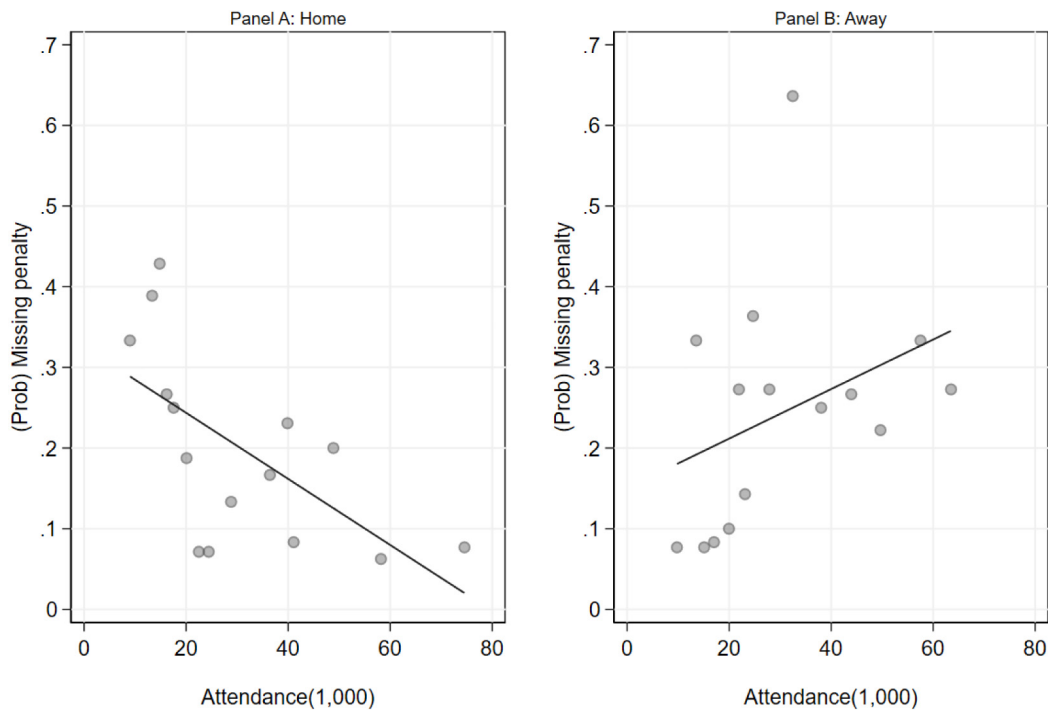


Fig. 1. Binned scatter plot of the probability of missing a penalty and (average) size attendance (before the lockdown – open doors). **Note:** each dot represents the average value of the probability of missing penalty by equally-sized bins (15 bins) based on stadium attendance.

and after the lockdown (without supporters) would be leading to biased results. Therefore, we test whether the rate of penalty kicks was different between home and away status behind open and closed doors, by comparing the (average) difference in the number of penalties awarded to home and away teams, before and after the closure of the stadiums. The result of this analysis is reported in Table A2 of the Online Appendix and, reassuringly, indicates that coefficients of the differences are not statistically significant, thus suggesting that the allocation of penalty kicks to home/away teams has not been significantly affected by crowd absence. Second, it shall be noted that a penalty kick could be missed either by the kicker *strictu sensu* (i.e., shot out of the target or hitting the post) – thus implying his mistake – or saved by the goalkeeper, instead (partially) exonerating the kicker by his faults. In order to rule out the possibility that the impact on missing penalties in the absence of supportive crowd is due to the goalkeepers' savings, rather than a mistake of the kicker, we have collected information on the missed penalty kicks.⁶ Then, we compare the difference in the number of saved penalties by home and away teams, before and after the stadiums' doors were closed. Were the number of saved penalties increasing across home and away teams before and after the closure of stadiums, we would conclude that the absence of the crowd has also had a positive impact on the goalkeepers' performances. Results are reported in Table A3 of the Online Appendix and show that the goalkeepers seem to have not been affected by the absence of the crowd, as the difference of the average (savings) between home and away teams is statistically insignificant with open doors, as well as the same difference turns out to be not statistically significant with closed-doors, and thus leading to a difference-in-differences coefficient indistinguishable from zero.

⁶ Out of 545 penalty kicks awarded during the 2019/2020 season, 119 were missed. Among these 119, the majority (92) was saved, and the rest (27) was kicked out of the target or on the post.

4. Results

Findings are shown in Table A4, columns 1 through 6. To help interpretation of the results, we also report estimates in Fig. 2. In particular, in Panel A we use the estimated coefficients of Eq. (1) to compute the combination of $\gamma + \lambda Audience_{it}$ for the sample of home teams, and then plot the relative coefficients (and their 90% confidence interval). In panel B, we replicate the same approach for the sample of visiting teams.⁷

As for home teams (Panel A), it turns out that the probability of missing a penalty increases when playing behind closed doors as compared to playing in front of a supportive audience, and such an effect is more pronounced as the size of the attendance increases. To see this, consider a level of attendance which, before the pandemic, was equal to 45,000. Then, the probability for the home team to miss a penalty after the lockdown – when playing behind closed doors – remains unchanged as compared to before ($-0.2836 + 0.0064 \times 45 = 0.0044$ an estimation that is not statistically significant). Take now a high level of attendance (say 75,000). In this case, kicking a penalty without being supported by the crowd implies an increase of the probability of missing it of approximately 20% ($-0.2836 + 0.0064 \times 75 = 0.1964$ an estimation that is statistically significant at 5% level).

Let us now consider away teams. According to the figure depicted in Panel B, it emerges that players choke less in the absence of (non-supportive) crowd, with this effect being more marked for higher levels of audience. As before, if the penalty is kicked in a stadium that, before the Covid-19 outbreak, was not so crowded (45,000 spectators), the probability of the away team to miss it is not significantly affected by playing without audience, as the estimation of Eq. (1) leads to an estimate that is not statistically significant. Conversely, when the penalty is kicked in a stadium that is very crowded under regular circumstances, the probability of failure decreases of about 21% once matches are forced to be

⁷ In particular, we use coefficients shown in Cols. (2) and (4) of Tables A4 of the Online Appendix.

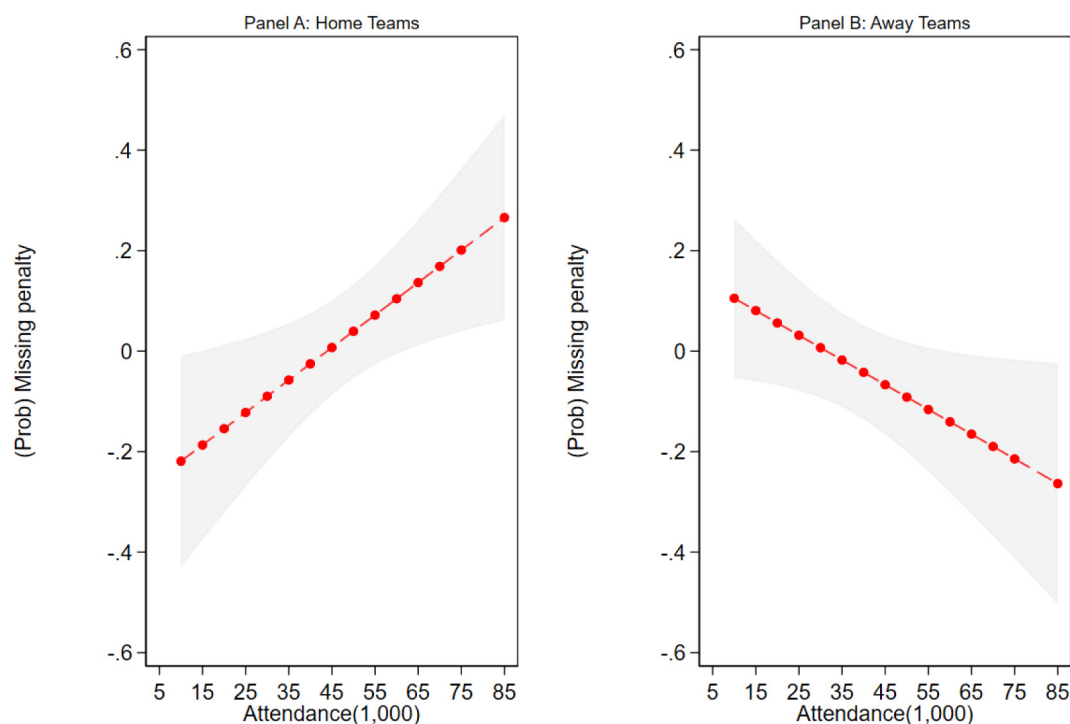


Fig. 2. Impact of closed doors on the probability of missing a penalty according to the (average) size of attendance. **Notes:** the figure depicts point estimates and its 90th confidence interval of estimations carried out in Cols. 2 and 4 of Table A4 of the Online Appendix.

played behind closed-doors ($0.1544 - 0.0049 \times 75 = -0.2131$ an estimation that is statistically significant at 5% level).

Taken together, these findings indicate the existence of an asymmetric response to the intensity of the crowd on the individual performance of home and away teams. While for home teams the (supportive) crowd has a positive effect and, indeed, when removing it the penalty conversion rate declines, for away teams the presence of (hostile) supporters puts pressure on the players, thereby inducing them to miss penalty kicks. When this pressure is removed, the probability of missing a penalty decreases significantly. In practice, we find evidence that pressure is more intense for away teams than for home teams.⁸

5. Summary and concluding remarks

This paper contributes to the literature that investigates the role of audience size on player's performance. To induce a source of plausible exogenous variation, we exploited the fact that teams of the five main national European football leagues had to play behind closed doors for a sizable fraction of the 2019/2020 season as a consequence of the Covid-19 pandemic. Moreover, we

⁸ The presence of an asymmetric response is also confirmed when we compare the impact on the probability of missing a penalty and the size of the crowd, before and after the lockdown, separately for home and away teams. As for home teams, we found that players respond positively to the support they get from the home crowd. Along these lines, and following results depicted in Figure A1 of the Online Appendix, it turns out that the supportive crowd has a positive impact as before the lockdown the probability that a player misses a penalty kick decreases as the size of the (supportive) crowd increases (Panel A). After the lockdown – when matches were forced to be played behind closed doors – the same relationship is much flatter (Panel B). For away teams, the (hostile) crowd seems to induce a decline in the penalty conversion rate. To see this, we have replicated the same figure as above on the sample of away teams. Results are shown in Figure A2 of the Online Appendix. While before the lockdown the probability of missing a penalty increases as the size of the attendance increases (Panel A), after it – when playing behind closed doors – the same probability of missing a penalty reduces significantly (Panel B).

analyse whether, and to what extent, the probability that a player misses a penalty kick is affected by the absence of the crowd.

What emerges from the empirical analysis is that social environment affects the performance of individuals. In particular, for home teams the social support leads to improved performance, as the probability of missing a penalty increases when matches are forced to be played behind closed doors, with such an effect being larger when the level of attendance registered before the pandemic was higher. Conversely, in the absence of audience, away teams are less likely to choke on a penalty kick, especially in stadiums that before the Covid-19 outbreak used to be very crowded. These results are consistent with recent findings that suggest that football team performances are negatively affected by the forced absence of friendly audiences (Ferraresi and Gucciardi, 2020; Reade et al., 2020; Scoppa, 2021). What all of this seems to indicate is that both supportive audience and the size of the support play a key role for success of skill tasks.

Appendix A. Supplementary data

Supplementary material related to this article can be found online at <https://doi.org/10.1016/j.econlet.2021.109868>.

References

- Apesteguía, J., Palacios-Huerta, I., 2010. Psychological pressure in competitive environments: evidence from a randomized natural experiment. *Amer. Econ. Rev.* 100 (5), 2548–2564.
- Böheim, R., Grübl, D., Lackner, M., 2019. Choking under pressure – evidence of the causal effect of audience size on performance. *J. Econ. Behav. Organ.* 168, 76–93.
- Braga, B., Guillén, D., 2012. Working under pressure: evidence from the impacts of soccer fans on players' performance. *Econom. Lett.* 114 (2), 212–215.
- Bryson, A., Dolton, P., Reade, J.J., Schreyer, D., Singleton, C., 2020. Causal effects of an absent crowd on performances and refereeing decisions during Covid-19. *Econom. Lett.* 109664.
- DeVaro, J., 2006. Internal promotion competitions in firms. *Rand J. Econ.* 37 (3), 521–542.

- Dohmen, T.J., 2008. Do professionals choke under pressure? *J. Econ. Behav. Organ.* 65 (3), 636–653.
- Endrich, M., Gesche, T., 2020. Home-bias in referee decisions: Evidence from 'ghost matches' during the COVID-19 pandemic. *Econom. Lett.* 197, 109621.
- Ferraresi, M., Gucciardi, G., 2020. Team performance and audience: experimental evidence from the football sector. Working papers 94, Società Italiana di Economia Pubblica.
- Harb-Wu, K., Krumer, A., 2019. Choking under pressure in front of a supportive audience: Evidence from professional biathlon. *J. Econ. Behav. Organ.* 166, 246–262.
- Reade, J.J., Schreyer, D., Singleton, C., 2020. Echoes: What Happens when Football Is Played behind Closed Doors?, Working Paper. Available at SSRN: <https://ssrn.com/abstract=3630130> or <http://dx.doi.org/10.2139/ssrn.3630130>.
- Scoppa, V., 2021. Social pressure in the stadiums: Do agents change behavior without crowd support? *J. Econ. Psychol.* 82, 102344.