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Using reminders with different reward opportunities to reduce no-show behavior: Empirical evidence from a large-scale field experiment in professional sports

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Center for Research in Economics, Management and the Arts

Using reminders with different reward opportunities to reduce no-show behavior: Empirical evidence from a large-scale field experiment in professional sport

Working Paper No. 2020-19

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**Using reminders with different reward opportunities to reduce no-show behavior:  
Empirical evidence from a large-scale field experiment in professional sports**

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**Abstract**

Because no-show behavior typically leads to operational inefficiencies and thus diminishing returns for service firms, a growing number of authors have demonstrated the potential of using reminders to reduce no-show rates. In this study, by examining the behavioral responses of 13,911 season ticket holders of a professional football team in Germany, we assess whether reminders containing different reward opportunities reduce no-show behavior in professional sports. According to the results of our large-scale field experiment, the reminders have only a short-term effect that operates most effectively through a monetary gift reward with no persistent behavioral change in subsequent games. As regards individual characteristics, spectators who attended the stadium more infrequently during the season under study, who had front row seats, or had seated rather than standing arrangements were also more likely to respond to the treatment.

**Keywords:** attendance, field experiment, no-shows, probabilistic rewards, reminders

**JEL:** C93, D12, L83, R22, Z20

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# Using reminders with different reward opportunities to reduce no-show behavior: Empirical evidence from a large-scale field experiment in professional sports

## 1. Introduction

For service firms, no-show behavior, a specific form of absenteeism,<sup>1</sup> typically leads to operational inefficiencies and thus diminishing returns.<sup>2</sup> In the health care industry, for example, the so-called no-show rate is, on average, about 23 percent, with a range from 4 to 79 percent depending on medical specialty (Dantas, Fleck, Oliveira, and Hamacher, 2018). In this setting, patient no-show behavior not only results in operational inefficiencies that impose costs for service providers (Kheirkhah, Feng, Travis, Tavakoli-Tabasi, and Sharafkhaneh, 2016) and nurtures patient stereotypes (Hussain-Gambles, Neal, Dempsey, Lawlor, and Hodgson, 2004) but also increases waiting times for other patients. In England, for instance, patients miss more than 15 million general practice appointments each year (NHS, 2019), most of which could have been assigned to other patients if canceled in time. Somewhat similarly, in the hospitality industry, restaurant owners who operate on small profit margins are likely to earn negative returns if customers routinely break appointments, while the maître d' on duty must turn away walk-ins at the door (Oh and Su, 2018).<sup>3</sup>

In the broader experimental literature, authors have suggested various strategies to reduce no-show behavior, including the introduction of no-show fines (Lesaca, 1995) or

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<sup>1</sup> Unlike excused absentees, no-shows are those who are expected to keep a scheduled appointment but fail to show up without notice or further arrangements (e.g., rescheduling). By definition, no-shows are neither late nor do they cancel last minute, meaning that they waste scarce appointment slots that otherwise (i.e., if demand exceeded fixed capacity) could have been assigned to an interested third party.

<sup>2</sup> Although today's professional service providers often bear the short-term consequences, such behavior might also harm the long-term outcomes for the individuals who do not show up. In the education industry, for example, student no-show behavior, perhaps better-known as truancy or unexcused absences, is likely to affect academic performance (Aucejo and Romano, 2016; Bosworth, 1994; Gottfried, 2009), just as in the health industry patient no-show behavior might negatively affect continuity of care and thus outcomes (Schectman, Schorling, and Voss, 2008).

<sup>3</sup> To paint a comprehensive picture, it is perhaps worth noting that some industries – for example, the fitness industry – also experience no-shows (DellaVigna and Malmendier, 2006) but, as Schreyer, Schmidt and Torgler (2019) point out, they often exploit such behavior to increase profits.

incentives (Smith, Weinmann, Johnson, and Wait, 1990) by health industry management teams, or the treatment of outpatients in their own homes (Anderson and Aquilina, 2002). Alternatively, predictive overbooking can preemptively fill expected no-show appointments (LaGanga and Lawrence, 2007), while different types of reminders can mitigate the forgetfulness that ranks among the most common explanations for no-show behavior (Herrick, Gilhooly, and Geddes, 1994). Although the commonest strategies currently in use are reminders by postal communications (Can, Macfarlane, and O'Brien, 2003), text messages (Liu, Harvey, Jaworsky, Shore, Guerrier, and Pianykh, 2017), and telephone calls (Parikh, Gupta, Wilson, Fields, Cosgrove, and Kostis, 2010), such strategies may need to be adjusted to the specific context.

In this paper, for the first time we conduct an experimental exploration into the potential of reminders with different reward opportunities to reduce no-show behavior among sports spectators, which behavior, although of major economic and historical importance, is the subject of relatively few experimental studies. Staging sports has a long tradition in human society, with the original function being religious in nature (Guttman, 1981). In the sixth century B.C., the Greeks constructed their first stadium, while the Romans brought such spectator sports games to a new level, with their chariot races and gladiatorial games lasting from daybreak to sunset in stadiums accommodating 50,000 people in the Colosseum and 250,000 spectators in Rome's Circus Maximus.<sup>4</sup>

Spectator no-show behavior has recently become a matter of top management concern in European professional football (AKA soccer; e.g., Borussia Dortmund, 2018), where the importance of physical presence in the stadium extends beyond mere income generation from ticket sales and potential future season ticket churn (e.g., McDonald, Karg, and Leckie, 2014). Such presence also contributes to the provision of a lively game atmosphere that benefits not

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<sup>4</sup> Those responsible for staging the games at the arena at Pompeii, for example, tried to lure the audience with sparsiones, sprinklings of perfume scented with balsam or saffron (Guttman, 1981).

only present and potential spectators but also significant external stakeholder groups like broadcasters, corporate sponsors, investors, and hospitality section members (McDonald, 2010; Schreyer, Schmidt, and Torgler, 2019; Solberg and Mehus, 2014).<sup>5</sup> Thousands of empty seats, in contrast, may not only significantly reduce match day income (e.g., from concessions, merchandise, and parking tickets) but diminish an otherwise significant home field advantage (e.g., Bryson, Dolton, Reade, Schreyer, and Singleton, 2020; Krumer and Lechner, 2018; Ponzio and Scoppa, 2018; Reade, Schreyer, and Singleton, 2020; Sutter and Kocher, 2004).

Because football spectator no-show behavior is more prominent among season ticket holders (STHs; Schreyer, Schmidt, and Torgler, 2019), our extensive field experiment tracked the behavioral responses of 13,911 STHs to five treatments with different reward opportunities designed to encourage STH attendance on game day over time. Our data collection, enabled through collaboration with an established German Bundesliga club, also included the compilation of individual STH characteristics to use as controls in the subsequent analyses. The design of the treatment interventions was based primarily on the empirical literature on reminder effectiveness, as well as that on behavioral economics and social marketing. For example, despite a few notable exceptions (e.g., Chong and Fantl, 2017), the health care industry has provided ample evidence of appointment reminder efficacy for reducing patient no-show behavior (Hasvold and Wootton, 2011; Stubbs, Stephen, Geraci, Stephenson, Jones, and Sanders, 2012; McLean, Booth, Gee, Salway, Cobb, Bhanbhro, and Nancarrow, 2016), with individuals regarding such communications as useful rather than intrusive (Perron, Dao, Kossovsky, Miserez, Chuard, Camly and Gaspoz 2013). Behavioral economics research has also continuously demonstrated the effectiveness of using reminders to nudge behavioral change (Allcott and Rogers, 2014; Calzolari and Nardotto, 2017; Karlan, McConnell,

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<sup>5</sup> As Oh, Sung, and Kwon (2017) observed, among TV audiences, intentions of future stadium visits are likely to decrease if stadium occupancy is perceived as being rather low.

Mullainathan, and Zinman, 2016; Mulilis and Lippa, 1990; Namazu, Zhao, and Dowlatabadi, 2018).<sup>6</sup>

Given that the highly contextually driven nature of field experimental results (Duflo, 2006) tends to reduce their transferability from one study to another, we believe it is well worth exploring whether reminders can also influence attendee behavior in the sports context, and if so how. In the health care industry, for example, patients who miss appointments, although they may eventually experience long-delayed benefits, frequently face no up-front cost; just as in the hospitality industry, a table reservation often comes free of charge and/or deposit. In the transportation industry, on the other hand, the costs incurred by a large share of customers (i.e., business travelers) might be covered by a third party (i.e., the firm). In sports attendance, however, the spectator, rather than feeling the long-term health benefits of active athletic participation, has less of an investment and no comparable individual purpose or goal. As a result, STHs may perceive the up-front investment as sunk costs with no additional benefit other than the immediate utility of going to the stadium and experiencing the game with others. They thus perceive no obvious benefits to behavioral change, which could reduce reminder effectiveness, especially as the common excuse of forgetfulness is less relevant in this particular context. Hence, although our setting is certainly different from previously explored environments, it shares notable similarities with other entertainment offerings such as theatrical performances, whose hosts are increasingly issuing season tickets.

## **2. Experimental Design**

### **2.1 Experimental setting**

The German Bundesliga, founded in 1962, is Germany's primary football competition, contested by 18 professional football clubs during a season that usually runs from August to

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<sup>6</sup> See also, for example, the literature on compliance behavior (Blumenthal et al., 2001; Torgler, 2004; 2013) and environmental conservation (Goldstein, Cialdini, and Griskevicius., 2008; Nolan, Schultz, Cialdini, Goldstein, and Griskevicius, 2008; Ferraro and Price, 2013).

May. Unlike most American sporting leagues, the competition operates on a system of promotion and relegation to Germany's second football division, Bundesliga 2. With an average of 42,738 tickets per match (DFL, 2020), Bundesliga still attracts a large group of spectators who, whether regularly or irregularly, decide to experience a football match as part of a group (Melnick, 1993). Within this ecosystem, STHs, who numbered approximately 441,000 in the 2019–20 season, play a decisive role, accounting for over half of the roughly 13.08 million Bundesliga tickets distributed among interested parties during that season as compared with about 43 percent to occasional match day ticket holders (see Supplementary Appendix Figure S1).

## **2.2 Participants**

Our field experiment subjects are STHs of a well-established Bundesliga club that prior to the 2012–13 season kick-off sold 19,390 season tickets; 17,805 to the broader public and an additional 1,585 to the club's remaining external stakeholders, including corporate sponsors, partners, and hospitality section members. In addition to the handful of STHs who relinquished their STH status for the upcoming season before our experiment began, we excluded a total of 5,479 records from the original data set based on our primary interest in individual STH behavioral responses. First, we eliminated tickets belonging to businesses, which, according to feedback from the club, are often shared among multiple employees, as well as season tickets owned by club employees or reserved for regular, but changing, guests of honor (e.g., former players, international guests). Second, for STH households with multiple season tickets, we excluded all but one to eliminate the potential irritation of their receiving different randomized reminders. Lastly, we excluded STHs who had not shown up at least once during the first round of the respective Bundesliga season (213); those under age 7 (79); those with exceptional seating (37); those living abroad (54); and those with incomplete information on either age (279), residence (66), or churn date (4). Our final sample thus consists of 13,911 STHs located



throughout the public area of the stadium. According to the descriptive statistics (see Table 1), most STHs in our sample are middle-aged males who on average traveled around 24 kilometers (roughly 15 miles) from home to stadium to attend a game.

*Insert Table 1 about here*

### **2.3 Treatment**

Our treatment designs were informed by previous studies that aimed to increase intervention effectiveness by combining reminders with additional contextual information beyond the mere date, time, and the place of the scheduled appointment (e.g., Henderson, 2008). For example, according to one early study of an outpatient pediatric psychology clinic, postal reminders offering an entry into a monthly lottery for a cash-equivalent prize (reward) and those threatening sanctions for nonattendance (punishment) were both more effective in reducing patient no-show behavior than a mere functional reminder (Parrish, Charlop, and Fenton, 1986). We thus similarly sent out the following five types of reminders: a simple repetition of the basic appointment information,<sup>7</sup> a basic repetition plus a moral suasion trigger, a repetition plus an offer of public recognition, and a repetition plus the opportunity to win either a unique experience or an expensive reward.

These reminders took the form of personalized letters signed by the Bundesliga club spokesperson sent out to 11,599 STHs three days before the day of home match 14, with no such reminders sent to 2,312 STHs used as a control group. In consultation with the club, we agreed not to inform any STHs that they were about to become part of a field experiment. To address the possibility of fans or media contacting the club about the letters, we also asked all employees working in fan and/or press relations (e.g., ticketing) to direct all treatment-related

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<sup>7</sup> Somewhat similar to most patients, STHs are typically informed about their respective appointments well in advance; weeks, sometimes even months, prior to the date. Hence, all five of our reminders begin with the following sentence, which provides the basic appointment information: “Dear [NAME], next [WEEKDAY], [DATE], [KICK-OFF TIME], we welcome [VISITING CLUB] to our [STADIUM].” We also maintain the Bundesliga club’s anonymity by only providing a template of the reminder rather than its specific information.

inquiries to the club or current activities sponsor. This approach was apparently successful because neither media reports of the letters nor any related social media activity appeared before the day of the treated home match.

### 2.3.1 Moral Suasion

To trigger moral suasion (i.e., elicit altruistic behavior; Romans, 1966), we first employed two related treatments that leverage the fact that STH desire to support a club is the major motivator of season ticket purchase (Karg, McDonald, and Leckie, 2019). The text of the first, labeled  $T_{\text{MORAL/low}}$ , translates from the German as follows:

*Having lost both previous encounters,<sup>8</sup> [...], we expect a tough match, for which we must mobilize all our forces!*

The content of the second, labeled  $T_{\text{MORAL/high}}$ , contains a more explicit trigger and is thus considerably stronger:

*The enormous level of support received by our team this season is certainly of great significance for our overall performance. Without the support of our loyal season ticket holders, the stadium atmosphere suffers tremendously and thus affects our team's performance. As a season ticket holder, you experience events in the Bundesliga first-hand week after week, you motivate our team and thus contribute to a unique stadium experience for all of us. Please provide support for [HOME CLUB] next weekend in the match against [VISITING CLUB]. Because one thing is for sure: Your support plays a vital role in the success of our team!*

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<sup>8</sup> Here, we refer to the two most recent games played against this particular opponent during the previous season(s) and in different competitions, not the two most recent Bundesliga games.

### 2.3.2 Recognition

A third treatment, labeled  $T_{\text{RECOGNITION}}$ , offered to reward STH support during the season with public acknowledgement:<sup>9</sup>

*The enormous level of support received by our team during this season is of great significance for the performance of both the team and each individual player. For this we would like to say Thank you! We therefore want to surprise you and a small number of other season ticket holders by mentioning you by name, representatively for all our fans, in the [STADIUM] magazine, available in the run-up to our last home match against [VISITING CLUB #2].*

### 2.3.3 Gift or exclusive reward

Lastly, because of evidence that combining reminders with delayed probabilistic rewards may induce behavioral change (Parrish et al., 1986), our fourth and fifth treatments, collectively labeled  $T_{\text{EXPENSIVE/EXPERIENCE}}$ , informed STHs that for attending the upcoming fixture, they could win either an *expensive* prize or a unique *experience*:

*We are pleased to inform you that, next match day, we will gift one of our season ticket holders either a spa trip worth roughly EUR 5,000 or a dinner with our team captain. You are one of a lucky 2,500 randomly preselected season ticket holders who now has the opportunity to enter the prize draw. To participate, all you need do is attend the*

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<sup>9</sup> Somewhat comparable is the finding by Markham, Scott, and McKee (2002) that employee attendance is higher in the presence of social recognition programs that publicly praise employees with perfect attendance records. Here, as in all other treatment groups, STH no-show behavior applied, on average, to about two matches; therefore, STHs did not attend, on average, two out of the first 13 home matches. Overall, about 51 percent of all 2,347 STHs in this particular treatment group missed either one or zero home matches. We thus concluded that receiving a reminder recognizing individual support was highly unlikely to irritate any STHs in this particular treatment group.

*match against [VISITING CLUB]. Once our stadium access control system recognizes your season ticket [BLOCK NUMBER; ROW NUMBER; SEAT NUMBER], you will automatically entered into the draw. The winner will be notified promptly.*

To capture STH attention, the letters for all five treatments were personalized, easy to read, understandable, and of adequate length. They were also all printed on official club stationery by the same regular service provider, electronically signed by the prominent chairman of the club, and sent in an official envelope displaying the club's crest. Although such mailed reminders, being relatively inexpensive, tend to preserve administrative resources, our choice for this distribution channel was more practical. That is, we rejected the option of reminding 11,599 STHs via telephone or SMS not only because of insufficient administrative resources for such a time-consuming task but because the frequent unavailability of STH email addresses and telephone numbers would have resulted in a significantly smaller sample. Domicile, in contrast, was available for the entire sample because all STHs must share their postal address during the season ticket purchasing process. In any case, as documented by a meta-analysis of randomized and controlled trials, mailed reminders have proven as consistently useful as telephone prompts for reducing patient no-show behavior in clinical settings (Macharia, Leon, Rowe, Stephenson, and Haynes, 1992).

## **2.4 Procedure**

### **2.4.1 Randomization and the necessary check for balances**

To balance unobserved characteristics across all five treatments, as well as across control conditions (List, 2011), we randomly allocated all 13,911 STHs to six similarly sized groups, accommodating the large sample size by using single random draw as the preferred randomization method (cf. Bruhn and McKenzie, 2009). We also made this randomization semi-public by having the authors of the current study present at the draw but allowing neither

club officials nor any reminder recipients to witness the process. A post-randomization assessment of the balance between all six conditions – conducted for a total of 24 different variables including no-show behavior patterns for all 13 home matches – revealed no significant group differences in either participant sociodemographic characteristics, ticket classification, or pretreatment behavior (see Tables S1 and S2). We therefore decided that any further re-randomization of cases was unnecessary.<sup>10</sup>

#### **2.4.2 Dependent variables**

Information on individual STH no-show behavior, our key dependent variable, was recorded using the club's stadium access system and provided by the club at various times during the season. The club also shared information on STH stadium admission times (TIME) to enable the exploration of potential second-order effects. Whereas no-show behavior is binary coded to be equal to 1 if a STH failed to attend the stadium on a particular match day (and 0 otherwise), time is measured in minutes prior to the official kick-off time.

### **3. Experimental results**

We first report the experimental behavioral responses to our five different treatments for home match 14 and then scrutinize potential treatment effects on the three subsequent match days: home matches 15, 16, and 17. In doing so, we address the possibility that whereas STHs offered the public recognition treatment ( $T_{\text{RECOGNITION}}$ ) may have been likely to attend the last home match of the season when the stadium magazine featured their name, STHs in the two tangible reward groups ( $T_{\text{EXPENSIVE}}/T_{\text{EXPERIENCE}}$ ) who did not win the prize may not have attended subsequent match days out of disappointment. As a corollary, we also explore the potential effects of our treatments on STH arrival time.

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<sup>10</sup> Through randomization, we also took into account our lack of individual information on the many reasons that fans might not show up to the stadium, allowing for similarity along unobserved factors and characteristic (i.e., we observed no systematic differences between control and treatment STHs).

### 3.1 No-show behavior

Overall, our analysis shows a statistically significant treatment effect on home match 14,  $F(5, 13,905) = 3.97, p < 0.01$ , indicating that the use of a reminder can indeed reduce spectator no-show behavior. In contrast, a one-way analysis of variance (ANOVA) with either Bonferroni or Sidak corrections for multiple comparisons reveals no such significant treatment effects on subsequent home matches 15, 16, and 17. Hence, for easier determination of each treatment's role in shaping STH decision-making, we list the STH no-show rates per treatment group on home match 14 in Table 2, and report the estimated difference in no-show rates between the different treatments and the control group with and without control variables in Figure 1 (cf. Table 1).<sup>11</sup> As these graphics clearly reveal, the no-show rate lies below the rate of the unmanipulated control group in only three out of five treatment groups:  $T_{\text{MORAL/high}}$  ( $M = 16.88, SD = 37.47$ ),  $T_{\text{EXPENSIVE}}$  ( $M = 14.94, SD = 35.66$ ), and  $T_{\text{EXPERIENCE}}$  ( $M = 16.88, SD = 37.47$ ). Only  $T_{\text{EXPENSIVE}}$ , however, results in a significant reduction in STH no-show behavior compared to  $T_{\text{CONTROL}}$  ( $M = 18.30, SD = 38.67; t(4,612) = -3.06, p < 0.01$ ).<sup>12</sup> Thus, the use of this particular reminder by a professional football club with 20,000 STHs would ultimately lower the number of no-shows by roughly 678. Nonetheless, although such a significant decline might positively affect stadium atmosphere on any given match day and thereby improve product perception (Oh et al., 2017), its economic significance may be debatable given the relative difference to the overall attendance.

*Insert Table 2 about here*

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<sup>11</sup> The estimated results using control variables are similar.

<sup>12</sup> It is worth noting that the results presented above are remarkably robust to employing additional analyses such as panel probit panel regression estimations, including such controls as match quality (e.g., away team market values, match outcome uncertainty, and geographical derbies), the potential opportunity costs of visiting a home match (e.g., fixture, matchday, and the temperature), and STH characteristics (e.g., age, gender, geographical distance, habit, and the ticket price). Although we refrain from reporting these additional probit results for the sake of brevity, we are happy to share these additional specifications with interested readers. For more information on the potential determinants of football spectator no-show behavior in Germany, see Frevel and Schreyer (2020); Schreyer and Däuper (2018), Schreyer et al. (2019); and for individual STH data, see Schreyer, Schmidt, and Torgler (2016).

*Insert Figure 1 about here*

As regards underlying mechanisms, the significantly lower no-show rate for  $T_{\text{EXPENSIVE}}$ , our second probabilistic reward intervention, strongly implies that the reward itself was responsible for the efficacy of this particular reminder. We therefore wonder whether certain interventions are more likely than others to influence particular STH groups. For example, given Schreyer's (2019) evidence that stronger levels of Bundesliga team identification result in reduced STH no-show behavior, would the outcome differences be larger among those with greater levels of loyalty or support? Such a likelihood is implied by the sports management research establishing a link between team identification and behavioral intentions to attend a future sports event in the stadium (e.g., Matsuoka, Chelladurai, and Harada, 2003; Rocha and Fleury, 2017; Wakefield, 1995). If this relation holds as true for actual behavior as for mere behavioral intention, then designing reminder content to trigger a particular behavioral response might not reduce STH no-show behavior for more loyal fans, who would not have missed attendance in the first place.

To explore the above conjecture empirically, we calculate the number of home games attended before the treatment game, splitting the subjects into five groups to account for the negatively skewed distribution of prior attendance: STHs that attended fewer than/equal to 9 (20.53%), 10 (10.59%), 11 (16.47%), 12 (24.05%), or all 13 (28.36%) of the previous home games. We then estimate the average treatment effect conditional on past stadium attendance, controlling for all other factors listed in Table 1. Contrary to the support level hypothesis, we find significant treatment effects for *less* loyal STHs; that is, STHs in the  $T_{\text{EXPENSIVE}}$ ,  $T_{\text{MORAL/high}}$ , and  $T_{\text{EXPERIENCE}}$  groups who attended a maximum of nine previous home games (see Figure 2). For instance, among STHs with the lowest previous attendance,  $T_{\text{EXPENSIVE}}$  reduced no-show behavior by around 10 percent relative to the control group. When we then split participants into five groups based on row number and location closest to farthest from the

field (see Table S3), the effects of the  $T_{\text{EXPENSIVE}}$ ,  $T_{\text{MORAL/high}}$ , and  $T_{\text{EXPERIENCE}}$  are most significant for the STHs located in the first five rows (see Figure S2).

*Insert Figure 2 about here*

We next explore other potential mediators of the treatment effects, beginning with accommodation type (seated or standing, Figure S3) and whether STHs have already re-signed for the upcoming season (Figure S4). Not only do we find a significant no-show reduction effect of  $T_{\text{EXPENSIVE}}$  on STHs with seating arrangements, but also a highly significant one on those who have renewed their ticket for the upcoming season when estimating the difference between treatment and control group values (marginally significant negative for  $T_{\text{MORAL/high}}$ ). On the other hand, three of the five treatments ( $T_{\text{EXPERIENCE}}$ ,  $T_{\text{MORAL/high}}$ , and  $T_{\text{MORAL/low}}$ ) show a positive treatment effect, indicating that they actually increase no-show behavior among re-signed STHs. When we then graph the results as a contour plot using STH age and travel distance to games with time, we find a significant interaction effect for  $T_{\text{EXPENSIVE}}$  that suggests it be more effective for young STHs and STHs living rather close to the stadium (see Figure S5).

As regards the duration of these influences, however, we observe no significant treatment effect on home match 17,  $F(5, 13,905) = 2.19$ ,  $p = 0.05$  (see Table 2), whose no-show rate is slightly below that of the unmanipulated control group in four of the five treatment groups (except for  $T_{\text{EXPERIENCE}}$ ). More important, according to an additional random-effects analysis, the difference between  $T_{\text{EXPENSIVE}}$  and  $T_{\text{CONTROL}}$  gradually loses its significance after match 14 (see Figure 3), indicating that our treatment induces no longer term effects.

*Insert Figure 3 about here*

### **3.2 Stadium entry time**

Whereas stadium admission captures an STH's interest in a game, stadium admission entry time may be seen best as a proxy for caring about the game (Schreyer, Schmidt, and Torgler, 2016).



Hence, in the Supplementary Appendix, we break out the stadium entry times for home match 14 by treatment group, which again reveals a statistically significant overall treatment effect:  $F(5, 11,441) = 3.97, p < 0.01$ . As evident from the same table, however, this effect results not from significant differences between treatment and control group values but from a significant difference in the stadium entry times of STHs randomized into the  $T_{\text{RECOGNITION}}$  ( $M = 28.66$  minutes prior to kick-off,  $SD = 21.32$ ) and  $T_{\text{EXPERIENCE}}$  groups ( $M = 26.22, SD = 20.74; t(3,747) = 3.54; p < 0.001$ ). We also observe no significant effect of our reminder on STH stadium admission times for subsequent home matches, including home match 17. Rather, when focusing on which treatments affect which types of STHs, we find almost no significant treatment/control group differences for any of the five treatments, and only minor quantitative effects (i.e., a less than a 4-minute difference).

#### **4. Discussion, limitations and future research**

Given the emerging challenge of managing no-show behavior in a range of sectors, it is somewhat surprising that neither experimental nor sports economists have yet explored adequate measures to reduce this negative behavior in alternative environments such as professional sports. As our empirical results indicate, both replicating and extending previous research findings in alternative environments is important to preventing premature assumptions about the potential effectiveness of already well-established measures. For example, this current analysis of behavioral responses among 11,599 STHs of an established German Bundesliga club strongly suggests that the use of single reminders to reduce football spectator no-show behavior may be rather unpromising, particularly in the long run. Not that this finding necessarily signals the inability of reminders to induce permanent behavioral changes in the context studied, but rather, as previous research has amply documented (see, e.g., Charness and Gneezy, 2009; Acland and Levy, 2015; Royer, Stehr and Sydnor, 2015), not only does it often

take time to induce behavioral change, but changes may eventually reverse once the stimulus is lifted.

Put another way, not only does the simple application of one reminder instead of repeated contacts have limited nudging power without the provision of a large expected reward, it has no effect beyond that game. This nudging efficacy may also be hindered by natural barriers like selection effects among the subjects, such as the tendency to develop a strong sense of identification with the team over time and engage in supportive behavior toward the club (Koenig-Lewis, Asaad, and Palmer, 2017, Mael and Ashforth, 1992). In this case, given high opportunity costs of game attendance or high reservation utility from nonattendance, no-show behavior may signal alternative demands with higher priority or greater urgency. This assumption is seemingly confirmed by the fact that, consistent with the economics literature on the power of monetary incentives to induce short-term behavioral changes (Gneezy, Meier, and Rey-Biel, 2011), our reminder offering a probabilistic reward (i.e., a material increase in attendance utility) had the most significant effect. This finding in turn implies that STHs who can afford to miss roughly five home games without experiencing a financial loss relative to having purchased game day tickets evaluate the expected utility of their stadium attendance on a game-by-game basis.

Even more intriguing is our observation that reminders tend to nudge only those with lower past attendance and thus lower loyalty. In addition, those who paid for front row seats or seated rather than standing arrangements were more likely to be affected by  $T_{EXPENSIVE}$ , with front row seaters also affected by  $T_{MORAL}$  and  $T_{EXPERIENCE}$ . Nonetheless, because we did not directly assess team identification among STHs – a clear limitation of our approach – future research is needed to clarify the role of team identification in shaping both no-show behavior and reminder efficacy in this context. Such research might consider expanding our treatment design to include reminders that use more nuanced moral appeals to reduce spectator nonattendance.

Another surprising outcome is that our public recognition treatment not only failed to reduce STH no-show behavior but showed a potential for increasing it, albeit insignificantly in our particular setting. Given the marginality of the STHs' pre-experimental no-show behavior (i.e., attendance at 11 out of the first 13 matches on average), this initially counterintuitive finding raises the question of whether the STHs actually wanted public acknowledgment or even felt that it was warranted.

As regards study limitations, although our experimental results offer useful initial insights into whether, and possibly how, reminders can reduce STH no-show behavior in the sports context, their reliance on data from only one professional football team may be considered problematic. Pragmatically, however, the substantial negotiation required to organize such a large-scale stadium field experiment makes its application to several first-tier football teams highly unrealistic. Hence, although this limitation may reduce the external validity of our findings, we were in fact extremely fortunate to secure the collaboration of even one major Bundesliga team. Not only did this particular club finish among the top teams in the season under study, they did so frequently both before and after, which reduced the potential bias toward a zero effect when nonresponse to nudges manifests as part of fan punishment for poor team performance.

A second consideration is that, although we document a significant treatment effect, the ratio of cost to treatment benefits may be too low to justify its regular use. For example, for a hypothetical Bundesliga club with about 24,497 STHs (the current Bundesliga average; DFL, 2020), sending out the postal reminders used in our experiment would ultimately have lowered the number of no-shows by roughly 823 STHs, with an estimated additional income from concessions of only about 4,115 euro per match day.<sup>13</sup> Hence, although the club might additionally benefit from increased merchandising sales or parking fees, the total cost for

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<sup>13</sup> In European professional football, spectators currently spend, on average, five euros per match day on concessions (ESSMA, 2018).

sending out the reminders is only defensible as an investment in product quality that is monetized elsewhere, such as through the club's many external corporate stakeholders who benefit from a livelier stadium atmosphere (McDonald, 2010; Schreyer et al., 2019; Solberg and Mehus, 2014). In reality, however, it remains unclear what atmospheric change an additional 823 spectators can effect in a stadium that seats tens of thousands of spectators.

Finally, although we believe it would be useful to determine whether our results remain robust across different industries and perhaps alternative distribution channels (e.g., email, SMS, and phone calls), sending out reminders to reduce no-show behavior is only one potential approach. We are thus convinced that future research could also benefit from exploring the potential of alternative measures such as intervention programs (DuMontier, Rindfleisch, Pruszyński, and Frey III, 2013), the threat of fines (Chariatte, Michaud, Berchtold, Akré, and Suris, 2007), and low-cost incentives (Pollastrì, Pokrywa, Walsh, Kranzler, and Gelernter, 2005) to reduce no-show behavior in general and football spectator no-show behavior in particular.<sup>14</sup>

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<sup>14</sup> For example, some German professional football clubs, most notably Bayern Munich, Borussia Dortmund, and Hamburger SV, have already begun exploring the potential of threatening STHs whose no-shows exceed a certain threshold with loss of the right to first refusal for season tickets (Schreyer, 2019).

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## Tables and Figures

**Table 1** Descriptive statistics (n = 13,911)

Variables		M	SD	Min	Max
<b>Socio-demographics</b>					
AGE	STHs' age on match day	41.18	18.11	7.04	92.07
MALE <sup>1</sup>	STHs' gender (male = 1; otherwise = 0)	0.80	0.40	0.00	1.00
CHILD <sup>1</sup>	STH is a child; i.e., younger than 18 years old (yes = 1; 0)	0.12	0.32	0.00	1.00
HOME <sup>1</sup>	STHs' geographic location; i.e., STH lives in the city (yes = 1; 0)	0.47	0.50	0.00	1.00
DISTANCE	STHs' distance to the stadium in kilometers	23.60	43.87	0.28	673.00
<b>Accommodation</b>					
TICKETS	Number of season tickets purchased (pre-season)	1.07	0.32	1.00	8.00
SEAT <sup>1</sup>	Type of accommodation; i.e., seating area (yes = 1; 0)	0.88	0.33	0.00	1.00
ROW	Distance from field to seat in rows	14.27	9.49	1.00	35.00
PRICE	Season ticket price in Euro	272.04	104.18	95.00	540.00
DISC <sup>1</sup>	Season ticket price is discounted (yes = 1; 0)	0.41	0.49	0.00	1.00
<b>Habit</b>					
CHURN <sup>1</sup>	STH has already resigned for the upcoming season (yes = 1; 0)	0.06	0.24	0.00	1.00

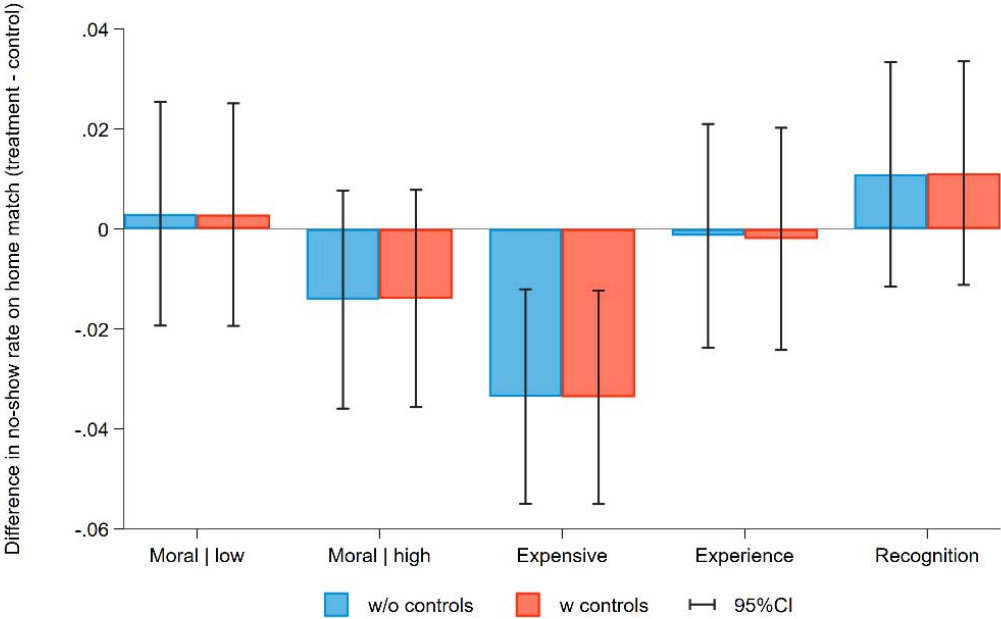
Notes: All figures are rounded; Descriptive information for home match 14 in season 2012-13; <sup>1</sup> Dummy variable.

**Table 2** No-show rate and stadium entry time on home match 14 to 17

Treatment	n	No-show rate at home match <sup>1</sup> ...				Average stadium entry time at home match <sup>2</sup> ...			
		#14	#15	#16	#17	#14	#15	#16	#17
TOTAL	13,911	0.1771	0.2010	0.1642	0.1756	27.311	23.368	27.274	35.627
MORAL   low	2,312	0.1860	0.2102	0.1596	0.1708	27.092	23.366	27.710	34.824
MORAL   high	2,369	0.1688	0.2001	0.1604	0.1731	27.008	23.241	26.813	34.915
RECOGNITION	2,347	0.1939	0.1956	0.1730	0.1662	28.655	23.505	27.417	36.208
EXPENSIVE	2,302	0.1494	0.1942	0.1603	0.1694	27.425	23.371	27.313	35.913
EXPERIENCE	2,269	0.1816	0.2019	0.1670	0.1988	26.221	22.490	27.022	35.824
CONTROL	2,312	0.1830	0.2042	0.1648	0.1760	27.449	24.224	27.371	36.094
F-Value		3.970	0.500	0.460	2.190	2.770	1.190	0.440	0.810
Prob > F		0.001	0.779	0.804	0.053	0.017	0.310	0.824	0.543
chi2(5)		19.829	2.4842	2.320	10.929				
Pr		0.001	0.779	0.803	0.053				

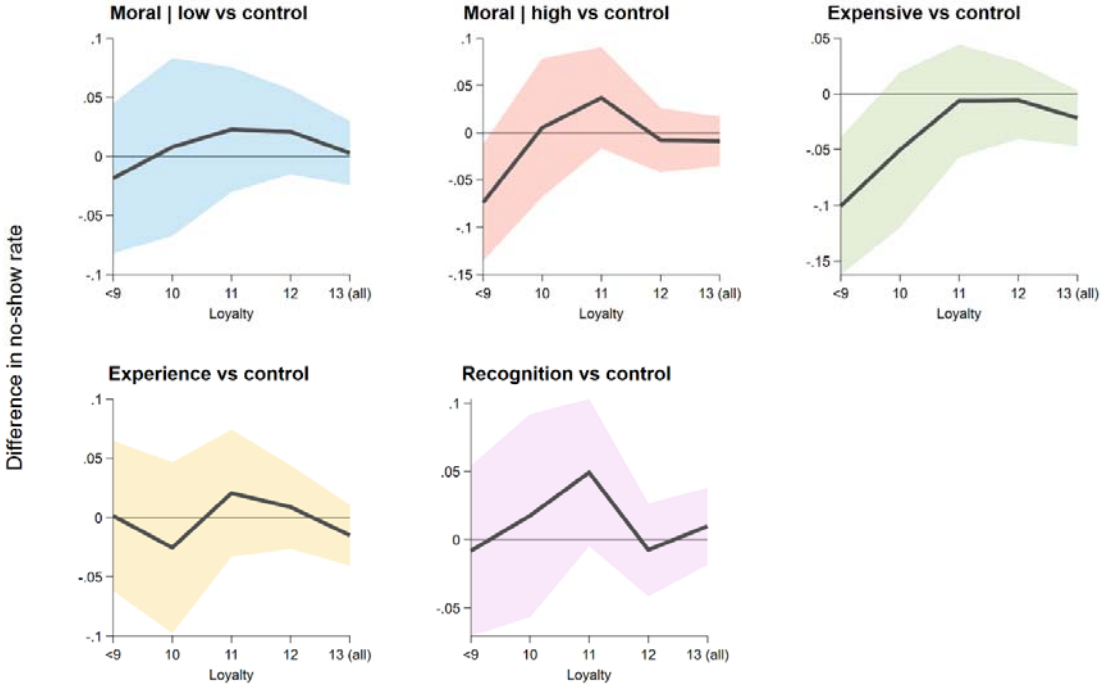
Notes: All figures are rounded; <sup>1</sup> Dummy-variable; <sup>2</sup> Sample size varies in accordance with STH no-show behavior on matchday.

**Figure 1** Estimated differences in no-show rates between treatments and control group on home matchday 14



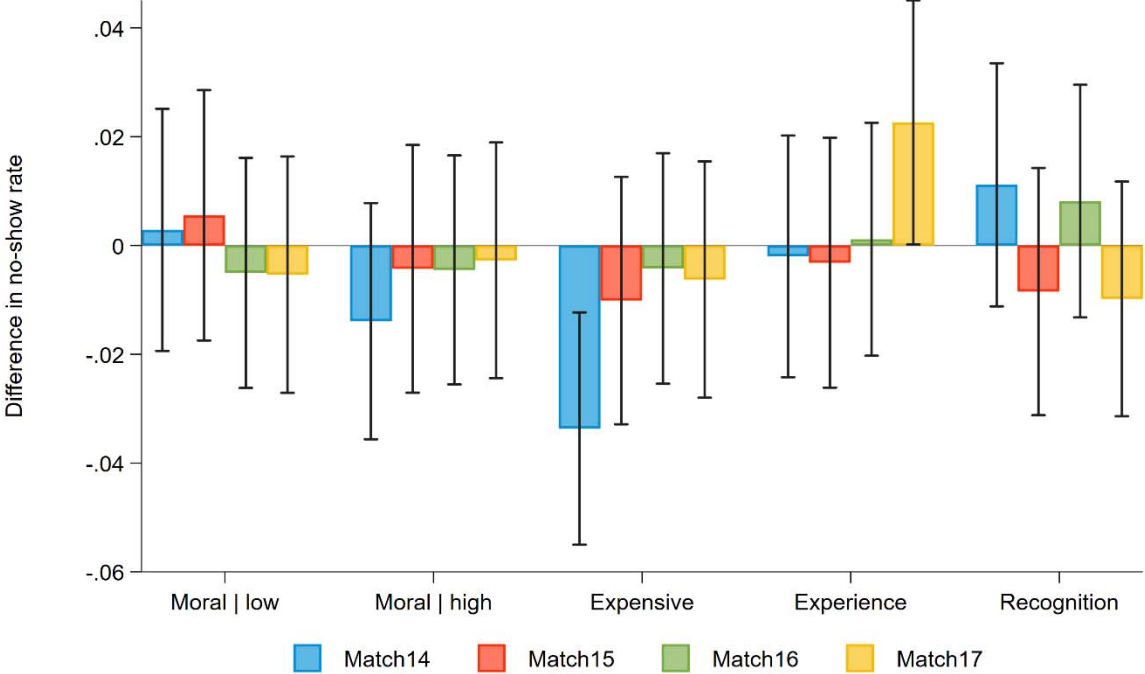
Notes: Estimations without controls (blue bars) and with controls (red bars). For the controls included to get the estimated differences, see Table 1.

**Figure 2** Estimated differences in no-show rates between treatments and control group on home matchday 14, conditional on past stadium attendance



Notes: Colored area: 95%CI

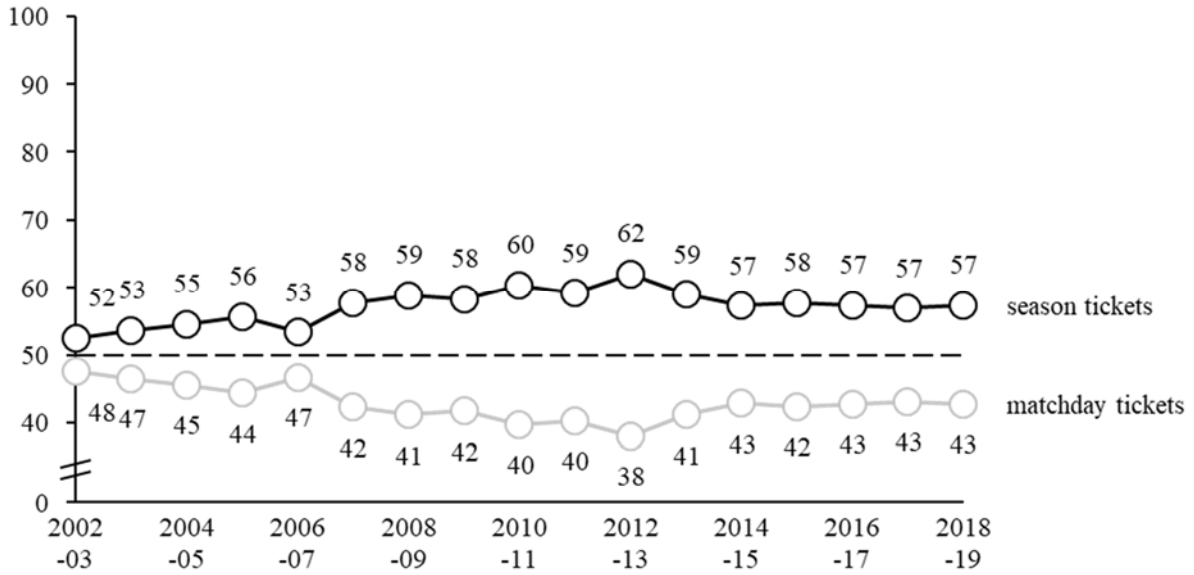
**Figure 3** Estimated differences in no-show rates between treatments and control group on home matchday 14 and subsequent home matches



Notes: Random-effects model estimations with controls based on variables reported in Table 1.

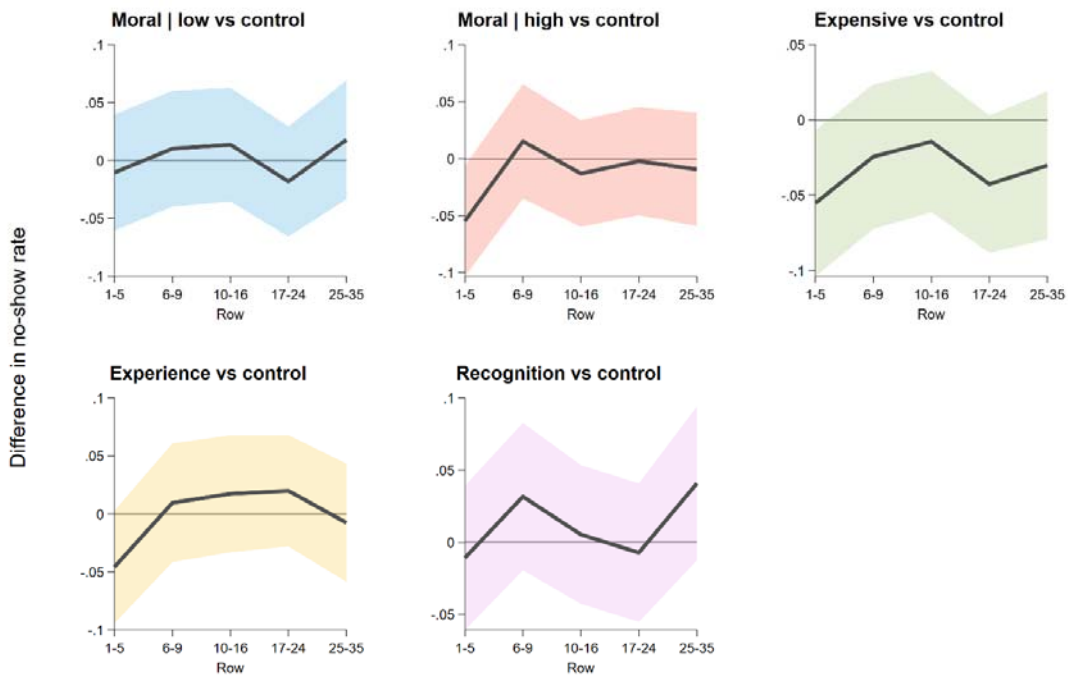
## For Online Publication: Supplementary Appendix

**Figure S1** Relative share of distributed matchday/season tickets in Bundesliga football over time



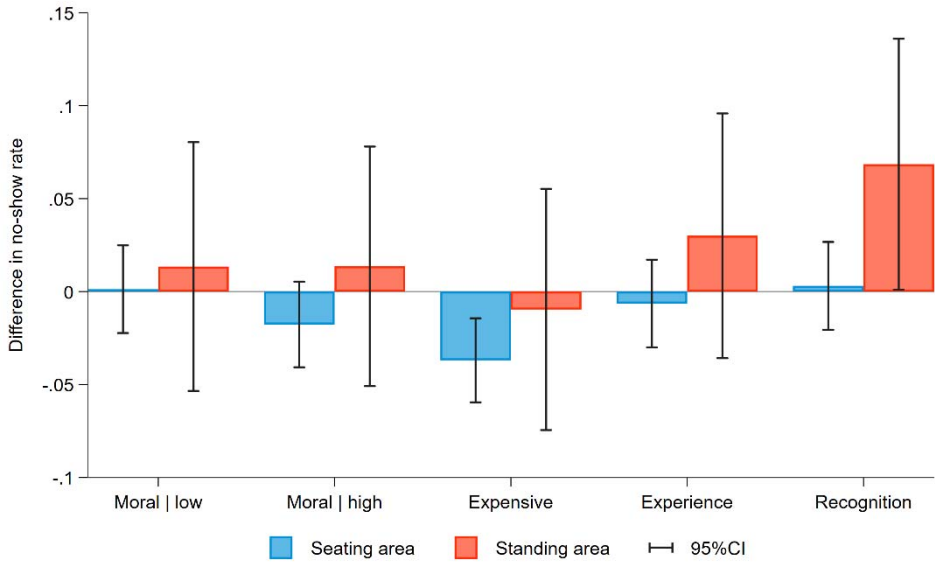
Notes: Information in percent; all figures are rounded

**Figure S2** Estimated differences in no-show rates between treatments and control group on home matchday 14, conditional on seating row

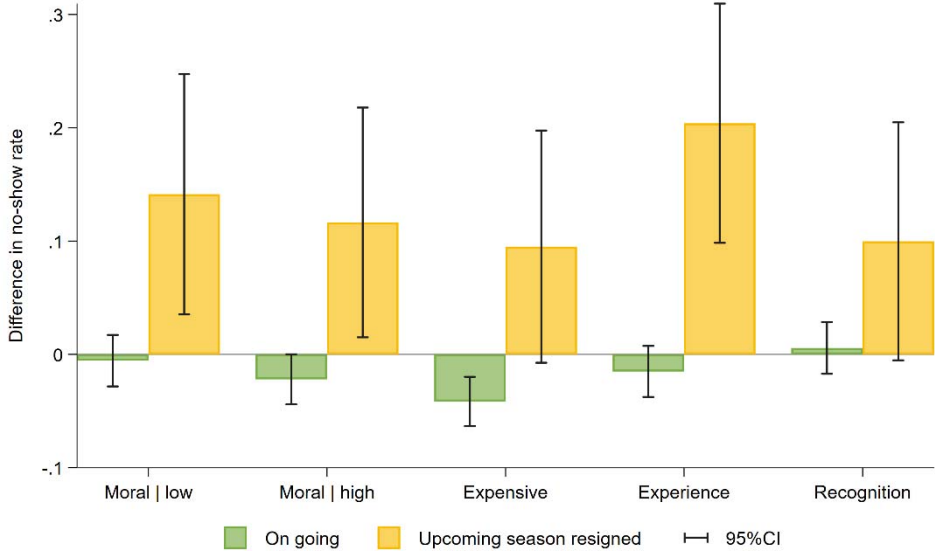


Notes: Colored area: 95%CI

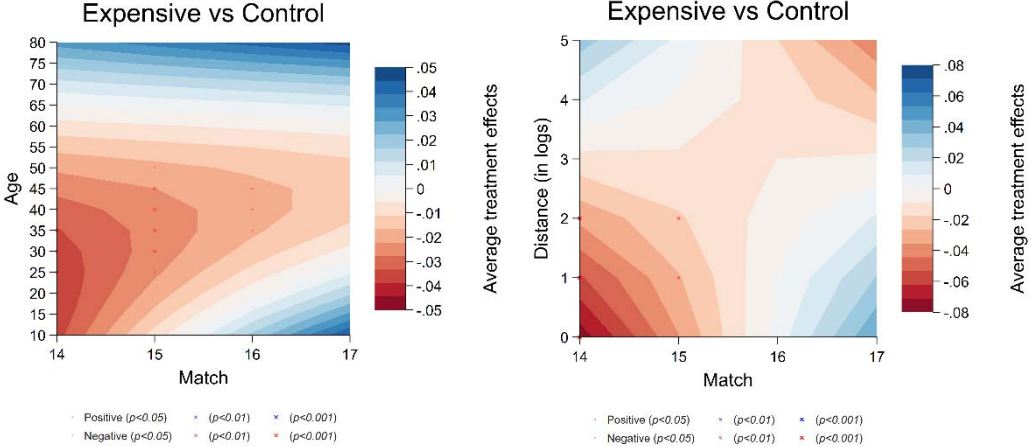
**Figure S3** Estimated differences in no-show rates between treatments and control group on home matchday 14, conditional on accommodation type



**Figure S4** Estimated differences in no-show rates between treatments and control group on home matchday 14, conditional on CHURN

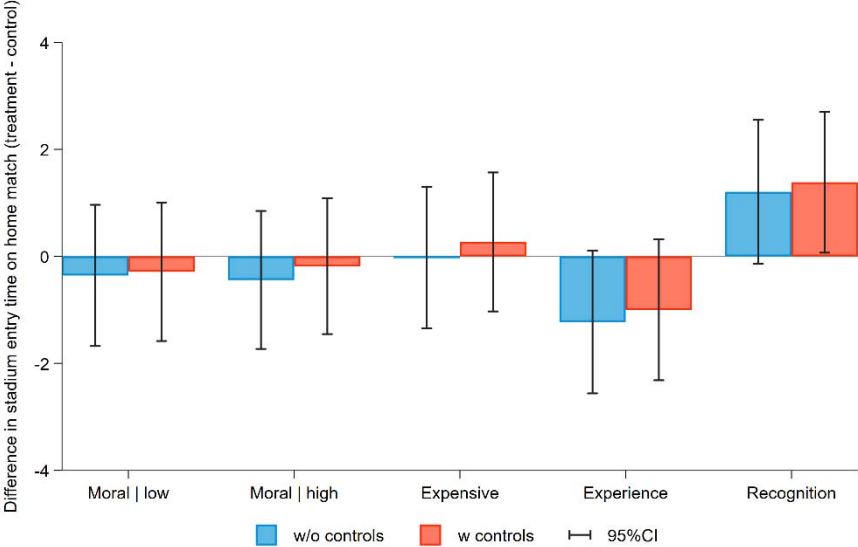


**Figure S5 Significant interaction effects between EXPENSIVE and STH characteristics on home matchday 14 and subsequent home matches**



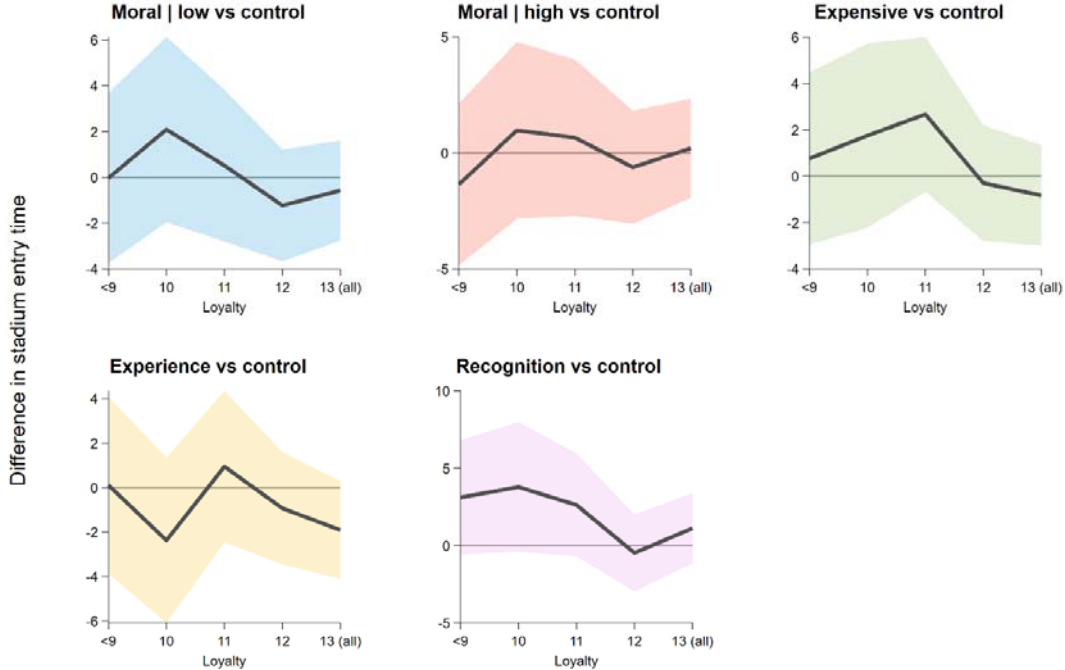
Notes: The heat maps are derived using random-effects models adding the control variables reported in Table 1.

**Figure S6 Estimated differences in stadium admission time between treatments and control group on home matchday 14**



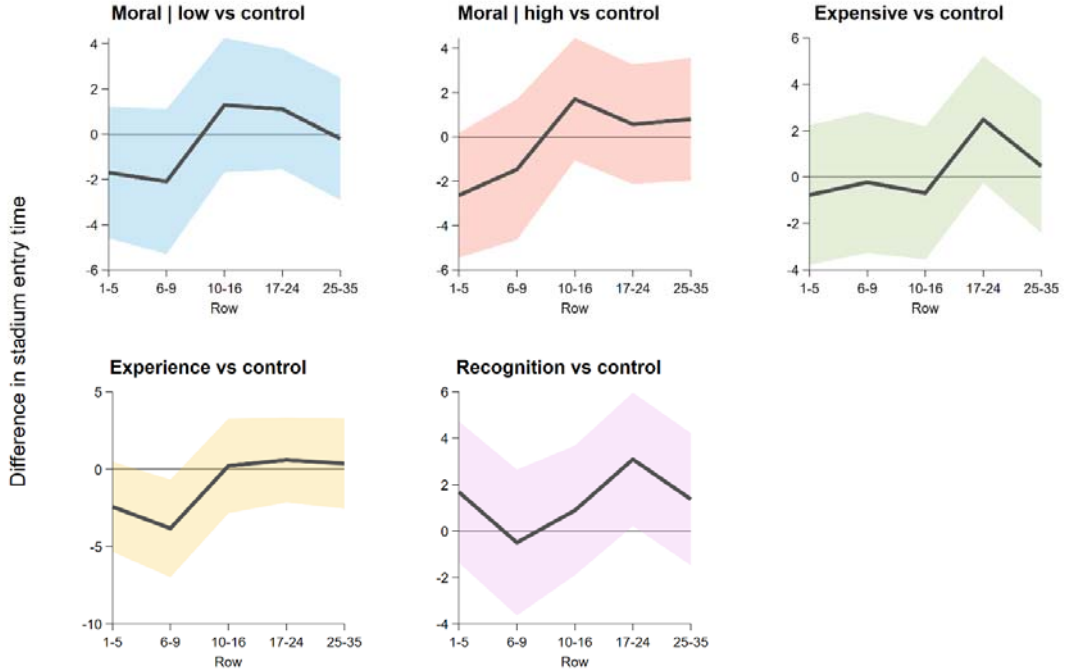
Notes: Estimations without controls (blue bars) and with controls (red bars). For the controls included to get the estimated differences, see Table 1.

**Figure S7** Estimated differences in average stadium entry time between treatment and control groups on home matchday 14, conditional on previous attendance



Notes: Colored area: 95%CI

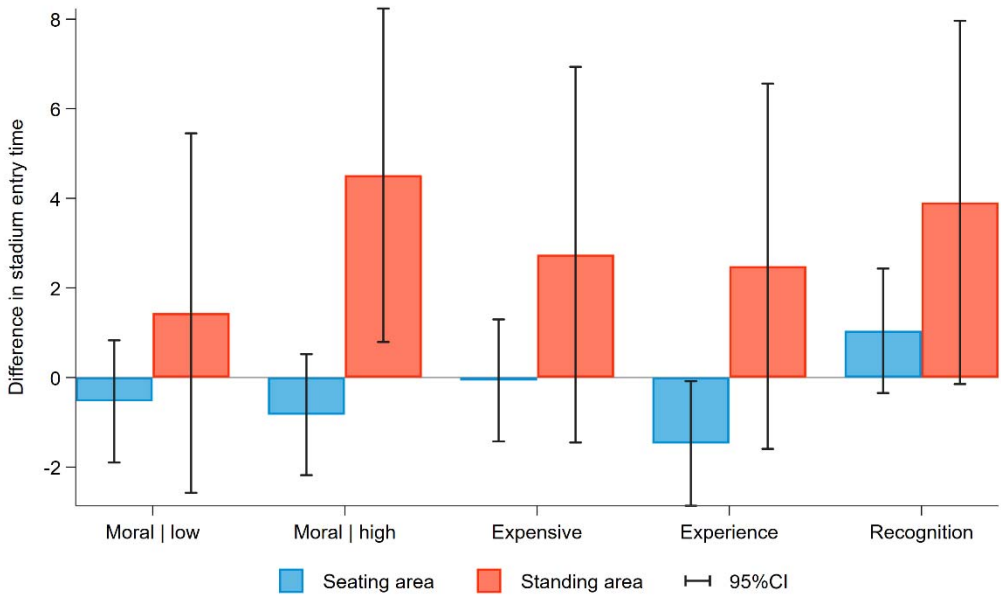
**Figure S8** Estimated differences in average stadium entry time between treatments and control group on home matchday 14, conditional on seating row



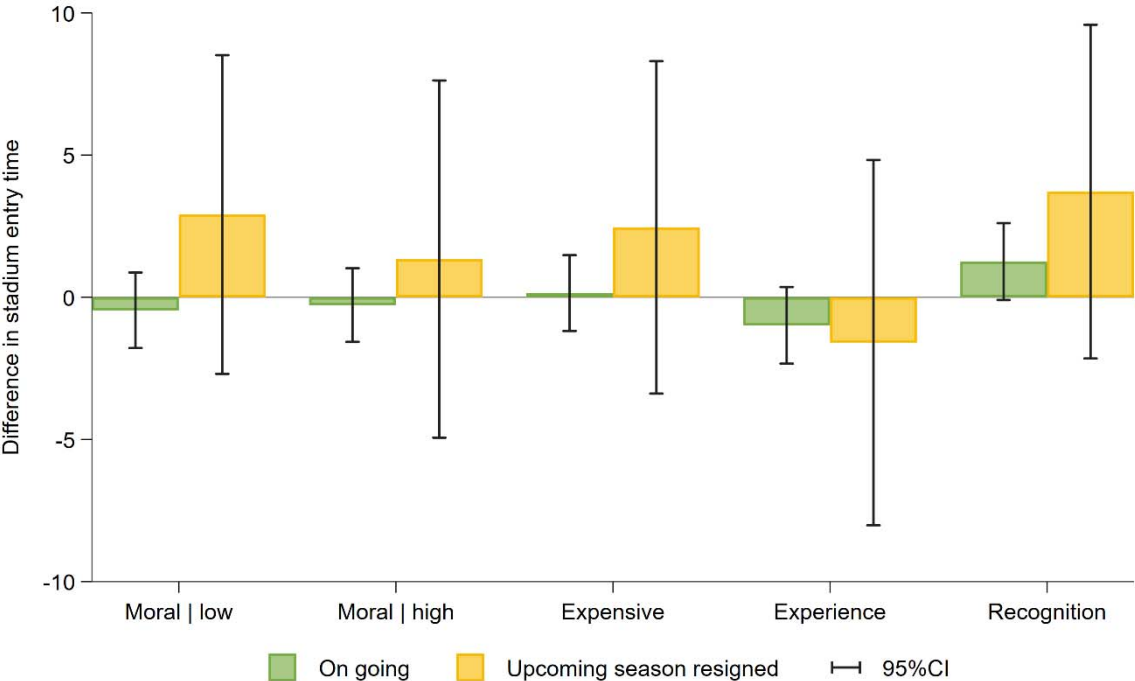
Notes: Colored area: 95%CI



**Figure S9** Estimated differences in average stadium entry time between treatments and control group on home matchday 14, conditional on accommodation



**Figure S10** Estimated differences in average stadium entry time between treatments and control group on home matchday 14, conditional on CHURN



**Table S1 Randomization and the necessary check for balances**

Treatments	n	Socio-demographics					Accommodation					Habit
		AGE years	MALE <sup>1</sup> %	CHILD <sup>1</sup> %	HOME <sup>1</sup> %	DISTANCE km	TICKETS n	SEAT %	ROW n	PRICE EUR	DISC <sup>1</sup> %	CHURN <sup>1</sup> %
TOTAL	13,911	41.185	0.802	0.115	0.474	23.605	1.070	0.878	14.275	272.042	0.412	0.059
MORAL   low	2,312	41.372	0.814	0.116	0.465	24.628	1.081	0.886	14.225	272.781	0.417	0.056
MORAL   high	2,369	41.302	0.800	0.115	0.486	22.378	1.071	0.873	14.323	271.439	0.420	0.063
RECOGNITION	2,347	40.957	0.805	0.118	0.476	23.485	1.069	0.873	13.974	270.560	0.423	0.055
EXPENSIVE	2,302	41.112	0.811	0.117	0.480	23.687	1.075	0.884	14.305	274.279	0.413	0.059
EXPERIENCE	2,269	40.917	0.787	0.116	0.485	23.034	1.055	0.873	14.344	268.433	0.423	0.063
CONTROL	2,312	41.444	0.795	0.115	0.451	24.438	1.070	0.879	14.480	274.736	0.386	0.058
F-Value		0.340	1.440	0.320	1.680	0.870	1.700	0.710	0.740	1.200	1.670	0.430
Prob > F		0.886	0.207	0.901	0.136	0.500	0.130	0.615	0.592	0.306	0.137	0.830
chi2(5)			7.191	1.599	8.393			3.558		73.078	8.371	2.135
Pr			0.207	0.901	0.136			0.615		0.120	0.137	0.830

Notes: All figures are rounded; Descriptive information for home match 14 in season 2012-13; <sup>1</sup> Dummy variable.

**Table S2 Randomization and the necessary check for balances (2)**

Treatment	n	No-show rate at home match day <sup>1</sup> ...												
		#01	#02	#03	#04	#05	#06	#07	#08	#09	#10	#11	#12	#13
TOTAL	13,911	0.191	0.132	0.189	0.192	0.116	0.111	0.234	0.173	0.193	0.070	0.259	0.179	0.044
MORAL   low	2,312	0.191	0.125	0.189	0.188	0.119	0.108	0.226	0.162	0.189	0.074	0.259	0.173	0.047
MORAL   high	2,369	0.193	0.135	0.183	0.198	0.105	0.117	0.233	0.170	0.185	0.072	0.252	0.176	0.042
RECOGNITION	2,347	0.191	0.129	0.194	0.197	0.122	0.119	0.234	0.183	0.200	0.074	0.259	0.178	0.041
EXPENSIVE	2,302	0.189	0.138	0.186	0.190	0.114	0.104	0.235	0.183	0.192	0.070	0.268	0.174	0.046
EXPERIENCE	2,269	0.196	0.139	0.201	0.187	0.111	0.101	0.234	0.166	0.197	0.067	0.265	0.189	0.046
CONTROL	2,312	0.186	0.126	0.180	0.192	0.126	0.117	0.243	0.171	0.193	0.061	0.248	0.182	0.045
F-Value		0.180	0.750	0.830	0.260	1.380	1.370	0.390	1.250	0.430	0.840	0.670	0.540	0.310
Prob > F		0.971	0.583	0.528	0.932	0.227	0.233	0.854	0.281	0.831	0.518	0.648	0.747	0.909
chi2(5)		0.889	3.769	4.149	1.325	6.910	6.836	1.968	6.265	2.127	4.222	3.342	2.694	1.534
Pr		0.971	0.583	0.528	0.932	0.227	0.233	0.854	0.281	0.831	0.518	0.647	0.747	0.909

Notes: All figures are rounded; <sup>1</sup> Dummy-variable

**Table S3 Splitting participants into 5 groups depending on the seat row number**

Group	Mean row	Min row	Max row	N
1	2.98	1	5	3079
2	7.42	6	9	2533
3	12.50	10	16	2772
4	20.57	17	24	2786
5	28.69	25	35	2741

Notes: From closest to the field (group 1) to the farthest (group 5).