Department of Economics

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Outcome uncertainty and the demand for women's football

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Abstract

We investigate the determinants of attendance demand in women's football across three European countries. Our main focus is on the role that short-term (game level) and medium term (seasonal level) uncertainty of outcome play in determining attendances. We find no evidence that fans respond to game uncertainty in England and France in their decisions to attend, though there is some evidence they do in Germany. We explore this using alternative estimators. Moreover, attendances are higher in France and Germany when the match is of greater significance for the away team in terms of winning the championship. Home and away team strengths and scheduling conflicts with the men's game produce are also shown to be important factors in shaping attendance demand at women's football matches.

Keywords: Attendance Demand, Women's Football, Outcome Uncertainty

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1. Introduction

Women's football in Europe has shown tremendous growth over recent years. In Figure 1 below, we document this growth in terms of fan numbers across the top leagues of England, France and Germany (especially so in England), but this growth has coincided with growing professionalism (including the introduction of professional contracts), improved investment in training and youth facilities, and ever sizeable broadcasting deals. For example, the latest broadcasting deal for the Women's Super League in England, commencing at the beginning of the 2025-26 season, represents a circa 50% per season increase on the value of the previous rights deal.[1] Notably, this deal was the first to be negotiated under the league's new ownership structure, independent from the English Football Association.

/*Figure 1 Here*/

This growth is a far cry from the conditions faced by female footballers over the last century. In the early part of the 20th century, women's football was extremely popular, and many matches drew impressive crowds. Numerous examples of successful women's football clubs around this time are described by Williams (2021). However, as the Football Association, the governing body for football in England, grew increasingly jealous of the revenues being generated by these games, in 1921 it set out to ban the women's game by not allowing women's matches to be played on fields under its control. Several other countries, including Germany (in 1955) followed suit. Szymanski (2022) outlines the lasting damage this has done to the women's game but also charts the beginnings of the reparation efforts being made.

In Europe, professional leagues are still relatively young. In England, the top division had its first season in 2011 following a rebrand of an earlier incarnation, though it only gained professional status in 2018. In France, the league has existed since 1975, but gained professional status in 2009. This makes these leagues a very interesting proposition for researchers, since we are left questioning whether the same determinants of attendance that are found in the literature for established leagues, are also at play here (Berri et al. 2023).

In this paper, we seek to address a popular question in the sports economics literature but apply it to a setting that has largely been neglected: women's football. Do football fans attached to women's football care about outcome uncertainty? We are by no means the first authors to pose this question for women's football (Meier et al. 2016; Valenti et al. 2020; Valenti et al. 2024;

[1] As reported by Forbes. https://www.forbes.com/sites/asifburhan/2025/09/03/sky-sports-to-introduce-multiview-in-coverage-of-womens-super-league/ (Accessed 08/09/2025)

Stephenson, 2024). We do, however, believe our work offers an advance on previous work along two dimensions. To our knowledge, this is the first paper on women's football to consider multiple leagues. Moreover, we also offer superior measurement in the assessment of medium-term uncertainty of outcome relating to end of season outcomes. We should also stress that we are testing for outcome uncertainty effects on attendance demand in leagues where there are high proportions of one-sided games, as we shall demonstrate below. Games that are expected to be one-sided might deter fans from attending.

The paper proceeds as follows. In Section 2, we review the previous literature on determinants of attendance, with a particular focus on women's leagues. Section 3 describes our data and methodological approach, before results are presented in Section 4. Section 5 concludes.

2. Previous Literature

Work examining the determinants of attendances at sporting fixtures forms a cornerstone of the sports economics literature. Schreyer and Ansari (2021) offer an excellent review of the empirical literature and as part of their review also include a list topics and themes that dominate the literature. One strand in particular, relevant to this study is the role of outcome uncertainty in shaping attendances, under the hypothesis that fans prefer a balanced, unpredictable contest (e.g. Borland and MacDonald, 2003). Empirical support, as we demonstrate below, is often not forthcoming. Of course, a natural alternative hypothesis is that fans simply want to see their own team win, i.e. displaying home win preferences.

Meier et al. (2016) were among the first to consider attendance demand for female football, focusing on the top division of German female football. They find match uncertainty to be an unimportant predictor of attendances, though this is based on a somewhat ad hoc definition of match uncertainty.[2] However, if either the home or away team is still in contention for the league title, these matches drew higher crowds. More recently, Valenti et al. (2024), for the case of the English Women's Super League finds evidence contrary to the uncertainty of outcome hypothesis, while Stephenson (2024) finds (mixed) evidence in favour of the hypothesis for the highest level of women's football in the United States (the National Women's Soccer League, NWSL), though this is dependent on the variable used to capture uncertainty.

[2] The authors created two dummy variables capturing vastly superior home teams or away teams. These were based on league positions prior to kick off being greater than five places in either direction.

Tournament structure and/or tournament type might also play a role in determining fan's preferences for uncertainty. For the case of the women's UEFA Champions League, Valenti et al. (2020) find strong evidence that attendances increase with uncertainty. More recently, Nasser and Deutscher (2025) examine the determinants of attendances in the German Frauen Bundesliga. While their primary focus is on the effects of competing schedules of men's and women's football matches, as part of their analysis they also find that fans are generally more inclined to go to matches where either team has a higher win probability. Thus, even though the literature on the role of uncertainty in women's football is not as well established as that of the men's game, a familiar theme is emerging. Findings on importance of outcome uncertainty are decidedly mixed. The literature on men's football (and indeed sports more broadly) reaches no clear consensus on the importance of uncertainty of outcome (see Collins and Humphreys, 2022 for a meta-analysis on the topic). Even studies on the same league can produce different results depending on methodology, variables used, timeframe considered etc.

The relevant theoretical framework for our work stems from Coates et al. (2014). They present a reference dependent utility model, where consumers earn utility from two sources. The first comes simply from seeing the team win (or lose). Consumers also derive utility depending on how far the match result is away from the consumer's expectation of the match outcome. Naturally, unexpected wins contribute to utility, while unexpected losses detract from utility. Depending on the relative size of these marginal utilities, it is possible to generate different consumer responses in relation to match uncertainty. That is, either a preference for uncertainty (attendance is maximised when uncertainty is highest), a preference for a home win (attendance increases in home win probability), or consumers may exhibit loss aversion (the diametric opposite of a preference for uncertainty).

Our work is also relevant to the strands of literature focusing on attendances during the early growth stages of sports leagues. Agha and Berri (2023) compare the determinants of attendance in the Women's National Basketball Association (WNBA) with the equivalent stage in the development of the NBA. Interestingly, even at a similar stage in the development of the two leagues, their fans respond quite differently to various factors. Berri et al. (2023) also offer an analysis of the determinants of attendance during the early stages of Major League Baseball.

The contribution of this paper is twofold. First, to the best of our knowledge, we are the first paper that considers multiple leagues in the assessment of outcome uncertainty in women's football. This allows for a comparison across fans in different countries which our results suggest is a non-trivial contribution. We identify substantial cross-country difference in the determinants of attendances in women's football. Moreover, our work also offers an improvement on the assessment of medium term (or seasonal) uncertainty, by employing the methodology of Buraimo et al. (2022). We provide more details on the specifics of this measure in the following section.

3. Data and Methodology

Our data consist of matches played from the top level of the women's football matches in England (the Women's Super League), France (Division 1 Femme) and Germany (Frauen Bundesliga). The seasons in question cover 2017-18 through to 2023-24 inclusive for England and France, and 2016-17 through to 2023-24 inclusive for Germany. During the 2020-21 season, many matches were cancelled or played behind closed doors due to the pandemic, which we omit from our sample. This leaves us with a sample of 1,875 matches across the three leagues.

Scheduling and attendance data are sourced from Fbref (https://fbref.com/en/) while betting odds are from betexplorer (www.betexplorer.com). Betting odds are then used to infer home win, draw, and away win probabilities for each match. The use of betting odds has been widely applied in the literature as an assessment of match uncertainty. Odds (in decimal format) are converted to probabilities by taking the reciprocal of the odds. We also correct for the bookmaker over-round using a simple weighting strategy, such that the sum of the (corrected) probabilities sums to one. Hegarty and Whelan (2024) show that these normalised probabilities are unbiased estimates of the true match probabilities.

Match uncertainty is not the only source of uncertainty that fans might value. Medium term, or seasonal uncertainty has also been shown to be an important determinant of attendances (Jennett, 1984; Czarnitski and Stadtmann, 2002). This is more concerned with the uncertainty associated with the rankings of teams at the end of a season, for example, the number of teams in contention for a particular seasonal prize (e.g. the league title). Multiple approaches have been used in the literature to capture this seasonal uncertainty, but many of these measures may be deemed imperfect proxies, with these critiques outlined in Buraimo et al. (2022). These authors proceed to develop a new measure of seasonal uncertainty called 'match significance', which describes the difference it would make to the probability of a team securing a particular seasonal prize (e.g. winning the league title) if the team won rather than lost a match.

In this paper, we adopt the approach of Buraimo et al. (2022) in the measurement of seasonal uncertainty, which we enter separately for home and away teams. We model the significance of a match separately for home and away teams (Buraimo and Forrest, 2025) for winning the league title, qualifying for the Women's UEFA Champions League, and for avoiding relegation.[3]

We follow similar steps to Buraimo and Forrest (2025) for match significance. A match is deemed to be significant if winning as opposed to losing would result in a greater chance of winning a specific end-of-season prize. The magnitude of the match significance for the championship for either team is expressed as the difference in two probabilities as follows:

$$sig_{ijt}^{title} = \Pr(\text{team i wins title}|\text{team i beats team j}) \\ - (\text{team i wins title}|\text{team i loses to team j})$$

A forecasting model (see Maher (1982) and Dixon and Coles (1997) for an exposition) is used to calculate the match outcome probabilities, which are then used to calculate the match significant variables. In the model, the number of goals by either team follows a Poisson distribution as follows:

$$\chi \sim Poisson(\gamma \alpha_H \beta_A) \text{ and } Y \sim Poisson(\alpha_A \beta_H)$$

where α_H is the home team's attacking strength, β_A is the defensive strength of the away team, α_A is the attacking strength of the away team, β_H the defensive strength of the home team. γ is a parameter for the home team's advantage. Attacking strength and defensive strength are proxied respectively by the mean goals scored and mean goals conceded in prior matches.

The forecasting model is updated before each match day and incorporates new match information up to but excluding the current match. The first iteration of the forecasting model uses only matches where the home team has played two home games in the season and the away club has also played two away games that season. The parameters from the model are used to estimate probabilities for the different numbers of goals for the home and away teams in the season's remaining matches. Using these goal probabilities, the probabilities of different scorelines are estimated. The scoreline probabilities which result in a home win are summed to generate the probability of a home win. The probabilities for a draw result and an away win are generated similarly.

[3] The different leagues across our study have different numbers of spots for relegated teams. In England, the last place team is relegated. In Germany, the bottom two teams are relegated. While in France, ordinarily two teams are relegated expect in 2021 when only the last placed team was relegated. Moreover, in more recent seasons, the Champions League has been expanded which has allowed more teams to qualify from our leagues. Up to 2019-20, only the top two teams would qualify for Europe, but in seasons since it is now the top three that qualify. To reflect these differences, our relegation and European qualification significance variables are season and league specific.

Having generated the home win, draw and away win probabilities for the season's remaining matches, the results of these remaining matches are simulated 10,000 times to generate as many end-of-season tables. Based on these simulations, the probabilities that a team finishes in any one of the various league positions conditioned on winning or losing the current match can be estimated at a given match day. The process is iterative and moves on to the next match and a new set of probabilities for the match significance computation is estimated on a rolling match-by-match basis until the last day of the season. Match significance is calculated for each end-of-season prize, in this case, winning the title, qualifying for UEFA Champions League, and avoiding relegation for the home and away teams.

The theoretical framework laid out by Coates et al. (2014) provides the basis for our empirical strategy. They propose that attendances are a function of home win probability, and the square of home win probability. The associated coefficients can then be used to test whether attendance demand adheres to the uncertainty of outcome of hypothesis, or otherwise. In particular, our empirical model follows previous attendance demand literature (e.g. Valenti et al, 2020, 2024) and is as follows:

$$\log(Attendance) = \beta_0 + \beta_1 HWP + \beta_2 HWP^2 + \boldsymbol{\delta X} + \gamma_h + \mu_m + \tau_t + \theta_j + \epsilon \quad (1)$$

HWP is the home win probability derived from betting odds. The test for the uncertainty of outcome hypothesis is then $\beta_1 > 0$ and $\beta_2 < 0$ i.e. an inverted U-shape. The vector $\boldsymbol{X}$ includes our measure of seasonal uncertainty, along with other potentially important determinants of attendance which we detail below. The model includes home team fixed effects (γ_h) to account for unobservable, but plausibly fixed differences across teams over times (market size, fan incomes, quality of local transport networks etc.), month fixed effects (μ_m) to capture any seasonality effects in attendances, season fixed effects (τ_t), and, when pooling leagues together, league fixed effects (θ_j). ϵ is the error term. Throughout our estimations, we use robust standard errors.

Estimation of (1) is via OLS. This modelling choice is appropriate since stadium capacities are not a binding constraint on attendances. Average stadium capacity usage stands at 23.4%, with fewer than 2% reaching an attendance figure that is 95% or greater of stadium capacity. In cases where capacity constraints were binding (i.e. the range of the dependent variable is constrained), a Tobit estimator might be more appropriate (Verbeek, 2017). Since this is not an issue for our leagues, estimation via OLS is sufficient.

We also present two alternative formulations of (1). First, we use the *Theil Index* as an alternative to Home Win Probability and its square. The index has the advantage that it can explicitly account for variations in all three probabilities (win/draw/loss). It is calculated as follows:

$$Theil = \sum_{i=1}^{3} \left(\frac{p_i}{\sum_{i=1}^{3} p_i} \right) * \log \left(\frac{\sum_{i=1}^{3} p_i}{p_i} \right) \quad (2)$$

Where p_i , $i \epsilon 1,2,3$ represent the probabilities of a home win, draw, and an away win. The index increases with uncertainty (hence its highest value occurs when all three outcomes are equally likely). Thus, a positive coefficient on the *Theil Index* in an OLS regression would indicate support for the uncertainty of outcome hypothesis. Second, to avoid imposing a quadratic structure on home win probability, we make use of regression spline estimators. Results of these alternative formulations can be found in the robustness checks section.

We also include a host of control variables to account for other potentially important determinants of attendance. These include match scheduling (a dummy variable indicating whether a game is played at the weekend) and scheduling conflicts with the men's game (along similar lines to Nasser and Deutscher, 2025). This includes whether the men's team is playing a home game on the same day (this definition includes if the men's team is playing in a lower division), whether any men's game is taking place on the same day, and, whether the men's game is on an international break. This variable was formed by creating a dummy variable equal to one if the date of a women's game coincided with dates on the European Men's International Match Calendar. We also include the (logged) distance between the two teams (measured in miles as a straight line) to capture any potential geographical rival effects as well the potential difficulty and/or cost of travel for away fans. Team quality is captured via a rolling points per game measure, which enters separately both for the home and away teams, as well as a dummy variable capturing whether the away team is participating in that season's UEFA Champions League. Finally, we include variables capturing the weather on the day of the game, namely temperature and rainfall. Table 1 below shows the descriptive statistics for our variables of interest.

/*Table 1 Here*/

Some differences do exist across countries. Appendix table A1 offers a complete picture of the descriptive statistics across countries, but we offer a short comment on those here. Average attendances are highest in England (3421), followed by Germany (1490) and France (912). The other notable differences across countries relates to the distance between teams. Clubs are, on average, geographically much closer together in England, with an average distance between clubs of 104 miles (range of 1 to 279 miles) compared to 190 miles (range 9 to 382) in Germany and 244 miles (range 1 to 550) in France. England is, on average, cooler compared to France and Germany but also typically receives less precipitation.

Before progressing with our formal analysis of outcome uncertainty, we offer some descriptive analysis about the nature of competition across the three leagues under consideration.[4] For comparison, we reproduce these statistics for the equivalent men's leagues as well. Figure 2 (Panel A) shows the distribution of home win probabilities for each of the three leagues under consideration. The distribution is somewhat trimodal, particularly in England and France, with higher peaks at both extremes. This suggests the presence of some very strong teams in these divisions, with very high win probabilities both at home and away from home, and potentially some much weaker teams who have very low home win probabilities. There would appear to be fewer games that might be classed as close or uncertain. Germany displays a slightly different distribution that appears to be bimodal, with even fewer close games.

/*Figure 2 Here*/

In contrast, Figure 2 (Panel B) also shows the distribution of these home win probabilities for the equivalent men's leagues. These feature more teams than in the women's leagues, 18 or 20 compared to 12 for the women's. All three leagues display a similar distribution, which is distinct from women's leagues. In the men's leagues, there appears to be a single peak of home win probability, between 38% and 50%, indicating that closer games are more of a feature in the men's leagues with more parity between teams in the men's leagues.

To further demonstrate the nature of uncertainty in women's leagues, Figure 3 displays the empirical distribution of scorelines (for the study period) across the leagues, for both men and women. Continuing from the distributions in Figure 2, Figure 3 also suggests that there is a larger proportion of one-sided games in the women's leagues, with the winning team scoring a higher number of goals. For example, in 53% of women's games, both teams score less than 3 goals each, compared with 66% for men. Furthermore, the average goal difference is 2.1 in the women's game as opposed to 1.5 for men. In 52% of women's matches, only one team scores, as opposed to 33% for men. 16% of women's games are draws as opposed to 24% of men's games.

/*Figure 3 Here*/

[4] See Mondal (2023) for a wider view on the state of competitive balance across a selection of top fight women's football leagues in Europe.

For seasonal measure of uncertainty, we can assess how many games are actually meaningful for a particular seasonal prize (Buraimo and Forrest, 2025). If, as we might hypothesise, the significance of a match is an important determinant of stadium attendances, league organisers would presumably like to minimise the number of games that are essentially meaningless for the league title, European qualification and relegation. However, the proportion of games in our sample where, for the home team, winning versus losing a fixture makes no difference to their probability of winning the league title is around 72%.[5] We can also consider the 'joint' match significance i.e. the sum of match significance for both the home and away teams, and again consider the proportion of matches that are meaningless for both teams. This figure stands at around 54%. This is, of course, a rather strict definition of match importance; by winning a match a team might statistically alter their chances of winning the league (say), even though practically they never will. If we change the threshold to 0.05 (that is, winning versus losing a match changes the probability of winning the league title by a maximum of 0.05), this proportion stands at 85% (or equivalently 74% for the joint significance). We can also consider the number of games that would be meaningless for UEFA Women's Champions League qualification. This figure stands at 53% for the home team (or 31% jointly), while games meaningless to relegation stand at 62% (41% jointly). To contextualise this, the lengths of the seasons are fairly short (18-22 games, so between 9 and 11 home games). Therefore, if 50% of games are insignificant for end of season prizes, this would amount to around 5 home games having little riding on them.

In short, this descriptive analysis reveals that a) fixtures across the women's leagues tend to have one particularly dominant team, rather than a match that displays a degree of parity and b) a large number of games are practically meaningless in terms of teams achieving a particular seasonal prize. These figures provide a useful backdrop with which to move to our empirical results.

4. Results and Discussion

Table 2 shows our baseline estimates.

/*Table 2 Here*/

4.1 Outcome uncertainty

[5] Looking at this figure across the three leagues, in England 46% of games would be not significant for the league title, in France 61% and 53% in Germany.

For the sample as a whole, home win probability and its square have significant positive and negative coefficients, respectively. While this suggests support for the uncertainty of outcome hypothesis, this is very much driven by the German Frauen Bundesliga. There is no support for the uncertainty of outcome hypothesis in either England or France. Nor is there support for any of the alternative patterns, namely home win preference or loss aversion. In Germany, the coefficient on the linear term of home win probability is positive and significant, while it is negative and significant on the squared term, which (potentially) indicates support for the uncertainty of outcome hypothesis.

It is worth, however, considering some additional context to these point estimates. The home win probability that maximises attendance in Germany is around 62%, which might be considered quite high if fans truly showed a preference for balanced matches. Games with a home win probability greater than 62% still represent around one third of all games played in Germany (and incidentally a similar proportion in England and France) over this period. It is also worth noting that Meier et al. (2016) and Nasser and Deutscher (2025) failed to uncover support for the uncertainty of outcome hypothesis in the German league, albeit using different measures of uncertainty, and examining a different timeframe.

Support for seasonal uncertainty (match significance) is quite mixed. Whether or not the home team is playing a match of significance for the league title does not significantly predict match day attendances. Bear in mind that a large portion of our sample consisted of games that were not important in determining the title. Instead, whether the away team is in contention for the league title (with the exception of England) is a significant, positive predictor of attendances. One might be tempted to conjecture that this is as a result of these teams being the 'best' teams with star quality on their rosters which might be driving attendances (see Stephenson, 2024), but this result emerges even with controls for away team quality (namely away team PPG and whether the away team is in the UEFA Champions League).

As for the other seasonal prizes, whether the home team is playing a match significant for European qualification is significant only in France (albeit only at a 10% significance level). If the away team faces a threat of relegation, this is a significant predictor only in France, while away teams with a possibility of qualifying for Europe enters the models negatively and significantly for France and Germany.

Perhaps surprisingly, away team contention for Champions' League places is negatively associated with league attendances in France and Germany (but not England). The coefficient on away team currently playing in the Champions' League is positive and significant for France and Germany (not for England). This does not suggest an innate fan distaste for the Champions' League competition Alternatively, this anomalous result could reflect home fan disillusionment that their team is not in contention for the Champions' League while the away team is in contention.

4.2 Control variables

There are several important aspects of the scheduling of women's football matches worthy of discussion. As expected, weekday games tend to attract fewer fans (with the exception of France). Specifically, this is in the region of 14% lower attendances in Germany, and 39% in England. Moreover, the calendar of the men's game also seems to play a substantial role in determining attendances at women's football matches. In particular, if the men's team of the equivalent club is playing at home on the same day, attendance at the women's team is around 19-20% lower than when the two teams play at home on different days.[6] Interestingly, this is not an issue in Germany, though these clashes appear less frequently in Germany than in France and England.[7]

In contrast, women's games played whilst the men's game is on an international weekend can attract crowds that are 24-29% higher than usual in England and Germany. It is worth noting however, that whether this effect is purely due to scheduling is unclear. Quite often, games on these weekends in the women's league are marketed more heavily. Particular fixtures (especially derby matches) are chosen to be played at these weekends, and games may occasionally take place at the men's team stadium. Some of these other factors might be taken into account with our other controls, namely distance between the teams and home and away team form. Taking these additional factors into account, it appears that scheduling high profile women's games during men's international breaks has considerable potential to raise women's league attendances.

In terms of measures of travel cost of attending games, bigger distances between teams detract from attendances, but only significantly so in England. Fans in England are also responsive to higher temperatures. The temperature that is associated with highest attendances in England is a little over 13ºC (compared to an average temperature in England of around 11.4ºC). There is only limited evidence to suggest that fans in Germany attend more with higher temperatures, although

[6] We also checked the importance of the affiliated men's team playing away from home on the same day, but this variable yielded insignificant results across all leagues.

[7] This result is in contrast to Nasser and Deutscher (2025) who show that a men's game on the same day causes attendances at the women's team to decrease in Germany. As for how we can explain this difference, Nasser and Deutscher's paper covers only up until 2019. It is possible that fan preferences have changed, or that league organisers have realised this has been a potential issue and have looked to resolve that by avoiding scheduling conflicts. Our variable also captures men's teams playing in lower divisions. Our reading of the Nasser and Deutscher paper is that they consider men's games played on the same day if the men's team is in the top flight.

higher rainfall, both in France and Germany discourages fans from attending. This is not the case in England.

Fans also appear to be drawn by higher quality of teams, both home team and opponent. Both home and away teams who are performing well (as measured by rolling seasonal points per game) draw in higher crowds. Similarly away teams who are participating in women's UEFA Champions League tournament draw higher crowds, especially so in France and Germany where crowds are on average 50% higher. This might be due to a desire by fans to see star and quality players who appear in elite team (Stephenson, 2024).

There is also some limited evidence of a seasonality effect in attendances, though any significant effects are limited to end of season games. Figure 4 plots the coefficients from the month fixed effects (the reference category is January) from models 1-4 in Table 3. Attendances are significantly higher in April and May, which is perhaps unsurprising as this is when seasonal outcomes are finalised. Occasionally the season can extend into June, but this is rare and this is reflected in much wider confidence interval around the estimated coefficient. There are substantial cross-country differences in this pattern. however. In May, the significance is driven by Germany (the point estimate for France is just insignificant at the 5% level, p-value of 0.054).

4.3 Robustness checks

We test the robustness of our main econometric specification, first by using an alternative measure of game uncertainty, namely the Theil index, and second by using a spline estimator. Table 3 shows the results of the alternative estimation of equation (1), instead using the Theil index. For brevity, we do not show the effects of the remaining controls as they behave the same as in Table 2. Coefficients on the Theil index echo the same conclusions as those from Table 2, in that support for the uncertainty of outcome hypothesis is only present in the German league.

/*Table 3 Here*/

We also model the relationship between home win probability and attendance using regression spline estimators. We estimate linear splines. Here, the relationship between (log) attendance and home win probability is modelled as a series of piecewise linear functions. The benefit of estimating the relationship in this manner is that we are not imposing the relationship to be quadratic.[8]

[8] In addition, we also experimented expressing home win probability as a cubic function. Of course, this does not avoid the pitfalls of imposing a particular functional form but might be useful insofar as checking the cubic term is insignificant. This is the case for France and Germany and the sign and significance of the linear and squared terms remain as reported in Table 2. In England, while the coefficient on the cubic term is significant, this does not

We estimate linear splines with knots in home win probability located at 0.2, 0.4, 0.6 and 0.8. One may broadly think of these sections as representing games where the away team is the strong favourite, moderate favourite, where the game is expected to be close, the home team is the moderate favourite, and finally strong favourite, respectively. Table 4 displays the results from the linear spline regressions. The coefficients displayed should be read as the slope of the line in that segment. All covariates and included in the model but are not displayed for brevity. Figure 5, panels A-D display these results graphically.

/*Table 4 Here*/

Results from the regression splines indicate that very few regions of home win probability have any impact on attendances. Hypothesis tests on the joint significance of the slopes of the different segments being equal to zero cannot be rejected for the case of England and France, but is rejected for the case of Germany. The results are generally supportive of the quadratic formulation of home win probability in Table 2, and making use of the Theil measure in Table 3, particularly in the case of England. In France, only the region between 60% and 80% of home win probability displays significance, and attendances are shown to be declining in this region, but further increases in home win probability then display no significant result. Results from Germany are perhaps slightly harder to square with our two previous formulations. Initial increases in home win probability (i.e. from a zero chance to a 20% chance of a win) displays a strong positive association with attendances, but further increases in home win probability do not significantly affect attendance. This does perhaps raise an important methodological point with regards to the quadratic formulation of home win probabilities as is commonplace in much of the literature.

5. Conclusion

In the face of growing popularity of women's football in Europe, we investigate the determinants of attendances in the top divisions of England, France and Germany, with a particular focus on the role that uncertainty of game and seasonal outcomes play in shaping attendances. A descriptive analysis of these leagues reveals that the nature of the product typically offers up matches that consist of a more dominant team, and a large number of matches that are unimportant in terms of achieving a particular end of season prize.

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produce any noticeable curvature until well outside the domain of home win probability and is thus practically meaningless.

Our results show considerable heterogeneity in fan responses to sporting variables across our three leagues. Attendance demand estimates should not be pooled across the leagues covered here. Our findings reveal that fans in England and France do not show any response to match uncertainty (proxied for by home win probabilities), while fan behaviour in Germany demonstrates support for the uncertainty of outcome hypothesis. However, our estimates also urge caution in interpreting this result, since different estimators (namely linear splines) show that this finding may be driven by attendance behaviours in particular regions of the home win probability distribution. Overall, it seems that the appearance of lack of competitive balance, with associated matches with predictable outcomes, need not result in lower attendances in women's football leagues. This is a reassuring finding for club and league executives and stakeholders (broadcasters, sponsors).

There does appear to be a fan attraction to matches where the away team has the possibility of winning the league title, which perhaps more widely hints at a fan preference to see particular star teams and or players, which is further evidenced by the significance of away team form and whether the away team is playing in that season's UEFA Women's Champions League. Further work might seek to examine this possibility in more detail. The effects on league attendances of winning a major national team tournament, especially England Women's team winning the 2025 European Championship, merit further investigation.

Our results also speak to a potential league policy implication calling for careful scheduling of women's fixtures. Games played on the same day as the men's team playing a home fixture typically attracts far fewer fans. Women's league games played while the men's leagues are on an international break attract much larger numbers of fans, albeit with some alternative explanations as discussed above.

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Tables and Figures

Table 1: Descriptive Statistics (full sample)

Variable	Mean	Std. dev.	Min	Max
N=1,875				
Dependent Variable				
Attendance	1872.07	4672.39	50	60160
Log(Attendance)	6.76	1.08	3.91	11.00
Independent Variables				
Home Win Probability	0.44	0.29	0.01	0.95
Theil	0.81	0.25	0.22	1.10
Weekday	0.16			
Men on International Weekend	0.15			
Men's Team at Home	0.06			
Men's Game same day	0.75			
Distance between clubs (miles)	182.44	109.63	1.00	550
Away team Champion's League	0.22			
Home Team Points Per Game	1.44	0.78	0.00	3.00
Away Team Points Per Game	1.42	0.78	0.00	3.00
Temperature (ºC)	13.10	5.79	-1.70	33.50
Rainfall (mm)	2.55	4.42	0.00	39.60
Championship significance Home	0.04	0.11	0.00	1.00
Championship significance Away	0.04	0.10	0.00	1.00
European significance Home	0.09	0.18	0.00	1.70
European significance Away	0.09	0.12	0.00	1.56
Relegation significance Home	0.05	0.12	0.00	1.00
Relegation significance Away	0.05	0.12	0.00	1.00

Table 2: Attendance demand, baseline estimates

	(1)	(2)	(3)	(4)
	All	EN	FR	GE
VARIABLES		Log(attendance)		
Home win probability	0.829***	0.016	0.729	1.570***
	(0.319)	(0.516)	(0.640)	(0.404)
Home win probability squared	-0.826***	-0.191	-1.097*	-1.270***
	(0.286)	(0.469)	(0.598)	(0.338)
Weekday (0,1)	-0.219***	-0.393***	0.037	-0.138***
	(0.045)	(0.089)	(0.088)	(0.049)
Men on Intrnational Weekend (0,1)	0.178**	0.247*	0.075	0.288***
	(0.073)	(0.129)	(0.121)	(0.084)
Men' s team at home (0,1)	-0.172***	-0.261***	-0.249**	0.084
	(0.056)	(0.095)	(0.097)	(0.101)
Men's game same day (0,1)	0.019	-0.067	0.086	0.068
	(0.058)	(0.090)	(0.107)	(0.064)
Log distance between teams	-0.126***	-0.221***	-0.021	-0.030
	(0.024)	(0.036)	(0.028)	(0.027)
Away team Champions League (0,1)	0.427***	0.124	0.570***	0.564***
	(0.062)	(0.098)	(0.134)	(0.082)
Championship significance home	-0.076	-0.332	-0.461	-0.320
	(0.281)	(0.415)	(0.481)	(0.384)
Championship significance away	0.949***	0.036	2.243***	1.018***
	(0.251)	(0.296)	(0.521)	(0.365)
European significance home	0.177	0.166	0.469*	-0.218
	(0.152)	(0.309)	(0.253)	(0.217)
European significance away	-0.335***	0.307	-0.573**	-0.445**
	(0.126)	(0.215)	(0.223)	(0.185)
Relegation significance home	0.046	0.518	0.109	-0.107
	(0.141)	(0.405)	(0.174)	(0.183)
Relegation significance away	0.264**	0.081	0.628***	-0.061
	(0.132)	(0.313)	(0.212)	(0.153)
Home team PPG	0.160***	0.188**	0.133*	0.195***
	(0.042)	(0.077)	(0.068)	(0.059)
Away team PPG	0.264***	0.152**	0.298***	0.201***
	(0.038)	(0.061)	(0.069)	(0.053)
Temperature	0.033***	0.075**	0.037	0.023*
	(0.011)	(0.032)	(0.022)	(0.013)
Temperature squared	-0.001**	-0.003**	-0.001	-0.000
	(0.000)	(0.001)	(0.001)	(0.000)
Precipitation	-0.010***	-0.010	-0.010**	-0.011**
	(0.004)	(0.007)	(0.004)	(0.005)
Constant	5.630***	7.422***	4.981***	5.311***
	(0.212)	(0.361)	(0.364)	(0.325)
League FE	Yes	n/a	n/a	n/a
Home team FE	Yes	Yes	Yes	Yes
Season FE	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes

Observations	1,875	584	617	674
R-squared	0.697	0.703	0.673	0.750

Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1

Table 3: Attendance demand, Theil index

	(1)	(2)	(3)	(4)
	All	EN	FR	GE
VARIABLES	Log(attendance)			
Theil	0.167**	0.029	0.246	0.290***
	(0.078)	(0.128)	(0.157)	(0.092)
League FE	Yes	n/a	n/a	n/a
Home team FE	Yes	Yes	Yes	Yes
Season FE	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Observations	1,787	548	617	622
R-squared	0.696	0.715	0.671	0.753

Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1

Table 4: Linear regression spline estimates

	(1)	(2)	(3)	(4)
	Logatt			
Home Win Prob. range	All	EN	FR	GE
<= 0.2	0.040	-0.658	-0.294	1.747**
	(0.564)	(0.934)	(0.986)	(0.805)
>0.2 , <=0.4	0.343	-0.449	0.348	0.640
	(0.360)	(0.688)	(0.540)	(0.455)
>0.4 , <=0.6	0.418	0.711	-0.033	0.436
	(0.388)	(0.739)	(0.621)	(0.455)
>0.6 , <=0.8	-0.892**	-0.635	-1.704**	-0.401
	(0.408)	(0.866)	(0.770)	(0.437)
>0.8	-0.626	-2.415	-0.434	0.256
	(0.890)	(1.739)	(1.497)	(1.024)
Constant	5.744***	7.584***	5.117***	5.249***
	(0.230)	(0.397)	(0.370)	(0.400)
League FE	Yes	n/a	n/a	n/a
Home team FE	Yes	Yes	Yes	Yes
Season FE	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Observations	1,787	548	617	622
R-squared	0.698	0.718	0.675	0.756
p value	0.029	0.427	0.186	0.011

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The final row (labelled p-value) gives the result of the test that the coefficients on each segment of home win probability are jointly equal to zero.

Figure 1: Average match day attendances in top division women's European football leagues

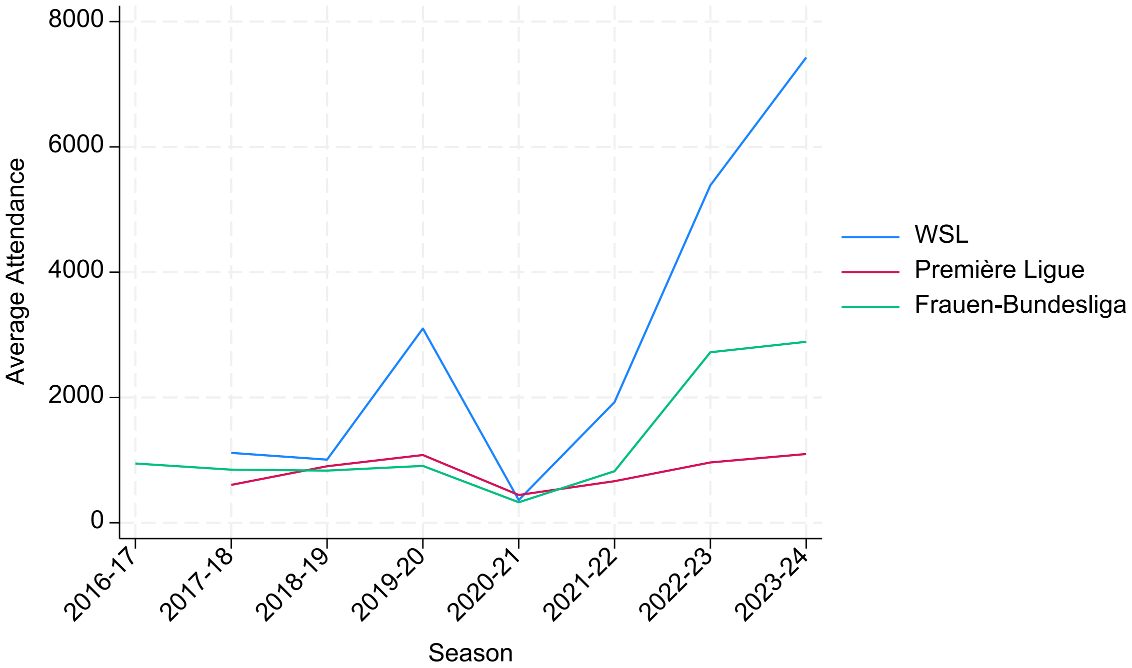


Figure 2: Distribution of home win probability by league for men and women

Note: For the purposes of comparison, the data covers 2017-18 through to 2023-24 (excluding the 2020-21 season) for all leagues. (The data for the male leagues is sourced from https://www.football-data.co.uk/ and calculated as described in Section 3). Source: Author's calculations.

Figure 3: Distribution of home and away goals

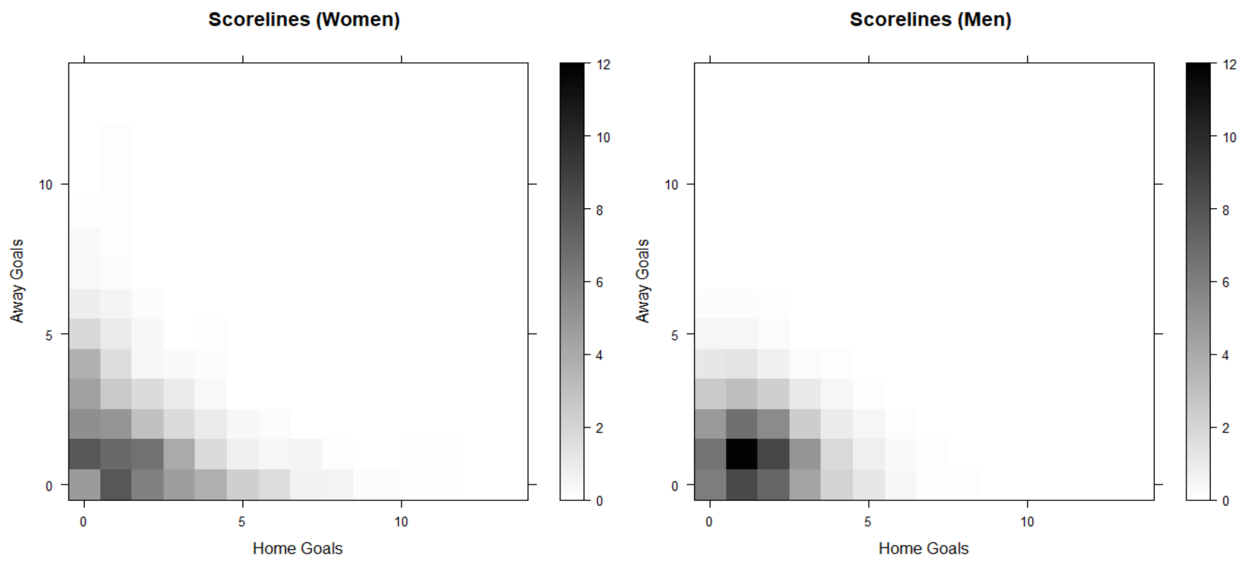


Figure 4: Estimated coefficients from month dummy variables

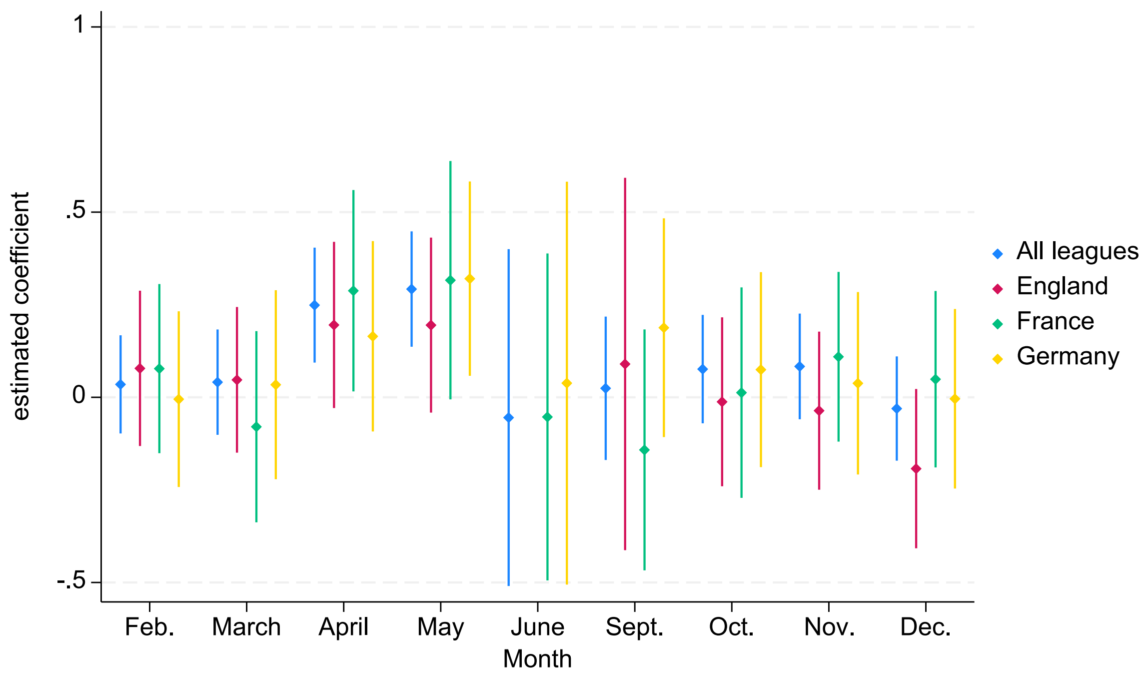
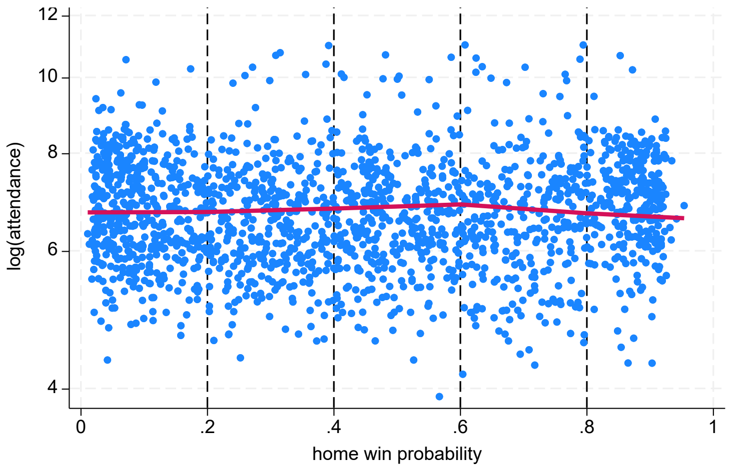
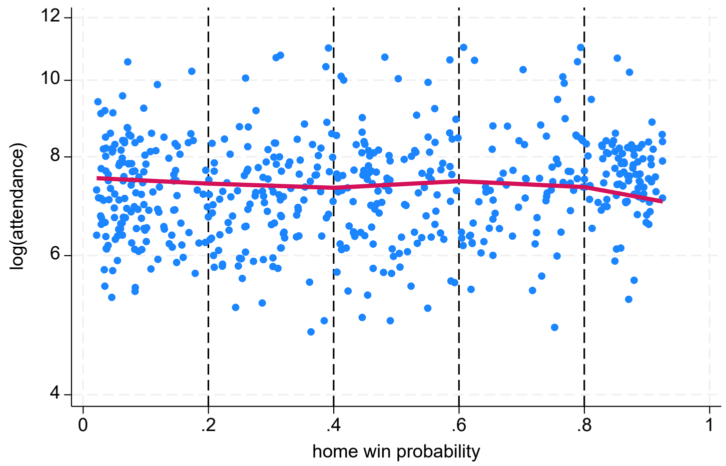


Figure 5: Linear regression splines

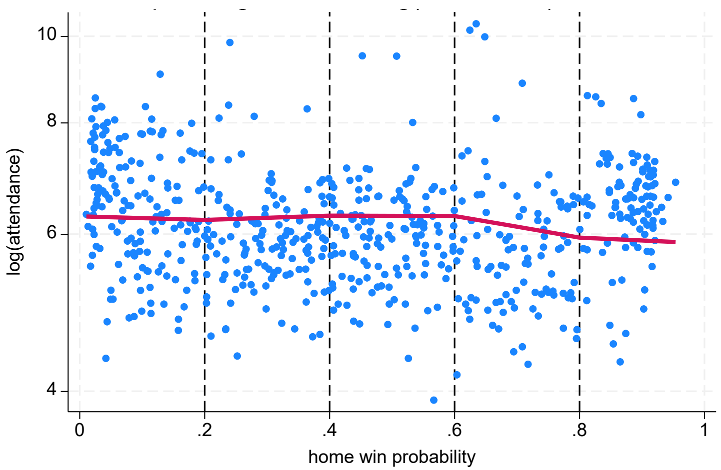
Panel A: All leagues



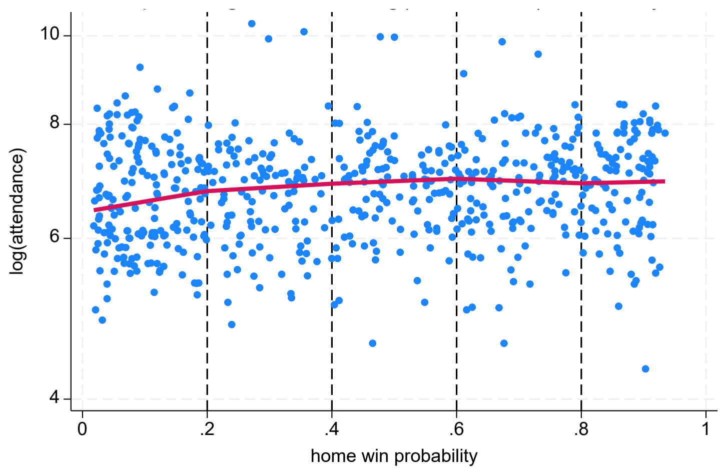
Panel B: England



Panel C: France



Panel D: Germany



Notes: Linear spline (red line) is the predicted value of log attendance, holding other variables at their means.

Appendix

Table A1: Descriptive statistics, by county

Variable	England N=584	France N=617	Germany N=674
Dependent Variable			
Attendance	3421.22	912.22	1490.58
Log(Attendance)	7.38	6.19	6.81
Independent Variables			
Home win probability	0.44	0.45	0.44
Theil	0.82	0.81	0.81
Weekday	0.13	0.14	0.19
Men on International Weekend	0.14	0.15	0.16
Men's Team ar Home	0.07	0.08	0.05
Men's Game Same Day	0.72	0.76	0.76
Distance between teams (miles)	104.00	243.56	189.99
Away team Champions League	0.23	0.22	0.21
Championship significance Home	0.05	0.03	0.03
Championship significance Away	0.05	0.02	0.03
European significance Home	0.11	0.07	0.09
European significance Away	0.12	0.06	0.09
Relegation significance Home	0.03	0.07	0.05
Relegation significance Away	0.03	0.07	0.05
Home team Points Per Game	1.43	1.44	1.43
Away team Points Per Game	1.44	1.41	1.43
Temperature	11.45	14.10	13.34
Precipitation	2.40	2.71	2.49