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# Referee bias in Scottish football – a statistical analysis of penalties conceded, 2016-2023.

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**Abstract:** This study presents a statistical analysis of penalties conceded in the top tier of the Scottish Professional Football League (SPFL) from seasons 2016/2017 - 2022/2023. In particular, claims in the media that the number of penalties conceded by Glasgow Rangers is statistically anomalous are considered. A t-test analysis of the penalties conceded by Rangers versus other SPFL premier league clubs, reveals a statistically significant difference, with Rangers conceding fewer penalties. This result is even more pronounced for Rangers if the analysis is restricted to penalties conceded at home. By comparison, the number of penalties conceded by Glasgow Celtic do not diverge significantly from the league's average, despite their dominant playing style and high possession rates. The study concludes that the number of penalties conceded by Rangers over this period is formally a statistical outlier, lending significant weight to concerns over the impartiality of match officiating in Scottish football.

**Keywords:** football; soccer; bias; referee.

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# 1. Introduction

In the realm of Scottish football, the impartiality of match officials is frequently challenged, particularly within the top competition, the Scottish Professional Football League (SPFL) premier league. Critical analysis in the press, social media and other public forums is intense, partly because it is fuelled by a sectarian divide that is deeply engrained in the west of Scotland society (Devine 2020). Glasgow Rangers is often seen as a club that embodies the traditional establishment in Scottish football, primarily drawing support from the majority Protestant and often Unionist segment of the local community (Bissett & McKillop 2014). In contrast, their archrivals, Glasgow Celtic, were established to aid the impoverished Irish immigrants who settled on Scotland's West coast in the late 1800s. Celtic's supporters are predominantly from the minority Catholic community in the west of Scotland, and their political leanings often align with progressive and republican principles (McBride 2022).

In recent years, there has been growing scrutiny in the media regarding the small number of penalties conceded by Rangers in the SPFL premier league. Since season 2016/2017, Rangers have conceded fewer penalties than any other SPFL club, and this has raised questions about the impartiality of match officials. Some have claimed that this demonstrates a positive bias in favour of the club. Unconscious referee bias and the effects of home advantage (e.g. Pollard 2008, Pollard 2014) are two well-documented phenomena in professional sports, especially in association football.

Until now, a proper statistical analysis of the penalties conceded in the SPFL has not been conducted. Media attention has focused on recent figures, especially since 2022 onwards. This paper seeks to address these claims by analysing an extensive data set from all SPFL premier league clubs over a much longer period of time – from season 2016/2017 to season 2022/2023. The 2016/2017 season was the first season Rangers competed in the SPFL premier league after the club went into liquidation in 2012. The main aim is to properly establish whether the low number penalties conceded by Rangers during this extended period is statistically significant or not. In section 2, we describe the data, and in section 3 statistical tests on the data are performed and the results presented. In section 4, we draw our conclusions.

## 2. Data sources

The data were sourced from <https://footystats.org/> and <https://www.fctables.com/> - all the data are in the public domain. For each season (2016/2017-2022/2023) we have recorded for each club participating in the SPFL premier league, the number of penalties conceded (total, home and away), plus possession statistics for the season. There are therefore 86 entries for these statistics over the 7-year period. Table 1 presents a subset of the data – statistics for season 2022/2023 only.

**Table 1.** Penalties conceded (total, home and away) for the SPFL (2016/2017-2022/2023). Only the figures for season 2022/2023 are presented here.

Club	Season	Penalties conceded (Total)	Penalties conceded (Home)	Penalties Conceded (Away)	Average Possession (%)
Aberdeen	2022/2023	13	3	10	47
Hibernian	2022/2023	12	7	5	53
St. Mirren	2022/2023	12	6	6	38
Livingston	2022/2023	11	4	7	44
Celtic	2022/2023	8	3	5	72
Ross County	2022/2023	7	3	4	43
Hearts	2022/2023	7	4	3	54
Kilmarnock	2022/2023	7	4	3	44
St. Johnstone	2022/2023	5	2	3	43
Dundee United	2022/2023	5	3	2	46
Motherwell	2022/2023	5	2	3	47
Rangers	2022/2023	0	0	0	67
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### 3. Statistical analysis

We perform a standard statistical analysis on the data. The total number of penalties conceded by all clubs is 479 across all 7 seasons. We initially split the sample into 2 groups – Rangers vs the other premier league clubs. The total number of penalties conceded by Rangers is 18 and the mean number per season is 2.57 with a standard error of 0.84. The mean number of penalties conceded per season for the other premier league clubs is 5.99 with a standard error of 0.32. We performed a statistical *t* test on the data - this reflects the degree to which the data for Rangers differ in terms of the standard error. The calculated *t*-value is -3.1. Adopting a standard significance level ( $\alpha$ ) of 0.05, the *p*-value is determined to be 0.0027. The *p*-value is smaller than the typical alpha level of 0.05, and by standard criteria this result is considered to be highly statistically significant. Indeed, the average penalties conceded per season between Rangers and the other clubs is statistically significant at the > 95% confidence interval (CI). The null hypothesis (Rangers concede the same number of penalties as the average of all clubs) can therefore be rejected. The analysis demonstrates that Rangers show a significant statistical deviation from what would be expected in terms of penalties conceded in the SPFL premier league.

The result becomes even more significant if we restrict ourselves to penalties conceded at home. The total number of penalties conceded by Rangers is 4 and the mean number per season is 0.57 with a standard error of 0.20. The *t*-value is then calculated to be -5.02 and the *p*-value is < 0.0001.

We repeated this statistical analysis for Celtic. The total number of penalties conceded by Celtic is 27 and the mean number per season is 3.86 with a standard error of 0.80. The *t*-value is then calculated to be -1.76. The *p*-value for Celtic is approximately 0.008, which is greater than the standard significance level of 0.05. We conclude that the number of penalties conceded by Celtic is not significantly different from the rest of the premier league.

In the SPFL premier league, Celtic and Rangers enjoy high levels of possession with most matches being played in the opposition's half (see Table 1). However, the amount of possession a team has correlates only very weakly with the number of penalties conceded. In particular, the Pearson correlation coefficient between the total number of penalties conceded and possession over this period is approximately -0.12 – applying this correction via regression to the data has no effect on the results presented here.

### 4. Conclusions

The analysis performed suggest that Rangers concede fewer penalties than other SPFL premier league clubs, and that this is a highly significant statistical result – the probability that this phenomenon occurs by chance is much less than 5%. It is also observed that the this is not the case for Celtic – even though they dominate SPFL premier league matches in terms of essentially all statistical measures, including possession. The results support many anecdotal claims (e.g. Wallace 2023) that Rangers enjoy privileged treatment by referees and other SPFL match officials, and this formally raises questions about the reputation and integrity of the SPFL.

**Supplementary Materials:** The full data set will be placed online

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**Conflicts of Interest:** The author declares no conflict of interest.

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