R22-09 Impact of Course Setup on Scoring and Driving Distance on the PGA TOUR

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1 Introduction

This report looks at the impact of rough height and fairway width on driving distance and scoring on the PGA TOUR.

2 Cost of rough and cost of missing fairway: overview

The cost of rough and cost of missing the fairway are defined and calculated using composite data from 2015 to 2021. The cost of non-fairway is the difference between the mean score on a hole for shots which do not finish on the fairway after the drive, and the mean hole score for shots that do finish on the fairway. This includes the effects of such features as hazards, obstacles, and penalty strokes, and as such would be expected to be higher than the cost of rough, which only considers the difference between shots which finish in the rough and those that finish in the fairway.

On average, the overall the cost of non-fairway is 0.09 strokes higher than the cost of rough. Further, the cost of rough and the cost of non-fairway are higher on Par 4s than Par 5s.

There is no statistically significant relationship between rough height and driving distance. An increase in rough height does slightly favour the scoring of the 25% of players with the shortest driving distance compared to the longest 25%, however again when we consider the extremes of any possible changes the effects are still minimal at approximately 0.16 strokes per round. It is worth noting that this value is based on all holes moving from the shortest rough group to the longest.

While fairway width at 300 yards also has a statistically significant relationship with driving distance and scoring, the effect here is also small. The impact on driving distance due to a fairway width change of 9 yards, the interquartile range of fairway width values at 300 yards on tour, is on average 4.86 yards. The impact on scoring is even less significant, with the same 9-yard increase in fairway width (at 300 yards) leading to a reduction in average round score of 0.301 strokes.

2.1 Cost of Non-Fairway and Rough

Figure 1 shows the distribution of cost of non-fairway and cost of rough values on Par 4 holes on the PGA TOUR between 2015 and 2021, and Figure 2 shows this for Par 5s. Holes less than

360 yards in length have been removed from this analysis to remove the impact of players going for the green. It is worth clarifying that the same hole played on multiple seasons will be included as a separate value for each season it was played.

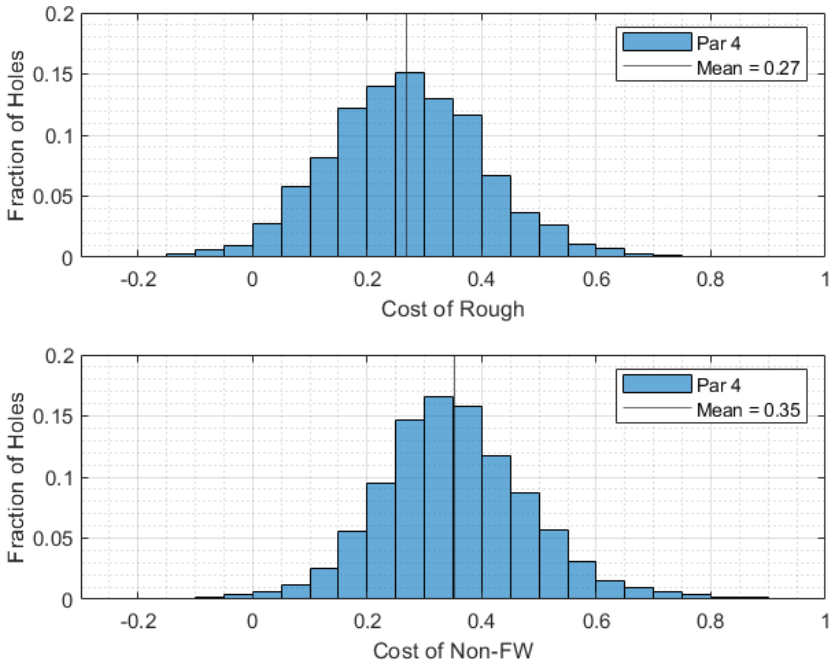

Figure 1: Distribution of cost of non-fairway and cost of rough values on the PGA TOUR from 2015 – 2021.

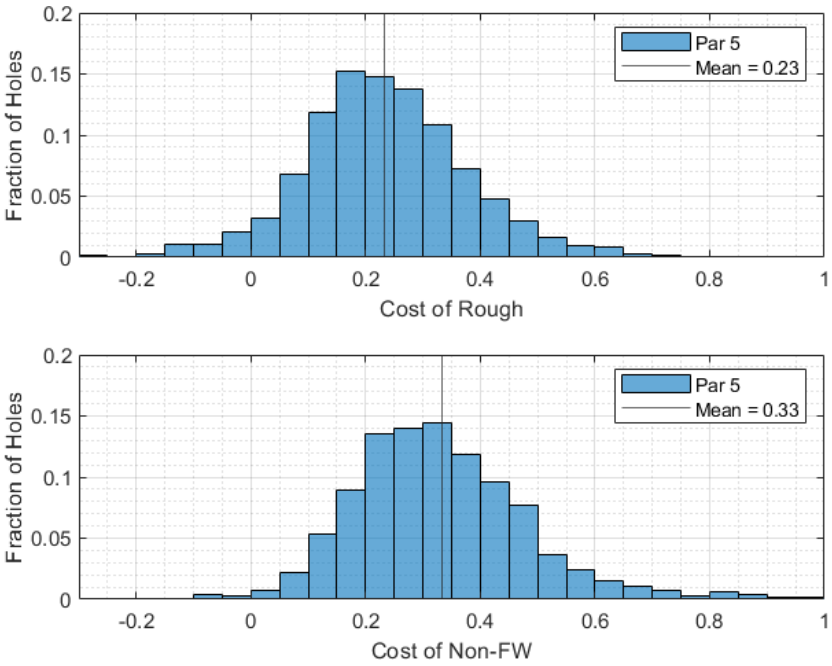

Figure 2: Distribution of cost of non-fairway and cost of rough values on the PGA TOUR from 2015 – 2021.

From these figures we can see that on average, the cost of rough is higher on Par 4s than Par 5s by 0.04 strokes, while the difference in the cost of non-fairway is smaller at a difference of 0.02 strokes. Table 1 summarizes these mean values, as well as the weighted mean.

Table 1: Mean cost of rough and cost of non-fairway on the PGA TOUR.

PGA TOUR 2015 – 2021	Cost of Rough	Cost of Non-Fairway
Par 4s	0.27	0.35
Par 5s	0.23	0.33
Combined	0.26	0.35

3 Rough Height

3.1 Driving Distance

The Shotlink data provided by the PGA TOUR includes rough height for most of the courses played. Figure 3 shows the distribution of driving distances at each rough height on the PGA TOUR in 2020 - 2021.

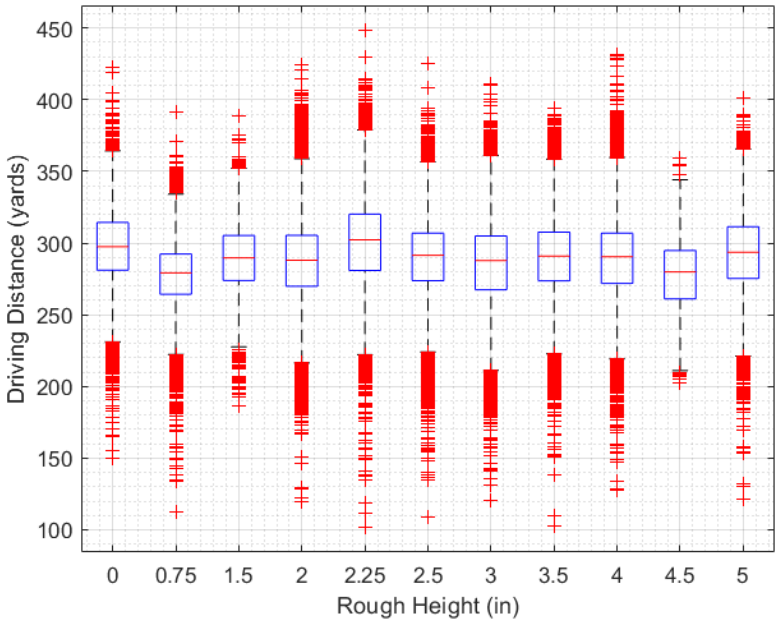

Figure 3: Distribution of driving distances by rough height. The central red lines show the median value at each rough height, with the blue boxes showing the 25th and 75th percentiles. The red crosses mark data points that are considered to be outliers from the distribution.

There is substantial noise such that a model predicting driving distance based on rough height alone showed that there was no statistically significant relationship between rough height and driving distance ($p>0.05$).

3.2 Scoring

To measure the impact of rough height on scoring, two groups were extracted from the data – 'Long Rough' where rough length is at least 3.5 inches long (group average 4.0 inches) and 'Short Rough' where rough length is at most 2.0 inches long (group average 1.7 inches). Data where rough length was listed as 0 inches long are not included here.

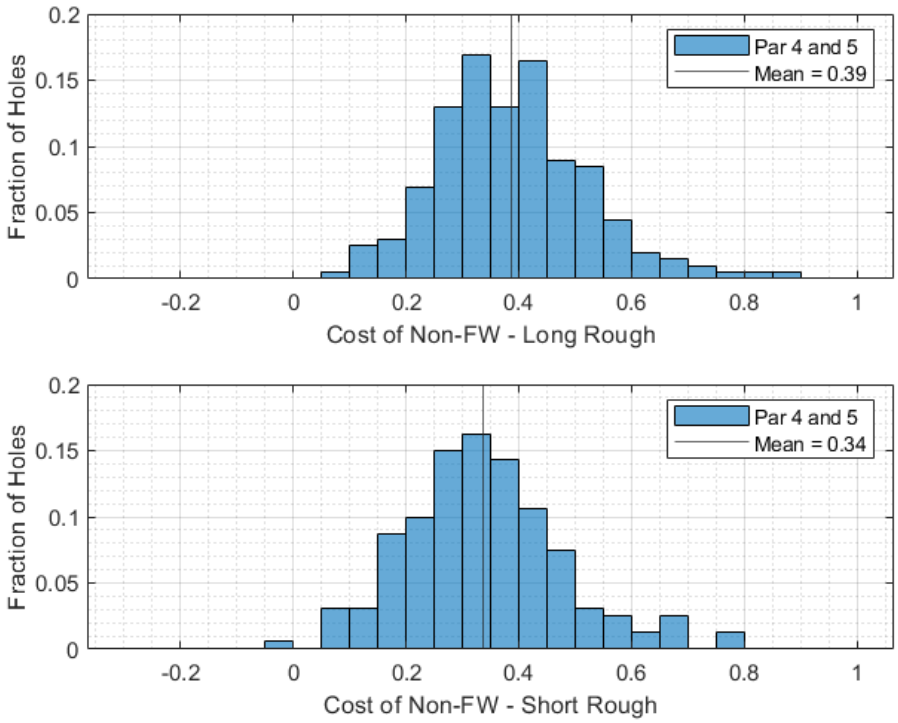

Figure 4: Cost of non-fairway by rough group.

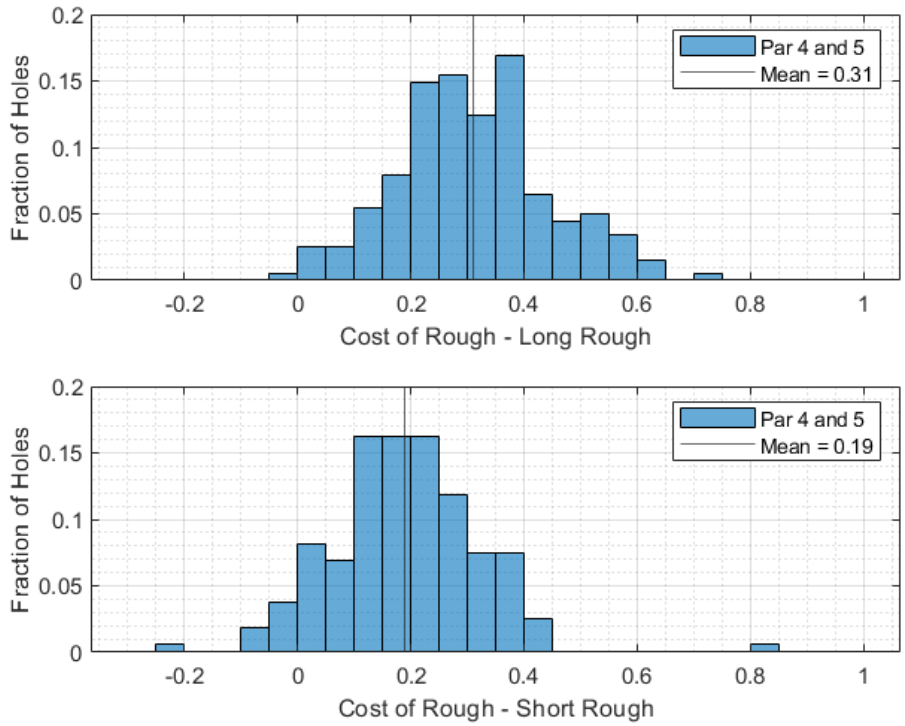

Figure 5: Cost of rough by group.

Figure 4 shows the distribution of cost of non-fairway values in each rough height group, and Figure 5 shows the cost of rough distribution. All Par 4s and Par 5s longer than 360 yards are included here.

As may be expected, the difference in the cost of rough between the short and long rough height groups is larger than the cost of missing the fairway. The cost of missing fairway increases by 0.04 strokes on holes in the long rough group compared to the short rough group, whereas the cost of rough increase 0.12 strokes.

Table 2 shows the cost of rough values when the longest and shortest 25% of players are considered.

Table 2: Cost of rough for longest and shortest players.

Rough Group	Longest 25% of Players	Shortest 25 % of Players
Long	0.31	0.30
Short	0.17	0.22
Difference	0.14	0.08
Statistically Significant (p<0.05)	Yes	Yes

On average, the shortest 25% of players hit the rough 26% of the time, while the longest 25% hit the rough 32% of the time. This suggests that, assuming the average of 14.75 Par 4s and 5s

per round on the PGA TOUR, we would expect the mean hole score to increase by 0.14*.26*14.75 = 0.54 strokes per round between short and long rough group holes for long players, and 0.08*.32*14.75 = 0.38 for short players. This results in a differential of 0.16 strokes per round between the groups.

4 Fairway Width

4.1 Driving Distance

The PGA TOUR also report the fairway width at 250 to 350 yards from the tee in increments of 25 yards. Here we focus on the width at 300 yards, which is closest to the mean measured driving distance on tour (296.2 yards in 2021). Figure 6 shows driving distances plotted against fairway width at 300 yards on the PGA TOUR in 2020 and 2021.

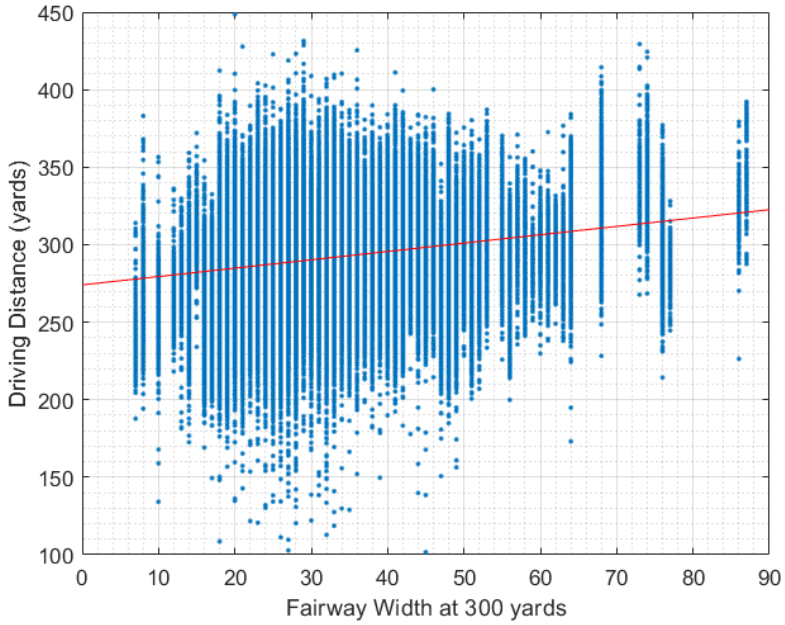

Figure 6: Driving distance by fairway width at 300 yards.

We can see that there is a relationship between fairway width and driving distance. The model suggests each yard increase in fairway width results in an increase of just over half a yard (0.54 yards) in driving distance on average. Like the relationship with rough height, the correlation is weak.

$$Driving\ Distance\ (yards) = 274.04 + 0.5420 * Fairway\ Width\ at\ 300\ yards\ (yards); R^2 = 0.034$$

However, the coefficient for fairway width in this model is statistically significant, with confidence intervals of [0.5317, 0.5523]. It is worth noting the distribution of fairway widths on tour. Figure 7 shows this.

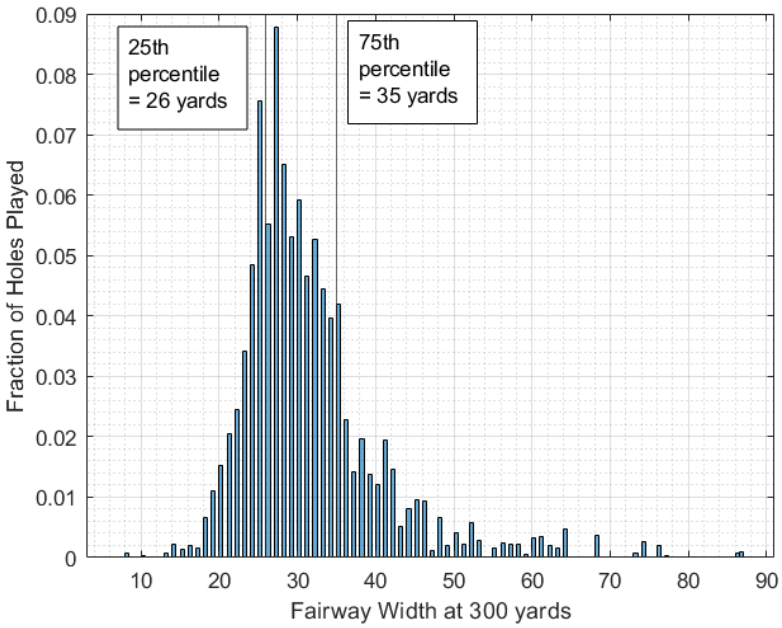

Figure 7: Distribution of fairway widths at 300 yards on tour.

The interquartile range is 9 yards, as shown in the figure. This means that even if the above equation correctly predicts how driving distance would change with a change in fairways width despite the low R^2, a shift in average fairway width at 300 yards by the interquartile range would only be expected to result in an increase in driving distance of 0.54*9.00 = 4.86 yards. Again, a change of this magnitude would likely not be practical on tour.

4.2 Scoring

The impact of fairway width at 300 yards on scoring appears to be minimal. Figure 8 shows the score-to-par on Par 4s and 5s by fairway width at 300 yards.

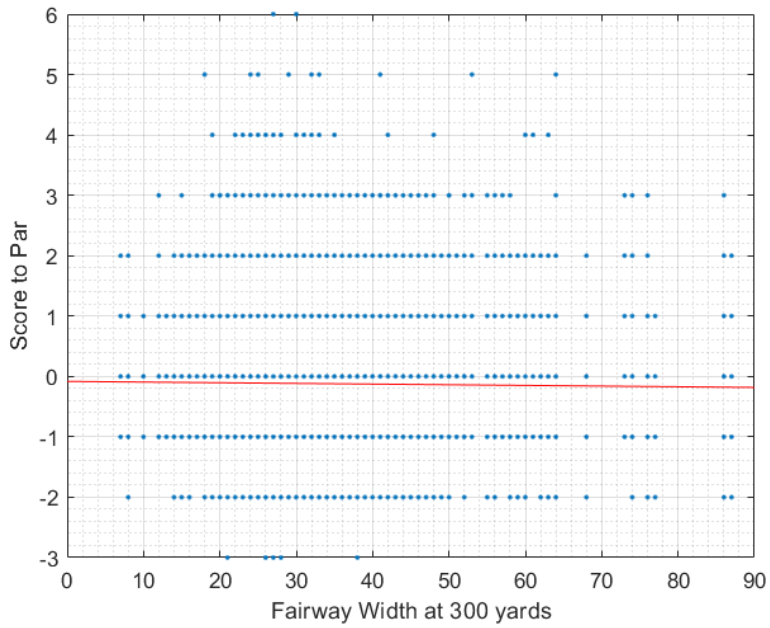

Figure 8: Score to par by fairway width at 300 yards.

The equation for the fitted line is shown below.

$$Score\ to\ Par = 0.0219 - 0.0023 * Fairway\ Width\ at\ 300\ yards\ (yards); \quad R^2 = 0.001$$

The coefficient for fairway width here is also statistically significant, with a confidence interval of [-0.0025, -0.0020]. This suggests that, with an increase in fairway width equal to the interquartile range of 9 yards, hole score would be expected to improve by 0.021 strokes on average. In a similar manner in which we estimated the impact of rough height changes, we can approximate that this equates to 0.021×14.75=0.310 strokes per round.

4.3 Fairway Width Change Simulations

Another way to look at the impact on scoring is by simulating how changes in fairway width impact scoring. Shotlink data collected by the PGA Tour includes the distance to the edge of the fairway from where a tee-shot finishes. In order to simulate fairway width reduction, we check this value against a given fairway width reduction parameter. For each of the combined groups outlined above, the fairway width is changed in 1-yard increments, from +15 to -15, as well as simulations where all shots are hit from outside the fairway and conversely when all shots are hit from the fairway. In order for the datasets to be large enough, the longest 25% and shortest 25% of players are analysed here. Figure 9 shows how the mean hole score changes on Par 4s, and Figure 10 the difference in mean score between these groups.

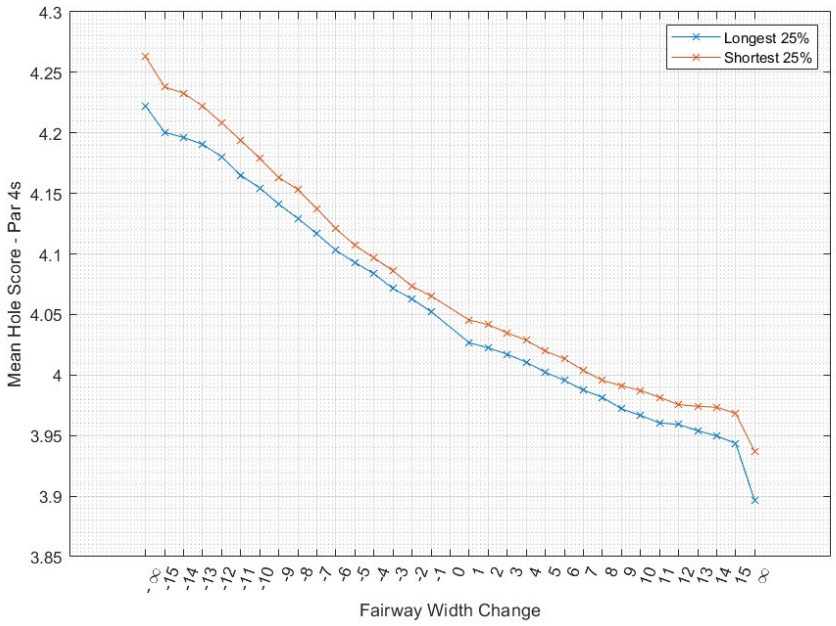

Figure 9: Mean hole score for longest and shortest players on Par 4s.

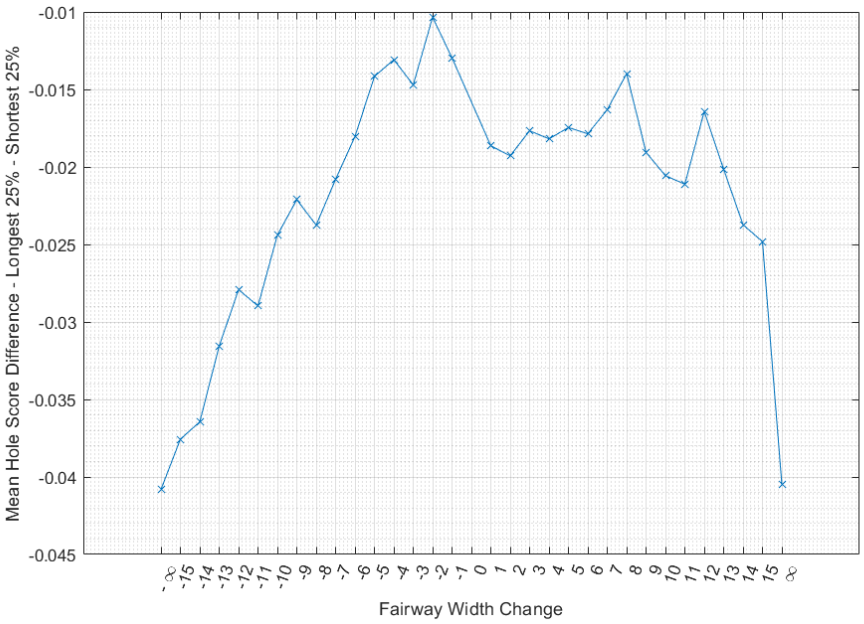

Figure 10: Difference in mean hole score for longest and shortest players on Par 4s.

The peak in Figure 10 is where the difference between the longest and shortest players is smallest. This suggests that a reduction in fairway width of around 2 yards would be expected to help the shortest 25% of players on Par 4s most. If there were no fairways, or a large reduction in fairway width, the shorter players who tend to be more accurate are no longer able to demonstrate this skill. Equally, when fairways are 'infinite' or their width is hugely increased, the longer players who tend to be more erratic are not punished for errant drives when considered on average.