Approach Shot Distances and Hole Lengths on the PGA TOUR

1 Introduction and Executive Summary

This paper looks at the question of whether the distance of approach shots on Par 4s and Par 5s have changed on the PGA TOUR since 2004, and the relationship between driving distance and approach shot distances.

The median approach distances played on Par 4s on the PGA TOUR has varied between a low value of 149.1 yards in 2006 and a high of 154.1 yards in 2014. The sensitivity to the distribution of hole lengths means it is difficult to make firm assertions about whether approach shot distances have significantly changed over this period. Median hole lengths on Par 4s have increased from 430 yards in 2004, 2006 and 2010 to 435 yards in 2018, an increase of 5 yards.

On Par 5s, the median distance to the hole after the drive has ranged from 262.4 yards in 2012 to a high of 270.2 yards in 2008. Once again, there has been significant variability in the median between 2004 and 2018. Median hole lengths on Par 5s have ranged from 554 to 560 yards.

The above suggests that increasing hole lengths on Par 4s could be mitigating the impact of the increasing driving distances on the PGA TOUR.

Contents

2 Par 4s

2.1 Approach Shot Distances

Table 1 shows basic statistics for the approach shot distances on Par 4s on the PGA TOUR since 2004.

Table 1 Approach shot distances on Par 4s on the PGA TOUR since 2004.

Year	Mean	1st Percentile	5th Percentile	10th Percentile	25th Percentile	Median	75th Percentile	90th Percentile	95th Percentile	99th Percentile	Total Shots
2004	147.9	34.4	83.8	101.6	125.9	150.4	173.0	192.2	203.8	227.0	166710
2005	147.1	29.7	79.1	98.5	123.6	149.4	174.1	194.5	206.1	229.5	172096
2006	146.7	31.4	79.1	98.7	123.7	149.1	173.3	193.0	204.6	227.2	171291
2007	147.7	27.0	79.0	99.4	124.8	150.1	174.4	195.0	207.0	230.3	165527
2008	150.1	25.9	77.7	101.0	127.7	153.0	177.1	197.8	209.5	232.0	169176
2009	149.2	22.9	75.1	99.7	127.6	152.5	176.0	196.8	208.9	231.6	154843
2010	148.9	26.4	80.8	101.3	126.0	151.3	175.4	196.2	207.9	230.4	158298
2011	148.6	22.6	79.8	101.8	126.8	151.1	175.0	195.5	207.2	230.4	153900
2012	149.5	24.4	82.8	103.8	127.9	151.6	175.3	195.5	207.0	230.2	150657
2013	151.7	27.4	87.2	105.7	129.8	153.7	177.6	197.8	209.2	232.1	135459
2014	151.7	23.1	82.4	102.9	129.0	154.1	178.9	199.6	211.5	235.5	150024
2015	149.8	24.4	82.2	102.6	127.5	152.1	176.1	197.0	208.7	233.4	155633
2016	150.1	25.7	84.0	103.5	128.5	152.2	175.7	196.1	208.3	232.0	151590
2017	147.5	21.4	76.8	100.0	125.8	150.2	173.9	194.7	207.4	230.4	159615
2018	146.5	18.6	72.8	98.7	125.1	149.6	173.2	193.8	205.7	228.9	159709

We can see that the mean approach shot distances have fluctuated between 146.5 and 151.7 yards over this period. The years with the maximum mean approach shot lengths are 2013 and 2014, with the shortest mean length of 146.5 yards in 2018. However, in order to get a clearer understanding of what these values mean, we also have to look at the hole lengths played in these years. These are shown in Table 2.

Table 2 Hole lengths on Par 4s on the PGA TOUR.

Year	Mean	1st Percentile	5th Percentile	10th Percentile	25th Percentile	Median	75th Percentile	90th Percentile	95th Percentile	99th Percentile
2004	423.4	308.7	347.7	366.7	400.0	430.0	452.7	468.3	478.7	496.7
2005	425.0	310.7	348.7	368.7	400.7	430.7	454.7	472.0	481.7	501.7
2006	424.0	308.0	346.0	370.0	398.0	430.0	454.0	472.0	481.0	499.0
2007	425.0	312.0	345.0	366.0	398.0	431.0	456.0	476.0	486.0	506.0
2008	426.9	304.0	346.0	369.0	402.0	432.0	458.0	477.0	487.0	507.0
2009	426.1	302.0	342.0	367.0	401.0	431.0	457.0	476.0	489.0	506.0
2010	426.3	298.0	347.0	370.0	400.0	430.0	457.0	476.0	487.0	505.0
2011	426.1	301.0	347.0	370.0	400.0	431.0	457.0	476.0	488.0	506.0
2012	427.3	306.0	349.0	371.0	401.0	431.0	458.0	477.0	489.0	506.0

2013	427.5	305.0	345.0	368.0	401.0	433.0	460.0	478.0	486.0	507.0
2014	428.8	298.0	347.0	371.0	403.0	434.0	461.0	479.0	490.0	513.0
2015	426.7	300.0	344.0	367.0	400.0	432.0	459.0	479.0	490.0	506.0
2016	428.6	300.0	349.0	371.0	404.0	433.0	460.0	479.0	490.0	509.0
2017	427.7	295.0	345.0	368.0	402.0	434.0	460.0	478.0	491.0	515.0
2018	428.4	289.0	347.0	372.0	401.0	435.0	460.0	481.0	493.0	513.0

It is interesting to note how the distributions of hole lengths have changed. If we look at the 1st percentile column, we can see that there have been more short Par 4 holes played in recent years. This links to the first column of Table 1, where the 1st percentile of approach shot lengths has decreased from 34.4 yards in 2004 to 18.6 yards in 2018. We can show this in a different way by looking at the percentage of Par 4s below 325 yards, shown in Table 3.

Table 3: Percentage of Par 4s under 325 yards each year between 2004 and 2018.

Year	% of Par 4s Under 325 yards
2004	2.206%
2005	2.096%
2006	2.460%
2007	2.258%
2008	2.662%
2009	2.588%
2010	2.196%
2011	3.070%
2012	2.313%
2013	2.596%
2014	2.591%
2015	2.748%
2016	2.537%
2017	3.401%
2018	3.307%

Despite the increase in Par 4-hole lengths on average, we can see that there has been an increase in short Par 4s in recent years. This could suggest that more risk/reward Par 4s are being set up due to a larger percentage of the field being able to reach these shorter holes.

Figure 1 shows a histogram of the distribution of approach shot distances in 2004 and 2018, and Figure 2 shows the distributions of hole lengths played.

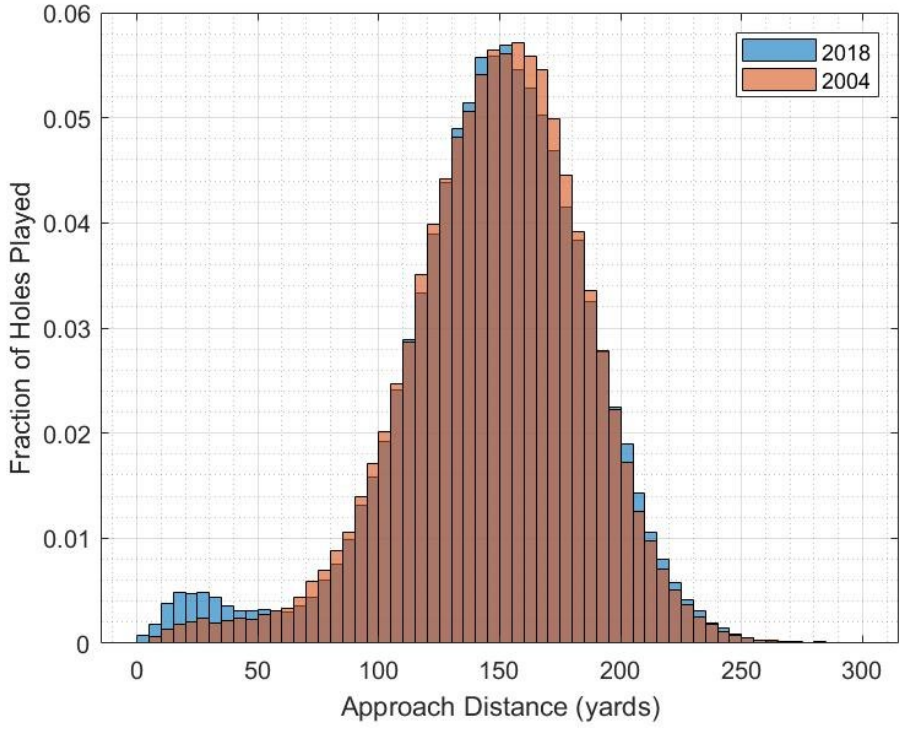

Figure 1: Approach shot distances on Par 4s on the PGA TOUR in 2004 and 2018.

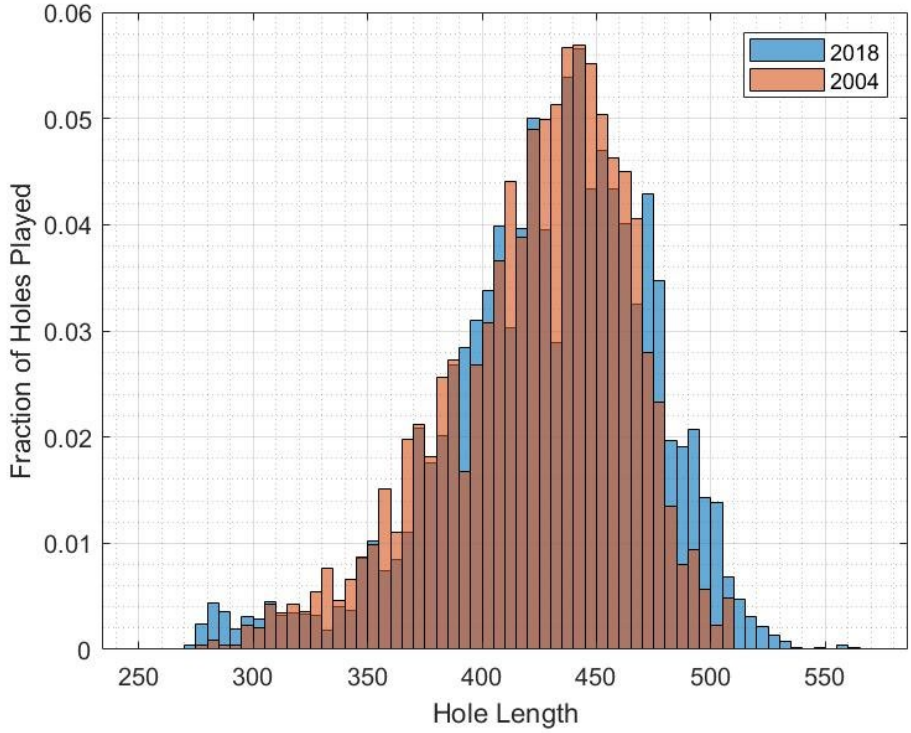

Figure 2: Par 4 Hole lengths played on the PGA TOUR in 2004 and 2018.

At the left-hand side of the distribution in Figure 2, we can see the increase in short Par 4s in 2018. We can also see the same at the right-hand side of the distribution, where there are more long Par 4s. This helps explain the increase in drives finishing within 50 yards of the pin on Par 4s, seen in the bump of the left-hand side of the distribution in Figure 1.

A t-test was performed on the data each year from 2004 to 2017 with the data from 2018. Table 5 summarises the results.

Table 4: Result of t-test on the Par 4 approach shot length data from 2004 to 2017 and 2018.

Year	Difference in the Mean (Year – 2018)	Is Statistically Significant	p-value	Upper Confidence Interval	Lower Confidence Interval
2004	1.5	Yes	<0.001	1.2	1.7
2005	0.7	Yes	<0.001	0.4	0.9
2006	0.2	No	0.118	-0.1	0.5
2007	1.2	Yes	<0.001	1.0	1.5
2008	3.6	Yes	<0.001	3.4	3.9
2009	2.7	Yes	<0.001	2.5	3.0
2010	2.4	Yes	<0.001	2.1	2.7
2011	2.2	Yes	<0.001	1.9	2.4
2012	3.0	Yes	<0.001	2.7	3.3
2013	5.3	Yes	<0.001	5.0	5.6
2014	5.2	Yes	<0.001	4.9	5.5
2015	3.3	Yes	<0.001	3.0	3.6
2016	3.6	Yes	<0.001	3.3	3.9
2017	1.0	Yes	<0.001	0.8	1.3

We can see that there has been a statistically significant difference between 2018 and all other years apart from 2006. However, it is again important to note that these mean values are very sensitive to the distribution of hole lengths, as can be seen from the variability in the difference in the mean column. For instance, approach lengths in 2006 were on average only 0.22 yards longer than in 2018.

2.2 Approach Shot Distance by Driving Distance on Par 4s

First, we look at simple Pearson correlations coefficients between annual driving distance for the player and approach shot distance, shown in Table 5.

Table 5: Correlation between players annual driving distance and approach shot lengths on Par 4s.

Year	Correlation
2004	-0.199
2005	-0.206
2006	-0.193
2007	-0.194
2008	-0.189
2009	-0.188

2010	-0.196
2011	-0.202
2012	-0.187
2013	-0.174
2014	-0.186
2015	-0.197
2016	-0.203
2017	-0.195
2018	-0.186

We can see that there has been a consistent correlation since 2004 between a player's driving distance and approach shot distance. There does not appear to be any historic trend in the correlation between driving distance and approach shot lengths.

We can look at whether the longest players on Tour have decreased their average approach distance relative to the rest of the field. Here we look at the top 10% in driving distance each, and their mean approach distances. Table 6 shows this data, and the values relative to the field.

Table 6: Approach distance of the Top 10% of players on Par 4s compared to annual average.

Year	Mean Approach Distance of Top 10% (yards)	Field Average	Comparison to Field Average (yards)
2004	137.0	147.9	10.9
2005	135.6	147.1	11.5
2006	135.9	146.7	10.8
2007	134.2	147.7	13.5
2008	138.5	150.1	11.6
2009	136.7	149.2	12.5
2010	137.3	148.9	11.6
2011	137.0	148.6	11.6
2012	139.2	149.5	10.3
2013	141.7	151.7	10.0
2014	141.5	151.7	10.2
2015	137.9	149.8	11.9
2016	138.6	150.1	11.5
2017	136.9	147.5	10.6
2018	134.1	146.5	12.4

Again, there is a lot of variability in the mean approach distance values here, however there is a lower mean approach distance for the Top 10% in driving distance in 2018, 134.1 yards, than in previous years. We can also look at the percentage of approach shots which finished within 50 yards from 2004 to 2018 for all players and the Top 10% in driving distance. Table 7 shows this data.

Table 7: Percentage of approach shots on Par 4s within 50 yards for the Top 10% in driving distance compared to field average.

Year	Percentage of Approach Shots Within 50 yards for Top 10% in Driving Distance	Field Percentage	Difference
2004	3.6%	1.7%	1.9%
2005	4.3%	2.2%	2.1%
2006	4.0%	2.1%	1.9%
2007	4.9%	2.4%	2.4%
2008	4.8%	2.5%	2.3%
2009	6.0%	3.0%	3.0%
2010	4.2%	2.2%	1.9%
2011	5.0%	2.7%	2.2%
2012	3.9%	2.5%	1.4%
2013	4.1%	2.0%	2.1%
2014	4.4%	2.5%	1.9%
2015	4.9%	2.6%	2.3%
2016	4.1%	2.3%	1.8%
2017	5.5%	3.2%	2.4%
2018	6.0%	3.5%	2.5%

We can see that, as would perhaps be expected, the longer group of players have more approach shots within 50 yards than the field. Further, the difference in the percentages between the Top 10% and the field is highest in 2018 than in any year since 2004. Once again, it is important to note the impact the distribution of hole lengths will have on these values.

3 Par 5s

3.1 Approach Shot Distances

We can do a similar analysis for distance to the pin after tee shots on Par 5s. Throughout this section we refer to the second shot on a Par 5 as an approach shot, even if the player does not make an attempt to hit the green. Table 8 shows the distribution of approach shot lengths on Par 5s each year since 2004, and Table 9 shows the distribution of hole lengths.

Table 8: Distribution of approach lengths on Par 5s on the PGA TOUR.

Year	Mean	1st Percentile	5th Percentile	10th Percentile	25th Percentile	Median	75th Percentile	90th Percentile	95th Percentile	99th Percentile	Total Shots
2004	265.2	185.7	206.1	217.7	238.4	263.6	290.5	315.1	329.4	356.9	53847
2005	266.8	179.1	204.4	217.6	240.7	266.7	293.2	316.4	329.7	352.9	54093
2006	265.2	181.2	204.7	217.5	238.7	263.4	290.8	316.0	330.4	355.8	53626
2007	268.6	186.6	209.2	221.4	242.5	267.0	293.9	319.3	332.5	356.1	48937
2008	270.7	183.4	208.8	221.6	244.3	270.2	296.5	321.4	334.7	358.2	48443

2009	266.8	185.1	208.4	220.4	241.5	265.6	291.1	314.9	329.5	355.6	45170
2010	269.2	189.2	210.5	222.2	241.9	267.2	295.9	319.5	331.7	357.6	42735
2011	265.6	187.2	207.3	218.5	239.1	264.3	291.2	314.4	327.7	352.5	42240
2012	263.9	182.1	203.8	216.0	237.2	262.4	289.8	314.4	327.6	350.3	39280
2013	265.8	185.6	205.6	216.9	238.8	264.8	291.1	315.6	331.7	358.1	40585
2014	267.7	185.4	206.9	219.3	240.9	266.6	294.3	317.5	330.4	354.9	45133
2015	265.8	180.8	205.7	218.6	240.3	266.0	290.6	313.3	326.7	350.1	43565
2016	264.8	170.7	200.3	214.0	237.3	264.1	292.2	317.1	332.3	359.3	44090
2017	265.1	177.9	203.6	217.0	238.7	264.0	290.9	315.7	330.3	353.4	44357
2018	262.9	174.3	201.9	215.7	237.3	262.8	288.2	311.5	325.1	347.6	43420

Table 9: Distribution of hole lengths on Par 5s on the PGA TOUR.

Year	Mean	1st Percentile	5th Percentile	10th Percentile	25th Percentile	Median	75th Percentile	90th Percentile	95th Percentile	99th Percentile
2004	555.6	487.7	503.7	514.7	530.0	554.0	579.3	601.0	615.0	647.3
2005	558.9	494.3	503.0	515.7	533.7	557.0	581.7	602.7	616.0	662.3
2006	557.7	493.0	503.0	514.0	531.0	555.0	581.0	604.0	619.0	659.0
2007	559.9	491.0	507.0	518.0	537.0	560.0	580.0	602.0	614.0	662.0
2008	561.1	495.0	508.0	520.0	534.0	560.0	584.0	606.0	618.0	656.0
2009	558.3	499.0	511.0	518.0	533.0	557.0	581.0	602.0	615.0	662.0
2010	558.5	496.0	510.0	518.0	534.0	557.0	582.0	602.0	613.0	638.0
2011	557.7	494.0	505.0	516.0	532.0	557.0	579.0	602.0	615.0	652.0
2012	556.7	495.0	507.0	516.0	532.0	556.0	580.0	602.0	613.0	644.0
2013	555.8	490.0	503.0	514.0	532.0	555.0	577.0	598.0	611.0	635.0
2014	560.7	494.0	507.0	517.0	537.0	560.0	584.0	602.0	615.0	644.0
2015	558.9	496.0	510.0	519.0	538.0	560.0	579.0	597.0	607.0	625.0
2016	558.4	494.0	509.0	518.0	534.0	558.0	579.0	600.0	611.0	636.0
2017	560.4	496.0	510.0	522.0	537.0	558.0	580.0	602.0	614.0	643.6
2018	560.7	497.0	509.0	519.0	537.0	560.0	581.0	602.0	613.0	636.0

We can again see that there is significant variability year to year in the distribution of approach shot lengths. Figure 3 and Figure 4 show the distributions of approach shot distances and hole lengths in 2004 and 2018 on Par 5s.

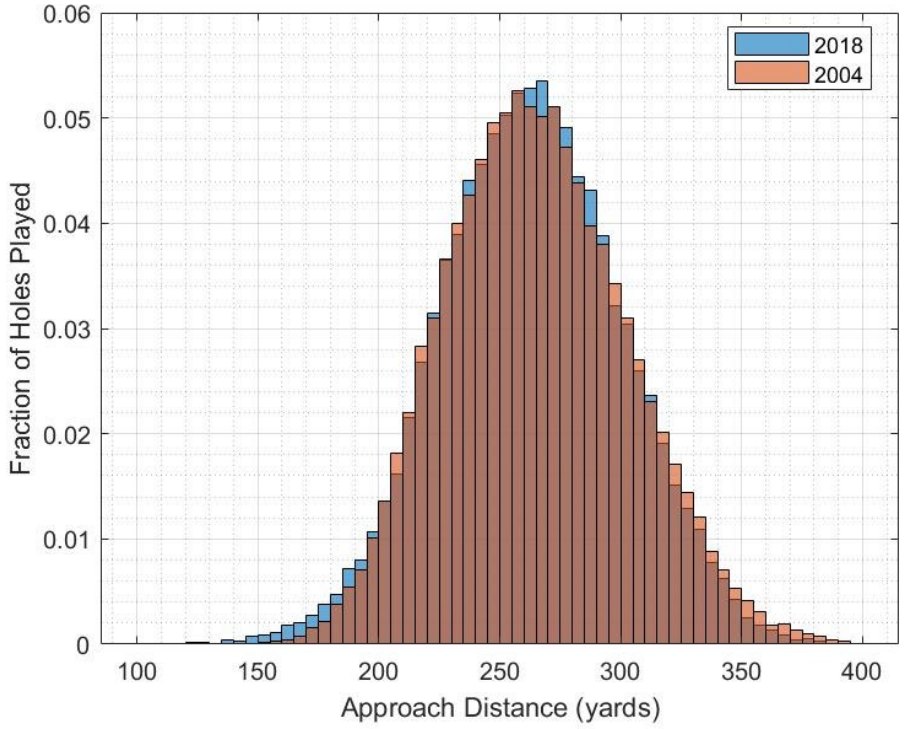

Figure 3: Approach shot distances on Par 5s on the PGA TOUR in 2004 and 2018.

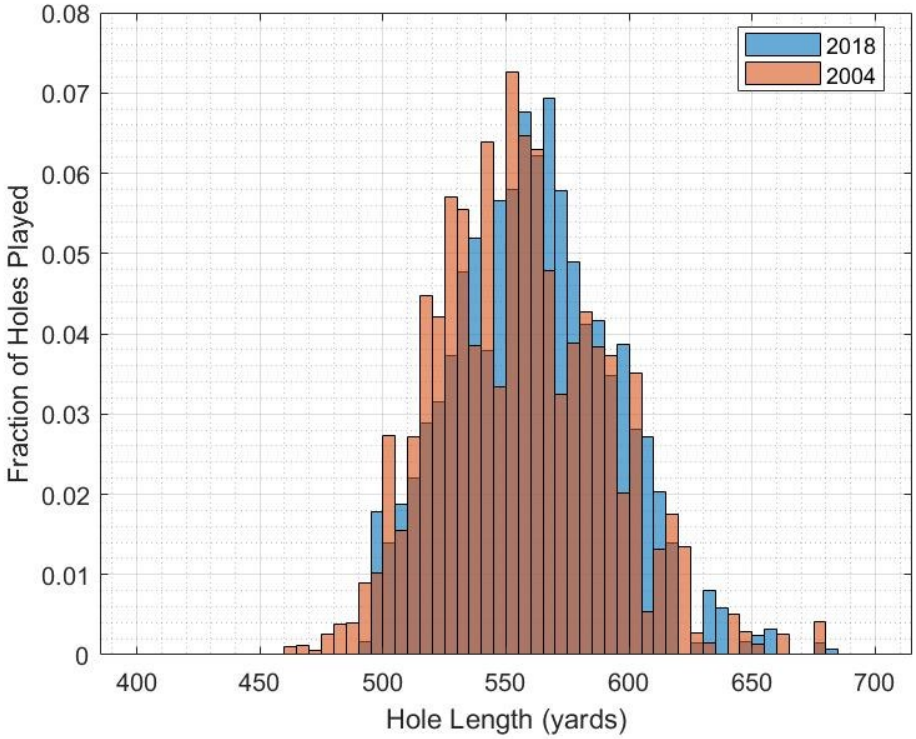

Figure 4: Par 5 Hole lengths played on the PGA TOUR in 2004 and 2018.

We can see here that despite the decrease in short Par 5s, there are fewer shots within 200 yards from the hole after the drive in 2004 than 2018. Again, however, there is significant variability year to year across both the distribution of approach shots and the distribution of hole lengths.

We again run t-tests on each year between 2004 and 2017 against 2018. Table 10 shows the results of this analysis.

Table 10: Result of t-test on the Par 5 data from 2004 to 2017 and 2018.

Year	Difference in the Mean (Year – 2018)	Is Statistically Significant	p-value	Upper Confidence Interval	Lower Confidence Interval
2004	2.3	Yes	<0.001	1.8	2.7
2005	3.9	Yes	<0.001	3.4	4.4
2006	2.3	Yes	<0.001	1.9	2.8
2007	5.7	Yes	<0.001	5.2	6.2
2008	7.8	Yes	<0.001	7.3	8.3
2009	3.9	Yes	<0.001	3.5	4.4
2010	6.3	Yes	<0.001	5.8	6.8
2011	2.7	Yes	<0.001	2.2	3.2
2012	1.0	Yes	<0.001	0.5	1.5
2013	3.0	Yes	<0.001	2.4	3.5
2014	4.8	Yes	<0.001	4.3	5.3
2015	2.9	Yes	<0.001	2.4	3.4
2016	1.9	Yes	<0.001	1.4	2.4
2017	2.2	Yes	<0.001	1.7	2.7

We can see that there are significantly significant differences in approach shots between every year from 2004 to 2017 and 2018. The largest difference in the mean is between 2018 and 2008. However, 2008 also had the longest hole lengths on Par 5s out of all the years studied, which may help explain the size of this difference.

3.2 Approach Shot Distance by Driving Distance on Par 5s

Similar to the analysis done for Par 4s, we can study the approach lengths of the of players with different average driving distances each season to the annual average to see whether this has changed. Table 11 shows the Pearson correlation coefficients for driving distance against approach shot length each season between 2004 and 2018.

Table 11: Correlation between players annual driving distance and approach shot lengths on Par 5s.

Year	Correlation
2004	-0.296
2005	-0.297
2006	-0.298
2007	-0.310
2008	-0.298

2009	-0.308
2010	-0.307
2011	-0.313
2012	-0.312
2013	-0.288
2014	-0.291
2015	-0.311
2016	-0.296
2017	-0.306
2018	-0.304

By comparing Table 11 to Table 5, we can see that the correlation between a player's average driving distance and their approach shot distance is stronger on Par 5s than Par 4s. Again, this coefficient has stayed relatively stable between 2004 and 2018.

We once again look at the mean approach lengths over the course of a season of the longest 10% of players compared to the field average. Table 12 shows this data for Par 5s.

Table 12: Approach distance of the Top 10% of players on Par 5s compared to annual average.

Year	Mean Approach Distance of Top 10% (yards)	Field Average	Comparison to Field Average (yards)
2004	250.9	265.2	14.3
2005	252.7	266.8	14.1
2006	250.8	265.2	14.4
2007	249.8	268.6	18.8
2008	254.8	270.7	15.9
2009	249.3	266.8	17.5
2010	252.6	269.2	16.6
2011	250.7	265.6	14.9
2012	246.5	263.9	17.3
2013	248.6	265.8	17.3
2014	254.8	267.7	13.0
2015	248.6	265.8	17.2
2016	249.3	264.8	15.5
2017	249.0	265.1	16.1
2018	245.2	262.9	17.7

By comparing Table 12 to Table 5, we can see that there are larger differences in approach shot length between the long players and the field on Par 5s compared to Par 4s. Once again, there is significant year to year variability in these values.

Finally, we look at the percentage of approach shots which are hit from within 200 yards of the hole on Par 5s. This data is shown in Table 13.

Table 13: Percentage of approach shots on Par 5s within 200 yards for the Top 10% of player's compared to field average.

Year	Percentage of Approach Shots Within 200 yards for Top 10%	Field Percentage	Difference
2004	8.5%	3.2%	5.2%
2005	8.2%	3.9%	4.3%
2006	8.1%	3.7%	4.4%
2007	8.1%	2.8%	5.4%
2008	7.7%	2.9%	4.8%
2009	9.0%	2.9%	6.1%
2010	7.4%	2.4%	5.0%
2011	8.1%	3.0%	5.1%
2012	10.9%	3.8%	7.0%
2013	9.2%	3.3%	5.9%
2014	7.0%	3.2%	3.8%
2015	9.9%	3.6%	6.4%
2016	10.3%	4.9%	5.4%
2017	9.1%	4.0%	5.1%
2018	11.1%	4.5%	6.6%

As would be expected, the longer players finish within 200 of the yards more often than the field average. Once again, the year to year variability and connection to the distribution of hole lengths renders it difficult to make assertions on whether there have been changes to the characteristics of the way players play Par 5s over this period.

Appendix A – List of Figures

Appendix B – List of Tables