FIVB Beach Volleyball Historic Top 8 Teams Analysis

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1 Project description

*Evaluation of winning trends related to court and hour for the top 8 FIVB Beach volleyball teams per gender since 2001. The concluding hypothesis is that teams ranked within the top 8 have a higher probability at winning on court 1 at 09:00. Generalized linear model is used in support of the hypothesis. Notes: ^**Court records are not kept by FIVB until 2009.** ^^**Hour records are not kept by FIVB until 2004**. This project has given me the skills necessary to add new insight to other projects I work on in the future.*

1.1 Source of data set

This data set was webscrapped from 2 sources. First from FIVB Beach competiton database. http://www.fivb.org/EN/BeachVolleyball/Competitions/Competitions.htm Second, FIVB Beach rankings from http://www.fivb.org/Vis/Public/JS/Beach/SeasonRank.aspx?Gender=1&id=BTechPlayW&Date=20191001. Numerous more links were accessed between these two links. But ultimatly I was able to access the data I was looking for. I will provide the final CSV I used for this project. I did end up doing a lot more work to get this final csv than I originally planned.

^Note: The team variable is already melted. One match is listed twice. For example if it was USA vs GER, I have the 'team' be 'USA' and the opp team be 'GER', the next time this match appears the team is 'GER' and the opp is 'USA'. I did this so I can look at specific teams results. I wouldn't be able to get a true reading on how many matches 1 team played if I had kept it seperated. I call this 'The focus team.'

1.2 Data dictionary

Variable Name	Description
no	Match number of specific tournament
date	Date of match
time	Time of match
court	Court match is played on
result	Result of the played match
duration	Duration of the played match
tourn	Tournament name
year	Year of tournament
phase	Phase of tournament the match was played
winning_team	Winning team of the match
losing_team	Losing team of the match
gender	Gender of teams
team	The focus team
team_country	The focus team country
team_rank	The rank of the focus teams at the end of that played year
opp	The focus teams opponent
opp_country	The focus teams opponent country
matches_played	This is always listed as '1'. Each row is one match. I wanted to be able to sum the total of matches played for my hypothesis
team_match_won	If the focus team had won the match this will be a '1' otherwise it is a '0'
opp_match_won	If the opponent team had won the match this will be a '1' otherwise it is a '0'
team_player_1	First listed player in the played match for the focus team
team_player_2	Second listed player in the played match for the focus team
opp_player_1	First listed player in the played match for the opp team
opp_player_2	Second listed player in the played match for the opp team

Each variable was considered and ultimatley I decided to do my hypothesis on my level. The main variables used were: date, court, year, gender, team, team_rank, matches_played, team_match_won, team_player_1 and team_player_2.

2 Preparation of Data

There was a lot of data munging I had to do in order to get to my final hypothesis. I had to change classes, column names, get rid of columns, replace strings, melt the players variable and get the hour of the time. This is a few things I did. There was more munging I originally did before I came to my final hypothesis.

2.1 FIVB data

I webscrapped all the data from the FIVB websites. With the amount of links (about 750) one can guess there was errors I found. I had to nix all the matches that ended in a 'injury' result. Player names were different across multiple tournaments, time of day was bad in some cases. For example: 01:00, 02:00, 04:00, 04:57 were all times I had to make correct. There were a couple of matches which still had the live score on the result. For example: LIVE (21-12, 13-15). It shouldn't have that 'LIVE' potion on the result.

2.2 Ranking of teams data

I webscrapped the rankings on Oct 1 of each year. After consulting with a friend we decided Oct 1 would be the final rank for that played year. Jan - Oct. The naming convention between the rankings and the FIVB schedule were different. So I had to spend some time doctoring in Excel in order to get the names, and rankings, of the player in the top 8 correct for each year. Also there were special charecters that caused some issues that I dealt with in this way:

```
unescape_html <- function(str){
  xml2::xml_text(xml2::read_html(paste0("<x>", str, "</x>")))
}
```

2.3 Final web scrapped data summary

```
summary(df)
```

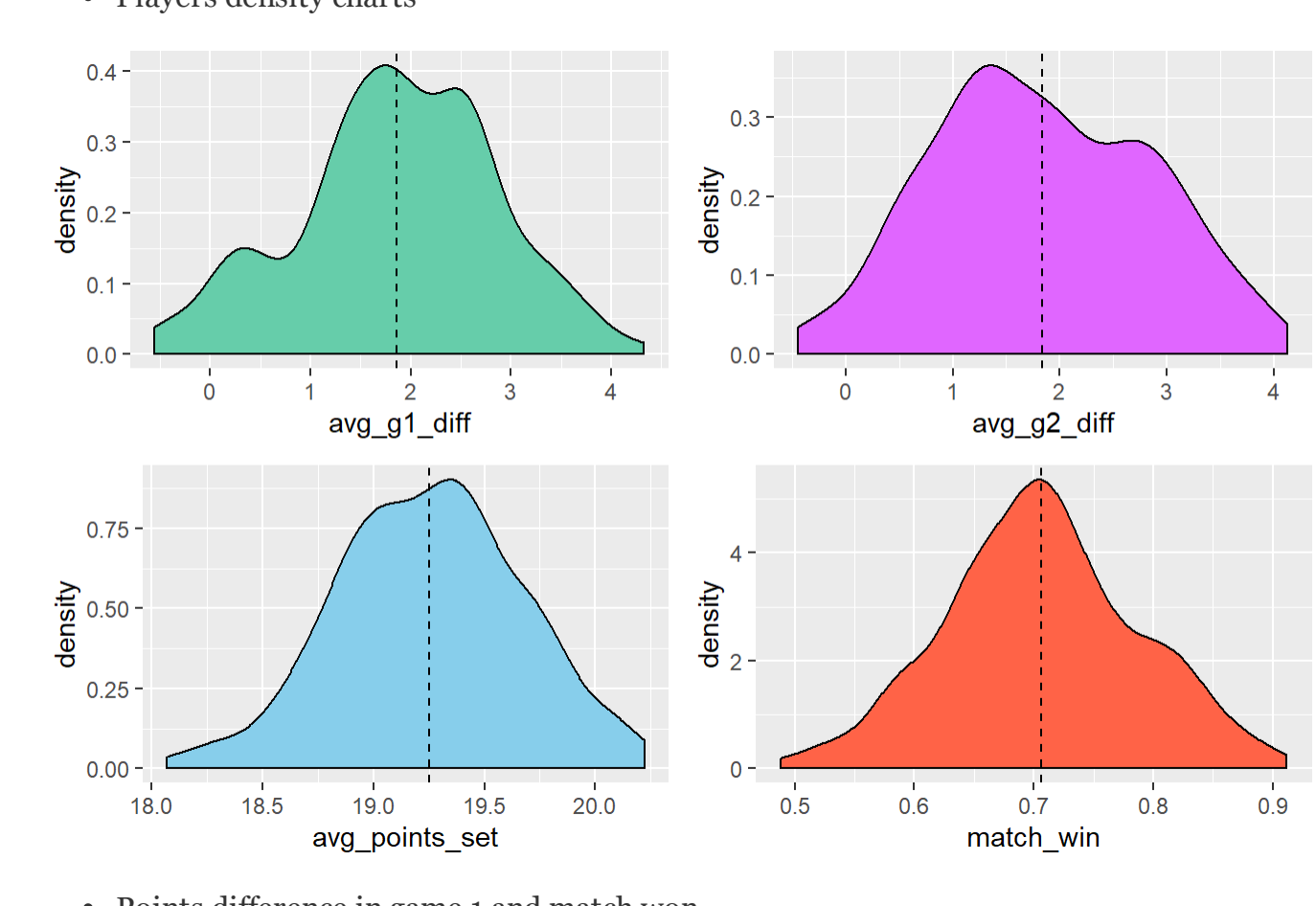
```
##     match_no          date                time               court
##  Min.   :  1.00   Min.   :2001-04-04   Length:226126      Min.   :1.00
##  1st Qu.: 12.00   1st Qu.:2006-07-19   Class :character   1st Qu.:1.00
##  Median : 25.00   Median :2010-08-24   Mode  :character   Median :2.00
##  Mean   : 29.38   Mean   :2011-02-19                      Mean   :2.45
##  3rd Qu.: 45.00   3rd Qu.:2016-03-18                      3rd Qu.:3.00
##  Max.   :136.00   Max.   :2019-11-09                      Max.   :8.00
##  NA's   :2086                                             NA's   :105034
##     duration        tourn                year        tourn_rank
##  Min.   :  300   Length:226126      Min.   :2001   Min.   :  7.20
##  1st Qu.: 2100   Class :character   1st Qu.:2006   1st Qu.: 18.63
##  Median : 2400   Mode  :character   Median :2010   Median : 23.41
##  Mean   : 2538                      Mean   :2011   Mean   : 49.55
##  3rd Qu.: 2940                      3rd Qu.:2016   3rd Qu.: 41.50
##  Max.   :14940                      Max.   :2019   Max.   :479.09
##
##  winning_team       losing_team           gender
##  Length:226126      Length:226126      Length:226126
##  Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character
##
##
##
##      team           team_country          team_rank
##  Length:226126      Length:226126      Min.   :   1.00
##  Class :character   Class :character   1st Qu.:  14.00
##  Mode  :character   Mode  :character   Median :  35.00
##                                        Mean   :  66.84
##                                        3rd Qu.:  84.00
##                                        Max.   :1976.00
##                                        NA's   :18
##  team_match_score   team_game_one   team_game_two   team_game_three
##  Length:226126      Min.   : 0.00   Min.   : 0.00   Min.   : 0.000
##  Class :character   1st Qu.:17.00   1st Qu.:17.00   1st Qu.: 0.000
##  Mode  :character   Median :21.00   Median :21.00   Median : 0.000
##                     Mean   :18.89   Mean   :18.86   Mean   : 4.496
##                     3rd Qu.:21.00   3rd Qu.:21.00   3rd Qu.:12.000
##                     Max.   :41.00   Max.   :42.00   Max.   :35.000
##
##      opp             opp_country        opp_match_score     opp_game_one
##  Length:226126      Length:226126      Length:226126      Min.   : 0.00
##  Class :character   Class :character   Class :character   1st Qu.:17.00
##  Mode  :character   Mode  :character   Mode  :character   Median :21.00
##                                                           Mean   :18.89
##                                                           3rd Qu.:21.00
##                                                           Max.   :41.00
##
##   opp_game_two   opp_game_three   opp_team_rank     matches_played
##  Min.   : 0.00   Min.   : 0.000   Min.   :   1.00   Min.   :1
##  1st Qu.:17.00   1st Qu.: 0.000   1st Qu.:  15.00   1st Qu.:1
##  Median :21.00   Median : 0.000   Median :  35.00   Median :1
##  Mean   :18.86   Mean   : 4.496   Mean   :  66.98   Mean   :1
##  3rd Qu.:21.00   3rd Qu.:12.000   3rd Qu.:  84.00   3rd Qu.:1
##  Max.   :42.00   Max.   :35.000   Max.   :1976.00   Max.   :1
##                                   NA's   :18
##  team_match_won opp_match_won opp_player_1       opp_player_2
##  Min.   :0.0    Min.   :0.0   Length:226126      Length:226126
##  1st Qu.:0.0    1st Qu.:0.0   Class :character   Class :character
##  Median :0.0    Median :1.0   Mode  :character   Mode  :character
##  Mean   :0.5    Mean   :0.5
##  3rd Qu.:1.0    3rd Qu.:1.0
##  Max.   :1.0    Max.   :1.0
##
##  score_diff_game_one score_diff_game_two score_diff_game_three
##  Min.   :-2.1e+01    Min.   :-2.1e+01    Min.   :-1.5e+01
##  1st Qu.:-4.0e+00    1st Qu.:-4.0e+00    1st Qu.: 0.0e+00
##  Median : 2.0e+00    Median :-2.0e+00    Median : 0.0e+00
##  Mean   : 5.3e-05    Mean   :-2.7e-05    Mean   :-2.7e-05
##  3rd Qu.: 4.0e+00    3rd Qu.: 4.0e+00    3rd Qu.: 0.0e+00
##  Max.   : 2.1e+01    Max.   : 2.1e+01    Max.   : 1.5e+01
##
##  team_final_score opp_team_final_score          variable
##  Min.   : 3.00    Min.   : 3.00        team_player_1:113063
##  1st Qu.:35.00    1st Qu.:35.00        team_player_2:113063
##  Median :42.00    Median :42.00
##  Mean   :42.24    Mean   :42.24
##  3rd Qu.:49.00    3rd Qu.:49.00
##  Max.   :85.00    Max.   :85.00
##
##     player          game_three_amount    phase                hour
##  Length:226126      Min.   :0.0000    Length:226126      Min.   : 8.00
##  Class :character   1st Qu.:0.0000    Class :character   1st Qu.:11.00
##  Mode  :character   Median :0.0000    Mode  :character   Median :13.00
##                     Mean   :0.3311                       Mean   :13.18
##                     3rd Qu.:1.0000                       3rd Qu.:16.00
##                     Max.   :1.0000                       Max.   :23.00
##                                                          NA's   :28864
```

3 Exploring the data

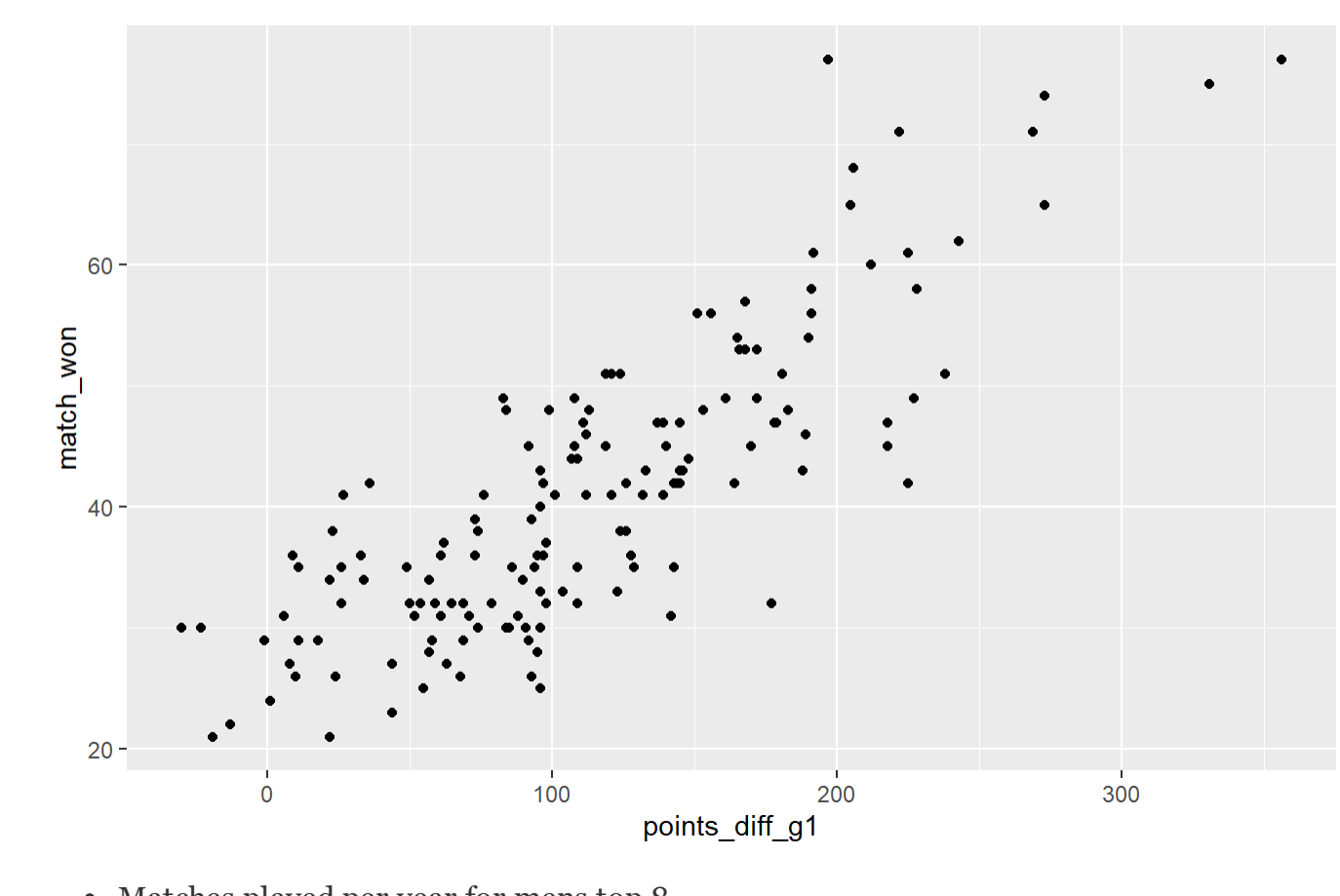
I ended up spending time exploring areas I didn't dive deeper into. A big part was trying to figure out how I could use 'score_difference' and how likely a team was to win the match as a varaible for a hypothesis. Other areas I explored:

3.1 Places explored

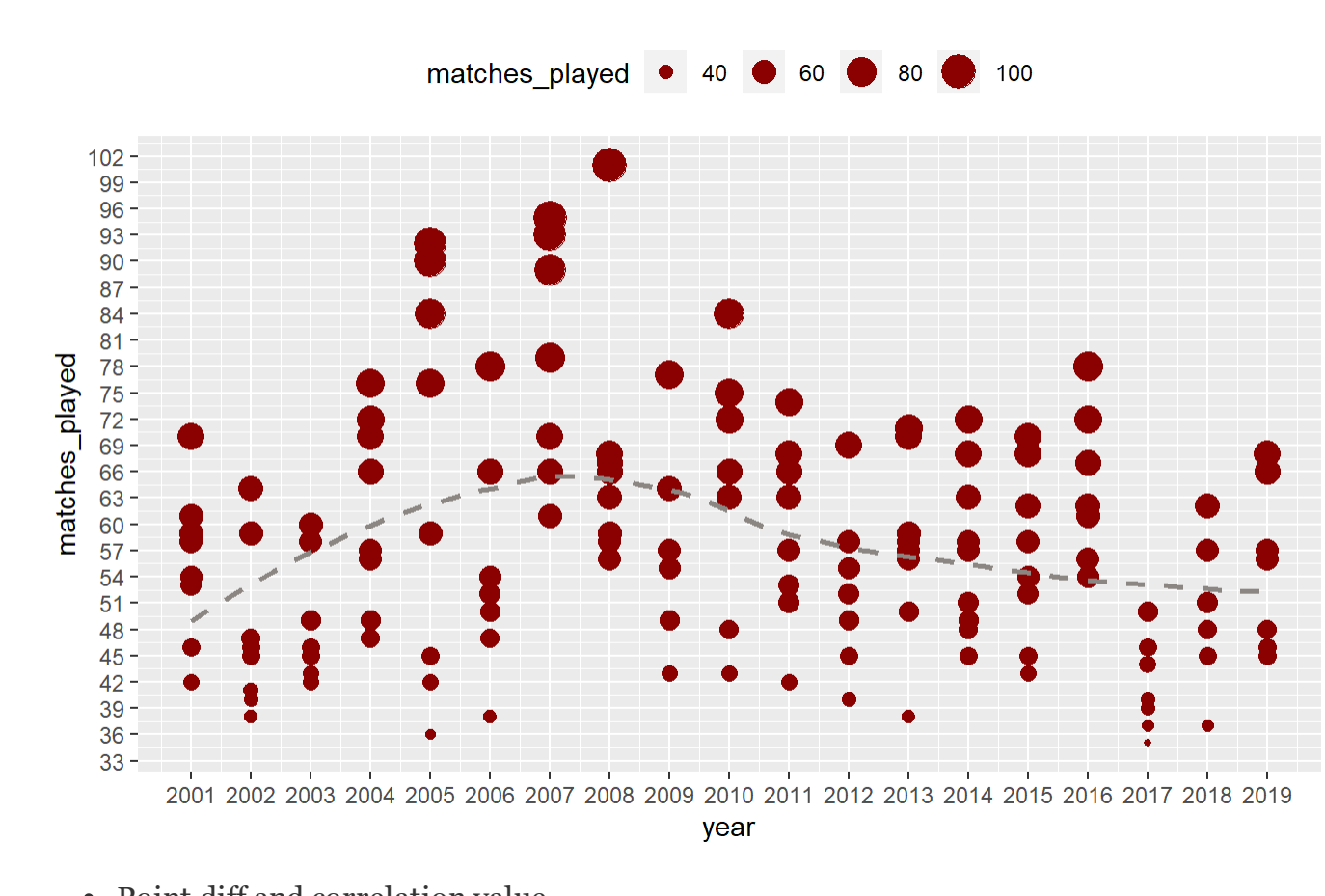
- Players density charts



- Points difference in game 1 and match won

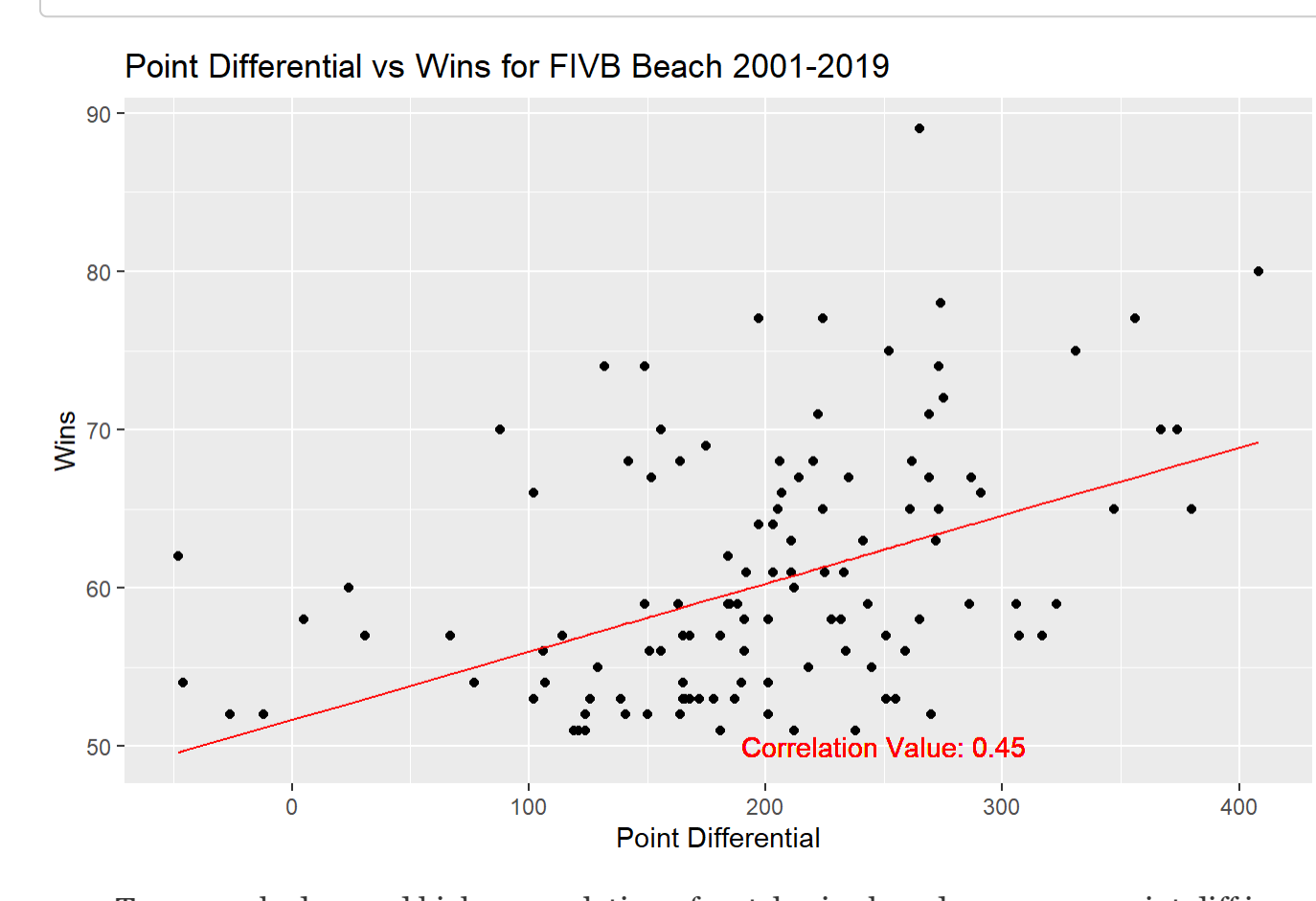


- Matches played per year for mens top 8

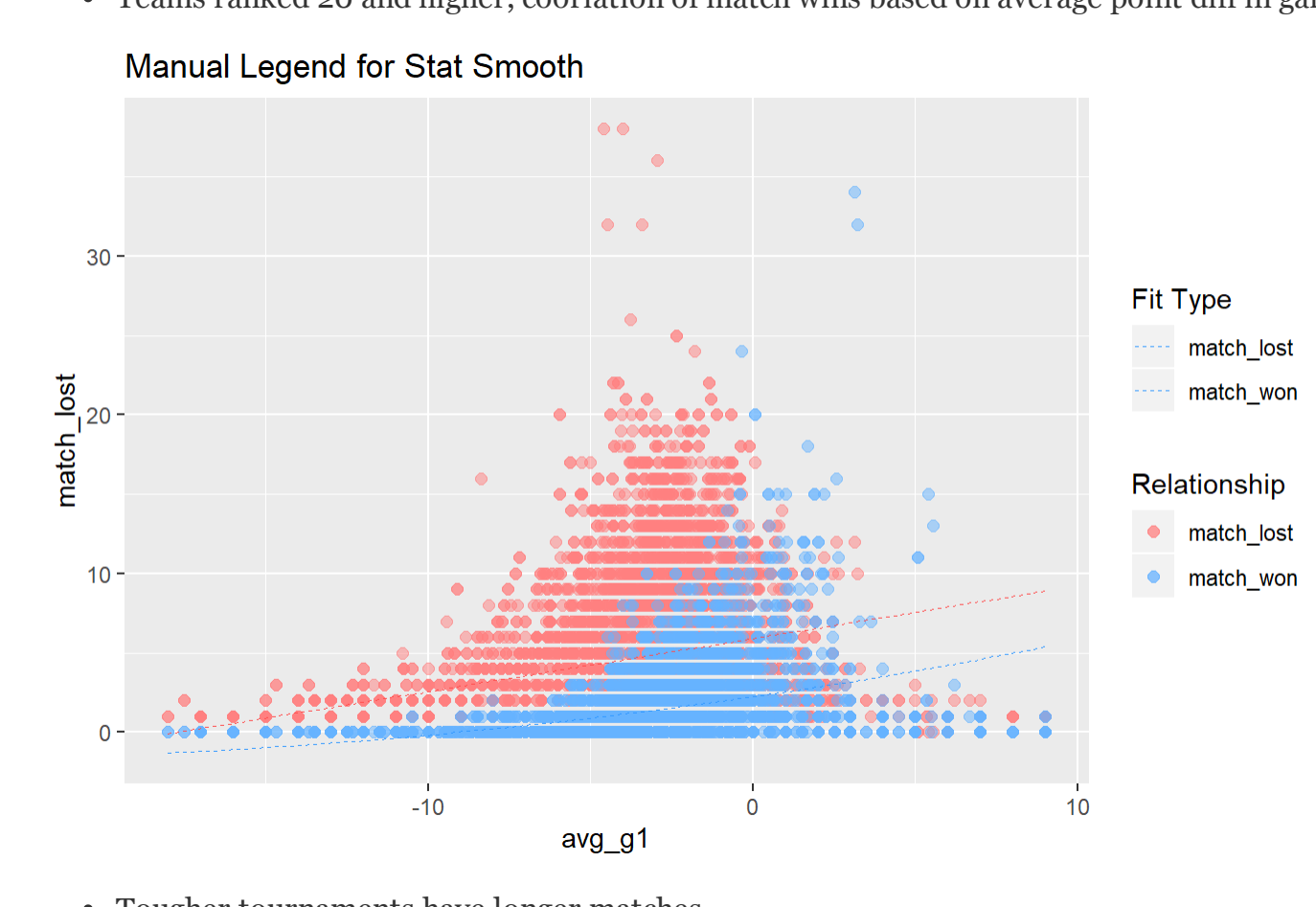


- Point diff and correlation value

```
##    (Intercept) points_diff_g1
##    51.67797528     0.04305242
```



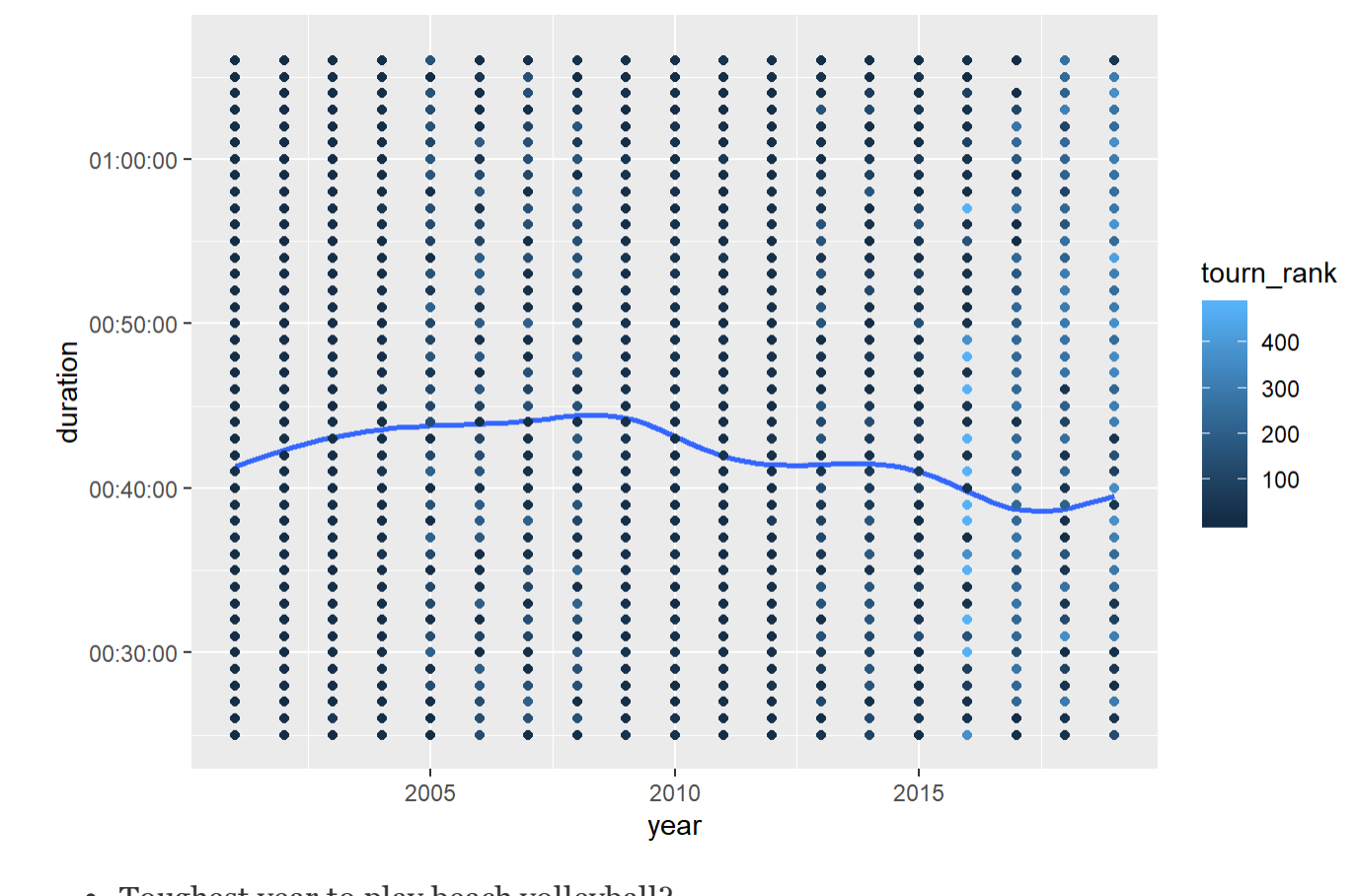
- Teams ranked 20 and higher, coorlation of match wins based on average point diff in game 1



- Tougher tournaments have longer matches

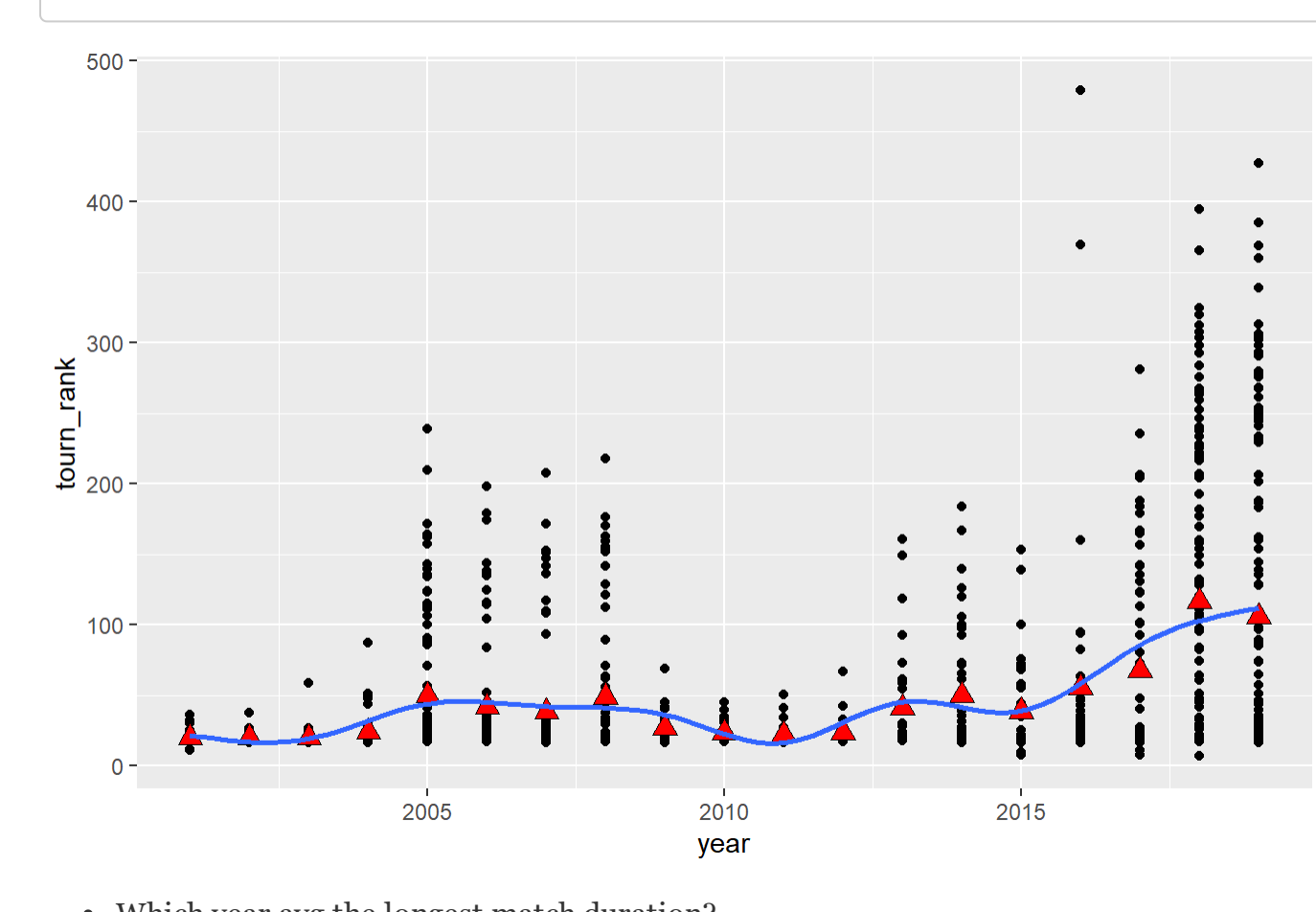
```
## `geom_smooth()` using method = 'gam' and formula 'y ~ s(x, bs = "cs")'
```

```
## Warning: Removed 5508 rows containing missing values (geom_point).
```

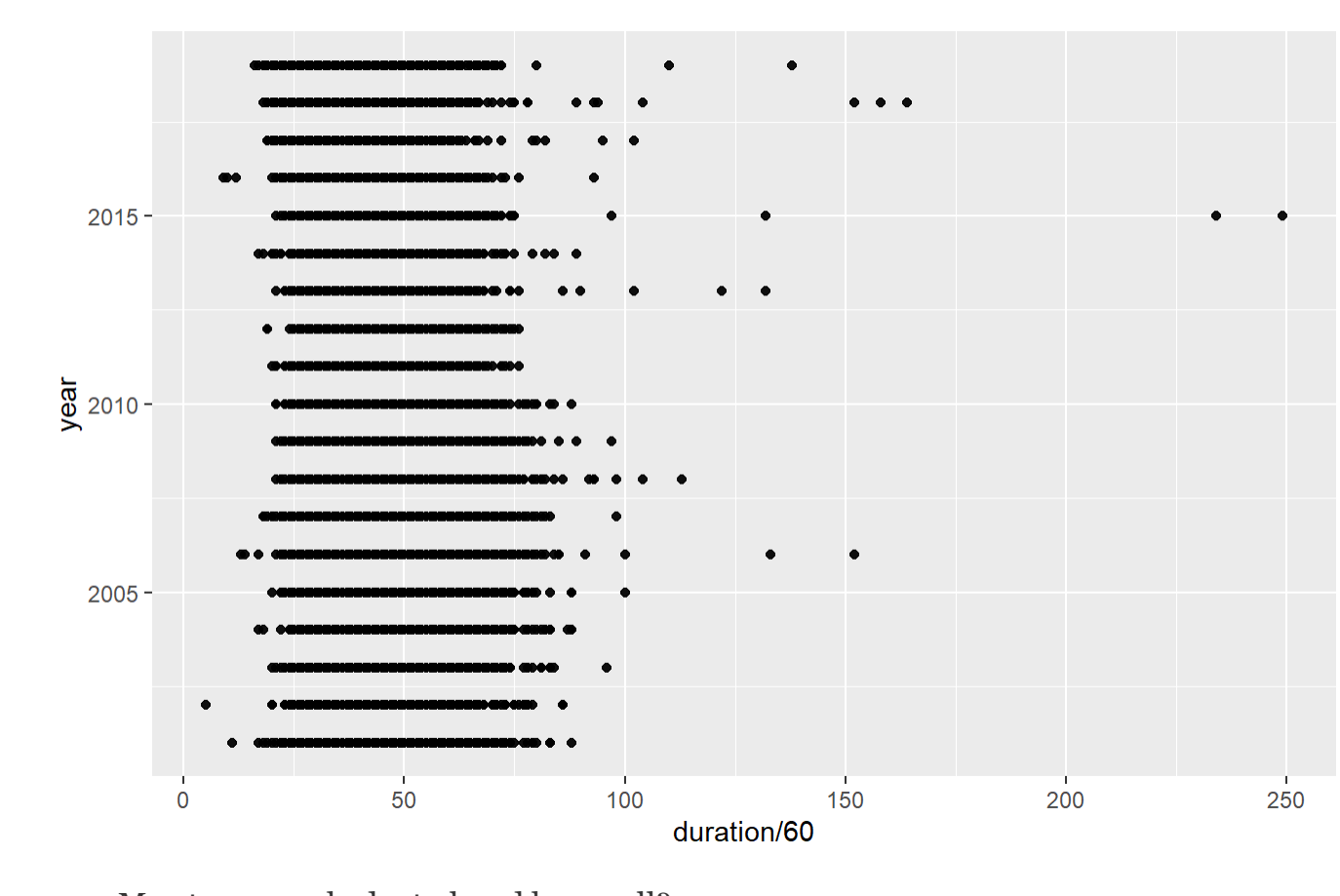


- Toughest year to play beach volleyball?

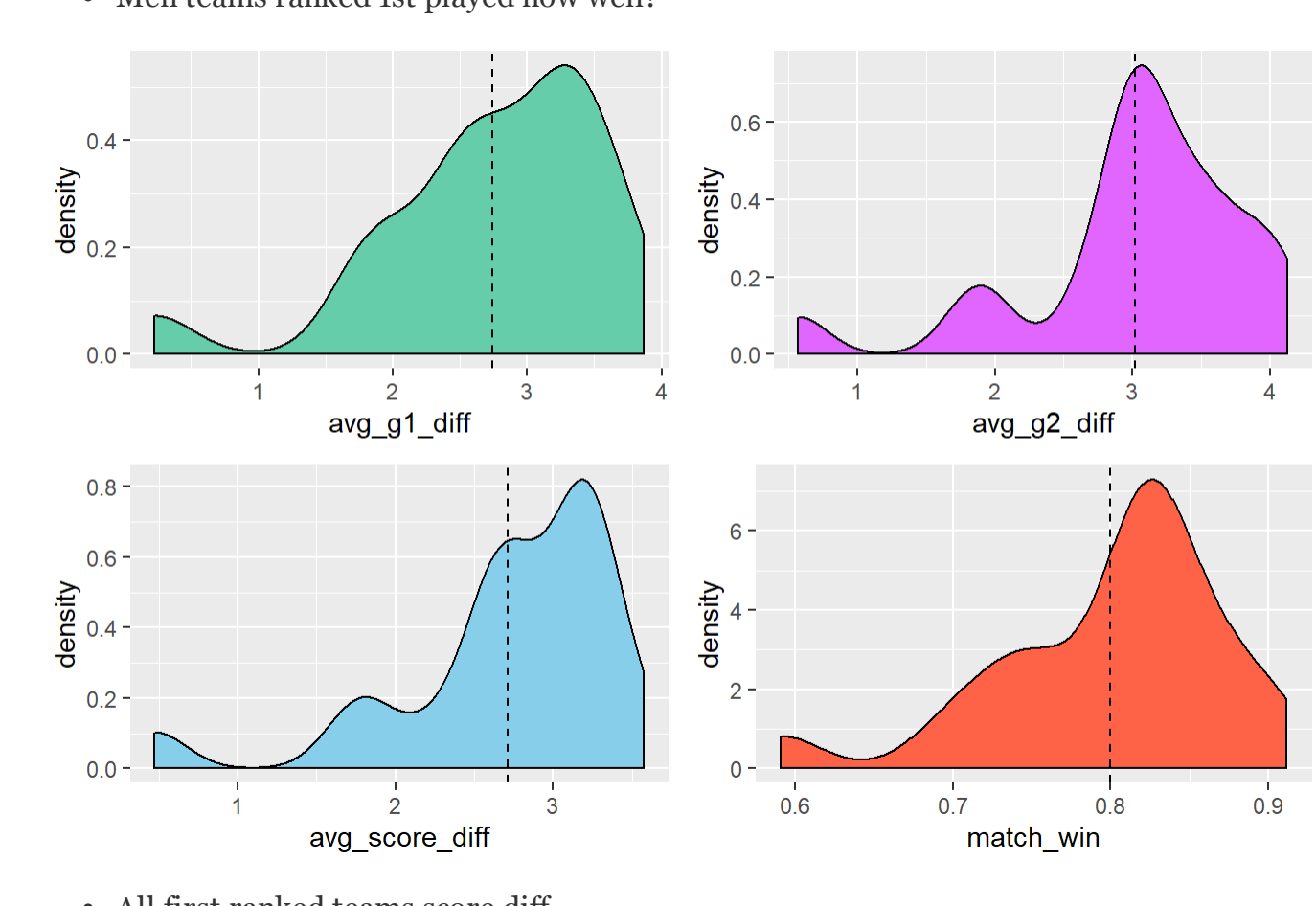
```
## `geom_smooth()` using method = 'gam' and formula 'y ~ s(x, bs = "cs")'
```



- Which year avg the longest match duration?

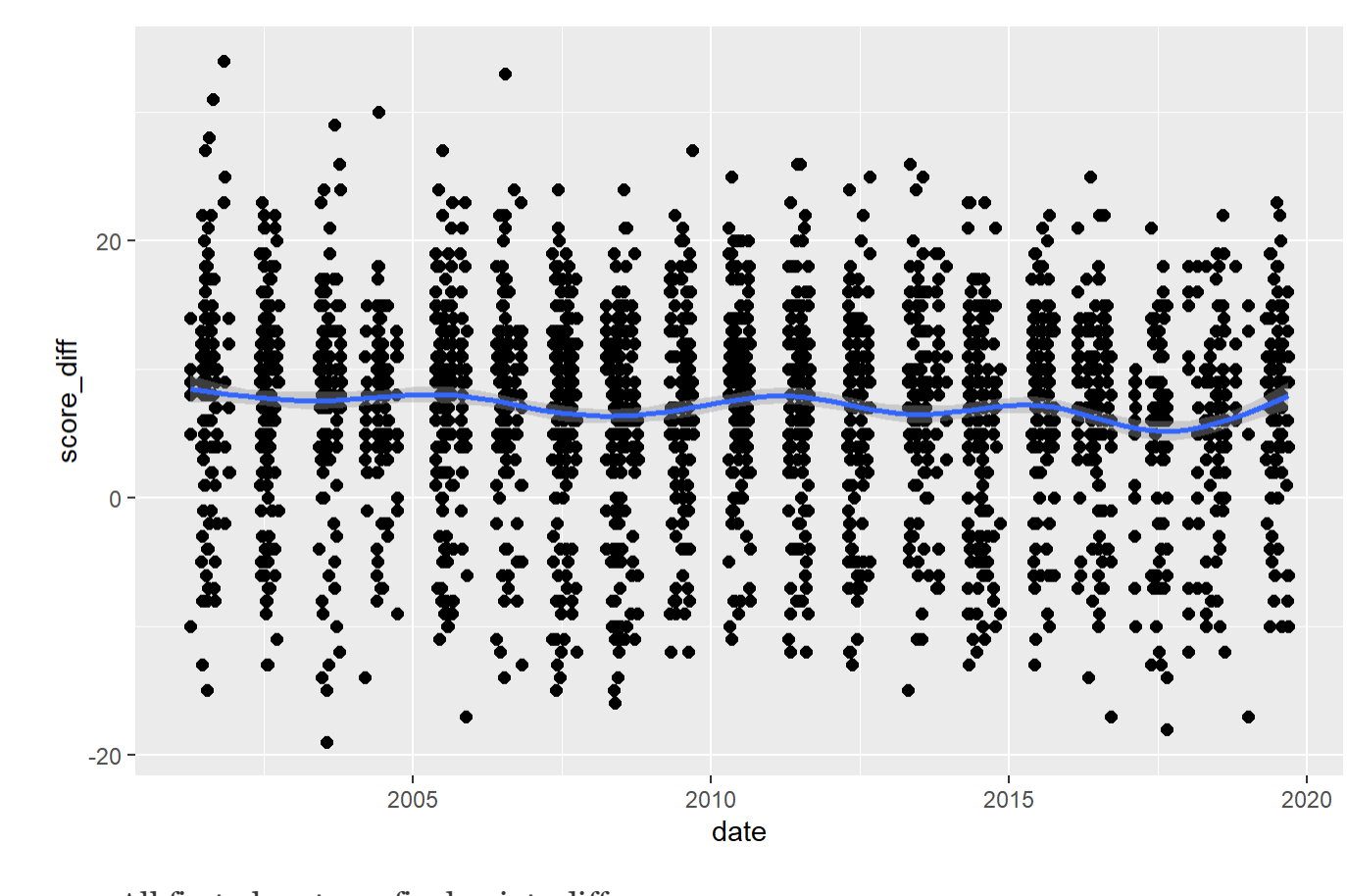


- Men teams ranked 1st played how well?

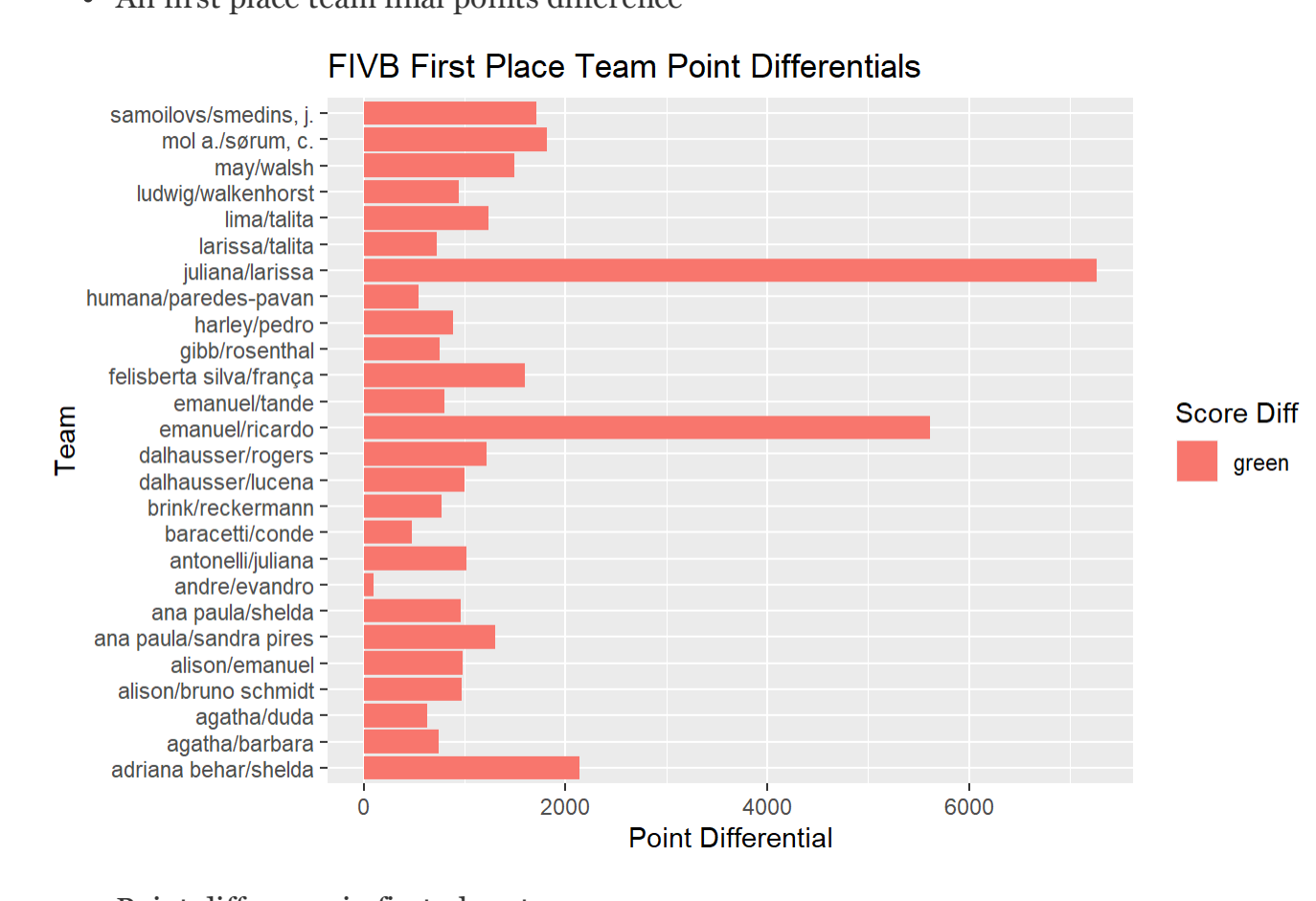


- All first ranked teams score diff

```
## `geom_smooth()` using method = 'gam' and formula 'y ~ s(x, bs = "cs")'
```

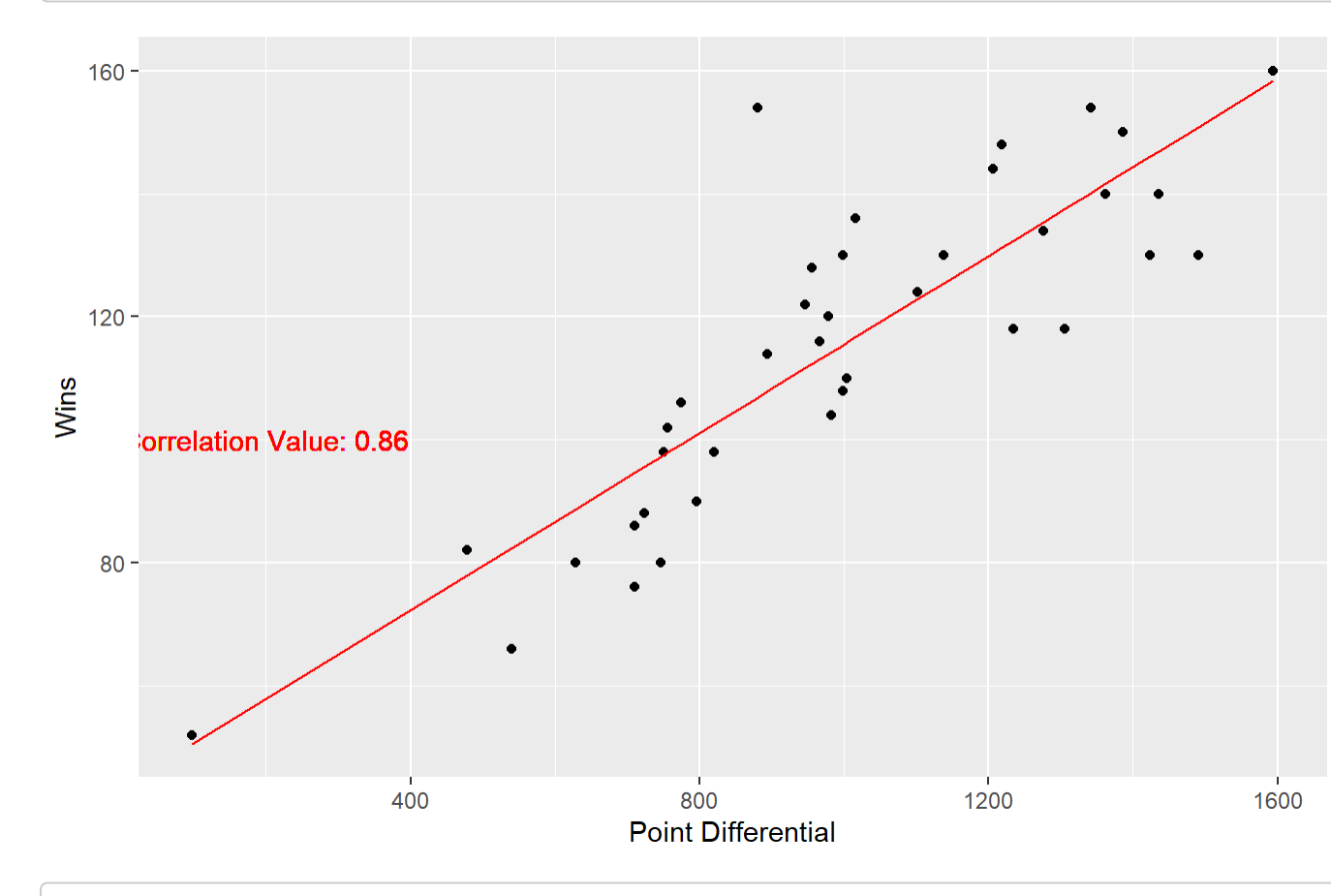


- All first place team final points difference

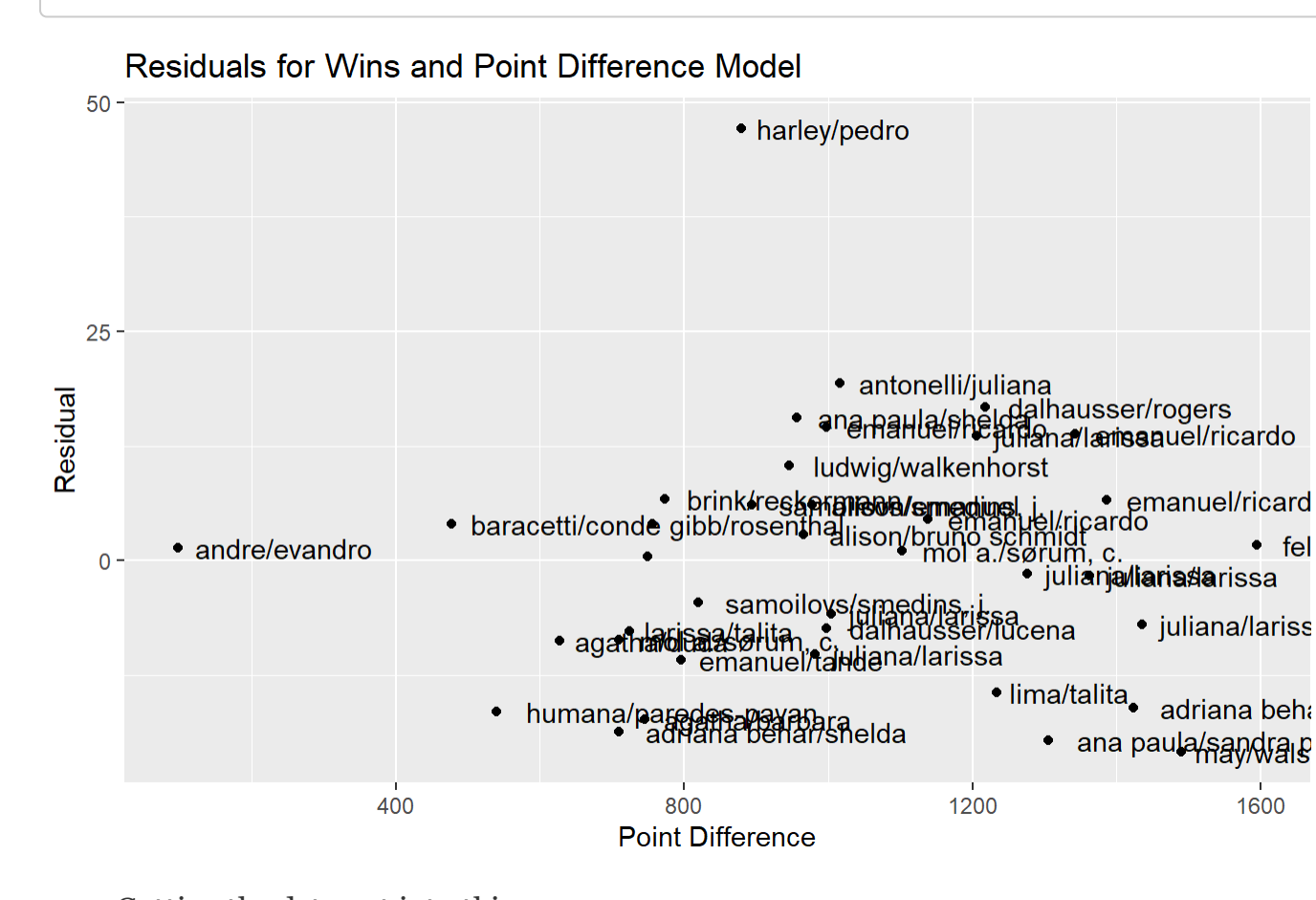


- Point difference in first place teams

```
## (Intercept)  score_diff
## 43.50886944  0.07202652
```




```
## Warning: Removed 1 rows containing missing values (geom_text).
```



- Getting the data put into this

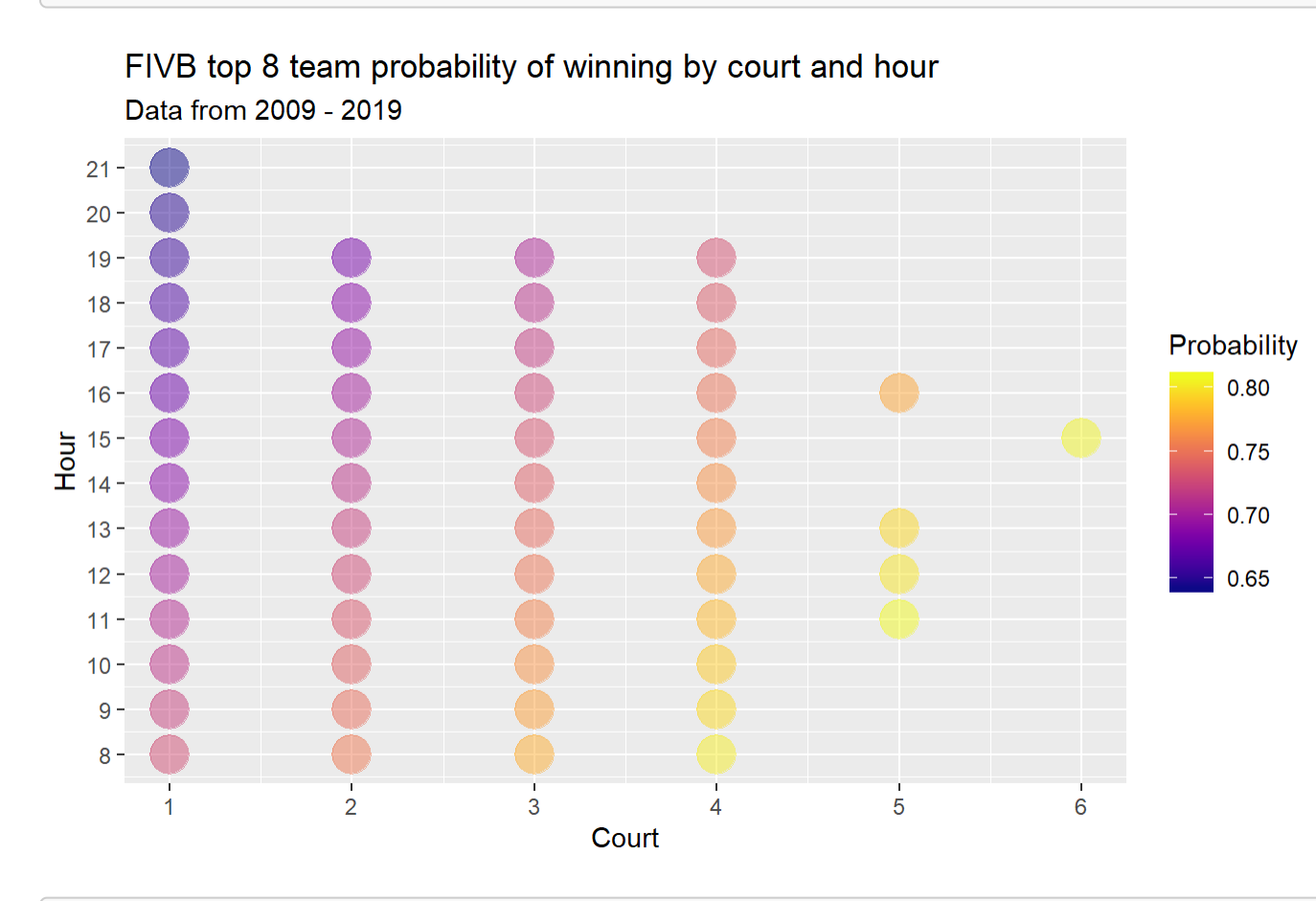
```
all_player_df <- df %>%
  dplyr::group_by(player, hour, team, team_country, tourn_rank, tourn, date, phase, year, match_no,
  dplyr::summarise(total_matches = sum(matches_played),
                   match_won = sum(team_match_won),
                   match_lost = sum(matches_played - team_match_won),
                   match_win = match_won / (match_won + match_lost),
                   total_set_threes = sum(game_three_amount),
                   total_sets_played = (total_matches + total_matches + total_set_threes),
                   rank = sum(team_rank))

all_player_df$total_matches<-suppressWarnings(as.character(all_player_df$total_matches))

all_player_df$total_matches <- str_replace(all_player_df$total_matches, '2', '1') #Each row is one m

all_player_df$total_matches <- suppressWarnings(as.integer(all_player_df$total_matches))

df_men <- all_player_df %>%
  dplyr::filter(gender == 'm' & team_rank <= 8)

df_women <- all_player_df %>%
  dplyr::filter(gender == 'w' & team_rank <= 8)
```

4 Machine learning

4.1 Decided predictors

After some time exploring and trying things I have never done (this being my first project) I realized I wanted to keep it a bit simplar with something I would understand. That led me to using court, hour, total matches, match win % and gender as my main variables for my hypothesis. ## glm

```
f <- df_men %>%
  dplyr::group_by(hour, court) %>%
  dplyr::summarise(total_matches = sum(total_matches),
                   match_win_perce = sum((match_won) / total_matches))

f <- na.omit(f)
f <- f %>% dplyr::filter(total_matches >= 29) #I wanted to get a sample size with more than 29 match

formula <- match_win_perce ~hour + court


mhlm <- glm(formula, data=f)

prob <- predict(mhlm, newdata=f, type="response")
prob <- round(prob,3)
f$prob <- prob


f %>%
  ggplot(aes(court, hour)) +
  geom_point(aes(color = prob), size = 7, alpha = 0.5) +
  scale_size(range = c(.5, 9)) +
  scale_y_continuous(breaks = seq(8, 22, by = 1)) +
  labs(title = 'FIVB top 8 team probability of winning by court and hour',
       subtitle = 'Data from 2009 - 2019',
       size = 'Probability%',
       color ='Probability',
       x = 'Court',
       y = 'Hour')+
  scale_color_viridis(option="C")+
  scale_x_continuous(breaks = 1:6)
```




```
f$prob<-format(round(f$prob,3))
f$match_win_perce <- NULL
f$total_matches <- NULL

f<-f[order(-prob),]
colnames(f) <- c('Hour', 'Court', 'Probablity')
kable(f) %>%
  kable_styling(bootstrap_options = "striped", full_width = F, position = 'left', fixed_thead = T) %
  scroll_box(width = '200px', height='500px')
```

11	5	0.808
15	6	0.806
8	4	0.803
12	5	0.801
9	4	0.796
13	5	0.795
10	4	0.790
11	4	0.783
8	3	0.778
12	4	0.777
16	5	0.775
9	3	0.772
13	4	0.770

5 *Conclusion*

5.1

There is an apparent trend of teams in the top 8 winning more and having higher probility of winning on lower courts earlier in the day. And lower probility later in the day on higher courts. This trend is likely due to teams in the top 8 advancing further into tournaments and playing other teams in the top 8.