

```

aggregated <- read.csv("../data/clean_data/player_salary.csv")
aggregated %>% colnames()

## [1] "Player"                  "Salary_Player"          "Adjusted_Player"        "Pos"                   "Age"
## [8] "MP_Player"               "FG_Player"              "FGA_Player"            "FG ."                 "X3P_Player"
## [15] "X2P_Player"              "X2PA_Player"            "X2P."                  "eFG ."                "FT_Player"
## [22] "ORB_Player"              "DRB_Player"              "TRB_Player"             "AST_Player"            "STL_Player"
## [29] "PF_Player"               "PTS_Player"              "Year"                  "Salary.Cap"           "Salary.Ca"
## [36] "Adjusted_Team"            "G_Team"                 "MP_Team"                "FG_Team"               "FGA_Team"
## [43] "X2P_Team"                "X2PA_Team"               "FT_Team"                "FTA_Team"              "ORB_Team"
## [50] "AST_Team"                 "STL_Team"                "BLK_Team"               "TOV_Team"              "PF_Team"

aggregated <- aggregated %>%
  filter(Team != "Total")

aggregated <- aggregated %>%
  mutate(
    FG_Player_pm = FG_Player / MP_Player,
    `X3P_Player_pm` = `X3P_Player` / MP_Player,
    `X2P_Player_pm` = `X2P_Player` / MP_Player,
    FT_Player_pm = FT_Player / MP_Player,
    ORB_Player_pm = ORB_Player / MP_Player,
    DRB_Player_pm = DRB_Player / MP_Player,
    TRB_Player_pm = TRB_Player / MP_Player,
    AST_Player_pm = AST_Player / MP_Player,
    STL_Player_pm = STL_Player / MP_Player,
    BLK_Player_pm = BLK_Player / MP_Player,
    TOV_Player_pm = TOV_Player / MP_Player,
    PF_Player_pm = PF_Player / MP_Player,
    PTS_Player_pm = PTS_Player / MP_Player,
  )
aggregated %>% head() %>% knitr::kable()

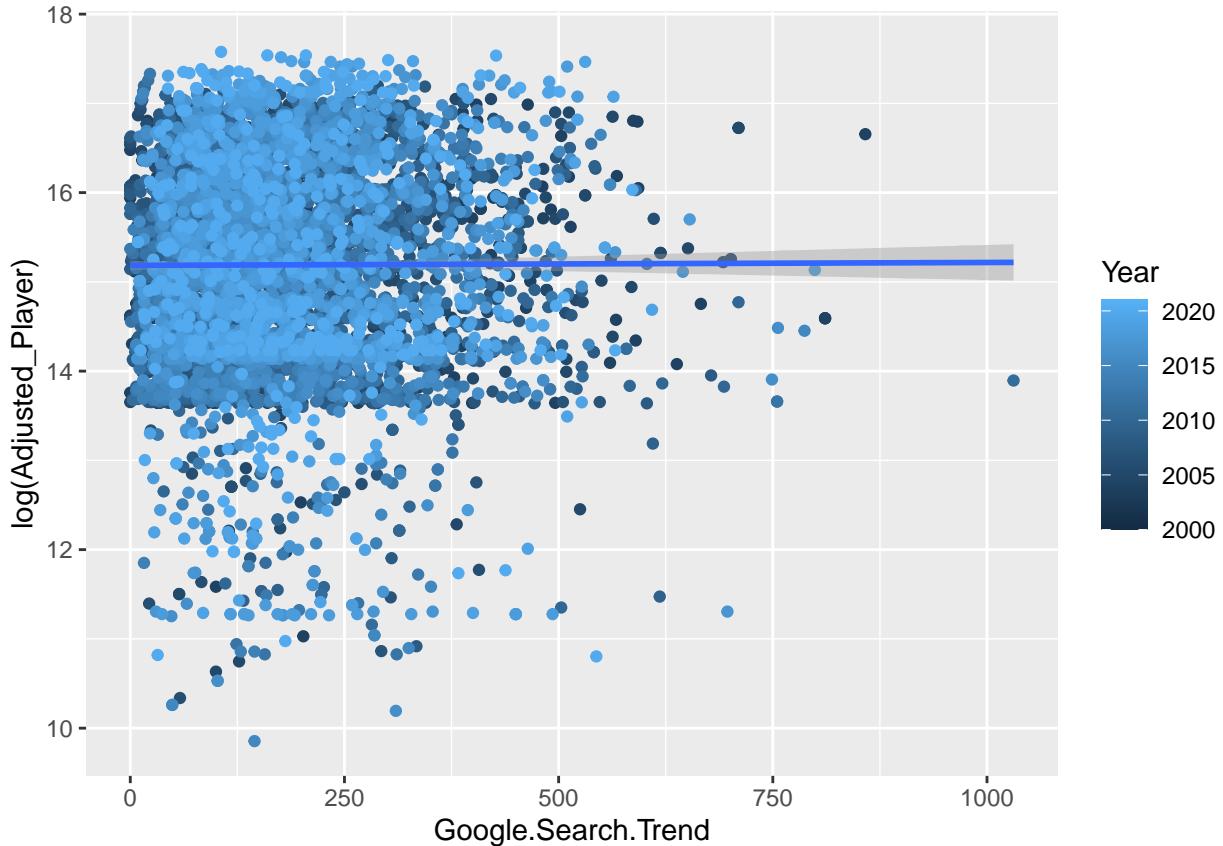
```

Player	Age	Pos	GP	MP	FG%	3P%	FT%	Reb	AST	STL	BLK	PF	PTS	DRW	TRB	AST%	STL%	BLK%	PF%	PTS%	DRW%	TRB%	AST%	STL%	BLK%	PF%
Kevin Garnett	31	S1	81	40.9	418.8	40.7	1.00.39	017.8	50.50	85.00.70	39.011.8	01.51.63.32.522.90	035.506.007.45.62	034.29.84.3.08.736.35.56.81.6												
Shawn O'Neal	31	S1	79	40.0	21.0	57.0	0.00.02.21.0	57.55.5	10.0.52.43.9.413.8	80.53.02.83.229.70	035.506.007.45.62	037.34.83.4.212.84.70.80.28.9														
Al Horford	29	S1	78	34.8	315.0	56.0	0.10.08.314.0	56.55.27.40.72.7	6.89.51.60.53.72.73.921.70	035.506.007.45.62	037.256.38.8.414.30.64.16.22.3															
Mourning	31	S1	82	35.6	213.0	46.0	0.10.06.213.0	46.23.53.40.73.54.15.73	00.80.32.73.614.90	035.506.007.45.62	037.38.6.81.4.110.92.60.69.25.7															
Howard	27	S1	28	23.8	49.60.46	80.00.00.49.50.46	44.562.50.61	64.86.21.40.91.61.72.010.20	035.506.007.45.62	037.106.8.81.3.119.89.61.49.26.2																
Ola-Juwon	31	S1	82	35.9	218.0	50.0	0.10.29.117.9	50.57.29.00.79.7	17.49.53.71.00.92.82.825.20	035.50400.00629.580.74.30.77.8	010.32.67.20.36.2															
Malone	31	S1	82	35.6	218.0	50.0	0.10.29.117.9	50.57.29.00.79.7	17.49.53.71.00.92.82.825.20	035.50400.00629.580.74.30.77.8	010.32.67.20.36.2															

```
aggregated %>%  
  ggplot(aes(x = `Google.Search.Trend` , y = log(Adjusted.Player), colour= Year)) +
```

```
geom_point() +  
geom_smooth(method="lm")
```

```
## `geom_smooth()` using formula 'y ~ x'  
## Warning: Removed 1698 rows containing non-finite values (stat_smooth).  
## Warning: Removed 1698 rows containing missing values (geom_point).
```



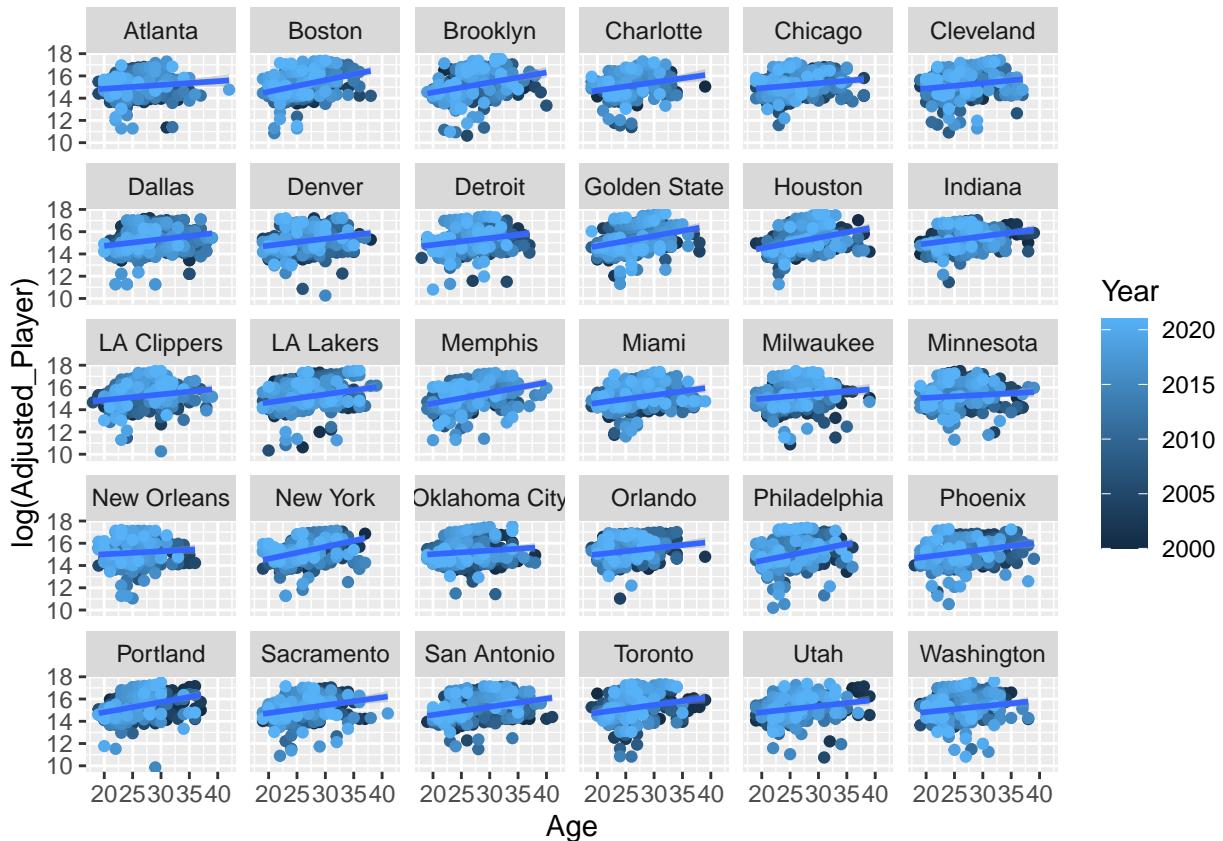
```
ggsave("../figures/exploratory_figures/Adjusted_Google.png", width = 13, height = 10, units = "in")
```

```
## `geom_smooth()` using formula 'y ~ x'  
## Warning: Removed 1698 rows containing non-finite values (stat_smooth).
```

```
## Warning: Removed 1698 rows containing missing values (geom_point).
```

```
aggregated %>%  
  ggplot(aes(x = Age, y = log(Adjusted_Player), colour= Year)) +  
  geom_point() +  
  geom_smooth(method="lm") +  
  facet_wrap(~Team)
```

```
## `geom_smooth()` using formula 'y ~ x'
```



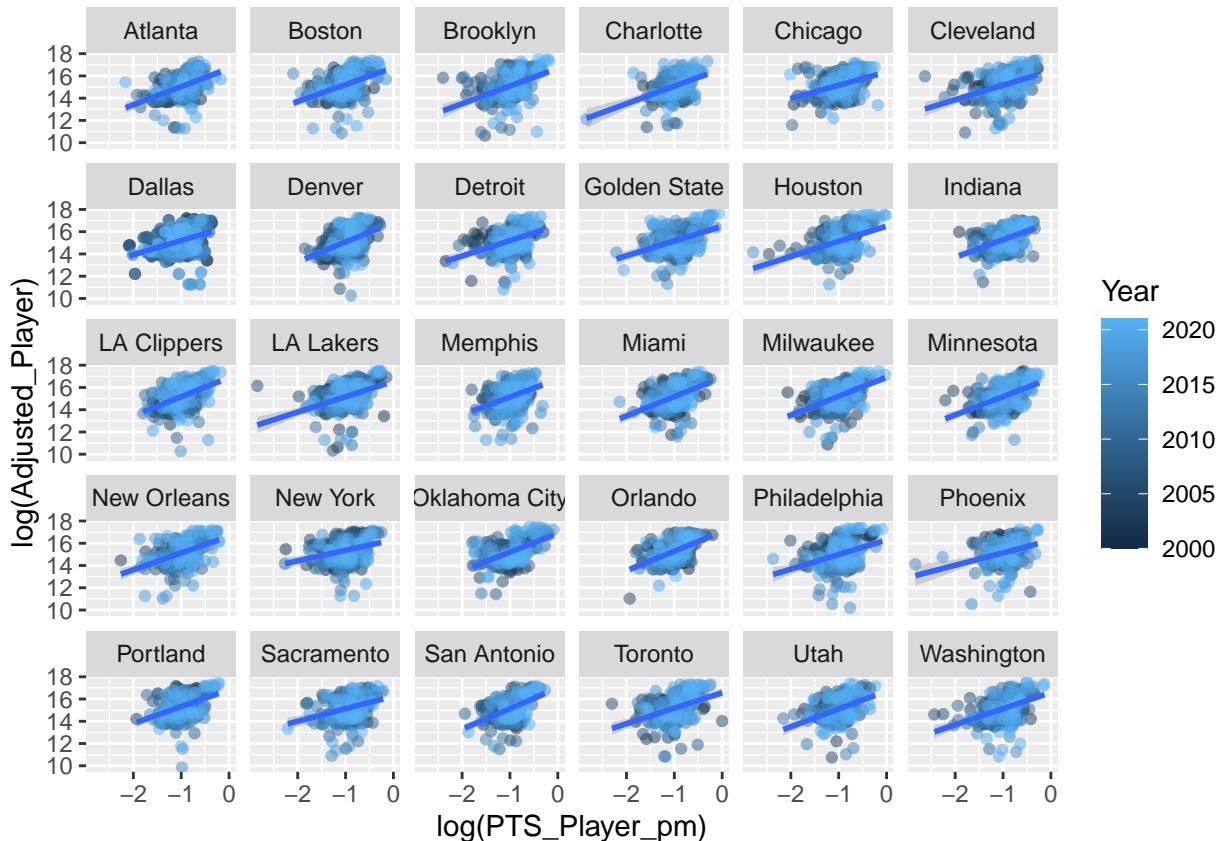
```

ggsave("../figures/exploratory_figures/Adjusted_Age.png", width = 13, height = 10, units = "in")

## `geom_smooth()` using formula 'y ~ x'
aggregated %>%
  ggplot(aes(x = log(PTS_Player_pm), y = log(Adjusted_Player), colour = Year)) +
  geom_point(alpha = 0.5) +
  geom_smooth(method = "lm") +
  facet_wrap(~Team)

## `geom_smooth()` using formula 'y ~ x'

```



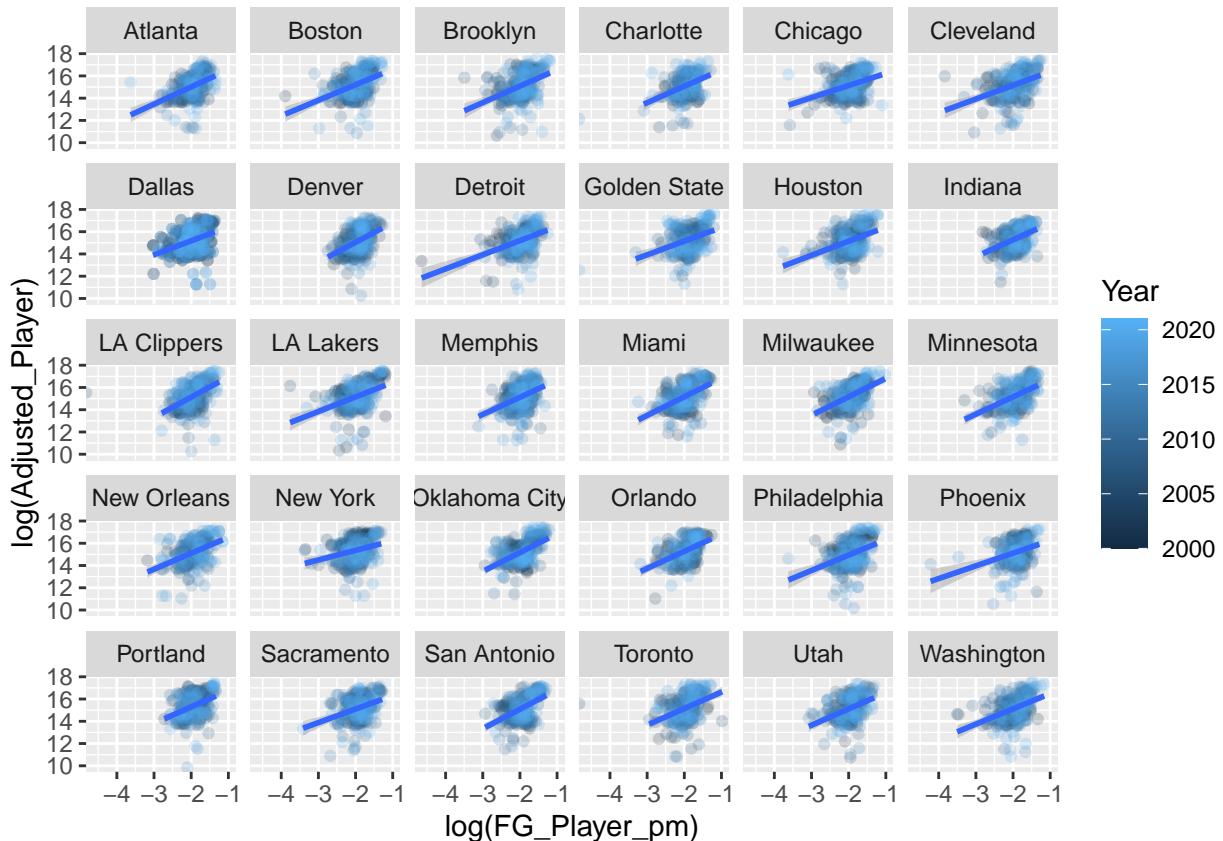
```

ggsave("../figures/exploratory_figures/Adjusted PTS.png", width = 13, height = 10, units = "in")

## `geom_smooth()` using formula 'y ~ x'
aggregated %>%
  ggplot(aes(x = log(FG_Player_pm), y = log(Adjusted_Player), colour = Year)) +
  geom_point(alpha = 0.2) +
  geom_smooth(method = "lm") +
  facet_wrap(~Team)

## `geom_smooth()` using formula 'y ~ x'
## Warning: Removed 4 rows containing non-finite values (stat_smooth).

```

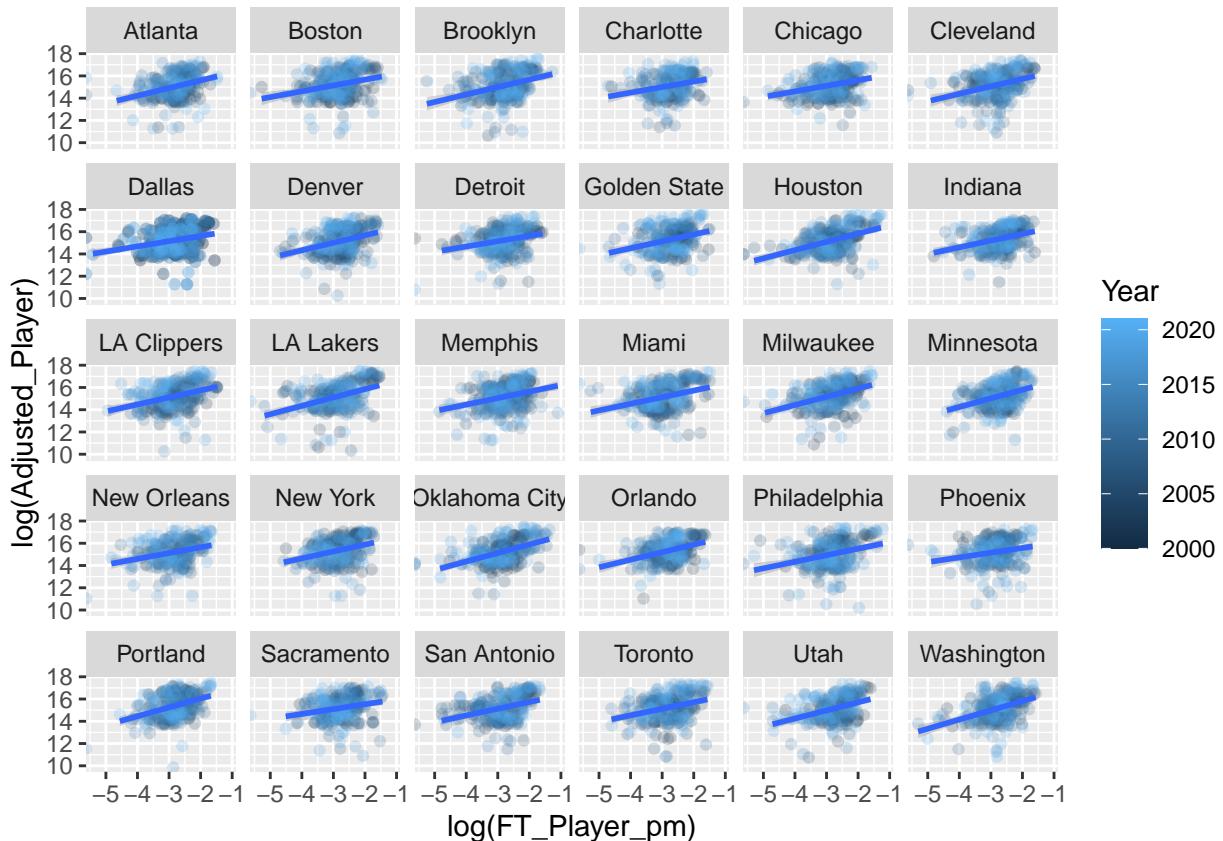


```
ggsave("../figures/exploratory_figures/Adjusted_FG.png", width = 13, height = 10, units = "in")
```

```
## `geom_smooth()` using formula 'y ~ x'
## Warning: Removed 4 rows containing non-finite values (stat_smooth).

aggregated %>%
  ggplot(aes(x = log(FT_Player_pm), y = log(Adjusted_Player), colour = Year)) +
  geom_point(alpha = 0.2) +
  geom_smooth(method = "lm") +
  facet_wrap(~Team)

## `geom_smooth()` using formula 'y ~ x'
## Warning: Removed 30 rows containing non-finite values (stat_smooth).
```

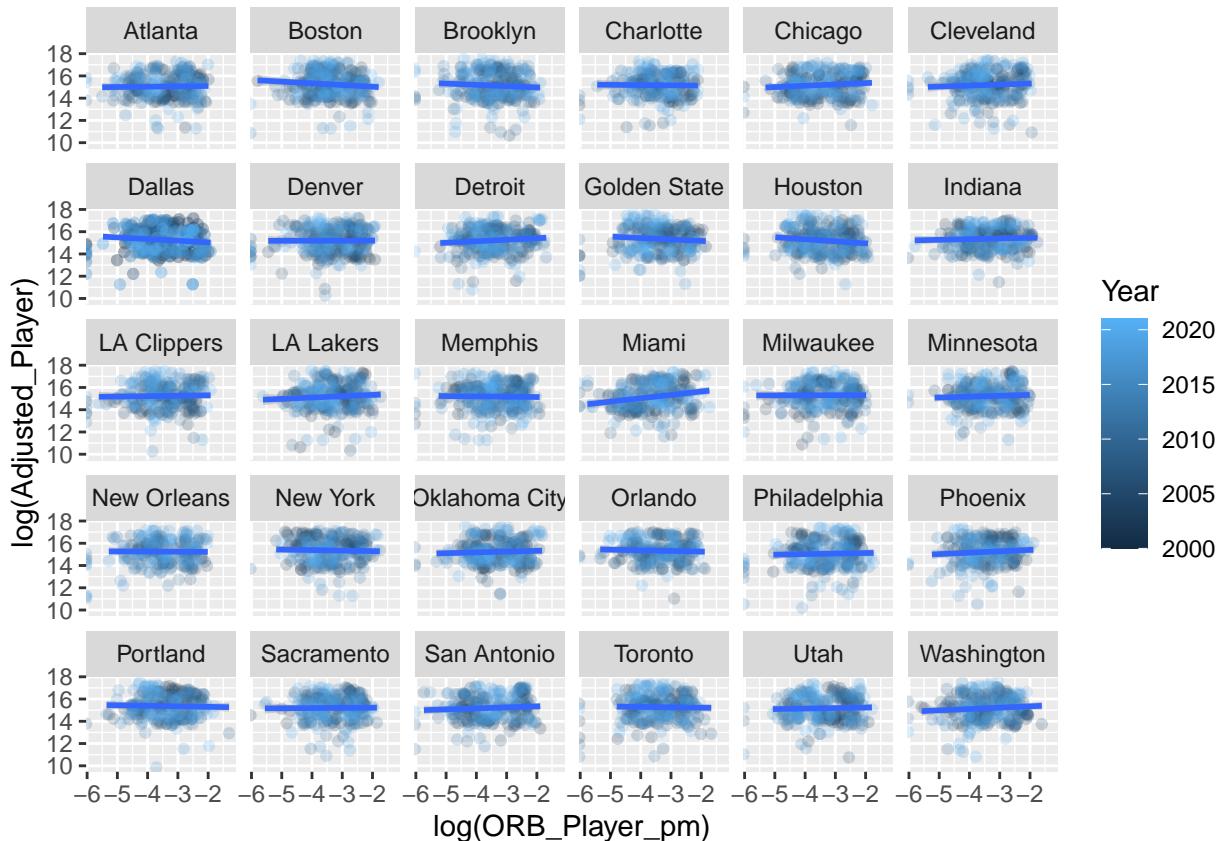


```
ggsave("../figures/exploratory_figures/Adjusted_FT.png", width = 13, height = 10, units = "in")
```

```
## `geom_smooth()` using formula 'y ~ x'
## Warning: Removed 30 rows containing non-finite values (stat_smooth).

aggregated %>%
  ggplot(aes(x = log(ORB_Player_pm), y = log(Adjusted_Player), colour = Year)) +
  geom_point(alpha = 0.2) +
  geom_smooth(method = "lm") +
  facet_wrap(~Team)

## `geom_smooth()` using formula 'y ~ x'
## Warning: Removed 124 rows containing non-finite values (stat_smooth).
```



```

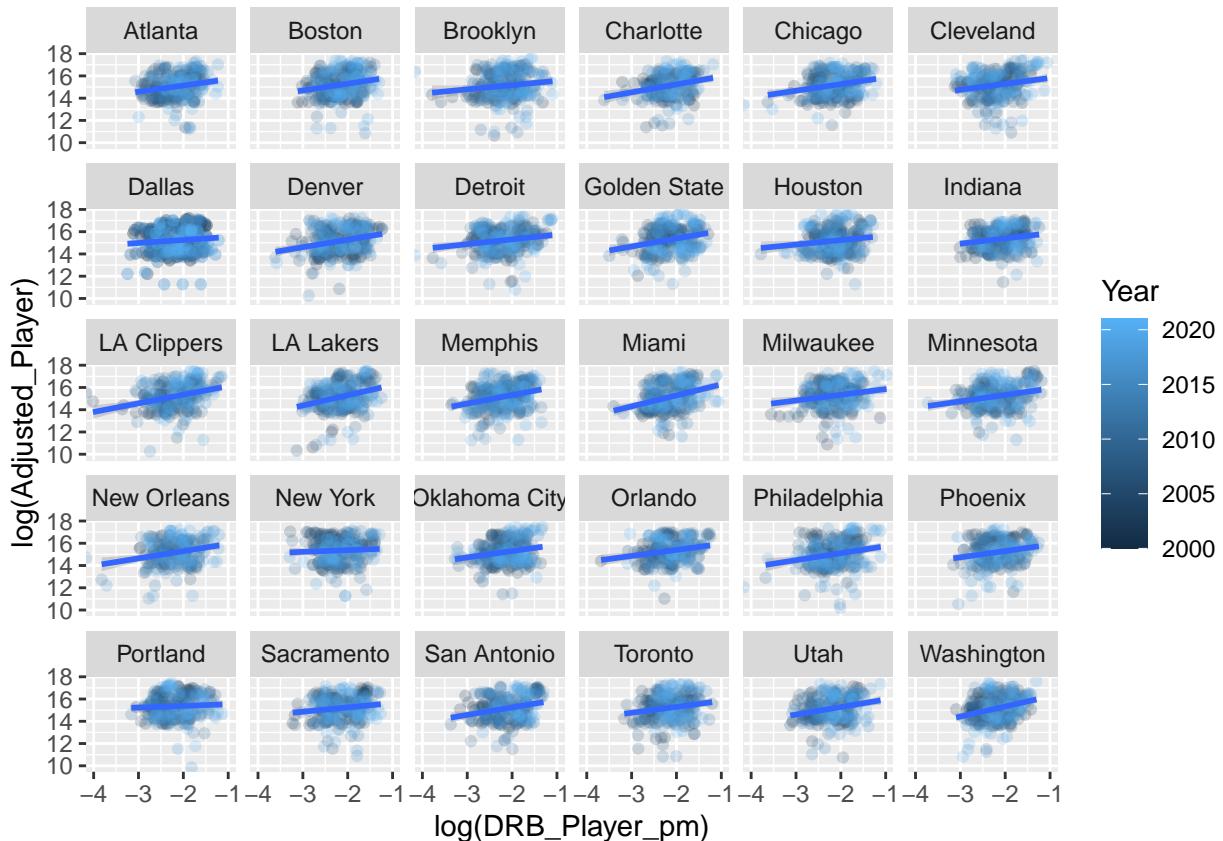
ggsave("../figures/exploratory_figures/Adjusted_ORB.png", width = 13, height = 10, units = "in")

## `geom_smooth()` using formula 'y ~ x'
## Warning: Removed 124 rows containing non-finite values (stat_smooth).

aggregated %>%
  ggplot(aes(x = log(DRB_Player_pm), y = log(Adjusted_Player), colour = Year)) +
  geom_point(alpha = 0.2) +
  geom_smooth(method = "lm") +
  facet_wrap(~Team)

## `geom_smooth()` using formula 'y ~ x'
## Warning: Removed 6 rows containing non-finite values (stat_smooth).

```



```

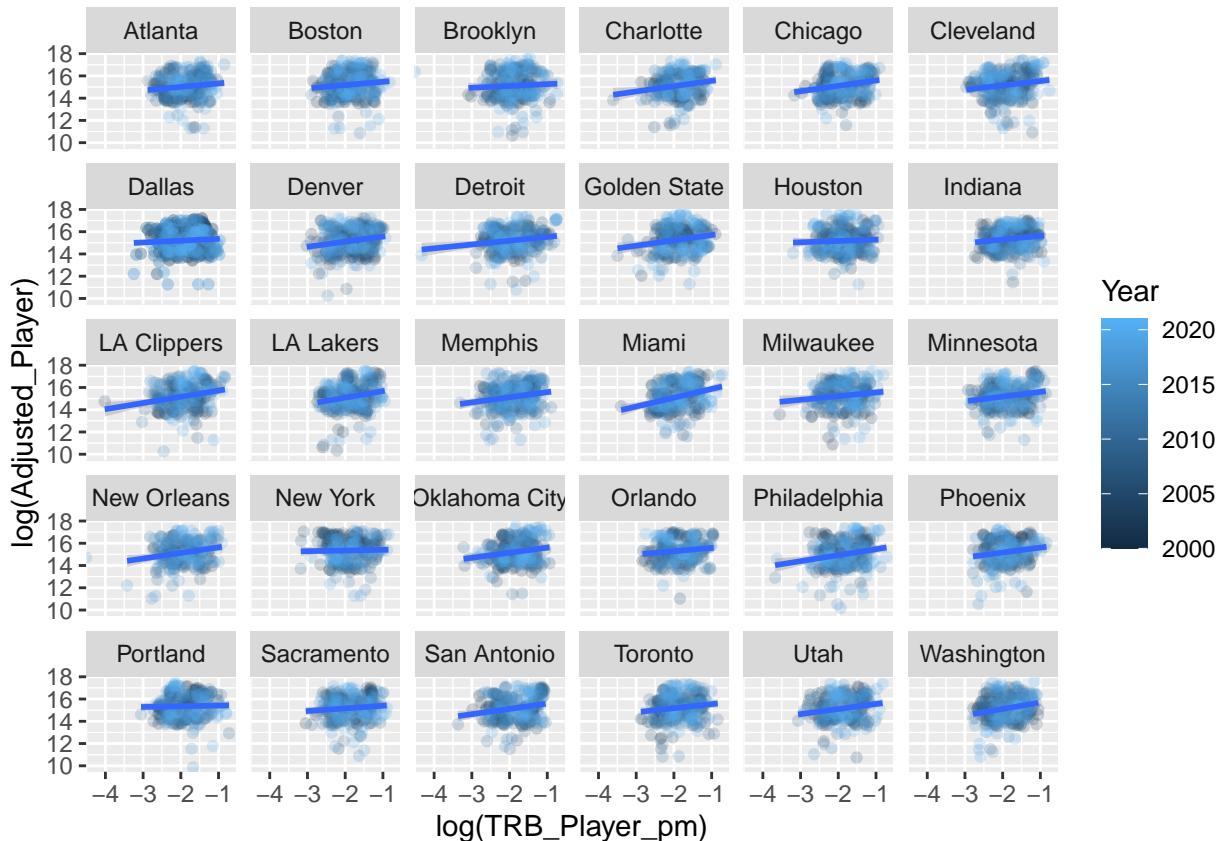
ggsave("../figures/exploratory_figures/Adjusted_DRB.png", width = 13, height = 10, units = "in")

## `geom_smooth()` using formula 'y ~ x'
## Warning: Removed 6 rows containing non-finite values (stat_smooth).

aggregated %>%
  ggplot(aes(x = log(TRB_Player_pm), y = log(Adjusted_Player), colour = Year)) +
  geom_point(alpha = 0.2) +
  geom_smooth(method = "lm") +
  facet_wrap(~Team)

## `geom_smooth()` using formula 'y ~ x'
## Warning: Removed 2 rows containing non-finite values (stat_smooth).

```



```

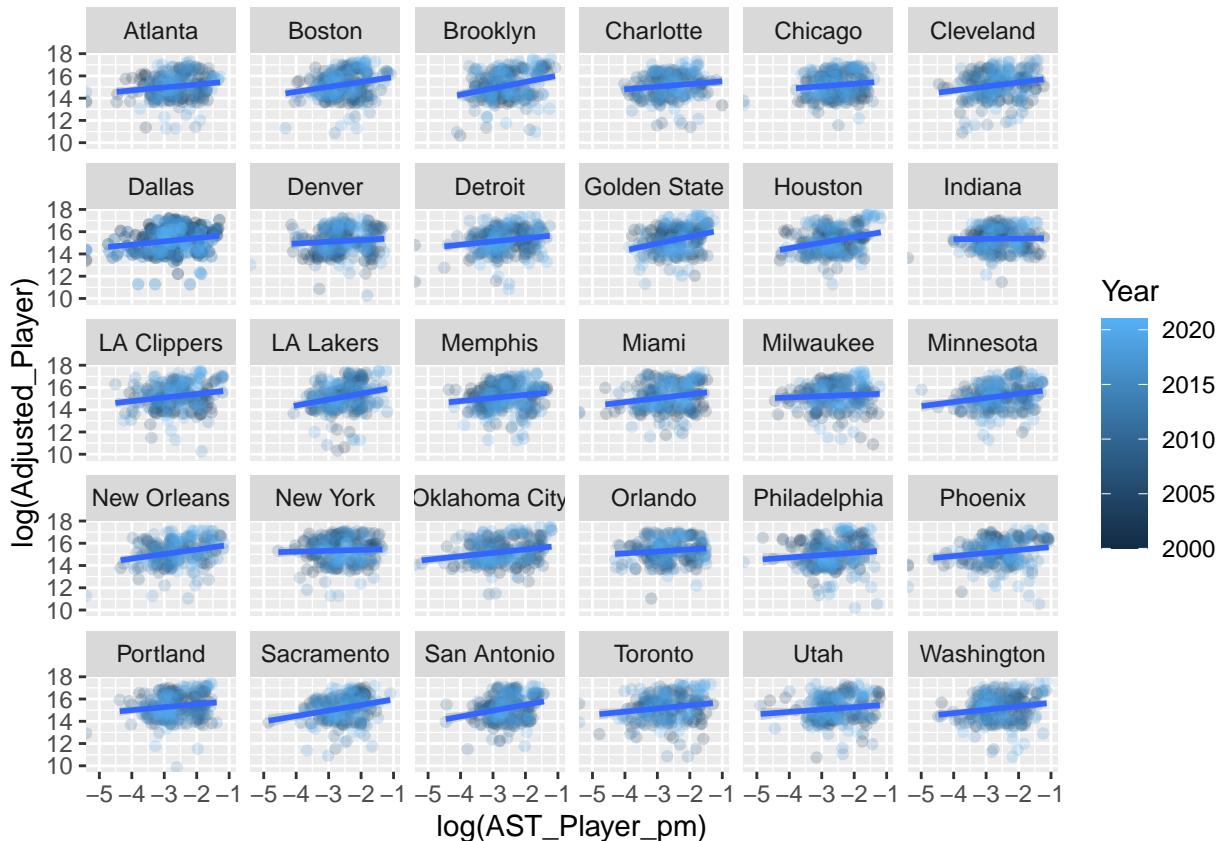
ggsave("../figures/exploratory_figures/Adjusted_TRB.png", width = 13, height = 10, units = "in")

## `geom_smooth()` using formula 'y ~ x'
## Warning: Removed 2 rows containing non-finite values (stat_smooth).

aggregated %>%
  ggplot(aes(x = log(AST_Player_pm), y = log(Adjusted_Player), colour = Year)) +
  geom_point(alpha = 0.2) +
  geom_smooth(method = "lm") +
  facet_wrap(~Team)

## `geom_smooth()` using formula 'y ~ x'
## Warning: Removed 26 rows containing non-finite values (stat_smooth).

```



```

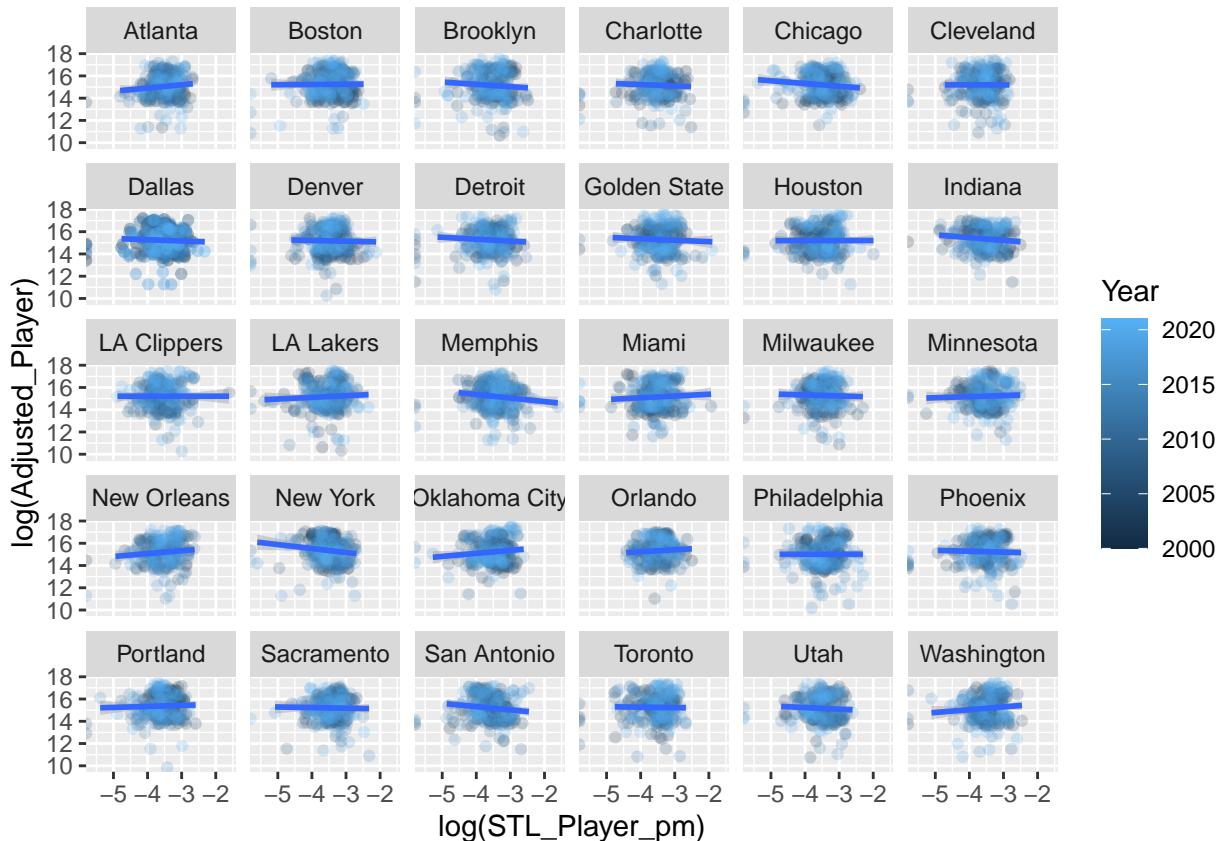
ggsave("../figures/exploratory_figures/Adjusted_AST.png", width = 13, height = 10, units = "in")

## `geom_smooth()` using formula 'y ~ x'
## Warning: Removed 26 rows containing non-finite values (stat_smooth).

aggregated %>%
  ggplot(aes(x = log(STL_Player_pm), y = log(Adjusted_Player), colour = Year)) +
  geom_point(alpha = 0.2) +
  geom_smooth(method = "lm") +
  facet_wrap(~Team)

## `geom_smooth()` using formula 'y ~ x'
## Warning: Removed 96 rows containing non-finite values (stat_smooth).

```



```

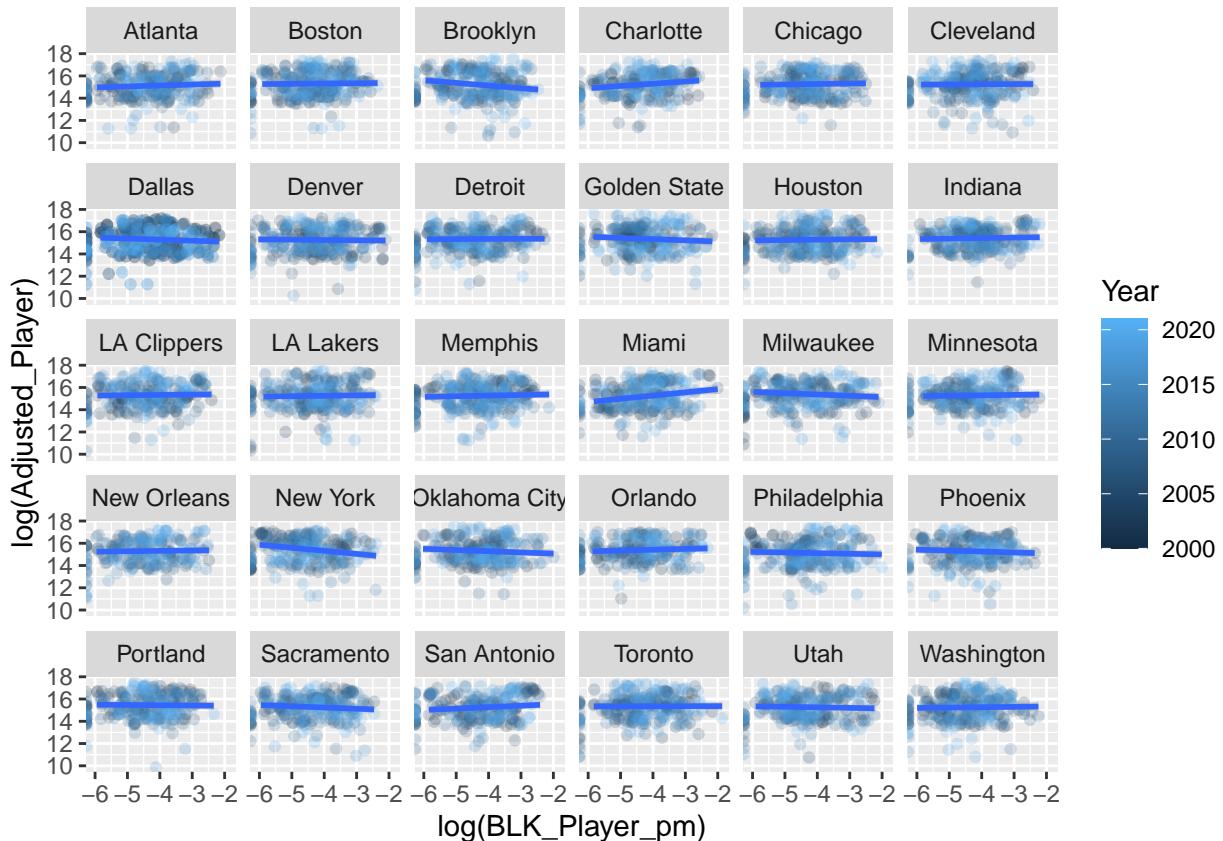
ggsave("../figures/exploratory_figures/Adjusted_STL.png", width = 13, height = 10, units = "in")

## `geom_smooth()` using formula 'y ~ x'
## Warning: Removed 96 rows containing non-finite values (stat_smooth).

aggregated %>%
  ggplot(aes(x = log(BLK_Player_pm), y = log(Adjusted_Player), colour = Year)) +
  geom_point(alpha = 0.2) +
  geom_smooth(method = "lm") +
  facet_wrap(~Team)

## `geom_smooth()` using formula 'y ~ x'
## Warning: Removed 713 rows containing non-finite values (stat_smooth).

```



```

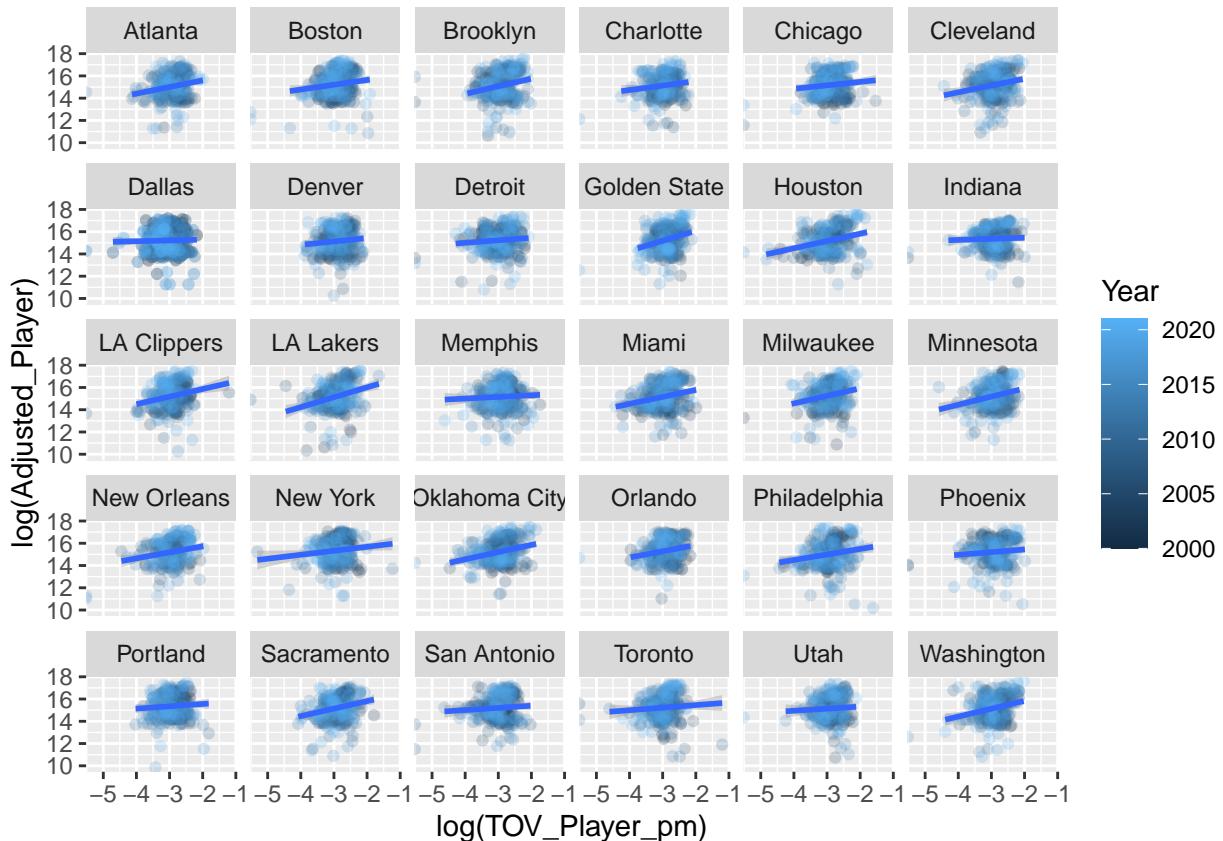
ggsave("../figures/exploratory_figures/Adjusted_BLK.png", width = 13, height = 10, units = "in")

## `geom_smooth()` using formula 'y ~ x'
## Warning: Removed 713 rows containing non-finite values (stat_smooth).

aggregated %>%
  ggplot(aes(x = log(TOV_Player_pm), y = log(Adjusted_Player), colour = Year)) +
  geom_point(alpha = 0.2) +
  geom_smooth(method = "lm") +
  facet_wrap(~Team)

## `geom_smooth()` using formula 'y ~ x'
## Warning: Removed 32 rows containing non-finite values (stat_smooth).

```



```

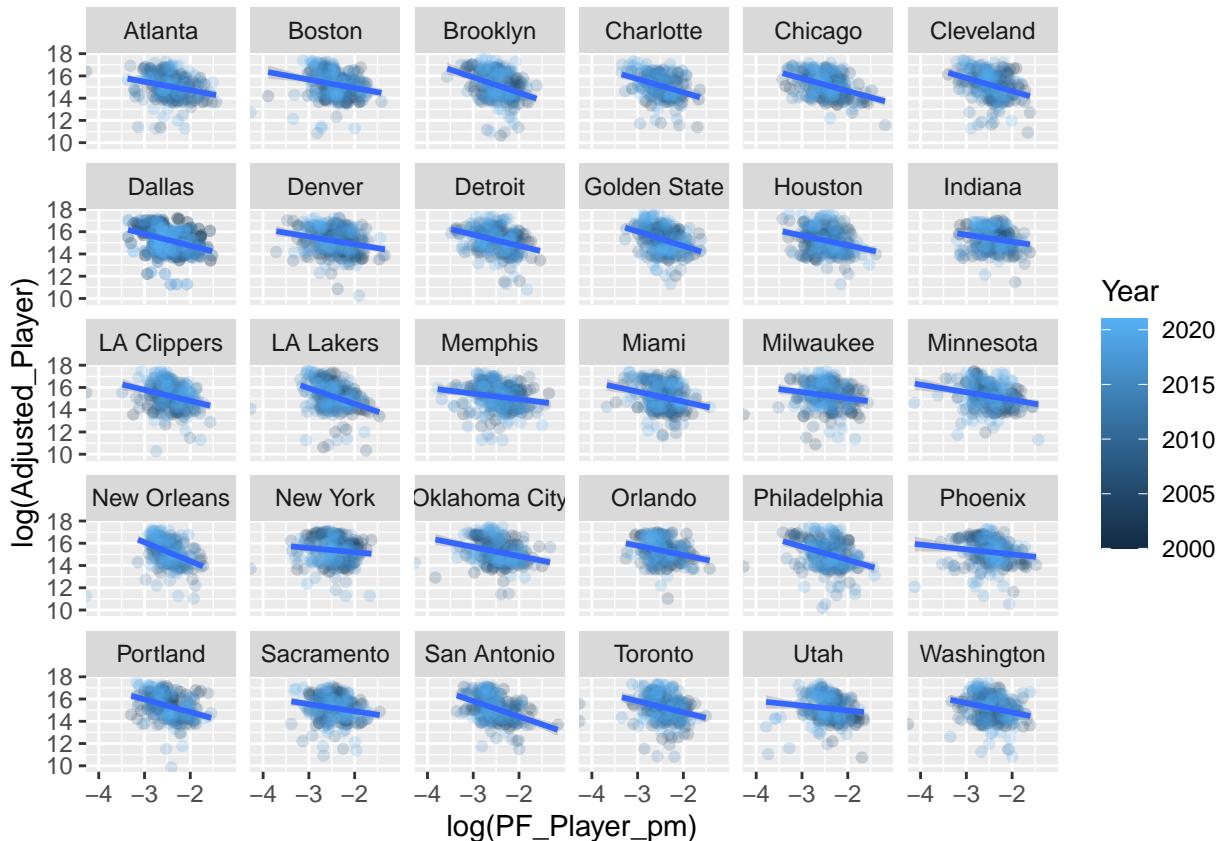
ggsave("../figures/exploratory_figures/Adjusted_TOV.png", width = 13, height = 10, units = "in")

## `geom_smooth()` using formula 'y ~ x'
## Warning: Removed 32 rows containing non-finite values (stat_smooth).

aggregated %>%
  ggplot(aes(x = log(PF_Player_pm), y = log(Adjusted_Player), colour = Year)) +
  geom_point(alpha = 0.2) +
  geom_smooth(method = "lm") +
  facet_wrap(~Team)

## `geom_smooth()` using formula 'y ~ x'
## Warning: Removed 12 rows containing non-finite values (stat_smooth).

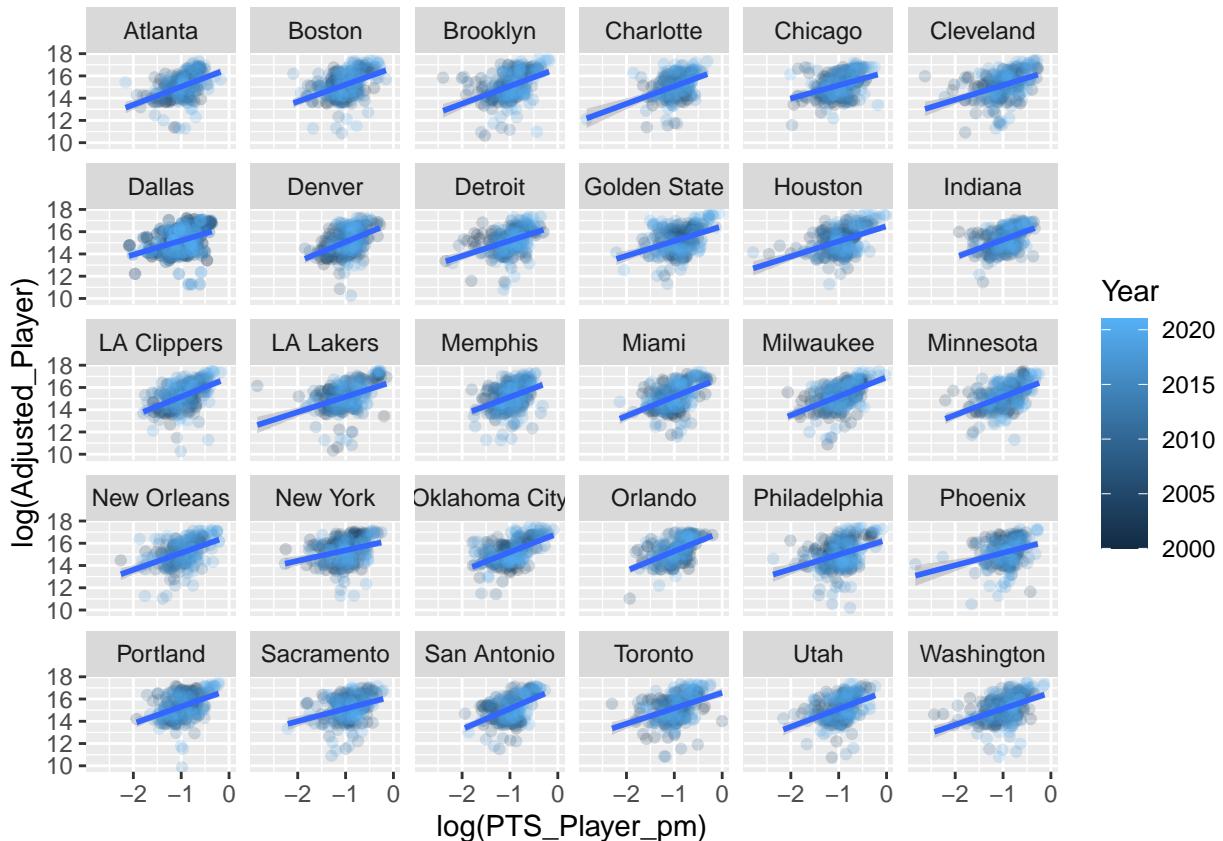
```



```
ggsave("../figures/exploratory_figures/Adjusted_PF.png", width = 13, height = 10, units = "in")
```

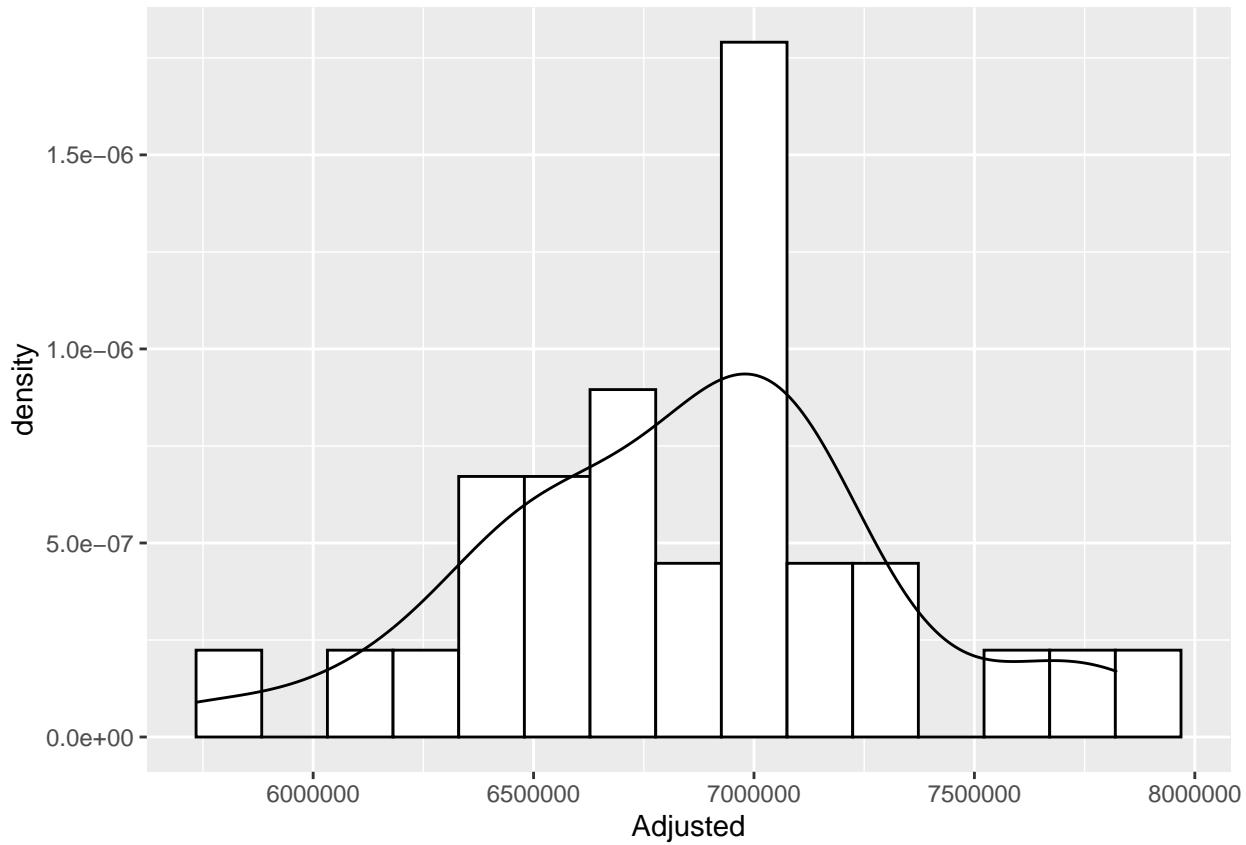
```
## `geom_smooth()` using formula 'y ~ x'
## Warning: Removed 12 rows containing non-finite values (stat_smooth).
aggregated %>%
  ggplot(aes(x = log(PTS_Player_pm), y = log(Adjusted_Player), colour = Year)) +
  geom_point(alpha = 0.2) +
  geom_smooth(method = "lm") +
  facet_wrap(~Team)

## `geom_smooth()` using formula 'y ~ x'
```



```
ggsave("../figures/exploratory_figures/Adjusted PTS.png", width = 13, height = 10, units = "in")
```

```
## `geom_smooth()` using formula 'y ~ x'
aggregated %>%
  group_by(Team) %>%
  summarise(Adjusted = mean(Adjusted_Player)) %>%
  ggplot() +
  geom_histogram(aes(x = Adjusted, y = ..density..), fill = "white", colour = "black", bins = 15) +
  geom_density(aes(x = Adjusted))
```



```

aggregated %>%
  select(
    Adjusted_Player,
    # FG_Player_pm,
    `X3P_Player_pm`,
    `X2P_Player_pm`,
    FT_Player_pm,
    # ORB_Player_pm,
    # DRB_Player_pm,
    TRB_Player_pm,
    AST_Player_pm,
    STL_Player_pm,
    BLK_Player_pm,
    TOV_Player_pm,
    PF_Player_pm
    # PTS_Player_pm
  ) %>%
  log() %>%
  rowwise() %>%
  filter(!any(is.infinite(c_across(Adjusted_Player:PF_Player_pm)))) %>%
  ggpairs()

```

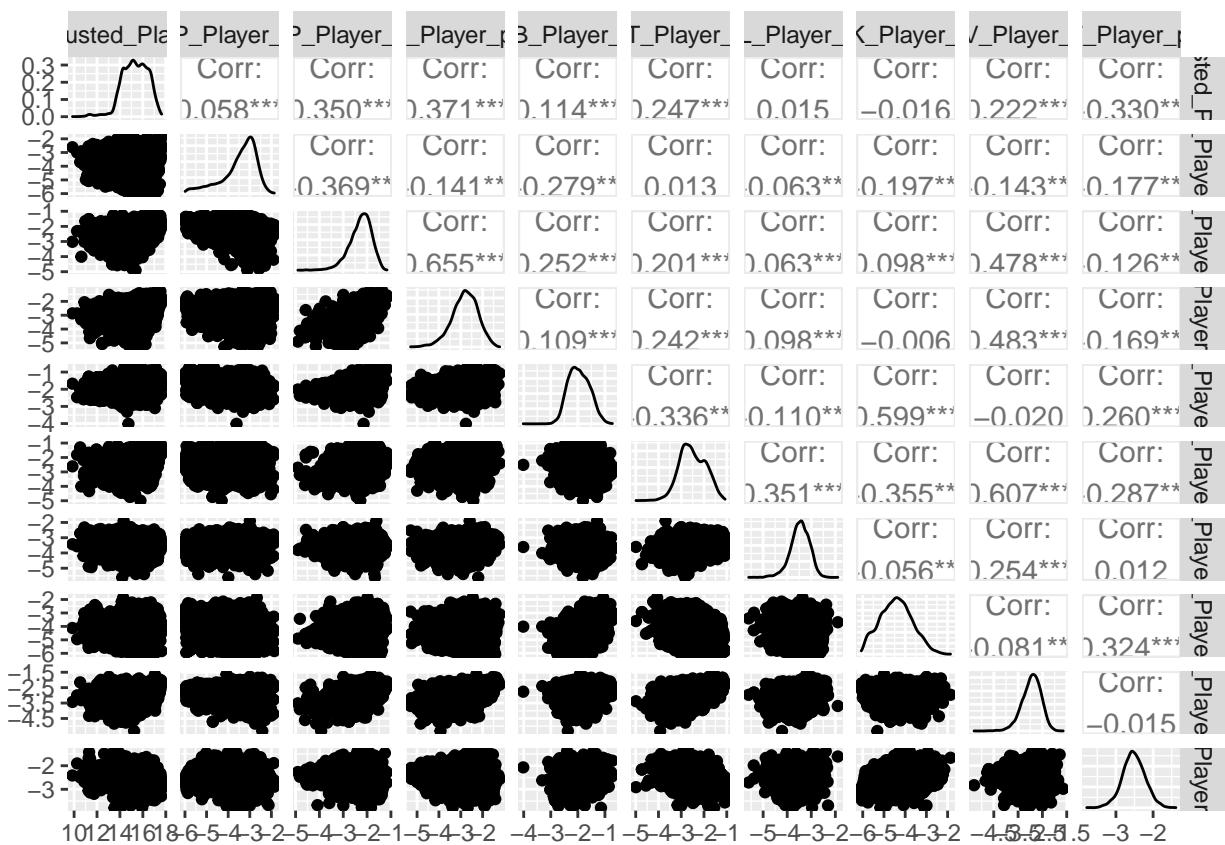
```

## plot: [1,1] [>-----
## plot: [1,2] [==>-----
## plot: [1,3] [====>-
## plot: [1,4] [=====>-
## plot: [1,5] [=====>-
## plot: [1,6] [=====>-
## plot: [1,7] [=====>-
## plot: [1,8] [=====>-

```

```
## plot: [1,9] [=====]>
## plot: [1,10] [=====]>
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## plot: [2,2] [=====]>
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## plot: [7,1] [=====]>
## plot: [7,2] [=====]>
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## plot: [7,4] [=====]>
```





```

ggsave(
  ".../figures/exploratory_figures/EDA_Pairs.png",
  width = 20,
  height = 20,
  units = "in"
)

```

```

## plot: [1,1] [>-----]
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```

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## plot: [8,9] [=====>
```

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## plot: [8,10] [=====
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## plot: [10,5] [=====
## plot: [10,6] [=====
## plot: [10,7] [=====
## plot: [10,8] [=====
## plot: [10,9] [=====
## plot: [10,10] [=====

selected <- aggregated %>%
  mutate(Adjusted_Player = log(Adjusted_Player),
    `X3P_Player_pm` = log(`X3P_Player_pm`),
    `X2P_Player_pm` = log(`X2P_Player_pm`),
    FT_Player_pm = log(FT_Player_pm),
    TRB_Player_pm = log(TRB_Player_pm),
    AST_Player_pm = log(AST_Player_pm),
    STL_Player_pm = log(STL_Player_pm),
    BLK_Player_pm = log(BLK_Player_pm),
    TOV_Player_pm = log(TOV_Player_pm),
    PF_Player_pm = log(PF_Player_pm),
    `Google.Search.Trend` = `Google.Search.Trend`) %>%
  select(`X3P_Player_pm`, `X2P_Player_pm`, FT_Player_pm, TRB_Player_pm,
         AST_Player_pm, STL_Player_pm, BLK_Player_pm, PF_Player_pm, Age, Adjusted_Player, `Google.Search.
  rowwise() %>%
  filter(!any(is.infinite(c_across(`X3P_Player_pm`:`Google.Search.Trend`)))))

lmmmod <- lmer(Adjusted_Player ~ `Google.Search.Trend` + `X3P_Player_pm` + `X2P_Player_pm` + TRB_Player_pm +
  STL_Player_pm + BLK_Player_pm + PF_Player_pm + Age + Adjusted_Player + (1 | Team), data = selected)

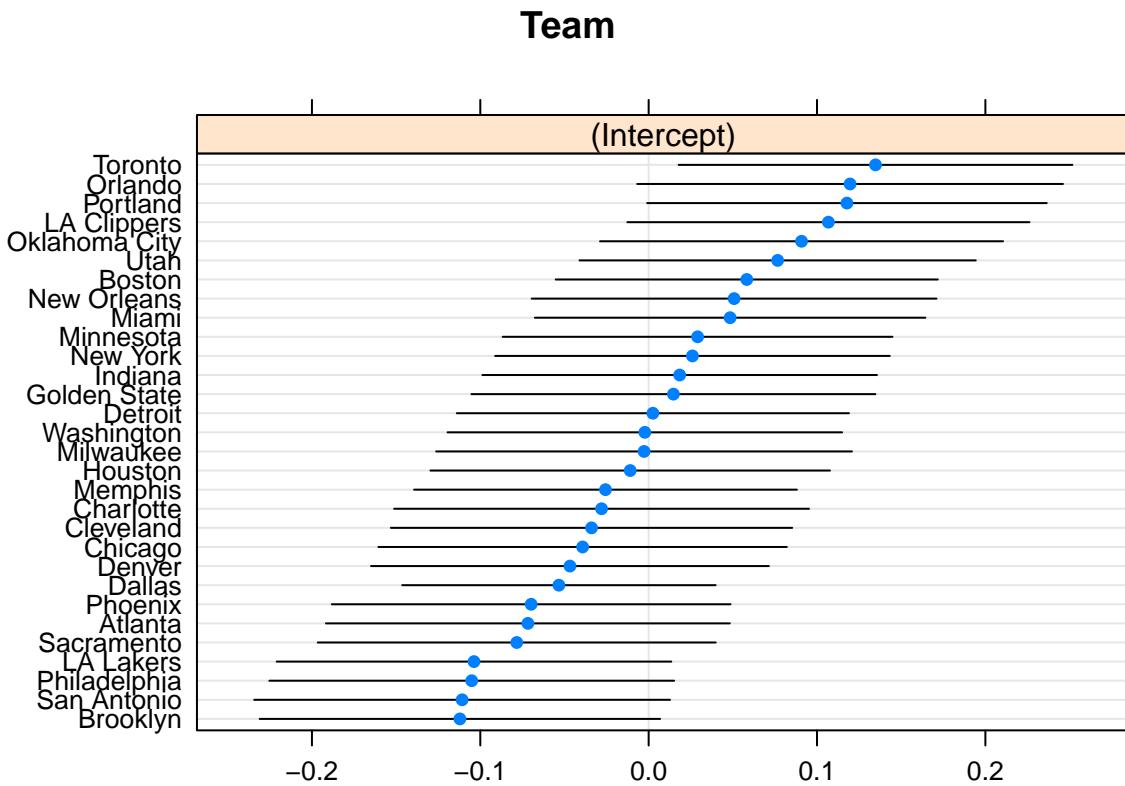
## Warning in model.matrix.default(fixedform, fr, contrasts): the response appeared on the right-hand side
## Warning in model.matrix.default(fixedform, fr, contrasts): problem with term 10 in model.matrix: no column
## Warning in model.matrix.default(fixedform, fr, contrasts): the response appeared on the right-hand side
## Warning in model.matrix.default(fixedform, fr, contrasts): problem with term 10 in model.matrix: no column
summary(lmmmod)

## Linear mixed model fit by REML. t-tests use Satterthwaite's method ['lmerModLmerTest']
## Formula: Adjusted_Player ~ Google.Search.Trend + X3P_Player_pm + X2P_Player_pm +      TRB_Player_pm + A
##          PF_Player_pm + Age + Adjusted_Player + (1 | Team)
## Data: selected
##
## REML criterion at convergence: 11672.2
##
## Scaled residuals:
```

```

##      Min     1Q   Median     3Q    Max
## -5.8226 -0.5411  0.1490  0.6922  2.7374
##
## Random effects:
## Groups   Name        Variance Std.Dev.
## Team     (Intercept) 0.008968 0.0947
## Residual          0.861886 0.9284
## Number of obs: 4309, groups: Team, 30
##
## Fixed effects:
##                               Estimate Std. Error      df t value Pr(>|t|) 
## (Intercept)           1.607e+01 2.582e-01 4.229e+03 62.236 <2e-16 ***
## Google.Search.Trend -3.400e-04 1.193e-04 4.280e+03 -2.849  0.0044 ** 
## X3P_Player_pm        2.516e-01 2.053e-02 4.297e+03 12.254 <2e-16 ***
## X2P_Player_pm        8.338e-01 3.637e-02 4.298e+03 22.925 <2e-16 *** 
## TRB_Player_pm        5.953e-01 4.934e-02 4.295e+03 12.065 <2e-16 *** 
## AST_Player_pm         3.026e-01 3.032e-02 4.299e+03  9.978 <2e-16 *** 
## STL_Player_pm        -2.284e-02 3.889e-02 4.298e+03 -0.587  0.5571  
## BLK_Player_pm         2.190e-02 2.482e-02 4.299e+03   0.882  0.3776  
## PF_Player_pm          -8.683e-01 5.159e-02 4.298e+03 -16.830 <2e-16 *** 
## Age                  6.916e-02 3.609e-03 4.237e+03 19.162 <2e-16 *** 
## ---                
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##            (Intr) Gg.S.T X3P_P_ X2P_P_ TRB_P_ AST_P_ STL_P_ BLK_P_ PF_P1_
## Ggl.Srch.Tr -0.098
## X3P_Plyr_pm  0.550 -0.038
## X2P_Plyr_pm  0.285 -0.064  0.322
## TRB_Plyr_pm  0.180  0.020  0.114 -0.268
## AST_Plyr_pm  0.284 -0.013  0.014 -0.278  0.212
## STL_Plyr_pm  0.359 -0.008  0.039  0.025  0.051 -0.349
## BLK_Plyr_pm  0.179 -0.022  0.055  0.010 -0.482  0.168 -0.073
## PF_Playr_pm  0.458 -0.010  0.140  0.208 -0.096  0.121 -0.086 -0.161
## Age          -0.256 -0.089 -0.020  0.193 -0.071 -0.122  0.074  0.043  0.108
lattice::dotplot(lme4::ranef(lmmmod, condVar = TRUE))

## $Team
```



```

lmod <- lm(Adjusted_Player ~ `Google.Search.Trend` + `X3P_Player_pm` + `X2P_Player_pm` + TRB_Player_pm + 
           AST_Player_pm + STL_Player_pm + BLK_Player_pm + PF_Player_pm + Age + Adjusted_Player + as.factor(Team), data = selected)

## Warning in model.matrix.default(mt, mf, contrasts): the response appeared on the right-hand side and was dropped
## Warning in model.matrix.default(mt, mf, contrasts): problem with term 10 in model.matrix: no columns are assigned to it
summary(lmod)

## 
## Call:
## lm(formula = Adjusted_Player ~ Google.Search.Trend + X3P_Player_pm +
##      X2P_Player_pm + TRB_Player_pm + AST_Player_pm + STL_Player_pm +
##      BLK_Player_pm + PF_Player_pm + Age + Adjusted_Player + as.factor(Team),
##      data = selected)
## 
## Residuals:
##    Min      1Q  Median      3Q     Max 
## -5.4919 -0.5114  0.1413  0.6454  2.5633 
## 
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)    
## (Intercept) 15.9274046  0.2704921 58.883 < 2e-16 ***
## Google.Search.Trend -0.0003365  0.0001200 -2.803  0.00509 ** 
## X3P_Player_pm   0.2516659  0.0206194 12.205 < 2e-16 ***
## X2P_Player_pm   0.8320711  0.0365141 22.788 < 2e-16 *** 
## TRB_Player_pm   0.6003433  0.0494475 12.141 < 2e-16 *** 
## AST_Player_pm   0.3069847  0.0304313 10.088 < 2e-16 *** 
## STL_Player_pm  -0.0228099  0.0389982 -0.585  0.55865  
## BLK_Player_pm   0.0236056  0.0249096  0.948  0.34336  
## PF_Player_pm   -0.8776258  0.0518065 -16.940 < 2e-16 *** 
## Age            0.0698091  0.0036365 19.197 < 2e-16 *** 
## as.factor(Team)Boston  0.2171003  0.1087041   1.997  0.04587 * 
## 
```

```

## as.factor(Team)Brooklyn      -0.0669229  0.1127626 -0.593  0.55289
## as.factor(Team)Charlotte     0.0740045  0.1164931  0.635  0.52529
## as.factor(Team)Chicago        0.0549237  0.1145884  0.479  0.63174
## as.factor(Team)Cleveland      0.0654232  0.1129353  0.579  0.56242
## as.factor(Team)Dallas         0.0512218  0.0979155  0.523  0.60092
## as.factor(Team)Denver         0.0448619  0.1121364  0.400  0.68913
## as.factor(Team)Detroit        0.1282908  0.1110370  1.155  0.24800
## as.factor(Team)Golden State   0.1480183  0.1137147  1.302  0.19310
## as.factor(Team)Houston        0.1040552  0.1128241  0.922  0.35644
## as.factor(Team)Indiana        0.1543739  0.1113776  1.386  0.16581
## as.factor(Team)LA Clippers    0.3062863  0.1133269  2.703  0.00691  **
## as.factor(Team)LA Lakers      -0.0499291  0.1113262 -0.448  0.65382
## as.factor(Team)Memphis        0.0828125  0.1089279  0.760  0.44715
## as.factor(Team)Miami          0.2020595  0.1106041  1.827  0.06779 .
## as.factor(Team)Milwaukee      0.1188610  0.1165997  1.019  0.30807
## as.factor(Team)Minnesota      0.1717128  0.1103077  1.557  0.11962
## as.factor(Team)New Orleans     0.2115568  0.1137828  1.859  0.06305 .
## as.factor(Team)New York       0.1677587  0.1114932  1.505  0.13249
## as.factor(Team)Oklahoma City   0.2801364  0.1134153  2.470  0.01355 *
## as.factor(Team)Orlando        0.3477880  0.1193496  2.914  0.00359  **
## as.factor(Team)Philadelphia   -0.0561720  0.1137675 -0.494  0.62151
## as.factor(Team)Phoenix        0.0063104  0.1124582  0.056  0.95525
## as.factor(Team)Portland        0.3246457  0.1127725  2.879  0.00401  **
## as.factor(Team)Sacramento     -0.0080482  0.1121652 -0.072  0.94280
## as.factor(Team)San Antonio    -0.0773798  0.1168556 -0.662  0.50789
## as.factor(Team)Toronto         0.3480481  0.1112182  3.129  0.00176  **
## as.factor(Team)Utah           0.2527654  0.1119867  2.257  0.02405 *
## as.factor(Team)Washington     0.1210287  0.1115510  1.085  0.27800
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.9283 on 4270 degrees of freedom
##   (1141 observations deleted due to missingness)
## Multiple R-squared:  0.3324, Adjusted R-squared:  0.3264
## F-statistic: 55.94 on 38 and 4270 DF,  p-value: < 2.2e-16
par(mfrow = c(2, 2))
plot(lmod)

## Warning in model.matrix.default(object, data = structure(list(Adjusted_Player = c(16.894827811776, : the
## Warning in model.matrix.default(object, data = structure(list(Adjusted_Player = c(16.894827811776, : pr
## assigned

```

