Adjusted_TOE

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```
team_stats <-read.csv('/home/chenjie/Desktop/Math564Project/WinRatio_TOE/toe_results.csv')
team_stats$color = "green"
team_stats$color[team_stats$win_ratio>=0.5]="blue"
team_stats$color[team_stats$win_ratio>=0.7317073]="red" #won more than 60 games
```

2014 win ratio against Team TOE

Season 2014 our new TOE:

```
s14 <- team_stats[team_stats$season == 2014,]
new_mod14 <- lm(win_ratio ~ new_toe, data = s14)
summary(new_mod14)
```

```
##
## Call:
## lm(formula = win_ratio ~ new_toe, data = s14)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.14514 -0.07483 -0.01923  0.04819  0.24369
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -2.7505     0.4995  -5.507 6.95e-06 ***
## new_toe       6.6228     1.0169   6.513 4.66e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1011 on 28 degrees of freedom
## Multiple R-squared:  0.6023, Adjusted R-squared:  0.5881
## F-statistic: 42.41 on 1 and 28 DF,  p-value: 4.661e-07
```

Season 2014 old TOE:

```
mod14 <- lm(win_ratio ~ toe, data = s14)
summary(mod14)
```

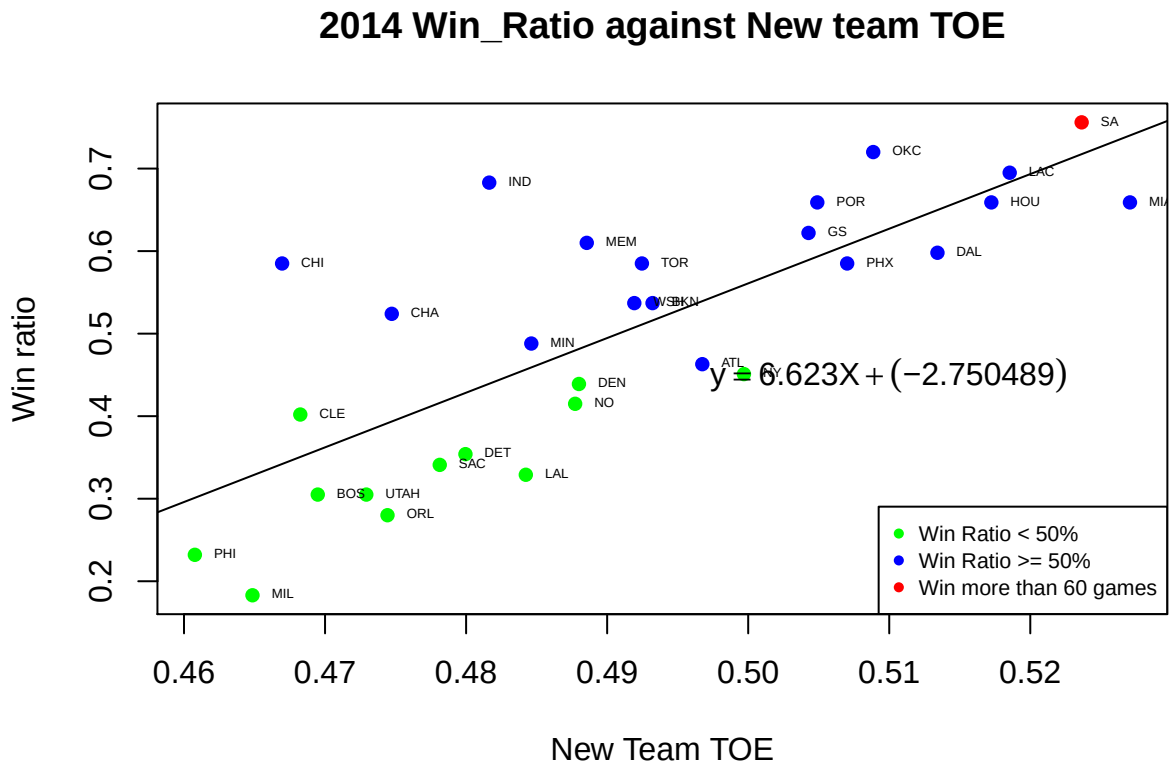
```
##
## Call:
## lm(formula = win_ratio ~ toe, data = s14)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
```

```
## -0.23709 -0.06599 -0.01423  0.08087  0.27310
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -2.7875     0.7047  -3.956 0.000473 ***
## toe           7.5582     1.6193   4.667 6.88e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1203 on 28 degrees of freedom
## Multiple R-squared:  0.4376, Adjusted R-squared:  0.4175
## F-statistic: 21.79 on 1 and 28 DF,  p-value: 6.883e-05
```

```
plot(s14$new_toe,s14$win_ratio,xlab = 'New Team TOE', ylab = 'Win ratio', main = '2014 Win_Ratio agains
```

```
## integer(0)
```

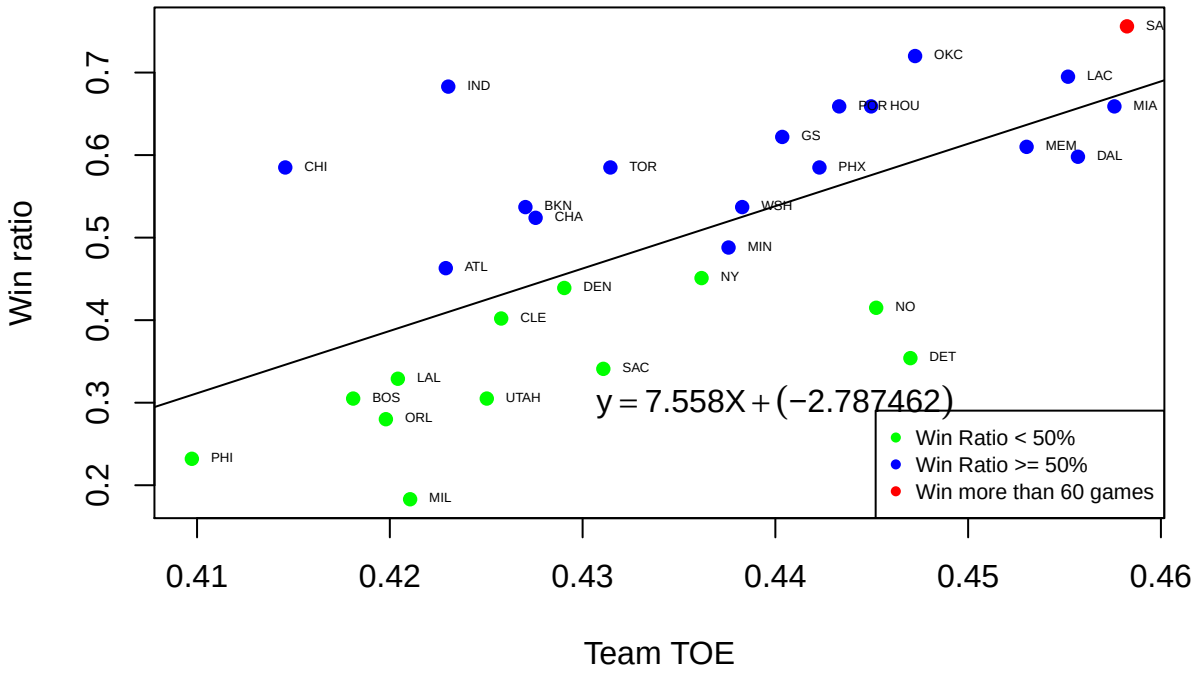
```
legend("bottomright",legend=c("Win Ratio < 50%", "Win Ratio >= 50%","Win more than 60 games"),
       col=c("green", "blue","red"), pch = c(16,16,16), cex = 0.7)
```




```
plot(s14$toe,s14$win_ratio,xlab = 'Team TOE', ylab = 'Win ratio', main = '2014 Win_Ratio against old tea
```

```
## integer(0)
```

```
legend("bottomright",legend=c("Win Ratio < 50%", "Win Ratio >= 50%","Win more than 60 games"),
       col=c("green", "blue","red"), pch = c(16,16,16), cex = 0.7)
```



2015 win ratio against Team TOE

Season 2015 our new TOE:

```
s15 <- team_stats[team_stats$season == 2015,]
new_mod15 <- lm(win_ratio ~ new_toe, data = s15)
summary(new_mod15)
```

```
##
## Call:
## lm(formula = win_ratio ~ new_toe, data = s15)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.145230 -0.038499 -0.005498  0.041102  0.179241
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -2.9699     0.3353  -8.857 1.31e-09 ***
## new_toe       7.1203     0.6875  10.357 4.41e-11 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.076 on 28 degrees of freedom
## Multiple R-squared:  0.793,  Adjusted R-squared:  0.7856
## F-statistic: 107.3 on 1 and 28 DF,  p-value: 4.414e-11
```

Season 2015 old TOE:

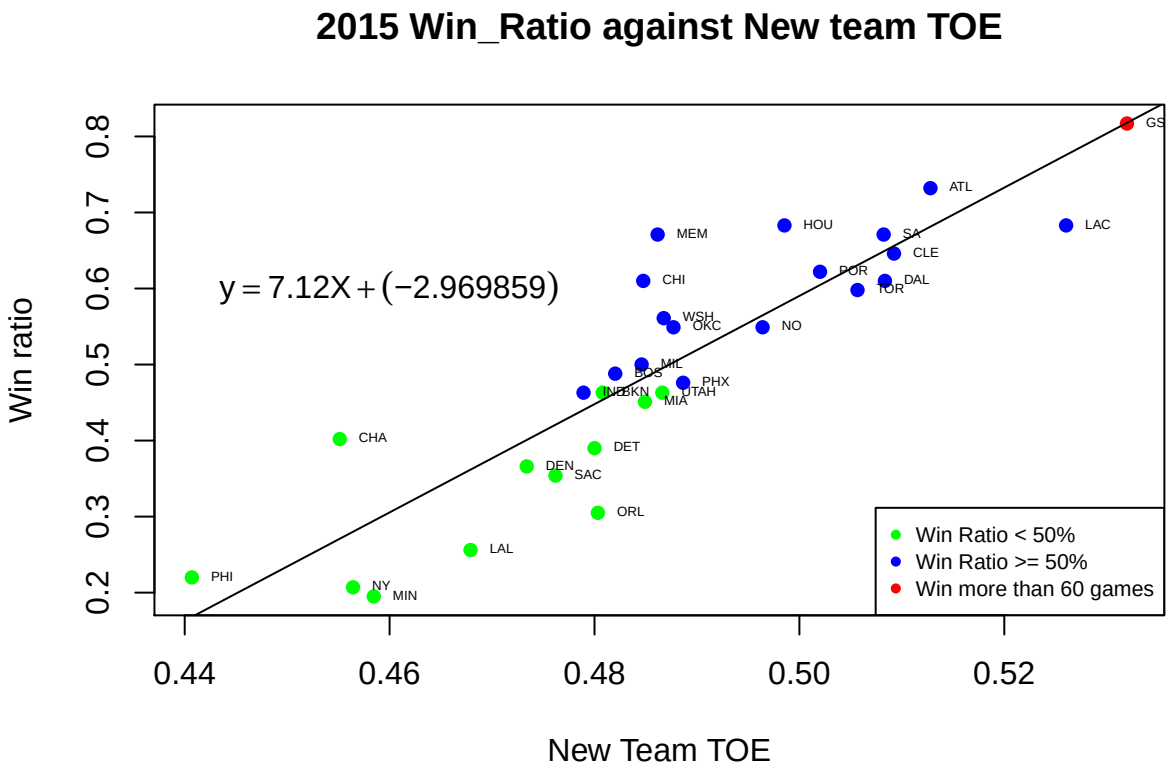
```
mod15 <- lm(win_ratio ~ toe, data = s15)
summary(mod15)
```

```
##
## Call:
## lm(formula = win_ratio ~ toe, data = s15)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.219372 -0.068909 -0.000372  0.063043  0.279014
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -2.9506     0.5896  -5.005 2.74e-05 ***
## toe           8.0058     1.3671   5.856 2.70e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.112 on 28 degrees of freedom
## Multiple R-squared:  0.5505, Adjusted R-squared:  0.5345
## F-statistic: 34.29 on 1 and 28 DF,  p-value: 2.697e-06
```

```
plot(s15$new_toe,s15$win_ratio,xlab = 'New Team TOE', ylab = 'Win ratio', main = '2015 Win_Ratio agains
```

```
## integer(0)
```

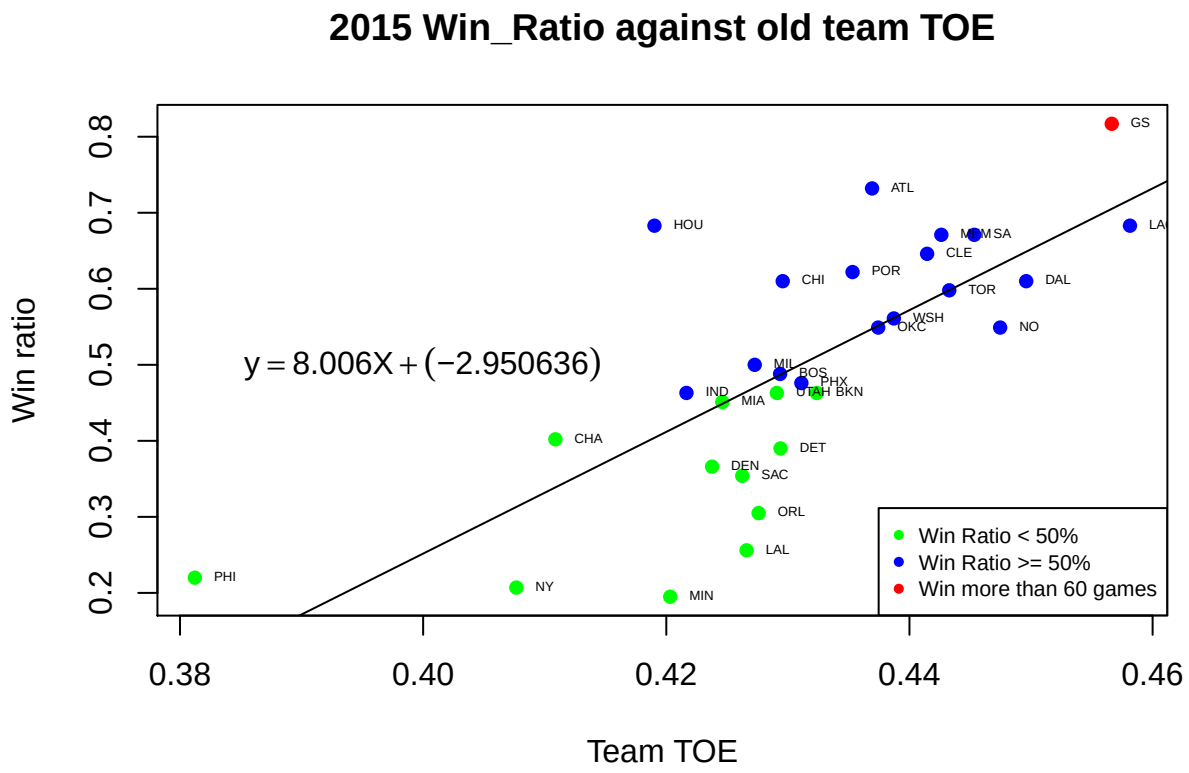
```
legend("bottomright",legend=c("Win Ratio < 50%", "Win Ratio >= 50%","Win more than 60 games"),
       col=c("green", "blue","red"), pch = c(16,16,16), cex = 0.7)
```



```
plot(s15$toe,s15$win_ratio,xlab = 'Team TOE', ylab = 'Win ratio', main = '2015 Win_Ratio against old tea
```

```
## integer(0)
```

```
legend("bottomright",legend=c("Win Ratio < 50%", "Win Ratio >= 50%","Win more than 60 games"),
       col=c("green", "blue","red"), pch = c(16,16,16), cex = 0.7)
```



2016 win ratio against Team TOE

Season 2016 our new TOE:

```
s16 <- team_stats[team_stats$season == 2016,]
new_mod16 <- lm(win_ratio ~ new_toe, data = s16)
summary(new_mod16)
```

```
##
## Call:
## lm(formula = win_ratio ~ new_toe, data = s16)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.154603 -0.052252 -0.004685  0.038798  0.180176
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -3.3433     0.3913  -8.544 2.75e-09 ***
## new_toe       7.8113     0.7948   9.828 1.41e-10 ***
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.08169 on 28 degrees of freedom
## Multiple R-squared:  0.7753, Adjusted R-squared:  0.7672
## F-statistic:  96.6 on 1 and 28 DF,  p-value: 1.409e-10
```

Season 2016 old TOE:

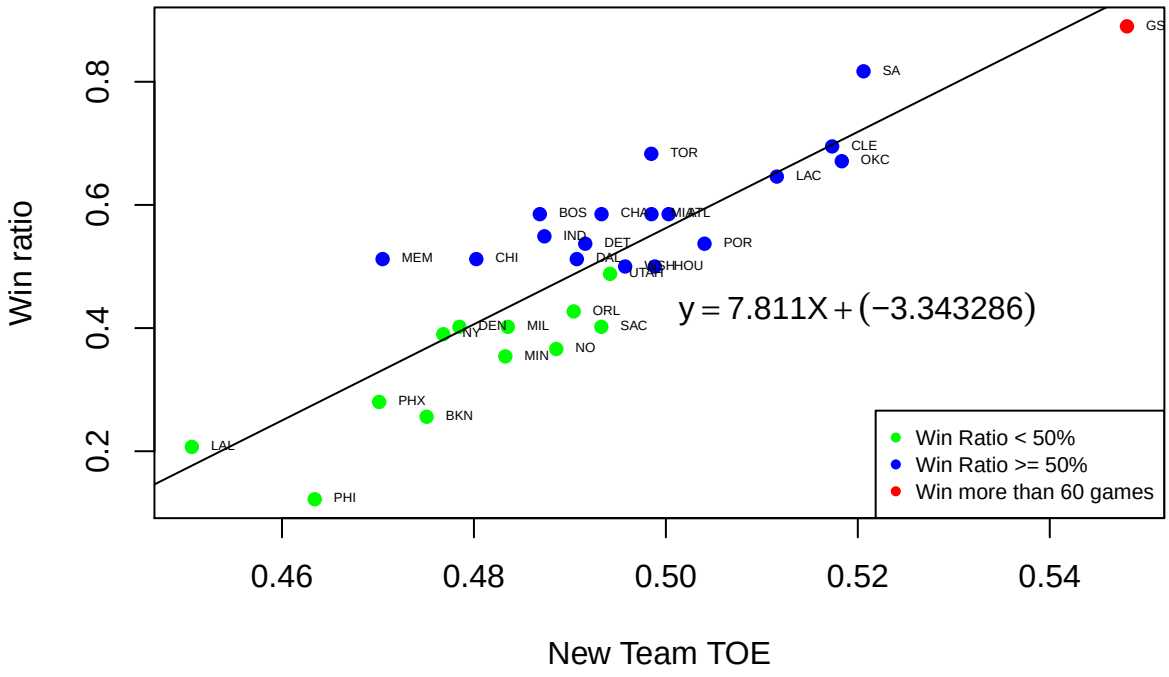
```
mod16 <- lm(win_ratio ~ toe, data = s16)
summary(mod16)
```

```
##
## Call:
## lm(formula = win_ratio ~ toe, data = s16)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.23305 -0.07065  0.01909  0.05874  0.18231
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -3.333      0.582  -5.727 3.83e-06 ***
## toe            8.874      1.347   6.589 3.81e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1079 on 28 degrees of freedom
## Multiple R-squared:  0.6079, Adjusted R-squared:  0.5939
## F-statistic: 43.42 on 1 and 28 DF,  p-value: 3.806e-07
```

```
plot(s16$new_toe,s16$win_ratio,xlab = 'New Team TOE', ylab = 'Win ratio', main = '2016 Win_Ratio agains
```

```
## integer(0)
```

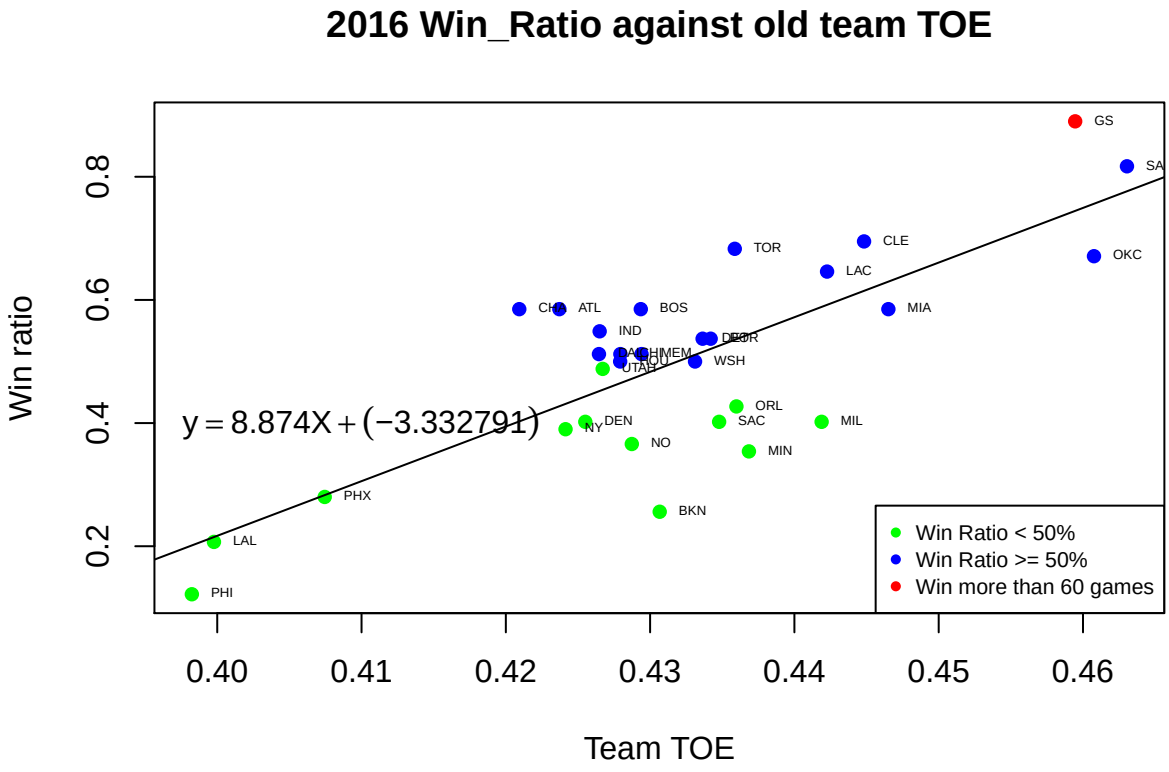
```
legend("bottomright",legend=c("Win Ratio < 50%", "Win Ratio >= 50%","Win more than 60 games"),
       col=c("green", "blue","red"), pch = c(16,16,16), cex = 0.7)
```




```
plot(s16$toe,s16$win_ratio,xlab = 'Team TOE', ylab = 'Win ratio', main = '2016 Win_Ratio against old tea
```

```
## integer(0)
```

```
legend("bottomright",legend=c("Win Ratio < 50%", "Win Ratio >= 50%","Win more than 60 games"),
       col=c("green", "blue","red"), pch = c(16,16,16), cex = 0.7)
```



2017 win ratio against Team TOE

Season 2017 our new TOE:

```
s17 <- team_stats[team_stats$season == 2017,]
new_mod17 <- lm(win_ratio ~ new_toe, data = s17)
summary(new_mod17)
```

```
##
## Call:
## lm(formula = win_ratio ~ new_toe, data = s17)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.133492 -0.046916 -0.009949  0.057958  0.146446
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -2.7251     0.4314  -6.318 7.82e-07 ***
## new_toe       6.3994     0.8554   7.481 3.79e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.08019 on 28 degrees of freedom
## Multiple R-squared:  0.6665, Adjusted R-squared:  0.6546
## F-statistic: 55.96 on 1 and 28 DF,  p-value: 3.788e-08
```

Season 2017 old TOE:

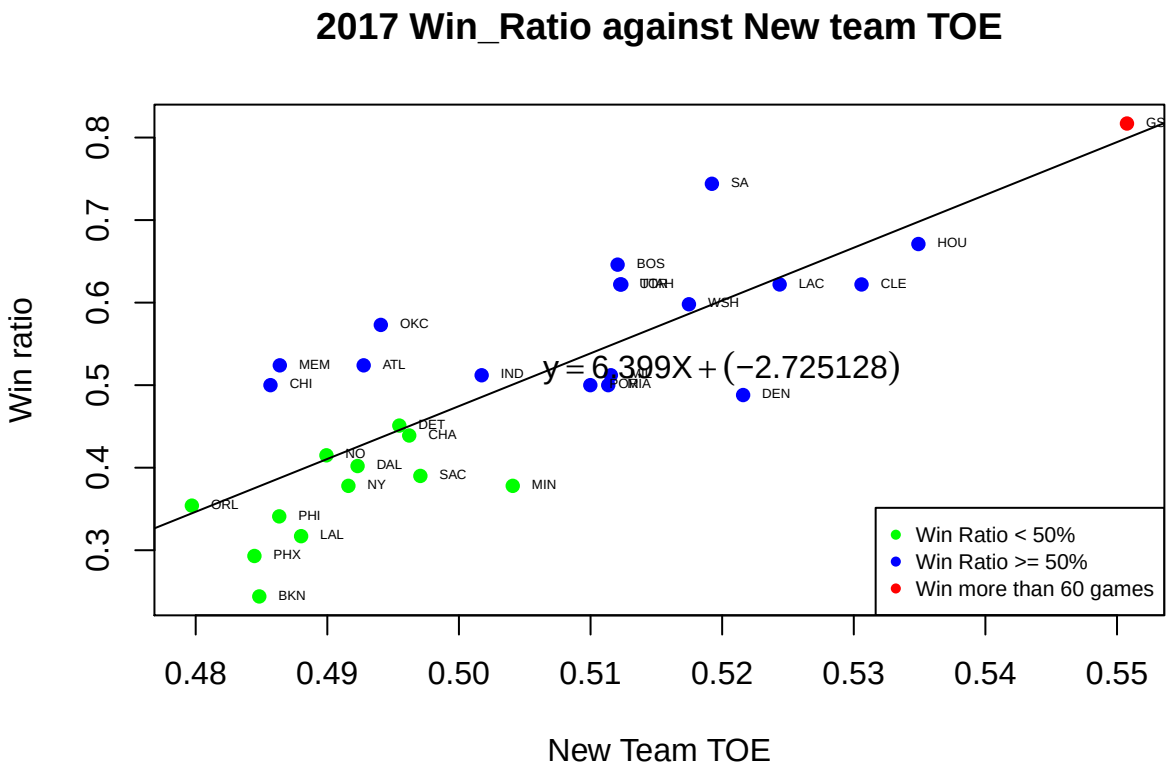
```
mod17 <- lm(win_ratio ~ toe, data = s17)
summary(mod17)
```

```
##
## Call:
## lm(formula = win_ratio ~ toe, data = s17)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.230886 -0.051278 -0.000371  0.068626  0.181794
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -2.4082     0.6082  -3.959 0.000468 ***
## toe           6.6452     1.3891   4.784 5.01e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.103 on 28 degrees of freedom
## Multiple R-squared:  0.4497, Adjusted R-squared:  0.4301
## F-statistic: 22.88 on 1 and 28 DF,  p-value: 5.009e-05
```

```
plot(s17$new_toe,s17$win_ratio,xlab = 'New Team TOE', ylab = 'Win ratio', main = '2017 Win_Ratio agains
```

```
## integer(0)
```

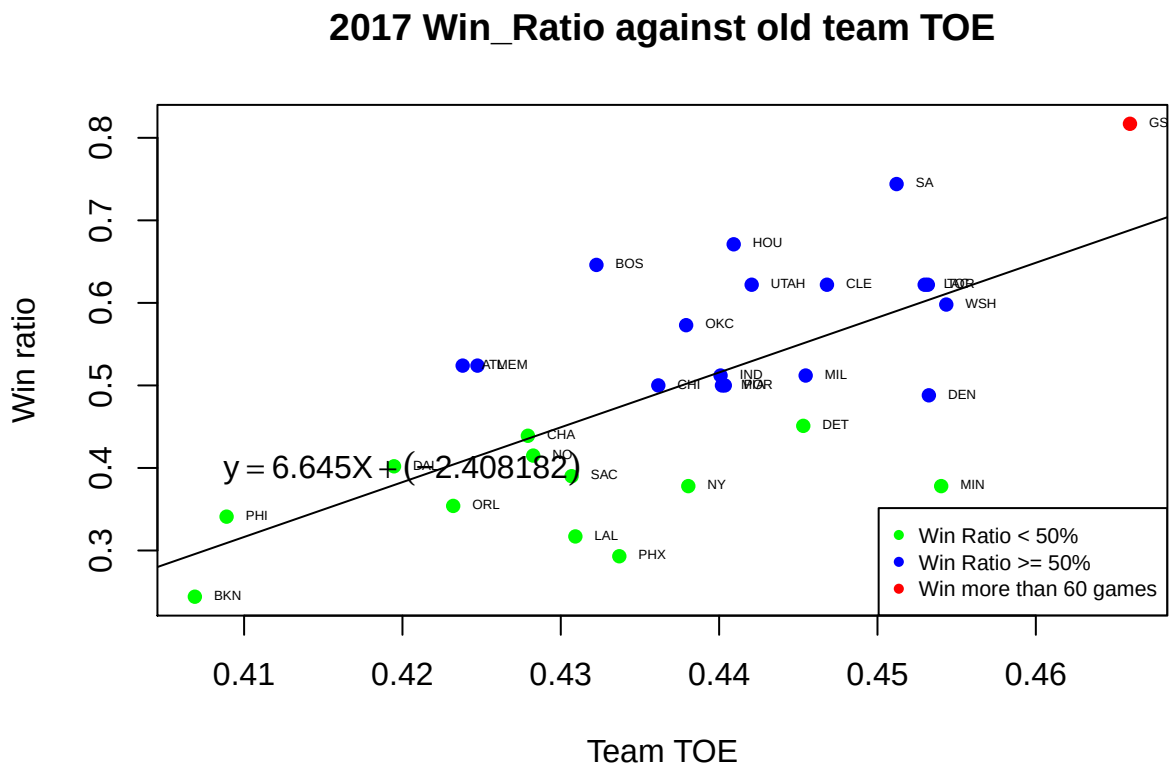
```
legend("bottomright",legend=c("Win Ratio < 50%", "Win Ratio >= 50%","Win more than 60 games"),
       col=c("green", "blue","red"), pch = c(16,16,16), cex = 0.7)
```



```
plot(s17$toe,s17$win_ratio,xlab = 'Team TOE', ylab = 'Win ratio', main = '2017 Win_Ratio against old tea
```

```
## integer(0)
```

```
legend("bottomright",legend=c("Win Ratio < 50%", "Win Ratio >= 50%","Win more than 60 games"),
       col=c("green", "blue","red"), pch = c(16,16,16), cex = 0.7)
```



2018 win ratio against Team TOE

Season 2018 our new TOE:

```
s18 <- team_stats[team_stats$season == 2018,]
new_mod18 <- lm(win_ratio ~ new_toe, data = s18)
summary(new_mod18)
```

```
##
## Call:
## lm(formula = win_ratio ~ new_toe, data = s18)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.146570 -0.050708 -0.001863  0.038705  0.188224
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -3.7317     0.4399  -8.482 3.19e-09 ***
## new_toe       8.3093     0.8634   9.623 2.23e-10 ***
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.0731 on 28 degrees of freedom
## Multiple R-squared:  0.7678, Adjusted R-squared:  0.7596
## F-statistic: 92.61 on 1 and 28 DF,  p-value: 2.23e-10
```

Season 2018 old TOE:

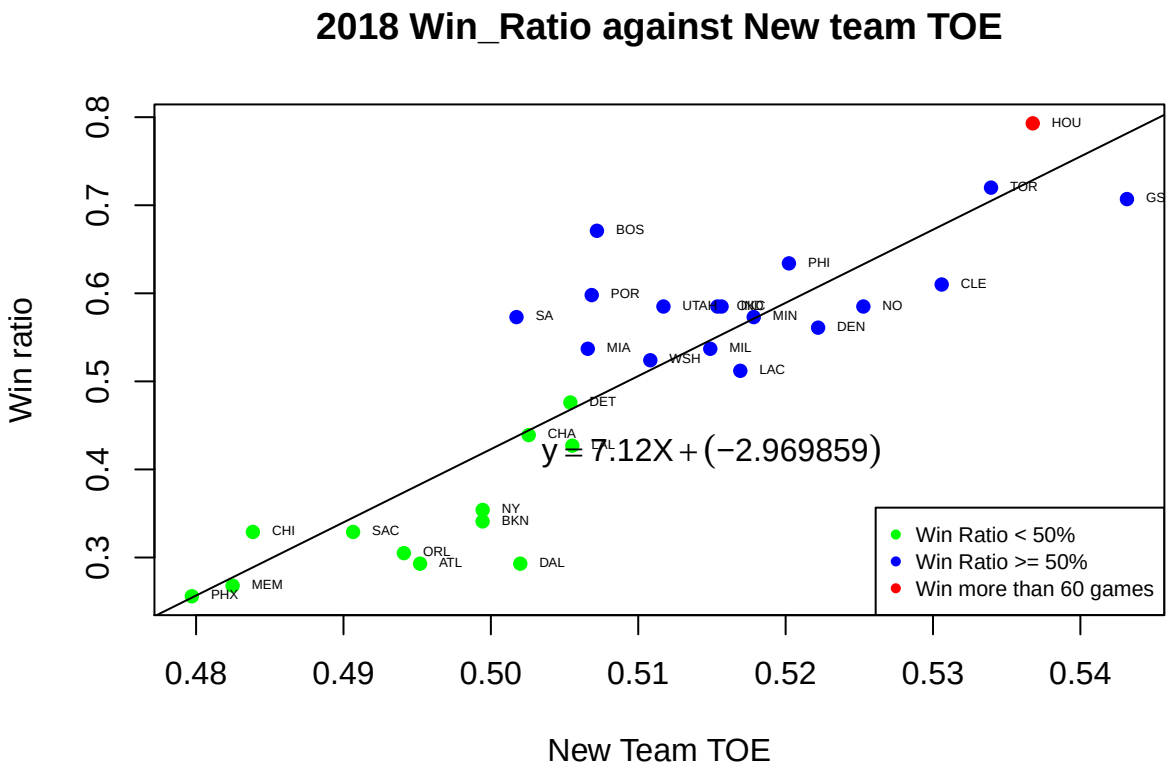
```
mod18 <- lm(win_ratio ~ toe, data = s18)
summary(mod18)
```

```
##
## Call:
## lm(formula = win_ratio ~ toe, data = s18)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.18725 -0.06340 -0.01733  0.03139  0.30990
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -2.6613     0.6128  -4.343 0.000166 ***
## toe           7.2314     1.4009   5.162 1.78e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1086 on 28 degrees of freedom
## Multiple R-squared:  0.4876, Adjusted R-squared:  0.4693
## F-statistic: 26.64 on 1 and 28 DF,  p-value: 1.782e-05
```

```
plot(s18$new_toe,s18$win_ratio,xlab = 'New Team TOE', ylab = 'Win ratio', main = '2018 Win_Ratio agains
```

```
## integer(0)
```

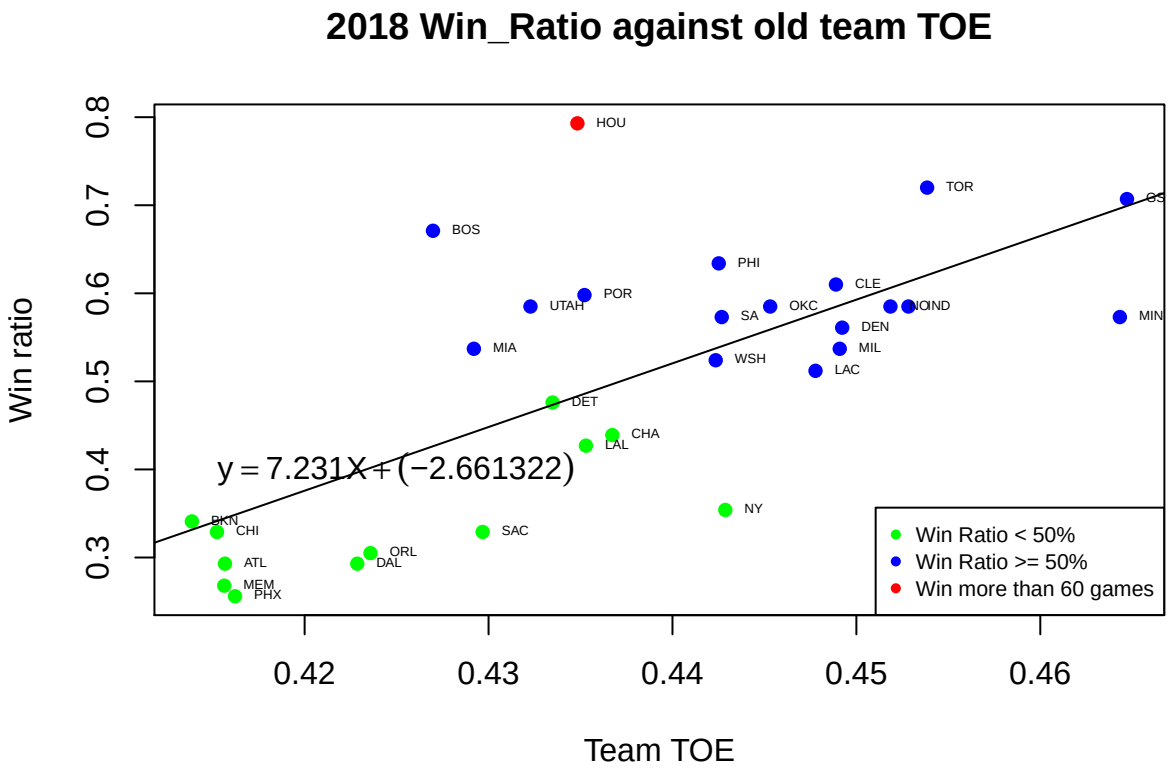
```
legend("bottomright",legend=c("Win Ratio < 50%", "Win Ratio >= 50%","Win more than 60 games"),
       col=c("green", "blue","red"), pch = c(16,16,16), cex = 0.7)
```




```
plot(s18$toe,s18$win_ratio,xlab = 'Team TOE', ylab = 'Win ratio', main = '2018 Win_Ratio against old tea
```

```
## integer(0)
```

```
legend("bottomright",legend=c("Win Ratio < 50%", "Win Ratio >= 50%","Win more than 60 games"),
       col=c("green", "blue","red"), pch = c(16,16,16), cex = 0.7)
```


2018 Win_Ratio against old team TOE
Win ratio
0.3
0.4
0.5
0.6
0.7
0.8
HOU
TOR
BOS
PHI
CLE
POR
UTAH
SA
OKC
IND
MIN
DEN
MIA
MIL
WSH
LAC
DET
CHA
LAL
y = 7.231X + (−2.661322)
NY
BKN
CHI
SAC
ORL
DAL
ATL
MEM
PHX
Win Ratio < 50%
Win Ratio >= 50%
Win more than 60 games
0.42
0.43
0.44
0.45
0.46
Team TOE