Spatial

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2015

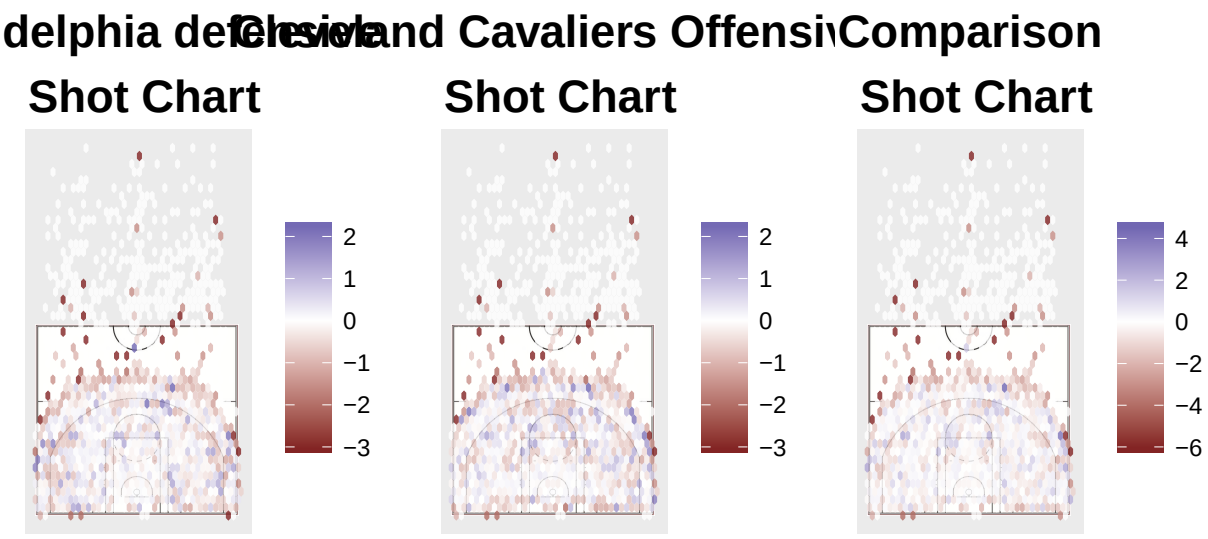
2016

2014

```
ShotComparison <- function(OffTeam, DefTown, SeasondataOff, SeasonDataDef, nbins = 40) {
  #Filter the offensive data of the Offensive Team
  Off <- filter(SeasondataOff, TEAM_NAME == OffTeam)
  #Filter the Deffensive data of the Defensive team
  deff <- SeasonDataDef[names(SeasonDataDef) == DefTown][[1]]
  #Get the maximum and minumum values for x and y
  xbnds <- range(c(SeasondataOff$LOC_X, deff$LOC_X))
  ybnds <- range(c(SeasondataOff$LOC_Y, deff$LOC_Y))
  #Make hexbin dataframes out of the teams
  makeHexData <- function(df) {
    h <- hexbin(df$LOC_X, df$LOC_Y, nbins, xbnds = xbnds, ybnds = ybnds, IDs = TRUE)
    data.frame(hcell2xy(h),
               PPS = tapply(as.numeric(as.character(df$SHOT_MADE_FLAG))*ifelse(tolower(df$SHOT_TYPE) ==
               ST = tapply(df$SHOT_MADE_FLAG, h@cID, FUN = function(z) length(z)),
               cid = h@cell)
  }
  ##Total NBA data
  Totalhex <- makeHexData(SeasondataOff)
  ##Defensive team data
  Defhex <- makeHexData(deff)
  ##Offensive team data
  Offhex <- makeHexData(Off)
  #Merge offensive and deffensive data with total data by Cell id
  DeffbyCell <- merge(Totalhex, Defhex, by = "cid", all = T)
  OffByCell <- merge(Totalhex, Offhex, by = "cid", all = T)
  ##  when calculating the difference empty cells should count as 0
  DeffbyCell$PPS.x[is.na(DeffbyCell$PPS.x)] <- 0
  DeffbyCell$PPS.y[is.na(DeffbyCell$PPS.y)] <- 0
  DeffbyCell$ST.y[is.na(DeffbyCell$ST.y)] <- 0

  OffByCell$PPS.x[is.na(OffByCell$PPS.x)] <- 0
  OffByCell$PPS.y[is.na(OffByCell$PPS.y)] <- 0
  OffByCell$ST.y[is.na(OffByCell$ST.y)] <- 0
  #  make a "difference" data.frame
  DiffDeff <- data.frame(x = ifelse(is.na(DeffbyCell$x.x), DeffbyCell$x.y, DeffbyCell$x.x),
                         y = ifelse(is.na(DeffbyCell$y.x), DeffbyCell$y.y, DeffbyCell$y.x),
                         PPS= DeffbyCell$PPS.y - DeffbyCell$PPS.x,
```

```
                      cid= DeffbyCell$cid,
                      ST = DeffbyCell$ST.y)

DiffOff <- data.frame(x = ifelse(is.na(OffByCell$x.x), OffByCell$x.y, OffByCell$x.x),
                      y = ifelse(is.na(OffByCell$y.x), OffByCell$y.y, OffByCell$y.x),
                      PPS= OffByCell$PPS.y - OffByCell$PPS.x,
                      ST = OffByCell$ST.x,
                      cid = OffByCell$cid,
                      ST = OffByCell$ST.y)
#make team comparisons
Comparison <- merge(DiffOff, DiffDeff, by = "cid", all = T)
Comparison <- Comparison[,-c(6:7)]
Comparison$Diff <- c(Comparison$PPS.x + Comparison$PPS.y)


PPSAA <- weighted.mean((Comparison$PPS.x + Comparison$PPS.y), Comparison$ST.x)

OFF <- ggplot(DiffOff)  +
  annotation_custom(court, -250, 250, -52, 418) +
  geom_hex(aes(x = x, y = y, fill = PPS),
           stat = "identity", alpha = 0.8) +
  guides(alpha = FALSE, size = FALSE) +
  coord_fixed()  +theme(line = element_blank(),
                        axis.title.x = element_blank(),
                        axis.title.y = element_blank(),
                        axis.text.x = element_blank(),
                        axis.text.y = element_blank(),
                        legend.title = element_blank(),
                        plot.title = element_text(size = 17, lineheight = 1.2, face = "bold")) + ggti
DEF <- ggplot(DiffDeff)  +
  annotation_custom(court, -250, 250, -52, 418) +
  geom_hex(aes(x = x, y = y, fill = PPS),
           stat = "identity", alpha = 0.8) +
  guides(alpha = FALSE, size = FALSE) +

  coord_fixed()  +theme(line = element_blank(),
                        axis.title.x = element_blank(),
                        axis.title.y = element_blank(),
                        axis.text.x = element_blank(),
                        axis.text.y = element_blank(),
                        legend.title = element_blank(),
                        plot.title = element_text(size = 17, lineheight = 1.2, face = "bold")) + ggti

COMP <- ggplot(Comparison)  +
  annotation_custom(court, -250, 250, -52, 418) +
  geom_hex(aes(x = x.x, y = y.x, fill = Diff),
           stat = "identity", alpha = 0.8) +
  guides(alpha = FALSE, size = FALSE) +

  coord_fixed()  +theme(line = element_blank(),
                        axis.title.x = element_blank(),
                        axis.title.y = element_blank(),
                        axis.text.x = element_blank(),
```

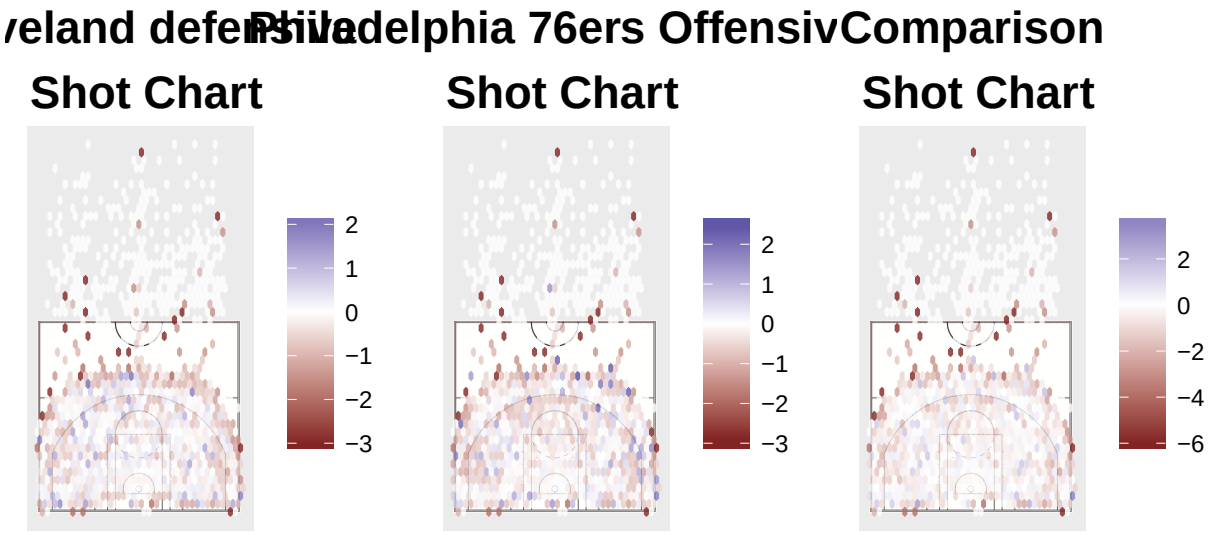
```
                          axis.text.y = element_blank(),
                          legend.title = element_blank(),
                          plot.title = element_text(size = 17, lineheight = 1.2, face = "bold")) + ggti

  grid.arrange(DEF, OFF, COMP, ncol=3)

  return(list(Off = DiffOff, deff = DiffDeff, Comparison = Comparison, Total = Totalhex, PPSAA = PPSAA))
}

Com1 <- ShotComparison(OffTeam = "Cleveland Cavaliers", DefTown = "Philadelphia", SeasondataOff = shotDa
```




```
Com1$PPSAA
```

```
## [1] 0.02043016
```

```
Com2 <- ShotComparison(OffTeam = "Philadelphia 76ers", DefTown = "Cleveland", SeasondataOff = shotDataT
```




```
Com2$PPSAA
```

```
## [1] -0.1028978
```

```
ShotComparison <- function(OffTeam, DefTown, SeasondataOff, SeasonDataDef, nbins = 40) {
  #Filter the offensive data of the Offensive Team
  Off <- filter(SeasondataOff, TEAM_NAME == OffTeam)
  #Filter the Deffensive data of the Defensive team
  deff <- SeasonDataDef[names(SeasonDataDef) == DefTown][[1]]
  #Get the maximum and minumum values for x and y
  xbnds <- range(c(SeasondataOff$LOC_X, deff$LOC_X))
  ybnds <- range(c(SeasondataOff$LOC_Y, deff$LOC_Y))
  #Make hexbin dataframes out of the teams
  makeHexData <- function(df) {
    h <- hexbin(df$LOC_X, df$LOC_Y, nbins, xbnds = xbnds, ybnds = ybnds, IDs = TRUE)
    data.frame(hcell2xy(h),
               PPS = tapply(as.numeric(as.character(df$SHOT_MADE_FLAG))*ifelse(tolower(df$SHOT_TYPE) ==
               ST = tapply(df$SHOT_MADE_FLAG, h@cID, FUN = function(z) length(z)),
               cid = h@cell)
  }
  ##Total NBA data
  Totalhex <- makeHexData(SeasondataOff)
  ##Defensive team data
  Defhex <- makeHexData(deff)
  ##Offensive team data
```

```r
Offhex <- makeHexData(Off)
#Merge offensive and deffensive data with total data by Cell id
DeffbyCell <- merge(Totalhex, Defhex, by = "cid", all = T)
OffByCell <- merge(Totalhex, Offhex, by = "cid", all = T)
##  when calculating the difference empty cells should count as 0
DeffbyCell$PPS.x[is.na(DeffbyCell$PPS.x)] <- 0
DeffbyCell$PPS.y[is.na(DeffbyCell$PPS.y)] <- 0
DeffbyCell$ST.y[is.na(DeffbyCell$ST.y)] <- 0

OffByCell$PPS.x[is.na(OffByCell$PPS.x)] <- 0
OffByCell$PPS.y[is.na(OffByCell$PPS.y)] <- 0
OffByCell$ST.y[is.na(OffByCell$ST.y)] <- 0
#  make a "difference" data.frame
DiffDeff <- data.frame(x = ifelse(is.na(DeffbyCell$x.x), DeffbyCell$x.y, DeffbyCell$x.x),
                       y = ifelse(is.na(DeffbyCell$y.x), DeffbyCell$y.y, DeffbyCell$y.x),
                       PPS= DeffbyCell$PPS.y - DeffbyCell$PPS.x,
                       cid= DeffbyCell$cid,
                       ST = DeffbyCell$ST.y)

DiffOff <- data.frame(x = ifelse(is.na(OffByCell$x.x), OffByCell$x.y, OffByCell$x.x),
                       y = ifelse(is.na(OffByCell$y.x), OffByCell$y.y, OffByCell$y.x),
                       PPS= OffByCell$PPS.y - OffByCell$PPS.x,
                       ST = OffByCell$ST.x,
                       cid = OffByCell$cid,
                       ST = OffByCell$ST.y)
#make team comparisons
Comparison <- merge(DiffOff, DiffDeff, by = "cid", all = T)
Comparison <- Comparison[,-c(6:7)]
Comparison$Diff <- c(Comparison$PPS.x + Comparison$PPS.y)


PPSAA <- weighted.mean((Comparison$PPS.x + Comparison$PPS.y), Comparison$ST.x)
print(PPSAA)
# OFF <- ggplot(DiffOff)  +
#   annotation_custom(court, -250, 250, -52, 418) +
#   geom_hex(aes(x = x, y = y, fill = PPS),
#            stat = "identity", alpha = 0.8) +
#   guides(alpha = FALSE, size = FALSE) +
#   coord_fixed()  +theme(line = element_blank(),
#                         axis.title.x = element_blank(),
#                         axis.title.y = element_blank(),
#                         axis.text.x = element_blank(),
#                         axis.text.y = element_blank(),
#                         legend.title = element_blank(),
#                         plot.title = element_text(size = 17, lineheight = 1.2, face = "bold")) + gg
# DEF <- ggplot(DiffDeff)  +
#   annotation_custom(court, -250, 250, -52, 418) +
#   geom_hex(aes(x = x, y = y, fill = PPS),
#            stat = "identity", alpha = 0.8) +
#   guides(alpha = FALSE, size = FALSE) +
#
#   coord_fixed()  +theme(line = element_blank(),
#                         axis.title.x = element_blank(),
```

```
  #                         axis.title.y = element_blank(),
  #                         axis.text.x = element_blank(),
  #                         axis.text.y = element_blank(),
  #                         legend.title = element_blank(),
  #                         plot.title = element_text(size = 17, lineheight = 1.2, face = "bold")) + gg
  #
  # COMP <- ggplot(Comparison)  +
  #   annotation_custom(court, -250, 250, -52, 418) +
  #   geom_hex(aes(x = x.x, y = y.x, fill = Diff),
  #            stat = "identity", alpha = 0.8) +
  #   guides(alpha = FALSE, size = FALSE) +
  #
  #   coord_fixed()  +theme(line = element_blank(),
  #                         axis.title.x = element_blank(),
  #                         axis.title.y = element_blank(),
  #                         axis.text.x = element_blank(),
  #                         axis.text.y = element_blank(),
  #                         legend.title = element_blank(),
  #                         plot.title = element_text(size = 17, lineheight = 1.2, face = "bold")) + gg
  #
  # grid.arrange(DEF, OFF, COMP, ncol=3)

  return(PPSAA)
}


Offensive_teams <- as.character(unique(shotDataTotal2016$TEAM_NAME))

defenseve_names <- names(shotDatafDef2016)
df <- data.frame(matrix(ncol = 30, nrow = 30))
colnames(df) <- as.character(unique(shotDataTotal2016$TEAM_NAME))
rownames(df) <- names(shotDatafDef2016)

comparisons <- list()

system.time(for (i in 1:length(Offensive_teams)) {
  Offensive_team <- Offensive_teams[i]
  for (j in 1:length(defenseve_names)){
    df[j,i] <- ShotComparison(OffTeam = Offensive_team, DefTown =                         defenseve_names
  }
})
```

```
## [1] -0.1155454
## [1] -0.08707377
## [1] -0.0830189
## [1] -0.01384599
## [1] -0.08412699
## [1] -0.05694221
## [1] -0.03634887
## [1] -0.09020081
## [1] -0.04160005
## [1] -0.0870888
## [1] -0.03884313
```

```
## [1] -0.08610983
## [1] -0.08418332
## [1] -0.05034676
## [1] -0.01471371
## [1] -0.08905573
## [1] -0.04785826
## [1] -0.08751748
## [1] -0.03115664
## [1] -0.02559498
## [1] -0.05279838
## [1] -0.009853816
## [1] -0.1022051
## [1] -0.1088658
## [1] -0.07024175
## [1] -0.07485516
## [1] -0.05301926
## [1] -0.03974702
## [1] -0.07151634
## [1] -0.08415645
## [1] -0.06973204
## [1] -0.04126043
## [1] -0.03720556
## [1] 0.03196734
## [1] -0.03831365
## [1] -0.01112888
## [1] 0.009464468
## [1] -0.04438748
## [1] 0.004213292
## [1] -0.04127546
## [1] 0.006970204
## [1] -0.04029649
## [1] -0.03836998
## [1] -0.004533422
## [1] 0.03109963
## [1] -0.04324239
## [1] -0.002044926
## [1] -0.04170414
## [1] 0.0146567
## [1] 0.02021836
## [1] -0.006985046
## [1] 0.03595952
## [1] -0.05639175
## [1] -0.06305243
## [1] -0.02442842
## [1] -0.02904183
## [1] -0.007205921
## [1] 0.006066315
## [1] -0.02570301
## [1] -0.03834312
## [1] -0.07673236
## [1] -0.04826075
## [1] -0.04420588
## [1] 0.02496703
## [1] -0.04531397
```

```
## [1] -0.01812919
## [1] 0.002464152
## [1] -0.05138779
## [1] -0.002787025
## [1] -0.04827578
## [1] -3.01121e-05
## [1] -0.04729681
## [1] -0.0453703
## [1] -0.01153374
## [1] 0.02409931
## [1] -0.05024271
## [1] -0.009045242
## [1] -0.04870446
## [1] 0.007656383
## [1] 0.01321804
## [1] -0.01398536
## [1] 0.0289592
## [1] -0.06339207
## [1] -0.07005274
## [1] -0.03142873
## [1] -0.03604214
## [1] -0.01420624
## [1] -0.000934001
## [1] -0.03270332
## [1] -0.04534343
## [1] -0.04250202
## [1] -0.01403041
## [1] -0.009975545
## [1] 0.05919736
## [1] -0.01108364
## [1] 0.01610114
## [1] 0.03669449
## [1] -0.01715746
## [1] 0.03144331
## [1] -0.01404544
## [1] 0.03420022
## [1] -0.01306647
## [1] -0.01113996
## [1] 0.0226966
## [1] 0.05832964
## [1] -0.01601238
## [1] 0.02518509
## [1] -0.01447412
## [1] 0.04188672
## [1] 0.04744837
## [1] 0.02024497
## [1] 0.06318954
## [1] -0.02916174
## [1] -0.03582241
## [1] 0.002801601
## [1] -0.001811809
## [1] 0.0200241
## [1] 0.03329633
## [1] 0.00152701
```

```
## [1] -0.0111131
## [1] -0.08122795
## [1] -0.05275633
## [1] -0.04870147
## [1] 0.02047144
## [1] -0.04980956
## [1] -0.02262478
## [1] -0.002031436
## [1] -0.05588338
## [1] -0.007282612
## [1] -0.05277136
## [1] -0.0045257
## [1] -0.05179239
## [1] -0.04986589
## [1] -0.01602933
## [1] 0.01960372
## [1] -0.0547383
## [1] -0.01354083
## [1] -0.05320005
## [1] 0.003160796
## [1] 0.008722454
## [1] -0.01848095
## [1] 0.02446362
## [1] -0.06788766
## [1] -0.07454833
## [1] -0.03592432
## [1] -0.04053773
## [1] -0.01870182
## [1] -0.005429589
## [1] -0.03719891
## [1] -0.04983902
## [1] 0.00994497
## [1] 0.03841658
## [1] 0.04247145
## [1] 0.1116444
## [1] 0.04136336
## [1] 0.06854813
## [1] 0.08914148
## [1] 0.03528954
## [1] 0.0838903
## [1] 0.03840155
## [1] 0.08664722
## [1] 0.03938052
## [1] 0.04130703
## [1] 0.07514359
## [1] 0.1107766
## [1] 0.03643462
## [1] 0.07763209
## [1] 0.03797287
## [1] 0.09433371
## [1] 0.09989537
## [1] 0.07269197
## [1] 0.1156365
## [1] 0.02328526
```

```
## [1] 0.01662459
## [1] 0.0552486
## [1] 0.05063519
## [1] 0.07247109
## [1] 0.08574333
## [1] 0.053974
## [1] 0.04133389
## [1] -0.05452651
## [1] -0.0260549
## [1] -0.02200003
## [1] 0.04717287
## [1] -0.02310812
## [1] 0.004076654
## [1] 0.02467
## [1] -0.02918194
## [1] 0.01941882
## [1] -0.02606993
## [1] 0.02217574
## [1] -0.02509096
## [1] -0.02316445
## [1] 0.01067211
## [1] 0.04630516
## [1] -0.02803686
## [1] 0.01316061
## [1] -0.02649861
## [1] 0.02986223
## [1] 0.03542389
## [1] 0.008220486
## [1] 0.05116505
## [1] -0.04118622
## [1] -0.04784689
## [1] -0.009222886
## [1] -0.01383629
## [1] 0.00799961
## [1] 0.02127185
## [1] -0.01049748
## [1] -0.02313759
## [1] -0.04901355
## [1] -0.02054194
## [1] -0.01648707
## [1] 0.05268583
## [1] -0.01759517
## [1] 0.009589611
## [1] 0.03018296
## [1] -0.02366899
## [1] 0.02493178
## [1] -0.02055697
## [1] 0.02768869
## [1] -0.019578
## [1] -0.01765149
## [1] 0.01618507
## [1] 0.05181811
## [1] -0.0225239
## [1] 0.01867356
```

```
## [1] -0.02098565
## [1] 0.03537519
## [1] 0.04093685
## [1] 0.01373344
## [1] 0.05667801
## [1] -0.03567327
## [1] -0.04233394
## [1] -0.003709929
## [1] -0.008323338
## [1] 0.01351257
## [1] 0.0267848
## [1] -0.004984519
## [1] -0.01762463
## [1] -0.1231036
## [1] -0.09463202
## [1] -0.09057715
## [1] -0.02140425
## [1] -0.09168524
## [1] -0.06450047
## [1] -0.04390712
## [1] -0.09775906
## [1] -0.0491583
## [1] -0.09464705
## [1] -0.04640138
## [1] -0.09366808
## [1] -0.09174157
## [1] -0.05790501
## [1] -0.02227196
## [1] -0.09661398
## [1] -0.05541651
## [1] -0.09507573
## [1] -0.03871489
## [1] -0.03315323
## [1] -0.06035663
## [1] -0.01741207
## [1] -0.1097633
## [1] -0.116424
## [1] -0.07780001
## [1] -0.08241342
## [1] -0.06057751
## [1] -0.04730527
## [1] -0.0790746
## [1] -0.09171471
## [1] -0.1081082
## [1] -0.07963662
## [1] -0.07558175
## [1] -0.006408848
## [1] -0.07668984
## [1] -0.04950507
## [1] -0.02891172
## [1] -0.08276367
## [1] -0.0341629
## [1] -0.07965165
## [1] -0.03140599
```

```
## [1] -0.07867268
## [1] -0.07674617
## [1] -0.04290961
## [1] -0.007276566
## [1] -0.08161858
## [1] -0.04042112
## [1] -0.08008033
## [1] -0.02371949
## [1] -0.01815783
## [1] -0.04536124
## [1] -0.002416671
## [1] -0.09476795
## [1] -0.1014286
## [1] -0.06280461
## [1] -0.06741802
## [1] -0.04558211
## [1] -0.03230988
## [1] -0.0640792
## [1] -0.07671931
## [1] -0.05540715
## [1] -0.02693554
## [1] -0.02288067
## [1] 0.04629223
## [1] -0.02398876
## [1] 0.003196014
## [1] 0.02378936
## [1] -0.03006258
## [1] 0.01853818
## [1] -0.02695057
## [1] 0.0212951
## [1] -0.0259716
## [1] -0.02404509
## [1] 0.009791469
## [1] 0.04542452
## [1] -0.0289175
## [1] 0.01227997
## [1] -0.02737925
## [1] 0.02898159
## [1] 0.03454325
## [1] 0.007339846
## [1] 0.05028441
## [1] -0.04206686
## [1] -0.04872753
## [1] -0.01010353
## [1] -0.01471693
## [1] 0.00711897
## [1] 0.02039121
## [1] -0.01137812
## [1] -0.02401823
## [1] -0.0588809
## [1] -0.03040928
## [1] -0.02635442
## [1] 0.04281849
## [1] -0.02746251
```

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## [1] 0.006317724
## [1] 0.04195077
## [1] -0.03239125
## [1] 0.008806221
## [1] -0.03085299
## [1] 0.02550785
## [1] 0.0310695
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## [1] -0.01357727
## [1] -0.01819068
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## [1] 0.01691746
## [1] -0.01485186
## [1] -0.02749197
## [1] -0.05359022
## [1] -0.02511861
## [1] -0.02106374
## [1] 0.04810917
## [1] -0.02217183
## [1] 0.005012946
## [1] 0.02560629
## [1] -0.02824565
## [1] 0.02035511
## [1] -0.02513364
## [1] 0.02311203
## [1] -0.02415467
## [1] -0.02222816
## [1] 0.0116084
## [1] 0.04724145
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## [1] 0.008935902
## [1] 0.02220814
## [1] -0.009561184
```

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## [1] -0.04252917
## [1] -0.0384743
## [1] 0.0306986
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## [1] -0.0237681
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## [1] 0.01364467
## [1] -0.05663633
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```

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## [1] -0.03681247
```

```
##    user  system elapsed
##  210.09    4.15  214.96
```

```
df
```

```
##               Detroit Pistons Atlanta Hawks Chicago Bulls
## Atlanta          -0.115545379  -0.069732042 -0.0767323581
## Boston           -0.087073768  -0.041260431 -0.0482607469
## Cleveland        -0.083018899  -0.037205562 -0.0442058784
## New Orleans      -0.013845994   0.031967343  0.0249670269
## Chicago          -0.084126990  -0.038313653 -0.0453139693
## Dallas           -0.056942214  -0.011128877 -0.0181291935
## Denver           -0.036348869   0.009464468  0.0024641519
## Golden State     -0.090200813  -0.044387476 -0.0513877921
## Houston          -0.041600045   0.004213292 -0.0027870246
## LA               -0.087088797  -0.041275460 -0.0482757761
## Los Angeles      -0.038843133   0.006970204 -0.0000301121
## Miami            -0.086109826  -0.040296489 -0.0472968054
## Milwaukee        -0.084183319  -0.038369982 -0.0453702981
## Minnesota        -0.050346759  -0.004533422 -0.0115337384
## Brooklyn         -0.014713712   0.031099625  0.0240993090
## New York         -0.089055729  -0.043242392 -0.0502427085
## Orlando          -0.047858263  -0.002044926 -0.0090452420
## Indiana          -0.087517478  -0.041704141 -0.0487044575
## Philadelphia     -0.031156638   0.014656699  0.0076563831
## Phoenix          -0.025594979   0.020218357  0.0132180413
## Portland         -0.052798382  -0.006985046 -0.0139853617
```

```
## Sacramento       -0.009853816   0.035959521  0.0289592045
## San Antonio      -0.102205091  -0.056391754 -0.0633920699
## Oklahoma City    -0.108865762  -0.063052426 -0.0700527418
## Toronto          -0.070241754  -0.024428417 -0.0314287328
## Utah             -0.074855163  -0.029041826 -0.0360421422
## Memphis          -0.053019258  -0.007205921 -0.0142062371
## Washington       -0.039747022   0.006066315 -0.0009340010
## Detroit          -0.071516344  -0.025703008 -0.0327033236
## Charlotte        -0.084156454  -0.038343117 -0.0453434334
##               Cleveland Cavaliers New Orleans Pelicans
## Atlanta               -0.042502025         -0.081227946
## Boston                -0.014030413         -0.052756335
## Cleveland             -0.009975545         -0.048701466
## New Orleans            0.059197360          0.020471439
## Chicago               -0.011083636         -0.049809557
## Dallas                 0.016101140         -0.022624781
## Denver                 0.036694485         -0.002031436
## Golden State          -0.017157459         -0.055883380
## Houston                0.031443309         -0.007282612
## LA                    -0.014045443         -0.052771364
## Los Angeles            0.034200221         -0.004525700
## Miami                 -0.013066472         -0.051792393
## Milwaukee             -0.011139965         -0.049865886
## Minnesota              0.022696595         -0.016029326
## Brooklyn               0.058329642          0.019603721
## New York              -0.016012375         -0.054738296
## Orlando                0.025185092         -0.013540830
## Indiana               -0.014474124         -0.053200045
## Philadelphia           0.041886717          0.003160796
## Phoenix                0.047448375          0.008722454
## Portland               0.020244972         -0.018480949
## Sacramento             0.063189538          0.024463617
## San Antonio           -0.029161736         -0.067887658
## Oklahoma City         -0.035822408         -0.074548329
## Toronto                0.002801601         -0.035924320
## Utah                  -0.001811809         -0.040537730
## Memphis                0.020024096         -0.018701825
## Washington             0.033296333         -0.005429589
## Detroit                0.001527010         -0.037198911
## Charlotte             -0.011113100         -0.049839021
##               Golden State Warriors Orlando Magic Washington Wizards
## Atlanta                  0.00994497  -0.054526511       -0.049013554
## Boston                   0.03841658  -0.026054900       -0.020541943
## Cleveland                0.04247145  -0.022000031       -0.016487074
## New Orleans              0.11164435   0.047172874        0.052685831
## Chicago                  0.04136336  -0.023108122       -0.017595165
## Dallas                   0.06854813   0.004076654        0.009589611
## Denver                   0.08914148   0.024669999        0.030182956
## Golden State             0.03528954  -0.029181945       -0.023668988
## Houston                  0.08389030   0.019418823        0.024931780
## LA                       0.03840155  -0.026069929       -0.020556972
## Los Angeles              0.08664722   0.022175735        0.027688692
## Miami                    0.03938052  -0.025090958       -0.019578001
## Milwaukee                0.04130703  -0.023164451       -0.017651494
```

```
## Minnesota               0.07514359   0.010672109        0.016185066
## Brooklyn                0.11077664   0.046305156        0.051818113
## New York                0.03643462  -0.028036861       -0.022523904
## Orlando                 0.07763209   0.013160605        0.018673562
## Indiana                 0.03797287  -0.026498610       -0.020985653
## Philadelphia            0.09433371   0.029862230        0.035375187
## Phoenix                 0.09989537   0.035423889        0.040936845
## Portland                0.07269197   0.008220486        0.013733442
## Sacramento              0.11563653   0.051165052        0.056678009
## San Antonio             0.02328526  -0.041186223       -0.035673266
## Oklahoma City           0.01662459  -0.047846895       -0.042333938
## Toronto                 0.05524860  -0.009222886       -0.003709929
## Utah                    0.05063519  -0.013836295       -0.008323338
## Memphis                 0.07247109   0.007999610        0.013512567
## Washington              0.08574333   0.021271846        0.026784803
## Detroit                 0.05397400  -0.010497476       -0.004984519
## Charlotte               0.04133389  -0.023137586       -0.017624629
##               Philadelphia 76ers Boston Celtics Brooklyn Nets
## Atlanta              -0.12310363   -0.108108233  -0.055407151
## Boston               -0.09463202   -0.079636622  -0.026935540
## Cleveland            -0.09057715   -0.075581754  -0.022880671
## New Orleans          -0.02140425   -0.006408848   0.046292234
## Chicago              -0.09168524   -0.076689845  -0.023988762
## Dallas               -0.06450047   -0.049505069   0.003196014
## Denver               -0.04390712   -0.028911723   0.023789359
## Golden State         -0.09775906   -0.082763667  -0.030062585
## Houston              -0.04915830   -0.034162900   0.018538183
## LA                   -0.09464705   -0.079651651  -0.026950569
## Los Angeles          -0.04640138   -0.031405987   0.021295095
## Miami                -0.09366808   -0.078672681  -0.025971598
## Milwaukee            -0.09174157   -0.076746173  -0.024045091
## Minnesota            -0.05790501   -0.042909614   0.009791469
## Brooklyn             -0.02227196   -0.007276566   0.045424516
## New York             -0.09661398   -0.081618584  -0.028917501
## Orlando              -0.05541651   -0.040421117   0.012279965
## Indiana              -0.09507573   -0.080080333  -0.027379250
## Philadelphia         -0.03871489   -0.023719492   0.028981590
## Phoenix              -0.03315323   -0.018157834   0.034543249
## Portland             -0.06035663   -0.045361237   0.007339846
## Sacramento           -0.01741207   -0.002416671   0.050284412
## San Antonio          -0.10976334   -0.094767945  -0.042066863
## Oklahoma City        -0.11642401   -0.101428617  -0.048727534
## Toronto              -0.07780001   -0.062804608  -0.010103525
## Utah                 -0.08241342   -0.067418017  -0.014716935
## Memphis              -0.06057751   -0.045582112   0.007118970
## Washington           -0.04730527   -0.032309876   0.020391206
## Detroit              -0.07907460   -0.064079199  -0.011378116
## Charlotte            -0.09171471   -0.076719309  -0.024018226
##                  Utah Jazz   Miami Heat Charlotte Hornets Toronto Raptors
## Atlanta       -0.0588808953 -0.053590219      -0.071000780    -0.037284768
## Boston        -0.0304092842 -0.025118608      -0.042529169    -0.008813157
## Cleveland     -0.0263544156 -0.021063739      -0.038474300    -0.004758289
## New Orleans    0.0428184896  0.048109166       0.030698605     0.064414616
## Chicago       -0.0274625065 -0.022171830      -0.039582391    -0.005866380
```

```
## Dallas        -0.0002777308  0.005012946      -0.012397616     0.021318396
## Denver         0.0203156146  0.025606291       0.008195730     0.041911741
## Golden State  -0.0335363294 -0.028245653      -0.045656214    -0.011940203
## Houston        0.0150644382  0.020355115       0.002944553     0.036660565
## LA            -0.0304243134 -0.025133637      -0.042544198    -0.008828187
## Los Angeles    0.0178213506  0.023112027       0.005701466     0.039417477
## Miami         -0.0294453427 -0.024154666      -0.041565227    -0.007849216
## Milwaukee     -0.0275188354 -0.022228159      -0.039638720    -0.005922708
## Minnesota      0.0063177243  0.011608401      -0.005802160     0.027913851
## Brooklyn       0.0419507717  0.047241448       0.029830887     0.063546899
## New York      -0.0323912458 -0.027100569      -0.044511131    -0.010795119
## Orlando        0.0088062208  0.014096897      -0.003313664     0.030402348
## Indiana       -0.0308529948 -0.025562318      -0.042972880    -0.009256868
## Philadelphia   0.0255078459  0.030798522       0.013387961     0.047103973
## Phoenix        0.0310695040  0.036360180       0.018949619     0.052665631
## Portland       0.0038661010  0.009156777      -0.008253784     0.025462228
## Sacramento     0.0468106672  0.052101344       0.034690782     0.068406794
## San Antonio   -0.0455406072 -0.040249931      -0.057660492    -0.023944480
## Oklahoma City -0.0522012790 -0.046910603      -0.064321164    -0.030605152
## Toronto       -0.0135772701 -0.008286594      -0.025697155     0.008018857
## Utah          -0.0181906795 -0.012900003      -0.030310564     0.003405447
## Memphis        0.0036452256  0.008935902      -0.008474659     0.025241352
## Washington     0.0169174618  0.022208138       0.004797577     0.038513589
## Detroit       -0.0148518609 -0.009561184      -0.026971746     0.006744266
## Charlotte     -0.0274919707 -0.022201294      -0.039611856    -0.005895844
##               Indiana Pacers Houston Rockets Denver Nuggets
## Atlanta         -0.055186486   -0.0783718074  -0.1000876527
## Boston          -0.026714875   -0.0499001962  -0.0716160416
## Cleveland       -0.022660006   -0.0458453276  -0.0675611730
## New Orleans      0.046512899    0.0233275776   0.0016117322
## Chicago         -0.023768097   -0.0469534186  -0.0686692639
## Dallas           0.003416678   -0.0197686428  -0.0414844882
## Denver           0.024010024    0.0008247026  -0.0208911428
## Golden State    -0.029841920   -0.0530272414  -0.0747430868
## Houston          0.018758847   -0.0044264738  -0.0261423192
## LA              -0.026729904   -0.0499152254  -0.0716310708
## Los Angeles      0.021515760   -0.0016695614  -0.0233854068
## Miami           -0.025750933   -0.0489362547  -0.0706521000
## Milwaukee       -0.023824426   -0.0470097474  -0.0687255928
## Minnesota        0.010012133   -0.0131731877  -0.0348890330
## Brooklyn         0.045645181    0.0224598597   0.0007440143
## New York        -0.028696837   -0.0518821578  -0.0735980032
## Orlando          0.012500630   -0.0106846912  -0.0324005366
## Indiana         -0.027158586   -0.0503439068  -0.0720597522
## Philadelphia     0.029202255    0.0060169339  -0.0156989115
## Phoenix          0.034763913    0.0115785920  -0.0101372534
## Portland         0.007560510   -0.0156248110  -0.0373406564
## Sacramento       0.050505076    0.0273197552   0.0056039098
## San Antonio     -0.041846198   -0.0650315192  -0.0867473646
## Oklahoma City   -0.048506870   -0.0716921911  -0.0934080364
## Toronto         -0.009882861   -0.0330681821  -0.0547840275
## Utah            -0.014496270   -0.0376815915  -0.0593974368
## Memphis          0.007339635   -0.0158456864  -0.0375615318
## Washington       0.020611871   -0.0025734503  -0.0242892956
```

```
## Detroit         -0.011157452   -0.0343427729  -0.0560586183
## Charlotte       -0.023797562   -0.0469828827  -0.0686987281
##                Memphis Grizzlies New York Knicks Milwaukee Bucks
## Atlanta           -0.1061160408   -0.0755485140    -0.088054716
## Boston            -0.0776444296   -0.0470769029    -0.059583105
## Cleveland         -0.0735895611   -0.0430220343    -0.055528236
## New Orleans       -0.0044166558    0.0261508709     0.013644669
## Chicago           -0.0746976520   -0.0441301252    -0.056636327
## Dallas            -0.0475128762   -0.0169453495    -0.029451552
## Denver            -0.0269195308    0.0036479959    -0.008858206
## Golden State      -0.0807714748   -0.0502039481    -0.062710150
## Houston           -0.0321707073   -0.0016031805    -0.014109383
## LA                -0.0776594588   -0.0470919321    -0.059598134
## Los Angeles       -0.0294137948    0.0011537319    -0.011352470
## Miami             -0.0766804881   -0.0461129613    -0.058619163
## Milwaukee         -0.0747539808   -0.0441864541    -0.056692656
## Minnesota         -0.0409174211   -0.0103498944    -0.022856096
## Brooklyn          -0.0052843737    0.0252831530     0.012776951
## New York          -0.0796263912   -0.0490588645    -0.061565067
## Orlando           -0.0384289247   -0.0078613979    -0.020367600
## Indiana           -0.0780881402   -0.0475206135    -0.060026816
## Philadelphia      -0.0217272996    0.0088402272    -0.003665975
## Phoenix           -0.0161656414    0.0144018853     0.001895683
## Portland          -0.0433690444   -0.0128015177    -0.025307720
## Sacramento        -0.0004244782    0.0301430485     0.017636846
## San Antonio       -0.0927757526   -0.0622082259    -0.074714428
## Oklahoma City     -0.0994364245   -0.0688688977    -0.081375100
## Toronto           -0.0608124155   -0.0302448888    -0.042751091
## Utah              -0.0654258249   -0.0348582981    -0.047364500
## Memphis           -0.0435899198   -0.0130223931    -0.025528595
## Washington        -0.0303176837    0.0002498431    -0.012256359
## Detroit           -0.0620870063   -0.0315194796    -0.044025682
## Charlotte         -0.0747271161   -0.0441595894    -0.056665791
##                Oklahoma City Thunder San Antonio Spurs Dallas Mavericks
## Atlanta                -0.047971867        0.01577549     -0.051839465
## Boston                 -0.019500256        0.04424710     -0.023367854
## Cleveland              -0.015445388        0.04830197     -0.019312986
## New Orleans             0.053727517        0.11747488      0.049859920
## Chicago                -0.016553479        0.04719388     -0.020421076
## Dallas                  0.010631297        0.07437866      0.006763699
## Denver                  0.031224642        0.09497200      0.027357045
## Golden State           -0.022627301        0.04112006     -0.026494899
## Houston                 0.025973466        0.08972083      0.022105868
## LA                     -0.019515286        0.04423207     -0.023382883
## Los Angeles             0.028730379        0.09247774      0.024862781
## Miami                  -0.018536315        0.04521104     -0.022403913
## Milwaukee              -0.016609807        0.04713755     -0.020477405
## Minnesota               0.017226752        0.08097411      0.013359154
## Brooklyn                0.052859800        0.11660716      0.048992202
## New York               -0.021482218        0.04226514     -0.025349816
## Orlando                 0.019715249        0.08346261      0.015847651
## Indiana                -0.019943967        0.04380339     -0.023811565
## Philadelphia            0.036416874        0.10016423      0.032549276
## Phoenix                 0.041978532        0.10572589      0.038110934
```

```
## Portland               0.014775129        0.07852249      0.010907531
## Sacramento             0.057719695        0.12146705      0.053852097
## San Antonio           -0.034631579        0.02911578     -0.038499177
## Oklahoma City         -0.041292251        0.02245511     -0.045159849
## Toronto               -0.002668242        0.06107912     -0.006535840
## Utah                  -0.007281652        0.05646571     -0.011149249
## Memphis                0.014554253        0.07830161      0.010686656
## Washington             0.027826490        0.09157385      0.023958892
## Detroit               -0.003942833        0.05980453     -0.007810431
## Charlotte             -0.016582943        0.04716442     -0.020450541
##                Phoenix Suns Portland Trail Blazers Los Angeles Clippers
## Atlanta       -1.016691e-01          -0.0642480049         -0.003310590
## Boston        -7.319752e-02          -0.0357763938          0.025161021
## Cleveland     -6.914265e-02          -0.0317215252          0.029215890
## New Orleans    3.025283e-05           0.0374513800          0.098388795
## Chicago       -7.025074e-02          -0.0328296161          0.028107799
## Dallas        -4.306597e-02          -0.0056448404          0.055292574
## Denver        -2.247262e-02           0.0149485050          0.075885920
## Golden State  -7.632457e-02          -0.0389034389          0.022033976
## Houston       -2.772380e-02           0.0096973286          0.070634743
## LA            -7.321255e-02          -0.0357914230          0.025145992
## Los Angeles   -2.496689e-02           0.0124542411          0.073391656
## Miami         -7.223358e-02          -0.0348124522          0.026124962
## Milwaukee     -7.030707e-02          -0.0328859449          0.028051470
## Minnesota     -3.647051e-02           0.0009506148          0.061888029
## Brooklyn      -8.374651e-04           0.0365836622          0.097521077
## New York      -7.517948e-02          -0.0377583554          0.023179059
## Orlando       -3.398202e-02           0.0034391112          0.064376526
## Indiana       -7.364123e-02          -0.0362201044          0.024717310
## Philadelphia  -1.728039e-02           0.0201407363          0.081078151
## Phoenix       -1.171873e-02           0.0257023945          0.086639809
## Portland      -3.892214e-02          -0.0015010085          0.059436406
## Sacramento     4.022430e-03           0.0414435577          0.102380972
## San Antonio   -8.832884e-02          -0.0509077167          0.010029698
## Oklahoma City -9.498952e-02          -0.0575683886          0.003369026
## Toronto       -5.636551e-02          -0.0189443797          0.041993035
## Utah          -6.097892e-02          -0.0235577890          0.037379626
## Memphis       -3.914301e-02          -0.0017218840          0.059215531
## Washington    -2.587078e-02           0.0115503522          0.072487767
## Detroit       -5.764010e-02          -0.0202189705          0.040718444
## Charlotte     -7.028021e-02          -0.0328590803          0.028078334
##               Sacramento Kings Los Angeles Lakers Minnesota Timberwolves
## Atlanta          -0.0435826028        -0.13695991          -0.0682013946
## Boston           -0.0151109916        -0.10848830          -0.0397297835
## Cleveland        -0.0110561231        -0.10443343          -0.0356749149
## New Orleans       0.0581167822        -0.03526052           0.0334979903
## Chicago          -0.0121642140        -0.10554152          -0.0367830058
## Dallas            0.0150205617        -0.07835674          -0.0095982301
## Denver            0.0356139071        -0.05776340           0.0109951153
## Golden State     -0.0182380368        -0.11161534          -0.0428568286
## Houston           0.0303627307        -0.06301457           0.0057439389
## LA               -0.0151260208        -0.10850333          -0.0397448127
## Los Angeles       0.0331196432        -0.06025766           0.0085008514
## Miami            -0.0141470501        -0.10752436          -0.0387658419
```

```
## Milwaukee        -0.0122205428       -0.10559785         -0.0368393346
## Minnesota         0.0216160169       -0.07176129         -0.0030027749
## Brooklyn          0.0572490643       -0.03612824          0.0326302724
## New York         -0.0170929533       -0.11047026         -0.0417117451
## Orlando           0.0241045133       -0.06927279         -0.0005142785
## Indiana          -0.0155547022       -0.10893201         -0.0401734941
## Philadelphia      0.0408061384       -0.05257117          0.0161873466
## Phoenix           0.0463677966       -0.04700951          0.0217490047
## Portland          0.0191643936       -0.07421291         -0.0054543983
## Sacramento        0.0621089598       -0.03126835          0.0374901680
## San Antonio      -0.0302423146       -0.12361962         -0.0548611064
## Oklahoma City    -0.0369029865       -0.13028029         -0.0615217783
## Toronto           0.0017210224       -0.09165628         -0.0228977694
## Utah             -0.0028923869       -0.09626969         -0.0275111787
## Memphis           0.0189435182       -0.07443379         -0.0056752737
## Washington        0.0322157543       -0.06116155          0.0075969625
## Detroit           0.0004464316       -0.09293087         -0.0241723602
## Charlotte        -0.0121936781       -0.10557098         -0.0368124700
```

```
max(df)
```

```
## [1] 0.1214671
```

```
min(df)
```

```
## [1] -0.1369599
```

```
write.csv(df, "datos2016.csv")

summary(df)
```

```
##  Detroit Pistons     Atlanta Hawks       Chicago Bulls
##  Min.   :-0.115545   Min.   :-0.069732   Min.   :-0.076732
##  1st Qu.:-0.086833   1st Qu.:-0.041019   1st Qu.:-0.048020
##  Median :-0.070879   Median :-0.025066   Median :-0.032066
##  Mean   :-0.063948   Mean   :-0.018134   Mean   :-0.025135
##  3rd Qu.:-0.040210   3rd Qu.: 0.005603   3rd Qu.:-0.001397
##  Max.   :-0.009854   Max.   : 0.035960   Max.   : 0.028959
##  Cleveland Cavaliers New Orleans Pelicans Golden State Warriors
##  Min.   :-0.042502   Min.   :-0.081228    Min.   :0.009945
##  1st Qu.:-0.013789   1st Qu.:-0.052515    1st Qu.:0.038658
##  Median : 0.002164   Median :-0.036562    Median :0.054611
##  Mean   : 0.009096   Mean   :-0.029630    Mean   :0.061543
##  3rd Qu.: 0.032833   3rd Qu.:-0.005893    3rd Qu.:0.085280
##  Max.   : 0.063190   Max.   : 0.024464    Max.   :0.115637
##  Orlando Magic       Washington Wizards  Philadelphia 76ers
##  Min.   :-0.054527   Min.   :-0.049014   Min.   :-0.12310
##  1st Qu.:-0.025814   1st Qu.:-0.020301   1st Qu.:-0.09439
##  Median :-0.009860   Median :-0.004347   Median :-0.07844
##  Mean   :-0.002929   Mean   : 0.002584   Mean   :-0.07151
##  3rd Qu.: 0.020809   3rd Qu.: 0.026322   3rd Qu.:-0.04777
##  Max.   : 0.051165   Max.   : 0.056678   Max.   :-0.01741
```

```
##  Boston Celtics      Brooklyn Nets         Utah Jazz
##  Min.   :-0.108108   Min.   :-0.055407   Min.   :-0.058881
##  1st Qu.:-0.079396   1st Qu.:-0.026695   1st Qu.:-0.030168
##  Median :-0.063442   Median :-0.010741   Median :-0.014215
##  Mean   :-0.056511   Mean   :-0.003809   Mean   :-0.007283
##  3rd Qu.:-0.032773   3rd Qu.: 0.019928   3rd Qu.: 0.016454
##  Max.   :-0.002417   Max.   : 0.050284   Max.   : 0.046811
##    Miami Heat        Charlotte Hornets   Toronto Raptors
##  Min.   :-0.053590   Min.   :-0.071001   Min.   :-0.037285
##  1st Qu.:-0.024878   1st Qu.:-0.042288   1st Qu.:-0.008572
##  Median :-0.008924   Median :-0.026334   Median : 0.007382
##  Mean   :-0.001993   Mean   :-0.019403   Mean   : 0.014313
##  3rd Qu.: 0.021745   3rd Qu.: 0.004334   3rd Qu.: 0.038050
##  Max.   : 0.052101   Max.   : 0.034691   Max.   : 0.068407
##  Indiana Pacers      Houston Rockets     Denver Nuggets
##  Min.   :-0.055186   Min.   :-0.078372   Min.   :-0.100088
##  1st Qu.:-0.026474   1st Qu.:-0.049659   1st Qu.:-0.071375
##  Median :-0.010520   Median :-0.033705   Median :-0.055421
##  Mean   :-0.003589   Mean   :-0.026774   Mean   :-0.048490
##  3rd Qu.: 0.020149   3rd Qu.:-0.003037   3rd Qu.:-0.024753
##  Max.   : 0.050505   Max.   : 0.027320   Max.   : 0.005604
##  Memphis Grizzlies    New York Knicks      Milwaukee Bucks
##  Min.   :-0.1061160   Min.   :-0.0755485   Min.   :-0.08805
##  1st Qu.:-0.0774034   1st Qu.:-0.0468359   1st Qu.:-0.05934
##  Median :-0.0614497   Median :-0.0308822   Median :-0.04339
##  Mean   :-0.0545184   Mean   :-0.0239508   Mean   :-0.03646
##  3rd Qu.:-0.0307809   3rd Qu.:-0.0002134   3rd Qu.:-0.01272
##  Max.   :-0.0004245   Max.   : 0.0301431   Max.   : 0.01764
##  Oklahoma City Thunder San Antonio Spurs Dallas Mavericks
##  Min.   :-0.047972     Min.   :0.01578   Min.   :-0.0518395
##  1st Qu.:-0.019259     1st Qu.:0.04449   1st Qu.:-0.0231269
##  Median :-0.003306     Median :0.06044   Median :-0.0071731
##  Mean   : 0.003626     Mean   :0.06737   Mean   :-0.0002418
##  3rd Qu.: 0.027363     3rd Qu.:0.09111   3rd Qu.: 0.0234956
##  Max.   : 0.057720     Max.   :0.12147   Max.   : 0.0538521
##   Phoenix Suns       Portland Trail Blazers Los Angeles Clippers
##  Min.   :-0.101669   Min.   :-0.06425       Min.   :-0.003311
##  1st Qu.:-0.072957   1st Qu.:-0.03554       1st Qu.: 0.025402
##  Median :-0.057003   Median :-0.01958       Median : 0.041356
##  Mean   :-0.050071   Mean   :-0.01265       Mean   : 0.048287
##  3rd Qu.:-0.026334   3rd Qu.: 0.01109       3rd Qu.: 0.072025
##  Max.   : 0.004022   Max.   : 0.04144       Max.   : 0.102381
##  Sacramento Kings    Los Angeles Lakers Minnesota Timberwolves
##  Min.   :-0.043583   Min.   :-0.13696   Min.   :-0.068201
##  1st Qu.:-0.014870   1st Qu.:-0.10825   1st Qu.:-0.039489
##  Median : 0.001084   Median :-0.09229   Median :-0.023535
##  Mean   : 0.008015   Mean   :-0.08536   Mean   :-0.016604
##  3rd Qu.: 0.031753   3rd Qu.:-0.06162   3rd Qu.: 0.007134
##  Max.   : 0.062109   Max.   :-0.03127   Max.   : 0.037490
```