NBA Player Salary Analysis

2024-04-20

R Markdown

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When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:

- NBA0 Original CSV Raw Dataset -NBA1 dataset = model 1 with SM
- NBA2 dataset = model without SM

```
# Load the data
NBA0 <- read.csv("NBA.csv")

# Show the first few rows to inspect the data
head(NBA0)
```

```
##           Player OFFRTG DEFRTG PGP Award      SM      Salary
## 1   Aaron Gordon  120.9  112.6  40     0 1207606  22266182
## 2  Aaron Nesmith  119.9  118.5  20     0   82267   5634257
## 3     Al Horford  117.6  107.6 167     1  677631  10000000
## 4    Alex Caruso  109.0  109.9  31     1 1480442   9460000
## 5 Alperen Şengün  114.4  112.0   0     0  597715   3536280
## 6 Andrew Wiggins  113.0  122.1  40     0 2181720  24330357
```

```
# Check the structure of the data to understand column types
str(NBA0)
```

```
## 'data.frame':    188 obs. of  7 variables:
##  $ Player: chr  "Aaron Gordon" "Aaron Nesmith" "Al Horford" "Alex Caruso" ...
##  $ OFFRTG: num  121 120 118 109 114 ...
##  $ DEFRTG: num  113 118 108 110 112 ...
##  $ PGP   : int  40 20 167 31 0 40 55 11 0 16 ...
##  $ Award : int  0 0 1 1 0 0 1 1 0 0 ...
##  $ SM    : int  1207606 82267 677631 1480442 597715 2181720 7208504 1805150 327230 1195872 ...
##  $ Salary: chr  " 22266182  " " 5634257  " " 10000000  " " 9460000  " ...
```

```
# Remove rows with NA values
NBA1 <- NBA0[complete.cases(NBA0), ]

# Check the data after removal
head(NBA1)
```

```
##           Player OFFRTG DEFRTG PGP Award      SM      Salary
## 1   Aaron Gordon  120.9  112.6  40     0 1207606  22266182
## 2  Aaron Nesmith  119.9  118.5  20     0   82267   5634257
## 3     Al Horford  117.6  107.6 167     1  677631  10000000
## 4    Alex Caruso  109.0  109.9  31     1 1480442   9460000
## 5 Alperen Şengün  114.4  112.0   0     0  597715   3536280
```

```
## 6 Andrew Wiggins  113.0  122.1  40     0 2181720  24330357
```

```
# Step 1: Ensure 'Salary' is numeric
NBA1$Salary <- as.numeric(gsub("[^0-9.-]", "", NBA1$Salary))

# Step 2: Remove rows with NA in 'Salary'
NBA1 <- NBA1[!is.na(NBA1$Salary), ]
```

Model 1

```
# multiple regression model
model1 <- lm(Salary ~ OFFRTG + DEFRTG + PGP + SM + Award, data = NBA1)
summary(model1)
```

```
##
## Call:
## lm(formula = Salary ~ OFFRTG + DEFRTG + PGP + SM + Award, data = NBA1)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -28430422  -5556185  -1527636   4658840  21436804
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) -6.824e+07  2.835e+07  -2.407  0.01708 *
## OFFRTG       4.759e+05  1.536e+05   3.098  0.00226 **
## DEFRTG       1.878e+05  1.820e+05   1.032  0.30350
## PGP          1.309e+05  2.255e+04   5.804 2.84e-08 ***
## SM           3.291e-02  6.904e-02   0.477  0.63417
## Award        8.616e+06  1.439e+06   5.987 1.12e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 9339000 on 181 degrees of freedom
## Multiple R-squared:  0.4788, Adjusted R-squared:  0.4644
## F-statistic: 33.26 on 5 and 181 DF,  p-value: < 2.2e-16
```

Second Model wiithout Social Media variable (SM)

```
# Remove SM
NBA2 <- NBA1[, !names(NBA1) %in% "SM"]
print(NBA2)
```

```
##                      Player OFFRTG DEFRTG PGP Award   Salary
## 1              Aaron Gordon  120.9  112.6  40     0 22266182
## 2             Aaron Nesmith  119.9  118.5  20     0  5634257
## 3                Al Horford  117.6  107.6 167     1 10000000
## 4               Alex Caruso  109.0  109.9  31     1  9460000
## 5            Alperen Şengün  114.4  112.0   0     0  3536280
## 6             Andrew Wiggins  113.0  122.1  40     0 24330357
## 7              Anthony Davis  114.6  114.4  55     1 40600080
## 8            Anthony Edwards  117.2  107.5  11     1 13534817
## 9             Ausar Thompson  104.8  116.2   0     0  7977480
## 10             Austin Reaves  111.7  116.1  16     0 12015150
## 11               Ayo Dosunmu  109.7  113.8   5     1  6481482
## 12               Bam Adebayo  108.9  110.2  69     1 32600060
## 13       Bennedict Mathurin  116.4  119.7   0     1  6916080
```

```
## 14           Bilal Coulibaly  109.0  119.0   0     0  6614280
## 15           Bismack Biyombo  111.3  115.3  40     0  5000000
## 16              Bobby Portis  120.8  117.1  43     0 11710818
## 17         Bogdan Bogdanović  118.2  115.9  28     1 18700000
## 18        Brandin Podziemski  117.8  114.3   0     0  3352440
## 19            Brandon Ingram  117.9  113.1   6     1 33833400
## 20            Brandon Miller  110.9  120.6   0     0 10880400
## 21               Brook Lopez  117.8  114.1  78     1 25000000
## 22               Bruce Brown  124.2  120.5  40     0 22000000
## 23               Buddy Hield  121.9  117.6   0     1 19279841
## 24          Cade Cunningham  109.4  119.3   0     1 11055360
## 25               Cam Reddish  109.9  112.0   4     0  2165000
## 26                Cam Thomas  111.3  118.5   3     0  2240160
## 27           Cameron Johnson  112.5  114.8  38     0 25679348
## 28              Caris LeVert  114.2  113.6  14     0 15384616
## 29             Cason Wallace  115.2  109.7   0     0  5291400
## 30             Chet Holmgren  120.1  110.7   0     0 10386000
## 31                Chris Paul  115.5  111.5 149     1 30800000
## 32              Clint Capela  114.5  117.6  87     0 20616000
## 33                Coby White  113.9  115.1   5     1 11111111
## 34              Cole Anthony  111.9  111.6   0     0  5539771
## 35             Collin Sexton  116.4  116.8   0     1 17325000
## 36             Corey Kispert  109.0  121.7   0     0  3722040
## 37          D'Angelo Russell  114.5  112.4  27     1 17307693
## 38            Damian Lillard  120.8  115.2  61     1 45640084
## 39            Daniel Gafford  114.4  122.0   5     0 12402000
## 40               Dario Šarić  114.9  113.4  24     1  2019706
## 41               David Roddy  106.5  112.6   6     0  2718240
## 42              De'Aaron Fox  118.0  114.7   7     1 32600060
## 43         De'Anthony Melton  122.8  112.1  26     0  8000000
## 44             DeMar DeRozan  111.5  115.6  63     1 28600000
## 45                 Dean Wade  113.2  105.4   2     0  5709877
## 46           Dejounte Murray  116.6  119.2  21     1 18214000
## 47               Deni Avdija  110.7  118.9   0     0  6263188
## 48           Dennis Schröder  116.1  115.0  68     0 12405000
## 49          Dereck Lively II  120.0  114.7   0     0  4775640
## 50         Derrick Jones Jr.  114.9  116.6  22     0  5379706
## 51             Derrick White  122.4  108.1  53     1 18357143
## 52              Desmond Bane  108.4  114.6  23     1  3845083
## 53              Devin Booker  120.3  114.5  43     1 36016200
## 54             Devin Vassell  106.5  113.1   0     0  5887899
## 55             Dillon Brooks  113.2  111.6  22     1 22627671
## 56          Domantas Sabonis  115.4  116.1  20     1 30600000
## 57          Donovan Mitchell  115.5  107.6  44     1 33162030
## 58          Donte DiVincenzo  117.8  117.2  26     0 10900000
## 59       Dorian Finney-Smith  111.4  114.7  35     0 13932008
## 60           Duncan Robinson  113.5  111.4  61     0 18154000
## 61             Dyson Daniels  115.4  111.0   0     0  5784120
## 62               Eric Gordon  116.8  115.4  60     1  3196448
## 63              Franz Wagner  110.1  108.7   0     1  5508720
## 64             Fred VanVleet  113.9  110.6  52     1 40806300
## 65           Gary Trent Jr.   116.5  116.5  11     0 18560000
## 66             Georges Niang  112.3  113.3  46     0  8800000
## 67     Giannis Antetokounmpo  121.7  114.7  79     1 45640084
```

```
## 68              Goga Bitadze  114.5  110.0   0     0  2066585
## 69            Grant Williams  112.7  118.1  61     0 12405000
## 70             Grayson Allen  119.3  116.3  24     0  8925000
## 71           Harrison Barnes  115.0  117.2  71     1 17000000
## 72             Herbert Jones  116.9  112.2   6     1 12015150
## 73         Immanuel Quickley  116.8  111.7  13     1  4171548
## 74               Isaac Okoro  110.7  110.1   5     1  8920795
## 75        Isaiah Hartenstein  119.2  110.2  13     0  9245121
## 76            Isaiah Stewart  110.3  115.2   0     1  5266713
## 77               Ivica Zubac  120.4  111.4  39     0 10933333
## 78          Jabari Smith Jr.  111.9  112.6   0     1  9326520
## 79                Jaden Ivey  111.7  118.9   0     1  7614480
## 80           Jaden McDaniels  116.9  110.3   6     0  3901399
## 81          Jaime Jaquez Jr.  113.4  113.2   0     0  3510600
## 82              Jakob Poeltl  112.6  113.6  22     0 19500000
## 83             Jalen Brunson  120.1  115.3  36     0 26346666
## 84               Jalen Green  111.7  113.8   0     1  9891480
## 85               Jalen Suggs  109.7  112.8   0     0  7252080
## 86            Jalen Williams  118.9  109.9   0     1  4558680
## 87               James Harden  122.0  113.2 160     1 35640000
## 88         Jaren Jackson Jr.  106.1  111.7  23     1 27102202
## 89              Jarrett Allen  114.8  109.0  14     1 20000000
## 90               Jaylen Brown  120.4  109.8 105     1 31830357
## 91               Jayson Tatum  120.3  109.3  94     1 32600060
## 92               Jerami Grant  105.5  118.3  35     0 27586207
## 93              Jeremy Sochan  106.4  116.3   0     1  5316960
## 94                Joel Embiid  122.0  109.4  53     1 47607350
## 95               John Collins  112.7  121.1  29     1 25340000
## 96         Jonas Valančiūnas  119.6  114.6  54     1 15435000
## 97          Jonathan Kuminga  114.6  114.7  26     0  6012840
## 98            Jordan Clarkson  114.1  116.2  43     1 23487629
## 99             Jordan Hawkins  115.3  115.8   0     0  4310160
## 100              Jordan Poole  110.2  123.9  35     0 27455357
## 101              Josh Giddey  120.5  111.8   0     1  6587040
## 102               Josh Green  118.8  116.3  17     0  4765339
## 103                Josh Hart  116.2  109.5  11     0 12960000
## 104           Josh Richardson  110.0  115.6  30     0  2891467
## 105              Jrue Holiday  120.2  110.5  70     1 36861707
## 106            Julius Randle  119.3  113.9  15     1 28226880
## 107             Jusuf Nurkić  120.2  111.9  16     1 16875000
## 108       Karl-Anthony Towns  116.3  108.3  16     1 36016200
## 109            Kawhi Leonard  120.3  110.1 137     1 45640084
## 110            Keegan Murray  114.9  114.0   7     1  8409000
## 111           Keldon Johnson  108.2  117.0   0     0 20000000
## 112              Kelly Olynyk  113.3  115.9  48     1 12195122
## 113 Kentavious Caldwell-Pope  123.1  112.2  50     0 14704938
## 114              Kevin Durant  118.2  115.2 166     1 47649433
## 115            Kevin Huerter  118.4  114.9  30     1 15669643
## 116             Kevon Looney  114.7  118.7  77     0  7500000
## 117           Keyonte George  109.3  115.2   0     0  3889800
## 118          Khris Middleton  122.2  115.6  74     1 29320988
## 119            Killian Hayes  106.8  117.3   0     0  7413955
## 120            Klay Thompson  117.2  120.8 158     1 43219440
## 121       Kristaps Porziņģis  120.4  109.4  10     1 36016200
```

```
## 122            Kyle Anderson  107.8  106.8  51     0  9219512
## 123               Kyle Kuzma  111.1  123.5  27     1 25568182
## 124               Kyle Lowry  114.0  112.8 130     1 29682540
## 125           Lauri Markkanen  119.3  115.3   0     1 17259999
## 126              LeBron James  113.7  112.4 282     1 47607350
## 127            Luguentz Dort  121.0  114.4   6     0 15277778
## 128              Luka Dončić  118.9  117.2  28     1 40064220
## 129            Malaki Branham  107.1  121.4   0     0  3071880
## 130           Malcolm Brogdon  109.9  114.2  43     1 22500000
## 131            Malik Beasley  119.7  114.9  31     0  2019706
## 132                Malik Monk  116.0  115.3   7     0  9945830
## 133          Matisse Thybulle  107.2  114.8  25     1 10500000
## 134                 Max Strus  114.7  107.3  43     0 14487684
## 135       Michael Porter Jr.  122.5  112.9  49     0 33386850
## 136             Mikal Bridges  113.2  115.6  39     1 21700000
## 137               Mike Conley  116.1  105.8  78     1 24360000
## 138             Myles Turner  123.5  117.1  26     1 20975000
## 139                 Naz Reid  110.1  106.2   5     0 12950400
## 140               Nic Claxton  109.2  115.1  20     0  9625000
## 141             Nick Richards  106.4  120.4   0     0  5000000
## 142 Nickeil Alexander-Walker  109.5  107.2   6     0  4687500
## 143              Nikola Jokić  123.8  112.5  68     1 47607350
## 144            Nikola Vučević  111.0  114.5  16     1 18518519
## 145             Norman Powell  118.1  111.3  78     0 18000000
## 146                OG Anunoby  116.4  108.9  27     1 18642857
## 147                Obi Toppin  121.2  119.8  16     0  6803012
## 148              Ochai Agbaji  110.0  113.4   0     0  4114200
## 149            Onyeka Okongwu  118.2  117.8  29     0  8109063
## 150           P.J. Washington  110.4  121.0   0     1 16847826
## 151            Paolo Banchero  110.5  112.6   0     1 11608080
## 152            Pascal Siakam  115.8  115.3  53     1 37893408
## 153           Pat Connaughton  118.9  116.7  77     0  9423869
## 154          Patrick Williams  114.1  114.0   5     1  9835881
## 155               Paul George  122.8  112.5 108     1 45640084
## 156          Payton Pritchard  121.0  109.5  39     0  4037277
## 157                RJ Barrett  116.7  116.1  16     0 23883929
## 158            Reggie Jackson  114.1  111.1  75     0  5000000
## 159             Royce O'Neale  112.3  112.5  44     0  9500000
## 160                Rudy Gobert  115.1  104.7  54     1 41000000
## 161         Russell Westbrook  114.4  112.5 116     1  3835738
## 162                Saddiq Bey  119.0  118.6   6     1  4556983
## 163                Sam Hauser  118.1  108.6  22     0  1927896
## 164              Santi Aldama  106.7  110.3   6     0  2194200
## 165           Scoot Henderson  105.6  119.6   0     0  9770880
## 166            Scottie Barnes  112.6  115.6   4     1  8008680
## 167            Shaedon Sharpe  105.8  116.0   0     0  6313800
## 168  Shai Gilgeous-Alexander  122.6  111.6  13     1 33386850
## 169         Simone Fontecchio  114.5  114.9   0     0  3044872
## 170         Spencer Dinwiddie  114.9  116.2  28     0 20357143
## 171             Stephen Curry  116.6  119.5 147     1 51915615
## 172      Talen Horton-Tucker  112.6  113.7   6     0 11020000
## 173            Taurean Prince  112.8  116.0  16     0  4516000
## 174              Terance Mann  120.3  115.9  37     0 10576923
## 175          Tim Hardaway Jr.  117.9  117.7  28     1 17897728
```

```
## 176            Tobias Harris  121.7  111.7  55     0 39270150
## 177          Toumani Camara  106.4  115.1   0     0  1119563
## 178              Trae Young  116.1  118.1  27     1 40064220
## 179               Tre Jones  111.2  114.6   0     0  9895833
## 180       Tyrese Haliburton  125.3  118.9   0     1  5808435
## 181            Tyrese Maxey  122.5  111.6  35     0  4343920
## 182              Tyus Jones  111.7  123.8  27     0 14000000
## 183       Victor Wembanyama  105.4  112.7   0     0 12160680
## 184     Vince Williams Jr.   109.7  109.1   0     0  2232308
## 185          Walker Kessler  111.9  109.8   0     1  2831160
## 186            Zach Collins  106.5  118.7  20     0  7700000
## 187         Zion Williamson  115.0  111.2   0     1 34005250
```

```
model2 = lm(Salary ~ OFFRTG + DEFRTG + PGP + Award, data = NBA2)
summary(model2)
```

```
##
## Call:
## lm(formula = Salary ~ OFFRTG + DEFRTG + PGP + Award, data = NBA2)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -29313308  -5715766  -1456557   4584147  21565748
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -67593807   28257099  -2.392  0.01777 *
## OFFRTG         463574     151087   3.068  0.00248 **
## DEFRTG         193329     181270   1.067  0.28760
## PGP            137363      17962   7.648 1.14e-12 ***
## Award         8648896    1434440   6.029 8.96e-09 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 9319000 on 182 degrees of freedom
## Multiple R-squared:  0.4782, Adjusted R-squared:  0.4667
## F-statistic: 41.69 on 4 and 182 DF,  p-value: < 2.2e-16
```

```
# Remove SM
NBA2 <- NBA1[, !names(NBA1) %in% "SM"]
print(NBA2)
```

```
##                     Player OFFRTG DEFRTG PGP Award   Salary
## 1             Aaron Gordon  120.9  112.6  40     0 22266182
## 2            Aaron Nesmith  119.9  118.5  20     0  5634257
## 3               Al Horford  117.6  107.6 167     1 10000000
## 4              Alex Caruso  109.0  109.9  31     1  9460000
## 5           Alperen Şengün  114.4  112.0   0     0  3536280
## 6           Andrew Wiggins  113.0  122.1  40     0 24330357
## 7            Anthony Davis  114.6  114.4  55     1 40600080
## 8          Anthony Edwards  117.2  107.5  11     1 13534817
## 9           Ausar Thompson  104.8  116.2   0     0  7977480
## 10           Austin Reaves  111.7  116.1  16     0 12015150
## 11             Ayo Dosunmu  109.7  113.8   5     1  6481482
## 12             Bam Adebayo  108.9  110.2  69     1 32600060
```

```
## 13        Bennedict Mathurin  116.4  119.7   0     1  6916080
## 14           Bilal Coulibaly  109.0  119.0   0     0  6614280
## 15           Bismack Biyombo  111.3  115.3  40     0  5000000
## 16              Bobby Portis  120.8  117.1  43     0 11710818
## 17         Bogdan Bogdanović  118.2  115.9  28     1 18700000
## 18        Brandin Podziemski  117.8  114.3   0     0  3352440
## 19            Brandon Ingram  117.9  113.1   6     1 33833400
## 20            Brandon Miller  110.9  120.6   0     0 10880400
## 21               Brook Lopez  117.8  114.1  78     1 25000000
## 22               Bruce Brown  124.2  120.5  40     0 22000000
## 23               Buddy Hield  121.9  117.6   0     1 19279841
## 24           Cade Cunningham  109.4  119.3   0     1 11055360
## 25               Cam Reddish  109.9  112.0   4     0  2165000
## 26                Cam Thomas  111.3  118.5   3     0  2240160
## 27           Cameron Johnson  112.5  114.8  38     0 25679348
## 28              Caris LeVert  114.2  113.6  14     0 15384616
## 29            Cason Wallace  115.2  109.7   0     0  5291400
## 30            Chet Holmgren  120.1  110.7   0     0 10386000
## 31               Chris Paul  115.5  111.5 149     1 30800000
## 32             Clint Capela  114.5  117.6  87     0 20616000
## 33               Coby White  113.9  115.1   5     1 11111111
## 34             Cole Anthony  111.9  111.6   0     0  5539771
## 35            Collin Sexton  116.4  116.8   0     1 17325000
## 36            Corey Kispert  109.0  121.7   0     0  3722040
## 37          D'Angelo Russell  114.5  112.4  27     1 17307693
## 38            Damian Lillard  120.8  115.2  61     1 45640084
## 39            Daniel Gafford  114.4  122.0   5     0 12402000
## 40               Dario Šarić  114.9  113.4  24     1  2019706
## 41               David Roddy  106.5  112.6   6     0  2718240
## 42              De'Aaron Fox  118.0  114.7   7     1 32600060
## 43         De'Anthony Melton  122.8  112.1  26     0  8000000
## 44             DeMar DeRozan  111.5  115.6  63     1 28600000
## 45                 Dean Wade  113.2  105.4   2     0  5709877
## 46           Dejounte Murray  116.6  119.2  21     1 18214000
## 47              Deni Avdija  110.7  118.9   0     0  6263188
## 48           Dennis Schröder  116.1  115.0  68     0 12405000
## 49          Dereck Lively II  120.0  114.7   0     0  4775640
## 50         Derrick Jones Jr.  114.9  116.6  22     0  5379706
## 51             Derrick White  122.4  108.1  53     1 18357143
## 52              Desmond Bane  108.4  114.6  23     1  3845083
## 53              Devin Booker  120.3  114.5  43     1 36016200
## 54             Devin Vassell  106.5  113.1   0     0  5887899
## 55            Dillon Brooks  113.2  111.6  22     1 22627671
## 56          Domantas Sabonis  115.4  116.1  20     1 30600000
## 57          Donovan Mitchell  115.5  107.6  44     1 33162030
## 58          Donte DiVincenzo  117.8  117.2  26     0 10900000
## 59       Dorian Finney-Smith  111.4  114.7  35     0 13932008
## 60           Duncan Robinson  113.5  111.4  61     0 18154000
## 61             Dyson Daniels  115.4  111.0   0     0  5784120
## 62               Eric Gordon  116.8  115.4  60     1  3196448
## 63              Franz Wagner  110.1  108.7   0     1  5508720
## 64             Fred VanVleet  113.9  110.6  52     1 40806300
## 65           Gary Trent Jr.  116.5  116.5  11     0 18560000
## 66             Georges Niang  112.3  113.3  46     0  8800000
```

```
## 67     Giannis Antetokounmpo  121.7  114.7  79     1 45640084
## 68               Goga Bitadze  114.5  110.0   0     0  2066585
## 69             Grant Williams  112.7  118.1  61     0 12405000
## 70              Grayson Allen  119.3  116.3  24     0  8925000
## 71            Harrison Barnes  115.0  117.2  71     1 17000000
## 72              Herbert Jones  116.9  112.2   6     1 12015150
## 73          Immanuel Quickley  116.8  111.7  13     1  4171548
## 74                Isaac Okoro  110.7  110.1   5     1  8920795
## 75         Isaiah Hartenstein  119.2  110.2  13     0  9245121
## 76             Isaiah Stewart  110.3  115.2   0     1  5266713
## 77                Ivica Zubac  120.4  111.4  39     0 10933333
## 78           Jabari Smith Jr.  111.9  112.6   0     1  9326520
## 79                 Jaden Ivey  111.7  118.9   0     1  7614480
## 80            Jaden McDaniels  116.9  110.3   6     0  3901399
## 81           Jaime Jaquez Jr.  113.4  113.2   0     0  3510600
## 82                Jakob Poeltl  112.6  113.6  22     0 19500000
## 83              Jalen Brunson  120.1  115.3  36     0 26346666
## 84                Jalen Green  111.7  113.8   0     1  9891480
## 85                Jalen Suggs  109.7  112.8   0     0  7252080
## 86            Jalen Williams  118.9  109.9   0     1  4558680
## 87              James Harden  122.0  113.2 160     1 35640000
## 88          Jaren Jackson Jr.  106.1  111.7  23     1 27102202
## 89              Jarrett Allen  114.8  109.0  14     1 20000000
## 90               Jaylen Brown  120.4  109.8 105     1 31830357
## 91               Jayson Tatum  120.3  109.3  94     1 32600060
## 92               Jerami Grant  105.5  118.3  35     0 27586207
## 93              Jeremy Sochan  106.4  116.3   0     1  5316960
## 94                Joel Embiid  122.0  109.4  53     1 47607350
## 95               John Collins  112.7  121.1  29     1 25340000
## 96          Jonas Valančiūnas  119.6  114.6  54     1 15435000
## 97           Jonathan Kuminga  114.6  114.7  26     0  6012840
## 98            Jordan Clarkson  114.1  116.2  43     1 23487629
## 99             Jordan Hawkins  115.3  115.8   0     0  4310160
## 100              Jordan Poole  110.2  123.9  35     0 27455357
## 101               Josh Giddey  120.5  111.8   0     1  6587040
## 102                Josh Green  118.8  116.3  17     0  4765339
## 103                 Josh Hart  116.2  109.5  11     0 12960000
## 104           Josh Richardson  110.0  115.6  30     0  2891467
## 105              Jrue Holiday  120.2  110.5  70     1 36861707
## 106             Julius Randle  119.3  113.9  15     1 28226880
## 107              Jusuf Nurkić  120.2  111.9  16     1 16875000
## 108       Karl-Anthony Towns  116.3  108.3  16     1 36016200
## 109              Kawhi Leonard  120.3  110.1 137     1 45640084
## 110              Keegan Murray  114.9  114.0   7     1  8409000
## 111            Keldon Johnson  108.2  117.0   0     0 20000000
## 112               Kelly Olynyk  113.3  115.9  48     1 12195122
## 113 Kentavious Caldwell-Pope  123.1  112.2  50     0 14704938
## 114              Kevin Durant  118.2  115.2 166     1 47649433
## 115             Kevin Huerter  118.4  114.9  30     1 15669643
## 116              Kevon Looney  114.7  118.7  77     0  7500000
## 117            Keyonte George  109.3  115.2   0     0  3889800
## 118           Khris Middleton  122.2  115.6  74     1 29320988
## 119             Killian Hayes  106.8  117.3   0     0  7413955
## 120             Klay Thompson  117.2  120.8 158     1 43219440
```

```
## 121       Kristaps Porziņģis  120.4  109.4  10     1 36016200
## 122            Kyle Anderson  107.8  106.8  51     0  9219512
## 123               Kyle Kuzma  111.1  123.5  27     1 25568182
## 124               Kyle Lowry  114.0  112.8 130     1 29682540
## 125          Lauri Markkanen  119.3  115.3   0     1 17259999
## 126             LeBron James  113.7  112.4 282     1 47607350
## 127            Luguentz Dort  121.0  114.4   6     0 15277778
## 128              Luka Dončić  118.9  117.2  28     1 40064220
## 129           Malaki Branham  107.1  121.4   0     0  3071880
## 130          Malcolm Brogdon  109.9  114.2  43     1 22500000
## 131            Malik Beasley  119.7  114.9  31     0  2019706
## 132               Malik Monk  116.0  115.3   7     0  9945830
## 133         Matisse Thybulle  107.2  114.8  25     1 10500000
## 134                Max Strus  114.7  107.3  43     0 14487684
## 135       Michael Porter Jr.  122.5  112.9  49     0 33386850
## 136            Mikal Bridges  113.2  115.6  39     1 21700000
## 137              Mike Conley  116.1  105.8  78     1 24360000
## 138             Myles Turner  123.5  117.1  26     1 20975000
## 139                 Naz Reid  110.1  106.2   5     0 12950400
## 140              Nic Claxton  109.2  115.1  20     0  9625000
## 141            Nick Richards  106.4  120.4   0     0  5000000
## 142 Nickeil Alexander-Walker  109.5  107.2   6     0  4687500
## 143              Nikola Jokić  123.8  112.5  68     1 47607350
## 144           Nikola Vučević  111.0  114.5  16     1 18518519
## 145            Norman Powell  118.1  111.3  78     0 18000000
## 146               OG Anunoby  116.4  108.9  27     1 18642857
## 147               Obi Toppin  121.2  119.8  16     0  6803012
## 148             Ochai Agbaji  110.0  113.4   0     0  4114200
## 149           Onyeka Okongwu  118.2  117.8  29     0  8109063
## 150          P.J. Washington  110.4  121.0   0     1 16847826
## 151           Paolo Banchero  110.5  112.6   0     1 11608080
## 152            Pascal Siakam  115.8  115.3  53     1 37893408
## 153          Pat Connaughton  118.9  116.7  77     0  9423869
## 154         Patrick Williams  114.1  114.0   5     1  9835881
## 155              Paul George  122.8  112.5 108     1 45640084
## 156         Payton Pritchard  121.0  109.5  39     0  4037277
## 157               RJ Barrett  116.7  116.1  16     0 23883929
## 158           Reggie Jackson  114.1  111.1  75     0  5000000
## 159            Royce O'Neale  112.3  112.5  44     0  9500000
## 160              Rudy Gobert  115.1  104.7  54     1 41000000
## 161        Russell Westbrook  114.4  112.5 116     1  3835738
## 162               Saddiq Bey  119.0  118.6   6     1  4556983
## 163              Sam Hauser  118.1  108.6  22     0  1927896
## 164             Santi Aldama  106.7  110.3   6     0  2194200
## 165          Scoot Henderson  105.6  119.6   0     0  9770880
## 166           Scottie Barnes  112.6  115.6   4     1  8008680
## 167           Shaedon Sharpe  105.8  116.0   0     0  6313800
## 168  Shai Gilgeous-Alexander  122.6  111.6  13     1 33386850
## 169        Simone Fontecchio  114.5  114.9   0     0  3044872
## 170        Spencer Dinwiddie  114.9  116.2  28     0 20357143
## 171             Stephen Curry  116.6  119.5 147     1 51915615
## 172      Talen Horton-Tucker  112.6  113.7   6     0 11020000
## 173            Taurean Prince  112.8  116.0  16     0  4516000
## 174              Terance Mann  120.3  115.9  37     0 10576923
```

```
## 175         Tim Hardaway Jr.  117.9  117.7  28     1 17897728
## 176            Tobias Harris  121.7  111.7  55     0 39270150
## 177          Toumani Camara  106.4  115.1   0     0  1119563
## 178              Trae Young  116.1  118.1  27     1 40064220
## 179               Tre Jones  111.2  114.6   0     0  9895833
## 180       Tyrese Haliburton  125.3  118.9   0     1  5808435
## 181            Tyrese Maxey  122.5  111.6  35     0  4343920
## 182              Tyus Jones  111.7  123.8  27     0 14000000
## 183       Victor Wembanyama  105.4  112.7   0     0 12160680
## 184     Vince Williams Jr.   109.7  109.1   0     0  2232308
## 185          Walker Kessler  111.9  109.8   0     1  2831160
## 186            Zach Collins  106.5  118.7  20     0  7700000
## 187         Zion Williamson  115.0  111.2   0     1 34005250
```

```
summary(NBA2)
```

```
##     Player              OFFRTG          DEFRTG          PGP
##  Length:187         Min.   :104.8   Min.   :104.7   Min.   :  0.00
##  Class :character   1st Qu.:111.3   1st Qu.:111.6   1st Qu.:  0.00
##  Mode  :character   Median :114.9   Median :114.5   Median : 22.00
##                     Mean   :114.9   Mean   :114.2   Mean   : 32.03
##                     3rd Qu.:118.8   3rd Qu.:116.3   3rd Qu.: 43.50
##                     Max.   :125.3   Max.   :123.9   Max.   :282.00
##      Award            Salary
##  Min.   :0.000   Min.   : 1119563
##  1st Qu.:0.000   1st Qu.: 5848167
##  Median :0.000   Median :12015150
##  Mean   :0.492   Mean   :16392242
##  3rd Qu.:1.000   3rd Qu.:24107143
##  Max.   :1.000   Max.   :51915615
```

```
# Calculate mean and standard deviation for continuous variables, handling missing values

mean_salary <- mean(NBA2$Salary, na.rm = TRUE)
sd_salary <- sd(NBA2$Salary, na.rm = TRUE)

mean_offrtg <- mean(NBA2$OFFRTG, na.rm = TRUE)
sd_offrtg <- sd(NBA2$OFFRTG, na.rm = TRUE)

mean_defrtg <- mean(NBA2$DEFRTG, na.rm = TRUE)
sd_defrtg <- sd(NBA2$DEFRTG, na.rm = TRUE)

mean_pgp <- mean(NBA2$PGP, na.rm = TRUE)
sd_pgp <- sd(NBA2$PGP, na.rm = TRUE)

# Calculate frequency and proportion for categorical variable 'Award'
award_frequency <- table(NBA2$Award)
award_proportion <- prop.table(award_frequency)

# Print mean and standard deviation for continuous variables
cat("Mean Salary:", mean_salary, "\n")
```

```
## Mean Salary: 16392242
```

```
cat("Standard Deviation of Salary:", sd_salary, "\n")
```

```
## Standard Deviation of Salary: 12761318
```

```
cat("Mean OFFRTG:", mean_offrtg, "\n")
```

```
## Mean OFFRTG: 114.877
```

```
cat("Standard Deviation of OFFRTG:", sd_offrtg, "\n")
```

```
## Standard Deviation of OFFRTG: 4.794761
```

```
cat("Mean DEFRTG:", mean_defrtg, "\n")
```

```
## Mean DEFRTG: 114.1973
```

```
cat("Standard Deviation of DEFRTG:", sd_defrtg, "\n")
```

```
## Standard Deviation of DEFRTG: 3.828507
```

```
cat("Mean PGP:", mean_pgp, "\n")
```

```
## Mean PGP: 32.02674
```

```
cat("Standard Deviation of PGP:", sd_pgp, "\n")
```

```
## Standard Deviation of PGP: 40.82133
```

```
# Print frequency and proportion for categorical variable 'Award'
cat("Frequency of Awards (Award):\n")
```

```
## Frequency of Awards (Award):
```

```
print(award_frequency)
```

```
##
##  0  1
## 95 92
```

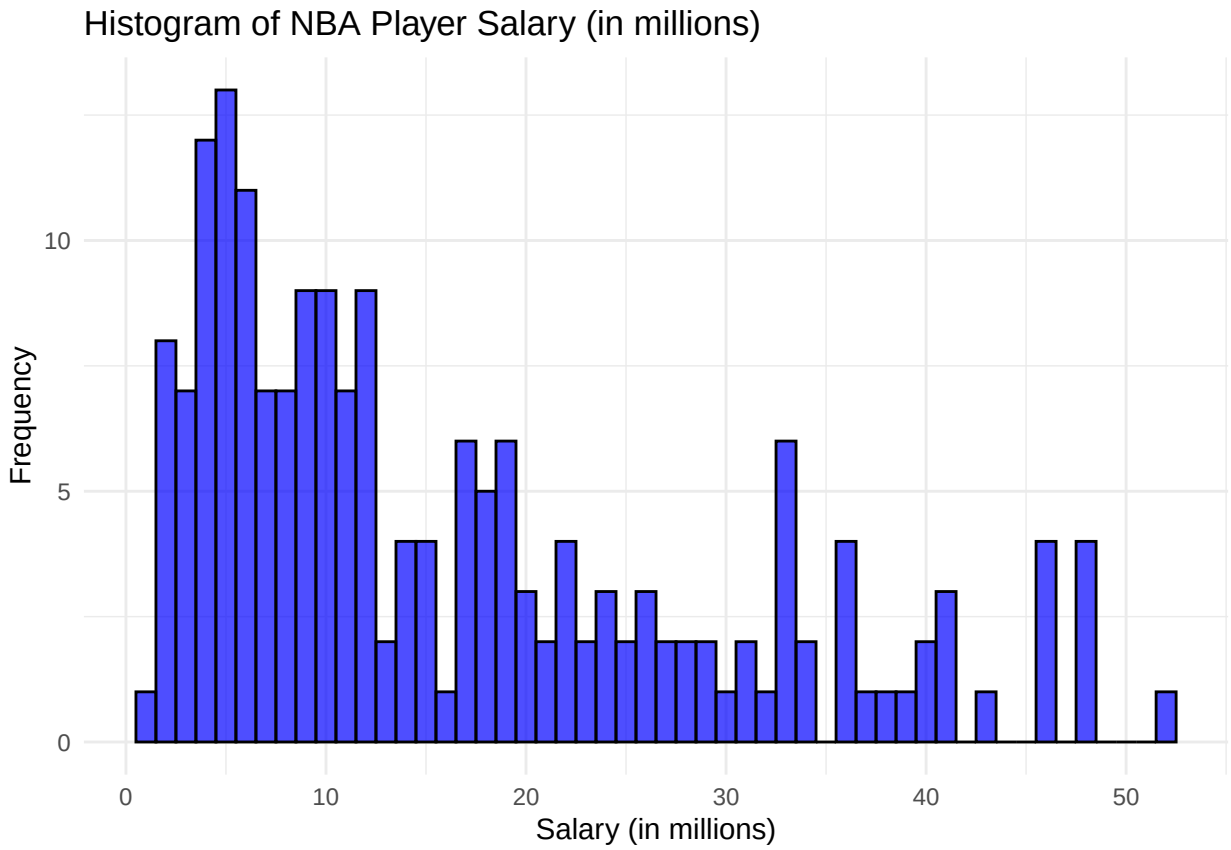
```
cat("Proportion of Awards (Award):\n")
```

```
## Proportion of Awards (Award):
```

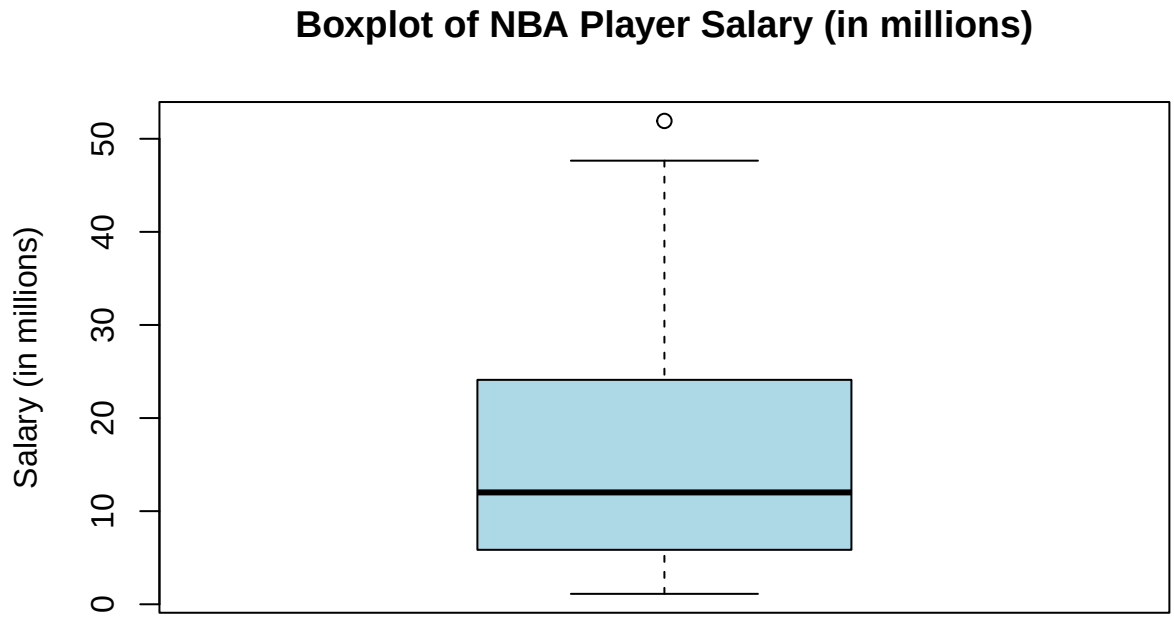
```
print(award_proportion)
```

```
##
##         0         1
## 0.5080214 0.4919786
```

```
# Load necessary package
library(ggplot2)

# Create a histogram of the dependent variable (Salary in millions)
ggplot(NBA2, aes(x = Salary / 1000000)) +
    geom_histogram(binwidth = 1, fill = "blue", color = "black", alpha = 0.7) +
    labs(title = "Histogram of NBA Player Salary (in millions)",
         x = "Salary (in millions)",
         y = "Frequency") +
    theme_minimal()
```




```r
# Create a boxplot of the dependent variable (Salary in millions)
boxplot(NBA2$Salary / 1000000,
        main = "Boxplot of NBA Player Salary (in millions)",
        ylab = "Salary (in millions)",
        col = "lightblue",
        outline = TRUE)
```



```r
# Find the summary statistics for the Salary variable
summary(NBA2$Salary)
```

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
##  1119563  5848167 12015150 16392242 24107143 51915615
```

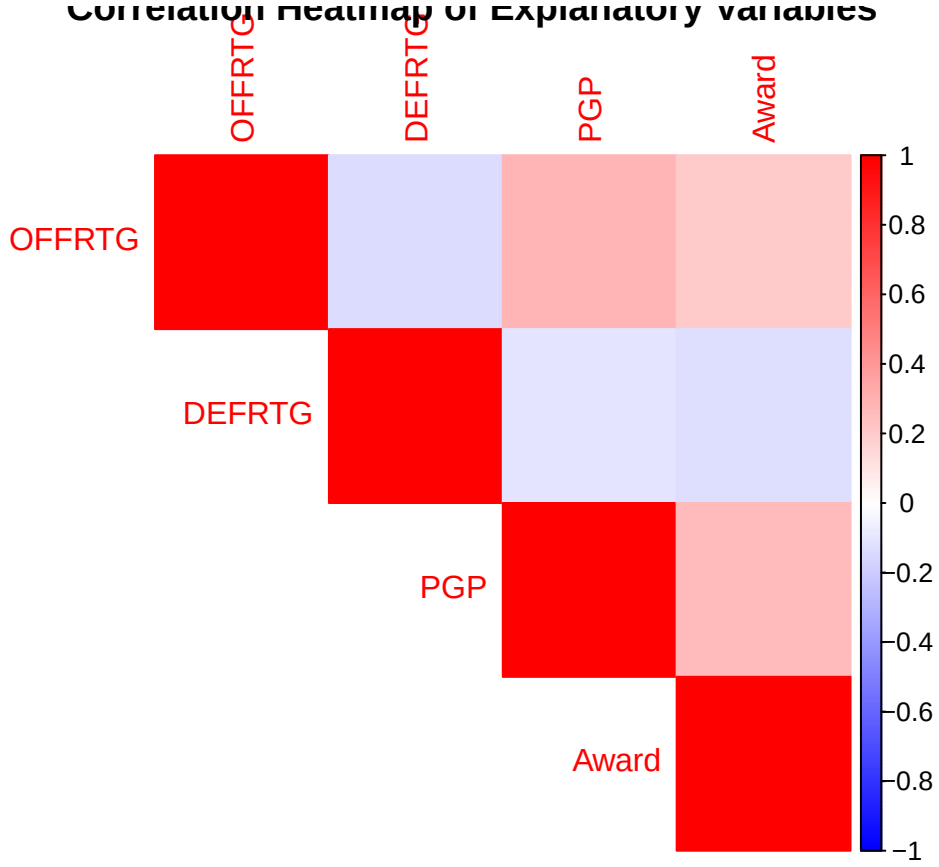
```r
# Load necessary libraries
library(corrplot)
```

```
## corrplot 0.92 loaded
```

```r
# Assuming NBA2 data frame is already loaded

# Step 1: Check for missing values
missing_values <- sum(is.na(NBA2))
cat("Number of missing values in the data:", missing_values, "\n")
```

```
## Number of missing values in the data: 0
```

```r
# Step 2: Handle missing values
# Option 1: Remove rows with missing values
NBA2_clean <- na.omit(NBA2)

# Step 3: Calculate correlation matrix
corr_matrix <- cor(NBA2_clean[, c("OFFRTG", "DEFRTG", "PGP", "Award")])

# Step 4: Create a heatmap of the correlation matrix
corrplot(corr_matrix, method = "color", type = "upper",
         col = colorRampPalette(c("blue", "white", "red"))(200),
         title = "Correlation Heatmap of Explanatory Variables")
```




```
# Load necessary packages
library(car)
```

```
## Loading required package: carData
```

```
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
```

```
## The following object is masked from 'package:car':
##
##     recode
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
# Assuming NBA2 data frame is already loaded
# Select the explanatory variables from the dataset
explanatory_vars <- NBA2 %>% select(OFFRTG, DEFRTG, PGP, Award)

# Fit a linear model using the explanatory variables and the dependent variable (Salary)
model <- lm(Salary ~ OFFRTG + DEFRTG + PGP + Award, data = NBA2)
```

```r
# Calculate VIF for each explanatory variable
vif_values <- vif(model)

# Print the VIF values
print(vif_values)
```

```
##   OFFRTG   DEFRTG      PGP    Award
## 1.123899 1.031455 1.151354 1.107292
```

```r
# 4 models
S1 <- lm(Salary ~ OFFRTG, data = NBA2)
S2 <- lm(Salary ~ OFFRTG + DEFRTG, data = NBA2)
S3 <- lm(Salary ~ OFFRTG + DEFRTG + PGP, data = NBA2)
S4 <- lm(Salary ~ OFFRTG + DEFRTG + PGP + Award, data = NBA2)

# Compute the 95% confidence intervals for each model and print them

# Model S1: lm(Salary ~ OFFRTG, data = NBA2)
ci_S1 <- confint(S1)
print("Model S1: 95% Confidence Intervals")
```

```
## [1] "Model S1: 95% Confidence Intervals"
```

```r
print(ci_S1)
```

```
##                    2.5 %    97.5 %
## (Intercept) -135975693.2 -53260886
## OFFRTG          606639.4   1326046
```

```r
# Model S2: lm(Salary ~ OFFRTG + DEFRTG, data = NBA2)
ci_S2 = confint(S2)
print("\nModel S2: 95% Confidence Intervals")
```

```
## [1] "\nModel S2: 95% Confidence Intervals"
```

```r
print(ci_S2)
```

```
##                    2.5 %      97.5 %
## (Intercept) -164240450.4 -21961364.6
## OFFRTG          600916.9   1329151.1
## DEFRTG         -467985.6    444043.3
```

```r
# Model S3: lm(Salary ~ OFFRTG + DEFRTG + PGP, data = NBA2)
ci_S3 = confint(S3)
print("\nModel S3: 95% Confidence Intervals")
```

```
## [1] "\nModel S3: 95% Confidence Intervals"
```

```r
print(ci_S3)
```

```
##                    2.5 %     97.5 %
## (Intercept) -127468121.9 -5671617.5
## OFFRTG          257111.5   903006.4
## DEFRTG         -291372.2   486979.0
## PGP             123272.5   198820.2
```

```r
# Model S4: lm(Salary ~ OFFRTG + DEFRTG + PGP + Award, data = NBA2)
ci_S4 = confint(S4)
print("\nModel S4: 95% Confidence Intervals")
```

```
## [1] "\nModel S4: 95% Confidence Intervals"
```

```
print(ci_S4)
```

```
##                     2.5 %      97.5 %
## (Intercept) -123347438.8 -11840175.3
## OFFRTG          165467.5    761681.4
## DEFRTG         -164331.9    550989.5
## PGP             101923.5    172803.3
## Award          5818625.5  11479167.4
```

```
# Assuming you have defined your models as S1, S2, S3, S4 and you have your NBA2 data set loaded

# Calculate fitted values for Model S1
fitted_values_S1 <- predict(S1, newdata = NBA2)

# Calculate fitted values for Model S2
fitted_values_S2 <- predict(S2, newdata = NBA2)

# Calculate fitted values for Model S3
fitted_values_S3 <- predict(S3, newdata = NBA2)

# Calculate fitted values for Model S4
fitted_values_S4 <- predict(S4, newdata = NBA2)

# Display the fitted values for each model
print(fitted_values_S1)
```

```
##        1        2        3        4        5        6        7        8
## 22212518 21246175 19023587 10713042 15931291 14578412 16124560 18637050
##        9       10       11       12       13       14       15       16
##  6654403 13322167 11389482 10616408 17863976 10713042 12935630 22115883
##       17       18       19       20       21       22       23       24
## 19603393 19216856 19313490 12549093 19216856 25401448 23178860 11099579
##       25       26       27       28       29       30       31       32
## 11582750 12935630 14095241 15738023 16704365 21439444 16994268 16027926
##       33       34       35       36       37       38       39       40
## 15448120 13515435 17863976 10713042 16027926 22115883 15931291 16414463
##       41       42       43       44       45       46       47       48
##  8297186 19410124 24048568 13128898 14771680 18057245 12355824 17574074
##       49       50       51       52       53       54       55       56
## 21342809 16414463 23662031 10133236 21632712  8297186 14771680 16897634
##       57       58       59       60       61       62       63       64
## 16994268 19216856 13032264 15061583 16897634 18250513 11776019 15448120
##       65       66       67       68       69       70       71       72
## 17960611 13901972 22985592 16027926 14288509 20666370 16511097 18347148
##       73       74       75       76       77       78       79       80
## 18250513 12355824 20569735 11969287 21729346 13515435 13322167 18347148
##       81       82       83       84       85       86       87       88
## 14964949 14191875 21439444 13322167 11389482 20279833 23275494  7910649
##       89       90       91       92       93       94       95       96
## 16317828 21729346 21632712  7330843  8200551 23275494 14288509 20956272
##       97       98       99      100      101      102      103      104
## 16124560 15641389 16801000 11872653 21825981 20183198 17670708 11679384
```

```
##      105      106      107      108      109      110      111      112
## 21536078 20666370 21536078 17767342 21632712 16414463  9939968 14868315
##      113      114      115      116      117      118      119      120
## 24338471 19603393 19796661 16221194 11002945 23468763  8587088 18637050
##      121      122      123      124      125      126      127      128
## 21729346  9553431 12742361 15544754 20666370 15254852 22309152 20279833
##      129      130      131      132      133      134      135      136
##  8876991 11582750 21052907 17477439  8973625 16221194 23758666 14771680
##      137      138      139      140      141      142      143      144
## 17574074 24725008 11776019 10906310  8200551 11196213 25014911 12645727
##      145      146      147      148      149      150      151      152
## 19506759 17863976 22502420 11679384 19603393 12065921 12162556 17284171
##      153      154      155      156      157      158      159      160
## 20279833 15641389 24048568 22309152 18153879 15641389 13901972 16607731
##      161      162      163      164      165      166      167      168
## 15931291 20376467 19506759  8490454  7427477 14191875  7620746 23855300
##      169      170      171      172      173      174      175      176
## 16027926 16414463 18057245 14191875 14385143 21632712 19313490 22985592
##      177      178      179      180      181      182      183      184
##  8200551 17574074 12838995 26464424 23758666 13322167  7234209 11389482
##      185      186      187
## 13515435  8297186 16511097
```

```
print(fitted_values_S2)
```

```
##        1        2        3        4        5        6        7        8
## 22223758 21188095 19099002 10772176 15958220 14486264 16122496 18714185
##        9       10       11       12       13       14       15       16
##  6643615 13303546 11401012 10672081 17796110 10663238 12927110 22073385
##       17       18       19       20       21       22       23       24
## 19578662 19211802 19322671 12477649 19214196 25313799 23128937 11045661
##       25       26       27       28       29       30       31       32
## 11615567 12888802 14091136 15746059 16757781 21474476 17025743 15987685
##       33       34       35       36       37       38       39       40
## 15438592 13550423 17830827 10630916 16049935 22096130 15838509 16423977
##       41       42       43       44       45       46       47       48
##  8327268 19400020 24063309 13116525 14879189 17995103 12304993 17562864
##       49       50       51       52       53       54       55       56
## 21330088 16385670 23725180 10136891 21621993  8321283 14804968 16874172
##       57       58       59       60       61       62       63       64
## 17072430 19177086 13030796 15096872 16935225 18233600 11848078 15492463
##       65       66       67       68       69       70       71       72
## 17930921 13916086 22970646 16078666 14244638 20635411 16474991 18368411
##       73       74       75       76       77       78       79       80
## 18277893 12410339 20611931 11963273 21755607 13538452 13270027 18391156
##       81       82       83       84       85       86       87       88
## 14978821 14202005 21419409 13331080 11412983 20326012 23278113  7952029
##       89       90       91       92       93       94       95       96
## 16380147 21774761 21684243  7293999  8186472 23323604 14208725 20945272
##       97       98       99      100      101      102      103      104
## 16118905 15618431 16781260 11762621 21847322 20152894 17725209 11668974
##      105      106      107      108      109      110      111      112
## 21573374 20664142 21556614 17836078 21674666 16416795  9915153 14849995
##      113      114      115      116      117      118      119      120
## 24351622 19587042 19783640 16167524 10998239 23442389  8560514 18554969
```

```
##      121      122      123      124      125      126      127      128
## 21779549  9651245 12635940 15562629 20647382 15277908 22298714 20238623
##      129      130      131      132      133      134      135      136
##  8800943 11589230 21038184 17462770  8976456 16303994 23764222 14757083
##      137      138      139      140      141      142      143      144
## 17672999 24678977 11878006 10902932  8137390 11287015 25023554 12647176
##      145      146      147      148      149      150      151      152
## 19537226 17925398 22427077 11695311 19555917 11990344 12187405 17269763
##      153      154      155      156      157      158      159      160
## 20244609 15644767 24058520 22357372 18128717 15679484 13925663 16721133
##      161      162      163      164      165      166      167      168
## 15952234 20318367 19569548  8547809  7374940 14178063  7611043 23876287
##      169      170      171      172      173      174      175      176
## 16020007 16390458 17991511 14200808 14366281 21605233 19267604 23006560
##      177      178      179      180      181      182      183      184
##  8200837 17525754 12838986 26394490 23779784 13211369  7264534 11457276
##      185      186      187
## 13571971  8254245 16546817
```

```
print(fitted_values_S3)
```

```
##        1        2        3        4        5        6        7        8
## 21013774 17789829 39063446 12397587 10742856 17360441 19951144 13698415
##        9       10       11       12       13       14       15       16
##  5585065 12154432  8997857 18488682 12656060  8295162 15709278 21879023
##       17       18       19       20       21       22       23       24
## 17837811 12940004 13846924  9553759 25482057 23700616 15640997  8556526
##       25       26       27       28       29       30       31       32
##  8776776 10063535 16034354 13037978 10981955 13922048 35327922 25359592
##       33       34       35       36       37       38       39       40
## 11561249  9253587 12372430  8559231 15188234 24592030 12526122 15034922
##       41       42       43       44       45       46       47       48
##  7185350 14222462 19812336 19558696  9723376 16105143  9271482 22973517
##       49       50       51       52       53       54       55       56
## 14255255 15025800 23537350 11220857 21334705  6267974 13550683 14944836
##       57       58       59       60       61       62       63       64
## 18036624 17410839 14903370 19985947 11225112 22130309  7925851 18690311
##       65       66       67       68       69       70       71       72
## 14172605 17060008 27964016 10605255 20177183 17870812 23033758 13178842
##       73       74       75       76       77       78       79       80
## 14199259  9216043 15444695  8677585 20445335  9351391  9851541 12993016
##       81       82       83       84       85       86       87       88
## 10280161 13398255 20169611  9352743  8094822 13147734 41036081  9603091
##       89       90       91       92       93       94       95       96
## 12936118 30917907 29039489 11833114  6522939 23432471 15317110 22709953
##       97       98       99      100      101      102      103      104
## 15310142 17904605 11636562 15107091 14261655 16453458 13313963 13374079
##      105      106      107      108      109      110      111      112
## 25233736 16186666 16674159 14059837 36042724 12355817  7635508 18216448
##      113      114      115      116      117      118      119      120
## 23861246 39993741 18178112 23972724  8097526 27536836  6852766 38673011
##      121      122      123      124      125      126      127      128
## 15579384 14619252 14301652 31525098 13907896 55791001 15772251 18370996
##      129      130      131      132      133      134      135      136
##  7427778 15272750 19093235 13121026 10866439 17382190 23420627 16679684
```

```
##      137      138      139      140      141      142      143      144
## 23684189 20707394  8486575 11250667  6923933  8397389 27195462 11591905
##      145      146      147      148      149      150      151      152
## 25382225 15948034 18026865  8327522 18184683  9302851  8539308 20413145
##      153      154      155      156      157      158      159      160
## 26213365 11569677 33057256 20607543 15054727 22559290 16659672 19131434
##      161      162      163      164      165      166      167      168
## 29473132 15022908 16099562  7076414  6381643 10695028  6145563 17553820
##      169      170      171      172      173      174      175      176
## 11084492 15952957 36426321 10831294 12782717 20505351 17839839 23805493
##      177      178      179      180      181      182      183      184
##  6405575 16673808  9140956 17740342 21038834 14679028  5590788  7732949
##      185      186      187
##  9077541 10036600 11012649
```

```
print(fitted_values_S4)
```

```
##        1        2        3        4        5        6        7        8
## 15715702 13645499 39313308 17089804  7091935 13890086 23852521 17679858
##        9       10       11       12       13       14       15       16
##  3453601  8830746 14596840 22321253 18156612  5941934 11787374 16951414
##       17       18       19       20       21       22       23       24
## 22102571  9112744 18400184  7132052 28437319 18772795 20300281 14834259
##       25       26       27       28       29       30       31       32
##  5555303  7323581 11972273  9231633  7018138  9482982 36621243 20171548
##       33       34       35       36       37       38       39       40
## 16795180  5855667 17595958  6463922 19573332 27705526  9712039 19540000
##       41       42       43       44       45       46       47       48
##  4369874 18893231 14576741 23746342  5534402 21037293  6710678 17800708
##       49       50       51       52       53       54       55       56
## 10209940 11235029 25975704 16621397 24865868  3642358 18129205 19744321
##       57       58       59       60       61       62       63       64
## 21444106 13244846 11030918 14937887  7362181 25752531 13109476 22381280
##       65       66       67       68       69       70       71       72
## 10446418 12688472 30498620  6751635 15862330 13491485 26777086 17762614
##       73       74       75       76       77       78       79       80
## 18581135 14345098 10754825 14458828 15114556 14697892 15823149  8746392
##       81       82       83       84       85       86       87       88
##  6860355  9588821 15317376 14837172  5067798 17420926 41474133 14994522
##       89       90       91       92       93       94       95       96
## 17269362 32520110 30866091  8991812 12863549 26041602 20695585 26071696
##       97       98       99      100      101      102      103      104
## 11278085 22320365  8243801 12253253 18529970 12298154  8954044  9869092
##      105      106      107      108      109      110      111      112
## 27755007 20440122 20608045 18104120 36927380 17320820  5184417 22578324
##      113      114      115      116      117      118      119      120
## 18031868 40923388 22276684 19103291  5346357 30217586  4593411 40443548
##      121      122      123      124      125      126      127      128
## 19393257 10032566 20143128 33567305 18650331 54230135 11439696 22678401
##      129      130      131      132      133      134      135      136
##  5525132 19986695 14367798  9433183 16378500 12228988 17751690 21237697
##      137      138      139      140      141      142      143      144
## 26044614 24516784  4664075  8027934  5007301  4716622 29535806 16845814
##      145      146      147      148      149      150      151      152
## 19386174 19777472 13950020  5322867 13958363 15626492 14048888 24308080
```

```
##      153      154      155      156      157      158      159      160
## 20663646 16675233 34566767 15025377 11148618 17081120 12259082 22071656
##      161      162      163      164      165      166      167      168
## 31771648 19973424 11171837  4017933  4481778 16151834  3878509 21250534
##      169      170      171      172      173      174      175      176
##  7698946 11981878 38403078  7410340  9321345 15663452 22311491 17973016
##      177      178      179      180      181      182      183      184
##  3982658 21417025  6111151 22127762 15577275 11830375  3055095  4352481
##      185      186      187
## 14156572  7472267 15864313
```

```r
# Assuming you have defined your models as S1, S2, S3, S4 and you have your NBA2 data set loaded

# Calculate confidence and prediction intervals for Model S1
conf_int_S1 <- predict(S1, newdata = NBA2, interval = "confidence")
pred_int_S1 <- predict(S1, newdata = NBA2, interval = "prediction")

# Calculate confidence and prediction intervals for Model S2
conf_int_S2 = predict(S2, newdata = NBA2, interval = "confidence")
pred_int_S2 = predict(S2, newdata = NBA2, interval = "prediction")

# Calculate confidence and prediction intervals for Model S3
conf_int_S3 = predict(S3, newdata = NBA2, interval = "confidence")
pred_int_S3 = predict(S3, newdata = NBA2, interval = "prediction")

# Calculate confidence and prediction intervals for Model S4
conf_int_S4 = predict(S4, newdata = NBA2, interval = "confidence")
pred_int_S4 = predict(S4, newdata = NBA2, interval = "prediction")

# Display the intervals for each model
print("Model S1: Confidence Interval")
```

```
## [1] "Model S1: Confidence Interval"
```

```r
print(conf_int_S1)
```

```
##          fit      lwr      upr
## 1   22212518 19446233 24978802
## 2   21246175 18751555 23740795
## 3   19023587 17044190 21002984
## 4   10713042  7987689 13438395
## 5   15931291 14202682 17659901
## 6   14578412 12730576 16426248
## 7   16124560 14401603 17847516
## 8   18637050 16724759 20549342
## 9    6654403  2642257 10666550
## 10  13322167 11257077 15387256
## 11  11389482  8854450 13924513
## 12  10616408  7863060 13369756
## 13  17863976 16058771 19669181
## 14  10713042  7987689 13438395
## 15  12935630 10787573 15083686
## 16  22115883 19377678 24854088
## 17  19603393 17508787 21697999
## 18  19216856 17200891 21232821
```

```
## 19  19313490 17278534 21348447
## 20  12549093 10311885 14786301
## 21  19216856 17200891 21232821
## 22  25401448 21632538 29170358
## 23  23178860 20122669 26235051
## 24  11099579  8484253 13714905
## 25  11582750  9100085 14065415
## 26  12935630 10787573 15083686
## 27  14095241 12174380 16016101
## 28  15738023 14000797 17475249
## 29  16704365 14980373 18428358
## 30  21439444 18892236 23986652
## 31  16994268 15259659 18728877
## 32  16027926 14302515 17753336
## 33  15448120 13692513 17203727
## 34  13515435 11489270 15541600
## 35  17863976 16058771 19669181
## 36  10713042  7987689 13438395
## 37  16027926 14302515 17753336
## 38  22115883 19377678 24854088
## 39  15931291 14202682 17659901
## 40  16414463 14694370 18134556
## 41   8297186  4827569 11766802
## 42  19410124 17355722 21464527
## 43  24048568 20719795 27377341
## 44  13128898 11023145 15234651
## 45  14771680 12948899 16594461
## 46  18057245 16228923 19885567
## 47  12355824 10071945 14639703
## 48  17574074 15798637 19349511
## 49  21342809 18822015 23863604
## 50  16414463 14694370 18134556
## 51  23662031 20455580 26868483
## 52  10133236  7237271 13029202
## 53  21632712 19031990 24233435
## 54   8297186  4827569 11766802
## 55  14771680 12948899 16594461
## 56  16897634 15167304 18627964
## 57  16994268 15259659 18728877
## 58  19216856 17200891 21232821
## 59  13032264 10905558 15158969
## 60  15061583 13271615 16851551
## 61  16897634 15167304 18627964
## 62  18250513 16396569 20104458
## 63  11776019  9344719 14207319
## 64  15448120 13692513 17203727
## 65  17960611 16144166 19777055
## 66  13901972 11948027 15855917
## 67  22985592 19988592 25982591
## 68  16027926 14302515 17753336
## 69  14288509 12398573 16178445
## 70  20666370 18323333 23009406
## 71  16511097 14790455 18231739
## 72  18347148 16479484 20214811
```

```
## 73  18250513 16396569 20104458
## 74  12355824 10071945 14639703
## 75  20569735 18250973 22888498
## 76  11969287  9588287 14350288
## 77  21729346 19101537 24357156
## 78  13515435 11489270 15541600
## 79  13322167 11257077 15387256
## 80  18347148 16479484 20214811
## 81  14964949 13164695 16765203
## 82  14191875 12286753 16096996
## 83  21439444 18892236 23986652
## 84  13322167 11257077 15387256
## 85  11389482  8854450 13924513
## 86  20279833 18032011 22527654
## 87  23275494 20189504 26361484
## 88   7910649  4315369 11505928
## 89  16317828 14597532 18038124
## 90  21729346 19101537 24357156
## 91  21632712 19031990 24233435
## 92   7330843  3544636 11117050
## 93   8200551  4699651 11701452
## 94  23275494 20189504 26361484
## 95  14288509 12398573 16178445
## 96  20956272 18538664 23373881
## 97  16124560 14401603 17847516
## 98  15641389 13898756 17384021
## 99  16801000 15074210 18527789
## 100 11872653  9466640 14278666
## 101 21825981 19170873 24481088
## 102 20183198 17958363 22408034
## 103 17670708 15886018 19455398
## 104 11679384  9222531 14136238
## 105 21536078 18962225 24109931
## 106 20666370 18323333 23009406
## 107 21536078 18962225 24109931
## 108 17767342 15972726 19561958
## 109 21632712 19031990 24233435
## 110 16414463 14694370 18134556
## 111  9939968  6985817 12894118
## 112 14868315 13057119 16679510
## 113 24338471 20916856 27760086
## 114 19603393 17508787 21697999
## 115 19796661 17660186 21933137
## 116 16221194 14499943 17942445
## 117 11002945  8360417 13645472
## 118 23468763 20322788 26614737
## 119  8587088  5210765 11963412
## 120 18637050 16724759 20549342
## 121 21729346 19101537 24357156
## 122  9553431  6481162 12625700
## 123 12742361 10550456 14934266
## 124 15544754 13795993 17293516
## 125 20666370 18323333 23009406
## 126 15254852 13483441 17026262
```

```
## 127 22309152 19514607 25103697
## 128 20279833 18032011 22527654
## 129  8876991  5593065 12160917
## 130 11582750  9100085 14065415
## 131 21052907 18609887 23495926
## 132 17477439 15710571 19244307
## 133  8973625  5720286 12226965
## 134 16221194 14499943 17942445
## 135 23758666 20521800 26995531
## 136 14771680 12948899 16594461
## 137 17574074 15798637 19349511
## 138 24725008 21178276 28271740
## 139 11776019  9344719 14207319
## 140 10906310  8236373 13576248
## 141  8200551  4699651 11701452
## 142 11196213  8607875 13784551
## 143 25014911 21373432 28656390
## 144 12645727 10431347 14860107
## 145 19506759 17432469 21581048
## 146 17863976 16058771 19669181
## 147 22502420 19650833 25354008
## 148 11679384  9222531 14136238
## 149 19603393 17508787 21697999
## 150 12065921  9709650 14422193
## 151 12162556  9830720 14494391
## 152 17284171 15532349 19035992
## 153 20279833 18032011 22527654
## 154 15641389 13898756 17384021
## 155 24048568 20719795 27377341
## 156 22309152 19514607 25103697
## 157 18153879 16313053 19994706
## 158 15641389 13898756 17384021
## 159 13901972 11948027 15855917
## 160 16607731 14885789 18329673
## 161 15931291 14202682 17659901
## 162 20376467 18105322 22647612
## 163 19506759 17432469 21581048
## 164  8490454  5083129 11897779
## 165  7427477  3673279 11181676
## 166 14191875 12286753 16096996
## 167  7620746  3930346 11311146
## 168 23855300 20587907 27122692
## 169 16027926 14302515 17753336
## 170 16414463 14694370 18134556
## 171 18057245 16228923 19885567
## 172 14191875 12286753 16096996
## 173 14385143 12509825 16260461
## 174 21632712 19031990 24233435
## 175 19313490 17278534 21348447
## 176 22985592 19988592 25982591
## 177  8200551  4699651 11701452
## 178 17574074 15798637 19349511
## 179 12838995 10669202 15008789
## 180 26464424 22339497 30589352
```

```
## 181 23758666 20521800 26995531
## 182 13322167 11257077 15387256
## 183  7234209  3415923 11052495
## 184 11389482  8854450 13924513
## 185 13515435 11489270 15541600
## 186  8297186  4827569 11766802
## 187 16511097 14790455 18231739
```

```
print("Model S1: Prediction Interval")
```

```
## [1] "Model S1: Prediction Interval"
```

```
print(pred_int_S1)
```

```
##          fit          lwr      upr
## 1   22212518  -1471234.94 45896270
## 2   21246175  -2407385.60 44899736
## 3   19023587  -4581196.37 42628371
## 4   10713042 -12965964.66 34392048
## 5   15931291  -7653786.39 39516369
## 6   14578412  -9015703.91 38172528
## 7   16124560  -7460104.24 39709224
## 8   18637050  -4962200.94 42236302
## 9    6654403 -17206969.58 30515776
## 10  13322167 -10289957.28 36934291
## 11  11389482 -12268375.08 35047338
## 12  10616408 -13065837.31 34298653
## 13  17863976  -5726838.94 41454792
## 14  10713042 -12965964.66 34392048
## 15  12935630 -10683895.05 36555154
## 16  22115883  -1564605.86 45796372
## 17  19603393  -4011330.86 43218116
## 18  19216856  -4391022.44 42824734
## 19  19313490  -4296017.53 42922998
## 20  12549093 -11078706.68 36176892
## 21  19216856  -4391022.44 42824734
## 22  25401448   1579766.79 49223129
## 23  23178860   -540501.35 46898221
## 24  11099579 -12567016.34 34766174
## 25  11582750 -12069552.64 35235053
## 26  12935630 -10683895.05 36555154
## 27  14095241  -9504706.52 37695188
## 28  15738023  -7847687.96 39323734
## 29  16704365  -6880374.43 40289105
## 30  21439444  -2219721.05 45098608
## 31  16994268  -6591250.13 40579786
## 32  16027926  -7556917.88 39612769
## 33  15448120  -8138951.70 39035192
## 34  13515435 -10093316.35 37124187
## 35  17863976  -5726838.94 41454792
## 36  10713042 -12965964.66 34392048
## 37  16027926  -7556917.88 39612769
## 38  22115883  -1564605.86 45796372
## 39  15931291  -7653786.39 39516369
## 40  16414463  -7169992.46 39998918
```

```
## 41   8297186 -15478979.65 32073351
## 42  19410124  -4201067.30 43021316
## 43  24048568    292547.34 47804589
## 44  13128898 -10486816.88 36744613
## 45  14771680  -8820486.37 38363847
## 46  18057245  -5535350.68 41649840
## 47  12355824 -11276439.91 35988088
## 48  17574074  -6014482.48 41162630
## 49  21342809  -2313526.14 44999145
## 50  16414463  -7169992.46 39998918
## 51  23662031    -77158.49 47401221
## 52  10133236 -13566012.86 33832486
## 53  21632712  -2032273.87 45297698
## 54   8297186 -15478979.65 32073351
## 55  14771680  -8820486.37 38363847
## 56  16897634  -6687570.04 40482838
## 57  16994268  -6591250.13 40579786
## 58  19216856  -4391022.44 42824734
## 59  13032264 -10585328.65 36649856
## 60  15061583  -8528071.13 38651237
## 61  16897634  -6687570.04 40482838
## 62  18250513  -5344081.62 41845108
## 63  11776019 -11870947.76 35422985
## 64  15448120  -8138951.70 39035192
## 65  17960611  -5631067.41 41552289
## 66  13901972  -9700690.89 37504635
## 67  22985592   -726215.82 46697399
## 68  16027926  -7556917.88 39612769
## 69  14288509  -9308941.16 37885959
## 70  20666370  -2971684.98 44304424
## 71  16511097  -7073398.26 40095592
## 72  18347148  -5248529.29 41942824
## 73  18250513  -5344081.62 41845108
## 74  12355824 -11276439.91 35988088
## 75  20569735  -3065925.48 44205396
## 76  11969287 -11672560.58 35611135
## 77  21729346  -1938631.75 45397324
## 78  13515435 -10093316.35 37124187
## 79  13322167 -10289957.28 36934291
## 80  18347148  -5248529.29 41942824
## 81  14964949  -8625488.06 38555386
## 82  14191875  -9406796.46 37790546
## 83  21439444  -2219721.05 45098608
## 84  13322167 -10289957.28 36934291
## 85  11389482 -12268375.08 35047338
## 86  20279833  -3348974.09 43908639
## 87  23275494   -447725.02 46998714
## 88   7910649 -15884179.23 31705477
## 89  16317828  -7266641.53 39902298
## 90  21729346  -1938631.75 45397324
## 91  21632712  -2032273.87 45297698
## 92   7330843 -16493580.50 31155267
## 93   8200551 -15580199.30 31981302
## 94  23275494   -447725.02 46998714
```

```
## 95  14288509  -9308941.16 37885959
## 96  20956272  -2689290.32 44601835
## 97  16124560  -7460104.24 39709224
## 98  15641389  -7944721.02 39227498
## 99  16801000  -6783944.81 40385944
## 100 11872653 -11771726.95 35517033
## 101 21825981  -1845043.91 45497005
## 102 20183198  -3443432.71 43809829
## 103 17670708  -5918546.48 41259962
## 104 11679384 -11970222.99 35328992
## 105 21536078  -2125970.30 45198126
## 106 20666370  -2971684.98 44304424
## 107 21536078  -2125970.30 45198126
## 108 17767342  -5822665.30 41357349
## 109 21632712  -2032273.87 45297698
## 110 16414463  -7169992.46 39998918
## 111  9939968 -13766461.72 33646398
## 112 14868315  -8722959.81 38459589
## 113 24338471    569262.96 48107679
## 114 19603393  -4011330.86 43218116
## 115 19796661  -3821813.02 43415136
## 116 16221194  -7363345.45 39805734
## 117 11002945 -12666672.03 34672561
## 118 23468763   -262334.06 47199860
## 119  8587088 -15175642.06 32349819
## 120 18637050  -4962200.94 42236302
## 121 21729346  -1938631.75 45397324
## 122  9553431 -14168007.45 33274869
## 123 12742361 -10881191.68 36365914
## 124 15544754  -8041808.94 39131318
## 125 20666370  -2971684.98 44304424
## 126 15254852  -8333401.75 38843105
## 127 22309152  -1377918.19 45996222
## 128 20279833  -3348974.09 43908639
## 129  8876991 -14872787.20 32626770
## 130 11582750 -12069552.64 35235053
## 131 21052907  -2595267.67 44701081
## 132 17477439  -6110473.32 41065352
## 133  8973625 -14771942.98 32719194
## 134 16221194  -7363345.45 39805734
## 135 23758666     15348.59 47501982
## 136 14771680  -8820486.37 38363847
## 137 17574074  -6014482.48 41162630
## 138 24725008    937466.99 48512549
## 139 11776019 -11870947.76 35422985
## 140 10906310 -12766382.00 34579003
## 141  8200551 -15580199.30 31981302
## 142 11196213 -12467414.93 34859841
## 143 25014911   1213058.49 48816763
## 144 12645727 -10979921.89 36271376
## 145 19506759  -4106171.75 43119689
## 146 17863976  -5726838.94 41454792
## 147 22502420  -1191447.11 46196288
## 148 11679384 -11970222.99 35328992
```

```
## 149 19603393  -4011330.86 43218116
## 150 12065921 -11573448.68 35705291
## 151 12162556 -11474391.25 35799503
## 152 17284171  -6302619.51 40870961
## 153 20279833  -3348974.09 43908639
## 154 15641389  -7944721.02 39227498
## 155 24048568    292547.34 47804589
## 156 22309152  -1377918.19 45996222
## 157 18153879  -5439688.75 41747447
## 158 15641389  -7944721.02 39227498
## 159 13901972  -9700690.89 37504635
## 160 16607731  -6976858.92 40192321
## 161 15931291  -7653786.39 39516369
## 162 20376467  -3254570.02 44007504
## 163 19506759  -4106171.75 43119689
## 164  8490454 -15276701.00 32257609
## 165  7427477 -16391880.38 31246835
## 166 14191875  -9406796.46 37790546
## 167  7620746 -16188639.92 31430132
## 168 23855300    107801.90 47602798
## 169 16027926  -7556917.88 39612769
## 170 16414463  -7169992.46 39998918
## 171 18057245  -5535350.68 41649840
## 172 14191875  -9406796.46 37790546
## 173 14385143  -9211140.63 37981427
## 174 21632712  -2032273.87 45297698
## 175 19313490  -4296017.53 42922998
## 176 22985592   -726215.82 46697399
## 177  8200551 -15580199.30 31981302
## 178 17574074  -6014482.48 41162630
## 179 12838995 -10782516.06 36460507
## 180 26464424   2583829.20 50345020
## 181 23758666     15348.59 47501982
## 182 13322167 -10289957.28 36934291
## 183  7234209 -16595333.84 31063752
## 184 11389482 -12268375.08 35047338
## 185 13515435 -10093316.35 37124187
## 186  8297186 -15478979.65 32073351
## 187 16511097  -7073398.26 40095592
```

```
print("Model S2: Confidence Interval")
```

```
## [1] "Model S2: Confidence Interval"
```

```
print(conf_int_S2)
```

```
##          fit      lwr      upr
## 1   22223758 19417032 25030485
## 2   21188095 17848603 24527587
## 3   19099002 15607262 22590742
## 4   10772176  7230648 14313703
## 5   15958220 13944084 17972356
## 6   14486264 10517057 18455471
## 7   16122496 14393027 17851965
## 8   18714185 15205552 22222819
```

```
## 9    6643615  2599528 10687701
## 10  13303546 11114685 15492408
## 11  11401012  8821362 13980662
## 12  10672081  7190682 14153480
## 13  17796110 14640168 20952052
## 14  10663238  7336443 13990034
## 15  12927110 10748850 15105370
## 16  22073385 18885954 25260816
## 17  19578662 17276713 21880611
## 18  19211802 17181163 21242441
## 19  19322671 17252382 21392960
## 20  12477649  8950742 16004557
## 21  19214196 17190166 21238227
## 22  25313799 20270957 30356641
## 23  23128937 19522260 26735614
## 24  11045661  7714593 14376729
## 25  11615567  8829857 14401277
## 26  12888802 10092125 15685480
## 27  14091136 12158673 16023599
## 28  15746059 13977374 17514744
## 29  16757781 14087824 19427737
## 30  21474476 18592672 24356281
## 31  17025743 14913181 19138305
## 32  15987685 13676169 18299201
## 33  15438592 13641148 17236037
## 34  13550423 11120557 15980290
## 35  17830827 15623737 20037916
## 36  10630916  6476974 14784859
## 37  16049935 14127358 17972512
## 38  22096130 19249179 24943081
## 39  15838509 11901990 19775028
## 40  16423977 14661497 18186458
## 41   8327268  4664274 11990263
## 42  19400020 17304338 21495703
## 43  24063309 20678508 27448109
## 44  13116525 10953035 15280015
## 45  14879189 10394524 19363853
## 46  17995103 15001006 20989200
## 47  12304993  9305996 15303990
## 48  17562864 15732070 19393659
## 49  21330088 18756353 23903824
## 50  16385670 14341669 18429671
## 51  23725180 19709681 27740679
## 52  10136891  7229649 13044132
## 53  21621993 18982366 24261620
## 54   8321283  4723096 11919470
## 55  14804968 12580419 17029516
## 56  16874172 14922453 18825892
## 57  17072430 13624177 20520683
## 58  19177086 16650919 21703253
## 59  13030796 10897525 15164066
## 60  15096872 12854417 17339327
## 61  16935225 14685560 19184890
## 62  18233600 16266091 20201108
```

```
## 63  11848078  8176772 15519385
## 64  15492463 13052741 17932184
## 65  17930921 15786946 20074897
## 66  13916086 11884357 15947815
## 67  22970646 19911979 26029313
## 68  16078666 13484589 18672742
## 69  14244638 11717926 16771351
## 70  20635411 18006584 23264238
## 71  16474991 14268506 18681475
## 72  18368411 16327973 20408849
## 73  18277893 16146280 20409506
## 74  12410339  9318874 15501805
## 75  20611931 17785304 23438558
## 76  11963273  9564776 14361770
## 77  21755607 18937099 24574115
## 78  13538452 11325615 15751289
## 79  13270027 10400750 16139305
## 80  18391156 15877661 20904651
## 81  14978821 13097881 16859760
## 82  14202005 12253075 16150934
## 83  21419409 18753641 24085178
## 84  13331080 11232675 15429485
## 85  11412983  8717964 14108002
## 86  20326012 17466821 23185204
## 87  23278113 20182053 26374173
## 88   7952029  4017348 11886709
## 89  16380147 13445689 19314605
## 90  21774761 18622606 24926915
## 91  21684243 18420182 24948304
## 92   7293999  3246295 11341703
## 93   8186472  4635237 11737707
## 94  23323604 19727198 26920009
## 95  14208725 10627066 17790384
## 96  20945272 18485085 23405459
## 97  16118905 14377845 17859964
## 98  15618431 13664402 17572460
## 99  16781260 14893518 18669002
## 100 11762621  6926414 16598827
## 101 21847322 19063583 24631060
## 102 20152894 17640987 22664801
## 103 17725209 14984255 20466163
## 104 11668974  9173671 14164277
## 105 21573374 18627266 24519482
## 106 20664142 18313147 23015136
## 107 21556614 18859746 24253482
## 108 17836078 14658966 21013190
## 109 21674666 18616077 24733254
## 110 16416795 14689698 18143891
## 111  9915153  6805740 13024566
## 112 14849995 12904378 16795613
## 113 24351622 20884245 27818999
## 114 19587042 17396283 21777801
## 115 19783640 17584631 21982648
## 116 16167524 13491930 18843117
```

```
## 117 10998239  8342408 13654070
## 118 23442389 20131678 26753101
## 119  8560514  5026836 12094193
## 120 18554969 14887110 22222829
## 121 21779549 18523714 25035384
## 122  9651245  4816584 14485906
## 123 12635940  8024550 17247329
## 124 15562629 13681511 17443748
## 125 20647382 18189106 23105658
## 126 15277908 13296370 17259445
## 127 22298714 19468437 25128991
## 128 20238623 17491868 22985378
## 129  8800943  4415125 13186761
## 130 11589230  9087548 14090912
## 131 21038184 18525090 23551278
## 132 17462770 15605020 19320520
## 133  8976456  5712414 12240498
## 134 16303994 12708533 19899456
## 135 23764222 20511587 27016857
## 136 14757083 12846593 16667573
## 137 17672999 13505276 21840721
## 138 24678977 20713753 28644201
## 139 11878006  7291408 16464604
## 140 10902932  8222583 13583282
## 141  8137390  3881523 12393258
## 142 11287015  6962643 15611386
## 143 25023554 21357274 28689834
## 144 12647176 10426037 14868316
## 145 19537226 17155367 21919085
## 146 17925398 14967176 20883621
## 147 22427077 18375727 26478426
## 148 11695311  9158120 14232501
## 149 19555917 16784250 22327584
## 150 11990344  8265967 15714720
## 151 12187405  9664845 14709964
## 152 17269763 15429394 19110132
## 153 20244609 17621479 22867738
## 154 15644767 13892623 17396912
## 155 24058520 20699160 27417881
## 156 22357372 19006786 25707959
## 157 18128717 16048814 20208619
## 158 15679484 13408076 17950891
## 159 13925663 11768515 16082811
## 160 16721133 12069029 21373237
## 161 15952234 14044105 17860363
## 162 20318367 17142738 23493996
## 163 19569548 16399831 22739264
## 164  8547809  4492320 12603298
## 165  7374940  3111534 11638346
## 166 14178063 12196585 16159540
## 167  7611043  3892109 11329977
## 168 23876287 20503802 27248773
## 169 16020007 14263768 17776247
## 170 16390458 14438258 18342659
```

```
## 171 17991511 14888124 21094898
## 172 14200808 12260392 16141223
## 173 14366281 12353222 16379340
## 174 21605233 18795149 24415317
## 175 19267604 16580765 21954442
## 176 23006560 19897007 26116113
## 177  8200837  4690319 11711355
## 178 17525754 14965008 20086500
## 179 12838986 10663243 15014729
## 180 26394490 21474595 31314386
## 181 23779784 20435833 27123735
## 182 13211369  8510141 17912596
## 183  7264534  3265311 11263757
## 184 11457276  7833612 15080940
## 185 13571971 10611228 16532715
## 186  8254245  4409764 12098725
## 187 16546817 14349465 18744169
```

```
print("Model S2: Prediction Interval")
```

```
## [1] "Model S2: Prediction Interval"
```

```
print(pred_int_S2)
```

```
##          fit          lwr      upr
## 1   22223758  -1528801.48 45976318
## 2   21188095  -2633294.73 45009484
## 3   19099002  -4744207.71 42942211
## 4   10772176 -13078375.96 34622727
## 5   15958220  -7713770.56 39630210
## 6   14486264  -9431532.66 38404061
## 7   16122496  -7526974.45 39771967
## 8   18714185  -5131504.05 42559875
## 9    6643615 -17286722.45 30573951
## 10  13303546 -10383950.43 36991043
## 11  11401012 -12325786.97 35127811
## 12  10672081 -13169616.56 34513778
## 13  17796110  -6000241.49 41592462
## 14  10663238 -13156374.60 34482851
## 15  12927110 -10759409.83 36613629
## 16  22073385  -1727163.49 45873934
## 17  19578662  -4119552.39 43276876
## 18  19211802  -4461598.36 42885203
## 19  19322671  -4354163.60 42999505
## 20  12477649 -11370735.87 36326034
## 21  19214196  -4458638.15 42887031
## 22  25313799   1194581.61 49433016
## 23  23128937   -731375.59 46989249
## 24  11045661 -12774549.45 34865871
## 25  11615567 -12134518.92 35365653
## 26  12888802 -10862572.49 36640177
## 27  14091136  -9574045.16 37756317
## 28  15746059  -7906311.32 39398430
## 29  16757781  -6979006.29 40494568
## 30  21474476  -2287072.18 45236025
```

```
## 31  17025743  -6654825.25 40706311
## 32  15987685  -7711460.43 39686831
## 33  15438592  -8215946.17 39093131
## 34  13550423 -10160558.16 37261405
## 35  17830827  -5858361.53 41520015
## 36  10630916 -13318230.44 34580063
## 37  16049935  -7614441.16 39714311
## 38  22096130  -1661216.52 45853477
## 39  15838509  -8073884.99 39750902
## 40  16423977  -7227930.11 40075885
## 41   8327268 -15541621.75 32196159
## 42  19400020  -4279047.90 43079089
## 43  24063309    235525.20 47891092
## 44  13116525 -10568640.65 36801691
## 45  14879189  -9129530.93 38887908
## 46  17995103  -5780325.97 41770531
## 47  12304993 -11471052.95 36081039
## 48  17562864  -6094231.75 41219961
## 49  21330088  -2396068.08 45056245
## 50  16385670  -7288880.50 40060220
## 51  23725180   -200342.83 47650702
## 52  10136891 -13627756.15 33901538
## 53  21621993  -2111401.75 45355388
## 54   8321283 -15537747.74 32180313
## 55  14804968  -8885853.60 38495789
## 56  16874172  -6792589.18 40540934
## 57  17072430  -6764449.54 40909310
## 58  19177086  -4543957.81 42898129
## 59  13030796 -10651628.79 36713220
## 60  15096872  -8595637.30 38789381
## 61  16935225  -6757967.69 40628418
## 62  18233600  -5434469.00 41901669
## 63  11848078 -12022088.87 35718246
## 64  15492463  -8219530.95 39204456
## 65  17930921  -5752469.95 41614313
## 66  13916086  -9757407.94 37589580
## 67  22970646   -813000.05 46754293
## 68  16078666  -7649706.13 39807037
## 69  14244638  -9476463.52 37965740
## 70  20635411  -3096785.03 44367607
## 71  16474991  -7214141.30 40164122
## 72  18368411  -5305832.14 42042654
## 73  18277893  -5404382.35 41960168
## 74  12410339 -11377547.49 36198226
## 75  20611931  -3142988.43 44366851
## 76  11963273 -11744514.48 35671060
## 77  21755607  -1998348.20 45509562
## 78  13538452 -10151272.14 37228177
## 79  13270027 -10490005.21 37030060
## 80  18391156  -5328541.56 42110853
## 81  14978821  -8682209.11 38639850
## 82  14202005  -9464526.70 37868536
## 83  21419409  -2316907.13 45155726
## 84  13331080 -10348229.37 37010389
```

```
## 85  11412983 -12326636.14 35152602
## 86  20326012  -3432804.14 44084829
## 87  23278113   -510370.96 47066597
## 88   7952029 -15960062.31 31864120
## 89  16380147  -7387844.93 40148139
## 90  21774761  -2021089.24 45570610
## 91  21684243  -2126689.27 45495175
## 92   7293999 -16636949.67 31224948
## 93   8186472 -15665523.04 32038467
## 94  23323604   -535158.44 47182365
## 95  14208725  -9647818.69 38065268
## 96  20945272  -2768835.86 44659380
## 97  16118905  -7531416.22 39769226
## 98  15618431  -8048521.09 39285383
## 99  16781260  -6880311.12 40442832
## 100 11762621 -12314241.43 35839483
## 101 21847322  -1902532.81 45597176
## 102 20152894  -3566635.43 43872423
## 103 17725209  -6019668.80 41470087
## 104 11668974 -12048802.47 35386751
## 105 21573374  -2196058.92 45342807
## 106 20664142  -3038887.06 44367170
## 107 21556614  -2183214.71 45296444
## 108 17836078  -5963090.94 41635246
## 109 21674666  -2108970.42 45458302
## 110 16416795  -7232502.38 40066092
## 111  9915153 -13875072.40 33705379
## 112 14849995  -8816263.96 38516254
## 113 24351622    511968.00 48191276
## 114 19587042  -4100630.59 43274714
## 115 19783640  -3904796.83 43472076
## 116 16167524  -7569898.16 39904945
## 117 10998239 -12736963.56 34733441
## 118 23442389   -374982.51 47259761
## 119  8560514 -15288872.98 32409902
## 120 18554969  -5314667.96 42424607
## 121 21779549  -2030256.74 45589355
## 122  9651245 -14425306.47 33727797
## 123 12635940 -11396773.54 36668653
## 124 15562629  -8098414.46 39223673
## 125 20647382  -3066527.67 44361292
## 126 15277908  -8391331.50 38947147
## 127 22298714  -1456640.45 46054068
## 128 20238623  -3506924.86 43984171
## 129  8800943 -15189509.17 32791395
## 130 11589230 -12129218.27 35307679
## 131 21038184  -2681470.96 44757839
## 132 17462770  -6196427.82 41121967
## 133  8976456 -14834473.74 32787385
## 134 16303994  -7554625.27 40162614
## 135 23764222    -45146.86 47573590
## 136 14757083  -8906314.09 38420480
## 137 17672999  -6278541.93 41624539
## 138 24678977    761840.92 48596113
```

```
## 139 11878006 -12149962.40 35905975
## 140 10902932 -12835025.81 34640891
## 141  8137390 -15829645.45 32104426
## 142 11287015 -12692280.28 35266309
## 143 25023554   1154159.66 48892949
## 144 12647176 -11043324.85 36337678
## 145 19537226  -4168884.19 43243336
## 146 17925398  -5845539.00 41696336
## 147 22427077  -1504488.90 46358642
## 148 11695311 -12026909.50 35417531
## 149 19555917  -4192525.93 43304359
## 150 11990344 -11888043.46 35868731
## 151 12187405 -11533255.24 35908064
## 152 17269763  -6388076.19 40927602
## 153 20244609  -3486956.66 43976174
## 154 15644767  -8006372.09 39295907
## 155 24058520    234337.28 47882703
## 156 22357372  -1465575.04 46180320
## 157 18128717  -5548960.35 41806394
## 158 15679484  -8015783.37 39374751
## 159 13925663  -9758924.43 37610250
## 160 16721133  -7319425.75 40761692
## 161 15952234  -7710972.24 39615441
## 162 20318367  -3480603.67 44117338
## 163 19569548  -4228634.91 43367730
## 164  8547809 -15384457.73 32480075
## 165  7374940 -16593435.58 31343315
## 166 14178063  -9491171.47 37847297
## 167  7611043 -16266496.11 31488582
## 168 23876287     50250.24 47702325
## 169 16020007  -7631436.19 39671450
## 170 16390458  -7276342.94 40057259
## 171 17991511  -5797927.52 41780950
## 172 14200808  -9465024.21 37866640
## 173 14366281  -9305617.89 38038180
## 174 21605233  -2147723.61 45358190
## 175 19267604  -4471088.25 43006296
## 176 23006560   -783684.35 46796804
## 177  8200837 -15645129.50 32046804
## 178 17525754  -6198997.08 41250505
## 179 12838986 -10847302.13 36525274
## 180 26394490   2300678.42 50488302
## 181 23779784    -42230.92 47601799
## 182 13211369 -10838744.14 37261482
## 183  7264534 -16658262.26 31187330
## 184 11457276 -12405609.83 35320162
## 185 13571971 -10199280.07 37343223
## 186  8254245 -15643170.00 32151659
## 187 16546817  -7141465.66 40235100
```

```
print("Model S3: Confidence Interval")
```

```
## [1] "Model S3: Confidence Interval"
```

```r
print(conf_int_S3)
```

```
##          fit      lwr      upr
## 1   21013774 18606892 23420657
## 2   17789829 14836464 20743194
## 3   39063446 33516459 44610434
## 4   12397587  9357768 15437406
## 5   10742856  8636161 12849551
## 6   17360441 13913856 20807026
## 7   19951144 18226205 21676083
## 8   13698415 10487333 16909498
## 9    5585065  2132350  9037779
## 10  12154432 10271102 14037762
## 11   8997857  6729970 11265744
## 12  18488682 15002952 21974413
## 13  12656060  9710557 15601564
## 14   8295162  5408264 11182059
## 15  15709278 13742922 17675633
## 16  21879023 19164356 24593689
## 17  17837811 15835492 19840130
## 18  12940004 10669718 15210291
## 19  13846924 11665725 16028123
## 20   9553759  6473086 12634432
## 21  25482057 23216654 27747461
## 22  23700616 19389705 28011527
## 23  15640997 12102988 19179007
## 24   8556526  5660468 11452585
## 25   8776776  6312906 11240647
## 26  10063535  7591523 12535546
## 27  16034354 14326795 17741913
## 28  13037978 11403379 14672578
## 29  10981955  8335321 13628590
## 30  13922048 10895457 16948638
## 31  35327922 30673390 39982454
## 32  25359592 22408884 28310299
## 33  11561249  9780825 13341672
## 34   9253587  6952021 11555154
## 35  12372430 10098334 14646526
## 36   8559231  4988688 12129774
## 37  15188234 13538619 16837849
## 38  24592030 22098005 27086056
## 39  12526122  9085090 15967154
## 40  15034922 13499111 16570733
## 41   7185350  4054619 10316082
## 42  14222462 12063857 16381067
## 43  19812336 16762396 22862276
## 44  19558696 17175962 21941430
## 45   9723376  5717525 13729226
## 46  16105143 13517245 18693042
## 47   9271482  6620395 11922568
## 48  22973517 20963258 24983776
## 49  14255255 11506225 17004286
## 50  15025800 13256231 16795370
## 51  23537350 20117634 26957065
```

```
## 52  11220857  8732150 13709564
## 53  21334705 19085898 23583511
## 54   6267974  3166289  9369659
## 55  13550683 11633642 15467725
## 56  14944836 13222326 16667345
## 57  18036624 15091540 20981709
## 58  17410839 15220132 19601545
## 59  14903370 13034423 16772317
## 60  19985947 17758498 22213396
## 61  11225112  8887640 13562583
## 62  22130309 20221777 24038841
## 63   7925851  4666972 11184730
## 64  18690311 16481494 20899128
## 65  14172605 12145208 16200002
## 66  17060008 15179276 18940740
## 67  27964016 25108171 30819860
## 68  10605255  8050286 13160224
## 69  20177183 17614796 22739570
## 70  17870812 15540188 20201435
## 71  23033758 20605372 25462145
## 72  13178842 11057350 15300335
## 73  14199259 12147403 16251115
## 74   9216043  6478939 11953147
## 75  15444695 12749746 18139644
## 76   8677585  6494567 10860604
## 77  20445335 18025614 22865055
## 78   9351391  7226466 11476316
## 79   9851541  7279984 12423097
## 80  12993016 10506172 15479860
## 81  10280161  8335906 12224416
## 82  13398255 11727955 15068555
## 83  20169611 17880704 22458518
## 84   9352743  7336858 11368628
## 85   8094822  5671478 10518166
## 86  13147734 10187516 16107953
## 87  41036081 36106604 45965558
## 88   9603091  6230176 12976007
## 89  12936118 10309930 15562306
## 90  30917907 27482174 34353640
## 91  29039489 25768079 32310900
## 92  11833114  8225577 15440652
## 93   6522939  3473787  9572091
## 94  23432471 20369815 26495126
## 95  15317110 12256059 18378162
## 96  22709953 20574463 24845443
## 97  15310142 13815441 16804842
## 98  17904605 16156367 19652843
## 99  11636562  9626522 13646602
## 100 15107091 10914733 19299448
## 101 14261655 11297698 17225612
## 102 16453458 14145125 18761790
## 103 13313963 10760831 15867095
## 104 13374079 11211873 15536284
## 105 25233736 22582115 27885357
```

```
## 106 16186666 13925921 18447412
## 107 16674159 14107923 19240395
## 108 14059837 11213045 16906628
## 109 36042724 31783484 40301965
## 110 12355817 10603587 14108047
## 111  7635508  4934213 10336802
## 112 18216448 16381102 20051794
## 113 23861246 20906333 26816159
## 114 39993741 34856582 45130901
## 115 18178112 16268037 20088186
## 116 23972724 21049918 26895530
## 117  8097526  5735808 10459245
## 118 27536836 24558490 30515183
## 119  6852766  3817090  9888442
## 120 38673011 33014199 44331822
## 121 15579384 12448597 18710172
## 122 14619252 10340527 18897977
## 123 14301652 10355396 18247907
## 124 31525098 27452767 35597429
## 125 13907896 11284731 16531062
## 126 55791001 46139883 65442118
## 127 15772251 12917054 18627449
## 128 18370996 15991308 20750685
## 129  7427778  3679136 11176420
## 130 15272750 12973890 17571611
## 131 19093235 16905105 21281364
## 132 13121026 11239606 15002446
## 133 10866439  8051788 13681090
## 134 17382190 14310018 20454361
## 135 23420627 20649646 26191607
## 136 16679684 14991448 18367921
## 137 23684189 19865321 27503057
## 138 20707394 17204633 24210156
## 139  8486575  4500637 12472512
## 140 11250667  8966736 13534597
## 141  6923933  3288655 10559212
## 142  8397389  4653081 12141697
## 143 27195462 24032122 30358802
## 144 11591905  9684349 13499462
## 145 25382225 22934062 27830389
## 146 15948034 13386596 18509472
## 147 18026865 14425834 21627896
## 148  8327522  6027081 10627962
## 149 18184683 15802634 20566733
## 150  9302851  6069290 12536412
## 151  8539308  6227050 10851566
## 152 20413145 18681195 22145096
## 153 26213365 23577156 28849573
## 154 11569677  9797722 13341632
## 155 33057256 29502187 36612326
## 156 20607543 17724955 23490132
## 157 15054727 13142435 16967019
## 158 22559290 20040317 25078263
## 159 16659672 14714020 18605325
```

```
## 160 19131434 15129760 23133108
## 161 29473132 25909735 33036529
## 162 15022908 12047072 17998744
## 163 16099562 13280325 18918799
## 164  7076414  3605727 10547101
## 165  6381643  2743636 10019650
## 166 10695028  8820316 12569739
## 167  6145563  2960074  9331052
## 168 17553820 14321673 20785967
## 169 11084492  9193257 12975727
## 170 15952957 14287380 17618534
## 171 36426321 31358741 41493902
## 172 10831294  8999636 12662951
## 173 12782717 11028702 14536732
## 174 20505351 18098535 22912168
## 175 17839839 15527461 20152217
## 176 23805493 21150905 26460082
## 177  6405575  3386653  9424497
## 178 16673808 14484047 18863569
## 179  9140956  7095200 11186713
## 180 17740342 13084929 22395756
## 181 21038834 18119593 23958075
## 182 14679028 10660885 18697171
## 183  5590788  2162663  9018912
## 184  7732949  4525923 10939975
## 185  9077541  6344781 11810301
## 186 10036600  6736216 13336984
## 187 11012649  8735318 13289980
```

```
print("Model S3: Prediction Interval")
```

```
## [1] "Model S3: Prediction Interval"
```

```
print(pred_int_S3)
```

```
##          fit          lwr      upr
## 1   21013774    785093.11 41242456
## 2   17789829  -2511127.40 38090786
## 3   39063446  18226567.23 59900326
## 4   12397587  -7916126.97 32711301
## 5   10742856  -9452307.41 30938020
## 6   17360441  -3018111.70 37738994
## 7   19951144   -207771.59 40110060
## 8   13698415  -6641631.68 34038463
## 9    5585065 -14794525.81 25964655
## 10  12154432  -8018653.80 32327518
## 11   8997857 -11214757.49 29210471
## 12  18488682  -1896527.59 38873892
## 13  12656060  -7643753.95 32955875
## 14   8295162 -11996231.66 28586555
## 15  15709278  -4471728.70 35890284
## 16  21879023   1611416.19 42146630
## 17  17837811  -2346731.71 38022353
## 18  12940004  -7272879.29 33152888
## 19  13846924  -6356147.28 34049996
```

```
## 20   9553759 -10766108.34 29873627
## 21  25482057   5269721.42 45694393
## 22  23700616   3158210.43 44243021
## 23  15640997  -4753216.95 36035212
## 24   8556526 -11736172.43 28849225
## 25   8776776 -11458764.97 29012317
## 26  10063535 -10172999.48 30300069
## 27  16034354  -4123081.87 36191790
## 28  13037978  -7113408.26 33189365
## 29  10981955  -9276651.16 31240562
## 30  13922048  -6389690.70 34233786
## 31  35327922  14710668.78 55945175
## 32  25359592   5059021.57 45660162
## 33  11561249  -8602490.25 31724988
## 34   9253587 -10962833.54 29470008
## 35  12372430  -7840881.54 32585742
## 36   8559231 -11840652.62 28959114
## 37  15188234  -4964375.95 35340844
## 38  24592030   4352795.33 44831265
## 39  12526122  -7851492.48 32903736
## 40  15034922  -5108691.69 35178536
## 41   7185350 -13142166.52 27512867
## 42  14222462  -5978182.79 34423107
## 43  19812336   -502894.63 40127567
## 44  19558696   -667126.21 39784518
## 45   9723376 -10757183.68 30203935
## 46  16105143  -4145873.63 36356160
## 47   9271482 -10987707.15 29530670
## 48  22973517   2788185.28 43158848
## 49  14255255  -6016982.59 34527494
## 50  15025800  -5136983.12 35188584
## 51  23537350   3163324.15 43911375
## 52  11220857  -9017723.39 31459437
## 53  21334705   1124222.19 41545187
## 54   6267974 -14055089.45 26591038
## 55  13550683  -6625577.93 33726944
## 56  14944836  -5213872.35 35103544
## 57  18036624  -2263129.11 38336378
## 58  17410839  -2793261.32 37614939
## 59  14903370  -5268378.38 35075118
## 60  19985947   -222170.07 40194064
## 61  11225112  -8995428.40 31445652
## 62  22130309   1954854.43 42305763
## 63   7925851 -12421796.11 28273499
## 64  18690311  -1515760.99 38896383
## 65  14172605  -6014440.63 34359650
## 66  17060008  -3112835.81 37232851
## 67  27964016   7677016.92 48251014
## 68  10605255  -9641579.94 30852090
## 69  20177183    -70589.89 40424955
## 70  17870812  -2348938.12 38090561
## 71  23033758   2802507.21 43265010
## 72  13178842  -7017870.40 33375555
## 73  14199259  -5990257.73 34388775
```

```
## 74   9216043 -11054580.98 29486667
## 75  15444695  -4820279.94 35709670
## 76   8677585 -11525682.64 28880853
## 77  20445335    215121.68 40675547
## 78   9351391 -10845682.58 29548464
## 79   9851541 -10397394.53 30100476
## 80  12993016  -7245335.54 33231367
## 81  10280161  -9898703.76 30459026
## 82  13398255  -6756059.24 33552569
## 83  20169611    -45372.40 40384595
## 84   9352743 -10833149.50 29538636
## 85   8094822 -12135824.84 28325468
## 86  13147734  -7154220.33 33449689
## 87  41036081  20355021.39 61717140
## 88   9603091 -10763131.30 29969314
## 89  12936118  -7319827.53 33192064
## 90  30917907  10541186.43 51294627
## 91  29039489   8689831.17 49389148
## 92  11833114  -8573276.56 32239505
## 93   6522939 -13792173.26 26838052
## 94  23432471   3115327.02 43749614
## 95  15317110  -4999791.41 35634012
## 96  22709953   2511765.58 42908141
## 97  15310142  -4830379.61 35450663
## 98  17904605  -2256317.85 38065528
## 99  11636562  -8548747.59 31821872
## 100 15107091  -5410763.38 35624945
## 101 14261655  -6040844.95 34564155
## 102 16453458  -3763734.60 36670650
## 103 13313963  -6932640.11 33560567
## 104 13374079  -6826950.82 33575109
## 105 25233736   4974477.16 45492995
## 106 16186666  -4025147.89 36398481
## 107 16674159  -3574101.07 36922419
## 108 14059837  -6225889.51 34345563
## 109 36042724  15511099.95 56574349
## 110 12355817  -7805452.50 32517086
## 111  7635508 -12630312.28 27901328
## 112 18216448  -1952214.56 38385111
## 113 23861246   3560064.36 44162428
## 114 39993741  19262198.38 60725284
## 115 18178112  -1997488.77 38353712
## 116 23972724   3676190.60 44269257
## 117  8097526 -12125830.96 28320884
## 118 27536836   7232230.66 47841442
## 119  6852766 -13460328.03 27165860
## 120 38673011  17806084.59 59539937
## 121 15579384  -4748141.39 35906910
## 122 14619252  -5916423.12 35154927
## 123 14301652  -6167334.61 34770638
## 124 31525098  11031431.84 52018764
## 125 13907896  -6347657.68 34163450
## 126 55791001  33507586.73 78074414
## 127 15772251  -4514656.23 36059159
```

```
## 128 18370996  -1854467.49 38596460
## 129  7427778 -13004030.29 27859586
## 130 15272750  -4943362.60 35488863
## 131 19093235  -1110586.26 39297055
## 132 13121026  -7051881.81 33293934
## 133 10866439  -9414801.36 31147680
## 134 17382190  -2936390.43 37700770
## 135 23420627   3145400.45 43695853
## 136 16679684  -3476123.86 36835493
## 137 23684189   3239379.59 44128998
## 138 20707394    319265.46 41095524
## 139  8486575 -11990099.21 28963248
## 140 11250667  -8963754.04 31465087
## 141  6923933 -13487380.28 27335247
## 142  8397389 -12033624.61 28828402
## 143 27195462   6862897.54 47528027
## 144 11591905  -8583456.67 31767268
## 145 25382225   5148590.77 45615860
## 146 15948034  -4299618.21 36195687
## 147 18026865  -2378376.89 38432107
## 148  8327522 -11888771.21 28543814
## 149 18184683  -2041058.24 38410425
## 150  9302851 -11040756.91 29646459
## 151  8539308 -11678332.63 28756949
## 152 20413145    253628.39 40572662
## 153 26213365   5956117.44 46470612
## 154 11569677  -8593316.19 31732670
## 155 33057256  12660075.46 53454437
## 156 20607543    316762.72 40898324
## 157 15054727  -5121083.54 35230537
## 158 22559290   2316965.63 42801614
## 159 16659672  -3519327.33 36838672
## 160 19131434  -1348308.57 39611177
## 161 29473132   9074497.85 49871766
## 162 15022908  -5281329.92 35327145
## 163 16099562  -4182315.89 36381440
## 164  7076414 -13306228.61 27459057
## 165  6381643 -14030156.26 26793443
## 166 10695028  -9477255.64 30867311
## 167  6145563 -14190459.60 26481585
## 168 17553820  -2789562.82 37897204
## 169 11084492  -9089333.61 31258317
## 170 15952957  -4200965.91 36106880
## 171 36426321  15711910.05 57140733
## 172 10831294  -9337033.77 30999621
## 173 12782717  -7378707.74 32944141
## 174 20505351    276677.81 40734025
## 175 17839839  -2377815.58 38057494
## 176 23805493   3545846.20 44065141
## 177  6405575 -13905022.02 26716172
## 178 16673808  -3530189.66 36877806
## 179  9140956 -11047941.24 29329854
## 180 17740342  -2877110.14 38357795
## 181 21038834    742813.57 41334854
```

```
## 182 14679028  -5803938.98 35161995
## 183  5590788 -14784650.79 25966227
## 184  7732949 -12606457.93 28072356
## 185  9077541 -11192496.86 29347579
## 186 10036600 -10317736.36 30390936
## 187 11012649  -9201027.37 31226325
```

```
print("Model S4: Confidence Interval")
```

```
## [1] "Model S4: Confidence Interval"
```

```
print(pred_int_S4)
```

```
##          fit          lwr      upr
## 1   15715702  -2884724.93 34316128
## 2   13645499  -4989533.25 32280532
## 3   39313308  20236876.10 58389741
## 4   17089804  -1570773.99 35750381
## 5    7091935 -11435389.65 25619259
## 6   13890086  -4801102.27 32581275
## 7   23852521   5352837.36 42352205
## 8   17679858   -987071.62 36346787
## 9    3453601 -15217039.59 22124241
## 10   8830746  -9669804.43 27331296
## 11  14596840  -3998385.38 33192065
## 12  22321253   3616407.69 41026099
## 13  18156612   -514925.93 36828149
## 14   5941934 -12650882.37 24534750
## 15  11787374  -6732949.98 30307699
## 16  16951414  -1673607.01 35576435
## 17  22102571   3570906.05 40634236
## 18   9112744  -9434576.67 27660065
## 19  18400184   -155738.85 36956107
## 20   7132052 -11487751.02 25751854
## 21  28437319   9907580.59 46967057
## 22  18772795   -102879.52 37648469
## 23  20300281   1567133.90 39033428
## 24  14834259  -3857035.48 33525553
## 25   5555303 -13000396.09 24111003
## 26   7323581 -11224741.24 25871903
## 27  11972273  -6529763.94 30474309
## 28   9231633  -9259053.29 27722320
## 29   7018138 -11574011.07 25610288
## 30   9482982  -9169158.78 28135123
## 31  36621243  17741310.42 55501176
## 32  20171548   1508902.33 38834193
## 33  16795180  -1744100.28 35334461
## 34   5855667 -12685928.95 24397263
## 35  17595958   -988199.19 36180116
## 36   6463922 -12224846.28 25152690
## 37  19573332   1067805.35 38078858
## 38  27705526   9148424.42 46262628
## 39   9712039  -8966472.89 28390552
## 40  19540000   1039597.74 38040402
## 41   4369874 -14262852.34 23002600
```

```
## 42  18893231    336394.87 37450067
## 43  14576741  -4100691.55 33254174
## 44  23746342   5178871.52 42313813
## 45   5534402 -13265684.48 24334489
## 46  21037293   2427274.69 39647312
## 47   6710678 -11855622.39 25276978
## 48  17800708   -756420.76 36357837
## 49  10209940  -8396537.45 28816417
## 50  11235029  -7265725.66 29735783
## 51  25975704   7306132.49 44645276
## 52  16621397  -1991206.44 35234000
## 53  24865868   6327032.36 43404704
## 54   3642358 -14983326.75 22268043
## 55  18129205   -402918.81 36661329
## 56  19744321   1222223.85 38266419
## 57  21444106   2826167.76 40062043
## 58  13244846  -5302270.30 31791962
## 59  11030918  -7479836.40 29541671
## 60  14937887  -3636339.87 33512114
## 61   7362181 -11192925.39 25917287
## 62  25752531   7243816.45 44261245
## 63  13109476  -5595959.62 31814912
## 64  22381280   3843140.16 40919419
## 65  10446418  -8075095.15 28967931
## 66  12688472  -5835179.56 31212123
## 67  30498620  11907270.16 49089970
## 68   6751635 -11827281.53 25330551
## 69  15862330  -2728296.54 34452957
## 70  13491485  -5075177.69 32058147
## 71  26777086   8214820.51 45339351
## 72  17762614   -788311.08 36313538
## 73  18581135     42004.25 37120267
## 74  14345098  -4288497.14 32978693
## 75  10754825  -7861220.97 29370870
## 76  14458828  -4133856.50 33051512
## 77  15114556  -3488266.65 33717380
## 78  14697892  -3875209.35 33270994
## 79  15823149  -2817555.27 34463853
## 80   8746392  -9833950.65 27326736
## 81   6860355 -11647352.30 25368062
## 82   9588821  -8904607.32 28082250
## 83  15317376  -3257524.54 33892277
## 84  14837172  -3730047.69 33404392
## 85   5067798 -13479920.66 23615516
## 86  17420926  -1218133.93 36059986
## 87  41474133  22539987.66 60408279
## 88  14994522  -3734132.67 33723177
## 89  17269362  -1329183.31 35867908
## 90  32520110  13857764.38 51182456
## 91  30866091  12226300.55 49505882
## 92   8991812  -9713454.42 27697078
## 93  12863549  -5850411.10 31577509
## 94  26041602   7421579.23 44661625
## 95  20695585   2012281.63 39378887
```

```
## 96  26071696   7547469.46 44595923
## 97  11278085  -7207801.66 29763972
## 98  22320365   3806471.31 40834259
## 99   8243801 -10269262.49 26756865
## 100 12253253  -6554135.94 31060642
## 101 18529970   -109468.38 37169408
## 102 12298154  -6260659.14 30856967
## 103  8954044  -9636641.23 27544730
## 104  9869092  -8660574.19 28398759
## 105 27755007   9189222.30 46320792
## 106 20440122   1883837.53 38996406
## 107 20608045   2026025.58 39190063
## 108 18104120   -514649.77 36722891
## 109 36927380  18128355.80 55726404
## 110 17320820  -1208285.06 35849925
## 111  5184417 -13386362.70 23755196
## 112 22578324   4058732.90 41097915
## 113 18031868   -651595.76 36715331
## 114 40923388  21941129.07 59905647
## 115 22276684   3757200.03 40796168
## 116 19103291    453522.93 37753058
## 117  5346357 -13190094.00 23882808
## 118 30217586  11607939.84 48827233
## 119  4593411 -14018009.71 23204832
## 120 40443548  21330998.41 59556097
## 121 19393257    741512.95 38045001
## 122 10032566  -8827756.48 28892889
## 123 20143128   1306433.23 38979822
## 124 33567305  14793362.44 52341247
## 125 18650331     41454.76 37259207
## 126 54230135  33823175.95 74637094
## 127 11439696  -7187096.02 30066488
## 128 22678401   4108323.93 41248478
## 129  5525132 -13190640.45 24240904
## 130 19986695   1414577.57 38558812
## 131 14367798  -4193417.75 32929014
## 132  9433183  -9074593.01 27940958
## 133 16378500  -2276476.43 35033477
## 134 12228988  -6449045.34 30907020
## 135 17751690   -902841.45 36406221
## 136 21237697   2724779.05 39750616
## 137 26044614   7311366.97 44777860
## 138 24516784   5809778.61 43223789
## 139  4664075 -14124099.23 23452249
## 140  8027934 -10508483.79 26564353
## 141  5007301 -13689871.75 23704473
## 142  4716622 -14026804.90 23460049
## 143 29535806  10905503.05 48166109
## 144 16845814  -1704666.49 35396295
## 145 19386174    758559.90 38013789
## 146 19777472   1198345.01 38356600
## 147 13950020  -4778648.24 32678688
## 148  5322867 -13211338.99 23857074
## 149 13958363  -4609972.44 32526698
```

```
## 150 15626492  -3112781.11 34365766
## 151 14048888  -4548057.53 32645834
## 152 24308080   5807992.16 42808168
## 153 20663646   2029335.43 39297956
## 154 16675233  -1859532.96 35210000
## 155 34566767  15886523.25 53247010
## 156 15025377  -3640524.24 33691277
## 157 11148618  -7366603.00 29663839
## 158 17081120  -1537324.02 35699565
## 159 12259082  -6270924.96 30789088
## 160 22071656   3297687.81 40845625
## 161 31771648  13081465.53 50461831
## 162 19973424   1314343.76 38632504
## 163 11171837  -7466203.14 29809877
## 164  4017933 -14669290.45 22705156
## 165  4481778 -14215655.85 23179212
## 166 16151834  -2402112.17 34705781
## 167  3878509 -14753986.02 22511005
## 168 21250534   2586829.26 39914240
## 169  7698946 -10803481.53 26201373
## 170 11981878  -6514834.90 30478590
## 171 38403078  19427911.81 57378245
## 172  7410340 -11087760.46 25908440
## 173  9321345  -9171252.73 27813943
## 174 15663452  -2923647.75 34250551
## 175 22311491   3744383.85 40878597
## 176 17973016   -672725.43 36618758
## 177  3982658 -14628681.87 22593998
## 178 21417025   2855162.14 39978887
## 179  6111151 -12398449.13 24620752
## 180 22127762   3197865.18 41057658
## 181 15577275  -3089579.20 34244129
## 182 11830375  -6945030.19 30605779
## 183  3055095 -15617158.10 21727347
## 184  4352481 -14301168.13 23006131
## 185 14156572  -4475021.53 32788165
## 186  7472267 -11181104.76 26125639
## 187 15864313  -2709379.21 34438005
```

```
# Assuming you have defined your models as S1, S2, S3, S4 and you have your NBA2 data set loaded

# Calculate fitted values for each model
fitted_values_S1 <- predict(S1, newdata = NBA2)
fitted_values_S2 <- predict(S2, newdata = NBA2)
fitted_values_S3 <- predict(S3, newdata = NBA2)
fitted_values_S4 <- predict(S4, newdata = NBA2)

# Display the first 5 comparisons of actual and fitted values for each model

# Model S1
cat("Model S1: Actual vs. Fitted Values\n")
```

```
## Model S1: Actual vs. Fitted Values
```

```r
comparison_S1 <- data.frame(
    Actual = NBA2$Salary[1:5],
    Fitted = fitted_values_S1[1:5]
)
print(comparison_S1)
```

```
##     Actual   Fitted
## 1 22266182 22212518
## 2  5634257 21246175
## 3 10000000 19023587
## 4  9460000 10713042
## 5  3536280 15931291
```

```r
# Model S2
cat("\nModel S2: Actual vs. Fitted Values\n")
```

```
##
## Model S2: Actual vs. Fitted Values
```

```r
comparison_S2 <- data.frame(
    Actual = NBA2$Salary[1:5],
    Fitted = fitted_values_S2[1:5]
)
print(comparison_S2)
```

```
##     Actual   Fitted
## 1 22266182 22223758
## 2  5634257 21188095
## 3 10000000 19099002
## 4  9460000 10772176
## 5  3536280 15958220
```

```r
# Model S3
cat("\nModel S3: Actual vs. Fitted Values\n")
```

```
##
## Model S3: Actual vs. Fitted Values
```

```r
comparison_S3 <- data.frame(
    Actual = NBA2$Salary[1:5],
    Fitted = fitted_values_S3[1:5]
)
print(comparison_S3)
```

```
##     Actual   Fitted
## 1 22266182 21013774
## 2  5634257 17789829
## 3 10000000 39063446
## 4  9460000 12397587
## 5  3536280 10742856
```

```r
# Model S4
cat("\nModel S4: Actual vs. Fitted Values\n")
```

```
##
## Model S4: Actual vs. Fitted Values
```

```r
comparison_S4 <- data.frame(
    Actual = NBA2$Salary[1:5],
    Fitted = fitted_values_S4[1:5]
)
print(comparison_S4)
```

```
##     Actual   Fitted
## 1 22266182 15715702
## 2  5634257 13645499
## 3 10000000 39313308
## 4  9460000 17089804
## 5  3536280  7091935
```

```r
# Calculate residuals for each model
residuals_S1 <- residuals(S1)
residuals_S2 <- residuals(S2)
residuals_S3 <- residuals(S3)
residuals_S4 <- residuals(S4)

# Find the smallest and largest residuals for Model S1
smallest_residual_S1 <- min(residuals_S1, na.rm = TRUE)
largest_residual_S1 <- max(residuals_S1, na.rm = TRUE)

# Find the smallest and largest residuals for Model S2
smallest_residual_S2 <- min(residuals_S2, na.rm = TRUE)
largest_residual_S2 <- max(residuals(S2), na.rm = TRUE)

# Find the smallest and largest residuals for Model S3
smallest_residual_S3 <- min(residuals_S3, na.rm = TRUE)
largest_residual_S3 <- max(residuals_S3, na.rm = TRUE)

# Find the smallest and largest residuals for Model S4
smallest_residual_S4 <- min(residuals_S4, na.rm = TRUE)
largest_residual_S4 <- max(residuals_S4, na.rm = TRUE)

# Display the results
cat("Model S1: Smallest Residual:", smallest_residual_S1, "\n")
```

```
## Model S1: Smallest Residual: -20655989
```

```r
cat("Model S1: Largest Residual:", largest_residual_S1, "\n")
```

```
## Model S1: Largest Residual: 33858370
```

```r
cat("\n")
```

```r
cat("Model S2: Smallest Residual:", smallest_residual_S2, "\n")
```

```
## Model S2: Smallest Residual: -20586055
```

```r
cat("Model S2: Largest Residual:", largest_residual_S2, "\n")
```

```
## Model S2: Largest Residual: 33924104
```

```r
cat("\n")
```

```r
cat("Model S3: Smallest Residual:", smallest_residual_S3, "\n")
```

```
## Model S3: Smallest Residual: -29063446
```

```
cat("Model S3: Largest Residual:", largest_residual_S3, "\n")
```

```
## Model S3: Largest Residual: 24174879
```

```
cat("\n")
```

```
cat("Model S4: Smallest Residual:", smallest_residual_S4, "\n")
```

```
## Model S4: Smallest Residual: -29313308
```

```
cat("Model S4: Largest Residual:", largest_residual_S4, "\n")
```

```
## Model S4: Largest Residual: 21565748
```