# Final Presentation

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# Introduction

| Stat | Pts |
|---|---|
| PassYds | 0.04 |
| PassTD | 4.00 |
| PassInt | -1.00 |
| RushYds | 0.10 |
| RushTD | 6.00 |
| Rec | 1.00 |
| RecYds | 0.10 |
| RecTD | 6.00 |
| FL | -2.00 |

# Data

# Passing Analysis pt. 1

Models that were used: - Multiple Linear Regression (MLR) - LASSO - Principal Component Analysis/Regression - Tree - Bagging

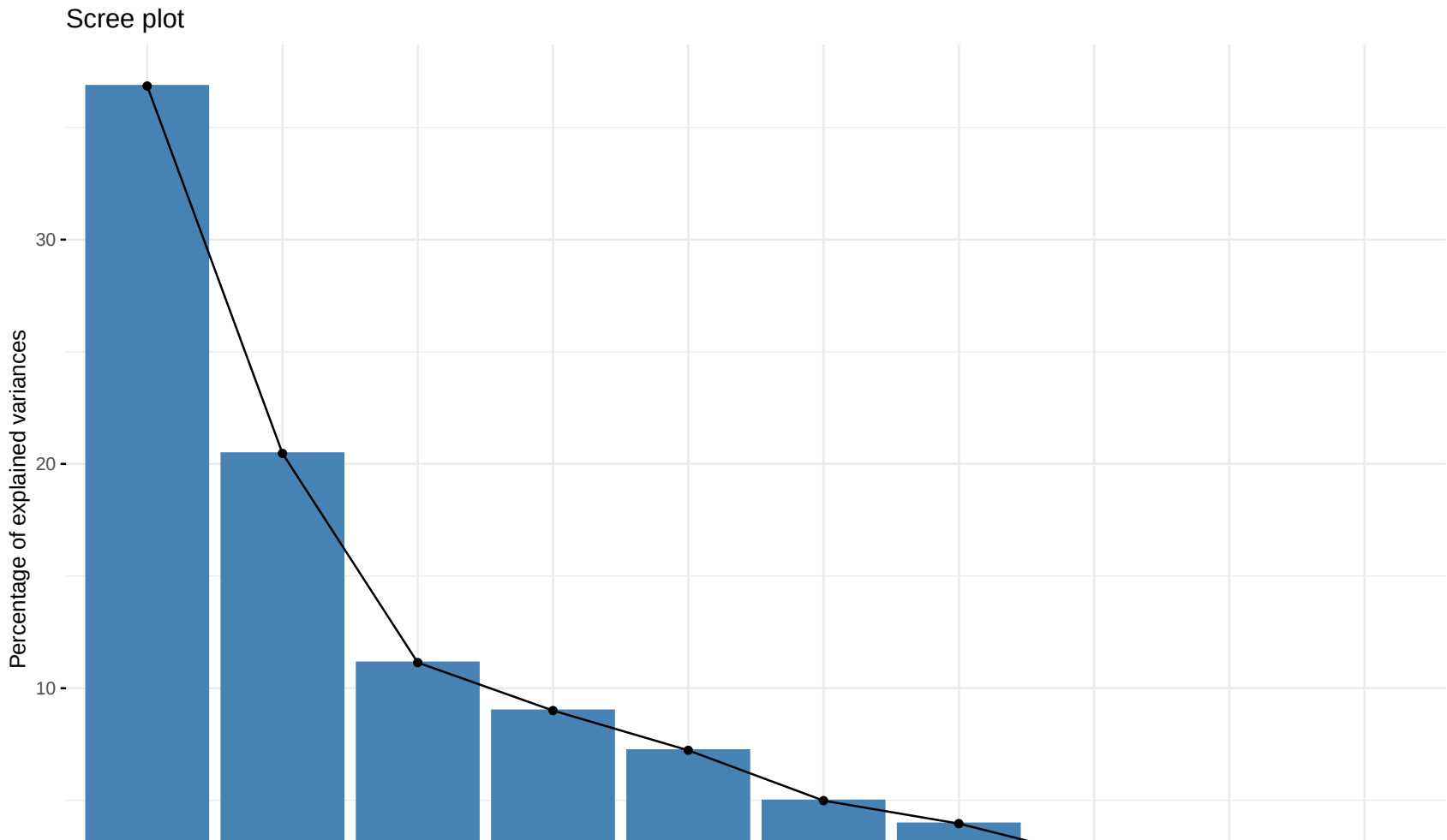
Predictors: `Cmp`, `PassAtt`, `Sk`, `YdsLost`, `PassLng`, `Rate`, `FirstDPass`, `FirstDPassPer`, `CAY`, `YACPerCmp`, `PassDrops`, `BadThrow`, `BadPer`

Dropped `PassYAC` (multicollinearity)

# Passing Analysis pt. 2

```
par(mfrow = c(2,2))

#Plot 1: Scree Plot
readRDS('../Plots/pcplot.rds')
```



# Passing Analysis pt. 3

```
readRDS('../Tables/master.rds')
```

```
## # A tibble: 4 x 6
##   Model       MLR   LASSO     PCR     Tree Bagging
##   <chr>     <dbl>   <dbl>   <dbl>    <dbl>   <dbl>
## 1 PassYds 420.    429.    691.    1641.    168.
## 2 PassInt   0.513   0.515   0.656    0.51    0.305
## 3 PassTD    0.374   0.647   0.788    0.609   0.468
## 4 FL        0.191   0.211   0.193    0.201   0.21
```

# Receiving Analysis pt. 1

Predictors: Tgt, RecLng, Fmb, FirstDRec, RecYBC, YBCPerR, RecYAC, YACPerR, ADOT, RecBrkTkl, RecPerBr, RecDrop, DropPerRec, RecInt, Rat

- Goal of simplicity and predictive accuracy
- Correlation matrix and VIF scores to identify multicollinearity (`FirstDRec`, `RecYBC`, `YBCPerR`, `YACPerR`, `DropPerRec`)
- `RecYAC` dropped

# Receiving Analysis pt. 2

- Dimension reduction techniques
  - Best Subset -> 3-5 predictors used with `Tgt` and `Rat` appearing most frequently
  - LASSO -> 5-10 predictors used but didn't perform better than best subset
  - PC regression -> 7-8 principal components used (sharp dropoff afterwards); excellent performance for `RecYds`
  - Pruned trees -> 2 terminal nodes used for `RecTD` and 6-7 otherwise. `Tgt` and `Rat`
  - Bagging and Random Forest -> 1-5 important variables with excellent predictive performance

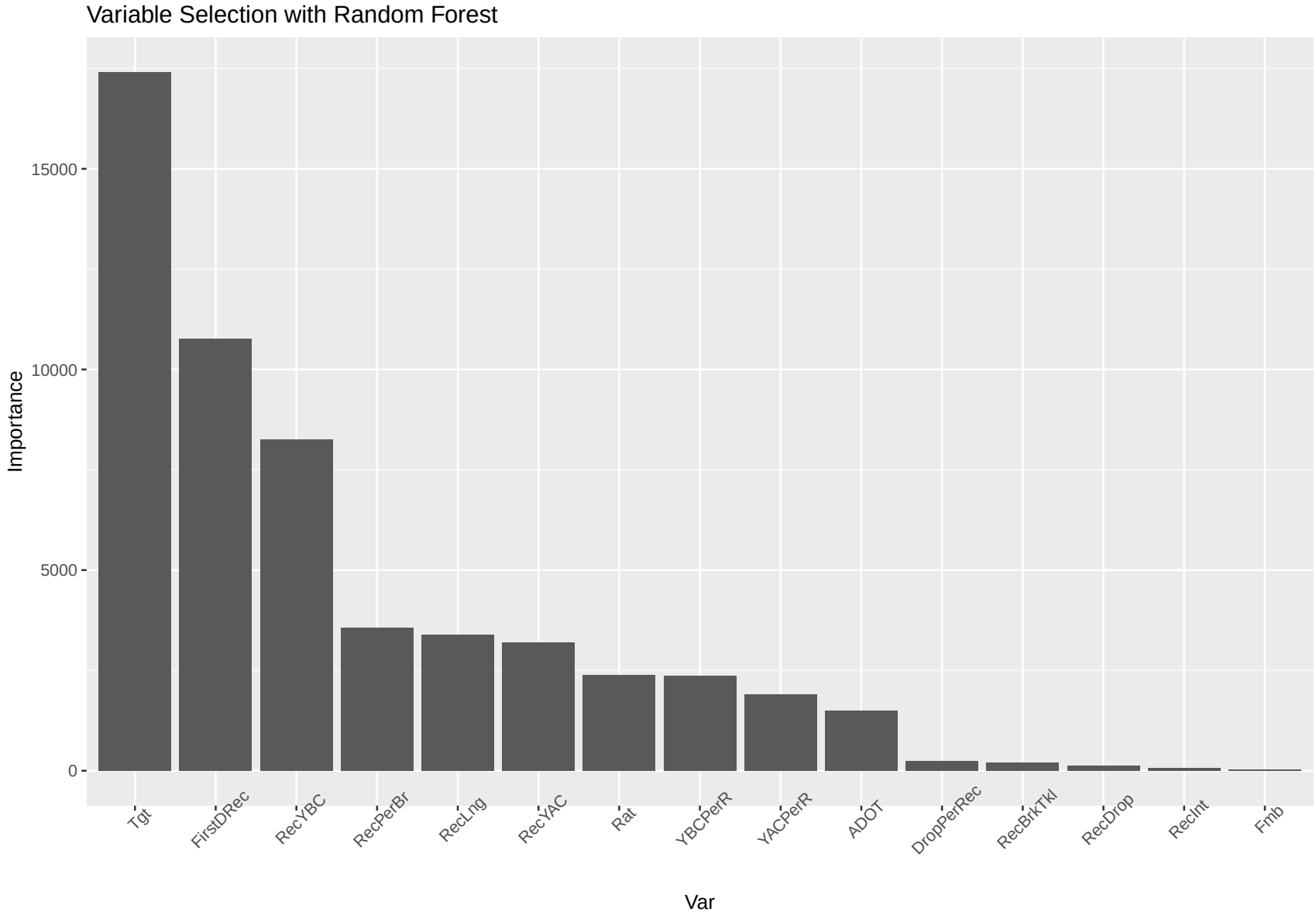
# Receiving Results

| Model | MLR | Subset | LASSO | PCR | Tree |
|---|---|---|---|---|---|
| Rec | 0.513 | 0.532 | 0.587 | 0.607 | 1.178 |
| RecYds | 64.832 | 71.766 | 84.867 | 47.466 | 191.374 |
| RecTD | 0.094 | 0.107 | 0.077 | 0.153 | 0.104 |

| Model | Boost | Bag | RF |
|---|---|---|---|
| Rec | 0.398 | 0.154 | 0.135 |
| RecYds | 50.249 | 17.797 | 22.757 |
| RecTD | 0.086 | 0.048 | 0.057 |

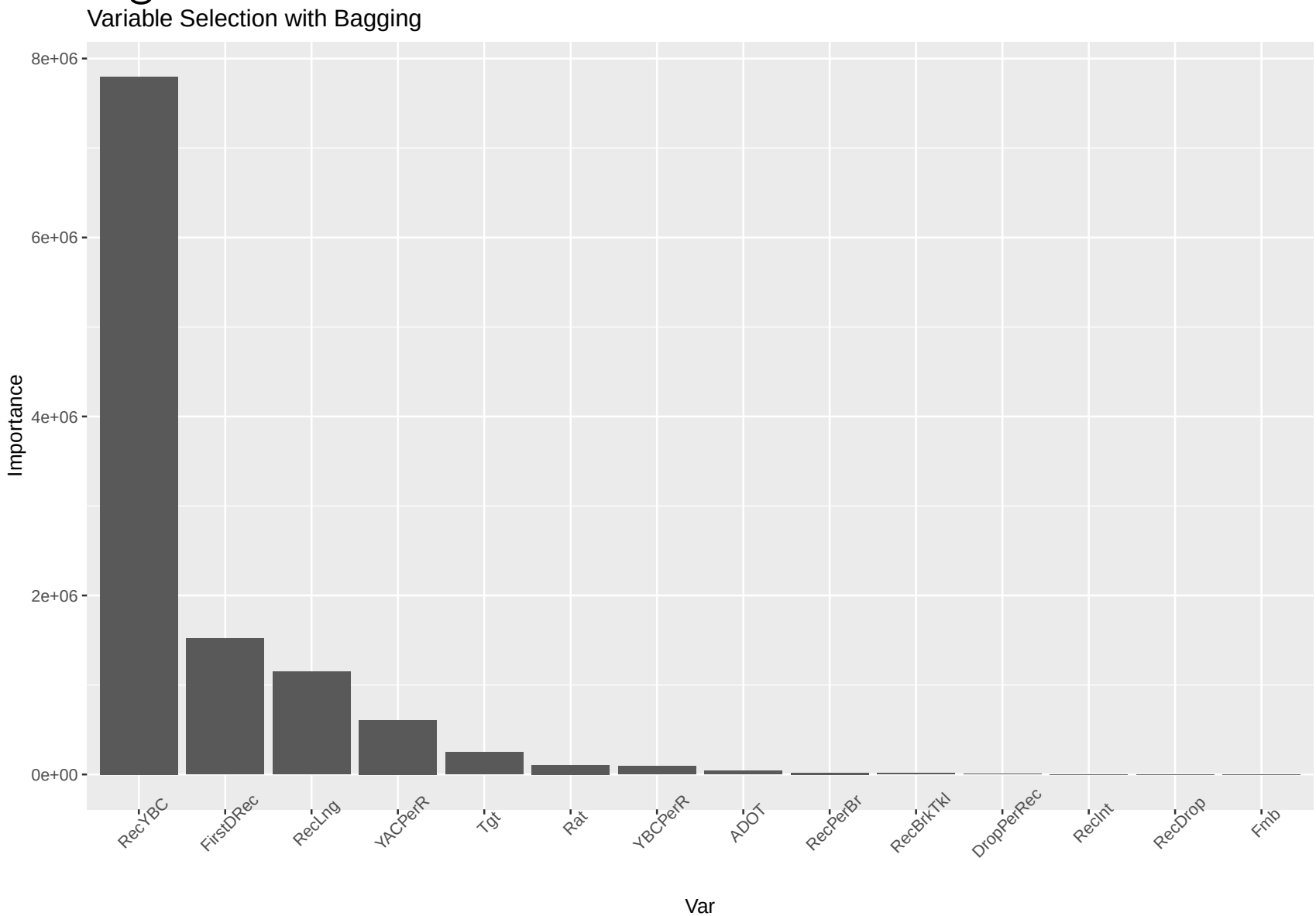
# Receptions Model

Rec: Random forest model chosen with `Tgt`, `FirstDRec`, `RecYAC`, `RecYBC`, `Rat`



# Receiving Yards Model

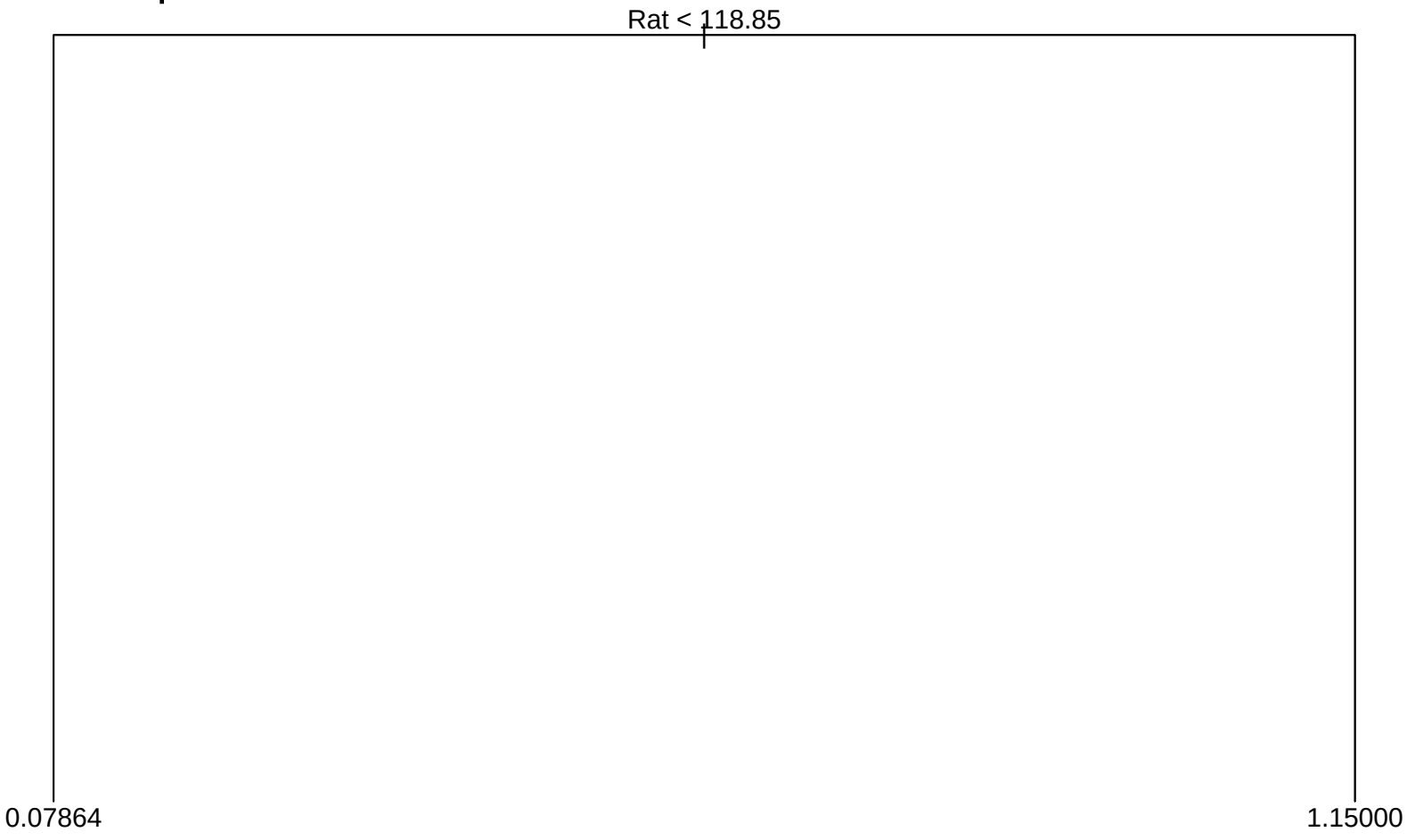
RecYds: Bagged tree model chosen with `RecYBC`, `FirstDRec`, `RecLng`, `YACPerR`



# Receiving TDs Model

RecTD: Tree model chosen with only `Rat` as a predictor

- QBR uses frequencies of completions, yards, touchdowns, and interceptions



# Rushing Analysis pt. 1

Rushing Predictors: RushYds, RushTD, FL -Started out with a number of predictors but determined that these 3 were the most important in this case. -When analyzing rushing data, we found that there are a lot of variables that are colinear. -One example of a predictor that I did not end up needing is 'FirstDRush'. This variable does not lead to fantasy points and relates closely with 'RushYds'.

# Rushing Analysis pt. 2

-Machine Learning Models: -The models I ended up using were Muliple Linear Regression, Lasso, PCR, Bagging, and Boosting -PCR ended up giving values that were not as useful for our rushing experimentation. -MLR provided the best MSE values for RushTD and FL (Fumbles lost) -Bagging gave the best value for RushYds -Thus these models were selected for final testing.

# Rushing Analysis pt. 3

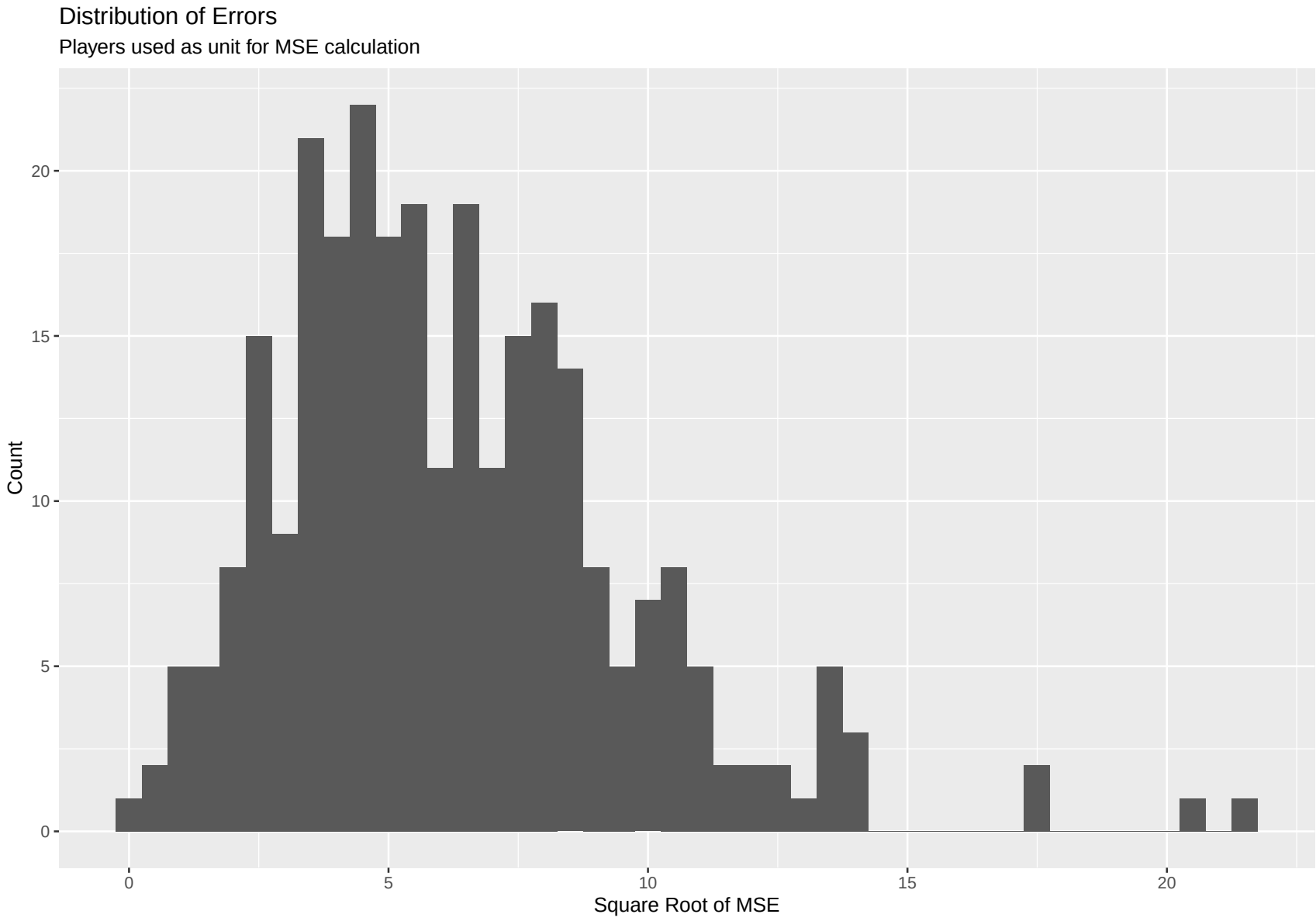
-Models: - Rush Yards Plot - Rush TDs Plot - Fumbles lost Plot

# Fumbles Analysis

# Results

| | Player | Pos | fanPts | MSE |
|---|---|---|---|---|
| 223 | Lamar Jackson | QB | 30.00 | 103.62164 |
| 65 | Christian McCaffrey | RB | 26.10 | 90.37000 |
| 222 | Kyler Murray | QB | 25.56 | 72.31625 |
| 282 | Patrick Mahomes | QB | 24.22 | 97.51247 |
| 307 | Russell Wilson | QB | 23.68 | 105.13337 |
| 192 | Josh Allen | QB | 22.50 | 70.22672 |
| 77 | Dak Prescott | QB | 22.46 | 71.10427 |
| 134 | Gardner Minshew II | QB | 21.84 | 457.96000 |
| 4 | Aaron Rodgers | QB | 21.42 | 66.35480 |
| 107 | Derek Carr | QB | 21.42 | 45.94648 |
| 308 | Ryan Fitzpatrick | QB | 21.28 | 422.71360 |

# MSE


Distribution of Errors
Players used as unit for MSE calculation
Count
0
5
10
15
20
Square Root of MSE

# Validation

| Stat | MSE |
|---|---|
| PassYds | 1647.63 |
| PassTD | 0.18 |
| PassInt | 0.98 |
| RushYds | 259.96 |
| RushTD | 0.12 |
| Rec | 3.84 |
| RecYds | 640.48 |
| RecTD | 0.20 |
| FL | 0.05 |
| fanPts | 50.29 |

# Future Efforts

- Refit Random Forest models with better subset of predictors
- Injuries
- Strength of opponent
- Assuming a Poisson distribution for Rec, TD, Int, FL