COMBINE SWING FINAL

2024-10-24

#Arizona

```
data <- read.csv("Voting Data - AZ.csv")
```

##Aggregate Total Percentage of Vote Shares and Average Vote Amount Across 2012, 2016, and 2020

```
data <- data %>%
  mutate(
    r12_r16_pct = rowSums(data[, c("r16_amt", "r12_amt")]) /
      rowSums(data[, c("r16_amt", "r12_amt", "d16_amt", "d12_amt",
                       "d20_amt", "o16_amt")]),
    d12_d16_pct = rowSums(data[, c("d16_amt", "d12_amt")]) /
      rowSums(data[, c("r16_amt", "r12_amt", "d16_amt", "d12_amt",
                       "d20_amt", "o16_amt")]),
    o16_o20_pct = rowSums(data[, c("o16_amt", "o20_amt")]) /
      rowSums(data[, c("r16_amt", "r20_amt", "r12_amt", "d16_amt", "d12_amt",
                       "d20_amt", "o16_amt", "o20_amt")])
  )


data <- data %>%
  mutate(
    r12_r16_amt = round(rowSums(data[, c("r16_amt", "r12_amt")])
                        / 2, 0),
    d12_d16_amt = round(rowSums(data[, c("d16_amt", "d12_amt")])
                        / 2, 0)
  )

data <- data %>%
  mutate(
    CAINC416_420 = round(rowMeans(data[, c("CAINC420", "CAINC416")]), 4)
  )
```

##Testing Models

```
#Republican
test1 <- lm(r20_amt ~ rreg20_pct + r12_r16_amt + CAINC416_420, data = data)
summary(test1)
```

```
##
## Call:
## lm(formula = r20_amt ~ rreg20_pct + r12_r16_amt + CAINC416_420,
##     data = data)
```

```
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -23269  -3105   1254   4184  15593
##
## Coefficients:
##                Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -2.916e+04  1.295e+04  -2.252   0.0458 *
## rreg20_pct    3.869e+04  2.500e+04   1.548   0.1499
## r12_r16_amt   2.281e+00  2.445e-02  93.268   <2e-16 ***
## CAINC416_420  2.308e+05  1.167e+05   1.978   0.0735 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 10020 on 11 degrees of freedom
## Multiple R-squared:  0.9987, Adjusted R-squared:  0.9984
## F-statistic:  2920 on 3 and 11 DF,  p-value: 3.097e-16
```

```
data$r1_predict <- predict(test1)
data$r1_error <- data$r20_amt - data$r1_predict
sum(data$r1_error)
```

```
## [1] 1.218723e-10
```

```
#Democrat
test2 <- lm(d20_amt ~ CAINC420 + dreg20_pct + d12_d16_amt, data = data)
summary(test2)
```

```
##
## Call:
## lm(formula = d20_amt ~ CAINC420 + dreg20_pct + d12_d16_amt, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -27338.6   -656.2   2005.8   3538.0   8523.2
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) -1.231e+03  1.210e+04  -0.102    0.921
## CAINC420     2.017e+04  7.542e+04   0.268    0.794
## dreg20_pct  -1.680e+04  2.248e+04  -0.747    0.471
## d12_d16_amt  1.588e+00  1.483e-02 107.127   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 9262 on 11 degrees of freedom
## Multiple R-squared:  0.9991, Adjusted R-squared:  0.9988
## F-statistic:  3896 on 3 and 11 DF,  p-value: < 2.2e-16
```

```
data$d2_predict <- predict(test2)
data$d2_error <- data$d20_amt - data$d2_predict
sum(data$d2_error)
```

```
## [1] 4.511094e-10
```

```
#Other
test3 <- lm(o20_amt ~ r12_r16_amt + o16_o20_pct + d12_d16_amt, data = data)
summary(test3)
```

```
##
## Call:
## lm(formula = o20_amt ~ r12_r16_amt + o16_o20_pct + d12_d16_amt,
##     data = data)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -303.7 -112.2   11.4  135.8  330.7
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) -6.172e+02  3.274e+02  -1.885   0.0861 .
## r12_r16_amt  5.939e-02  5.164e-03  11.501  1.8e-07 ***
## o16_o20_pct  1.701e+04  9.627e+03   1.767   0.1050
## d12_d16_amt  9.062e-03  3.365e-03   2.693   0.0209 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 228.6 on 11 degrees of freedom
## Multiple R-squared:  0.9994, Adjusted R-squared:  0.9992
## F-statistic:  5782 on 3 and 11 DF,  p-value: < 2.2e-16
```

```
data$o2_predict <- predict(test3)
data$o2_error <- data$o20_amt - data$o2_predict
sum(data$d2_error)
```

```
## [1] 4.511094e-10
```

##Testing with 24 registration details

```
#Republican
(test1_coeff <- test1$coefficients)
```

```
##   (Intercept)    rreg20_pct   r12_r16_amt  CAINC416_420
## -29161.937689  38694.171915      2.280545 230812.466919
```

```
data <- data %>%
  mutate(
    predict_r24_amt = round(test1_coeff["(Intercept)"] +
                      test1_coeff["rreg20_pct"] * rreg24_pct +
                      test1_coeff["r12_r16_amt"] * r12_r16_amt +
                      test1_coeff["CAINC416_420"] * CAINC422, 0)
  )
pr24_amt <- sum(data$predict_r24_amt)

#Democrats
(test2_coeff <- test2$coefficients)
```

```
##   (Intercept)      CAINC420    dreg20_pct   d12_d16_amt
##  -1230.596165  20174.854875 -16803.710868      1.588475
```

```
data <- data %>%
  mutate(
    predict_d24_amt = round(test2_coeff["(Intercept)"] +
                      test2_coeff["CAINC420"] * CAINC422 +
                      test2_coeff["dreg20_pct"] * dreg24_pct +
                      test2_coeff["d12_d16_amt"] * d12_d16_amt, 0)
  )
pd24_amt <- sum(data$predict_d24_amt)

#Other
(test3_coeff <- test3$coefficients)
```

```
##   (Intercept)   r12_r16_amt   o16_o20_pct   d12_d16_amt
## -6.171517e+02  5.938901e-02  1.700696e+04  9.061994e-03
```

```
data <- data %>%
  mutate(
    predict_o24_amt = round(test3_coeff["(Intercept)"] +
                      test3_coeff["r12_r16_amt"] * r12_r16_amt +
                      test3_coeff["o16_o20_pct"] * o16_o20_pct +
                      test3_coeff["d12_d16_amt"] * d12_d16_amt, 0)
  )
po24_amt <- sum(data$predict_o24_amt)
```

##Results

```
AZ24_Predict <- data.frame(
    Party = c("Democrats", "Republican", "Other"),
    `Predicted Vote Amount` = c(pd24_amt, pr24_amt, po24_amt),
    `Predict Vote Share` = c(pd24_amt / (pd24_amt + pr24_amt + po24_amt)*100, pr24_amt
                             / (pd24_amt + pr24_amt + po24_amt) *100, po24_amt / (pd24_amt + pr24_amt +
                                                                                   po24_amt)*100)
  )
AZ24_Predict
```

```
##        Party Predicted.Vote.Amount Predict.Vote.Share
## 1  Democrats               1648664          50.001638
## 2 Republican               1597090          48.437472
## 3      Other                 51466           1.560891
```

#Georgia

```
data <- read.csv("Voting Data - GA.csv")
```

##Testing Models

```r
#Republican
test1 <- lm(r20_amt ~ d12_amt + d16_amt + r16_amt + o16_amt + CAINC420, data = data)
summary(test1)
```

```
##
## Call:
## lm(formula = r20_amt ~ d12_amt + d16_amt + r16_amt + o16_amt +
##     CAINC420, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -6782.4  -263.4   -67.1   338.6  6712.6
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -10.25541  394.14126  -0.026    0.979
## d12_amt       -0.04587    0.05899  -0.778    0.438
## d16_amt        0.08331    0.06076   1.371    0.172
## r16_amt        1.26489    0.02022  62.549  < 2e-16 ***
## o16_amt       -1.66760    0.31677  -5.264 4.69e-07 ***
## CAINC420    -550.07901 3930.79705  -0.140    0.889
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1350 on 153 degrees of freedom
## Multiple R-squared:  0.9972, Adjusted R-squared:  0.9971
## F-statistic: 1.091e+04 on 5 and 153 DF,  p-value: < 2.2e-16
```

```r
data$r1_predict <- predict(test1)
data$r1_error <- data$r20_amt - data$r1_predict
sum(data$r1_error)
```

```
## [1] -2.733032e-10
```

```r
#Democrats
test2 <- lm(d20_amt ~ d12_amt + d16_amt + r16_amt + o16_amt + CAINC420, data = data)
summary(test2)
```

```
##
## Call:
## lm(formula = d20_amt ~ d12_amt + d16_amt + r16_amt + o16_amt +
##     CAINC420, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -5656.9  -420.0    18.4   341.9  7812.4
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) -1.185e+03  3.498e+02  -3.386 0.000901 ***
## d12_amt     -5.927e-01  5.235e-02 -11.321  < 2e-16 ***
## d16_amt      1.767e+00  5.392e-02  32.777  < 2e-16 ***
```

```
## r16_amt      1.659e-01  1.795e-02   9.247  < 2e-16 ***
## o16_amt     -3.230e-01  2.811e-01  -1.149 0.252441
## CAINC420     6.684e+03  3.489e+03   1.916 0.057221 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1198 on 153 degrees of freedom
## Multiple R-squared:  0.9994, Adjusted R-squared:  0.9994
## F-statistic: 4.957e+04 on 5 and 153 DF,  p-value: < 2.2e-16
```

```
data$d2_predict <- predict(test2)
data$d2_error <- data$d20_amt - data$d2_predict
sum(data$d2_error)
```

```
## [1] -7.77618e-11
```

```
#Other
test3 <- lm(o20_amt ~ d12_amt + d16_amt + o16_amt + r12_amt, data = data)
summary(test3)
```

```
##
## Call:
## lm(formula = o20_amt ~ d12_amt + d16_amt + o16_amt + r12_amt,
##     data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -120.279  -28.759    0.722   14.072  194.724
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) -2.383e+01  6.203e+00  -3.842 0.000178 ***
## d12_amt      1.052e-02  2.184e-03   4.818 3.44e-06 ***
## d16_amt     -6.702e-03  2.229e-03  -3.007 0.003078 **
## o16_amt      2.251e-01  1.326e-02  16.974  < 2e-16 ***
## r12_amt      1.281e-02  8.881e-04  14.420  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 51.18 on 154 degrees of freedom
## Multiple R-squared:  0.9971, Adjusted R-squared:  0.9971
## F-statistic: 1.342e+04 on 4 and 154 DF,  p-value: < 2.2e-16
```

```
data$o2_predict <- predict(test3)
data$o2_error <- data$o20_amt - data$o2_predict
sum(data$d2_error)
```

```
## [1] -7.77618e-11
```

##Testing with updated CAINC4 data

```r
#Republican
(test1_coeff <- test1$coefficients)
```

```
##   (Intercept)       d12_amt       d16_amt       r16_amt       o16_amt
##  -10.25541271   -0.04587459    0.08331385    1.26488842   -1.66760388
##      CAINC420
## -550.07900584
```

```r
data <- data %>%
  mutate(
    predict_r24_amt = round(test1_coeff["(Intercept)"] +
                      test1_coeff["d12_amt"] * d12_amt +
                      test1_coeff["d16_amt"] * d16_amt +
                      test1_coeff["r16_amt"] * r16_amt +
                      test1_coeff["o16_amt"] * o16_amt +
                      test1_coeff["CAINC420"] * CAINC422, 0)
  )
pr24_amt <- sum(data$predict_r24_amt)

#Democrats
(test2_coeff <- test2$coefficients)
```

```
##   (Intercept)       d12_amt       d16_amt       r16_amt       o16_amt
## -1184.5180816    -0.5926818     1.7674793     0.1659541    -0.3229652
##      CAINC420
##  6684.4172436
```

```r
data <- data %>%
  mutate(
    predict_d24_amt = round(test2_coeff["(Intercept)"] +
                      test2_coeff["d12_amt"] * d12_amt +
                      test2_coeff["d16_amt"] * d16_amt +
                      test2_coeff["r16_amt"] * r16_amt +
                      test2_coeff["o16_amt"] * o16_amt +
                      test2_coeff["CAINC420"] * CAINC422, 0)
  )
pd24_amt <- sum(data$predict_d24_amt)

#Other
(test3_coeff <- test3$coefficients)
```

```
##   (Intercept)       d12_amt       d16_amt       o16_amt       r12_amt
## -23.834538725   0.010521074  -0.006702317   0.225089322   0.012805550
```

```r
data <- data %>%
  mutate(
    predict_o24_amt = round(test3_coeff["(Intercept)"] +
                      test3_coeff["d12_amt"] * d12_amt +
                      test3_coeff["d16_amt"] * d16_amt +
                      test3_coeff["r12_amt"] * r12_amt +
                      test3_coeff["o16_amt"] * o16_amt, 0)
  )
po24_amt <- sum(data$predict_o24_amt)
```

##Results

```
GA24_Predict <- data.frame(
    Party = c("Democrats", "Republican", "Other"),
    `Predicted Vote Amount` = c(pd24_amt, pr24_amt, po24_amt),
    `Predict Vote Share` = c(pd24_amt / (pd24_amt + pr24_amt + po24_amt)*100, pr24_amt
                             / (pd24_amt + pr24_amt + po24_amt) *100, po24_amt / (pd24_amt + pr24_amt +
                                                                                   po24_amt)*100)
  )
GA24_Predict
```

```
##        Party Predicted.Vote.Amount Predict.Vote.Share
## 1  Democrats               2388833          48.554957
## 2 Republican               2468882          50.182018
## 3      Other                 62139           1.263025
```

#Florida

```
data <- read.csv("Voting Data - FL.csv")
```

Aggregate Total Percentage of Vote Shares and Average Vote Amount Across 2012, 2016, and 2020

```
data <- data %>%
  mutate(
    r12_r20_pct = rowSums(data[, c("r16_amt", "r20_amt", "r12_amt")]) /
      rowSums(data[, c("r16_amt", "r20_amt", "r12_amt", "d16_amt", "d12_amt",
                       "d20_amt", "o16_amt", "o20_amt")]),
    d12_d20_pct = rowSums(data[, c("d16_amt", "d20_amt", "d12_amt")]) /
      rowSums(data[, c("r16_amt", "r20_amt", "r12_amt", "d16_amt", "d12_amt",
                       "d20_amt", "o16_amt", "o20_amt")]),
    o16_o20_pct = rowSums(data[, c("o16_amt", "o20_amt")]) /
      rowSums(data[, c("r16_amt", "r20_amt", "r12_amt", "d16_amt", "d12_amt",
                       "d20_amt", "o16_amt", "o20_amt")])
  )

data <- data %>%
  mutate(
    r12_r20_amt = round(rowSums(data[, c("r16_amt", "r20_amt", "r12_amt")])
                        / 3, 0),
    d12_d20_amt = round(rowSums(data[, c("d16_amt", "d20_amt", "d12_amt")])
                        / 3, 0)
  )

data <- data %>%
  mutate(
    CAINC416_420 = round(rowMeans(data[, c("CAINC420", "CAINC416")]), 4)
  )
```

Testing Models

```
#Republican
test1 <- lm(r20_amt ~ r12_r20_pct + rreg20_pct + r12_r20_amt + d12_d20_amt + oreg20_pct + o16_o20_pct, d
summary(test1)
```

```
##
## Call:
## lm(formula = r20_amt ~ r12_r20_pct + rreg20_pct + r12_r20_amt +
##     d12_d20_amt + oreg20_pct + o16_o20_pct, data = data)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -21064  -2378     35   2348  40727
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) -1.245e+04  1.008e+04  -1.235  0.22162
## r12_r20_pct  2.784e+04  2.179e+04   1.278  0.20619
## rreg20_pct  -1.077e+04  2.359e+04  -0.457  0.64956
## r12_r20_amt  1.141e+00  3.739e-02  30.502  < 2e-16 ***
## d12_d20_amt  5.331e-02  2.551e-02   2.090  0.04090 *
## oreg20_pct   5.720e+04  2.417e+04   2.366  0.02121 *
## o16_o20_pct -1.045e+06  3.132e+05  -3.338  0.00145 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 7546 on 60 degrees of freedom
## Multiple R-squared:  0.9953, Adjusted R-squared:  0.9948
## F-statistic:  2115 on 6 and 60 DF,  p-value: < 2.2e-16
```

```
data$r1_predict <- predict(test1)
data$r1_error <- data$r20_amt - data$r1_predict
sum(data$r1_error)
```

```
## [1] 7.70342e-10
```

```
##summary(lm(r20_amt ~ rreg20_pct + d16_amt + r16_amt, data = data))


#Democrat
test2 <- lm(d20_amt ~ d12_d20_pct + dreg20_pct + d12_d20_amt + CAINC420 + o16_o20_pct, data = data)
summary(test2)
```

```
##
## Call:
## lm(formula = d20_amt ~ d12_d20_pct + dreg20_pct + d12_d20_amt +
##     CAINC420 + o16_o20_pct, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
```

```
## -31461.8  -1992.1   -131.9   1661.2  22842.3
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) -1.720e+04  6.276e+03  -2.741  0.00803 **
## d12_d20_pct  2.360e+04  1.181e+04   1.998  0.05015 .
## dreg20_pct  -1.675e+04  1.226e+04  -1.366  0.17691
## d12_d20_amt  1.096e+00  9.329e-03 117.518  < 2e-16 ***
## CAINC420     9.292e+04  4.122e+04   2.254  0.02778 *
## o16_o20_pct  6.660e+05  2.509e+05   2.654  0.01012 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 6527 on 61 degrees of freedom
## Multiple R-squared:  0.9978, Adjusted R-squared:  0.9976
## F-statistic:  5570 on 5 and 61 DF,  p-value: < 2.2e-16
```

```
data$d2_predict <- predict(test2)
data$d2_error <- data$d20_amt - data$d2_predict
sum(data$d2_error)
```

```
## [1] -4.780532e-09
```

```
#Other
test3 <- lm(o20_amt ~ o16_o20_pct + d12_d20_amt + r12_r20_amt, data = data)
summary(test3)
```

```
##
## Call:
## lm(formula = o20_amt ~ o16_o20_pct + d12_d20_amt + r12_r20_amt,
##     data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1845.35  -298.61   -60.64   166.37  2127.10
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) -1.509e+03  2.704e+02  -5.583 5.36e-07 ***
## o16_o20_pct  1.299e+05  2.237e+04   5.804 2.28e-07 ***
## d12_d20_amt  3.440e-03  1.739e-03   1.978   0.0523 .
## r12_r20_amt  1.554e-02  2.531e-03   6.138 6.18e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 576.9 on 63 degrees of freedom
## Multiple R-squared:  0.9197, Adjusted R-squared:  0.9159
## F-statistic: 240.4 on 3 and 63 DF,  p-value: < 2.2e-16
```

```
data$o2_predict <- predict(test3)
data$o2_error <- data$o20_amt - data$o2_predict
sum(data$d2_error)
```

```
## [1] -4.780532e-09
```

Testing with 24 registration details

```
#Republican
(test1_coeff <- test1$coefficients)
```

```
##   (Intercept)   r12_r20_pct    rreg20_pct   r12_r20_amt   d12_d20_amt
## -1.245331e+04  2.784172e+04 -1.077349e+04  1.140535e+00  5.330701e-02
##    oreg20_pct   o16_o20_pct
##  5.720480e+04 -1.045384e+06
```

```
data <- data %>%
  mutate(
    predict_r24_amt = round(test1_coeff["(Intercept)"] +
                      test1_coeff["r12_r20_pct"] * r12_r20_pct +
                      test1_coeff["rreg20_pct"] * rreg24_pct +
                      test1_coeff["r12_r20_amt"] * r12_r20_amt +
                      test1_coeff["d12_d20_amt"] * d12_d20_amt +
                      test1_coeff["oreg20_pct"] * oreg24_pct +
                      test1_coeff["o16_o20_pct"] * o16_o20_pct  , 0)
  )
pr24_amt <- sum(data$predict_r24_amt)

#Democrats
(test2_coeff <- test2$coefficients)
```

```
##   (Intercept)   d12_d20_pct    dreg20_pct   d12_d20_amt      CAINC420
## -17200.385599  23600.809964 -16749.117222      1.096356  92923.743912
##   o16_o20_pct
## 665976.602955
```

```
data <- data %>%
  mutate(
    predict_d24_amt = round(test2_coeff["(Intercept)"] +
                      test2_coeff["d12_d20_pct"] * d12_d20_pct +
                      test2_coeff["dreg20_pct"] * dreg24_pct +
                      test2_coeff["d12_d20_amt"] * d12_d20_amt +
                      test2_coeff["CAINC420"] * CAINC422 +
                      test2_coeff["o16_o20_pct"] * o16_o20_pct, 0)
  )
pd24_amt <- sum(data$predict_d24_amt)

#Other
(test3_coeff <- test3$coefficients)
```

```
##   (Intercept)   o16_o20_pct   d12_d20_amt   r12_r20_amt
## -1.509423e+03  1.298659e+05  3.439571e-03  1.553705e-02
```

```
data <- data %>%
  mutate(
    predict_o24_amt = round(test3_coeff["(Intercept)"] +
                      test3_coeff["o16_o20_pct"] * o20_pct +
```

```
                    test3_coeff["d12_d20_amt"] * (d16_amt + d20_amt)/2 +
                    test3_coeff["r12_r20_amt"] * (r16_amt + r20_amt)/2, 0)
  )
po24_amt <- sum(data$predict_o24_amt)
```

Results

```
FL24_Predict <- data.frame(
    Party = c("Democrats", "Republican", "Other"),
    `Predicted Vote Amount` = c(pd24_amt, pr24_amt, po24_amt),
    `Predict Vote Share` = c(pd24_amt / (pd24_amt + pr24_amt + po24_amt)*100, pr24_amt
                             / (pd24_amt + pr24_amt + po24_amt) *100, po24_amt / (pd24_amt + pr24_amt +
                                                                                   po24_amt)*100)
  )

FL24_Predict
```

```
##        Party Predicted.Vote.Amount Predict.Vote.Share
## 1  Democrats               5040368         46.7990662
## 2 Republican               5656163         52.5166310
## 3      Other                 73701          0.6843028
```

#Michigan

```
data <- read.csv("Voting Data - MI.csv")
```

##Testing Models

```
#Republican
test1 <- lm(r20_amt ~ d12_amt + d16_amt + r16_amt + o16_amt + CAINC420, data = data)
summary(test1)
```

```
##
## Call:
## lm(formula = r20_amt ~ d12_amt + d16_amt + r16_amt + o16_amt +
##     CAINC420, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -2767.5  -308.2  -129.2   196.8  2963.9
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  6.512e+02  4.893e+02   1.331   0.1871
## d12_amt      1.802e-01  2.079e-02   8.665 5.32e-13 ***
## d16_amt     -2.064e-01  2.610e-02  -7.908 1.53e-11 ***
## r16_amt      1.182e+00  9.952e-03 118.737  < 2e-16 ***
## o16_amt     -2.227e-01  1.242e-01  -1.793   0.0769 .
## CAINC420    -4.081e+03  4.315e+03  -0.946   0.3473
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 797.7 on 77 degrees of freedom
## Multiple R-squared:  0.9998, Adjusted R-squared:  0.9998
## F-statistic: 8.05e+04 on 5 and 77 DF,  p-value: < 2.2e-16
```

```
data$r1_predict <- predict(test1)
data$r1_error <- data$r20_amt - data$r1_predict
sum(data$r1_error)
```

```
## [1] 1.166427e-09
```

```
#Democrats
test2 <- lm(d20_amt ~ d12_amt + d16_amt + r16_amt + o16_amt + CAINC420, data = data)
summary(test2)
```

```
##
## Call:
## lm(formula = d20_amt ~ d12_amt + d16_amt + r16_amt + o16_amt +
##     CAINC420, data = data)
##
## Residuals:
##    Min     1Q Median     3Q    Max
##  -2628   -272    120    306   2464
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) -6.722e+02  4.038e+02  -1.664   0.1001
## d12_amt     -3.978e-01  1.716e-02 -23.179   <2e-16 ***
## d16_amt      1.528e+00  2.154e-02  70.902   <2e-16 ***
## r16_amt      1.387e-01  8.214e-03  16.883   <2e-16 ***
## o16_amt      3.071e-01  1.025e-01   2.994   0.0037 **
## CAINC420     2.416e+03  3.562e+03   0.678   0.4995
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 658.5 on 77 degrees of freedom
## Multiple R-squared:  0.9999, Adjusted R-squared:  0.9999
## F-statistic: 2.836e+05 on 5 and 77 DF,  p-value: < 2.2e-16
```

```
data$d2_predict <- predict(test2)
data$d2_error <- data$d20_amt - data$d2_predict
sum(data$d2_error)
```

```
## [1] 9.761152e-10
```

```
#Other
test3 <- lm(o20_amt ~ d12_amt + d16_amt + o16_amt + r12_amt, data = data)
summary(test3)
```

```
##
## Call:
## lm(formula = o20_amt ~ d12_amt + d16_amt + o16_amt + r12_amt,
##     data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -262.57  -18.37    8.39   31.46  209.98
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) -28.293019  10.458893  -2.705  0.00838 **
## d12_amt       0.017231   0.001653  10.425  < 2e-16 ***
## d16_amt      -0.019432   0.002079  -9.346 2.30e-14 ***
## o16_amt       0.405148   0.011986  33.802  < 2e-16 ***
## r12_amt      -0.006617   0.001073  -6.164 2.91e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 73.05 on 78 degrees of freedom
## Multiple R-squared:  0.9986, Adjusted R-squared:  0.9986
## F-statistic: 1.436e+04 on 4 and 78 DF,  p-value: < 2.2e-16
```

```
data$o2_predict <- predict(test3)
data$o2_error <- data$o20_amt - data$o2_predict
sum(data$d2_error)
```

```
## [1] 9.761152e-10
```

##Testing with updated CAINC4 data

```
#Republican
(test1_coeff <- test1$coefficients)
```

```
##   (Intercept)       d12_amt       d16_amt       r16_amt       o16_amt
##   651.2326843     0.1801656    -0.2063961     1.1816493    -0.2227481
##      CAINC420
## -4080.5231769
```

```
data <- data %>%
  mutate(
    predict_r24_amt = round(test1_coeff["(Intercept)"] +
                      test1_coeff["d12_amt"] * d12_amt +
                      test1_coeff["d16_amt"] * d16_amt +
                      test1_coeff["r16_amt"] * r16_amt +
                      test1_coeff["o16_amt"] * o16_amt +
                      test1_coeff["CAINC420"] * CAINC422, 0)
  )
pr24_amt <- sum(data$predict_r24_amt)

#Democrats
(test2_coeff <- test2$coefficients)
```

```
##  (Intercept)      d12_amt      d16_amt      r16_amt      o16_amt     CAINC420
## -672.1507279   -0.3978340    1.5275528    0.1386883    0.3070610 2416.4913259
```

```
data <- data %>%
  mutate(
    predict_d24_amt = round(test2_coeff["(Intercept)"] +
                      test2_coeff["d12_amt"] * d12_amt +
                      test2_coeff["d16_amt"] * d16_amt +
                      test2_coeff["r16_amt"] * r16_amt +
                      test2_coeff["o16_amt"] * o16_amt +
                      test2_coeff["CAINC420"] * CAINC422, 0)
  )
pd24_amt <- sum(data$predict_d24_amt)

#Other
(test3_coeff <- test3$coefficients)
```

```
##  (Intercept)      d12_amt      d16_amt      o16_amt      r12_amt
## -28.29301911   0.01723082  -0.01943169   0.40514803  -0.00661687
```

```
data <- data %>%
  mutate(
    predict_o24_amt = round(test3_coeff["(Intercept)"] +
                      test3_coeff["d12_amt"] * d12_amt +
                      test3_coeff["d16_amt"] * d16_amt +
                      test3_coeff["r12_amt"] * r12_amt +
                      test3_coeff["o16_amt"] * o16_amt, 0)
  )
po24_amt <- sum(data$predict_o24_amt)
```

##Results

```
MI24_Predict <- data.frame(
    Party = c("Democrats", "Republican", "Other"),
    `Predicted Vote Amount` = c(pd24_amt, pr24_amt, po24_amt),
    `Predict Vote Share` = c(pd24_amt / (pd24_amt + pr24_amt + po24_amt)*100, pr24_amt
                             / (pd24_amt + pr24_amt + po24_amt) *100, po24_amt / (pd24_amt + pr24_amt +
                                                                                   po24_amt)*100)
  )
MI24_Predict
```

```
##        Party Predicted.Vote.Amount Predict.Vote.Share
## 1  Democrats               2782086          50.087786
## 2 Republican               2686928          48.374592
## 3      Other                 85406           1.537622
```

#North Carolina

```
data <- read.csv("Voting Data - NC.csv")
```

Aggregate Total Percentage of Vote Shares and Average Vote Amount Across 2012, 2016, and 2020

```
data <- data %>%
  mutate(
    r12_r20_pct = rowSums(data[, c("r16_amt", "r20_amt", "r12_amt")]) /
      rowSums(data[, c("r16_amt", "r20_amt", "r12_amt", "d16_amt", "d12_amt",
                       "d20_amt", "o16_amt", "o20_amt")]),
    d12_d20_pct = rowSums(data[, c("d16_amt", "d20_amt", "d12_amt")]) /
      rowSums(data[, c("r16_amt", "r20_amt", "r12_amt", "d16_amt", "d12_amt",
                       "d20_amt", "o16_amt", "o20_amt")]),
    o16_o20_pct = rowSums(data[, c("o16_amt", "o20_amt")]) /
      rowSums(data[, c("r16_amt", "r20_amt", "r12_amt", "d16_amt", "d12_amt",
                       "d20_amt", "o16_amt", "o20_amt")])
  )

data <- data %>%
  mutate(
    r12_r20_amt = round(rowSums(data[, c("r16_amt", "r20_amt", "r12_amt")])
                        / 3, 0),
    d12_d20_amt = round(rowSums(data[, c("d16_amt", "d20_amt", "d12_amt")])
                        / 3, 0),
    white16_20_pct = round(rowSums(data[, c("white16_pct", "white20_pct")])
                        / 2, 0),
    hispanic16_20_pct = round(rowSums(data[, c("hispanic16_pct", "hispanic20_pct")])
                        / 2, 0),
    black16_20_pct = round(rowSums(data[, c("black16_pct", "black20_pct")])
                        / 2, 0)
  )

data <- data %>%
  mutate(
    CAINC416_420 = round(rowMeans(data[, c("CAINC420", "CAINC416")]), 4)
  )
```

Testing Models

```
#Republican
test1 <- lm(r20_amt ~  rreg20_pct + r12_r20_amt + d12_d20_amt + dreg20_pct + d12_d20_amt + o16_o20_pct +
summary(test1)
```

```
##
## Call:
## lm(formula = r20_amt ~ rreg20_pct + r12_r20_amt + d12_d20_amt +
##     dreg20_pct + d12_d20_amt + o16_o20_pct + black16_20_pct +
##     white16_20_pct, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -2831.7  -422.0    49.7   452.0  3731.3
```

```
##
## Coefficients:
##                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)     1.152e+04  2.238e+03   5.146 1.50e-06 ***
## rreg20_pct     -1.277e+04  2.834e+03  -4.504 1.95e-05 ***
## r12_r20_amt     1.184e+00  9.301e-03 127.357  < 2e-16 ***
## d12_d20_amt    -7.601e-02  6.208e-03 -12.243  < 2e-16 ***
## dreg20_pct     -1.216e+04  2.681e+03  -4.536 1.73e-05 ***
## o16_o20_pct    -7.161e+04  3.476e+04  -2.060   0.0422 *
## black16_20_pct -8.629e+02  5.922e+02  -1.457   0.1485
## white16_20_pct -2.334e+03  4.609e+02  -5.065 2.10e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 992.8 on 92 degrees of freedom
## Multiple R-squared:  0.9992, Adjusted R-squared:  0.9991
## F-statistic: 1.608e+04 on 7 and 92 DF,  p-value: < 2.2e-16
```

```
data$r1_predict <- predict(test1)
data$r1_error <- data$r20_amt - data$r1_predict
sum(data$r1_error)
```

```
## [1] 3.310561e-09
```

```
##summary(lm(r20_amt ~ rreg20_pct + d16_amt + r16_amt, data = data))


#Democrat
test2 <- lm(d20_amt ~ rreg20_pct + d12_d20_pct + dreg20_pct + d12_d20_amt + CAINC416_420 + black16_20_p
summary(test2)
```

```
##
## Call:
## lm(formula = d20_amt ~ rreg20_pct + d12_d20_pct + dreg20_pct +
##     d12_d20_amt + CAINC416_420 + black16_20_pct, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -11224.2   -818.4    213.7   1115.7   6847.0
##
## Coefficients:
##                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)     1.735e+04  3.854e+03   4.502 1.95e-05 ***
## rreg20_pct     -2.605e+04  5.734e+03  -4.543 1.66e-05 ***
## d12_d20_pct    -1.994e+04  5.022e+03  -3.969 0.000142 ***
## dreg20_pct     -1.180e+04  3.755e+03  -3.142 0.002249 **
## d12_d20_amt     1.212e+00  5.532e-03 219.022  < 2e-16 ***
## CAINC416_420    2.424e+04  1.136e+04   2.134 0.035508 *
## black16_20_pct  3.302e+03  1.059e+03   3.117 0.002432 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2031 on 93 degrees of freedom
```

```
## Multiple R-squared:  0.9989, Adjusted R-squared:  0.9988
## F-statistic: 1.377e+04 on 6 and 93 DF,  p-value: < 2.2e-16
```

```
data$d2_predict <- predict(test2)
data$d2_error <- data$d20_amt - data$d2_predict
sum(data$d2_error)
```

```
## [1] 3.683454e-10
```

```
#Other
test3 <- lm(o20_amt ~ o16_o20_pct + white16_20_pct, data = data)
summary(test3)
```

```
##
## Call:
## lm(formula = o20_amt ~ o16_o20_pct + white16_20_pct, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -2610.7  -485.1  -163.4   354.5 10058.1
##
## Coefficients:
##                Estimate Std. Error t value Pr(>|t|)
## (Intercept)      -703.4      514.2  -1.368   0.1745
## o16_o20_pct    161350.6    30504.4   5.289 7.59e-07 ***
## white16_20_pct  -1105.8      435.3  -2.540   0.0127 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1472 on 97 degrees of freedom
## Multiple R-squared:  0.2287, Adjusted R-squared:  0.2128
## F-statistic: 14.38 on 2 and 97 DF,  p-value: 3.386e-06
```

```
data$o2_predict <- predict(test3)
data$o2_error <- data$o20_amt - data$o2_predict
sum(data$d2_error)
```

```
## [1] 3.683454e-10
```

Testing with 24 registration details

```
#Republican
(test1_coeff <- test1$coefficients)
```

```
##    (Intercept)     rreg20_pct    r12_r20_amt    d12_d20_amt     dreg20_pct
##   1.151782e+04  -1.276546e+04   1.184495e+00  -7.600568e-02  -1.216140e+04
##    o16_o20_pct black16_20_pct white16_20_pct
##  -7.160675e+04  -8.629167e+02  -2.334367e+03
```

```
data <- data %>%
  mutate(
    predict_r24_amt = round(test1_coeff["(Intercept)"] +
                      test1_coeff["rreg20_pct"] * rreg24_pct +
                      test1_coeff["r12_r20_amt"] * r12_r20_amt +
                      test1_coeff["d12_d20_amt"] * d12_d20_amt +
                      test1_coeff["dreg20_pct"] * dreg20_pct +
                      test1_coeff["o16_o20_pct"] * o16_o20_pct +
                      test1_coeff["black16_20_pct"] * black24_pct +
                      test1_coeff["white16_20_pct"] * white24_pct, 0)
  )
pr24_amt <- sum(data$predict_r24_amt)

#Democrats
(test2_coeff <- test2$coefficients)
```

```
##    (Intercept)     rreg20_pct    d12_d20_pct     dreg20_pct    d12_d20_amt
##   17352.806089  -26048.038974  -19936.485330  -11798.829987       1.211618
##   CAINC416_420 black16_20_pct
##   24241.848712    3301.982860
```

```
data <- data %>%
  mutate(
    predict_d24_amt = round(test2_coeff["(Intercept)"] +
                      test2_coeff["rreg20_pct"] * rreg20_pct +
                      test2_coeff["d12_d20_pct"] * d12_d20_pct +
                      test2_coeff["dreg20_pct"] * dreg24_pct +
                      test2_coeff["d12_d20_amt"] * d12_d20_amt +
                      test2_coeff["CAINC416_420"] * CAINC422 +
                      test2_coeff["black16_20_pct"] * black24_pct, 0)
  )
pd24_amt <- sum(data$predict_d24_amt)

#Other
(test3_coeff <- test3$coefficients)
```

```
##    (Intercept)    o16_o20_pct white16_20_pct
##      -703.3697    161350.5567     -1105.8121
```

```
data <- data %>%
  mutate(
    predict_o24_amt = round(test3_coeff["(Intercept)"] +
                      test3_coeff["o16_o20_pct"] * o20_pct +
                      test3_coeff["white16_20_pct"] * white24_pct, 0)
  )
po24_amt <- sum(data$predict_o24_amt)
```

Results

```
NC24_Predict <- data.frame(
    Party = c("Democrats", "Republican", "Other"),
    `Predicted Vote Amount` = c(pd24_amt, pr24_amt, po24_amt),
    `Predict Vote Share` = c(pd24_amt / (pd24_amt + pr24_amt + po24_amt)*100, pr24_amt
                             / (pd24_amt + pr24_amt + po24_amt) *100, po24_amt / (pd24_amt + pr24_amt +
                                                                                   po24_amt)*100)
  )

NC24_Predict
```

```
##        Party Predicted.Vote.Amount Predict.Vote.Share
## 1  Democrats               2697887          48.966470
## 2 Republican               2760412          50.101295
## 3      Other                 51363           0.932235
```

#Nevada

```
data <- read.csv("Voting Data - NV.csv")
```

##Aggregate Total Percentage of Vote Shares and Average Vote Amount Across 2012, 2016, and 2020

```
data <- data %>%
  mutate(
    r12_r20_pct = rowSums(data[, c("r16_amt", "r20_amt", "r12_amt")]) /
      rowSums(data[, c("r16_amt", "r20_amt", "r12_amt", "d16_amt", "d12_amt",
                       "d20_amt", "o16_amt", "o20_amt")]),
    d12_d20_pct = rowSums(data[, c("d16_amt", "d20_amt", "d12_amt")]) /
      rowSums(data[, c("r16_amt", "r20_amt", "r12_amt", "d16_amt", "d12_amt",
                       "d20_amt", "o16_amt", "o20_amt")]),
    o16_o20_pct = rowSums(data[, c("o16_amt", "o20_amt")]) /
      rowSums(data[, c("r16_amt", "r20_amt", "r12_amt", "d16_amt", "d12_amt",
                       "d20_amt", "o16_amt", "o20_amt")])
  )

data <- data %>%
  mutate(
    r12_r20_amt = round(rowSums(data[, c("r16_amt", "r20_amt", "r12_amt")])
                        / 3, 0),
    d12_d20_amt = round(rowSums(data[, c("d16_amt", "d20_amt", "d12_amt")])
                        / 3, 0)
  )

data <- data %>%
  mutate(
    CAINC416_420 = round(rowMeans(data[, c("CAINC420", "CAINC416")]), 4)
  )
```

##Testing Models

```
#Republican
test1 <- lm(r20_amt ~ r12_r20_pct + rreg20_pct + r12_r20_amt + d12_d20_amt +
              CAINC416_420, data = data)
summary(test1)
```

```
##
## Call:
## lm(formula = r20_amt ~ r12_r20_pct + rreg20_pct + r12_r20_amt +
##     d12_d20_amt + CAINC416_420, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2915.61  -553.52    53.54   621.62  1460.68
##
## Coefficients:
##                Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -8.575e+03  4.298e+03  -1.995   0.0714 .
## r12_r20_pct   2.015e+04  1.121e+04   1.798   0.0997 .
## rreg20_pct   -1.158e+04  1.297e+04  -0.893   0.3912
## r12_r20_amt   1.032e+00  7.875e-02  13.102 4.69e-08 ***
## d12_d20_amt   1.706e-01  6.107e-02   2.794   0.0175 *
## CAINC416_420  2.158e+04  1.247e+04   1.731   0.1114
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1338 on 11 degrees of freedom
## Multiple R-squared:  0.9999, Adjusted R-squared:  0.9998
## F-statistic: 1.952e+04 on 5 and 11 DF,  p-value: < 2.2e-16
```

```
data$r1_predict <- predict(test1)
data$r1_error <- data$r20_amt - data$r1_predict
sum(data$r1_error)
```

```
## [1] 2.542038e-10
```

```
#Democrat
test2 <- lm(d20_amt ~ dreg20_pct + r12_r20_amt + d12_d20_amt +
              CAINC420, data = data)
summary(test2)
```

```
##
## Call:
## lm(formula = d20_amt ~ dreg20_pct + r12_r20_amt + d12_d20_amt +
##     CAINC420, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -255.10  -82.07   -7.72   76.83  330.42
##
## Coefficients:
##                Estimate Std. Error t value Pr(>|t|)
## (Intercept) -2.919e+02  1.532e+02  -1.905   0.0810 .
## dreg20_pct   1.679e+03  9.825e+02   1.708   0.1133
## r12_r20_amt  2.013e-02  9.476e-03   2.124   0.0552 .
## d12_d20_amt  1.175e+00  7.371e-03 159.416   <2e-16 ***
## CAINC420    -2.667e+03  1.115e+03  -2.392   0.0340 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## Residual standard error: 168.6 on 12 degrees of freedom
## Multiple R-squared:      1,  Adjusted R-squared:      1
## F-statistic: 2.288e+06 on 4 and 12 DF,  p-value: < 2.2e-16
```

```
data$d2_predict <- predict(test2)
data$d2_error <- data$d20_amt - data$d2_predict
sum(data$d2_error)
```

```
## [1] 3.259402e-10
```

```
#Other
test3 <- lm(o20_amt ~ r12_r20_amt + o16_o20_pct + d12_d20_amt, data = data)
summary(test3)
```

```
##
## Call:
## lm(formula = o20_amt ~ r12_r20_amt + o16_o20_pct + d12_d20_amt,
##     data = data)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -490.3 -215.5  -56.8  134.2  971.6
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) -9.639e+02  7.225e+02  -1.334 0.205047
## r12_r20_amt  9.122e-02  1.916e-02   4.761 0.000372 ***
## o16_o20_pct  2.304e+04  2.072e+04   1.112 0.286185
## d12_d20_amt -2.587e-02  1.520e-02  -1.702 0.112444
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 359.3 on 13 degrees of freedom
## Multiple R-squared:  0.9956, Adjusted R-squared:  0.9946
## F-statistic:   990 on 3 and 13 DF,  p-value: 1.372e-15
```

```
data$o2_predict <- predict(test3)
data$o2_error <- data$o20_amt - data$o2_predict
sum(data$d2_error)
```

```
## [1] 3.259402e-10
```

##Testing with 24 registration details

```
#Republican
(test1_coeff <- test1$coefficients)
```

```
##   (Intercept)   r12_r20_pct    rreg20_pct   r12_r20_amt   d12_d20_amt
## -8.574876e+03  2.014970e+04 -1.157625e+04  1.031781e+00  1.706087e-01
##  CAINC416_420
##  2.157770e+04
```

```
data <- data %>%
  mutate(
    predict_r24_amt = round(test1_coeff["(Intercept)"] +
                      test1_coeff["r12_r20_pct"] * r12_r20_pct +
                      test1_coeff["rreg20_pct"] * rreg24_pct +
                      test1_coeff["r12_r20_amt"] * r12_r20_amt +
                      test1_coeff["d12_d20_amt"] * d12_d20_amt +
                      test1_coeff["CAINC416_420"] * CAINC422, 0)
  )
pr24_amt <- sum(data$predict_r24_amt)

#Democrats
(test2_coeff <- test2$coefficients)
```

```
##   (Intercept)    dreg20_pct   r12_r20_amt   d12_d20_amt      CAINC420
## -2.919235e+02  1.678565e+03  2.012506e-02  1.175134e+00 -2.667079e+03
```

```
data <- data %>%
  mutate(
    predict_d24_amt = round(test2_coeff["(Intercept)"] +
                      test2_coeff["dreg20_pct"] * dreg24_pct +
                      test2_coeff["r12_r20_amt"] * r12_r20_amt +
                      test2_coeff["d12_d20_amt"] * d12_d20_amt +
                      test2_coeff["CAINC420"] * CAINC422, 0)
  )
pd24_amt <- sum(data$predict_d24_amt)

#Other
(test3_coeff <- test3$coefficients)
```

```
##   (Intercept)   r12_r20_amt   o16_o20_pct   d12_d20_amt
## -9.638903e+02  9.121827e-02  2.304351e+04 -2.587099e-02
```

```
data <- data %>%
  mutate(
    predict_o24_amt = round(test3_coeff["(Intercept)"] +
                      test3_coeff["r12_r20_amt"] * (r16_amt + r20_amt)/2 +
                      test3_coeff["o16_o20_pct"] * o16_o20_pct +
                      test3_coeff["d12_d20_amt"] * (d16_amt + d20_amt)/2, 0)
  )
po24_amt <- sum(data$predict_o24_amt)
```

##Results

```
NV24_Predict <- data.frame(
    Party = c("Democrats", "Republican", "Other"),
    `Predicted Vote Amount` = c(pd24_amt, pr24_amt, po24_amt),
    `Predict Vote Share` = c(pd24_amt / (pd24_amt + pr24_amt + po24_amt)*100, pr24_amt
                             / (pd24_amt + pr24_amt + po24_amt) *100, po24_amt / (pd24_amt + pr24_amt +
                                                                                   po24_amt)*100)
  )
NV24_Predict
```

```
##        Party Predicted.Vote.Amount Predict.Vote.Share
## 1  Democrats                705627          50.399733
## 2 Republican                659338          47.093519
## 3      Other                 35096           2.506748
```

#Pennsylvania

```
data <- read.csv("Voting Data - PA.csv")
```

Aggregate Total Percentage of Vote Shares and Average Vote Amount Across 2012, 2016, and 2020

```
data <- data %>%
  mutate(
    r12_r20_pct = rowSums(data[, c("r16_amt", "r20_amt", "r12_amt")]) /
      rowSums(data[, c("r16_amt", "r20_amt", "r12_amt", "d16_amt", "d12_amt",
                       "d20_amt", "o16_amt", "o20_amt")]),
    d12_d20_pct = rowSums(data[, c("d16_amt", "d20_amt", "d12_amt")]) /
      rowSums(data[, c("r16_amt", "r20_amt", "r12_amt", "d16_amt", "d12_amt",
                       "d20_amt", "o16_amt", "o20_amt")]),
    o16_o20_pct = rowSums(data[, c("o16_amt", "o20_amt")]) /
      rowSums(data[, c("r16_amt", "r20_amt", "r12_amt", "d16_amt", "d12_amt",
                       "d20_amt", "o16_amt", "o20_amt")])
  )

data <- data %>%
  mutate(
    r12_r20_amt = round(rowSums(data[, c("r16_amt", "r20_amt", "r12_amt")])
                        / 3, 0),
    d12_d20_amt = round(rowSums(data[, c("d16_amt", "d20_amt", "d12_amt")])
                        / 3, 0)
  )

data <- data %>%
  mutate(
    CAINC416_420 = round(rowMeans(data[, c("CAINC420", "CAINC416")]), 4)
  )
```

Testing Models

```
#Republican
test1 <- lm(r20_amt ~ r12_r20_pct + rreg20_pct + r12_r20_amt + d12_d20_amt +
              CAINC416_420, data = data)
summary(test1)
```

```
##
## Call:
## lm(formula = r20_amt ~ r12_r20_pct + rreg20_pct + r12_r20_amt +
##     d12_d20_amt + CAINC416_420, data = data)
```

```
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -8273.3 -1011.6   -36.9  1286.0  5701.3
##
## Coefficients:
##                Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -1.221e+03  3.333e+03  -0.366  0.71537
## r12_r20_pct   1.734e+04  7.741e+03   2.240  0.02878 *
## rreg20_pct   -1.947e+04  7.160e+03  -2.720  0.00849 **
## r12_r20_amt   1.066e+00  9.328e-03 114.312  < 2e-16 ***
## d12_d20_amt   8.679e-03  6.083e-03   1.427  0.15872
## CAINC416_420  4.875e+04  2.383e+04   2.046  0.04509 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2399 on 61 degrees of freedom
## Multiple R-squared:  0.9982, Adjusted R-squared:  0.998
## F-statistic:  6598 on 5 and 61 DF,  p-value: < 2.2e-16
```

```
data$r1_predict <- predict(test1)
data$r1_error <- data$r20_amt - data$r1_predict
sum(data$r1_error)
```

```
## [1] 4.729372e-11
```

```
##summary(lm(r20_amt ~ rreg20_pct + d16_amt + r16_amt, data = data))


#Democrat
test2 <- lm(d20_amt ~ d12_d20_pct + dreg20_pct + r12_r20_amt + d12_d20_amt +
              CAINC420, data = data)
summary(test2)
```

```
##
## Call:
## lm(formula = d20_amt ~ d12_d20_pct + dreg20_pct + r12_r20_amt +
##     d12_d20_amt + CAINC420, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -8678.5 -1483.1    26.8  1329.2 17002.7
##
## Coefficients:
##                Estimate Std. Error t value Pr(>|t|)
## (Intercept) -5.392e+03  3.414e+03  -1.579  0.11947
## d12_d20_pct  2.807e+04  1.001e+04   2.804  0.00676 **
## dreg20_pct  -3.296e+04  9.809e+03  -3.360  0.00135 **
## r12_r20_amt  1.611e-01  1.568e-02  10.272 6.33e-15 ***
## d12_d20_amt  1.013e+00  1.074e-02  94.406  < 2e-16 ***
## CAINC420     5.401e+04  3.179e+04   1.699  0.09443 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## Residual standard error: 4005 on 61 degrees of freedom
## Multiple R-squared:  0.9986, Adjusted R-squared:  0.9984
## F-statistic:  8479 on 5 and 61 DF,  p-value: < 2.2e-16
```

```
data$d2_predict <- predict(test2)
data$d2_error <- data$d20_amt - data$d2_predict
sum(data$d2_error)
```

```
## [1] -1.400622e-09
```

```
#Other
test3 <- lm(o20_amt ~ r12_r20_amt + o16_o20_pct + d12_d20_amt, data = data)
summary(test3)
```

```
##
## Call:
## lm(formula = o20_amt ~ r12_r20_amt + o16_o20_pct + d12_d20_amt,
##     data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -699.32  -90.57    2.02  113.95  760.89
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) -1.137e+03  1.592e+02  -7.146 1.11e-09 ***
## r12_r20_amt  2.782e-02  8.932e-04  31.148  < 2e-16 ***
## o16_o20_pct  5.001e+04  7.815e+03   6.399 2.20e-08 ***
## d12_d20_amt  7.851e-03  4.807e-04  16.331  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 222.1 on 63 degrees of freedom
## Multiple R-squared:  0.9884, Adjusted R-squared:  0.9879
## F-statistic:  1793 on 3 and 63 DF,  p-value: < 2.2e-16
```

```
data$o2_predict <- predict(test3)
data$o2_error <- data$o20_amt - data$o2_predict
sum(data$d2_error)
```

```
## [1] -1.400622e-09
```

Testing with 24 registration details

```
#Republican
(test1_coeff <- test1$coefficients)
```

```
##   (Intercept)   r12_r20_pct    rreg20_pct   r12_r20_amt   d12_d20_amt
## -1.220899e+03  1.733563e+04 -1.947443e+04  1.066257e+00  8.679497e-03
##  CAINC416_420
##  4.875247e+04
```

```
data <- data %>%
  mutate(
    predict_r24_amt = round(test1_coeff["(Intercept)"] +
                      test1_coeff["r12_r20_pct"] * r12_r20_pct +
                      test1_coeff["rreg20_pct"] * rreg24_pct +
                      test1_coeff["r12_r20_amt"] * r12_r20_amt +
                      test1_coeff["d12_d20_amt"] * d12_d20_amt +
                      test1_coeff["CAINC416_420"] * CAINC422, 0)
  )
pr24_amt <- sum(data$predict_r24_amt)

#Democrats
(test2_coeff <- test2$coefficients)
```

```
##   (Intercept)   d12_d20_pct    dreg20_pct   r12_r20_amt   d12_d20_amt
## -5.391859e+03  2.806924e+04 -3.295806e+04  1.611099e-01  1.013466e+00
##      CAINC420
##  5.400561e+04
```

```
data <- data %>%
  mutate(
    predict_d24_amt = round(test2_coeff["(Intercept)"] +
                      test2_coeff["d12_d20_pct"] * d12_d20_pct +
                      test2_coeff["dreg20_pct"] * dreg24_pct +
                      test2_coeff["r12_r20_amt"] * r12_r20_amt +
                      test2_coeff["d12_d20_amt"] * d12_d20_amt +
                      test2_coeff["CAINC420"] * CAINC422, 0)
  )
pd24_amt <- sum(data$predict_d24_amt)


#Other
(test3_coeff <- test3$coefficients)
```

```
##   (Intercept)   r12_r20_amt   o16_o20_pct   d12_d20_amt
## -1.137492e+03  2.782010e-02  5.001122e+04  7.851123e-03
```

```
data <- data %>%
  mutate(
    predict_o24_amt = round(test3_coeff["(Intercept)"] +
                      test3_coeff["r12_r20_amt"] * (r16_amt + r20_amt)/2 +
                      test3_coeff["o16_o20_pct"] * o16_o20_pct +
                      test3_coeff["d12_d20_amt"] * (d16_amt + d20_amt)/2, 0)
  )
po24_amt <- sum(data$predict_o24_amt)
```

Results

```
PA24_Predict <- data.frame(
    Party = c("Democrats", "Republican", "Other"),
```

```
    `Predicted Vote Amount` = c(pd24_amt, pr24_amt, po24_amt),
    `Predict Vote Share` = c(pd24_amt / (pd24_amt + pr24_amt + po24_amt)*100, pr24_amt
                             / (pd24_amt + pr24_amt + po24_amt) *100, po24_amt / (pd24_amt + pr24_amt +
                                                                                   po24_amt)*100)
  )
PA24_Predict
```

```
##        Party Predicted.Vote.Amount Predict.Vote.Share
## 1  Democrats               3247857          50.018465
## 2 Republican               3140167          48.359990
## 3      Other                105292           1.621544
```

#Wisconsin

```
data <- read.csv("Voting Data - WI.csv")
```

##Testing Models

```
#Republican
test1 <- lm(r20_amt ~ d12_amt + d16_amt + r16_amt + o16_amt + CAINC420, data = data)
summary(test1)
```

```
##
## Call:
## lm(formula = r20_amt ~ d12_amt + d16_amt + r16_amt + o16_amt +
##     CAINC420, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -1968.8  -441.8  -159.1   366.0  3982.1
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  7.947e+02  5.274e+02   1.507    0.137
## d12_amt      1.512e-02  4.580e-02   0.330    0.742
## d16_amt     -6.921e-02  6.678e-02  -1.036    0.304
## r16_amt      1.106e+00  2.992e-02  36.972   <2e-16 ***
## o16_amt      4.374e-01  3.436e-01   1.273    0.207
## CAINC420    -2.495e+03  6.799e+03  -0.367    0.715
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 948.5 on 66 degrees of freedom
## Multiple R-squared:  0.9989, Adjusted R-squared:  0.9988
## F-statistic: 1.191e+04 on 5 and 66 DF,  p-value: < 2.2e-16
```

```
data$r1_predict <- predict(test1)
data$r1_error <- data$r20_amt - data$r1_predict
sum(data$r1_error)
```

```
## [1] 4.538379e-10
```

```r
#Democrats
test2 <- lm(d20_amt ~ d12_amt + d16_amt + r16_amt + o16_amt + CAINC420, data = data)
summary(test2)
```

```
##
## Call:
## lm(formula = d20_amt ~ d12_amt + d16_amt + r16_amt + o16_amt +
##     CAINC420, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -2224.2  -361.6  -165.7   205.8  2918.2
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  607.71547  524.94318   1.158  0.25117
## d12_amt       -0.46466    0.04559 -10.192  3.5e-15 ***
## d16_amt        1.54358    0.06648  23.219  < 2e-16 ***
## r16_amt        0.01264    0.02978   0.425  0.67257
## o16_amt        1.01620    0.34199   2.971  0.00413 **
## CAINC420    -624.68011 6767.60797  -0.092  0.92674
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 944.1 on 66 degrees of freedom
## Multiple R-squared:  0.9997, Adjusted R-squared:  0.9996
## F-statistic: 3.783e+04 on 5 and 66 DF,  p-value: < 2.2e-16
```

```r
data$d2_predict <- predict(test2)
data$d2_error <- data$d20_amt - data$d2_predict
sum(data$d2_error)
```

```
## [1] 2.341949e-09
```

```r
#Other
test3 <- lm(o20_amt ~ d12_amt + d16_amt + o16_amt + r12_amt, data = data)
summary(test3)
```

```
##
## Call:
## lm(formula = o20_amt ~ d12_amt + d16_amt + o16_amt + r12_amt,
##     data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -299.70  -42.13  -11.08   27.25  356.10
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 20.800945  16.473656   1.263  0.21108
## d12_amt      0.023429   0.004189   5.593 4.45e-07 ***
## d16_amt     -0.028625   0.005766  -4.965 5.00e-06 ***
```

```
## o16_amt      0.353508   0.028942  12.214  < 2e-16 ***
## r12_amt     -0.007296   0.002337  -3.122  0.00266 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 100.7 on 67 degrees of freedom
## Multiple R-squared:  0.9937, Adjusted R-squared:  0.9933
## F-statistic:  2632 on 4 and 67 DF,  p-value: < 2.2e-16
```

```
data$o2_predict <- predict(test3)
data$o2_error <- data$o20_amt - data$o2_predict
sum(data$d2_error)
```

```
## [1] 2.341949e-09
```

##Testing with updated CAINC4 data

```
#Republican
(test1_coeff <- test1$coefficients)
```

```
##   (Intercept)       d12_amt       d16_amt       r16_amt       o16_amt
##  7.946981e+02  1.512239e-02 -6.921403e-02  1.106259e+00  4.373620e-01
##      CAINC420
## -2.495123e+03
```

```
data <- data %>%
  mutate(
    predict_r24_amt = round(test1_coeff["(Intercept)"] +
                      test1_coeff["d12_amt"] * d12_amt +
                      test1_coeff["d16_amt"] * d16_amt +
                      test1_coeff["r16_amt"] * r16_amt +
                      test1_coeff["o16_amt"] * o16_amt +
                      test1_coeff["CAINC420"] * CAINC422, 0)
  )
pr24_amt <- sum(data$predict_r24_amt)

#Democrats
(test2_coeff <- test2$coefficients)
```

```
##   (Intercept)       d12_amt       d16_amt       r16_amt       o16_amt
##  607.71546572   -0.46465953    1.54358020    0.01264411    1.01619876
##      CAINC420
## -624.68010671
```

```
data <- data %>%
  mutate(
    predict_d24_amt = round(test2_coeff["(Intercept)"] +
                      test2_coeff["d12_amt"] * d12_amt +
                      test2_coeff["d16_amt"] * d16_amt +
                      test2_coeff["r16_amt"] * r16_amt +
                      test2_coeff["o16_amt"] * o16_amt +
```

```
                    test2_coeff["CAINC420"] * CAINC422, 0)
  )
pd24_amt <- sum(data$predict_d24_amt)

#Other
(test3_coeff <- test3$coefficients)
```

```
##  (Intercept)      d12_amt      d16_amt      o16_amt      r12_amt
## 20.800944915  0.023429342 -0.028624792  0.353508453 -0.007295854
```

```
data <- data %>%
  mutate(
    predict_o24_amt = round(test3_coeff["(Intercept)"] +
                    test3_coeff["d12_amt"] * d12_amt +
                    test3_coeff["d16_amt"] * d16_amt +
                    test3_coeff["r12_amt"] * r12_amt +
                    test3_coeff["o16_amt"] * o16_amt, 0)
  )
po24_amt <- sum(data$predict_o24_amt)
```

##Results

```
WI24_Predict <- data.frame(
    Party = c("Democrats", "Republican", "Other"),
    `Predicted Vote Amount` = c(pd24_amt, pr24_amt, po24_amt),
    `Predict Vote Share` = c(pd24_amt / (pd24_amt + pr24_amt + po24_amt)*100, pr24_amt
                             / (pd24_amt + pr24_amt + po24_amt) *100, po24_amt / (pd24_amt + pr24_amt +
                                                                                   po24_amt)*100)
  )
WI24_Predict
```

```
##        Party Predicted.Vote.Amount Predict.Vote.Share
## 1  Democrats               1633160          49.343655
## 2 Republican               1619994          48.945862
## 3      Other                 56613           1.710483
```