Application to 2016 Election Data

```
## Erin's path
path_data = "~/Dropbox/Documents/2019__2020/work/kpop/2016_reweighting_example/data/"
```

```
vote_contrast <- quote((recode_vote_2016Democrat - recode_vote_2016Republican) /
                           (recode_vote_2016Democrat + recode_vote_2016Republican))

### Function for creating targets from auxiliary information and formula
create_targets <- function (target_design, target_formula) {
    target_mf <- model.frame(target_formula, model.frame(target_design))
    target_mm <- model.matrix(target_formula, target_mf)
    wts <- weights(target_design)
    colSums(target_mm * wts) / sum(wts)
}
```

Load Data

```
## SURVEY DATA (PEW)
### Load
###This needs to be loaded from dropbox/local not github bc it's too big
pew <- readRDS(paste0(path_data, "pew.rds"))

## AUXILIARY INFORMATION (CCES)
### Load
#This needs to be loaded from dropbox/local not github bc it's too big
cces <- readRDS(paste0(path_data, "cces.rds"))
### Drop invalid cases
cces <- cces %>%
    filter((CC16_401 == "I definitely voted in the General Election.") &
               !is.na(commonweight_vv_post))

## make recode_educ_white column
cces <- cces %>%
  mutate(recode_educ_white =
           factor(case_when(recode_race == "White" ~ as.character(recode_educ),
                            TRUE ~ "No Split"),
                  levels = c(levels(cces$recode_educ), "No Split")))

pew <- pew %>%
  mutate(recode_educ_white =
           factor(case_when(recode_race == "White" ~ as.character(recode_educ),
                            TRUE ~ "No Split"),
                  levels = c(levels(pew$recode_educ), "No Split")))

### Actual results
pres <- readRDS(paste0(path_data, "election.rds"))
```

```r
natl_margin <- pres %>%
    summarise(margin = (sum(demtotal) - sum(reptotal)) /
                  (sum(demtotal) + sum(reptotal))) %>%
    as.numeric()
natl_margin
```

```
## [1] 0.02325013
```

```r
formula_rake_demos_noeduc <- ~recode_age_bucket + recode_female +
  recode_race + recode_region + recode_pid_3way
formula_rake_demos_weduc <- ~recode_age_bucket + recode_female +
  recode_race + recode_region + recode_educ + recode_pid_3way
formula_ps <- ~recode_age_3way + recode_female + recode_race +
    recode_region + recode_educ_3way + recode_pid_3way
formula_retrospective <- ~recode_age_bucket:recode_pid_3way +
  recode_female:recode_pid_3way+
    recode_race_educ_reg:recode_pid_3way
```

```r
## Find Missing Strata
## Make "strata" variable in CCES and Pew
cces <- bind_cols(cces, cces %>%
                    unite("strata", all.vars(formula_ps), remove = FALSE) %>%
                    unite("strata_wage", c(all.vars(formula_ps), "recode_age"),
                          remove = FALSE) %>%
                    select(strata, strata_wage))

pew <- bind_cols(pew, pew %>%
                   unite("strata", all.vars(formula_ps), remove = FALSE) %>%
                   unite("strata_wage", c(all.vars(formula_ps), "recode_age"),
                         remove = FALSE) %>%
                   select(strata, strata_wage))


missing_strata <- unique(cces$strata)[!(unique(cces$strata) %in% unique(pew$strata))]

## recode missing age
pew$recode_age[is.na(pew$recode_age)] <- mean(pew$recode_age, na.rm = TRUE)
cces$recode_age[is.na(cces$recode_age)] <- mean(cces$recode_age, na.rm = TRUE)

### Make survey designs

## For Pew, since there are no design weights, assume SRS
pew_srs <- svydesign(ids = ~1, data = pew)
cces_awt <- svydesign(ids = ~1, weights = ~commonweight_vv_post, data = cces)
```

```r
### Population targets
targets_rake_demos_noeduc <- create_targets(cces_awt, formula_rake_demos_noeduc)
targets_rake_demos_weduc <- create_targets(cces_awt, formula_rake_demos_weduc)
targets_retrospective <- create_targets(cces_awt, formula_retrospective)
```

```r
## Raking on demographics, excluding education
rake_demos_noeduc <- calibrate(design = pew_srs,
                       formula = formula_rake_demos_noeduc,
                       population = targets_rake_demos_noeduc,
                       calfun = "raking")
```

```
rake_demos_noeduc <- svydesign(~1, data = pew, weights = weights(rake_demos_noeduc))

## Raking on demographics, including education
rake_demos_weduc <- calibrate(design = pew_srs,
                              formula = formula_rake_demos_weduc,
                              population = targets_rake_demos_weduc,
                              calfun = "raking")

rake_demos_weduc <- svydesign(~1, data = pew, weights = weights(rake_demos_weduc))

## Post-stratification
targets_ps <- svytable(formula = ~strata,
                       design = subset(cces_awt, !(strata %in% missing_strata)))

post_stratification <- postStratify(design = pew_srs,
                          strata = ~strata,
                          population = targets_ps)

post_stratification <- svydesign(~1, data = pew,
                                 weights = weights(post_stratification))

## Retrospective weighting scheme
rake_retrospective <- calibrate(design = pew_srs,
                              formula = formula_retrospective,
                              population = targets_retrospective,
                              calfun = "raking",
                              force = TRUE)
```

```
## Warning in grake(mm, ww, calfun, bounds = bounds, population = population, :
## Failed to converge: eps=0.00688873036014645 in 51 iterations
```

```
rake_retrospective <- svydesign(~1, data = pew, weights = weights(rake_retrospective))
```

```
##############################################
##### PUT FINAL KPOP CODE HERE
##############################################

load("./cleaned data/Full SVD/weights_wPid_full.Rdata")

kpop <- svydesign(~1, data = pew, weights = wts_wPid[, "wtkbal_b.5x"])
kpop_mf <- svydesign(~1, data = pew, weights = wts_wPid[, "wtkbal_mf_b2x"])
```

```
margin_summary <- round(cbind(cces = svymean(formula_rake_demos_weduc, cces_awt),
                              unweighted = svymean(formula_rake_demos_weduc, pew_srs),
            rake_demos_noeduc = svymean(formula_rake_demos_weduc, rake_demos_noeduc),
            rake_demos_weduc = svymean(formula_rake_demos_weduc, rake_demos_weduc),
            post_stratification = svymean(formula_rake_demos_weduc, post_stratification),
            rake_retrospective = svymean(formula_rake_demos_weduc, rake_retrospective),
            kpop = svymean(formula_rake_demos_weduc, kpop),
            kpop_mf = svymean(formula_rake_demos_weduc, kpop_mf)) * 100, 1) %>%
  data.frame() %>%
  rownames_to_column() %>%
  mutate(variable = case_when(str_detect(rowname, "age") ~ "4-way Age Bucket",
                              str_detect(rowname, "female") ~ "Gender",
```

```
                            str_detect(rowname, "race") ~ "Race/Ethnicity",
                            str_detect(rowname, "region") ~ "Region",
                            str_detect(rowname, "educ") ~ "Education Level",
                            str_detect(rowname, "pid") ~ "Party Identification",
                            TRUE ~ "Empty"),
         level =
           gsub("recode_|age_bucket|female|race|region|educ|pid_3way", "", rowname)) %>%
  select(level, everything(), -rowname, -variable)
```

```
## Total missing strata
sum(cces$commonweight_vv_post[cces$strata %in% missing_strata])/sum(cces$commonweight_vv_post)
```

```
## [1] 0.08405765
```

```
round(cbind(cces = svymean(formula_rake_demos_weduc, cces_awt),
            not_missing = svymean(formula_rake_demos_weduc,
                                  subset(cces_awt, !(strata %in% missing_strata))),
            missing = svymean(formula_rake_demos_weduc,
                              subset(cces_awt, (strata %in% missing_strata)))) * 100, 1) %>%
  data.frame() %>%
  rownames_to_column() %>%
  mutate(variable = case_when(str_detect(rowname, "age") ~ "4-way Age Bucket",
                            str_detect(rowname, "female") ~ "Gender",
                            str_detect(rowname, "race") ~ "Race/Ethnicity",
                            str_detect(rowname, "region") ~ "Region",
                            str_detect(rowname, "educ") ~ "Education Level",
                            str_detect(rowname, "pid") ~ "Party Identification",
                            TRUE ~ "Empty"),
         level =
           gsub("recode_|age_bucket|female|race|region|educ|pid_3way", "", rowname)) %>%
  select(level, everything(), -rowname, -variable)
```

```
##                   level cces not_missing missing
## 1              18 to 35 34.8        37.6     4.0
## 2              36 to 50 22.6        24.5     2.0
## 3              51 to 64 28.9        29.7    20.6
## 4                   65+ 13.7         8.3    73.4
## 5                Female 50.8        50.8    51.5
## 6                  Male 49.2        49.2    48.5
## 7                 Black 11.8        11.5    14.9
## 8              Hispanic  6.5         6.2    10.1
## 9                 Other  6.8         6.5    10.3
## 10                White 74.9        75.8    64.8
## 11              Midwest 23.4        23.2    25.5
## 12            Northeast 19.7        19.3    24.4
## 13                South 35.5        36.9    19.9
## 14                 West 21.4        20.6    30.2
## 15               No HS  6.8         6.2    13.2
## 16 High school graduate 30.6        30.3    32.9
## 17         Some college 23.0        23.5    17.6
## 18               2-year 10.6        10.8     8.6
## 19               4-year 18.7        19.0    15.0
## 20            Post-grad 10.4        10.1    12.8
## 21                  Dem 38.1        38.5    33.1
## 22                  Ind 32.5        32.5    32.0
```

Table 1: Marginal distribution, in precentage poitns, of important demographics under different weighting models.

	Target (CCES)	Unweighted Pew	Raking Demographics without Education	Raking Demographics with Education	Post-Stratification	Raking Retrospective	KPop	KPop Mean First
4-way Age Bucket								
18 to 35	34.8	43.7	34.8	34.8	35.4	34.8	34.4	34.8
36 to 50	22.6	32.6	22.6	22.6	26.7	22.6	23.6	22.6
51 to 64	28.9	21.0	28.9	28.9	29.7	28.9	29.5	28.9
65+	13.7	2.7	13.7	13.7	8.3	13.7	12.5	13.7
Gender								
Female	50.8	47.3	50.8	50.8	50.8	50.8	50.8	50.8
Male	49.2	52.7	49.2	49.2	49.2	49.2	49.2	49.2
Race/Ethnicity								
Black	11.8	8.9	11.8	11.8	11.5	13.4	11.7	11.8
Hispanic	6.5	7.6	6.5	6.5	6.2	6.5	5.9	6.5
Other	6.8	7.1	6.8	6.8	6.5	6.8	6.2	6.8
White	74.9	76.4	74.9	74.9	75.8	73.2	76.3	74.9
Region								
Midwest	23.4	22.3	23.4	23.4	23.2	24.7	23.6	23.4
Northeast	19.7	18.2	19.7	19.7	19.3	19.7	19.5	19.7
South	35.5	37.9	35.5	35.5	36.9	34.8	36.0	35.5
West	21.4	21.6	21.4	21.4	20.6	20.8	20.8	21.4
Education Level								
No HS	6.8	1.8	1.8	6.8	2.4	3.6	1.9	6.8
High school	30.6	19.7	21.5	30.6	28.8	29.4	31.2	30.6
Some college	23.0	16.7	17.7	23.0	24.5	23.0	24.4	23.0
2-year	10.6	11.3	10.6	10.6	9.5	11.7	10.9	10.6
4-year	18.7	28.6	26.2	18.7	22.2	20.2	20.3	18.7
Post-grad	10.4	21.9	22.3	10.4	12.6	12.2	11.3	10.4
Party Identification								
Dem	38.1	34.4	38.1	38.1	38.5	38.1	37.6	38.1
Ind	32.5	35.2	32.5	32.5	32.5	32.5	32.8	32.5
Rep	29.5	30.4	29.5	29.5	29.0	29.5	29.5	29.5

Note:
Cells present the precentage of the population represented by each variable level.

```
## 23                  Rep 29.5        29.0    34.9
```

```
margin_summary_educ <- round(cbind(cces = svymean(~recode_educ_white, cces_awt),
                                   unweighted = svymean(~recode_educ_white, pew_srs),
            rake_demos_noeduc = svymean(~recode_educ_white, rake_demos_noeduc),
            rake_demos_weduc = svymean(~recode_educ_white, rake_demos_weduc),
            post_stratification = svymean(~recode_educ_white, post_stratification),
            rake_retrospective = svymean(~recode_educ_white, rake_retrospective),
            kpop = svymean(~recode_educ_white, kpop),
            kpop_mf = svymean(~recode_educ_white, kpop_mf)) * 100, 1) %>%
  data.frame() %>%
  rownames_to_column() %>%
  mutate(variable = case_when(str_detect(rowname, "age") ~ "4-way Age Bucket",
                              str_detect(rowname, "female") ~ "Gender",
                              str_detect(rowname, "race") ~ "Race/Ethnicity",
                              str_detect(rowname, "region") ~ "Region",
                              str_detect(rowname, "educ") ~ "Education Level",
                              str_detect(rowname, "pid") ~ "Party Identification",
                              TRUE ~ "Empty"),
         level =
           gsub("recode_|age_bucket|female|race|region|educ|pid_3way|educ_3way|_white",
                "", rowname)) %>%
  select(level, everything(), -rowname, -variable)
```

```
## Warning: funs() is soft deprecated as of dplyr 0.8.0
## Please use a list of either functions or lambdas:
##
##   # Simple named list:
##   list(mean = mean, median = median)
##
##   # Auto named with `tibble::lst()`:
##   tibble::lst(mean, median)
##
##   # Using lambdas
##   list(~ mean(., trim = .2), ~ median(., na.rm = TRUE))
## This warning is displayed once per session.
```

```
target_margin <- svycontrast(svymean(~recode_vote_2016, cces_awt, na.rm = TRUE),
                      vote_contrast)[1]

svymean(~recode_vote_2016, rake_demos_noeduc, deff = TRUE)
```

```
## Warning in svymean.survey.design2(~recode_vote_2016, rake_demos_noeduc, : Sample
## size greater than population size: are weights correctly scaled?
```

```
##                                 mean        SE DEff
## recode_vote_2016Democrat   0.5152342 0.0137716   NA
## recode_vote_2016Other      0.0610503 0.0068547   NA
## recode_vote_2016Republican 0.4237155 0.0135460   NA
```

```
comp_df <- data.frame(
    cces = svycontrast(svymean(~recode_vote_2016,
                               cces_awt, na.rm = TRUE),
                       vote_contrast),
    unweighted = svycontrast(svymean(~recode_vote_2016,
                                     pew_srs, na.rm = TRUE),
```

Table 2: Marginal distribution of education level for white voters under different weighting models.

	Target (CCES)	Unweighted Pew	Raking Demographics without Education	Raking Demographics with Education	Post-Stratification	Raking Retrospective	KPop	KPop Mean First
Education Level for White Voters								
No HS	4.6	1.1	1.1	4.5	1.8	3.0	1.2	4.8
High school	22.6	14.6	15.5	22.9	23.1	22.6	23.6	21.9
Some college	16.9	11.5	12.1	16.3	19.5	16.9	18.3	17.7
2-year	7.8	8.3	7.0	7.3	6.1	7.8	7.7	7.2
4-year	14.8	23.0	20.7	15.2	17.1	14.8	16.3	14.8
Post-grad	8.3	18.0	18.5	8.8	8.2	8.3	9.1	8.4
Error								
Mean Absolute Error	–	6.6	5.8	0.4	1.6	0.1	1.2	0.5

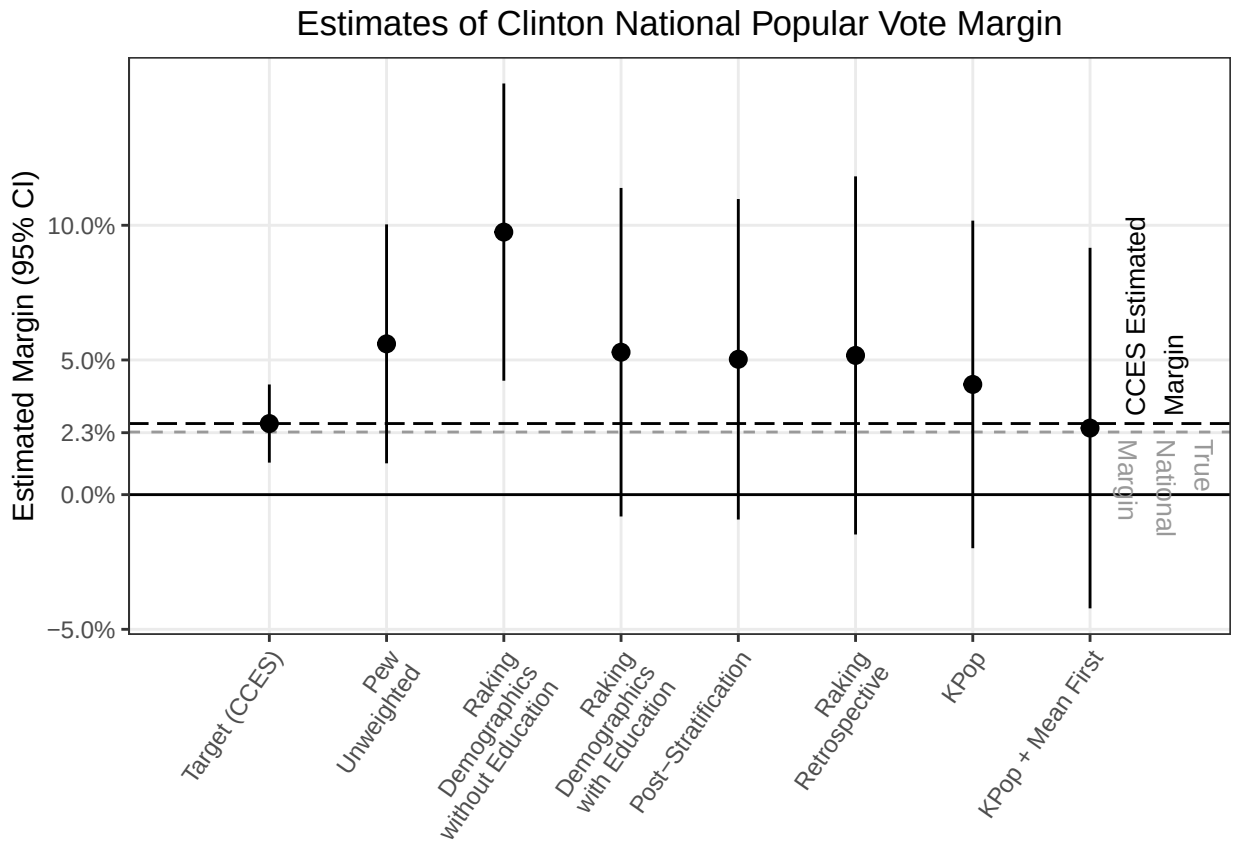
Note:
Cells present the precentage of the population represented by each variable level. Mean absolute error is the absoluate error in each cell, relative to the target (CCES), weighted by the edcuation level's proportion among white voters in the target population.

```
                      vote_contrast),
  rake_demos_noeduc = svycontrast(svymean(~recode_vote_2016,
                                          rake_demos_noeduc, na.rm = TRUE),
                      vote_contrast),
  rake_demos_weduc = svycontrast(svymean(~recode_vote_2016,
                                         rake_demos_weduc, na.rm = TRUE),
                      vote_contrast),
  post_stratification = svycontrast(svymean(~recode_vote_2016,
                                            post_stratification, na.rm = TRUE),
                      vote_contrast),
  rake_retrospective = svycontrast(svymean(~recode_vote_2016,
                                           rake_retrospective, na.rm = TRUE),
                      vote_contrast),
  kpop = svycontrast(svymean(~recode_vote_2016,
                             kpop, na.rm = TRUE),
                      vote_contrast),
  kpop_mf = svycontrast(svymean(~recode_vote_2016,
                                kpop_mf, na.rm = TRUE),
                      vote_contrast)) %>%
  pivot_longer(cols = everything(),
               names_to = c("source", ".value"),
               names_pattern = "(.*)\\.(.*)") %>%
  rename(est = nlcon) %>%
  mutate(est = est * 100,
         SE = SE * 100,
         err_target = est - target_margin * 100,
         source = str_replace(source, "_", " "),
```

```
            source_name = factor(source, labels = c("Target (CCES)",
                                                    "KPop",
                                                    "KPop + Mean First",
                                                    "Post-Stratification",
                                                    "Raking\nDemographics\nwithout Education",
                                                    "Raking\nDemographics\nwith Education",
                                                    "Raking\nRetrospective",
                                                    "Pew\nUnweighted"),
                                 ordered = TRUE))

comp_df
```

```
## # A tibble: 8 x 5
##   source                est    SE err_target source_name
##   <chr>               <dbl> <dbl>      <dbl> <ord>
## 1 cces                 2.64 0.740       0     "Target (CCES)"
## 2 unweighted           5.60 2.26        2.96  "Pew\nUnweighted"
## 3 rake demos_noeduc    9.75 2.81        7.11  "Raking\nDemographics\nwithout Educ~
## 4 rake demos_weduc     5.29 3.11        2.65  "Raking\nDemographics\nwith Educati~
## 5 post stratificati~   5.03 3.04        2.39  "Post-Stratification"
## 6 rake retrospective   5.17 3.39        2.53  "Raking\nRetrospective"
## 7 kpop                 4.09 3.10        1.45  "KPop"
## 8 kpop mf              2.47 3.41       -0.168 "KPop + Mean First"
```




```
ggsave("./plots/weighted_pew_results.pdf", width = 6, height = 4)
```

Note from `survey` package:

The design effect compares the variance of a mean or total to the variance from a study of the same size using simple random sampling without replacement. Note that the design effect will be incorrect if the weights have been rescaled so that they are not reciprocals of sampling probabilities. To obtain an estimate of the design effect comparing to simple random sampling with replacement, which does not have this requirement, use `deff="replace"`. This with-replacement design effect is the square of Kish's "deft".

```
lapply(list(rake_demos_noeduc, rake_demos_weduc, post_stratification, rake_retrospective, kpop, kpop_mf
       function(x) {
         svymean(~recode_vote_2016, x, deff = "replace")
       })
```

```
## [[1]]
##                                 mean        SE   DEff
## recode_vote_2016Democrat   0.5152342 0.0137716 1.5741
## recode_vote_2016Other      0.0610503 0.0068547 1.6992
## recode_vote_2016Republican 0.4237155 0.0135460 1.5578
##
## [[2]]
##                                 mean       SE   DEff
## recode_vote_2016Democrat   0.492440 0.015599 2.0182
## recode_vote_2016Other      0.064585 0.010645 3.8881
## recode_vote_2016Republican 0.442974 0.015397 1.9917
##
## [[3]]
##                                 mean        SE   DEff
## recode_vote_2016Democrat   0.4951602 0.0146016 1.7681
## recode_vote_2016Other      0.0570701 0.0064833 1.6192
## recode_vote_2016Republican 0.4477697 0.0147349 1.8202
##
## [[4]]
##                                 mean        SE   DEff
## recode_vote_2016Democrat   0.4955713 0.0162761 2.1968
## recode_vote_2016Other      0.0575692 0.0077328 2.2847
## recode_vote_2016Republican 0.4468595 0.0165905 2.3084
##
## [[5]]
##                                 mean        SE   DEff
## recode_vote_2016Democrat   0.4911832 0.0149371 1.8507
## recode_vote_2016Other      0.0562514 0.0062328 1.5170
## recode_vote_2016Republican 0.4525654 0.0149954 1.8815
##
## [[6]]
##                                 mean       SE   DEff
## recode_vote_2016Democrat   0.482228 0.016914 2.3751
## recode_vote_2016Other      0.058803 0.010303 3.9758
## recode_vote_2016Republican 0.458969 0.016838 2.3668
```