Study 5

2x2 Pool (Women vs Men) × Feedback (Control vs Treatment)

December 10, 2025

Items

Variable Names

Variable	Description
`treatment`	Binary indicator of whether a participant was randomly assigned to treatment condition (1 = treat, 0 = control).
`men_pool`	Binary indicator of pool condition where women are underrepresented (1 = men pool/25% women, 0 = women pool/75% women).
`female_pick`	Binary indicator of whether the 7th (final) selection is a woman (PRIMARY DV).
`base_gender`	Count of women selected in the initial 6 choices (0-6).
`tech_pick`	Binary indicator of whether the 7th selection is a technologist.
`choice-1 to choice-7`	The selected CEOs/Founders (choices 1-6 are initial, choice-7 is final DV)
`gender`	Self-selected gender.
`race`	Self-selected race.
`age`	Self-entered age.

Demographics

```
## Excluded Participants: 176

## Total N: 1200

##                         Percentage gender
## 1 Another gender not listed here:   0.17
## 2                                Man  39.25
## 3                         Non-binary   1.58
## 4                              Woman  59.00

##                            Percentage  Race
## 1 American Indian or Alaskan Native  1.08
## 2          Asian / Pacific Islander  8.42
## 3         Black or African American 11.17
## 4                 Hispanic / Latinx  9.33
## 5                 White / Caucasian 70.00

## # A tibble: 1 x 2
##   mean_age sd_age
##      <dbl>  <dbl>
## 1     42.7   13.4

##
##
## Cell Sizes by Condition:

## # A tibble: 4 x 3
##   pool  cond        n
##   <chr> <chr>   <int>
## 1 men   control   297
## 2 men   treat     301
## 3 women control   301
## 4 women treat     301

##
##
## Mean number of women in initial 6 selections:  2.45

## SD of women in initial 6 selections:  1.73

## # A tibble: 4 x 5
##   cond    pool   mean    sd     n
##   <chr>   <chr> <dbl> <dbl> <int>
## 1 control men    1.23  1.32   297
## 2 control women  3.59  1.18   301
## 3 treat   men    1.29  1.34   301
## 4 treat   women  3.69  1.17   301

##
##
## Proportion who selected a woman for final choice:  0.585
```

```
## SD:  0.493
```

```
## # A tibble: 4 x 5
##   cond    pool   mean    sd     n
##   <chr>   <chr> <dbl> <dbl> <int>
## 1 control men   0.333 0.472   297
## 2 control women 0.767 0.423   301
## 3 treat   men   0.575 0.495   301
## 4 treat   women 0.661 0.474   301
```

Primary Analysis: 2x2 Interaction

```
## === 2x2 Interaction: Treatment × Women Underrepresented Pool ===

## Model: female_pick ~ treatment * men_pool

## (men_pool: 1 = women underrepresented, 0 = women overrepresented)

##
## Call:
## lm(formula = female_pick ~ treatment * men_pool, data = d0)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.7674 -0.3937  0.2326  0.3389  0.6667
##
## Coefficients:
##                    Estimate Std. Error t value Pr(>|t|)
## (Intercept)         0.76744    0.02443  31.412  < 2e-16 ***
## treatment          -0.10631    0.03669  -2.898  0.00383 **
## men_pool           -0.43411    0.03674 -11.814  < 2e-16 ***
## treatment:men_pool  0.34773    0.05401   6.438 1.74e-10 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.4669 on 1196 degrees of freedom
## Multiple R-squared:  0.1051, Adjusted R-squared:  0.1028
## F-statistic:  46.8 on 3 and 1196 DF,  p-value: < 2.2e-16

##                         2.5 %      97.5 %
## (Intercept)         0.7195085  0.81537527
## treatment          -0.1782968 -0.03432774
## men_pool           -0.5062001 -0.36201693
## treatment:men_pool  0.2417684  0.45369123

##
##
## Cell Means:

## # A tibble: 4 x 5
##   cond    pool      n mean_female_pick    se
##   <chr>   <chr> <int>            <dbl> <dbl>
## 1 control men     297             33.3  2.74
## 2 control women   301             76.7  2.44
## 3 treat   men     301             57.5  2.85
## 4 treat   women   301             66.1  2.73
```

Simple Effects by Pool

Women Underrepresented Pool (Men Pool, 25% Women)

```
## === WOMEN UNDERREPRESENTED POOL (MEN POOL, 25% WOMEN) ===

## Model: female_pick ~ treatment

##
## Call:
## lm(formula = female_pick ~ treatment, data = d0 %>% filter(men_pool ==
##     1))
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.5747 -0.3333 -0.3333  0.4253  0.6667
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.33333    0.02745  12.145  < 2e-16 ***
## treatment    0.24142    0.03963   6.091 2.01e-09 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.4839 on 596 degrees of freedom
## Multiple R-squared:  0.05876,    Adjusted R-squared:  0.05718
## F-statistic: 37.21 on 1 and 596 DF,  p-value: 1.912e-09

##                 2.5 %    97.5 %
## (Intercept) 0.2794306 0.3872361
## treatment   0.1635818 0.3192532

##
##
## Cell Means - Women Underrepresented Pool:

## # A tibble: 2 x 4
##   cond        n mean_female_pick    se
##   <chr>   <int>            <dbl> <dbl>
## 1 control   297             33.3  2.74
## 2 treat     301             57.5  2.85
```

Women Overrepresented Pool (Women Pool, 75% Women)

```
## === WOMEN OVERREPRESENTED POOL (WOMEN POOL, 75% WOMEN) ===

## --- MAIN EFFECT MODEL ---

## Model: female_pick ~ treatment

##
## Call:
## lm(formula = female_pick ~ treatment, data = d0 %>% filter(men_pool ==
##     0))
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.7674 -0.6611  0.2326  0.3389  0.3389
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.76744    0.02443  31.412   <2e-16 ***
## treatment   -0.10631    0.03669  -2.898   0.0039 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.4494 on 600 degrees of freedom
## Multiple R-squared:  0.01385,    Adjusted R-squared:  0.0122
## F-statistic: 8.424 on 1 and 600 DF,  p-value: 0.003839

##                   2.5 %      97.5 %
## (Intercept)  0.7194602  0.81542355
## treatment   -0.1783693 -0.03425524

##
##
## Cell Means by Treatment:

## # A tibble: 2 x 4
##   cond        n mean_female_pick    se
##   <chr>   <int>            <dbl> <dbl>
## 1 control   301             76.7  2.44
## 2 treat     301             66.1  2.73
```

Wald Test: Comparing Treatment Effects Across Pools

```
## === WALD TEST: DIFFERENCE IN TREATMENT EFFECTS BETWEEN POOLS ===

## Treatment Effect (Men Pool 25%):   0.2414 (SE = 0.0396)

## Treatment Effect (Women Pool 75%): -0.1063 (SE = 0.0367)

## Difference in Treatment Effects: 0.3477

## Standard Error of Difference:    0.0540

## Wald Statistic (z):              6.4385

## P-value (two-tailed):            0.0000

## 95% CI for Difference:           [0.2419, 0.4536]
```

Visualization

Interaction Plot: Treatment × Pool

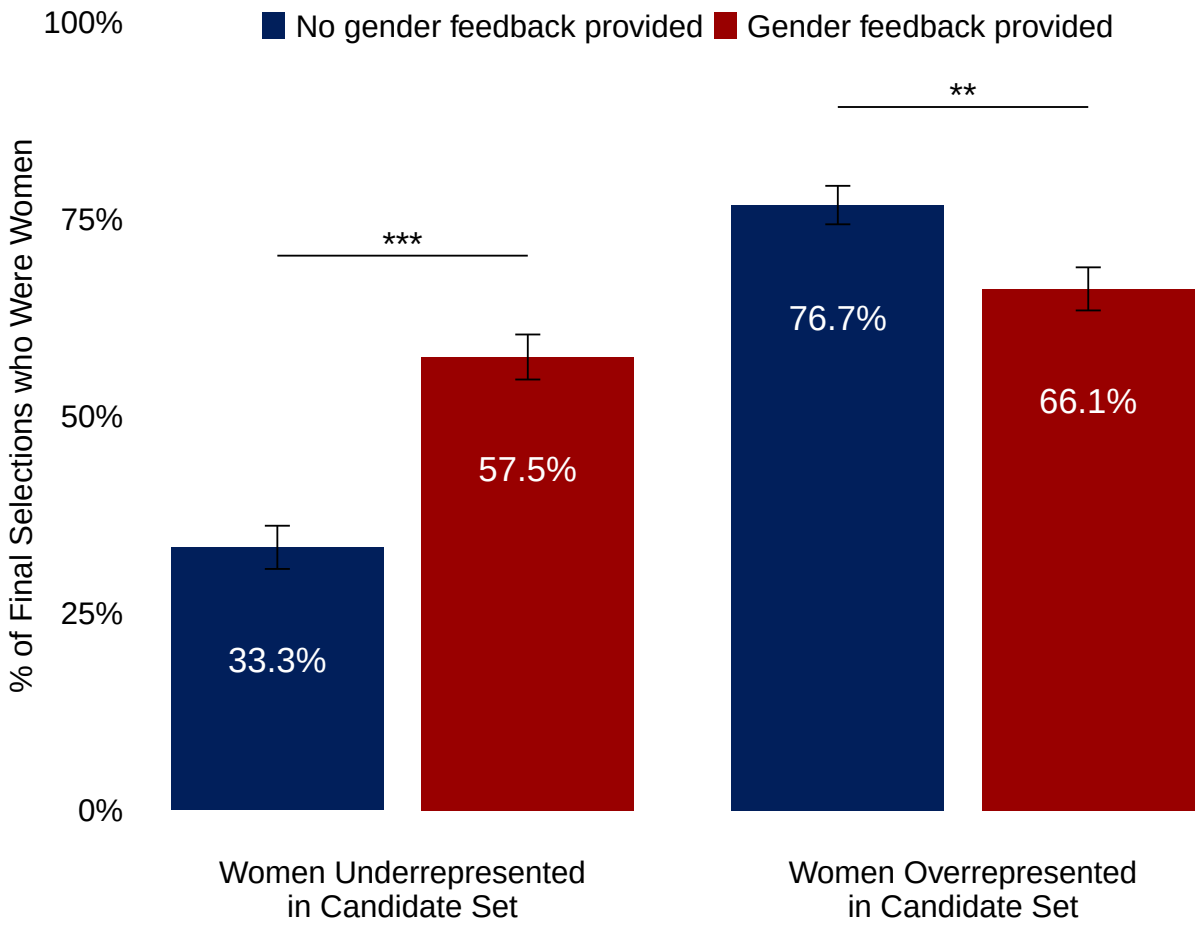


Figure 1: Effect of Gender Feedback by Pool Condition

Mechanism Analysis

Scale Descriptives

```
## ======================================================

## MECHANISM SCALE DESCRIPTIVES

## ======================================================

## === OVERALL SCALE DESCRIPTIVES ===
##
## Fairness Scale (fair1, fair2, fair3):
##   Mean: 3.415
##   SD: 1.718
##   N (non-missing): 1200
##   Alpha: 0.898
##
## Internal Motivation Scale (I1, I2, I3, I4):
##   Mean: 3.477
##   SD: 1.72
##   N (non-missing): 1200
##   Alpha: 0.927
##
## External Motivation Scale (E1, E2, E3):
##   Mean: 2.82
##   SD: 1.518
##   N (non-missing): 1200
##   Alpha: 0.905
##
## === SCALE MEANS BY CONDITION ===
##
## # A tibble: 4 x 9
##   pool  cond        n fairness_m fairness_sd internal_m internal_sd external_m
##   <chr> <chr>   <int>      <dbl>       <dbl>      <dbl>       <dbl>      <dbl>
## 1 men   control   297       3.1         1.58       3.13        1.65       2.57
## 2 men   treat     301       4.01        1.97       4.12        1.87       3.27
## 3 women control   301       3.11        1.46       3.09        1.54       2.61
## 4 women treat     301       3.44        1.66       3.57        1.6        2.83
## # i 1 more variable: external_sd <dbl>
```

Mediation Analysis: Women Overrepresented Pool

```r
# Set seed for reproducibility
set.seed(123)

# Filter to women overrepresented pool only
d_women_pool <- d0 |> filter(men_pool == 0, !is.na(fairness))

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

```
## ============================================================
```

```r
cat("MEDIATION ANALYSIS: WOMEN OVERREPRESENTED POOL\n")
```

```
## MEDIATION ANALYSIS: WOMEN OVERREPRESENTED POOL
```

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

```
## ============================================================
```

```r
cat("Sample size for mediation analysis:", nrow(d_women_pool), "\n\n")
```

```
## Sample size for mediation analysis: 602
```

```r
# Define function for Sobel Test
sobel_test <- function(med.fit, out.fit, mediator) {
  med.se <- sqrt(diag(vcovHC(med.fit)))[mediator]
  out.se <- sqrt(diag(vcovHC(out.fit)))[mediator]
  sobel_test_statistic <- coef(out.fit)[mediator] / sqrt(vcovHC(out.fit)[mediator,
↪  mediator])
  sobel_p_value <- 2 * (1 - pnorm(abs(sobel_test_statistic)))
  list(statistic = sobel_test_statistic, p_value = sobel_p_value, se = out.se)
}

# ------------------------------
# Fairness Analysis
# ------------------------------

# Direct effect model
dir.fit.fairness <- lm(female_pick ~ treatment, data = d_women_pool)

# Mediator model (a path)
med.fit.fairness <- lm(fairness ~ treatment, data = d_women_pool)

# Outcome model including mediator (b path)
out.fit.fairness <- lm(female_pick ~ treatment + fairness, data = d_women_pool)

# Mediation analysis using Imai's mediation package
med.out.fairness <- mediate(med.fit.fairness, out.fit.fairness, boot = TRUE,
```

```
                            treat = "treatment", boot.ci.type = "perc", mediator =
                            ↪  "fairness", sims = 10000)

# Sensitivity analysis
sens.out.fairness <- medsens(med.out.fairness, rho.by = 0.01, eps = .01, effect.type =
↪  "indirect", sims = 10000)

# Sobel test for fairness
sobel.fairness <- sobel_test(med.fit.fairness, out.fit.fairness, "fairness")

# Print and visualize results for fairness
cat("\n--- FAIRNESS MEDIATION ---\n\n")
```

```
##
## --- FAIRNESS MEDIATION ---
```

```
cat("Sobel test for Fairness\n")
```

```
## Sobel test for Fairness
```

```
print(sobel.fairness)
```

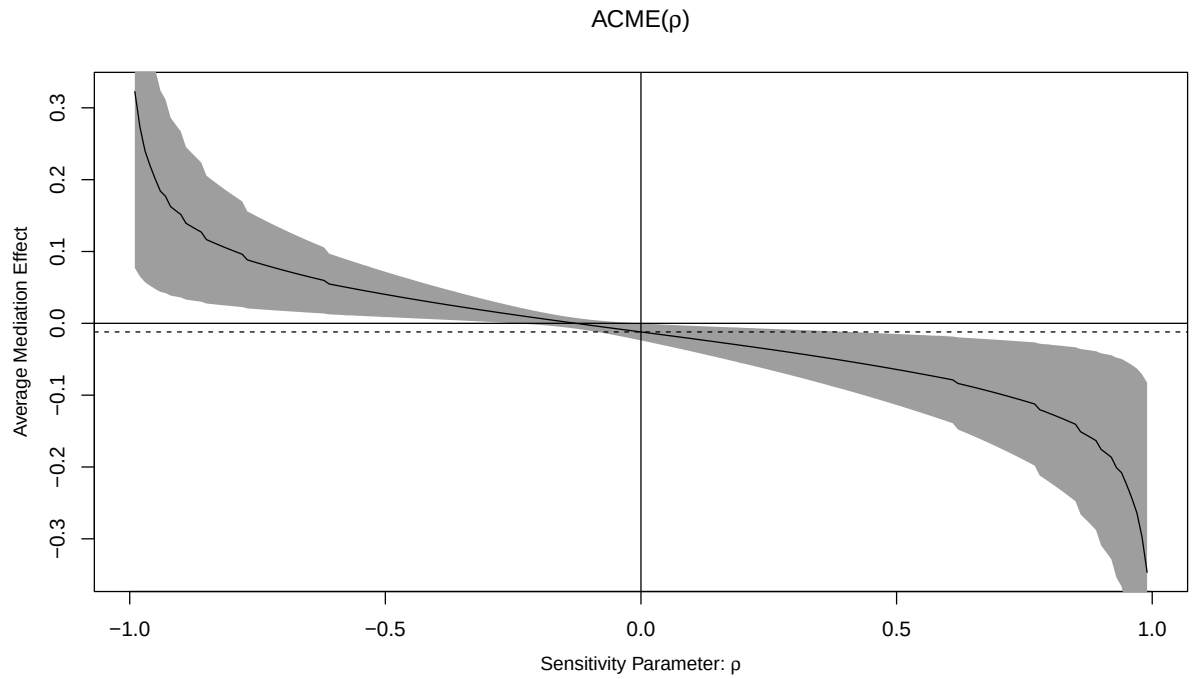
```
## $statistic
##  fairness
## -3.133809
##
## $p_value
##    fairness
## 0.001725531
##
## $se
##   fairness
## 0.01167607
```

```
summary(med.out.fairness)
```

```
##
## Causal Mediation Analysis
##
## Nonparametric Bootstrap Confidence Intervals with the Percentile Method
##
##                  Estimate 95% CI Lower 95% CI Upper p-value
## ACME           -0.0119942   -0.0261952   -0.0017671  0.0134 *
## ADE            -0.0943180   -0.1647812   -0.0251431  0.0082 **
## Total Effect   -0.1063123   -0.1781680   -0.0357640  0.0040 **
## Prop. Mediated  0.1128209    0.0164698    0.3515553  0.0166 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Sample Size Used: 602
```

```
##
##
## Simulations: 10000
```

```r
plot(sens.out.fairness)
```




```r
# ------------------------------
# Internal Motivation Analysis
# ------------------------------

# Mediator model (a path)
med.fit.internal <- lm(internal_motivation ~ treatment, data = d_women_pool)

# Outcome model including mediator (b path)
out.fit.internal <- lm(female_pick ~ treatment + internal_motivation, data =
↪  d_women_pool)

# Mediation analysis
med.out.internal <- mediate(med.fit.internal, out.fit.internal, boot = TRUE,
                            treat = "treatment", boot.ci.type = "perc", mediator =
                            ↪  "internal_motivation", sims = 10000)

# Sensitivity analysis
sens.out.internal <- medsens(med.out.internal, rho.by = 0.01, eps = .01, effect.type =
↪  "indirect", sims = 10000)

# Sobel test for internal motivation
sobel.internal <- sobel_test(med.fit.internal, out.fit.internal, "internal_motivation")
```

```r
# Print and visualize results for internal motivation
cat("\n--- INTERNAL MOTIVATION MEDIATION ---\n\n")
```

```
##
## --- INTERNAL MOTIVATION MEDIATION ---
```

```r
cat("Sobel test for Internal Motivation\n")
```

```
## Sobel test for Internal Motivation
```

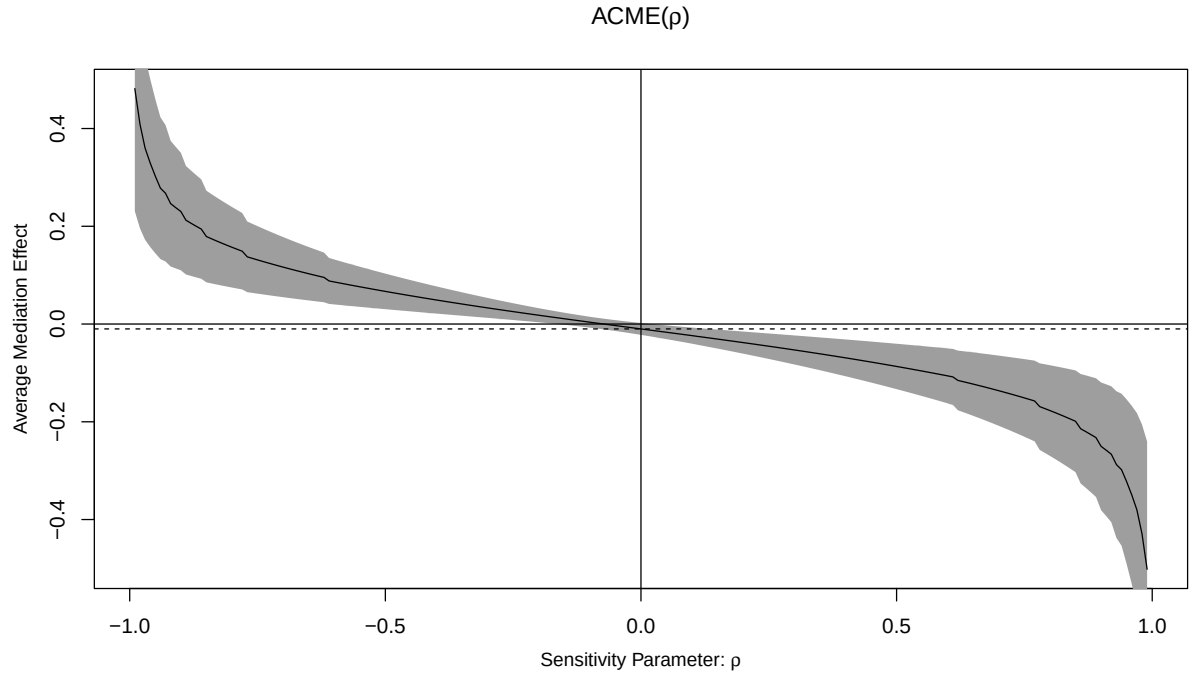
```r
print(sobel.internal)
```

```
## $statistic
## internal_motivation
##           -1.807569
##
## $p_value
## internal_motivation
##          0.07067363
##
## $se
## internal_motivation
##          0.01150776
```

```r
summary(med.out.internal)
```

```
##
## Causal Mediation Analysis
##
## Nonparametric Bootstrap Confidence Intervals with the Percentile Method
##
##                    Estimate 95% CI Lower 95% CI Upper p-value
## ACME           -0.01000317  -0.02407438   0.00070076  0.0720 .
## ADE            -0.09630912  -0.16699996  -0.02356042  0.0074 **
## Total Effect   -0.10631229  -0.17805740  -0.03275986  0.0034 **
## Prop. Mediated  0.09409234  -0.00891778   0.34062595  0.0746 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Sample Size Used: 602
##
##
## Simulations: 10000
```

```r
plot(sens.out.internal)
```




```r
# ------------------------------
# External Motivation Analysis
# ------------------------------

# Mediator model (a path)
med.fit.external <- lm(external_motivation ~ treatment, data = d_women_pool)

# Outcome model including mediator (b path)
out.fit.external <- lm(female_pick ~ treatment + external_motivation, data =
↪  d_women_pool)

# Mediation analysis
med.out.external <- mediate(med.fit.external, out.fit.external, boot = TRUE,
                            treat = "treatment", boot.ci.type = "perc", mediator =
                             ↪  "external_motivation", sims = 10000)

# Sensitivity analysis
sens.out.external <- medsens(med.out.external, rho.by = 0.01, eps = .01, effect.type =
↪  "indirect", sims = 10000)

# Sobel test for external motivation
sobel.external <- sobel_test(med.fit.external, out.fit.external, "external_motivation")

# Print and visualize results for external motivation
cat("\n--- EXTERNAL MOTIVATION MEDIATION ---\n\n")
```

```
##
## --- EXTERNAL MOTIVATION MEDIATION ---
```

```r
cat("Sobel test for External Motivation\n")
```

```
## Sobel test for External Motivation
```

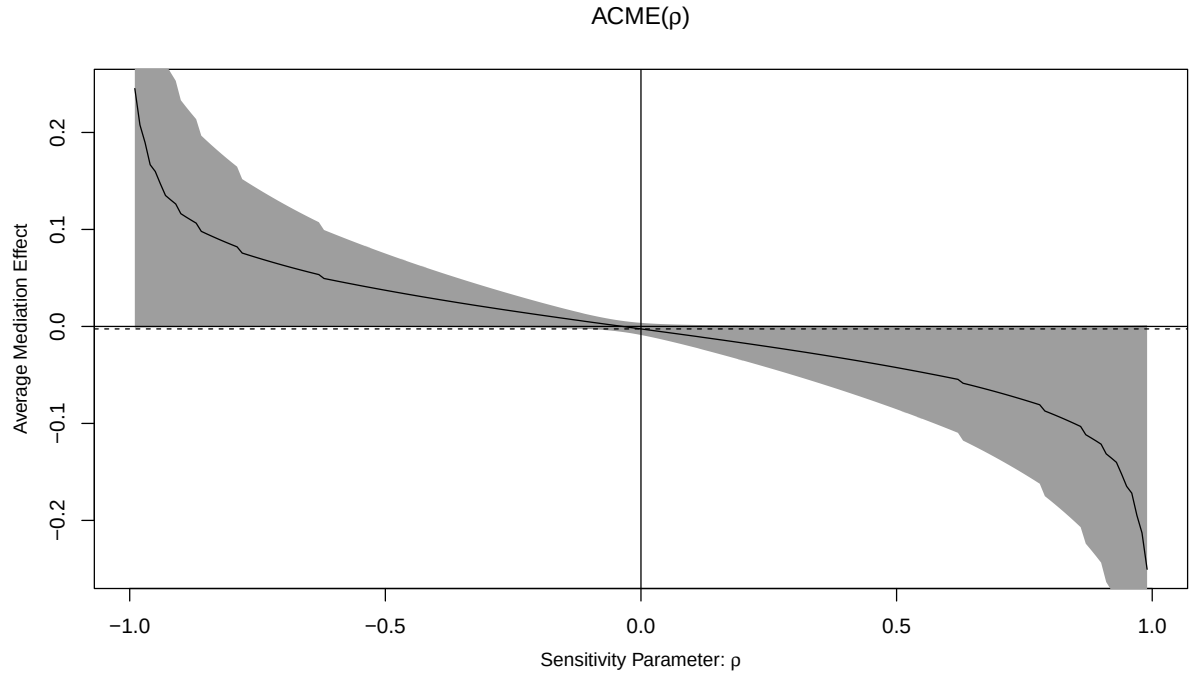
```r
print(sobel.external)
```

```
## $statistic
## external_motivation
##          -0.8749026
##
## $p_value
## external_motivation
##           0.3816269
##
## $se
## external_motivation
##           0.0129537
```

```r
summary(med.out.external)
```

```
##
## Causal Mediation Analysis
##
## Nonparametric Bootstrap Confidence Intervals with the Percentile Method
##
##                  Estimate 95% CI Lower 95% CI Upper p-value
## ACME           -0.0025603   -0.0106881    0.0033033  0.4094
## ADE            -0.1037520   -0.1742735   -0.0316267  0.0060 **
## Total Effect   -0.1063123   -0.1767591   -0.0345689  0.0050 **
## Prop. Mediated  0.0240831   -0.0389347    0.1382644  0.4124
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Sample Size Used: 602
##
##
## Simulations: 10000
```

```r
plot(sens.out.external)
```




```
# ---------------------------------
# Combined Multiple Mediation Model
# ---------------------------------

# Compute the correlation coefficient and p-value between mediators
cat("\n--- MEDIATOR CORRELATIONS ---\n\n")
```

```
##
## --- MEDIATOR CORRELATIONS ---
```

```
cor_fair_int <- cor.test(d_women_pool$fairness, d_women_pool$internal_motivation)
cor_fair_ext <- cor.test(d_women_pool$fairness, d_women_pool$external_motivation)
cor_int_ext <- cor.test(d_women_pool$internal_motivation,
↪  d_women_pool$external_motivation)

cat("Correlation (Fairness, Internal):", round(cor_fair_int$estimate, 3), "p =",
↪  round(cor_fair_int$p.value, 4), "\n")
```

```
## Correlation (Fairness, Internal): 0.789 p = 0
```

```
cat("Correlation (Fairness, External):", round(cor_fair_ext$estimate, 3), "p =",
↪  round(cor_fair_ext$p.value, 4), "\n")
```

```
## Correlation (Fairness, External): 0.647 p = 0
```

```r
cat("Correlation (Internal, External):", round(cor_int_ext$estimate, 3), "p =",
↪  round(cor_int_ext$p.value, 4), "\n\n")
```

```
## Correlation (Internal, External): 0.752 p = 0
```

```r
# Building combined outcome model with all mediators
out.fit.combined <- lm(female_pick ~ treatment + fairness + internal_motivation +
↪  external_motivation, data = d_women_pool)

# Run combined mediation analyses
med.out.combined.fairness <- mediate(med.fit.fairness, out.fit.combined, boot = TRUE,
                                     treat = "treatment", boot.ci.type = "perc", mediator
                                     ↪  = "fairness", sims = 10000)
med.out.combined.internal <- mediate(med.fit.internal, out.fit.combined, boot = TRUE,
                                     treat = "treatment", boot.ci.type = "perc", mediator
                                     ↪  = "internal_motivation", sims = 10000)
med.out.combined.external <- mediate(med.fit.external, out.fit.combined, boot = TRUE,
                                     treat = "treatment", boot.ci.type = "perc", mediator
                                     ↪  = "external_motivation", sims = 10000)

# Summarize and print the results for combined analysis
cat("\n--- COMBINED MULTIPLE MEDIATION MODEL RESULTS ---\n\n")
```

```
##
## --- COMBINED MULTIPLE MEDIATION MODEL RESULTS ---
```

```r
cat("Fairness (controlling for other mediators):\n")
```

```
## Fairness (controlling for other mediators):
```

```r
summary(med.out.combined.fairness)
```

```
##
## Causal Mediation Analysis
##
## Nonparametric Bootstrap Confidence Intervals with the Percentile Method
##
##                  Estimate 95% CI Lower 95% CI Upper p-value
## ACME           -0.0181997   -0.0417490   -0.0022375  0.0148 *
## ADE            -0.0968789   -0.1677729   -0.0258105  0.0078 **
## Total Effect   -0.1150786   -0.1883002   -0.0400464  0.0032 **
## Prop. Mediated  0.1581501    0.0198721    0.4558110  0.0180 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Sample Size Used: 602
##
##
## Simulations: 10000
```

```r
cat("\nInternal Motivation (controlling for other mediators):\n")
```

```
##
## Internal Motivation (controlling for other mediators):
```

```r
summary(med.out.combined.internal)
```

```
##
## Causal Mediation Analysis
##
## Nonparametric Bootstrap Confidence Intervals with the Percentile Method
##
##                  Estimate 95% CI Lower 95% CI Upper p-value
## ACME            0.0040061   -0.0179039    0.0268675  0.6944
## ADE            -0.0968789   -0.1685563   -0.0262503  0.0090 **
## Total Effect   -0.0928729   -0.1661897   -0.0207390  0.0128 *
## Prop. Mediated -0.0431348   -0.5901270    0.2113310  0.7032
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Sample Size Used: 602
##
##
## Simulations: 10000
```

```r
cat("\nExternal Motivation (controlling for other mediators):\n")
```

```
##
## External Motivation (controlling for other mediators):
```

```r
summary(med.out.combined.external)
```

```
##
## Causal Mediation Analysis
##
## Nonparametric Bootstrap Confidence Intervals with the Percentile Method
##
##                  Estimate 95% CI Lower 95% CI Upper p-value
## ACME            0.0047603   -0.0038565    0.0176710  0.3074
## ADE            -0.0968789   -0.1666242   -0.0241396  0.0086 **
## Total Effect   -0.0921187   -0.1621690   -0.0193986  0.0130 *
## Prop. Mediated -0.0516753   -0.3797989    0.0550423  0.3180
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Sample Size Used: 602
##
##
## Simulations: 10000
```

Mediation Path Summary

```
## ========================================================

## MEDIATION PATH SUMMARY: WOMEN OVERREPRESENTED POOL

## ========================================================

## N = 602

## === TOTAL EFFECT (c path) ===

## Model: female_pick ~ treatment

##
## Call:
## lm(formula = female_pick ~ treatment, data = d_women_pool)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.7674 -0.6611  0.2326  0.3389  0.3389
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.76744    0.02443  31.412   <2e-16 ***
## treatment   -0.10631    0.03669  -2.898   0.0039 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.4494 on 600 degrees of freedom
## Multiple R-squared:  0.01385,    Adjusted R-squared:  0.0122
## F-statistic: 8.424 on 1 and 600 DF,  p-value: 0.003839

##                  2.5 %      97.5 %
## (Intercept)  0.7194602  0.81542355
## treatment   -0.1783693 -0.03425524

##
##
## === a PATHS (Treatment -> Mediators) ===

## --- Fairness ---

## Model: fairness ~ treatment

## a = 0.3278

## SE = 0.1276

## p = 0.0105
```

```
## --- Internal Motivation ---

## Model: internal_motivation ~ treatment

## a = 0.4809

## SE = 0.1281

## p = 2e-04

## --- External Motivation ---

## Model: external_motivation ~ treatment

## a = 0.2259

## SE = 0.1162

## p = 0.0523

##
##
## === b PATHS (Mediator -> DV) & c' PATHS (Direct Effects) ===

## --- Fairness ---

## Model: female_pick ~ treatment + fairness

## b (fairness) = -0.0366

## SE = 0.0117

## p = 0.0018

## c' (direct) = -0.0943

## SE = 0.0363

## p = 0.0096

## --- Internal Motivation ---

## Model: female_pick ~ treatment + internal_motivation

## b (internal) = -0.0208

## SE = 0.0115
```

```
## p = 0.0712

## c' (direct) = -0.0963

## SE = 0.0364

## p = 0.0084

## --- External Motivation ---

## Model: female_pick ~ treatment + external_motivation

## b (external) = -0.0113

## SE = 0.013

## p = 0.382

## c' (direct) = -0.1038

## SE = 0.0367

## p = 0.0049

##
##
## === BOOTSTRAP INDIRECT EFFECTS SUMMARY (10,000 simulations) ===

##                                Mediator a_path b_path    ACME ACME_CI_lower
## fairness                       Fairness  0.328 -0.037 -0.0120       -0.0262
## internal_motivation Internal Motivation  0.481 -0.021 -0.0100       -0.0241
## external_motivation External Motivation  0.226 -0.011 -0.0026       -0.0107
##                     ACME_CI_upper ACME_p
## fairness                  -0.0018 0.0134
## internal_motivation        0.0007 0.0720
## external_motivation        0.0033 0.4094

##
## ACME = Average Causal Mediation Effect (indirect effect)

## CI = 95% Percentile Bootstrap Confidence Interval
```

Mediation Analysis: Women Underrepresented Pool

```r
# Set seed for reproducibility
set.seed(456)

# Filter to women underrepresented pool only (men pool, 25% women)
d_men_pool <- d0 |> filter(men_pool == 1, !is.na(fairness))

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

```
## ============================================================
```

```r
cat("MEDIATION ANALYSIS: WOMEN UNDERREPRESENTED POOL\n")
```

```
## MEDIATION ANALYSIS: WOMEN UNDERREPRESENTED POOL
```

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

```
## ============================================================
```

```r
cat("Sample size for mediation analysis:", nrow(d_men_pool), "\n\n")
```

```
## Sample size for mediation analysis: 598
```

```r
# ----------------------------
# Fairness Analysis
# ----------------------------

# Direct effect model
dir.fit.fairness.underrep <- lm(female_pick ~ treatment, data = d_men_pool)

# Mediator model (a path)
med.fit.fairness.underrep <- lm(fairness ~ treatment, data = d_men_pool)

# Outcome model including mediator (b path)
out.fit.fairness.underrep <- lm(female_pick ~ treatment + fairness, data = d_men_pool)

# Mediation analysis using Imai's mediation package
med.out.fairness.underrep <- mediate(med.fit.fairness.underrep,
↪  out.fit.fairness.underrep, boot = TRUE,
                             treat = "treatment", boot.ci.type = "perc", mediator =
                              ↪  "fairness", sims = 10000)

# Sensitivity analysis
sens.out.fairness.underrep <- medsens(med.out.fairness.underrep, rho.by = 0.01, eps =
↪  .01, effect.type = "indirect", sims = 10000)

# Sobel test for fairness
sobel.fairness.underrep <- sobel_test(med.fit.fairness.underrep,
↪  out.fit.fairness.underrep, "fairness")
```

```r
# Print and visualize results for fairness
cat("\n--- FAIRNESS MEDIATION ---\n\n")
```

```
##
## --- FAIRNESS MEDIATION ---
```

```r
cat("Sobel test for Fairness\n")
```

```
## Sobel test for Fairness
```

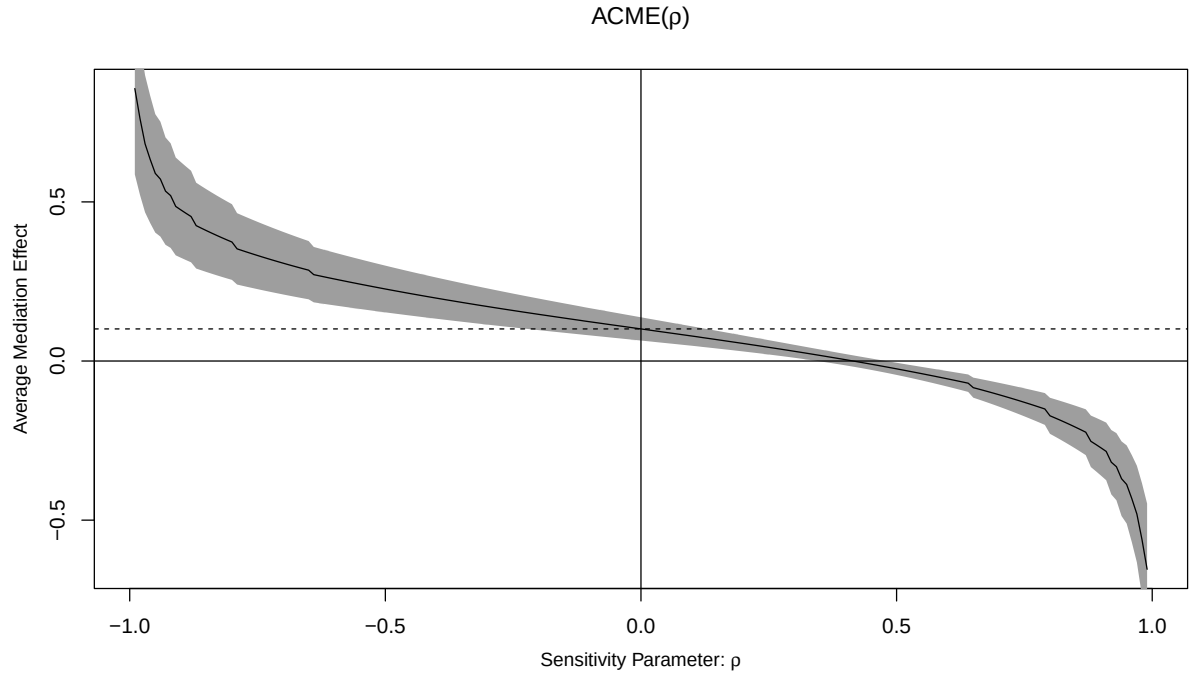
```r
print(sobel.fairness.underrep)
```

```
## $statistic
## fairness
##  11.7266
##
## $p_value
## fairness
##        0
##
## $se
##    fairness
## 0.009453088
```

```r
summary(med.out.fairness.underrep)
```

```
##
## Causal Mediation Analysis
##
## Nonparametric Bootstrap Confidence Intervals with the Percentile Method
##
##                Estimate 95% CI Lower 95% CI Upper p-value
## ACME           0.100888     0.067239     0.137071  <2e-16 ***
## ADE            0.140530     0.065716     0.213965   2e-04 ***
## Total Effect   0.241417     0.163329     0.318045  <2e-16 ***
## Prop. Mediated 0.417898     0.278724     0.630291  <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Sample Size Used: 598
##
##
## Simulations: 10000
```

```r
plot(sens.out.fairness.underrep)
```




```r
# ------------------------------
# Internal Motivation Analysis
# ------------------------------

# Mediator model (a path)
med.fit.internal.underrep <- lm(internal_motivation ~ treatment, data = d_men_pool)

# Outcome model including mediator (b path)
out.fit.internal.underrep <- lm(female_pick ~ treatment + internal_motivation, data =
↪  d_men_pool)

# Mediation analysis
med.out.internal.underrep <- mediate(med.fit.internal.underrep,
↪  out.fit.internal.underrep, boot = TRUE,
                            treat = "treatment", boot.ci.type = "perc", mediator =
                             ↪  "internal_motivation", sims = 10000)

# Sensitivity analysis
sens.out.internal.underrep <- medsens(med.out.internal.underrep, rho.by = 0.01, eps =
↪  .01, effect.type = "indirect", sims = 10000)

# Sobel test for internal motivation
sobel.internal.underrep <- sobel_test(med.fit.internal.underrep,
↪  out.fit.internal.underrep, "internal_motivation")

# Print and visualize results for internal motivation
cat("\n--- INTERNAL MOTIVATION MEDIATION ---\n\n")
```

```
##
```

```
## --- INTERNAL MOTIVATION MEDIATION ---
```

```
cat("Sobel test for Internal Motivation\n")
```

```
## Sobel test for Internal Motivation
```

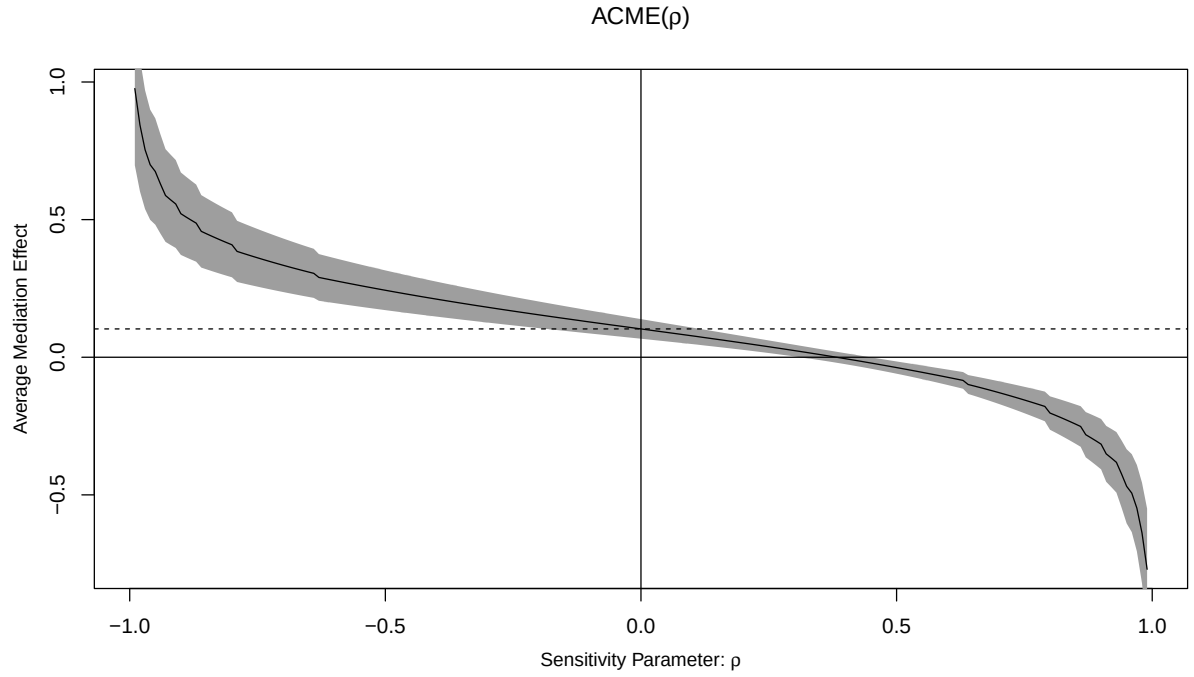
```
print(sobel.internal.underrep)
```

```
## $statistic
## internal_motivation
##            10.23571
##
## $p_value
## internal_motivation
##                   0
##
## $se
## internal_motivation
##          0.01014876
```

```
summary(med.out.internal.underrep)
```

```
##
## Causal Mediation Analysis
##
## Nonparametric Bootstrap Confidence Intervals with the Percentile Method
##
##                Estimate 95% CI Lower 95% CI Upper p-value
## ACME           0.102924     0.069796     0.138808  <2e-16 ***
## ADE            0.138493     0.063919     0.216489   6e-04 ***
## Total Effect   0.241417     0.164832     0.319598  <2e-16 ***
## Prop. Mediated 0.426333     0.282022     0.644070  <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Sample Size Used: 598
##
##
## Simulations: 10000
```

```
plot(sens.out.internal.underrep)
```




```r
# ------------------------------
# External Motivation Analysis
# ------------------------------

# Mediator model (a path)
med.fit.external.underrep <- lm(external_motivation ~ treatment, data = d_men_pool)

# Outcome model including mediator (b path)
out.fit.external.underrep <- lm(female_pick ~ treatment + external_motivation, data =
↪  d_men_pool)

# Mediation analysis
med.out.external.underrep <- mediate(med.fit.external.underrep,
↪  out.fit.external.underrep, boot = TRUE,
                             treat = "treatment", boot.ci.type = "perc", mediator =
                              ↪  "external_motivation", sims = 10000)

# Sensitivity analysis
sens.out.external.underrep <- medsens(med.out.external.underrep, rho.by = 0.01, eps =
↪  .01, effect.type = "indirect", sims = 10000)

# Sobel test for external motivation
sobel.external.underrep <- sobel_test(med.fit.external.underrep,
↪  out.fit.external.underrep, "external_motivation")

# Print and visualize results for external motivation
cat("\n--- EXTERNAL MOTIVATION MEDIATION ---\n\n")
```

```
##
```

```
## --- EXTERNAL MOTIVATION MEDIATION ---
```

```
cat("Sobel test for External Motivation\n")
```

```
## Sobel test for External Motivation
```

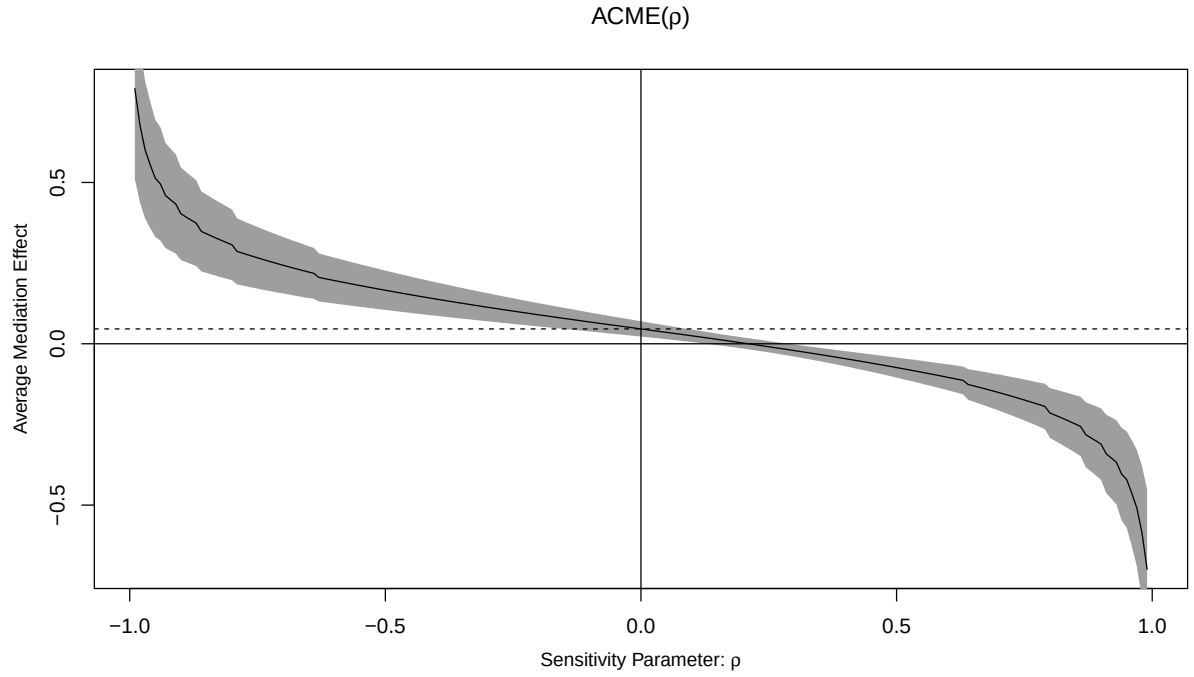
```
print(sobel.external.underrep)
```

```
## $statistic
## external_motivation
##            5.288926
##
## $p_value
## external_motivation
##        1.230366e-07
##
## $se
## external_motivation
##          0.01230329
```

```
summary(med.out.external.underrep)
```

```
##
## Causal Mediation Analysis
##
## Nonparametric Bootstrap Confidence Intervals with the Percentile Method
##
##                Estimate 95% CI Lower 95% CI Upper   p-value
## ACME           0.046062     0.024885     0.071768 < 2.2e-16 ***
## ADE            0.195355     0.118357     0.275134 < 2.2e-16 ***
## Total Effect   0.241417     0.166161     0.320806 < 2.2e-16 ***
## Prop. Mediated 0.190799     0.100439     0.329114 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Sample Size Used: 598
##
##
## Simulations: 10000
```

```
plot(sens.out.external.underrep)
```




```
# ---------------------------------
# Combined Multiple Mediation Model
# ---------------------------------

# Compute the correlation coefficient and p-value between mediators
cat("\n--- MEDIATOR CORRELATIONS ---\n\n")
```

```
##
## --- MEDIATOR CORRELATIONS ---
```

```
cor_fair_int.underrep <- cor.test(d_men_pool$fairness, d_men_pool$internal_motivation)
cor_fair_ext.underrep <- cor.test(d_men_pool$fairness, d_men_pool$external_motivation)
cor_int_ext.underrep <- cor.test(d_men_pool$internal_motivation,
↪  d_men_pool$external_motivation)

cat("Correlation (Fairness, Internal):", round(cor_fair_int.underrep$estimate, 3), "p =",
↪  round(cor_fair_int.underrep$p.value, 4), "\n")
```

```
## Correlation (Fairness, Internal): 0.857 p = 0
```

```
cat("Correlation (Fairness, External):", round(cor_fair_ext.underrep$estimate, 3), "p =",
↪  round(cor_fair_ext.underrep$p.value, 4), "\n")
```

```
## Correlation (Fairness, External): 0.684 p = 0
```

```r
cat("Correlation (Internal, External):", round(cor_int_ext.underrep$estimate, 3), "p =",
↪  round(cor_int_ext.underrep$p.value, 4), "\n\n")
```

```
## Correlation (Internal, External): 0.736 p = 0
```

```r
# Building combined outcome model with all mediators
out.fit.combined.underrep <- lm(female_pick ~ treatment + fairness + internal_motivation
↪  + external_motivation, data = d_men_pool)

# Run combined mediation analyses
med.out.combined.fairness.underrep <- mediate(med.fit.fairness.underrep,
↪  out.fit.combined.underrep, boot = TRUE,
                                    treat = "treatment", boot.ci.type = "perc", mediator
                                    ↪  = "fairness", sims = 10000)
med.out.combined.internal.underrep <- mediate(med.fit.internal.underrep,
↪  out.fit.combined.underrep, boot = TRUE,
                                    treat = "treatment", boot.ci.type = "perc", mediator
                                    ↪  = "internal_motivation", sims = 10000)
med.out.combined.external.underrep <- mediate(med.fit.external.underrep,
↪  out.fit.combined.underrep, boot = TRUE,
                                    treat = "treatment", boot.ci.type = "perc", mediator
                                    ↪  = "external_motivation", sims = 10000)

# Summarize and print the results for combined analysis
cat("\n--- COMBINED MULTIPLE MEDIATION MODEL RESULTS ---\n\n")
```

```
##
## --- COMBINED MULTIPLE MEDIATION MODEL RESULTS ---
```

```r
cat("Fairness (controlling for other mediators):\n")
```

```
## Fairness (controlling for other mediators):
```

```r
summary(med.out.combined.fairness.underrep)
```

```
##
## Causal Mediation Analysis
##
## Nonparametric Bootstrap Confidence Intervals with the Percentile Method
##
##                Estimate 95% CI Lower 95% CI Upper p-value
## ACME           0.085767     0.046679     0.132153  <2e-16 ***
## ADE            0.136964     0.061841     0.213727   6e-04 ***
## Total Effect   0.222731     0.137101     0.311288  <2e-16 ***
## Prop. Mediated 0.385070     0.226843     0.605834  <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Sample Size Used: 598
##
##
## Simulations: 10000
```

```r
cat("\nInternal Motivation (controlling for other mediators):\n")
```

```
##
## Internal Motivation (controlling for other mediators):
```

```r
summary(med.out.combined.internal.underrep)
```

```
##
## Causal Mediation Analysis
##
## Nonparametric Bootstrap Confidence Intervals with the Percentile Method
##
##                Estimate 95% CI Lower 95% CI Upper p-value
## ACME           0.056096     0.011477     0.107932  0.0140 *
## ADE            0.136964     0.061623     0.212519  0.0006 ***
## Total Effect   0.193060     0.111199     0.279585  <2e-16 ***
## Prop. Mediated 0.290564     0.069440     0.555670  0.0140 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Sample Size Used: 598
##
##
## Simulations: 10000
```

```r
cat("\nExternal Motivation (controlling for other mediators):\n")
```

```
##
## External Motivation (controlling for other mediators):
```

```r
summary(med.out.combined.external.underrep)
```

```
##
## Causal Mediation Analysis
##
## Nonparametric Bootstrap Confidence Intervals with the Percentile Method
##
##                 Estimate 95% CI Lower 95% CI Upper p-value
## ACME           -0.037410    -0.065981    -0.014000  0.0016 **
## ADE             0.136964     0.062246     0.214794  0.0008 ***
## Total Effect    0.099554     0.019247     0.180103  0.0150 *
## Prop. Mediated -0.375773    -1.998599    -0.091728  0.0166 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Sample Size Used: 598
##
##
## Simulations: 10000
```

Mediation Path Summary: Women Underrepresented Pool

```
## ========================================================

## MEDIATION PATH SUMMARY: WOMEN UNDERREPRESENTED POOL

## ========================================================

## N = 598

## === TOTAL EFFECT (c path) ===

## Model: female_pick ~ treatment

##
## Call:
## lm(formula = female_pick ~ treatment, data = d_men_pool)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.5747 -0.3333 -0.3333  0.4253  0.6667
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.33333    0.02745  12.145  < 2e-16 ***
## treatment    0.24142    0.03963   6.091 2.01e-09 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.4839 on 596 degrees of freedom
## Multiple R-squared:  0.05876,    Adjusted R-squared:  0.05718
## F-statistic: 37.21 on 1 and 596 DF,  p-value: 1.912e-09

##                 2.5 %    97.5 %
## (Intercept) 0.2794306 0.3872361
## treatment   0.1635818 0.3192532

##
##
## === a PATHS (Treatment -> Mediators) ===

## --- Fairness ---

## Model: fairness ~ treatment

## a = 0.9101

## SE = 0.1464

## p = 0
```

```
## --- Internal Motivation ---

## Model: internal_motivation ~ treatment

## a = 0.9908

## SE = 0.1446

## p = 0

## --- External Motivation ---

## Model: external_motivation ~ treatment

## a = 0.7079

## SE = 0.1278

## p = 0

##
##
## === b PATHS (Mediator -> DV) & c' PATHS (Direct Effects) ===

## --- Fairness ---

## Model: female_pick ~ treatment + fairness

## b (fairness) = 0.1109

## SE = 0.0095

## p = 0

## c' (direct) = 0.1405

## SE = 0.0381

## p = 2e-04

## --- Internal Motivation ---

## Model: female_pick ~ treatment + internal_motivation

## b (internal) = 0.1039

## SE = 0.0101
```

```
## p = 0

## c' (direct) = 0.1385

## SE = 0.0392

## p = 4e-04

## --- External Motivation ---

## Model: female_pick ~ treatment + external_motivation

## b (external) = 0.0651

## SE = 0.0123

## p = 0

## c' (direct) = 0.1954

## SE = 0.0403

## p = 0

##
##
## === BOOTSTRAP INDIRECT EFFECTS SUMMARY (10,000 simulations) ===

##                               Mediator a_path b_path   ACME ACME_CI_lower
## fairness                      Fairness  0.910  0.111 0.1009        0.0672
## internal_motivation Internal Motivation  0.991  0.104 0.1029        0.0698
## external_motivation External Motivation  0.708  0.065 0.0461        0.0249
##                     ACME_CI_upper ACME_p
## fairness                   0.1371      0
## internal_motivation        0.1388      0
## external_motivation        0.0718      0

##
## ACME = Average Causal Mediation Effect (indirect effect)

## CI = 95% Percentile Bootstrap Confidence Interval
```