

# Study 5 (Gender 2x2 Business Panel)

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## 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: 188

## 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 (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 (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]
```

**Figure 4 Code**

# Mediation Analysis

## 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

```
# 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")

## =====

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

## MEDIATION ANALYSIS: WOMEN OVERREPRESENTED POOL

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

## =====

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

## Sample size for mediation analysis: 602

# 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

```

```

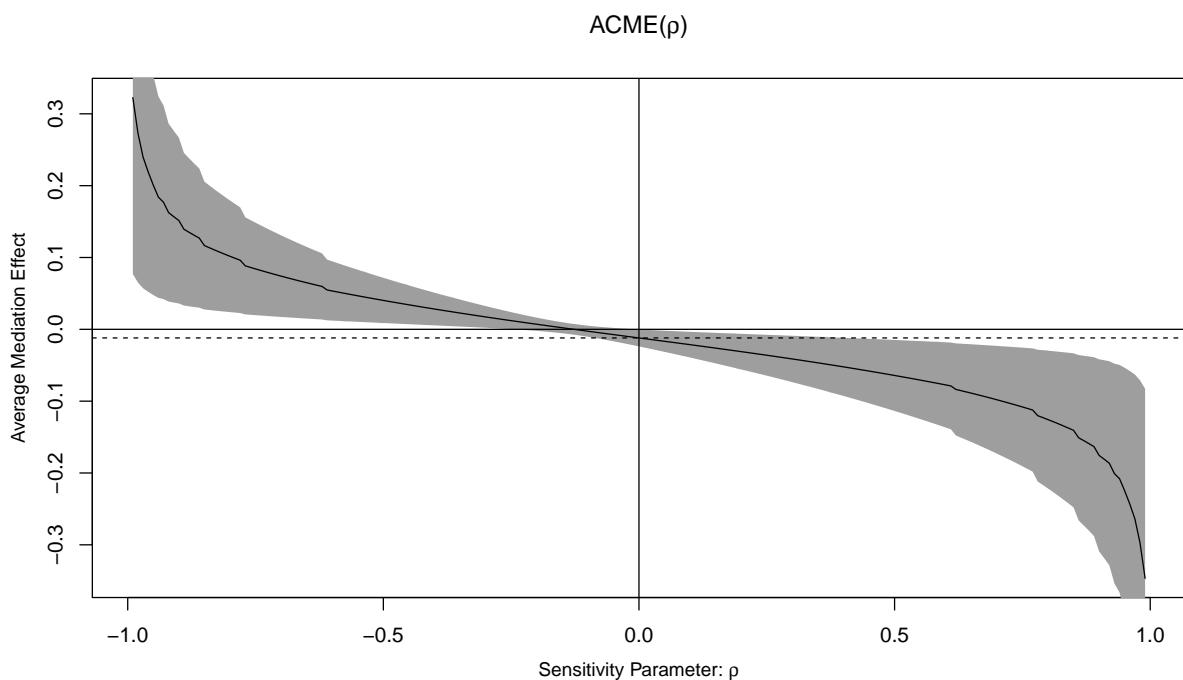
##  

##  

## Simulations: 10000  
  

plot(sens.out.fairness)

```



```

# -----  

# 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")

```

```

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

## 
## --- INTERNAL MOTIVATION MEDIACTION ---

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

## Sobel test for Internal Motivation

print(sobel.internal)

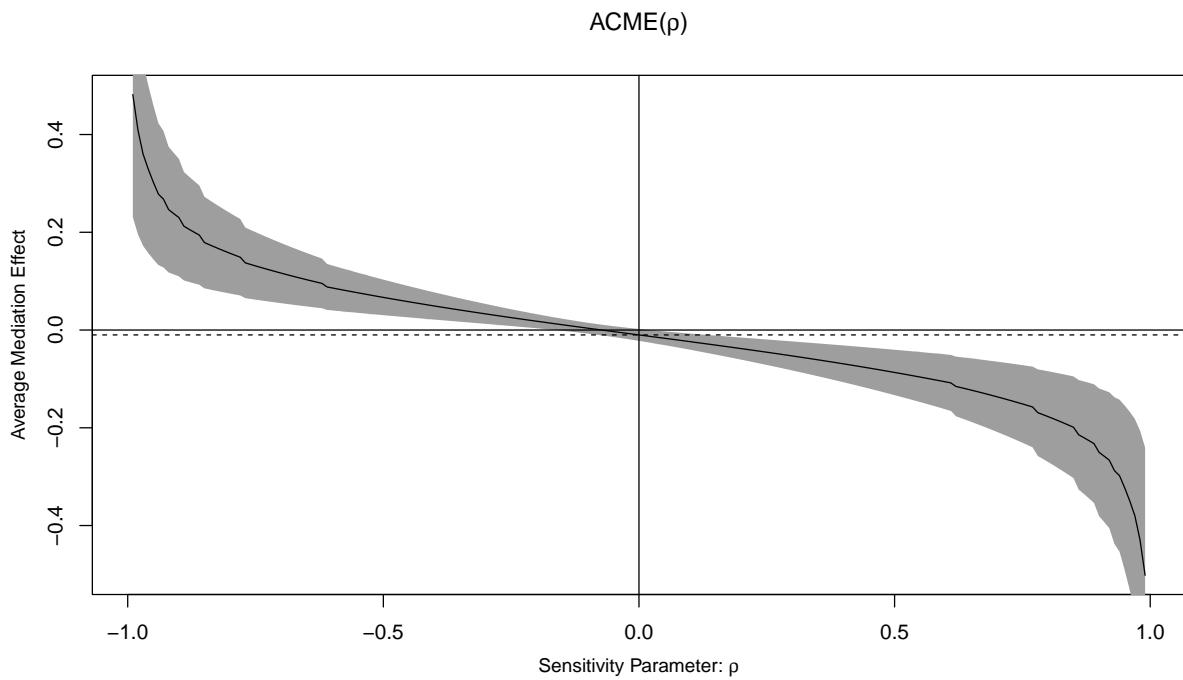
## $statistic
## internal_motivation
##             -1.807569
##
## $p_value
## internal_motivation
##             0.07067363
##
## $se
## internal_motivation
##             0.01150776

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

plot(sens.out.internal)

```



```

# -----
# 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 ---

```

```

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

## Sobel test for External Motivation

print(sobel.external)

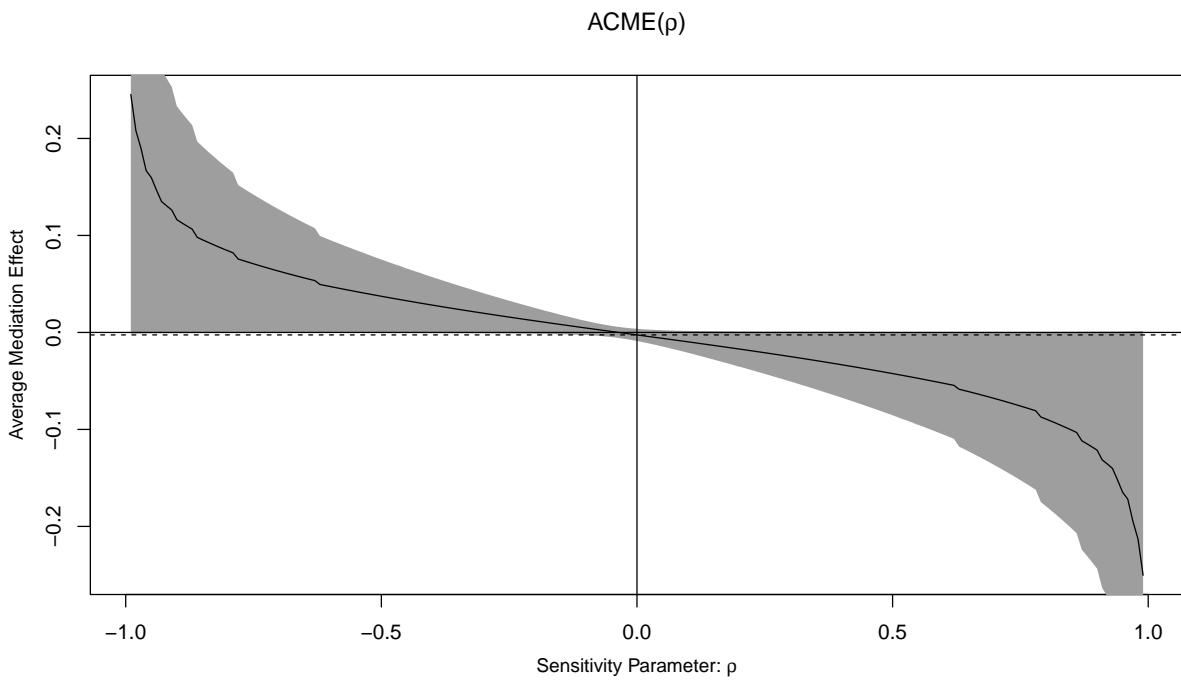
## $statistic
## external_motivation
##             -0.8749026
##
## $p_value
## external_motivation
##             0.3816269
##
## $se
## external_motivation
##             0.0129537

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

plot(sens.out.external)

```



```

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


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

```

```

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

# 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 ---

```

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

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

```
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

```

```

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

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

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

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

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

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 -0.16666242 -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 Analysis: Women Underrepresented Pool

```
# 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")

## =====

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

## MEDIATION ANALYSIS: WOMEN UNDERREPRESENTED POOL

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

## =====

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

## Sample size for mediation analysis: 598

# -----
# 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")
```

```

# 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.underrep)

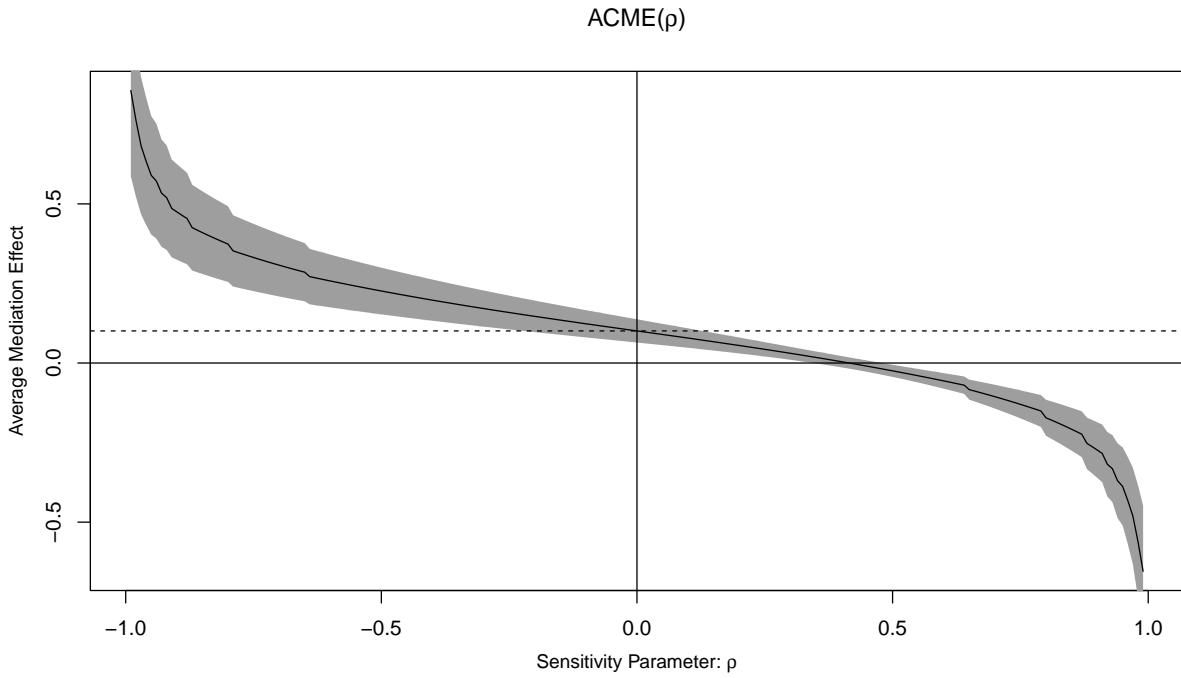
## $statistic
## fairness
## 11.7266
##
## $p_value
## fairness
## 0
##
## $se
## fairness
## 0.009453088

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

plot(sens.out.fairness.underrep)

```



```

# -----
# 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 ---\n\n")

##
```

```

## --- INTERNAL MOTIVATION MEDIATION ---

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

## Sobel test for Internal Motivation

print(sobel.internal.underrep)

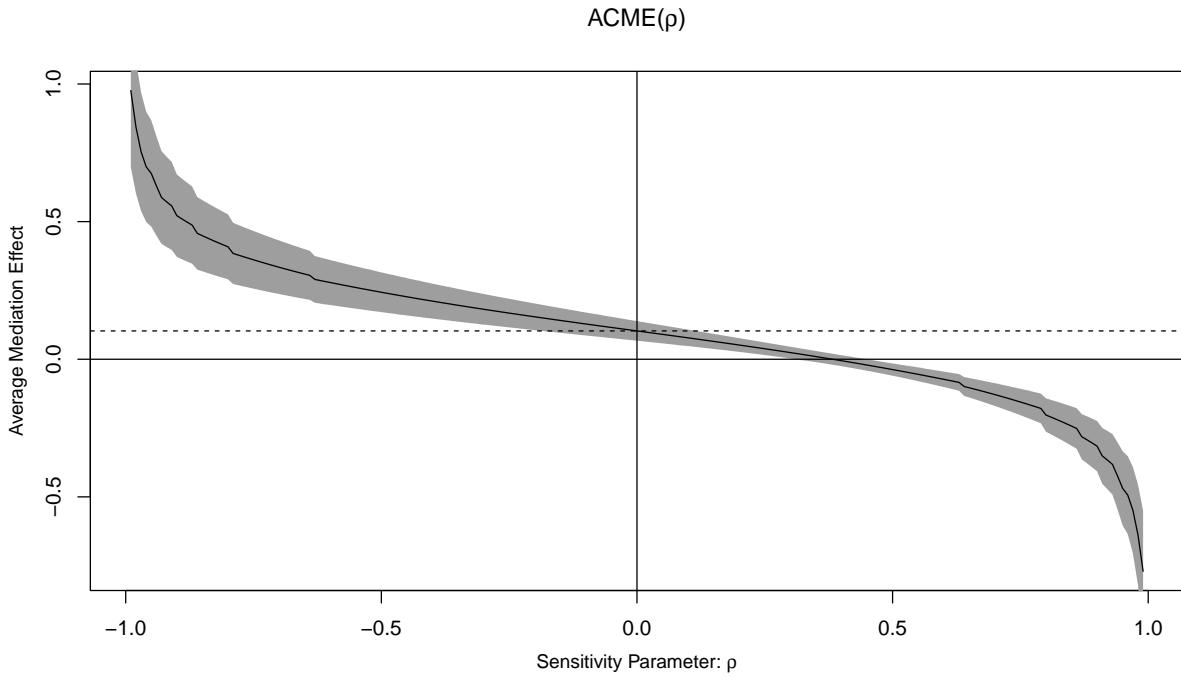
## $statistic
## internal_motivation
##          10.23571
##
## $p_value
## internal_motivation
##          0
##
## $se
## internal_motivation
##          0.01014876

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)

```



```

# -----
# 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 ---\n\n")

```

##

```

## --- EXTERNAL MOTIVATION MEDIATION ---

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

## Sobel test for External Motivation

print(sobel.external.underrep)

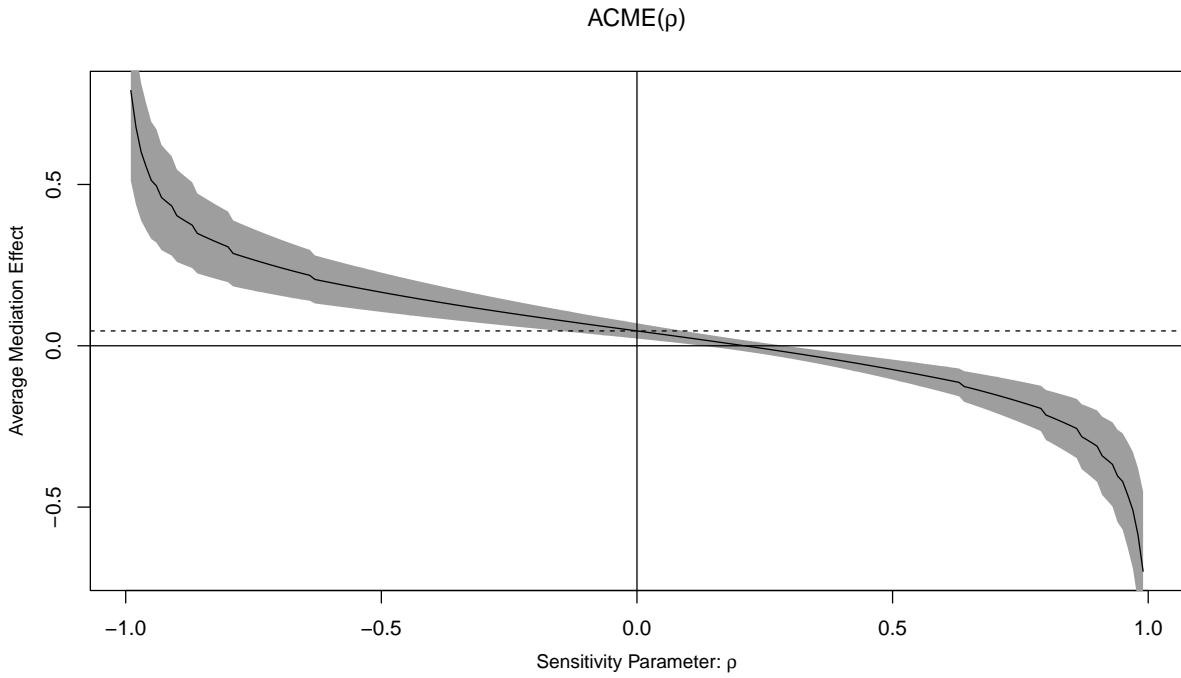
## $statistic
## external_motivation
##           5.288926
##
## $p_value
## external_motivation
##       1.230366e-07
##
## $se
## external_motivation
##       0.01230329

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")
cat("Correlation (Fairness, External):", round(cor_fair_ext.underrep$estimate, 3), "p =", 
    round(cor_fair_ext.underrep$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

```

```

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

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

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

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

## Fairness (controlling for other mediators):

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

```

```

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

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

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

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

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

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

```