

# Homework 7

## The Moving to Opportunity Experiment

Millions of low-income Americans live in high-poverty neighborhoods, which also tend to be racially segregated and often dangerous. While social scientists have long believed that living in these neighborhoods contributes to negative outcomes for its residents, it is often difficult to establish a causal link between neighborhood conditions and individual outcomes. The Moving to Opportunity (MTO) demonstration was designed to test whether offering housing vouchers to families living in public housing in high-poverty neighborhoods could improve their lives by helping them move to lower-poverty neighborhoods.

Between 1994 and 1998 the U.S. Department of Housing and Urban Development enrolled 4,604 low-income households from from public housing projects in Baltimore, Boston, Chicago, Los Angeles, and New York in MTO, randomly assigning enrolled families in each site to one of three groups: (1) The low-poverty voucher group received special MTO vouchers, which could only be used in census tracts with 1990 poverty rates below 10% and counseling to assist with relocation, (2) the traditional voucher group received regular section 8 vouchers, which they could use anywhere, and (3) the control group, who received no vouchers but continued to qualify for any project-based housing assistance they were entitled to receive. Today we will use the MTO data to learn if being given the opportunity to move to lower-poverty neighborhoods actually improved participants' economic and subjective well-being. This exercise is based on the following article:

Ludwig, J., Duncan, G.J., Gennetian, L.A., Katz, L.F., Kessler, J.R.K., and Sanbonmatsu, L., 2012. "[Neighborhood Effects on the Long-Term Well-Being of Low-Income Adults](#)." *Science*, Vol. 337, Issue 6101, pp. 1505-1510.

```
mto <- read.csv("mto.csv")
```

Name	Description
group	lpv (low-poverty voucher), sec8 (traditional section 8 voucher), and control

Name	Description
complier	1 for lpv and sec8 group members who used their MTO vouchers to relocate, 0 otherwise
site	MTO demonstration cities (Baltimore, Boston, Chicago, Los Angeles, New York)
wellbeing_zscore	Standardized measure of subjective well-being (happiness)
econ_ss_zscore	Standardized measure of economic self-sufficiency

## Question 1

1.1. Begin by creating a new variable called `treatment` based on the group variable where 1 indicates membership in either the lpv or sec8 groups (treatment groups) and 0 indicates membership in the control group.

```
mto$treatment <- 1
mto$treatment[mto$group == "control"] <- 0
```

1.2. Did receiving MTO vouchers improve economic self-sufficiency (`econ_ss_zscore`) among treatment group participants? Compute a difference in means to see if MTO influenced economic self-sufficiency. Compute 95% confidence intervals around the mean difference.

```
# Calculate mean economic self-sufficiency for treatment
# and control groups
mean_treatment <- mean(mto$econ_ss_zscore[mto$treatment == 1])
mean_control <- mean(mto$econ_ss_zscore[mto$treatment == 0])

# Calculate difference in means
diff_means <- round(mean_treatment - mean_control, 2)

# Perform t-test for economic self-sufficiency
econ_ttest <- t.test(mto$econ_ss_zscore[mto$treatment == 1],
  mto$econ_ss_zscore[mto$treatment == 0])

# Extract 95% confidence interval
conf_interval <- round(econ_ttest$conf.int, 2)

# Print results
print(paste("Difference in means:", diff_means))
```

```
[1] "Difference in means: -0.05"
```

```
print(paste0("95% Confidence Interval: [", conf_interval[1],
            ",", conf_interval[2], "]""))
```

```
[1] "95% Confidence Interval: [-0.14,0.04]"
```

Answer (mean): -0.05 Answer: (95% CI): [-0.14,0.04]

1.3. Repeat this analysis for happiness.

```
# Calculate mean economic self-sufficiency for treatment
# and control groups
mean_treatment <- mean(mto$wellbeing_zscore[mto$treatment ==
1])
mean_control <- mean(mto$wellbeing_zscore[mto$treatment == 0])

# Calculate difference in means
diff_means <- round(mean_treatment - mean_control, 2)

# Perform t-test for economic self-sufficiency
econ_ttest <- t.test(mto$wellbeing_zscore[mto$treatment == 1],
                    mto$wellbeing_zscore[mto$treatment == 0])

# Extract 95% confidence interval
conf_interval <- round(econ_ttest$conf.int, 2)

# Print results
print(paste("Difference in means:", diff_means))
```

```
[1] "Difference in means: 0.11"
```

```
print(paste0("95% Confidence Interval: [", conf_interval[1],
            ",", conf_interval[2], "]""))
```

```
[1] "95% Confidence Interval: [0.02,0.2]"
```

Answer (mean): 0.11 Answer: (95% CI): [0.02,0.20]

1.4. Interpret your results.

Both mean differences are small. We fail to reject the null hypothesis for economic outcomes, but we reject the null hypothesis of no difference for happiness.

## Question 2

2.1. MTO was designed to test whether moving from a high-poverty to a low-poverty neighborhood improved individual outcomes. But the MTO intervention only provided vouchers and counseling that would facilitate relocation for the treatment group. It would have been unethical to force treatment group members to move and force control group members to stay where they were living. Treatment group individuals could choose not to relocate, and control group individuals could choose to relocate. About half of the participants who received MTO vouchers actually complied with the experiment by using their vouchers to move to a low-poverty neighborhood.

Subset the data to voucher recipients (`group != 'control'`). Then compute the proportion of individuals who moved.

```
# Subset the data to voucher recipients (group !=
# 'control')
voucher_recipients <- mto[mto$group != "control", ]

# Compute the proportion of individuals who moved
# (compliers)
proportion_moved <- mean(voucher_recipients$complier)

# Print the proportion of individuals who moved
print(paste("Proportion of voucher recipients who moved:", round(proportion_moved,
2)))
```

```
[1] "Proportion of voucher recipients who moved: 0.51"
```

Answer: .51

2.2. Was the average complier rate for those in group (lpv and sec8) significantly different? Report the mean difference and the 95% confidence interval.

```
# Subset the data to voucher recipients (group !=
# 'control')
voucher_recipients <- mto[mto$group != "control", ]

# Perform a t-test to compare the complier rates between
# lpv and sec8 groups
complier_ttest <- t.test(voucher_recipients$complier ~ voucher_recipients$group)

# Extract mean difference and 95% confidence interval
mean_difference <- round(diff(complier_ttest$estimate), 2)
```

```
conf_interval <- round(complier_ttest$conf.int, 2)

# Print the results
print(paste("Mean difference in complier rates:", mean_difference))
```

```
[1] "Mean difference in complier rates: 0.12"
```

```
print(paste0("95% Confidence Interval: [", conf_interval[1],
            ", ", conf_interval[2], "]" ))
```

```
[1] "95% Confidence Interval: [-0.17, -0.08]"
```

Answer (mean): 0.12 Answer (95% CI): [-0.17, -0.08]

### Question 3

3.1. Explore the possibility that the null result we observed for economic self-sufficiency was the consequence of low numbers of movers among voucher recipients in some MTO sites (i.e. cities). Moving, defined as using a voucher if one is assigned to the treatment (either `lpv` or `sec8` groups), ranged from a low of 36% in Chicago to 68% in Los Angeles. Examine whether the treatment had an effect on economic self-sufficiency in Los Angeles, the MTO city with the movement compliance rate. Specifically, compute the average treatment effect of MTO on economic self sufficiency for LPV participants in Los Angeles relative to the control. Also compute 95% CIs.

```
# Subset the data to Los Angeles participants
la_participants <- mto[mto$site == "Los Angeles", ]

# Further subset to include only LPV participants and the
# control group
la_lpv_control <- la_participants[la_participants$group %in%
    c("lpv", "control"), ]

# Create the treatment variable for this subset (1 for lpv,
# 0 for control)
la_lpv_control$treatment <- as.numeric(la_lpv_control$group ==
    "lpv")

# Perform t-test for economic self-sufficiency in Los
# Angeles for LPV vs. control
```

```
econ_ttest_la_lpv <- t.test(la_lpv_control$econ_ss_zscore ~ la_lpv_control$treatment)

# Extract mean difference and 95% confidence interval
mean_difference_la_lpv <- round(diff(econ_ttest_la_lpv$estimate),
  2)
conf_interval_la_lpv <- round(econ_ttest_la_lpv$conf.int, 2)

# Print the results
print(paste("Mean difference in economic self-sufficiency for LPV in Los Angeles relative to control",
  mean_difference_la_lpv))
```

```
[1] "Mean difference in economic self-sufficiency for LPV in Los Angeles relative to control"
```

```
print(paste("95% Confidence Interval: [", conf_interval_la_lpv[1],
  ", ", conf_interval_la_lpv[2], "]" ))
```

```
[1] "95% Confidence Interval: [ -0.17 , 0.24 ]"
```

Answer (mean): -0.03 Answer (95% CI): [ -0.17 , 0.24 ]

3.2. Interpret your results. The estimated average treatment effect of MTO on the economic self-sufficiency index of Los Angeles participants is negative, small, and not significant.

## Question 4

4.1. Generate a regression model testing for changes in economic self-sufficiency. Use economic self-sufficiency as the dependent measure, and group, complier, and site as predictors.

```
model <- lm(econ_ss_zscore ~ group + complier + site, data = mto)
model
```

Call:

```
lm(formula = econ_ss_zscore ~ group + complier + site, data = mto)
```

Coefficients:

(Intercept)	grouplpv	groupsec8	complier
0.06118	-0.26923	-0.40729	0.46180
siteBoston	siteChicago	siteLos Angeles	siteNew York City
-0.03555	0.07392	-0.25105	0.01788

4.2. Compute confidence intervals for this model.

```
confint(model)
```

	2.5 %	97.5 %
(Intercept)	-0.07365509	0.19601126
grouplpv	-0.38529381	-0.15316948
groupsec8	-0.54950688	-0.26507048
complier	0.34788758	0.57571062
siteBoston	-0.19116367	0.12006619
siteChicago	-0.08267857	0.23051013
siteLos Angeles	-0.40386397	-0.09824245
siteNew York City	-0.13557035	0.17132105

4.3. Interpret your results.

Compared to control, the estimate for lpv and sec8 is negative, while the effect for complier is positive. This suggests that economic self-sufficiency only increased for those who moved.

4.4. Generate a regression model testing for changes in happiness. Use happiness as the dependent measure, and group, complier, and site as predictors.

```
model <- lm(wellbeing_zscore ~ group + complier + site, data = mto)
model
```

Call:

```
lm(formula = wellbeing_zscore ~ group + complier + site, data = mto)
```

Coefficients:

(Intercept)	grouplpv	groupsec8	complier
0.15446	-0.15156	-0.07355	0.45143
siteBoston	siteChicago	siteLos Angeles	siteNew York City
-0.05873	-0.02710	-0.27038	-0.31368

4.5. Compute confidence intervals for this model.

```
confint(model)
```

	2.5 %	97.5 %
(Intercept)	0.02001237	0.28891748
grouplpv	-0.26729547	-0.03582640
groupsec8	-0.21536801	0.06826545
complier	0.33784209	0.56502200
siteBoston	-0.21390983	0.09644146
siteChicago	-0.18324884	0.12905577
siteLos Angeles	-0.42275617	-0.11799739
siteNew York City	-0.46669417	-0.16066909

#### 4.6. Interpret your results.

As with the economic measure, compared to control the estimate for lpv and sec8 is negative, while the effect for complier is positive. This suggests that happiness only increased for those who moved.