

# Homework 7

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## 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., Genetian, 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("/data/qss/UNCERTAINTY/mto.csv")
```

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

The data we will use are not the original data, this dataset has been modified to protect participants' confidentiality, but the results of our analysis will be consistent with published data on the MTO demonstration. In the Science article the authors pooled the two voucher groups into a single treatment group because their outcomes converged over time. We will follow their strategy to assess the experiment's results.

### Question 1

1.1. Did receiving MTO vouchers improve economic self-sufficiency (`econ_ss_zscore`) and subjective well-being (`wellbeing_zscore`) among treatment group participants? 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$treatment <- NA  
mto$treatment[mto$group == "lpv" | mto$group == "sec8"] <- 1
```

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

1.2. Compute a difference in means to see if MTO influenced economic self-sufficiency. Compute 95% confidence intervals around the mean difference.

```
mean(mto$econ_ss_zscore[mto$treatment == 1]) - mean(mto$econ_ss_zscore[mto$treatment == 0])
```

```
## [1] -0.05267531
```

```
t.test((mto$econ_ss_zscore[mto$treatment == 1]), (mto$econ_ss_zscore[mto$treatment == 0]))
```

```
##
## Welch Two Sample t-test
##
## data: (mto$econ_ss_zscore[mto$treatment == 1]) and (mto$econ_ss_zscore[mto$treatment == 0])
## t = -1.1559, df = 2733, p-value = 0.2478
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
## -0.14203452 0.03668391
## sample estimates:
## mean of x mean of y
## -5.266525e-02 1.005579e-05
## (t.test((mto$econ_ss_zscore[mto$treatment == 1]), (mto$econ_ss_zscore[mto$treatment == 0])))$conf.int
```

```
## [1] -0.14203452 0.03668391
## attr("conf.level")
## [1] 0.95
```

1.3. Repeat this analysis for happiness.

```
mean(mto$wellbeing_zscore[mto$treatment == 1]) - mean(mto$wellbeing_zscore[mto$treatment == 0])
```

```
## [1] 0.1118683
```

```
t.test((mto$wellbeing_zscore[mto$treatment == 1]), (mto$wellbeing_zscore[mto$treatment == 0]))
```

```
##
## Welch Two Sample t-test
##
## data: (mto$wellbeing_zscore[mto$treatment == 1]) and (mto$wellbeing_zscore[mto$treatment == 0])
## t = 2.4652, df = 2759.1, p-value = 0.01375
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
## 0.02288887 0.20084775
## sample estimates:
## mean of x mean of y
## 0.1115819865 -0.0002863246
## (t.test((mto$wellbeing_zscore[mto$treatment == 1]), (mto$wellbeing_zscore[mto$treatment == 0])))$conf.int
```

```
## [1] 0.02288887 0.20084775
## attr("conf.level")
```

```
## [1] 0.95
```

#### 1.4. Interpret your results.

Both mean differences are within the confidence interval, so we can thus say they're both valid and representative of the whole population, and that the control group experienced greater economic self-sufficiency, while the treated group experienced greater average 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') and compute the proportion of individuals who moved among the traditional section 8 voucher recipients and the low-poverty voucher recipients.

```
voucher.recipients <- mto[mto$group != "control", ]

prop.table(table(voucher.recipients$complier))
```

```
##
##           0           1
## 0.4917724 0.5082276
```

2.2. Test the hypothesis that relocation among the traditional section 8 voucher recipients was greater than among the low-poverty voucher recipients. Is the difference in proportions significant at the 5% significance level?

```
tab <- table(voucher.recipients$group, voucher.recipients$complier)
tab <- tab[-1, ]
prop.test(tab, conf.level = 0.95)
```

```
##
## 2-sample test for equality of proportions with continuity
## correction
##
## data:  tab
## X-squared = 27.267, df = 1, p-value = 1.772e-07
## alternative hypothesis: two.sided
## 95 percent confidence interval:
##  0.07661387 0.16907832
## sample estimates:
##      prop 1      prop 2
## 0.5305842 0.4077381
```

#### 2.3. Interpret your results.

Since the p-value is less than .05, this indicates strong evidence against the null hypothesis and thus we fail to reject the null hypothesis, indicating that the test has failed to find any causal relationship between poverty rates and improved individual outcomes.

## 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 a high of 68% in Los Angeles. Examine whether the treatment had an effect on economic self-sufficiency in Los Angeles, compute the ATE of the treatment on economic self sufficiency for MTO participants in Los Angeles. Also compute 95% CIs.

```
mean(mto$econ_ss_zscore[mto$site == "Los Angeles" & mto$treatment ==
  1]) - mean(mto$econ_ss_zscore[mto$site == "Los Angeles" &
  mto$treatment == 0])

## [1] -0.02803714

t.test((mto$econ_ss_zscore[mto$site == "Los Angeles" & mto$treatment ==
  1]), (mto$econ_ss_zscore[mto$site == "Los Angeles" & mto$treatment ==
  0]))

##
## Welch Two Sample t-test
##
## data: (mto$econ_ss_zscore[mto$site == "Los Angeles" & mto$treatment == and (mto$econ_ss_zscore[mto$
## t = -0.29374, df = 709.38, p-value = 0.769
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
## -0.2154332 0.1593589
## sample estimates:
## mean of x mean of y
## -0.1889664 -0.1609293

(t.test((mto$econ_ss_zscore[mto$site == "Los Angeles" & mto$treatment ==
  1]), (mto$econ_ss_zscore[mto$site == "Los Angeles" & mto$treatment ==
  0])))$conf.int

## [1] -0.2154332 0.1593589
## attr(,"conf.level")
## [1] 0.95
```

3.2. Interpret your results.

The average treatment effect fits within the 95 percent confidence interval, simply indicating that the null result that we observed for economic self-sufficiency was the consequence of low numbers of movers, and by extension, the control group in LA experienced the greatest economic self-sufficiency.

## Question 4

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

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

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

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

4.2. Compute confidence intervals for this model.

```
confint(regression.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.

Every value is within the confidence interval, confirming that group, complier, and site are all important factors in determining the economic self-sufficiency score. Overall, the confidence intervals, except for the complier variable, are all negative suggesting that the demonstration cities decrease economic self-sufficiency (also for individuals in groups sce8 and lpv), while actually moving (complier group) vastly increases economic self-sufficiency.

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

```
(regression.model.2 <- lm(wellbeing_zscore ~ group + complier +
  site, data = mto))
```

```
##
## Call:
## lm(formula = wellbeing_zscore ~ group + complier + site, data = mto)
##
## Coefficients:
##      (Intercept)      grouplpv      groupsec8
##      0.15446      -0.15156      -0.07355
##      complier      siteBoston      siteChicago
##      0.45143      -0.05873      -0.02710
## siteLos Angeles siteNew York City
##      -0.27038      -0.31368
```

4.5. Compute confidence intervals for this model.

```
confint(regression.model.2)
```

```
##              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.

Every value is within the confidence interval, confirming that group, complier, and site are all important factors in determining the well being score. Overall, the confidence intervals, except for the complier variable, are all negative suggesting that the demonstration cities decrease happiness, while actually moving (complier group) vastly increases happiness.