Final Project Milestone 2: Analyses

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11/17/2020

Data Processing

```
colnames(MoCo_MD_LEED_Cert)
```

Renaming the columns to make them workable

```
##  [1] "Building Name"                  "Path"
##  [3] "Certification date"             "City"
##  [5] "State"                          "Country"
##  [7] "Rating system"                  "Version"
##  [9] "Certification level (name)"     "Certification level (numeric)"
```

```
MoCo_MD_LEED_Cert <- MoCo_MD_LEED_Cert %>%
  rename(
    name = "Building Name",
    path = "Path",
    cert_date = "Certification date",
    city = "City",
    state = "State",
    country = "Country",
    build_type = "Rating system",
    version = "Version",
    cert_name = "Certification level (name)",
    cert_num = "Certification level (numeric)"
  ) %>%
  select(name, cert_date, build_type, cert_name, cert_num)
```

```
MoCo_MD_LEED_Cert <- MoCo_MD_LEED_Cert %>%
  mutate(new_build = case_when(
    build_type == "Commercial Interiors" ~ 0,
    build_type == "New Construction" ~ 1,
    build_type == "Core and Shell" ~ 1,
    build_type == "Schools - New Construction" ~ 1,
    build_type == "Existing Buildings" ~ 0,
    build_type == "Retail - New Construction" ~ 1,
```

```
    build_type == "Retail - Commercial Interiors" ~ 0
  )) %>%
  drop_na(new_build)

summarize(MoCo_MD_LEED_Cert,
          mean_new_build = mean(new_build))
```

Making the independent variable

```
## # A tibble: 1 x 1
##   mean_new_build
##            <dbl>
## 1          0.612
```

```
MoCo_MD_LEED_Cert %>%
  group_by(new_build) %>%
  summarize(
    mean_score = mean(cert_num)
  )
```

Working with the Dependent Variable

```
## `summarise()` ungrouping output (override with `.groups` argument)

## # A tibble: 2 x 2
##   new_build mean_score
##       <dbl>      <dbl>
## 1         0       2.46
## 2         1       2.52
```

```
summarize(MoCo_MD_LEED_Cert,
          mean_score = mean(cert_num))
```

```
## # A tibble: 1 x 1
##   mean_score
##        <dbl>
## 1        2.5
```

```
MoCo_MD_LEED_Cert <- MoCo_MD_LEED_Cert %>%
  mutate(cert_date = substr(cert_date, 7L, 10L)) %>%
  mutate(cert_date = as.numeric(cert_date))
```

Date

```
write.csv(MoCo_MD_LEED_Cert, file = "data_output/MoCo_MD_LEED_Cert_edit.csv",
          row.names = FALSE)
```

Saving Data

Analysis

```
MoCo_MD_LEED_Cert %>%
  group_by(new_build) %>%
  summarize(
    level_mean = mean(cert_num),
    level_se = sd(cert_num) / sqrt(n())
  ) %>%
  pivot_wider(names_from = new_build, values_from = c(level_mean, level_se)) %>%
  mutate(
    ate_level_diff = level_mean_1 - level_mean_0,
    ate_level_se = sqrt(level_se_1 ^ 2 + level_se_0 ^2)
  ) %>%
  select(ate_level_diff, ate_level_se)
```

ATE Calculations

```
## `summarise()` ungrouping output (override with `.groups` argument)
```

```
## # A tibble: 1 x 2
##   ate_level_diff ate_level_se
##            <dbl>        <dbl>
## 1         0.0592        0.129
```

```
ggplot(MoCo_MD_LEED_Cert, aes(cert_num)) +
  geom_histogram(fill = "seagreen", binwidth = 1, color = "black") +
  labs(y = "Number of Certified Buildings", x = "Certification Level",
       title = "Distribution of Building Certification Levels")
```

Plot

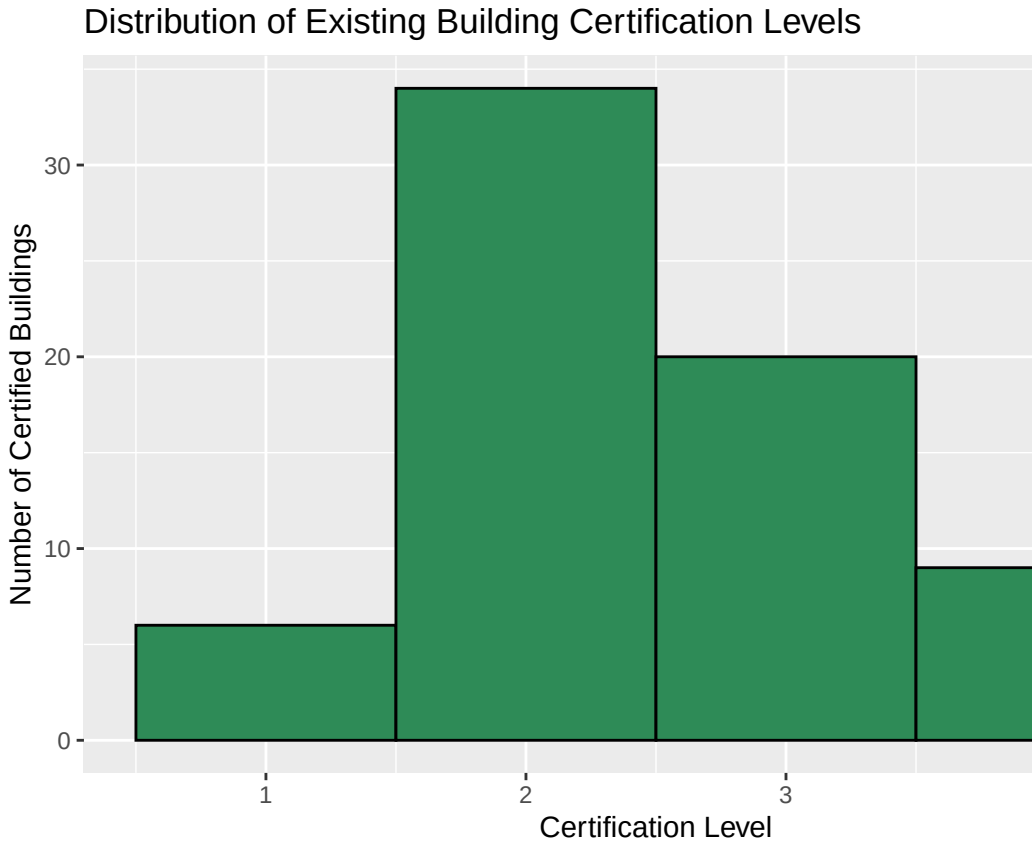
```
MoCo_MD_LEED_Cert_new <- MoCo_MD_LEED_Cert %>%
  filter(new_build == 1)

ggplot(MoCo_MD_LEED_Cert_new, aes(cert_num)) +
  geom_histogram(fill = "seagreen", binwidth = 1, color = "black") +
  labs(y = "Number of Certified Buildings", x = "Certification Level",
       title = "Distribution of New Building Certification Levels")
```

New Building Histogram

```
MoCo_MD_LEED_Cert_exist <- MoCo_MD_LEED_Cert %>%
  filter(new_build == 0)

ggplot(MoCo_MD_LEED_Cert_exist, aes(cert_num)) +
  geom_histogram(fill = "seagreen", binwidth = 1, color = "black") +
  labs(y = "Number of Certified Buildings", x = "Certification Level",
       title = "Distribution of Existing Building Certification Levels")
```



Existing Building Histogram

```
lin_fit <- lm(cert_num ~ new_build, data = MoCo_MD_LEED_Cert)
summary(lin_fit)
```

Regression

```
##
## Call:
## lm(formula = cert_num ~ new_build, data = MoCo_MD_LEED_Cert)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -1.5229 -0.5229 -0.4638  0.5362  1.5362
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  2.46377    0.10119  24.347   <2e-16 ***
## new_build    0.05917    0.12931   0.458    0.648
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.8406 on 176 degrees of freedom
## Multiple R-squared:  0.001188,   Adjusted R-squared:  -0.004487
## F-statistic: 0.2094 on 1 and 176 DF,  p-value: 0.6478
```

```r
multi_fit <- lm(cert_num ~ new_build + cert_date, data = MoCo_MD_LEED_Cert)
summary(multi_fit)
```

```
##
## Call:
## lm(formula = cert_num ~ new_build + cert_date, data = MoCo_MD_LEED_Cert)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -1.5534 -0.5370 -0.4709  0.5291  1.5620
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) -14.081878  60.913184  -0.231    0.817
## new_build     0.074265   0.129080   0.575    0.566
## cert_date     0.008223   0.030273   0.272    0.786
##
## Residual standard error: 0.8372 on 174 degrees of freedom
##   (1 observation deleted due to missingness)
## Multiple R-squared:  0.002272,   Adjusted R-squared:  -0.009196
## F-statistic: 0.1981 on 2 and 174 DF,  p-value: 0.8205
```

```r
# I am not sure how to plot the regression for this data, but here it is

# also considering doing a regression like lm(cert_num ~ new_build + cert_date),
# but the date data is strange
```