ECON2250_Group11_FinalProject

Wendell, Connor, & Caroline

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```
# Install Necessary Packages
options(repos = c(CRAN = "https://cran.rstudio.com/"))

packages <- c("tidyverse", "tidycensus", "bea.R", "janitor")
install.packages(setdiff(packages, rownames(installed.packages())))
lapply(packages, library, character.only = TRUE)
```

```
## -- Attaching core tidyverse packages ------------------------ tidyverse 2.0.0 --
## v dplyr     1.1.4     v readr     2.1.5
## v forcats   1.0.0     v stringr   1.5.2
## v ggplot2   4.0.0     v tibble    3.3.0
## v lubridate 1.9.4     v tidyr     1.3.1
## v purrr     1.1.0
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors
## Loading required package: data.table
##
##
## Attaching package: 'data.table'
##
##
## The following objects are masked from 'package:lubridate':
##
##     hour, isoweek, mday, minute, month, quarter, second, wday, week,
##     yday, year
##
##
## The following objects are masked from 'package:dplyr':
##
##     between, first, last
##
##
## The following object is masked from 'package:purrr':
##
##     transpose
##
##
## Note: As of February 2018, beaGet() requires 'TableName' for NIPA and NIUnderlyingDetail data instead
##
##
```

```
## Attaching package: 'janitor'
##
##
## The following objects are masked from 'package:stats':
##
##     chisq.test, fisher.test
```

```
## [[1]]
##  [1] "lubridate" "forcats"   "stringr"   "dplyr"     "purrr"     "readr"
##  [7] "tidyr"     "tibble"    "ggplot2"   "tidyverse" "stats"     "graphics"
## [13] "grDevices" "utils"     "datasets"  "methods"   "base"
##
## [[2]]
##  [1] "tidycensus" "lubridate"  "forcats"    "stringr"    "dplyr"
##  [6] "purrr"      "readr"      "tidyr"      "tibble"     "ggplot2"
## [11] "tidyverse"  "stats"      "graphics"   "grDevices"  "utils"
## [16] "datasets"   "methods"    "base"
##
## [[3]]
##  [1] "bea.R"      "data.table" "tidycensus" "lubridate"  "forcats"
##  [6] "stringr"    "dplyr"      "purrr"      "readr"      "tidyr"
## [11] "tibble"     "ggplot2"    "tidyverse"  "stats"      "graphics"
## [16] "grDevices"  "utils"      "datasets"   "methods"    "base"
##
## [[4]]
##  [1] "janitor"    "bea.R"      "data.table" "tidycensus" "lubridate"
##  [6] "forcats"    "stringr"    "dplyr"      "purrr"      "readr"
## [11] "tidyr"      "tibble"     "ggplot2"    "tidyverse"  "stats"
## [16] "graphics"   "grDevices"  "utils"      "datasets"   "methods"
## [21] "base"
```

```
install.packages("tinytex")
```

```
##
## The downloaded binary packages are in
##  /var/folders/wb/3yb0r8bs6179459cgnh43p640000gn/T//Rtmpy7Grlo/downloaded_packages
```

```
library(tinytex)
```

```
## Warning: package 'tinytex' was built under R version 4.5.2
```

```
# Enable Census Data
census_api_key("fa1f22a59be49b0aa3a0a638fc8ec6ab84af62be", install = TRUE, overwrite = TRUE)
```

```
## Your original .Renviron will be backed up and stored in your R HOME directory if needed.
## Your API key has been stored in your .Renviron and can be accessed by Sys.getenv("CENSUS_API_KEY").
## To use now, restart R or run `readRenviron("~/.Renviron")`
```

```
## [1] "fa1f22a59be49b0aa3a0a638fc8ec6ab84af62be"
```

```r
# Enable BEA Data
bea_Key <- "9EFC7A8B-2A67-486D-9F8B-6AA3A26DBCF8"

beaGet(list(
  'UserID' = bea_Key,
  'Method' = 'GetParameterValues',
  'datasetname' = 'Regional'
))
```

```
## No encoding supplied: defaulting to UTF-8.
```

```
## Warning in bea.R::bea2List(beaPayload): When requesting a list of parameter
## values, the Parameter name must be included in the request - no name.
```

```
## [1] "When requesting a list of parameter values, the Parameter name must be included in the request -
```

```r
# Stops BEA Related Errors
safe_bea_data <- function(bea_object) {
  if (!("Data" %in% names(bea_object))) {
    print("X: BEA returned an error instead of data:")
    print(bea_object)
    stop("Fix the BEA request above - no $Data field found.")
  }
  return(bea_object$Data)
}

# Pull economic data
income_data <- get_acs(
  geography = "county",
  variables = "B19013_001",
  year = 2020,
  survey = "acs5"
) %>%
  select(county = NAME, median_income = estimate)
```

```
## Getting data from the 2016-2020 5-year ACS
```

```r
# Education Variables
education_var <- c("B15003_022", "B15003_023", "B15003_024", "B15003_025")

# Pull education data
education_raw <- get_acs(
  geography = "county",
  variables = education_var,
  year = 2020,
  survey = "acs5"
)
```

```
## Getting data from the 2016-2020 5-year ACS
```

```r
education_final <- education_raw %>%
  group_by(NAME) %>%
  summarise(
    edu_bachelors_plus = sum(estimate)
  ) %>%
  rename(county = NAME)

# Race Variables
race_var <- c(
  black = "DP05_0038PE",
  hispanic = "DP05_0071PE",
  asian = "DP05_0066PE",
  white = "DP05_0037PE"
)

# Pull Race Data
race_data <- get_acs(
  geography = "county",
  variables = race_var,
  year = 2020,
  survey = "acs5"
) %>%
  select(county = NAME, variable, estimate) %>%
  spread(variable, estimate)
```

```
## Getting data from the 2016-2020 5-year ACS
## Using the ACS Data Profile
```

```r
# Pull Age Data
age_data <- get_acs(
  geography = "county",
  variables = "DP05_0017E",
  year = 2020,
  survey = "acs5"
) %>%
  select(county = NAME, median_age = estimate)
```

```
## Getting data from the 2016-2020 5-year ACS
## Using the ACS Data Profile
```

```r
# Pull Income Per Capita
income_per_capita <- get_acs(
  geography = "county",
  variables = "B19301_001",
  year = 2020,
  survey = "acs5"
) %>%
  select(county = NAME, bea_personal_income = estimate)
```

```
## Getting data from the 2016-2020 5-year ACS
```

```r
# Pull County GDP
county_gdp_final <- get_acs(
  geography = "county",
  variables = "B01003_001",
  year = 2020,
  survey = "acs5"
) %>%
  select(county = NAME, gdp_county = estimate)
```

```
## Getting data from the 2016-2020 5-year ACS
```

```r
# Get Data Together
county_data <- income_data %>%
  left_join(education_final, by = "county") %>%
  left_join(race_data, by = "county") %>%
  left_join(age_data, by = "county") %>%
  left_join(income_per_capita, by = "county") %>%
  left_join(county_gdp_final, by = "county") %>%
  clean_names()

# Develop Regression Model
regression_model <- lm(
  median_income ~ edu_bachelors_plus + dp05_0038p + dp05_0071p + dp05_0066p + dp05_0037p + median_age +
  data = county_data
)

summary(regression_model)
```

```
##
## Call:
## lm(formula = median_income ~ edu_bachelors_plus + dp05_0038p +
##     dp05_0071p + dp05_0066p + dp05_0037p + median_age + bea_personal_income +
##     gdp_county, data = county_data)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -65104  -3876   -277   3609  36021
##
## Coefficients:
##                         Estimate Std. Error t value Pr(>|t|)
## (Intercept)          2.205e+04  2.576e+03   8.561  < 2e-16 ***
## edu_bachelors_plus  -2.491e-02  6.748e-03  -3.691 0.000227 ***
## dp05_0038p          -2.621e+02  2.624e+01  -9.991  < 2e-16 ***
## dp05_0071p          -2.794e+01  1.003e+01  -2.787 0.005347 **
## dp05_0066p          -1.506e+02  2.889e+01  -5.215 1.95e-07 ***
## dp05_0037p          -2.052e+02  2.402e+01  -8.543  < 2e-16 ***
## median_age          -6.364e-01  7.711e-02  -8.254  < 2e-16 ***
## bea_personal_income  1.813e+00  2.139e-02  84.774  < 2e-16 ***
## gdp_county           1.862e-02  1.944e-03   9.580  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 7004 on 3211 degrees of freedom
```

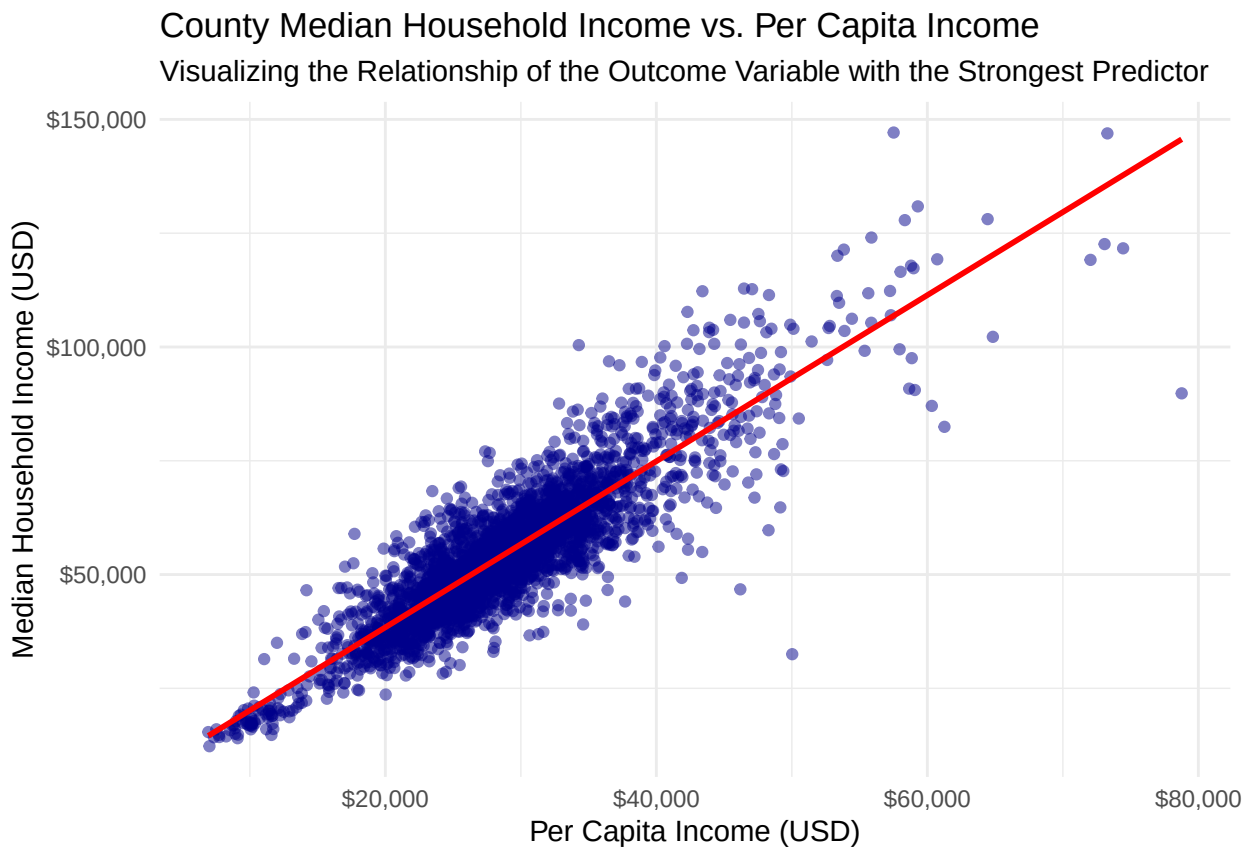
```
##   (1 observation deleted due to missingness)
## Multiple R-squared:  0.7958, Adjusted R-squared:  0.7953
## F-statistic:  1565 on 8 and 3211 DF,  p-value: < 2.2e-16
```

```r
# Plot Relating PCI & Household Income
library(ggplot2)

ggplot(county_data, aes(x = bea_personal_income, y = median_income)) +

  geom_point(
    alpha = 0.5,
    color = "darkblue"
  ) +
  geom_smooth(
    method = "lm",
    color = "red",
    se = FALSE
  ) +

  labs(
    title = "County Median Household Income vs. Per Capita Income",
    subtitle = "Visualizing the Relationship of the Outcome Variable with the Strongest Predictor",
    x = "Per Capita Income (USD)",
    y = "Median Household Income (USD)"
  ) +

  theme_minimal() +

  scale_y_continuous(labels = scales::dollar) +
  scale_x_continuous(labels = scales::dollar)
```

```
## `geom_smooth()` using formula = 'y ~ x'
```

```
## Warning: Removed 1 row containing non-finite outside the scale range
## (`stat_smooth()`).
```

```
## Warning: Removed 1 row containing missing values or values outside the scale range
## (`geom_point()`).
```



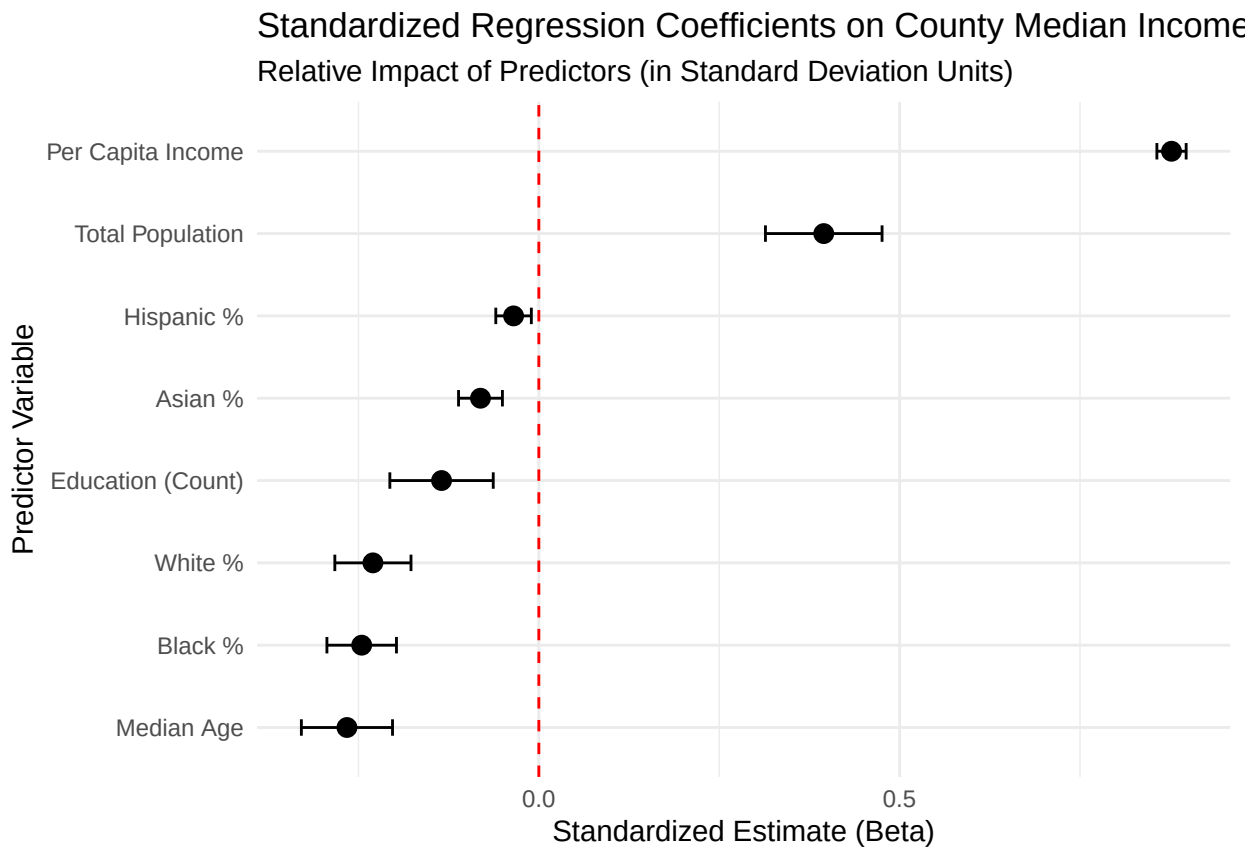

```
# Plot Relating All Variables

install.packages("broom")
```

```
##
## The downloaded binary packages are in
##  /var/folders/wb/3yb0r8bs6l79459cgnh43p640000gn/T//Rtmpy7Grlo/downloaded_packages
```

```
library(broom)
library(ggplot2)
library(dplyr)

standardized_data <- county_data %>%
  mutate(across(where(is.numeric), scale))

standardized_regression_model <- lm(
  median_income ~ edu_bachelors_plus + dp05_0038p + dp05_0071p + dp05_0066p + dp05_0037p + median_age +
  data = standardized_data
)

coef_data <- tidy(standardized_regression_model, conf.int = TRUE) %>%
  filter(term != "(Intercept)") %>%
  mutate(
    term = case_when(
      term == "edu_bachelors_plus" ~ "Education (Count)",
```

```
      term == "dp05_0038p" ~ "Black %",
      term == "dp05_0071p" ~ "Hispanic %",
      term == "dp05_0066p" ~ "Asian %",
      term == "dp05_0037p" ~ "White %",
      term == "median_age" ~ "Median Age",
      term == "bea_personal_income" ~ "Per Capita Income",
      term == "gdp_county" ~ "Total Population",
      TRUE ~ term
    )
  )

ggplot(coef_data, aes(x = estimate, y = reorder(term, estimate))) +
  geom_point(size = 3) +
  geom_errorbarh(aes(xmin = conf.low, xmax = conf.high), height = 0.2) +
  geom_vline(xintercept = 0, linetype = "dashed", color = "red") +
  labs(
    title = "Standardized Regression Coefficients on County Median Income",
    subtitle = "Relative Impact of Predictors (in Standard Deviation Units)",
    x = "Standardized Estimate (Beta)",
    y = "Predictor Variable"
  ) +
  theme_minimal()
```

```
## Warning: ‘geom_errobarh()‘ was deprecated in ggplot2 4.0.0.
## i Please use the ‘orientation‘ argument of ‘geom_errorbar()‘ instead.
## This warning is displayed once every 8 hours.
## Call ‘lifecycle::last_lifecycle_warnings()‘ to see where this warning was
## generated.

## ‘height‘ was translated to ‘width‘.
```




```r
# Create a Plot Relating Education & Income
library(ggplot2)

ggplot(county_data, aes(x = edu_bachelors_plus, y = median_income)) +

  geom_point(
    alpha = 0.5,
    color = "darkgreen"
  ) +

  geom_smooth(
    method = "lm",
    color = "red",
    se = FALSE
  ) +

  labs(
    title = "County Median Household Income vs. Count of Highly Educated Residents",
    subtitle = "Relationship between Income and Absolute Count of Residents with Bachelor's Degree or Hi
    x = "Count of Residents with Bachelor's Degree or Higher",
    y = "Median Household Income (USD)"
  ) +

  theme_minimal() +

  scale_y_continuous(labels = scales::dollar) +
```

```
  scale_x_continuous(labels = scales::comma)
```

```
## `geom_smooth()` using formula = 'y ~ x'
```

```
## Warning: Removed 1 row containing non-finite outside the scale range (`stat_smooth()`).
## Removed 1 row containing missing values or values outside the scale range
## (`geom_point()`).
```