

We load previously loaded census data. The code for fetching this data is also shown in this section.

Table 1: Census Data, 2021 (truncated rows and columns)

1

Food data

```
food_data <- st_read(here("data/free-and-low-cost-food-programs.shp")) %>%
  select(
    "program_nam",
    "program_sta",
    "meal_cost",
    "local_areas",
    "latitude",
    "longitude",
    "geometry"
  ) %>%
  drop_na("latitude", "longitude") %>%
  # set to wgs 84 as per can census
  st_set_crs(4326)

## Reading layer `free-and-low-cost-food-programs' from data source
##   `/Users/sid/Documents/ubc classes/2024w1/econ 326/foodprograms-326/data/free-and-low-cost-food-programs.shp'
##   using driver `ESRI Shapefile'
## replacing null geometries with empty geometries
## Simple feature collection with 83 features and 25 fields (with 2 geometries empty)
## Geometry type: POINT
## Dimension:      XY
## Bounding box:   xmin: -123.1821 ymin: 49.20725 xmax: -123.0287 ymax: 49.286
## CRS:            NAD83

# Food data processing
food_count <- food_data %>%
  st_set_geometry(NULL) %>%
  group_by(local_areas) %>%
  summarise(count = n(), .groups = "drop")

food_data_count <- food_data %>%
  left_join(food_count, by = "local_areas") %>%
  distinct(local_areas, .keep_all = TRUE) # one row per neighbourhood

combo_food_census <- census_data %>%
  st_join(food_data_count)

census_data_food <- combo_food_census %>%
  mutate(program_count = replace_na(count, 0),
         food_density = program_count / `Shape Area`)

head(census_data_food[, 1:5]) %>%
  kable(format = "latex", booktabs = TRUE, caption = "Food Data merged with Census Data, 2021 (truncated)",
        kable_styling(latex_options = c("striped", "hold_position"))
```

Crime data

```
crime <- read_csv(here("data/crime_data_all_neighborhoods.csv"), show_col_types = FALSE) %>%
  mutate(TYPE = as_factor(TYPE),
         HUNDRED_BLOCK = as_factor(HUNDRED_BLOCK),
         NEIGHBOURHOOD = as_factor(NEIGHBOURHOOD)) %>%
```

Table 2: Food Data merged with Census Data, 2021 (truncated rows and columns)

Shape Area	Type	Households	Quality Flags	name	geometry
0.2991	DA	266	0	59150307	MULTIPOLYGON (((-123.0231 4...
0.1096	DA	218	0	59150308	MULTIPOLYGON (((-123.0234 4...
0.1119	DA	282	0	59150309	MULTIPOLYGON (((-123.0283 4...
0.1094	DA	389	0	59150310	MULTIPOLYGON (((-123.0234 4...
0.0809	DA	187	0	59150311	MULTIPOLYGON (((-123.0257 4...
0.0871	DA	201	0	59150312	MULTIPOLYGON (((-123.0234 4...

```

filter(!is.na(X) & !is.na(Y))

crime_data <- st_as_sf(crime, coords = c("X", "Y"), crs = "+proj=utm +zone=10") %>%
  st_transform(crs = "+proj=longlat +datum=WGS84")

intersections <- st_is_within_distance(census_data, crime_data, sparse = FALSE, dist = 5)

crimes_contained <- rowSums(intersections, dims = 1)

census_data_crime <- census_data %>%
  cbind(crimes_contained) %>%
  mutate(crime_density = crimes_contained / Shape.Area)

unique_crimes <- unique(crime_data$TYPE)

for (type in unique_crimes) {
  type_data <- crime_data %>% filter(TYPE == type)
  intersections <- st_is_within_distance(census_data, type_data, sparse = FALSE, dist = 5)
  sum <- rowSums(intersections, dims = 1)
  df <- as.data.frame(sum)
  census_data_crime <- census_data_crime %>% cbind(df$sum) %>% rename_with(~ paste0("crimes_", type), d
}

```

Training data

Now we merge all of our data-sets into one table so we can feed it into our model.

```

training_data <- st_join(census_data_crime, census_data_food)

training_data <- training_data %>%
  rename_with(
    ~ gsub(".*$", "", .), # Remove everything after the colon, including the colon
    starts_with("v_CA21") # Apply only to columns starting with "v_CA21"
  )

median_lico_at <- median(training_data$v_CA21_1085, na.rm = TRUE)

training_data <- training_data %>%
  mutate(
    low_income = ifelse(
      v_CA21_1085 > median_lico_at,
      1,

```

```
0))
```

```
training_data[is.na(training_data)] <- 0
```

Model

Specification

```
# Specification models
# 1. Model with all variables (including interaction term)
reg_all_vars <- lm(crime_density ~
  food_density:low_income +
  food_density +
  pop_density.x +
  v_CA21_452 +
  low_income,
  data = st_set_geometry(training_data, NULL))

# 2. Model without the interaction term
reg_no_interaction <- lm(crime_density ~
  food_density +
  pop_density.x +
  v_CA21_452 +
  low_income,
  data = st_set_geometry(training_data, NULL))

# 3. Model with only food density, crime density, and low income
reg_food_crime_low_income <- lm(crime_density ~
  food_density +
  low_income,
  data = st_set_geometry(training_data, NULL))

# 4. Model with all variables (including interaction term) but replacing v_CA21_452 with v_CA21_449
reg_all_vars_449 <- lm(crime_density ~
  food_density:low_income +
  food_density +
  pop_density.x +
  v_CA21_449 + # Replaced v_CA21_452 with v_CA21_449
  low_income,
  data = st_set_geometry(training_data, NULL))

models_spec <- list(
  "All Variables" = reg_all_vars,
  "Without Interaction" = reg_no_interaction,
  "Food Density, Crime, Low Income" = reg_food_crime_low_income
)

# Summary for each specification tested
summary_all_vars <- summary(reg_all_vars)
summary_no_interaction <- summary(reg_no_interaction)
summary_food_crime_low_income <- summary(reg_food_crime_low_income)
```

```
summary_all_vars_449 <- summary(reg_all_vars_449)

# Add to the list of model summaries
model_summaries <- list(
  "All Variables" = summary_all_vars,
  "Without Interaction" = summary_no_interaction,
  "Food Density, Crime, Low Income" = summary_food_crime_low_income,
  "All Variables (with v_CA21_449)" = summary_all_vars_449
)
```

RESULTS FROM SPEC

```
stargazer(
  reg_all_vars,
  reg_no_interaction,
  reg_food_crime_low_income,
  type = "latex",
  covariate.labels = c(
    "(Intercept)",
    "Food Program Density: Low Income",
    "Food Program Density",
    "Population Density",
    "Average Household Size (v\\_CA21\\_452)",
    "Low Income"
  ),
  omit = c("pop_density.x", "v_CA21_452"),
  add.lines = list(
    c("Includes Interaction?", "Yes", "No", "No"),
    c("Population Density Included?", "Yes", "Yes", "No"),
    c("Average Household Size (v\\_CA21\\_452) Included?", "Yes", "Yes", "No")
  ),
  title = "Regression Specification Table",
  digits = 3
)
```

% Table created by stargazer v.5.2.3 by Marek Hlavac, Social Policy Institute. E-mail: marek.hlavac at gmail.com % Date and time: Sun, Dec 01, 2024 - 13:27:10

Model 1:

```
# Model 1: reg_all_vars
stargazer(reg_all_vars, type = "latex",
  covariate.labels = c("(Intercept)",
    "Food Program Density: Low Income",
    "Food Program Density",
    "Population Density",
    "Average Household Size (v\\_CA21\\_452)",
    "Low Income"),
  add.lines = list(
    c("Includes Interaction?", "Yes", "No", "No"),
    c("Population Density Included?", "Yes", "Yes", "No"),
  )
```

Table 3: Regression Specification Table

	<i>Dependent variable:</i>		
	crime_density		
	(1)	(2)	
(Intercept)	−0.203 (2.154)	8.053*** (0.771)	9.6 (0)
Food Program Density: Low Income	244.697*** (24.734)	252.689*** (24.682)	577. (27)
Food Program Density	9.460*** (2.305)		
Population Density	1,291.286*** (62.011)	1,283.891*** (62.047)	383. (18)
Includes Interaction?	Yes	No	
Population Density Included?	Yes	Yes	
Average Household Size (v_CA21_452) Included?	Yes	Yes	
Observations	7,860	7,860	7
R ²	0.315	0.313	0
Adjusted R ²	0.314	0.313	0
Residual Std. Error	1,050.245 (df = 7854)	1,051.304 (df = 7855)	1,225.029
F Statistic	720.960*** (df = 5; 7854)	895.186*** (df = 4; 7855)	282.621***

Note:

*p<0.1; **p<0.01; ***p<0.001

```

    c("Average Household Size (v\\_CA21\\_452) Included?", "Yes", "Yes", "No")
  ),
  title = "Spec 1: All Variables",
  digits = 3)

```

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Table 4: Spec 1: All Variables

	<i>Dependent variable:</i>
	crime_density
(Intercept)	−0.203 (2.154)
Food Program Density: Low Income	0.043*** (0.001)
Food Program Density	−517.756*** (22.439)
Population Density	244.697*** (24.734)
Average Household Size (v_CA21_452)	9.460*** (2.305)
Low Income	1,291.286*** (62.011)
Includes Interaction?	Yes
Population Density Included?	Yes
Average Household Size (v_CA21_452) Included?	Yes
Observations	7,860
R ²	0.315
Adjusted R ²	0.314
Residual Std. Error	1,050.245 (df = 7854)
F Statistic	720.960*** (df = 5; 7854)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

Model 2:

```

# Model 2: reg_no_interaction
stargazer(reg_no_interaction, type = "latex",
  covariate.labels = c("(Intercept)",
    "Food Program Density",
    "Population Density",
    "Average Household Size (v\\_CA21\\_452)",
    "Low Income"),
  add.lines = list(
    c("Includes Interaction?", "No", "No", "No"),

```

```

c("Population Density Included?", "Yes", "Yes", "No"),
c("Average Household Size (v\\_CA21\\_452) Included?", "Yes", "Yes", "No")
),
title = "Spec 2: Omitted interaction term",
digits = 3)

```

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Table 5: Spec 2: Omitted interaction term

	<i>Dependent variable:</i>
	crime_density
(Intercept)	8.053*** (0.771)
Food Program Density	0.044*** (0.001)
Population Density	-517.272*** (22.461)
Average Household Size (v_CA21_452)	252.689*** (24.682)
Low Income	1,283.891*** (62.047)
Includes Interaction?	No
Population Density Included?	Yes
Average Household Size (v_CA21_452) Included?	Yes
Observations	7,860
R ²	0.313
Adjusted R ²	0.313
Residual Std. Error	1,051.304 (df = 7855)
F Statistic	895.186*** (df = 4; 7855)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

Model 3:

```

# Model 3: reg_food_crime_low_income
stargazer(reg_food_crime_low_income, type = "latex",
covariate.labels = c("(Intercept)",
                      "Food Program Density",
                      "Low Income"),
omit = c("pop_density.x", "v_CA21_452"),
add.lines = list(
  c("Includes Interaction?", "No", "No", "No"),
  c("Population Density Included?", "No", "Yes", "No"),
  c("Average Household Size (v\\_CA21\\_452) Included?", "No", "Yes", "No")
),

```



```
title = "Spec 3: Food Density and Low Income",
digits = 3)
```

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Table 6: Spec 3: Food Density and Low Income

	<i>Dependent variable:</i>
	crime_density
(Intercept)	9.631*** (0.897)
Food Program Density	577.872*** (27.744)
Low Income	383.969*** (18.802)
Includes Interaction?	No
Population Density Included?	No
Average Household Size (v_CA21_452) Included?	No
Observations	7,860
R ²	0.067
Adjusted R ²	0.067
Residual Std. Error	1,225.029 (df = 7857)
F Statistic	282.621*** (df = 2; 7857)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

```
stargazer(reg_all_vars_449,
  type = "latex",
  covariate.labels = c("Food Program Density: Low Income",
    "Food Program Density",
    "Population Density",
    "Persons in Household (v\\_CA21\\_449)",
    "Low Income"),
  dep.var.labels = "Crime Density",
  title = "Regression Model Summary (with Persons in Household)",
  digits = 3)
```

% Table created by stargazer v.5.2.3 by Marek Hlavac, Social Policy Institute. E-mail: marek.hlavac at gmail.com % Date and time: Sun, Dec 01, 2024 - 13:27:10

Table 7: Regression Model Summary (with Persons in Household)

	<i>Dependent variable:</i>
	Crime Density
Food Program Density: Low Income	1.513 (2.218)
Food Program Density	0.053*** (0.001)
Population Density	0.225*** (0.031)
Persons in Household (v_CA21_449)	344.584*** (25.039)
Low Income	9.063*** (2.374)
Constant	-196.408*** (25.778)
Observations	7,860
R ²	0.273
Adjusted R ²	0.273
Residual Std. Error	1,081.556 (df = 7854)
F Statistic	590.191*** (df = 5; 7854)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01