# ECON 0150 | Economic Data Analysis

*The economist's data analysis skillset.*

## *Part 1.6 | Relationships In Space*

# Geographic Data

*Some types of relationships in space*

- *Geographic data is data organized on three axes (latitude, longitude, altitude)*
- *We typically only use latitude and longitude*
- *Geo data is often combined with other variables like population*
- *Two main types of geo data: points, shapes*
- *We sometimes observe points, but most data comes in groups*

# Example: Restaurants by Zipcode

*Are there fewer restaurants further from downtown Pittsburgh?*

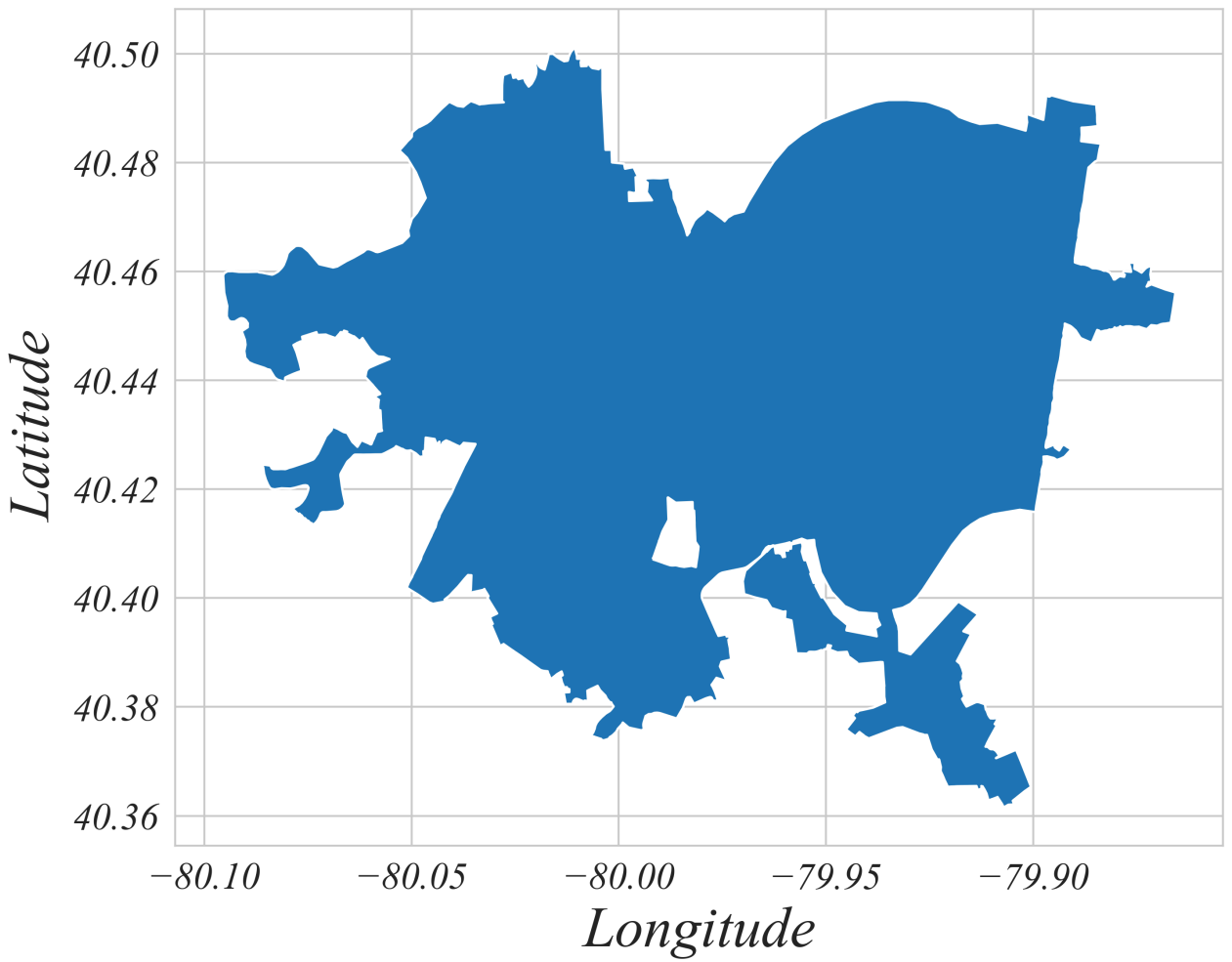
We're going to use a Census maps and openly available data on restaurant locations to answer this question.

- ***Data:*** `Census Shapefiles` *and* `Open Street Maps`

# Geographic Data

*Maps are (typically) plots on two axis*

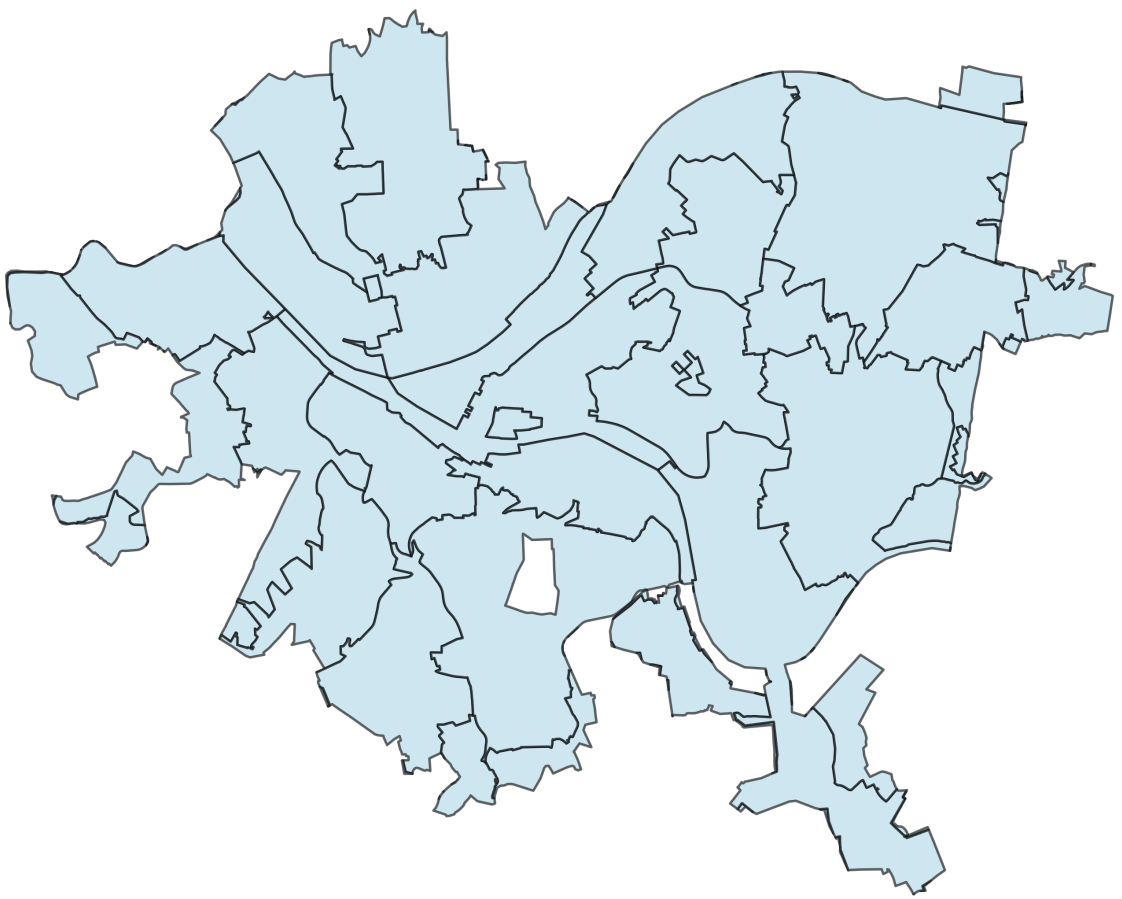
> *a basic map of Pittsburgh*



# Geographic Data

*Maps can show any level of detail available in the data*

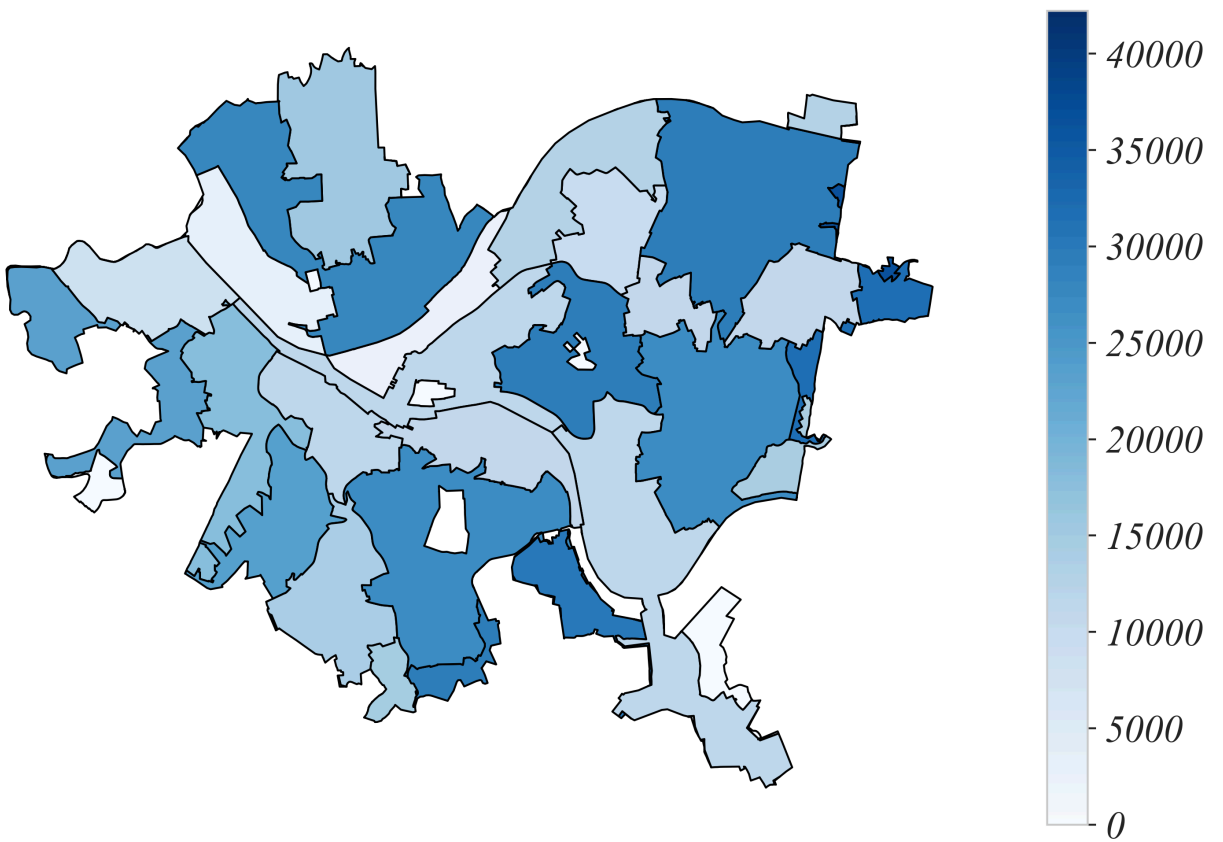
> *a map of Pittsburgh Zipcodes*



# Geographic Data

*We can add information: colors*

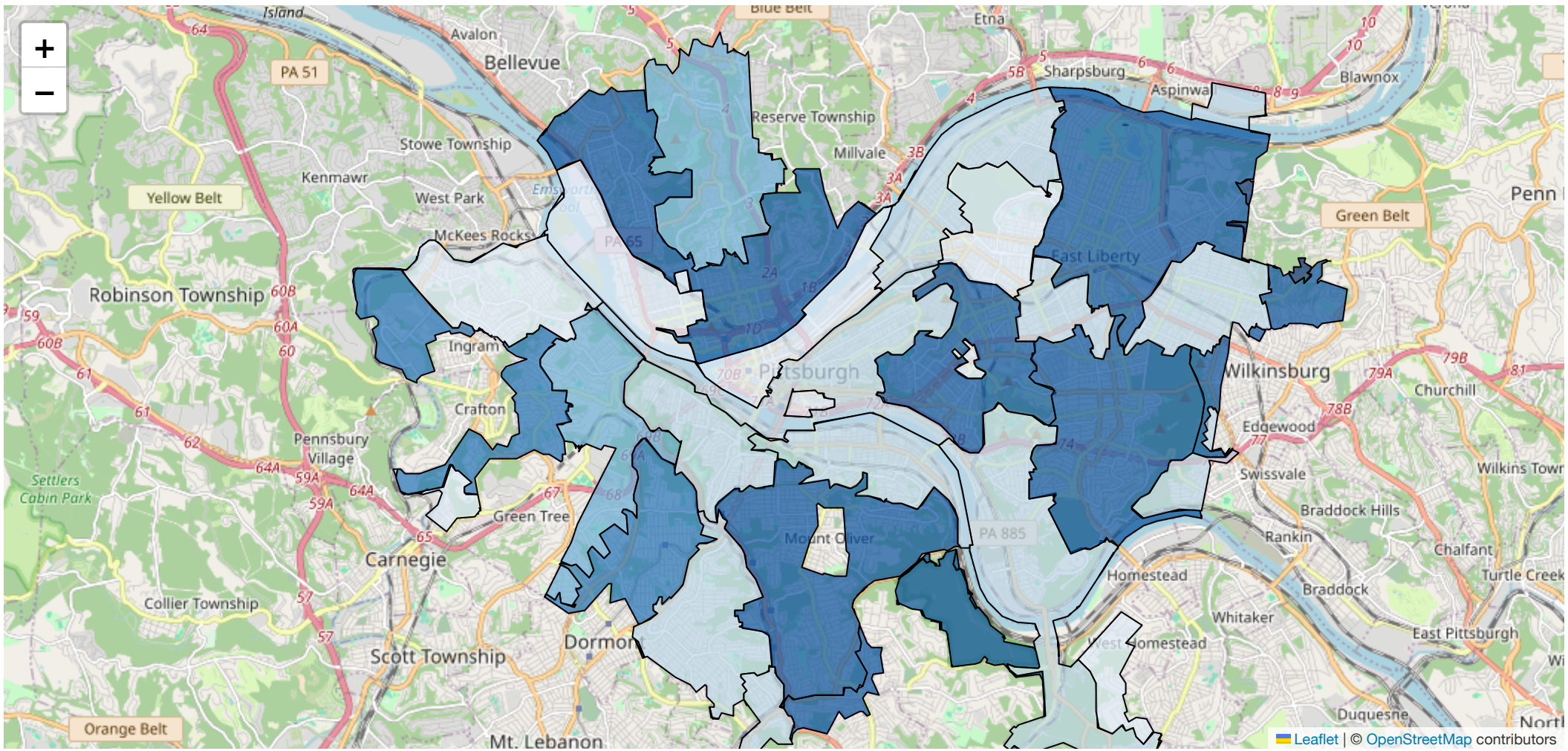
*> a map of Pittsburgh Zipcode populations*



# Geographic Data

*We can add information: colors*

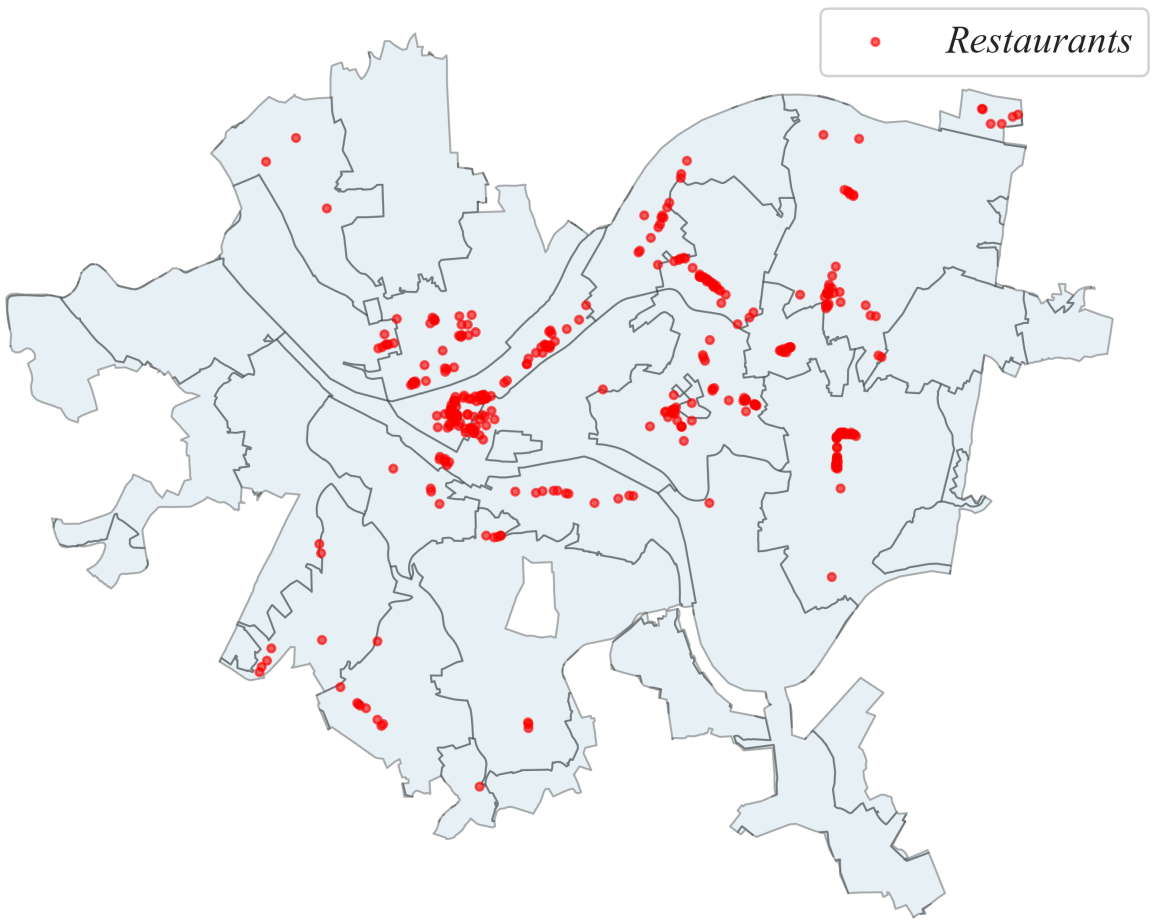
*> a map of Pittsburgh Zipcode populations: interactive!*



# Geographic Data

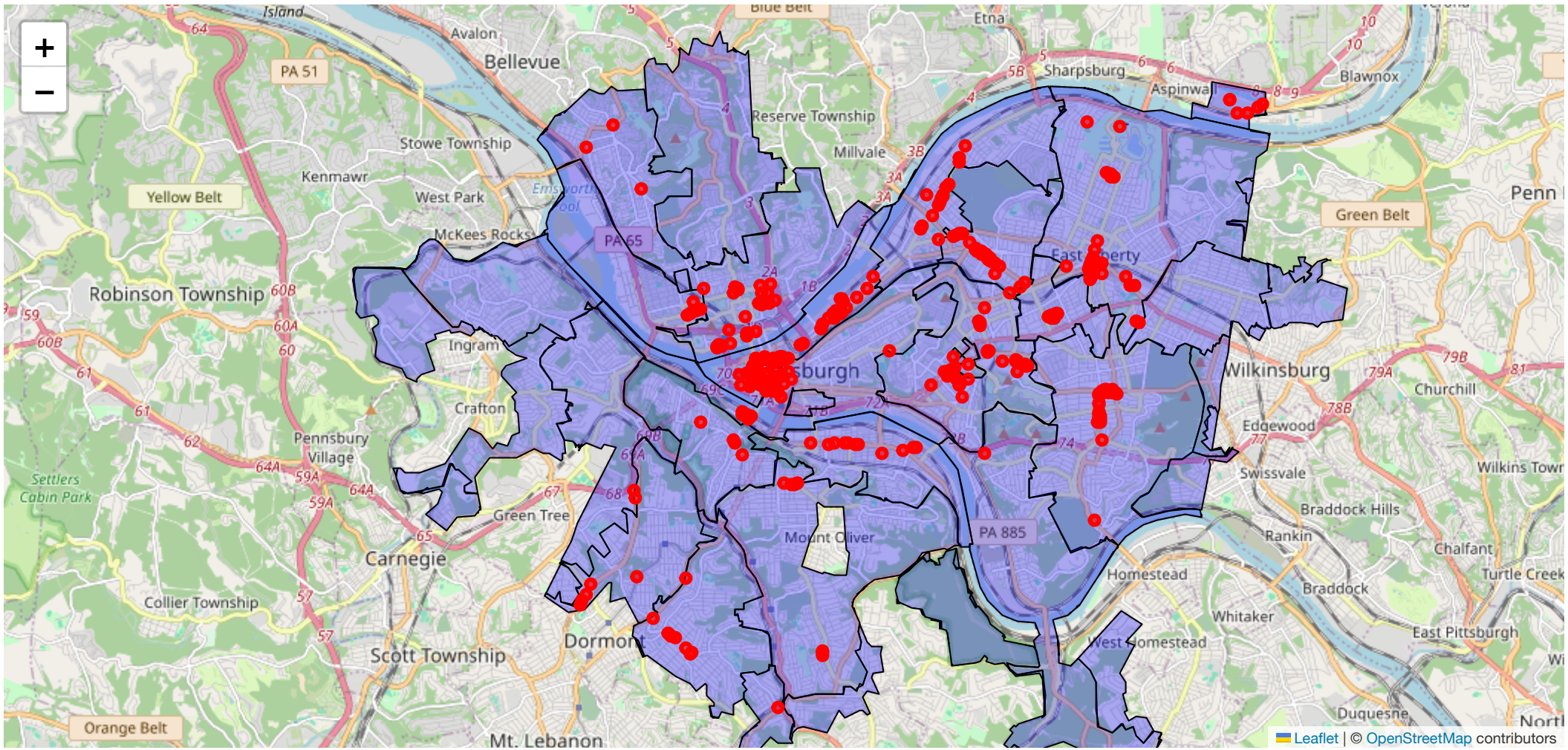
*Maps can also show points*

> *some restaurants in Pittsburgh!*



# Geographic Data

*Maps can also show points*



# Geographic Data

*Maps can also show points*

- *Points are nice but we typically can't use them raw*
- *Some point transformations: distances between points; group by area; etc*
- *We can also relate points to other variables (eg. zipcode population for each restaurant)*

# Geographic Data Example: Nunn (2008)

*Did the historical trade of enslaved people impact modern economic development in Africa?*

**Method:** Uses historical data and the distance from major ports

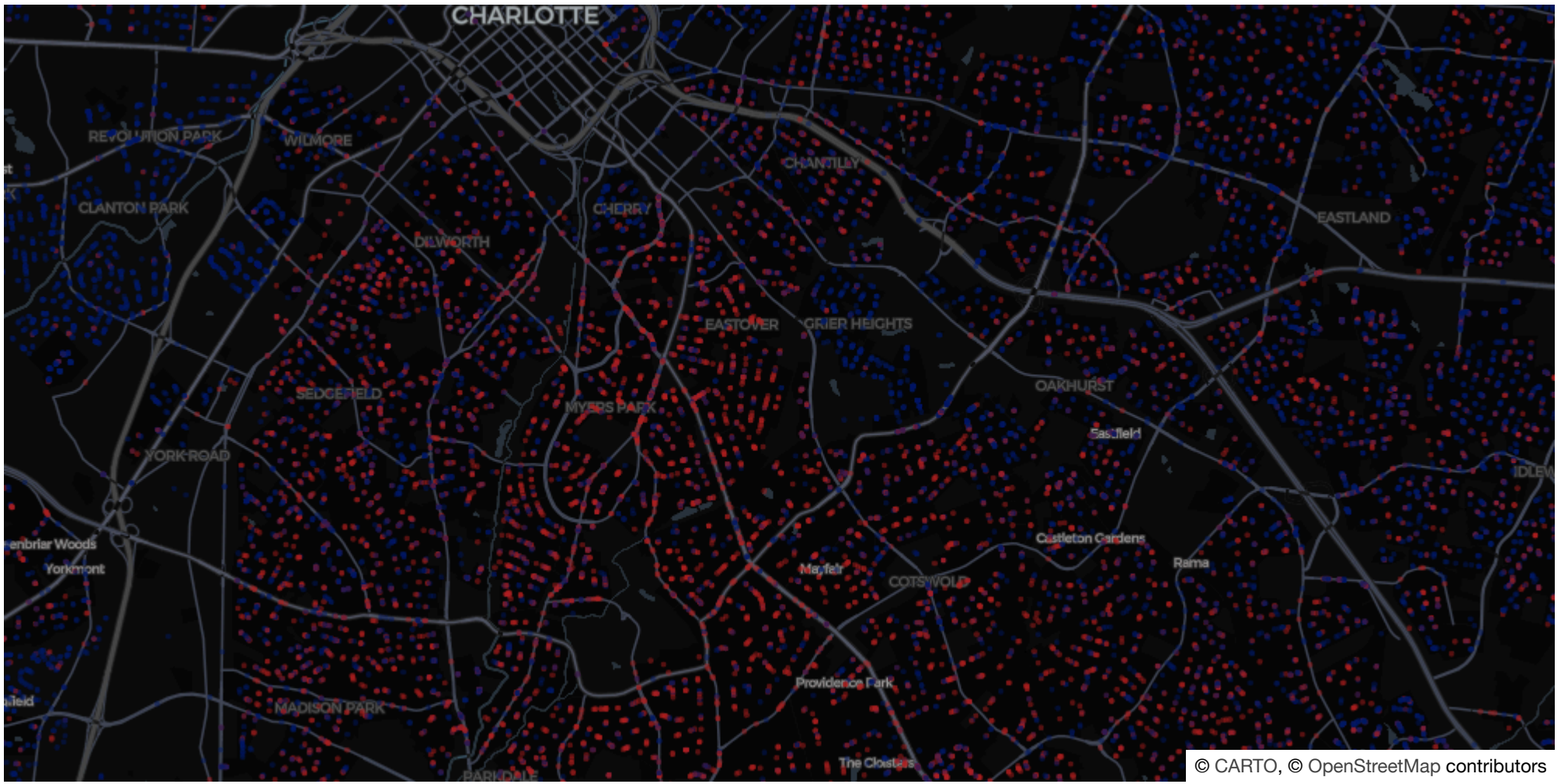
**Findings:** Areas more disrupted by enslavement have lower GDP today, due to:

- ***Weakened institutions*** *(political fragmentation, mistrust).*
- ***Disrupted societies*** *(population loss, economic stagnation).*

**Implication:** Historical shocks can have persistent economic effects.

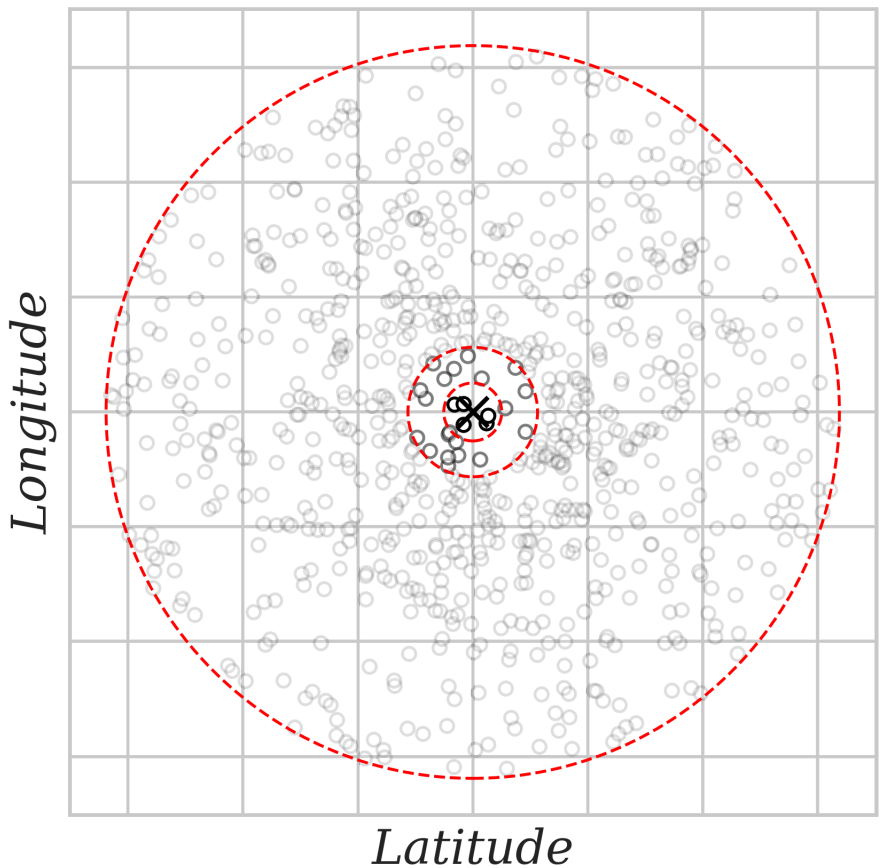
# Geographic Data Example: Weidman (2024)

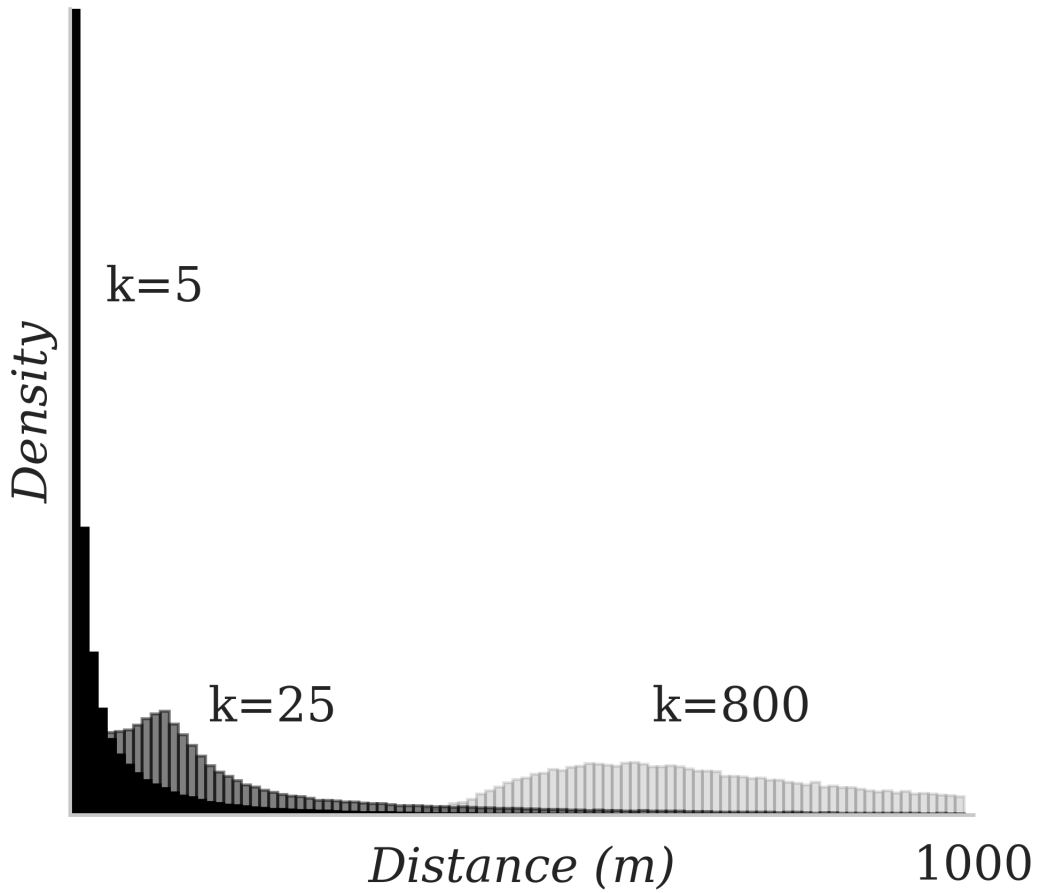
*Does the party of your neighbors impact your decision to vote?*



# Geographic Data Example: Weidman (2024)

*My dissertation involved measuring distances between voters*



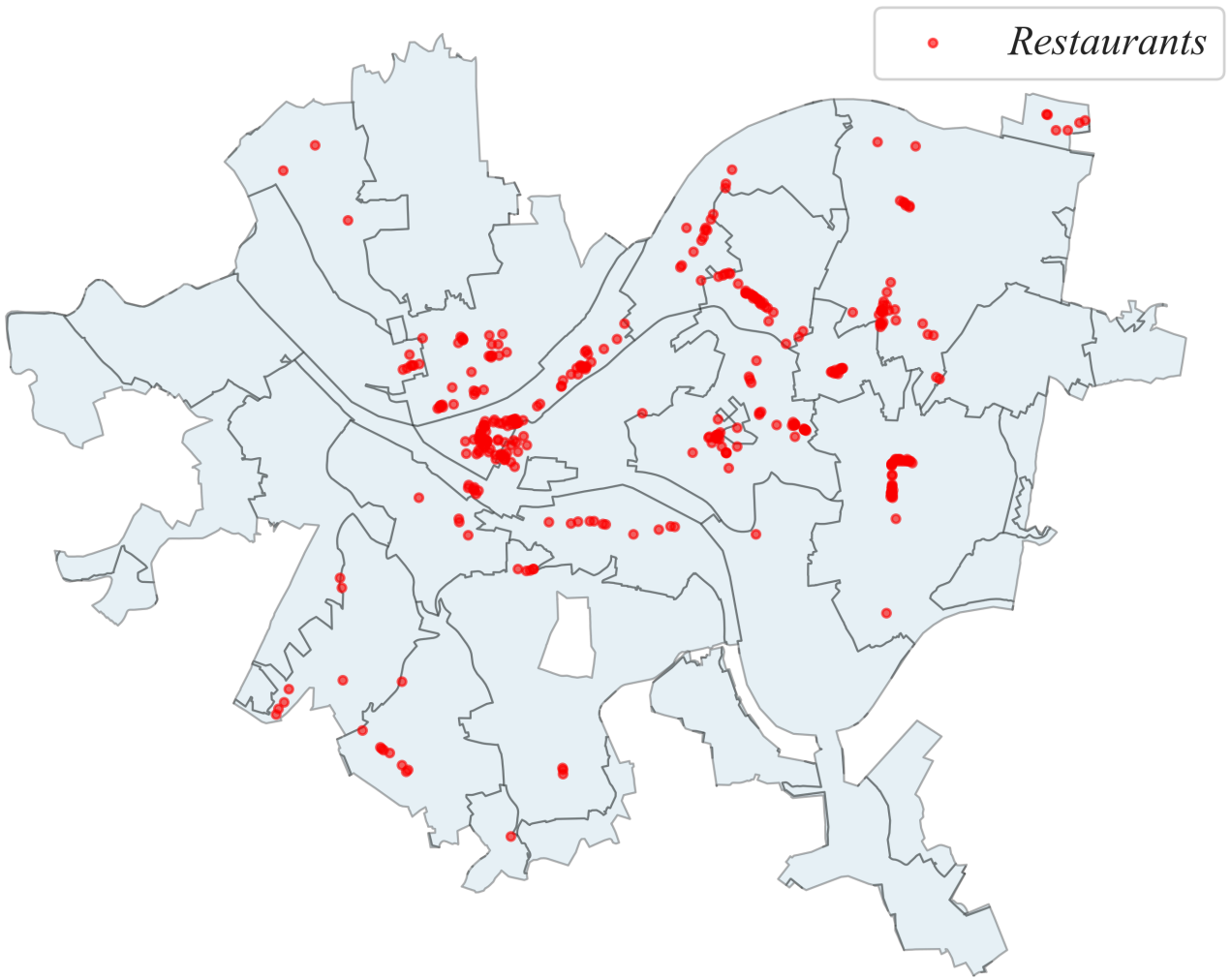
# Geographic Data

*Are there fewer restaurants further from downtown Pittsburgh?*

> *lets get back to our question!*

# Geographic Data

*Are there fewer restaurants further from downtown Pittsburgh?*



# Geographic Data

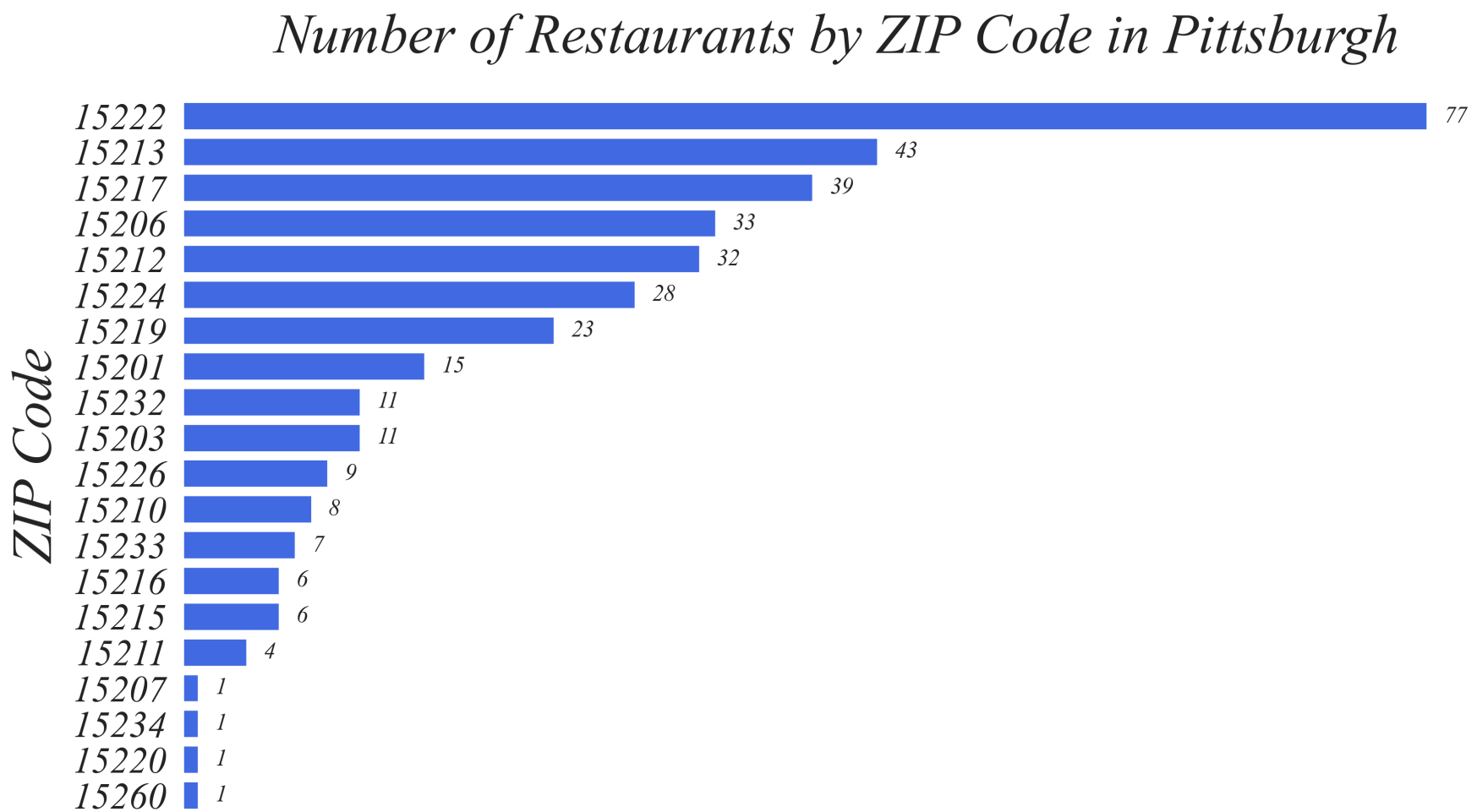
*Are there fewer restaurants further from downtown Pittsburgh?*

**Steps:**

- *Measure points by zipcode area*
- *Measure distances between groups (take the centroid, etc)*

# Geographic Data

*Subquestion 1: how many restaurants are in each Pittsburgh zipcode?*



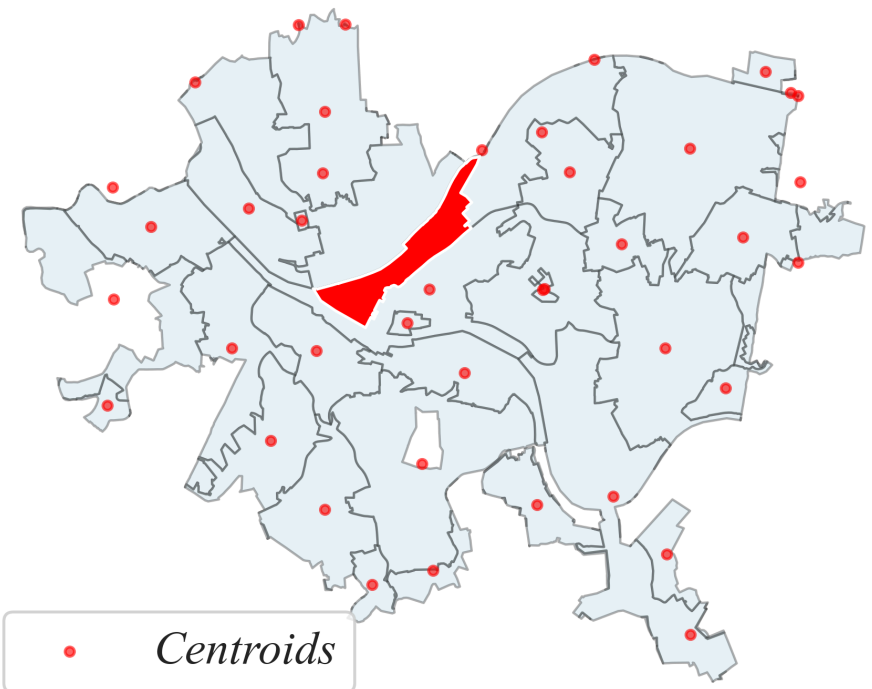
# Geographic Data

*Subquestion 2: how far is each zipcode from downtown?*

*> measure from the center (centroid) of the zipcode*

# Geographic Data

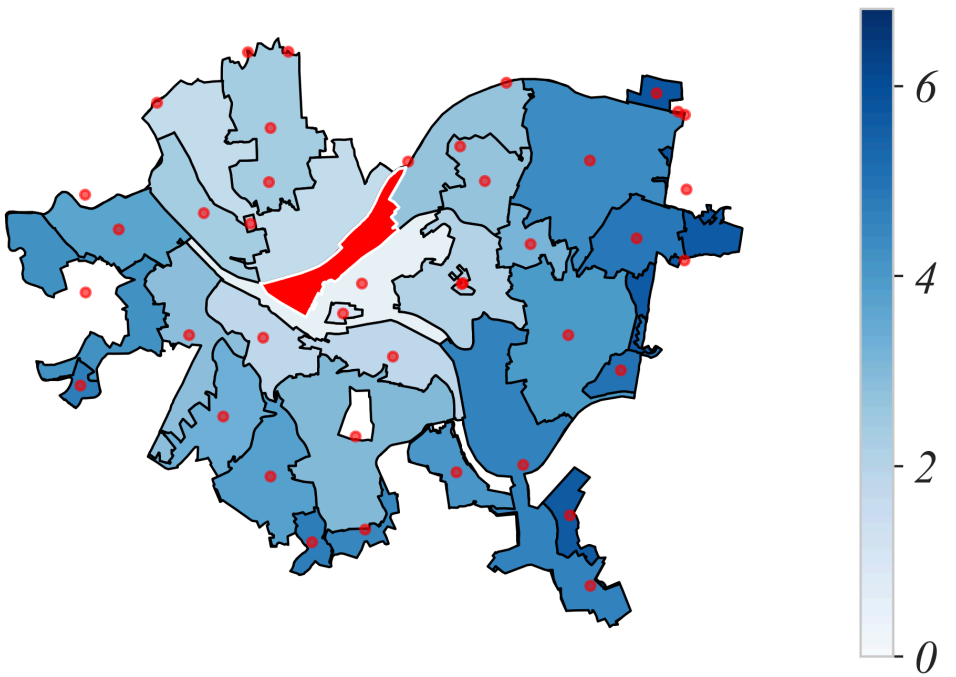
*Subquestion 2: how far is each zipcode from downtown?*




*> measure from the center (centroid) of the zipcode*

# Geographic Data

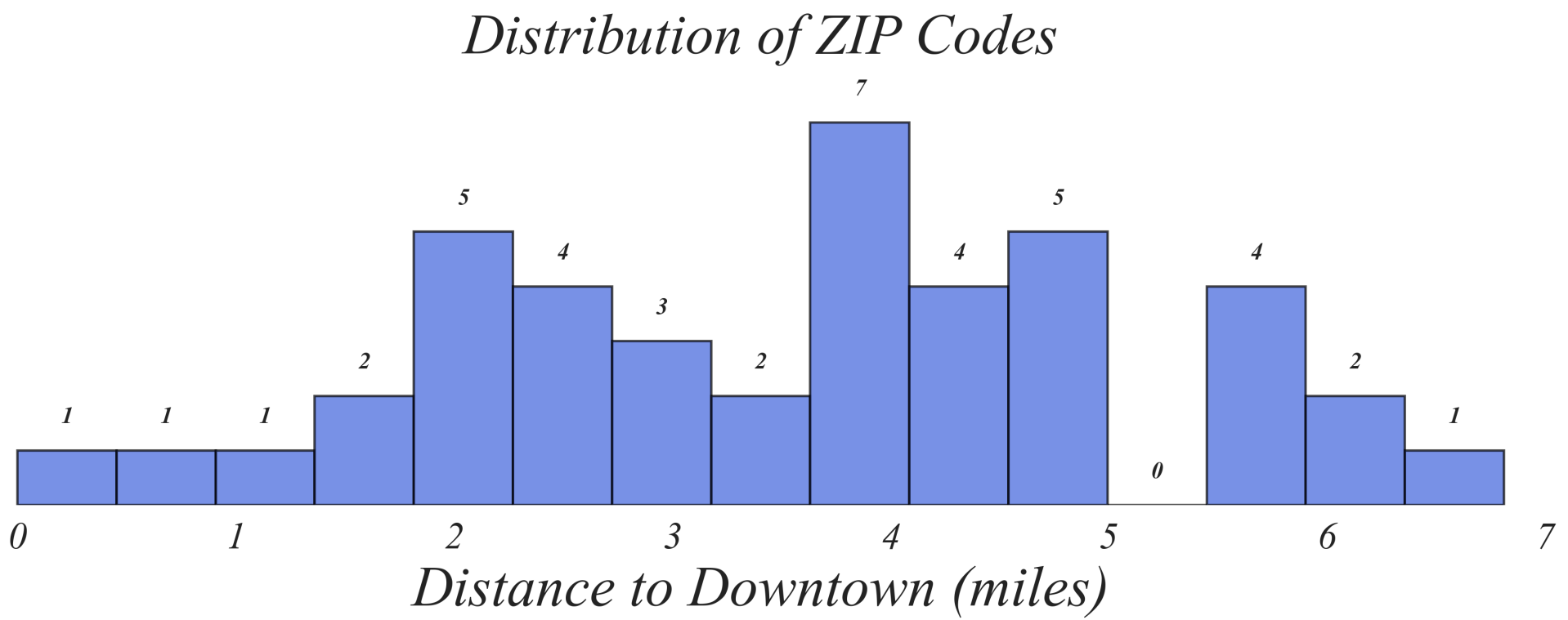
*Subquestion 2: how far is each zipcode from downtown?*




*> what's the distribution?*

# Geographic Data

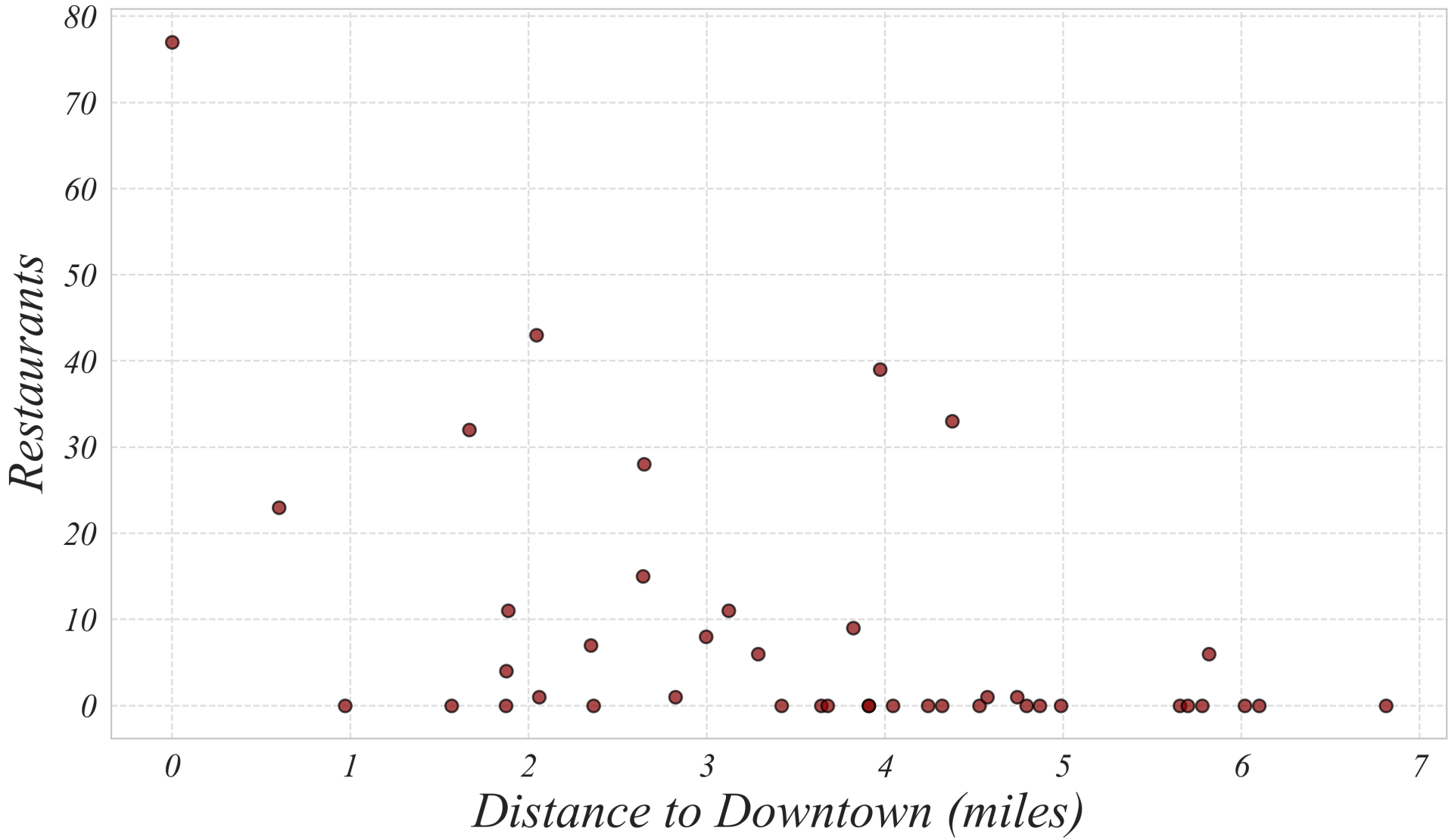
*Subquestion 2: how far is each zipcode from downtown?*




> *we now have enough to answer our main question!*

# Geographic Data

*Are there fewer restaurants in areas further from downtown Pittsburgh?*



# Homework 1.6 | US City Population and Temp

We're going to use data on locations (`lat`, `lng`), `population`, and temperature (`avg_temp`) of US cities to map temerature and examine whether there is a relationship between latitute (north/south) is related to temperature.

- ***Data:*** *`US_Cities.csv` and `Eastern_Cities.csv`*

# Part 1 Wrap Up

# Exercise 1: Employment Status

*What 1) are the dimensions of this dataset, and 2) an effecitve visualization?*

A dataset on the employment status of individuals.

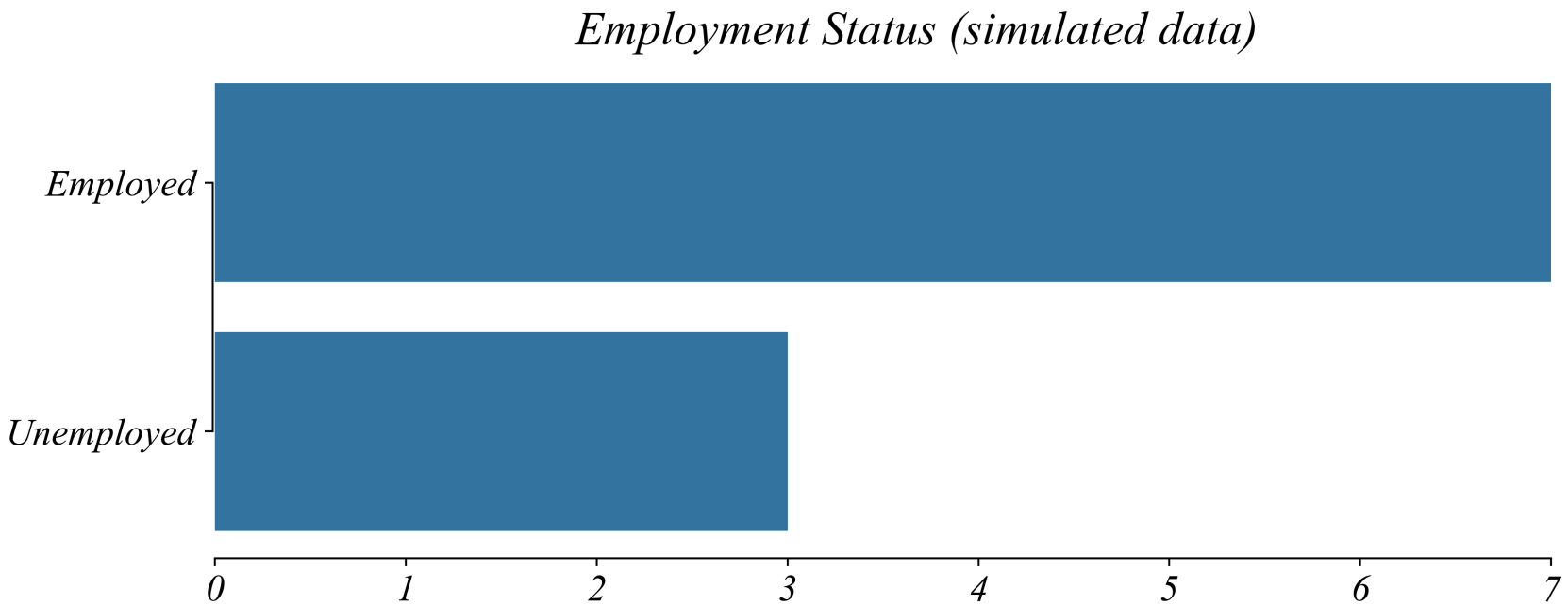
| id | status |
|---|---|
| 1 | Employed |
| 2 | Unemployed |
| 3 | Employed |
| 4 | Employed |
| 5 | Unemployed |

Data Dimensions:

1. ***Data Structure***: *Cross-Sectional*
2. ***Number of Variables***: *Univariate*
3. ***Variable Type(s)***: *Binary Categorical*

# Exercise 1: Employment Status

*What 1) are the dimensions of this dataset, and 2) an effecitve visualization?*




A ***Barplot*** effectively visualizes

1. *Cross-Sectional*
2. *Binary Categorical*
3. *Univeriate*

# Exercise 2: Employment Industry

*What 1) are the dimensions of this dataset, and 2) an effecitve visualization?*

A dataset on the employment sector of individuals.

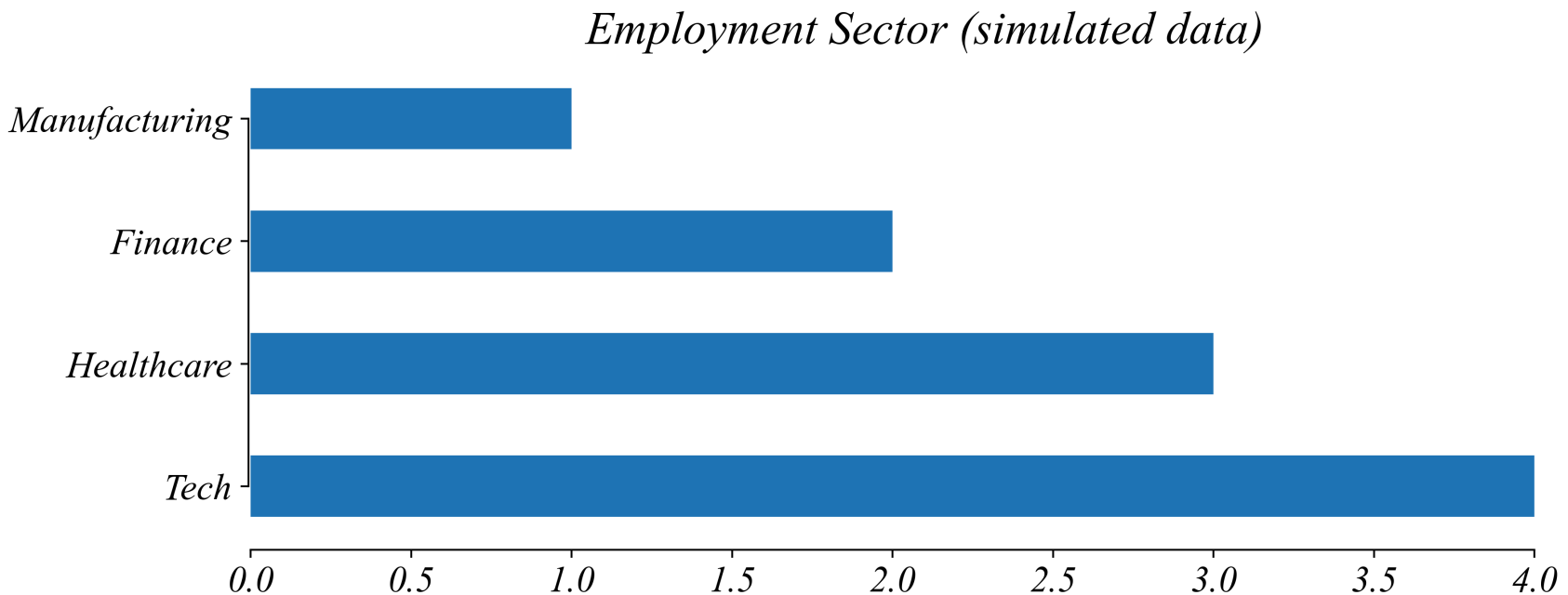
| sector |
| --- |
| Tech |
| Healthcare |
| Finance |
| Tech |
| Manufacturing |

Data Dimensions:

1. ***Data Structure***: *Cross-Sectional*
2. ***Number of Variables***: *Univariate*
3. ***Variable Type(s)***: *Nominal Categorical*

# Exercise 2: Employment Industry

*What 1) are the dimensions of this dataset, and 2) an effecitve visualization?*




A ***Barplot*** effectively visualizes

*1. Cross-Sectional*

*2. Nominal Categorical*

*3. Univeriate*

# Exercise 3: Educational Attainment

*What 1) are the dimensions of this dataset, and 2) an effecitve visualization?*

A dataset on the educational attainment of individuals.

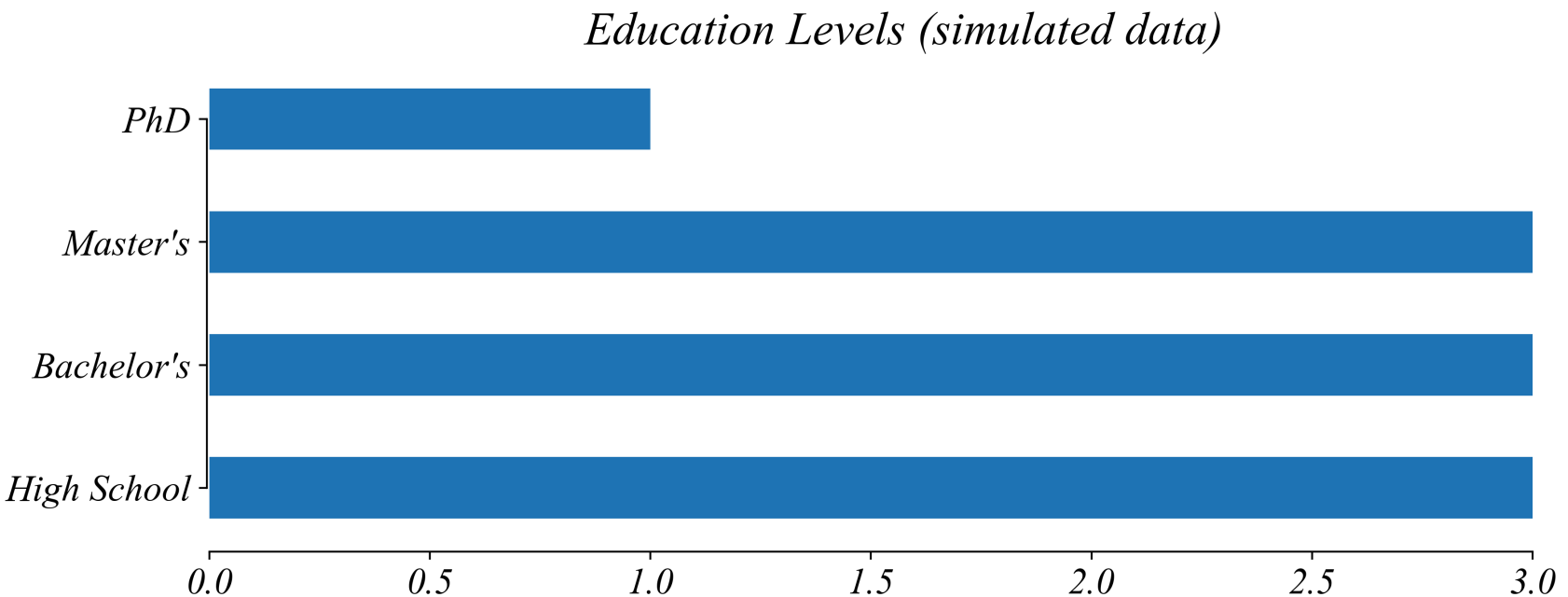
| level |
|---|
| High School |
| Bachelor's |
| Master's |
| High School |
| Bachelor's |

Data Dimensions:

1. ***Data Structure***: *Cross-Sectional*
2. ***Number of Variables***: *Univariate*
3. ***Variable Type(s)***: *Ordinal Categorical*

# Exercise 3: Educational Attainment

*What 1) are the dimensions of this dataset, and 2) an effecitve visualization?*




A ***Barplot*** *(or histogram)* effectively visualizes

1. *Cross-Sectional*
2. *Ordinal Categorical*
3. *Univeriate*

# Exercise 4: Annual Income

*What 1) are the dimensions of this dataset, and 2) an effecitve visualization?*

A dataset on annual individual income.

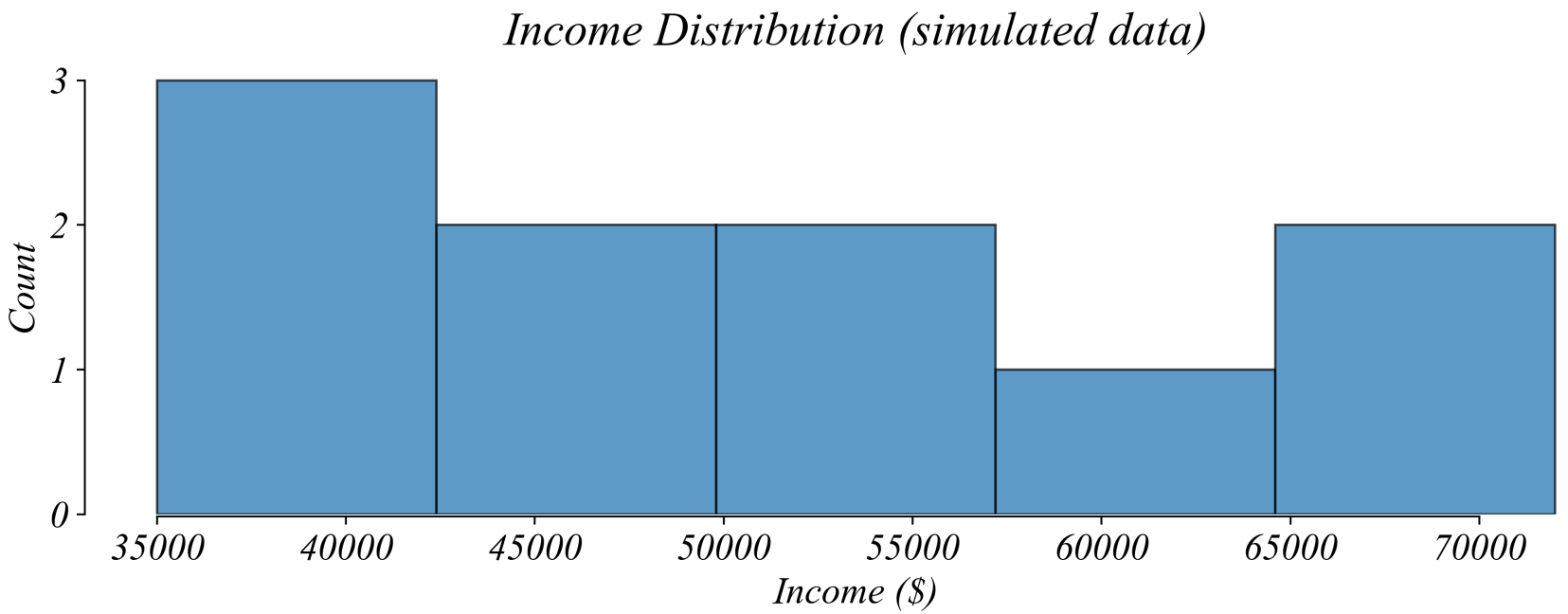
| income |
|---|
| 45000 |
| 52000 |
| 38000 |
| 65000 |
| 41000 |

Data Dimensions:

1. ***Data Structure***: *Cross-Sectional*
2. ***Number of Variables***: *Univariate*
3. ***Variable Type(s)***: *Numerical*

# Exercise 4: Annual Income

*What 1) are the dimensions of this dataset, and 2) an effecitve visualization?*




A ***Histogram*** *(or boxplot)* effectively visualizes

1. *Cross-Sectional*
2. *Numerical*
3. *Univeriate*

# Exercise 5: Employment by Education

*What 1) are the dimensions of this dataset, and 2) an effecitve visualization?*

A dataset on employment by education level.

| education | employed |
|---|---|
| High School | Yes |
| Bachelor's | Yes |
| Master's | No |
| High School | No |
| Bachelor's | Yes |

Data Dimensions:

1. ***Data Structure***: *Cross-Sectional*
2. ***Number of Variables***: *Bivariate*
3. ***Variable Type(s)***: *Categorical by Categorical*

# Exercise 5: Employment by Education

*What 1) are the dimensions of this dataset, and 2) an effecitve visualization?*

We didn’t cover how to visualize categorical by categorical bivariate data.

# Exercise 6: Income by Education

*What 1) are the dimensions of this dataset, and 2) an effecitve visualization?*

A dataset on annual individual income by education.

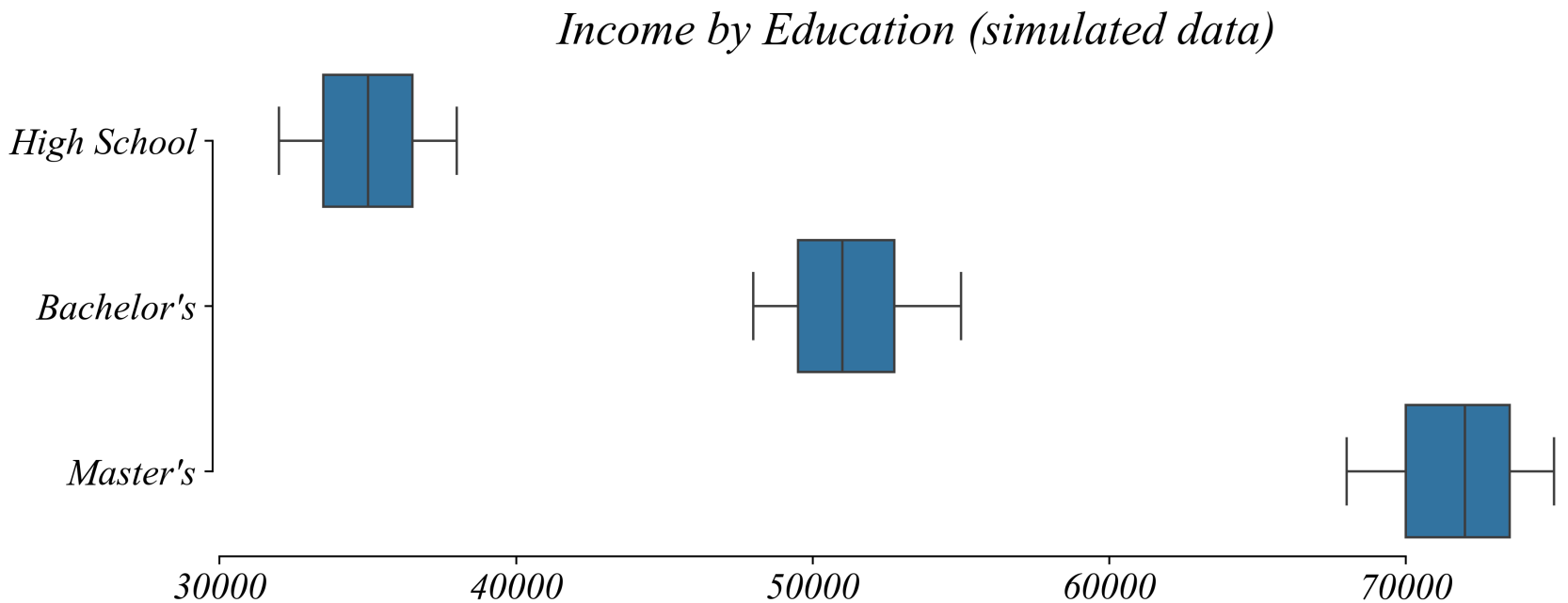
| education | income |
|---|---|
| High School | 35000 |
| Bachelor's | 52000 |
| Master's | 68000 |
| High School | 38000 |
| Bachelor's | 55000 |

Data Dimensions:

1. ***Data Structure***: *Cross-Sectional*
2. ***Number of Variables***: *Bivariate*
3. ***Variable Type(s)***: *Numerical by Categorical*

# Exercise 6: Income by Education

*What 1) are the dimensions of this dataset, and 2) an effecitve visualization?*




A ***Multi-Boxplot*** *(or multi-linegraph-histogram)* effectively visualizes

*1. Cross-Sectional*

*2. Numerical by Categorical*

*3. Biveriate*

# Exercise 7: Income by Age

*What 1) are the dimensions of this dataset, and 2) an effecitve visualization?*

A dataset on annual individual income by age.

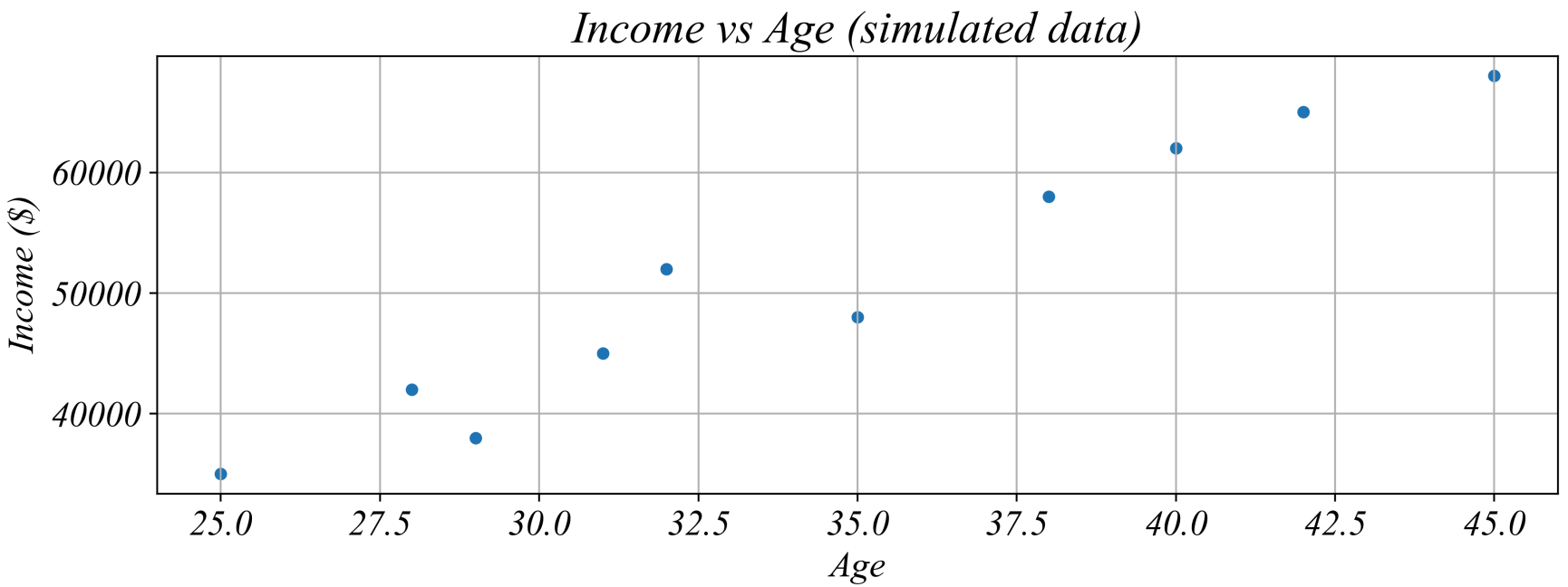
| age | income |
|---|---|
| 25 | 35000 |
| 32 | 52000 |
| 28 | 42000 |
| 45 | 68000 |
| 38 | 58000 |

Data Dimensions:

1. ***Data Structure***: *Cross-Sectional*
2. ***Number of Variables***: *Bivariate*
3. ***Variable Type(s)***: *Numerical by Numerical*

# Exercise 7: Income by Age

*What 1) are the dimensions of this dataset, and 2) an effecitve visualization?*




A ***Scatterplot*** effectively visualizes

*1. Cross-Sectional*

*2. Numerical*

*3. Biveriate*

# Exercise 8: GDP After 2015

*What 1) are the dimensions of this dataset, and 2) an effecitve visualization?*

A dataset on US GDP between 2015 and 2015.

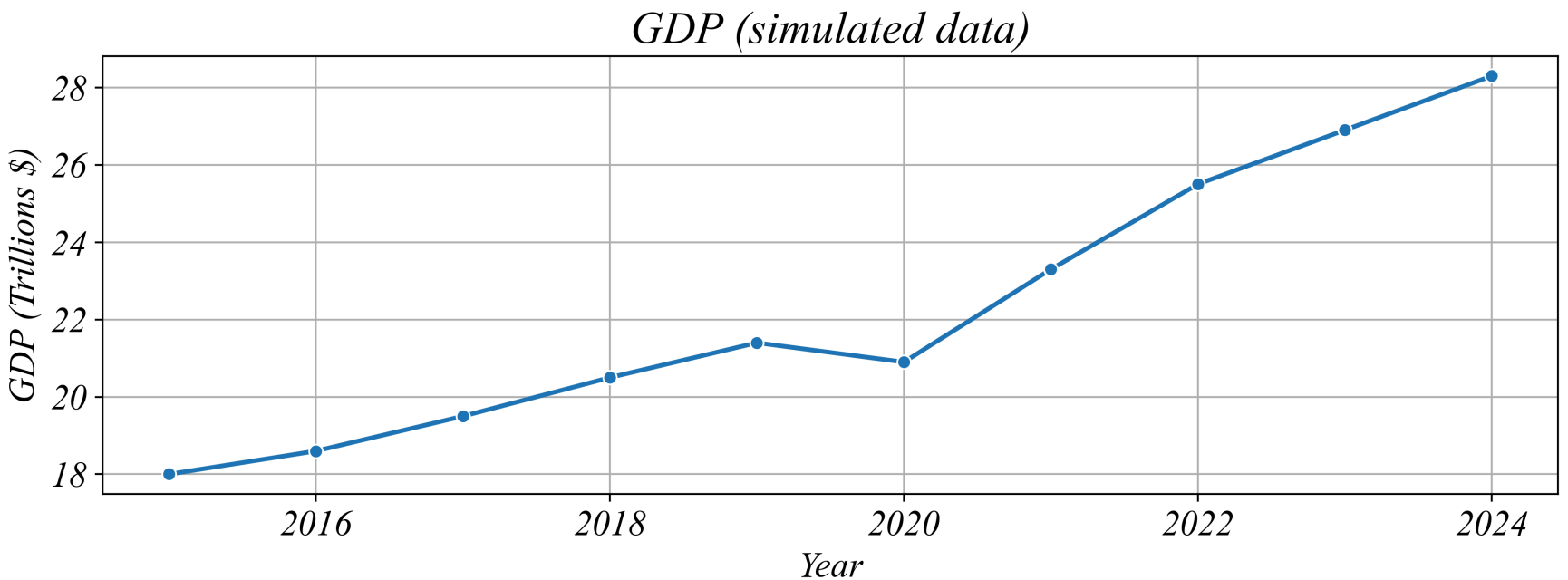
| year | gdp |
|---|---|
| 2015 | 18.000000 |
| 2016 | 18.600000 |
| 2017 | 19.500000 |
| 2018 | 20.500000 |
| 2019 | 21.400000 |

Data Dimensions:

1. ***Data Structure***: *Cross-Sectional*
2. ***Number of Variables***: *Univariate*
3. ***Variable Type(s)***: *Numerical*

# Exercise 8: GDP After 2015

*What 1) are the dimensions of this dataset, and 2) an effecitve visualization?*




A ***Linegraph*** effectively visualizes

1. *Timeseries*
2. *Numerical*
3. *Univariate*

# Exercise 9: Inflation and Unemployment

*What 1) are the dimensions of this dataset, and 2) an effecitve visualization?*

A dataset on inflation and unemployment after 2015.

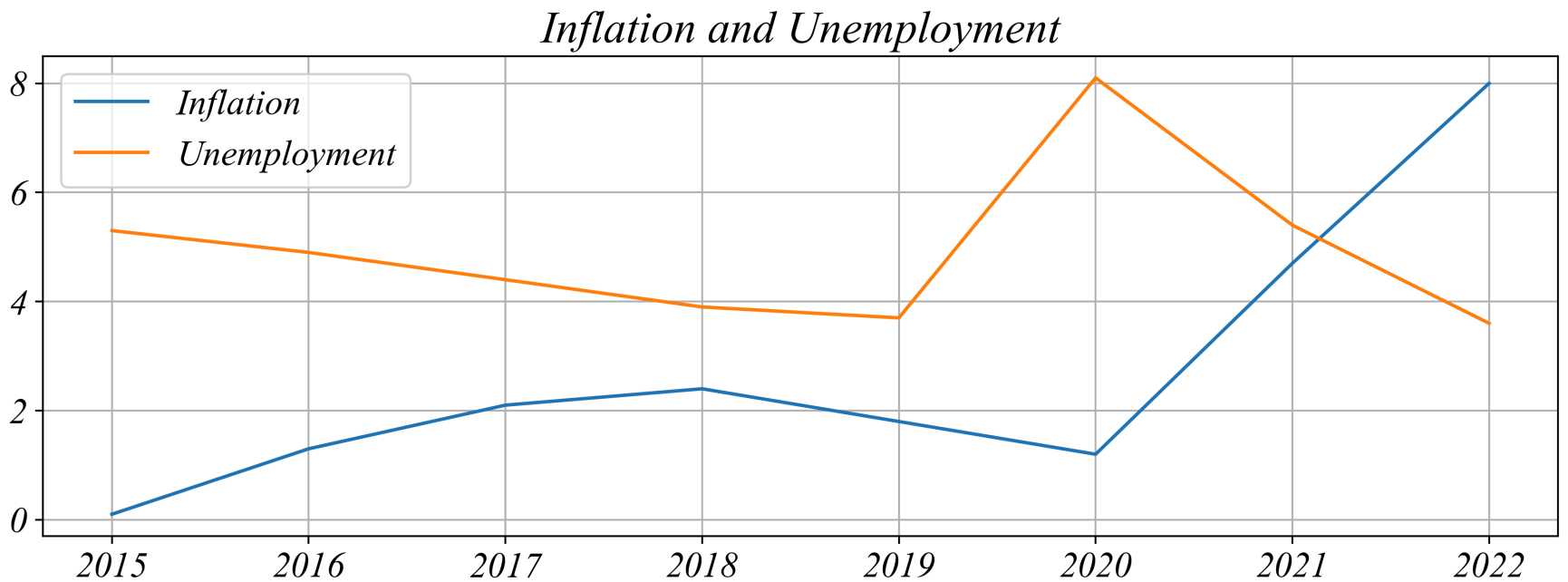
| year | unemployment | inflation |
|---|---|---|
| 2015 | 5.300000 | 0.100000 |
| 2016 | 4.900000 | 1.300000 |
| 2017 | 4.400000 | 2.100000 |
| 2018 | 3.900000 | 2.400000 |
| 2019 | 3.700000 | 1.800000 |

Data Dimensions:

1. ***Data Structure***: *Timeseries*
2. ***Number of Variables***: *Bivariate*
3. ***Variable Type(s)***: *Numerical*

# Exercise 9: Inflation and Unemployment

*What 1) are the dimensions of this dataset, and 2) an effecitve visualization?*




A ***Scatterplot*** *(or sometimes a multilinegraph)* effectively visualizes

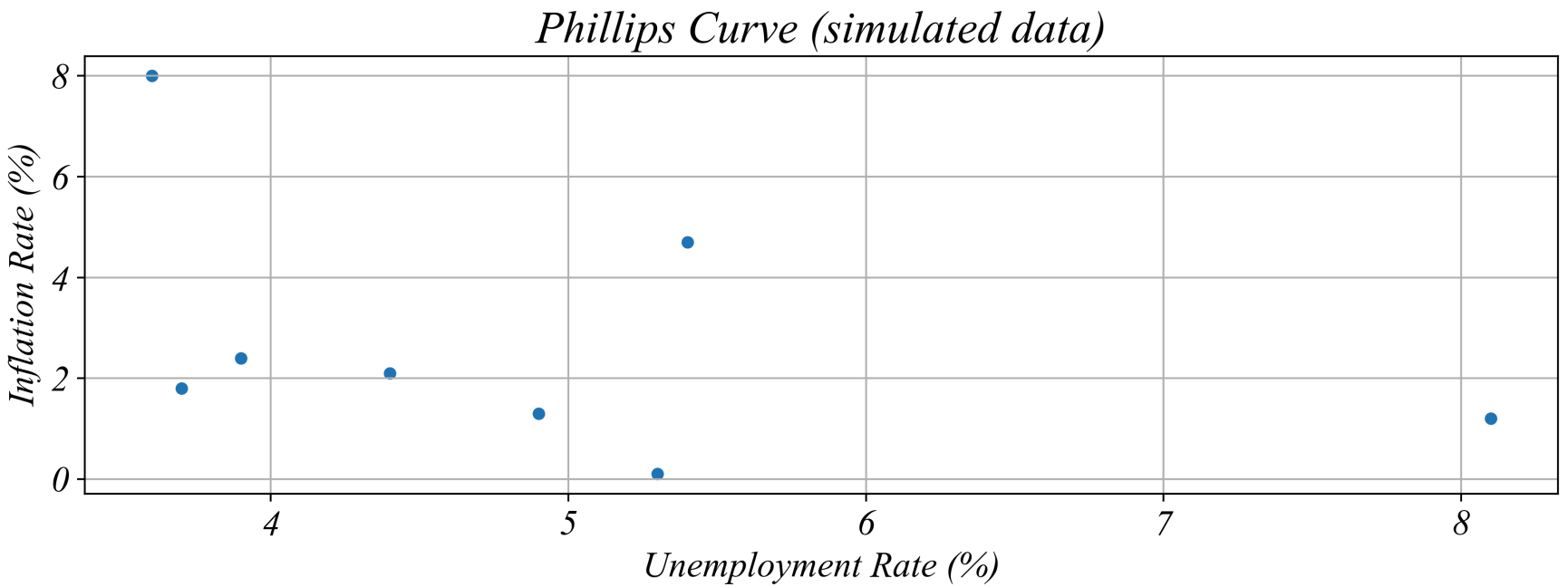
*1. Timeseries*

*2. Numerical*

*3. Bivariate*

# Exercise 9: Inflation and Unemployment

*What 1) are the dimensions of this dataset, and 2) an effecitve visualization?*




A ***Scatterplot*** *(or sometimes a multilinegraph)* effectively visualizes

*1. Timeseries*

*2. Numerical*

*3. Bivariate*

# Exercise 10: GDP Growth by Country

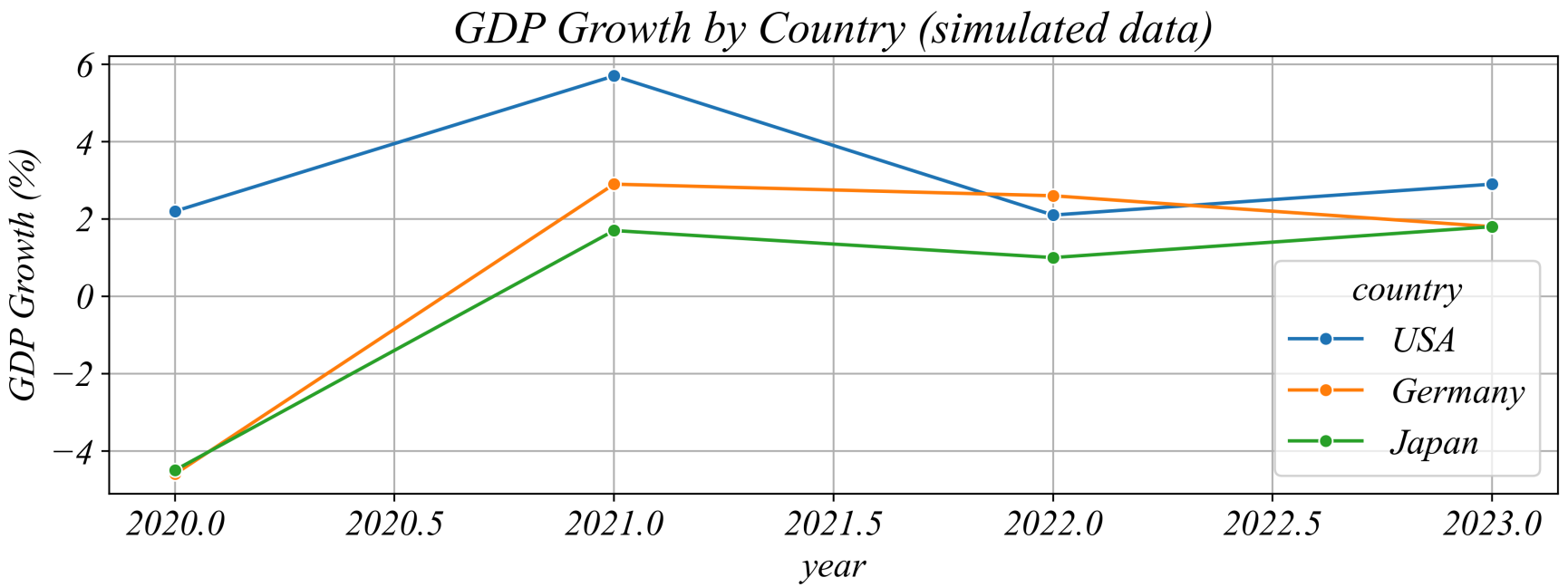
*What 1) are the dimensions of this dataset, and 2) an effecitve visualization?*

A dataset on GDP growth by country after 2020.

| country | year | gdp_growth |
|---|---|---|
| USA | 2020 | 2.200000 |
| USA | 2021 | 5.700000 |
| USA | 2022 | 2.100000 |
| USA | 2023 | 2.900000 |
| Germany | 2020 | -4.600000 |

# Exercise 10: GDP Growth by Country

*What 1) are the dimensions of this dataset, and 2) an effecitve visualization?*




A ***Multi-Linegraph*** *(or sometimes a scatterplot)* effectively visualizes

1. *Panel*
2. *Numerical*
3. *Univariate*