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Private vs. State Prison Spending

Introduction

Research Question: How do private prisons and state prisons spend money differently? Does this uncover any underlying patterns amongst private or state prisons?

Context: In a post emancipation America, state governments established prison contracts with rich white former slave–owners. Former slave–owners used forced prison labor as a replacement to slave labor, continuing their cruel ways of money making. They treated prisoners worse than slaves – seeing them as replaceable. Private prisons were attractive to governments because it was cheaper to send prisoners there than to imprison them in state facilities. Today, conglomerates benefit from a high incarceration rate – making private prisons incompatible to a country with an equitable justice system.

→

Bauer, Shane. "The True History of America's Private Prison Industry." *Time*, Time, 25 Sept. 2018, time.com/5405158/the–true–history–of–americas–private–prison–industry/.

Data Wrangling

Source   [Wikipedia of Private Prisons](#)
                    [Arizona Department of Corrections- Cost Report](#)
                    [Arizona Department of Corrections - Inmate Fact Sheet](#)

Challenges   PDF → XLSX → CSV
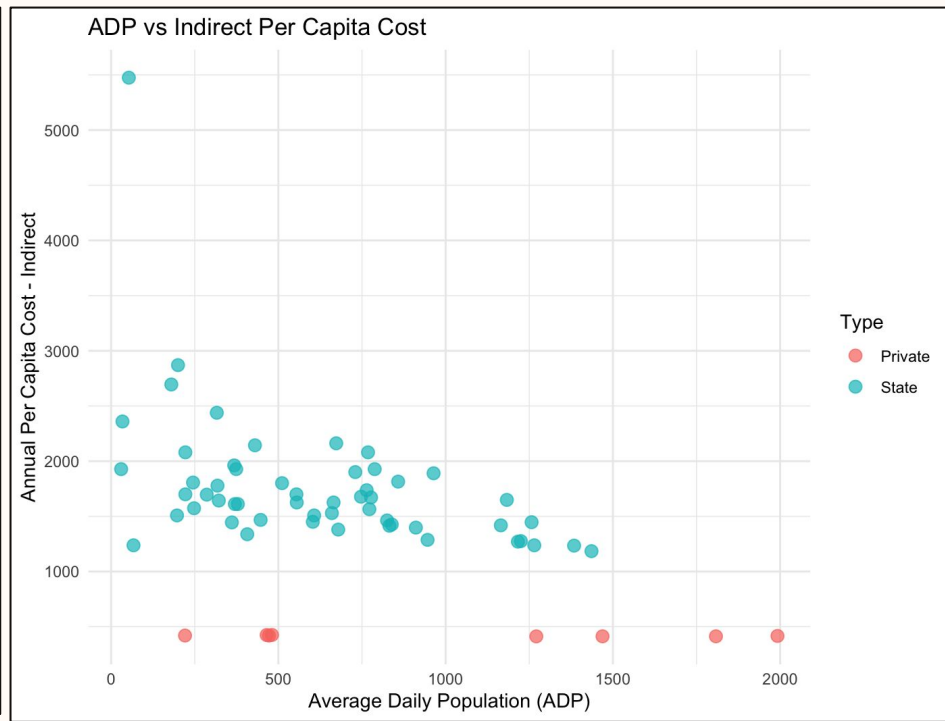
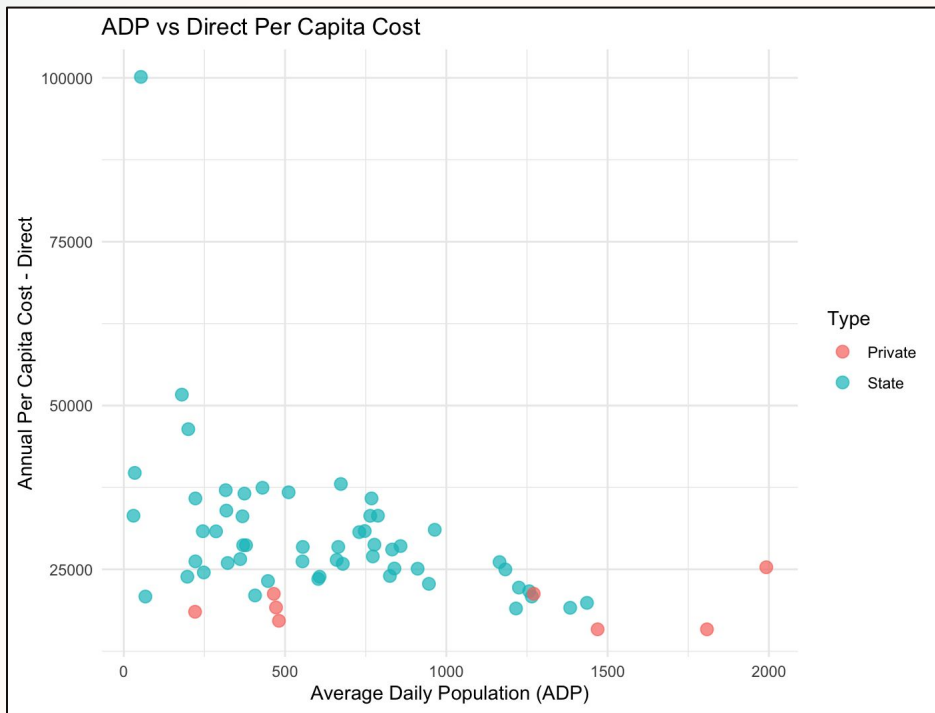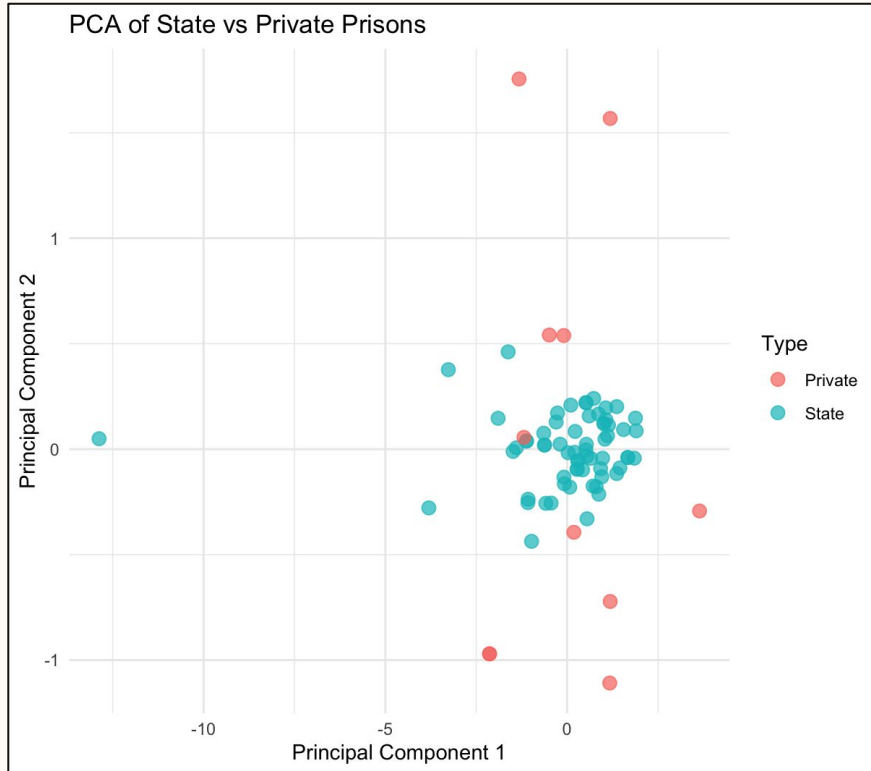**Tools**   Adobe Acrobat, Excel, and R

Methods   Extract and save certain lines of a csv to new csv
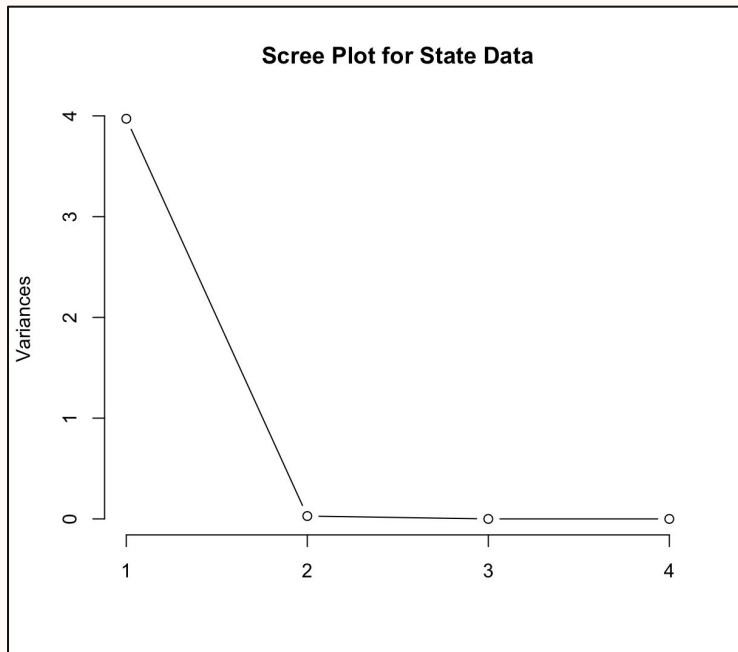   Make multiple csv files with each table from the original

EDA

Modeling - PCA

PCA of State vs Private Prisons

Does not show clear separation between Private and State

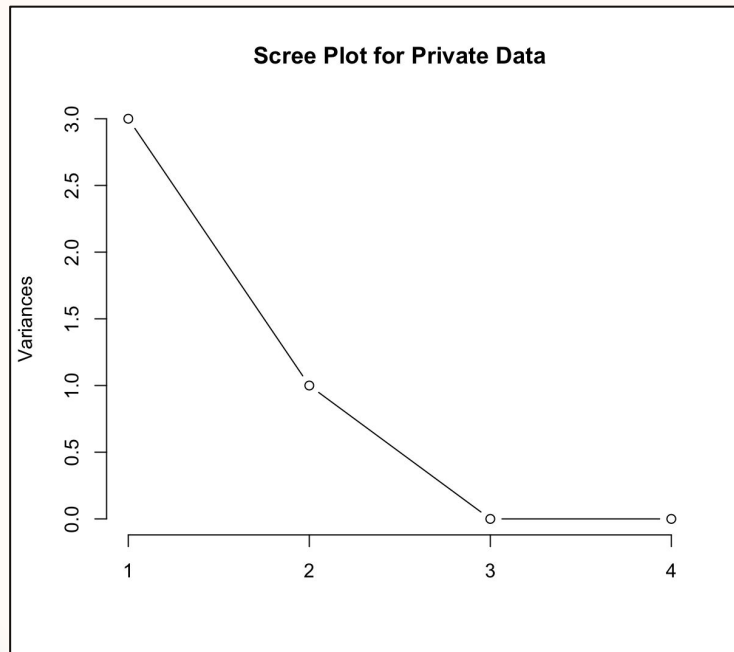Private is more spread out, whereas State is clustered to one area

Modeling - PCA

Scree Plot for State Data

Scree Plot for Private Data

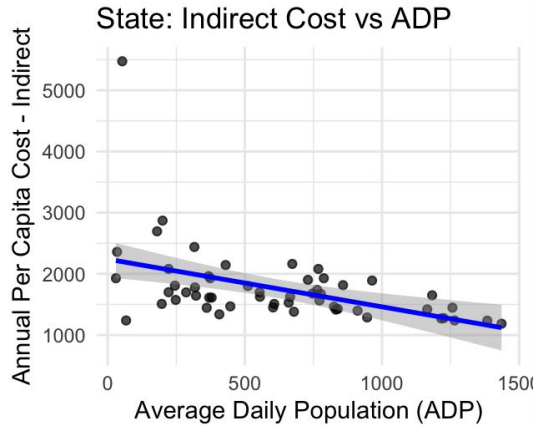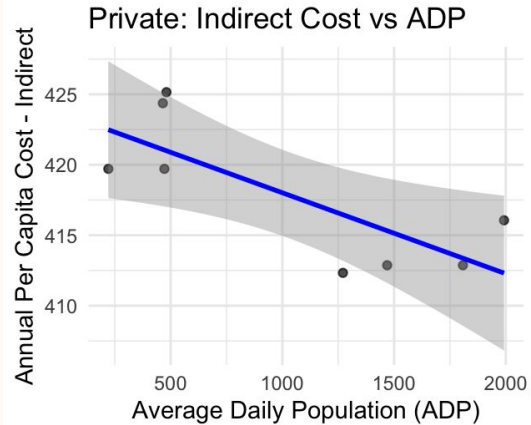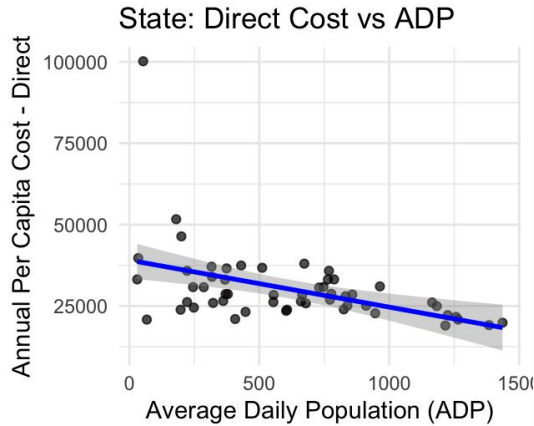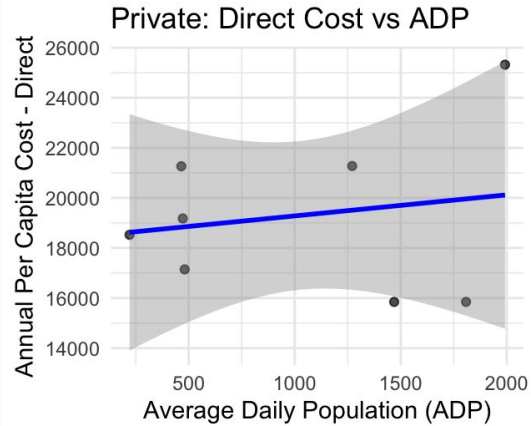**PC1 (State) and PC1 (Private):**
    Annual Per Capita Cost - Total
    Daily Per Capita Cost
    Annual Per Capita Cost - Direct
    Annual Per Capita Cost - Indirect

PC2 (Private):
    Annual Per Capita Cost - Indirect
    Annual Per Capita Cost - Direct
    Daily Per Capita Cost
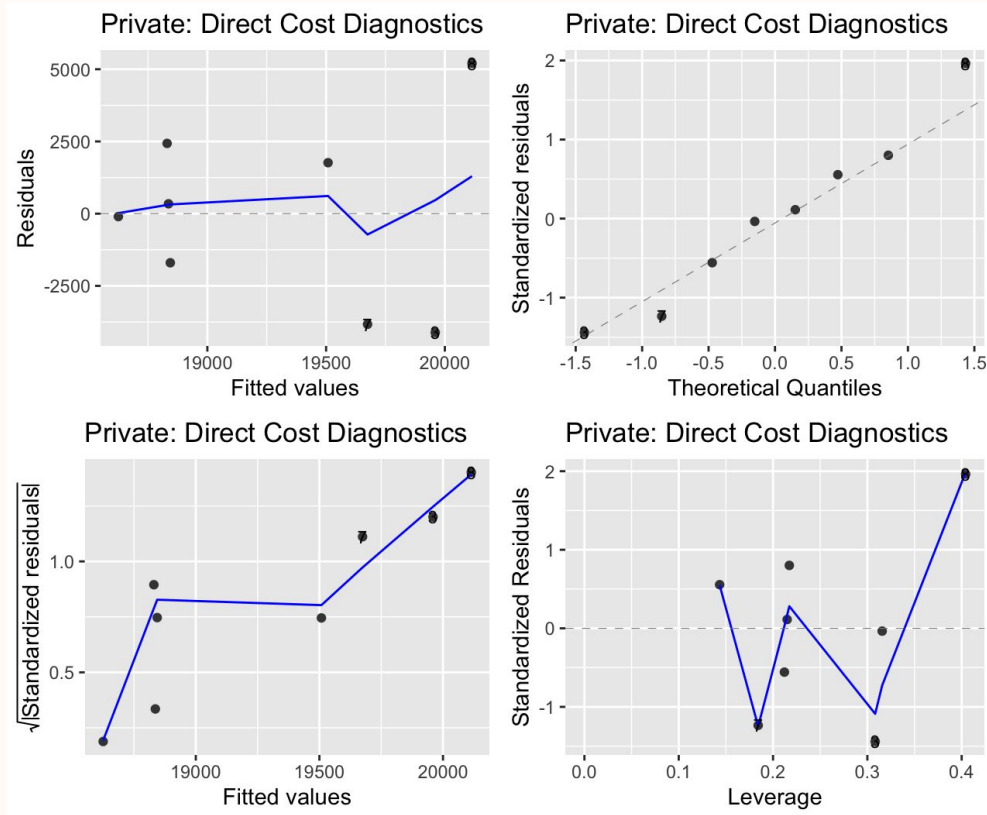   **Annual Per Capita Cost - Total**

Individual Regression

Private:
No clear relationship

State:
Negative relationship

Per Capita costs decreases as Population increases

Coefficients were significant in all cases.

Regression: Private

Private: Direct Cost Diagnostics
(Residuals vs Fitted values)

Private: Direct Cost Diagnostics
(Standardized residuals vs Theoretical Quantiles)

Private: Direct Cost Diagnostics
(√|Standardized residuals| vs Fitted values)

Private: Direct Cost Diagnostics
(Standardized Residuals vs Leverage)

Residuals (top left)
- Non-randomness suggests heteroscedasticity

Q-Q Plot (top right)
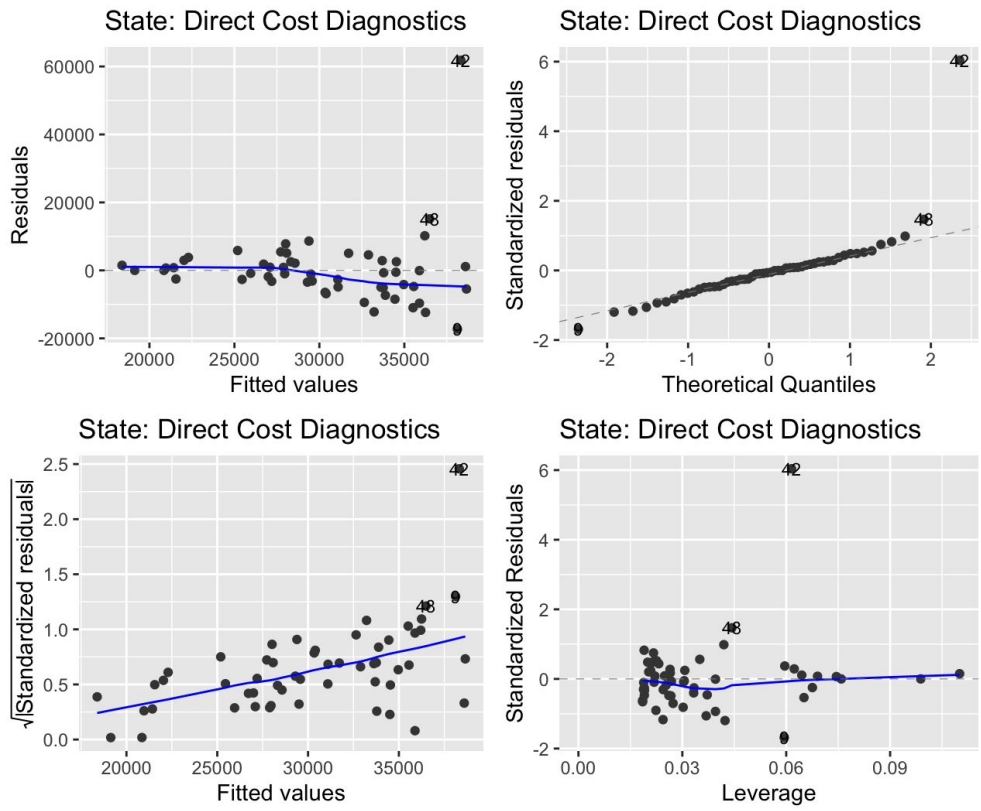- Diagonal means normal distribution

Scale-Location Plot (bottom left)
- Non-flat suggests heteroscedasticity

Residuals vs. Leverage (bottom right)
- Inflection points suggest one point has high influence

Regression: State

Residuals (top left)
- Non-randomness suggests a linear relationship may not accurately capture relationship

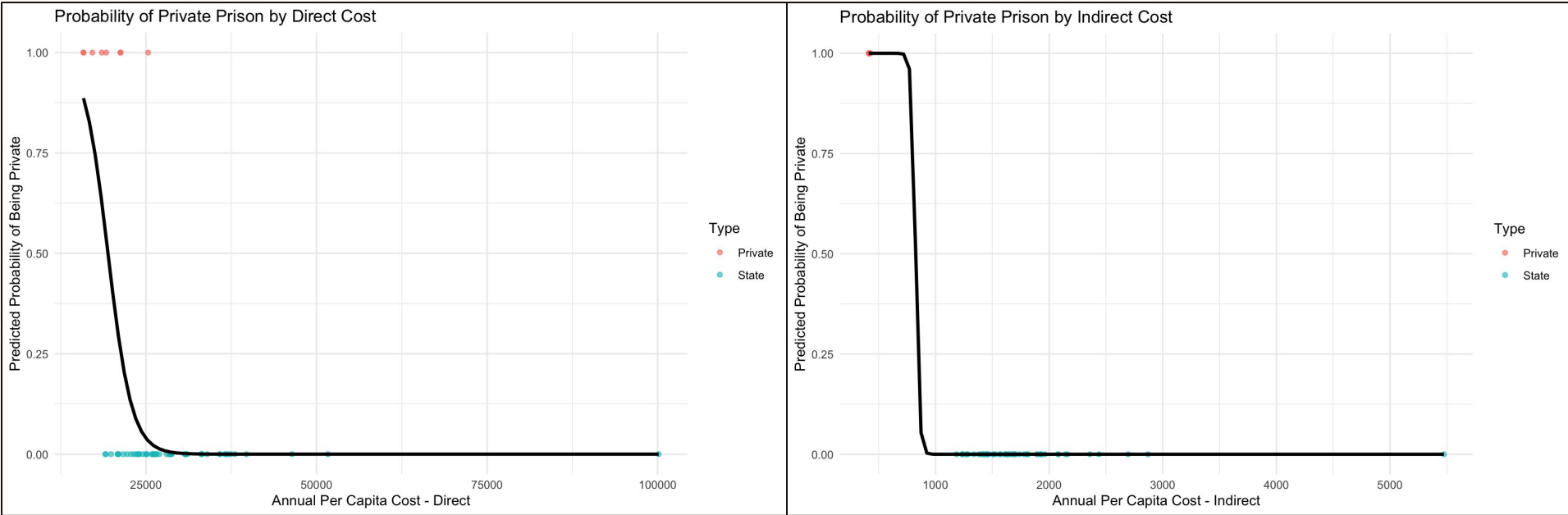**Q-Q Plot (top right)**
- Diagonal means normal distribution

Scale-Location Plot (bottom left)
- Flat suggests constant variance

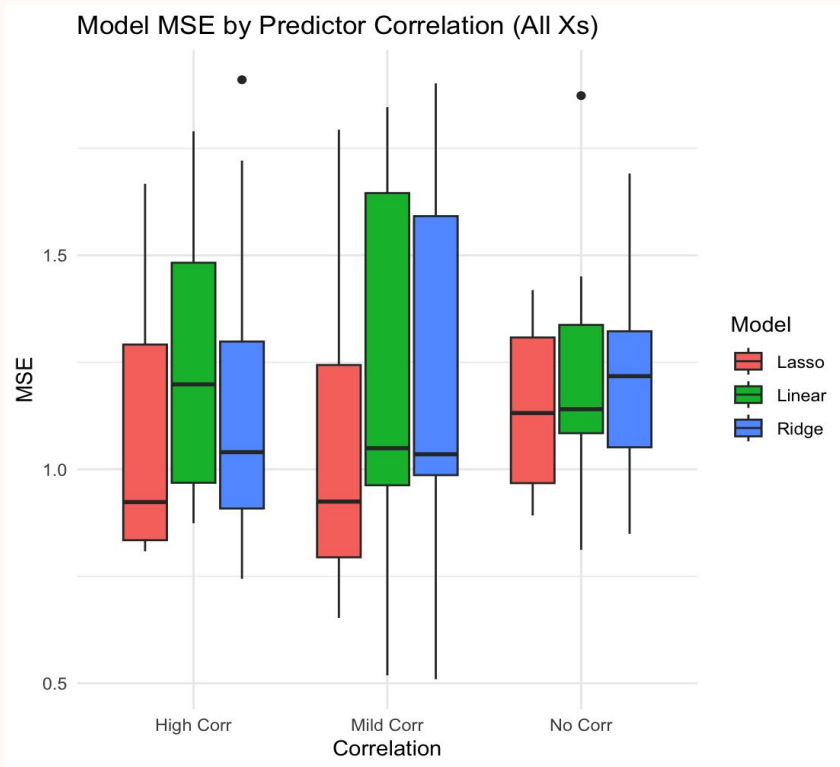**Residuals vs. Leverage (bottom right)**
- Inflection points suggest one point has high influence

Combined Regression

Likely overfit due to small amount of data. Model picked up on general trend, higher per capita costs are incurred by state prisons. Coefficients were not significant.

Monte Carlo Simulation

Model MSE by Predictor Correlation (All Xs)

My Example:
x1 –> x15

Y = 1 * x2 + 2 * x3 + 3 * x4 + 4 * x5 + noise

Class Example:
x1, x2
Y = 4 * x2 + noise

MSE still not significantly different

Summary/Reflection

Model Summary
- As population increases, the average cost per inmate goes down in state-run facilities
  - Economies of scale — larger prisons can spread out fixed costs more effectively
- For private facilities, the cost per inmate stays the same or even increases slightly as the population grows.
- Private prisons have lower costs, likely because they aim to maximize profits.
- Challenges: Far less data for private than state data, potentially skewing results.

Implications
- Questions the level of care of incarcerated people in private prisons receive.
- No clear benefit to privatization, state prisons seem to budget better.
- Could be the start of using data driven evidence to lean governments away from private prisons
- There is not much data from prisons, so analyzing what is publicly available is all we can do.

I learned
- Reproducible repo: relative paths, make dependencies easy to download, explain steps in comments/README
- Structuring a data science project: importance of EDA, how to choose appropriate model

Thanks! Questions?