Galvanize
Denver g64

1° Capstone – Feb/16/2018
Nei Costa

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Dataset: Census

Source: Fact Finder interface

https://factfinder.census.gov

Goal:

Identify the factors that influence the percentage of senior in counties (Seniors = people 60 years and over).

This information could be used to improve health programs and other services specific to these people.

Imported files:

ACS (American Community Survey 5-Year Estimates)

Population Statistics: ACS_16_5YR_CP05_with_ann.csv

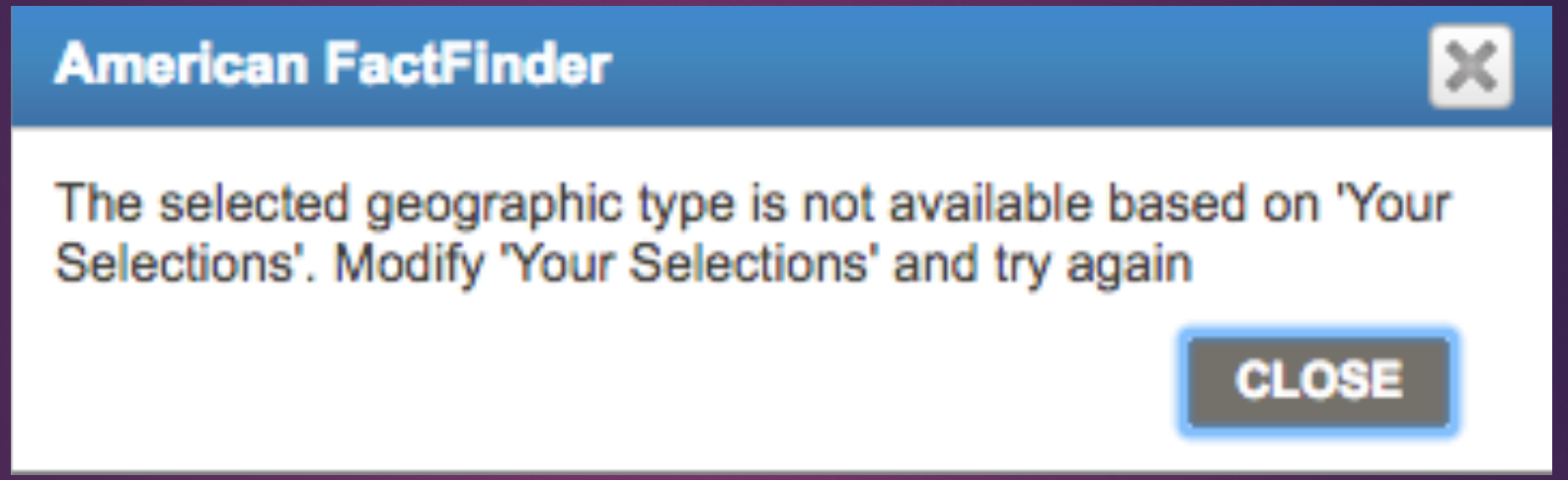
Per capita income : ACS_16_5YR_DP03_with_ann.csv

ECN (Economic Census of the United States)

Industries by County: ECN_2012_US_31A1_with_ann.csv

OBS: Unfortunately I did not find other information related to the weather, health condition, cost of living per County.

Information not available on this site:



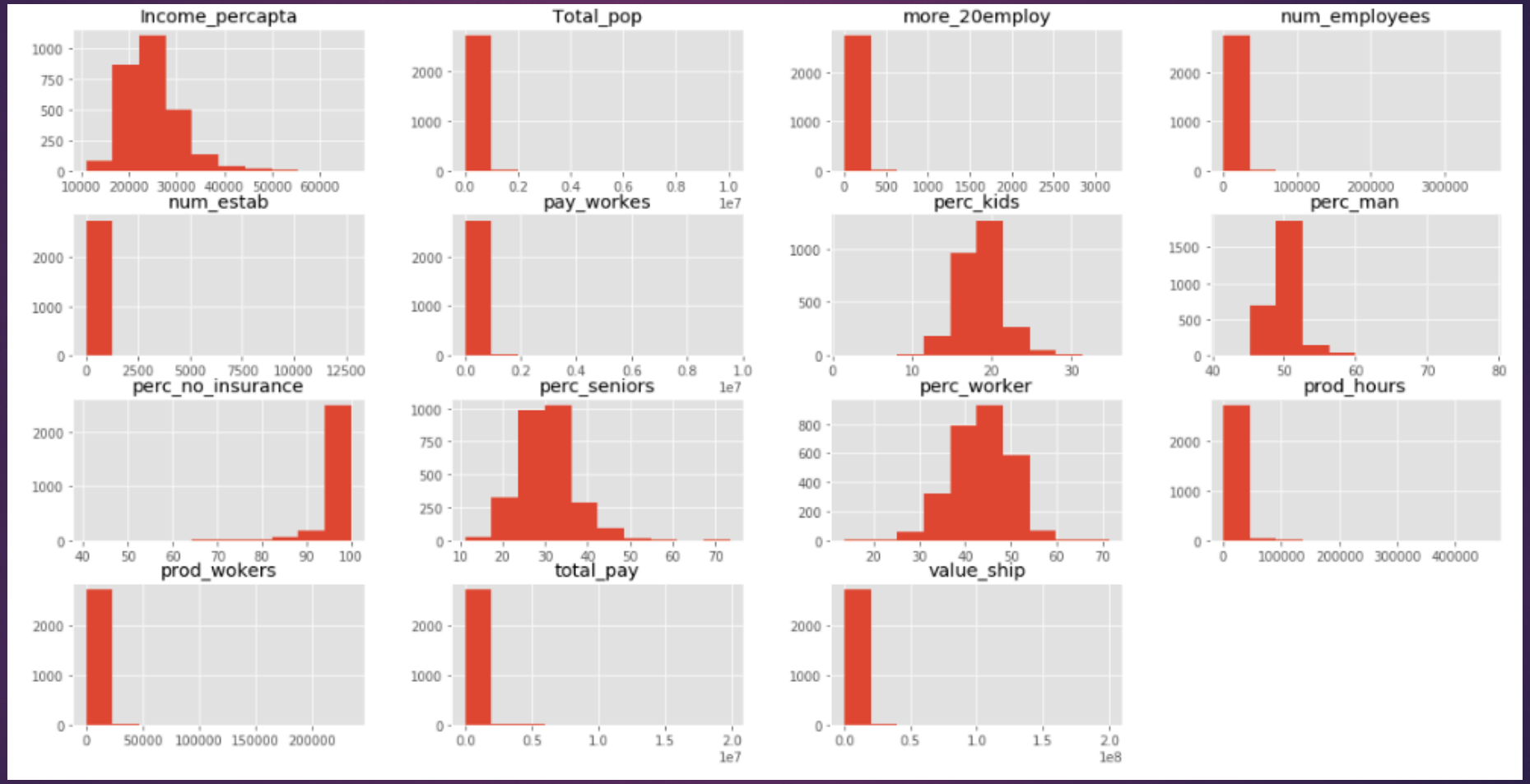
Some relevant information was not available by state or county.

Cleansing and Organizing Data:

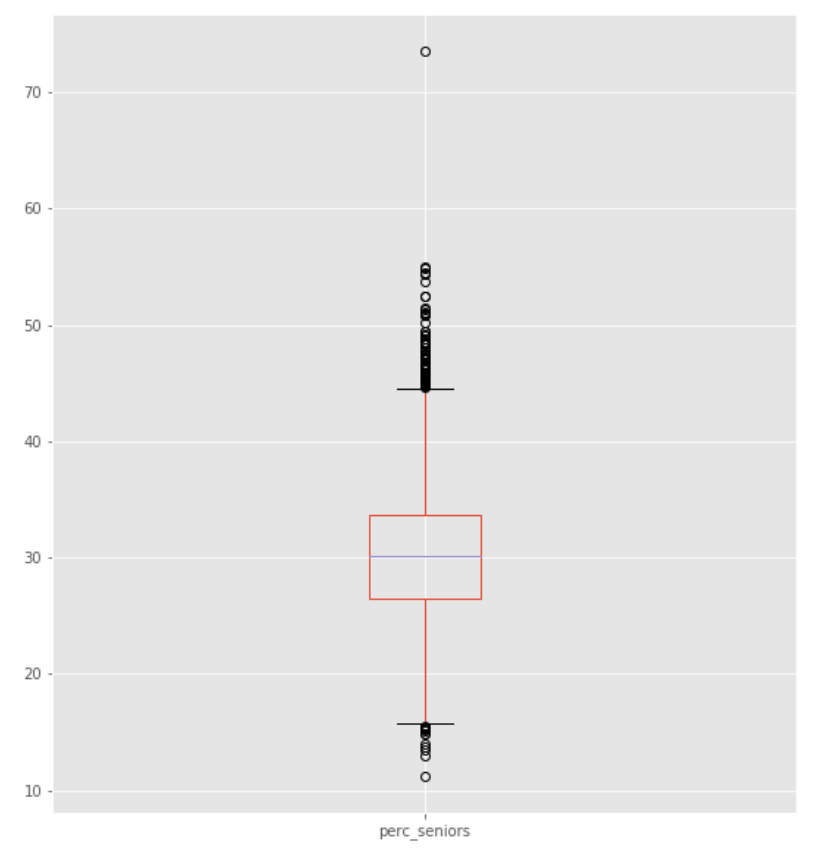
Imported files bring lots of information, requiring to delete unnecessary columns, and renaming columns to names most closely related to your content.

This work was done in the data_select.py file in the SRC folder that provides the data already prepared.

Exploring the data:



Removing Outliers



Mean % Seniors in USA Counties: 30.33%
Std (6.13%)

More than 4 standard deviations

% Seniors < 5.81%:

% Seniors > 54.85%:

Charlotte (Florida): 55.00%

Sumter (Florida): 73.50%

Describe % Seniors

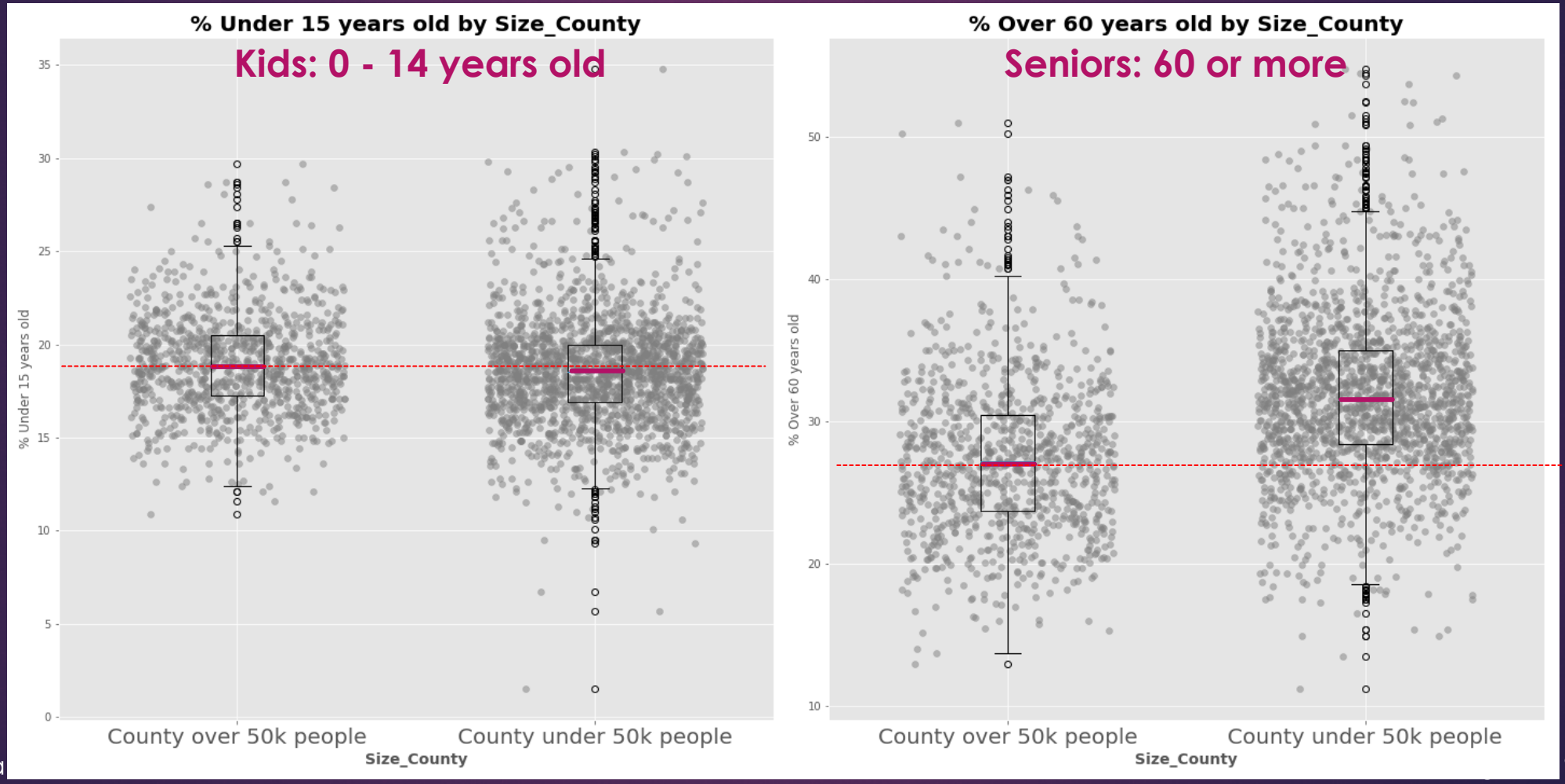
	perc_seniors
count	2760.00
mean	30.31
std	6.06
min	11.20
25%	26.50
50%	30.05
75%	33.70
max	54.80

Comparing Counties large and small

Small County:
< 50.000 people

Large County:
> 50.000 people

Comparing Counties large and small



Comparing Counties large and small

Size_County	Total_pop	perc_man	perc_kids	perc_seniors
County over 50k people	284,384.9213	49.3496	18.9646	27.4079
County under 50k people	21,705.5730	50.2147	18.5466	31.8959

Using the t-test to confirm if this difference is statistically significant

H_0: Mean % Seniors of Small County == Mean % Seniors of Big County

H_1: Mean % Seniors of Small Couty != Mean % Seniors of Big County

t-stat: -20.2343 - P-val: 0.000

Reject H_0:

Conclusion:

Mean % Seniors of Small Couty **!=** Mean % Seniors of Big County

Why?

What factors could be causing the lowest percentage of seniors in the larger Counties?

I could find:

- Family income;
- Conditions of employment;

I couldn't find:

- Cost of living;
- Climate;
- Health conditions.

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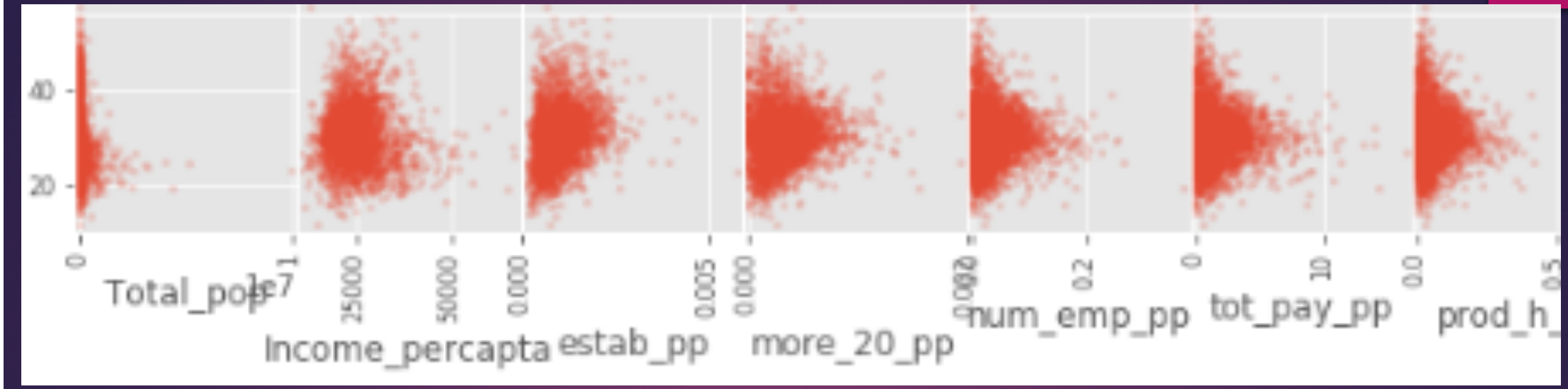
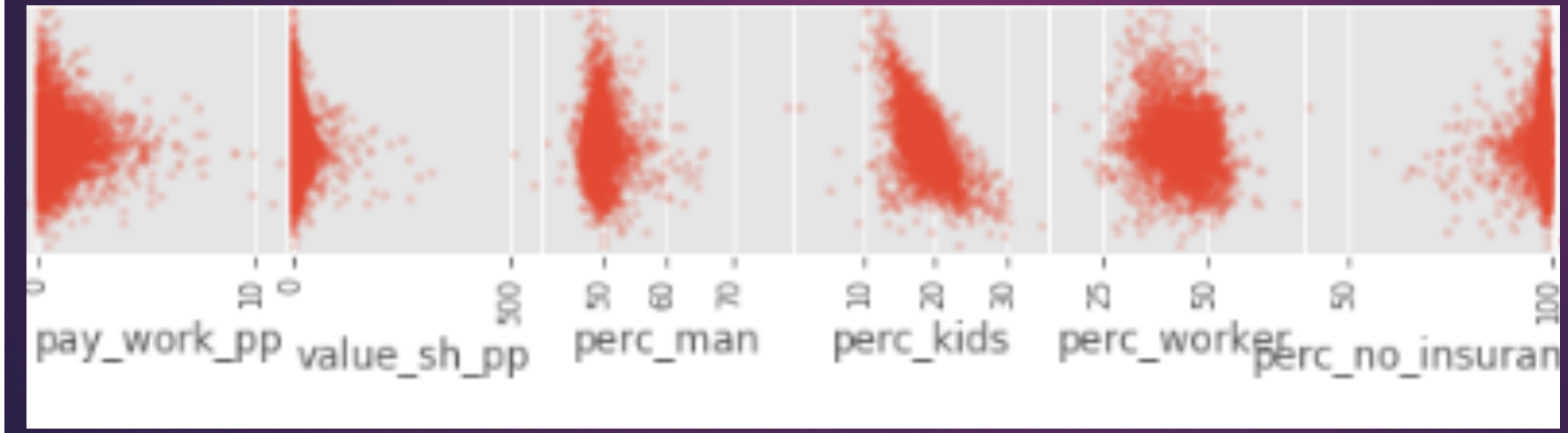
EDA

Well, let's work with what we have then.

Relationship with % of seniors





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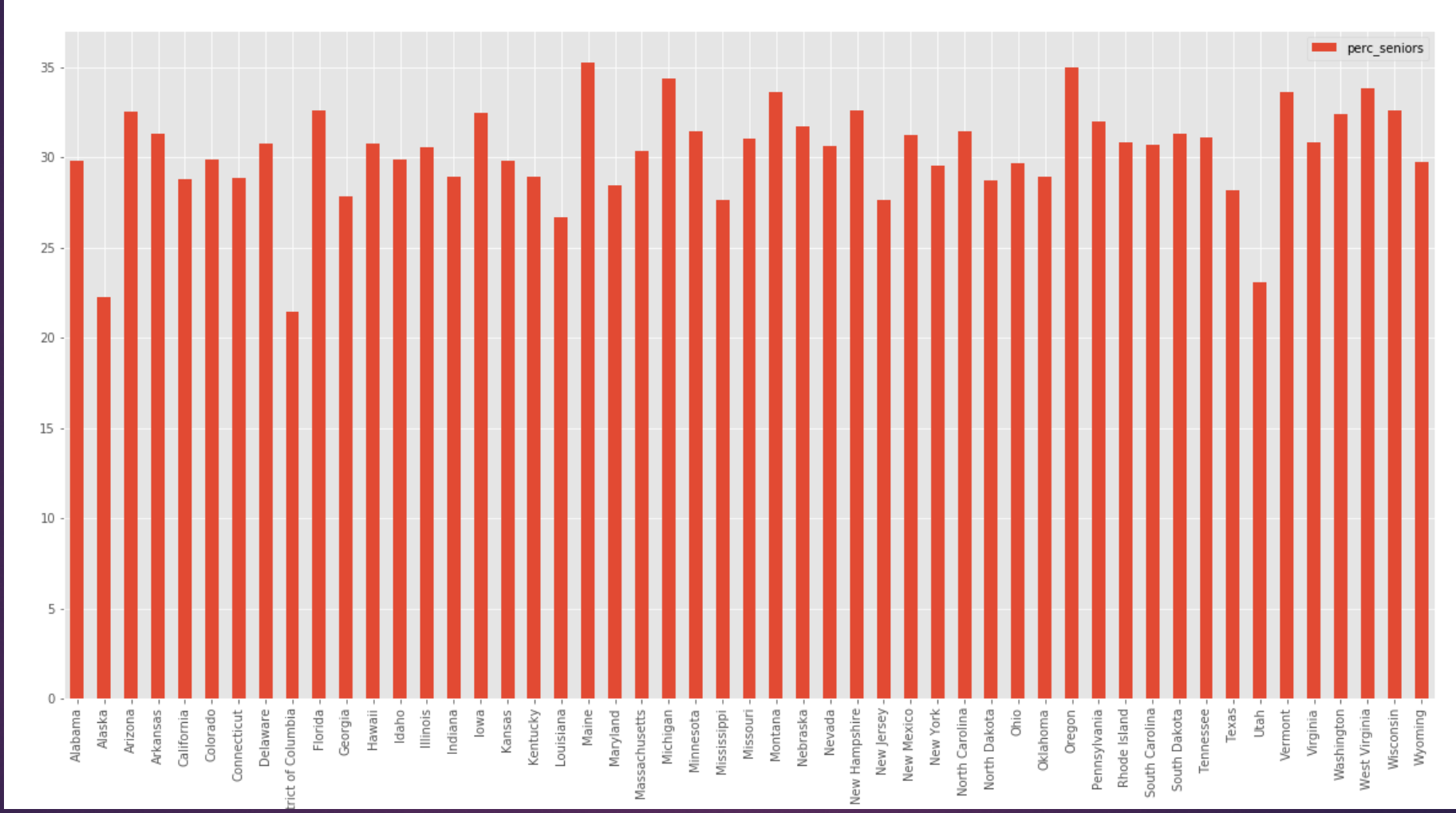
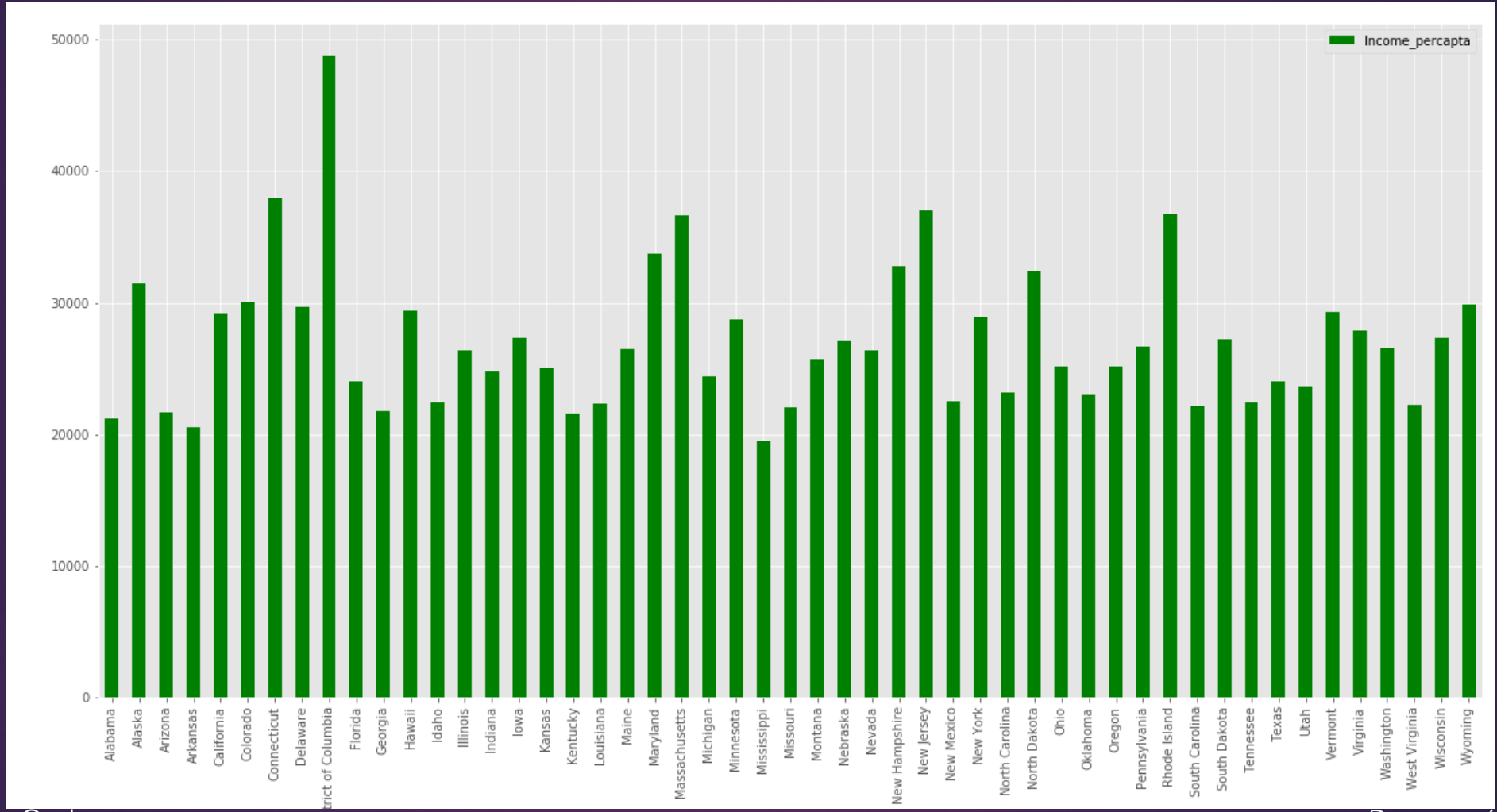
Some information grouped by state (to facilitate visualization)

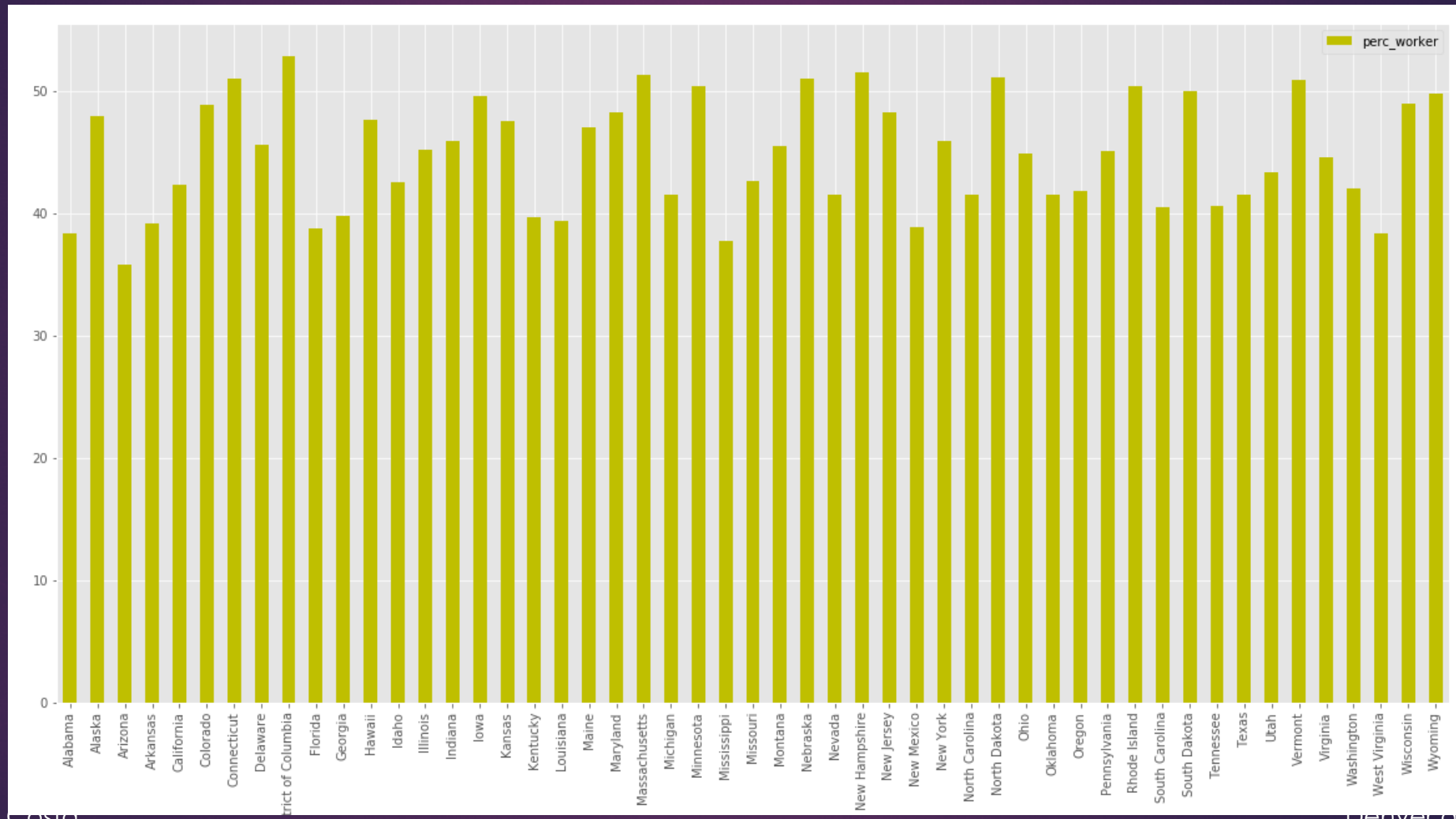
% Seniors


perc_seniors
35
30
25
20
15
10
5
0
Alabama
Alaska
Arizona
Arkansas
California
Colorado
Connecticut
Delaware
trict of Columbia
Florida
Georgia
Hawaii
Idaho
Illinois
Indiana
Iowa
Kansas
Kentucky
Louisiana
Maine
Maryland
Massachusetts
Michigan
Minnesota
Mississippi
Missouri
Montana
Nebraska
Nevada
New Hampshire
New Jersey
New Mexico
New York
North Carolina
North Dakota
Ohio
Oklahoma
Oregon
Pennsylvania
Rhode Island
South Carolina
South Dakota
Tennessee
Texas
Utah
Vermont
Virginia
Washington
West Virginia
Wisconsin
Wyoming

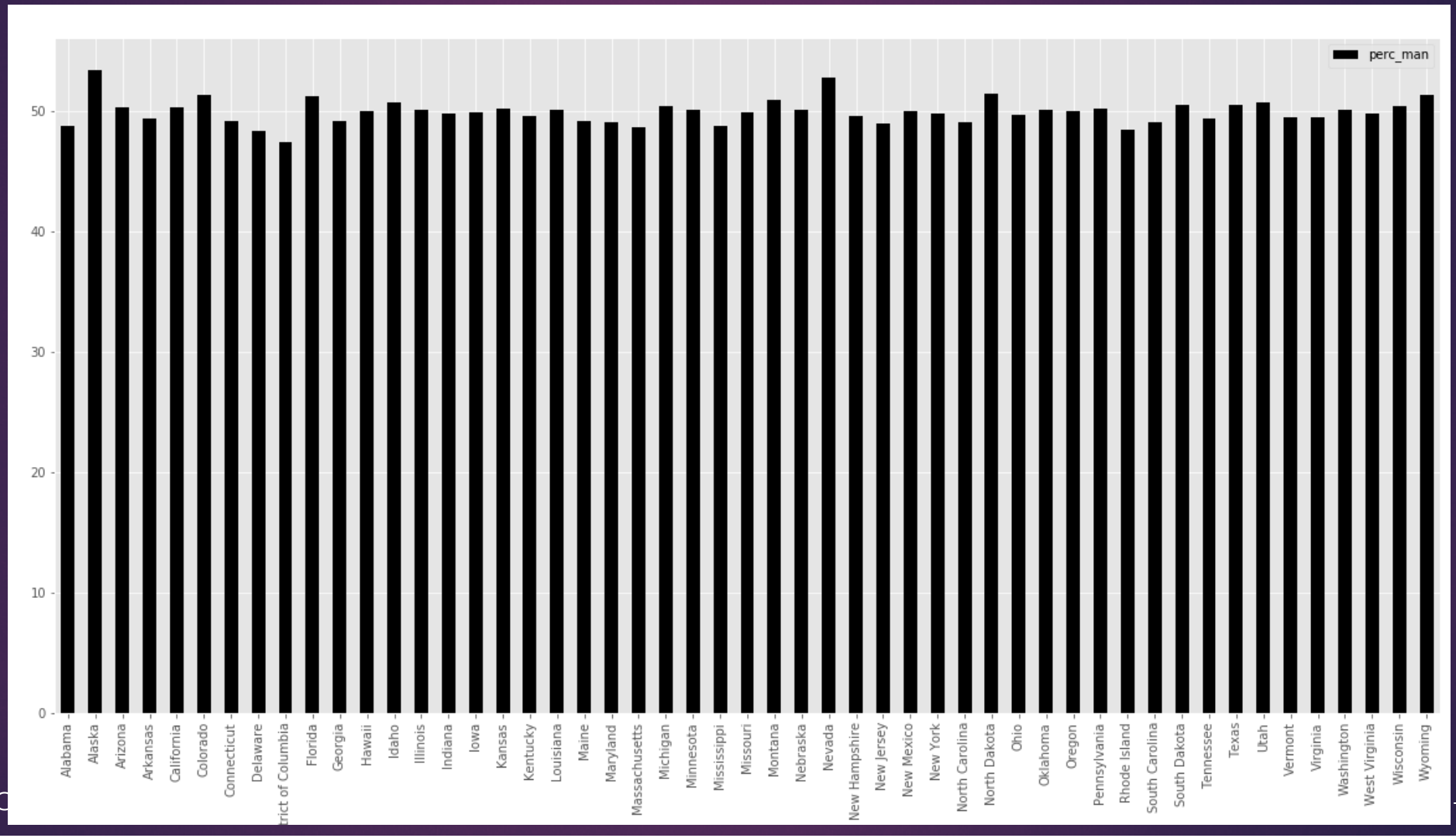
Per Capita Income



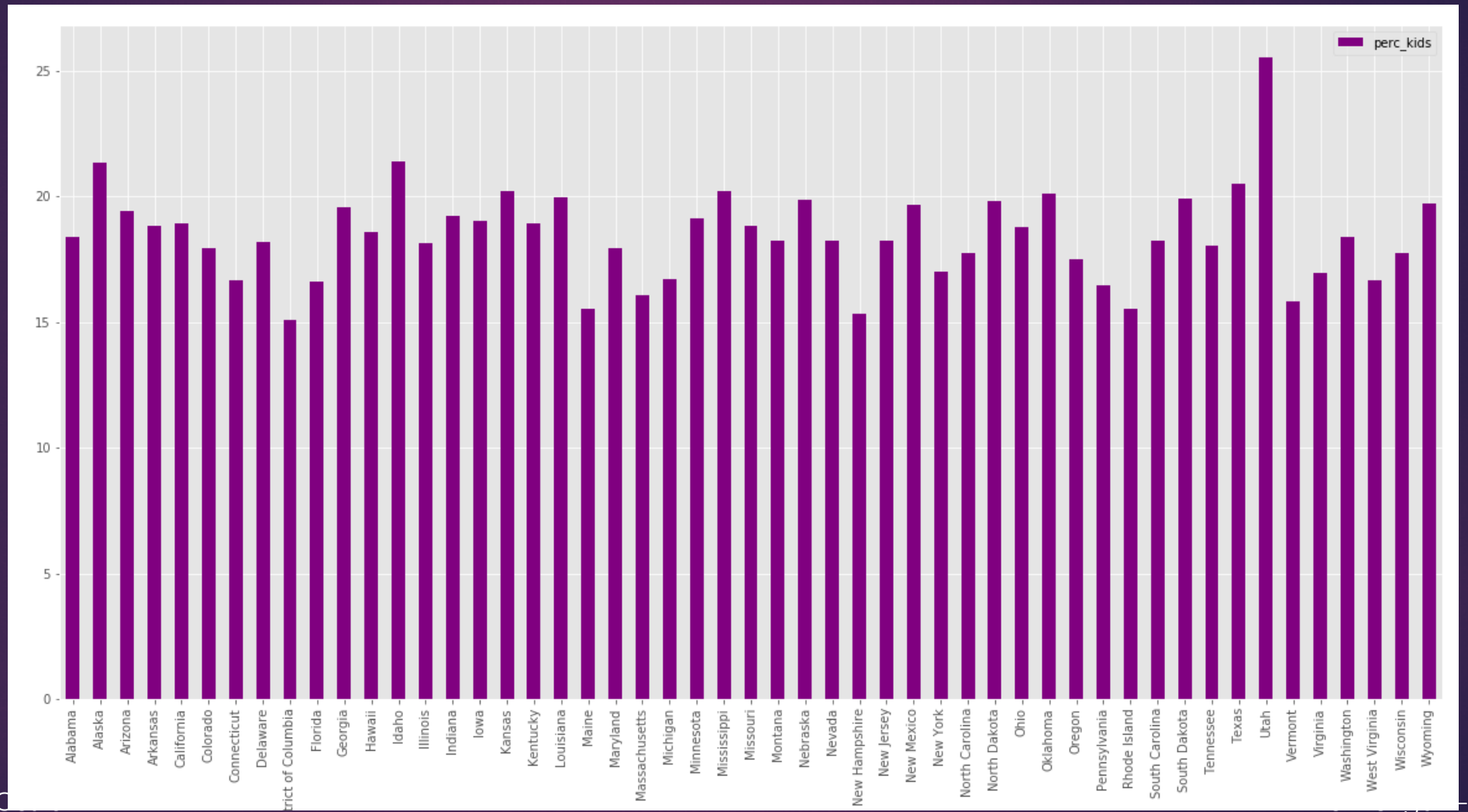
Percentage of working population



Percentage of men



Percentage of kids



Building Models

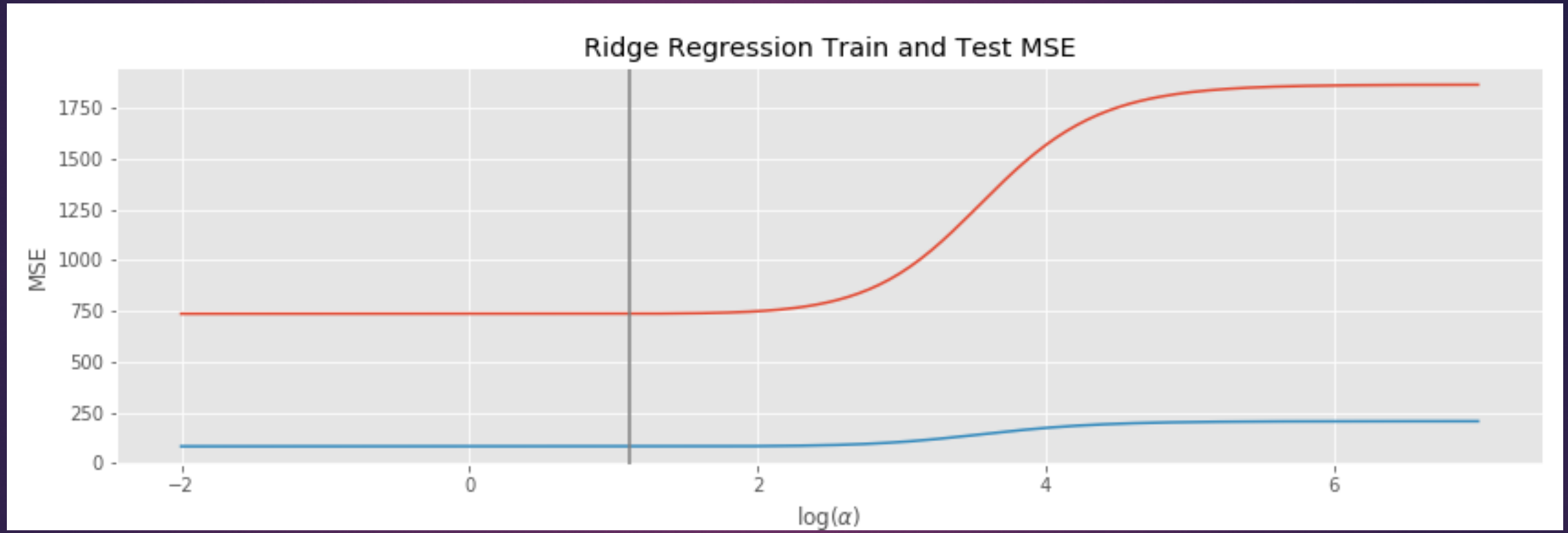
Selected predictors:

- Income per capta
- % of men
- % of worker
- % of people no insurance
- % of kids
- Number total population
- N° per person:
  - N° industries;
  - N° industries +20 employees;
  - Total employees;
  - Total paid to employees;
  - Production Hours;
  - Total paid production employees;
  - Amount paid shipping

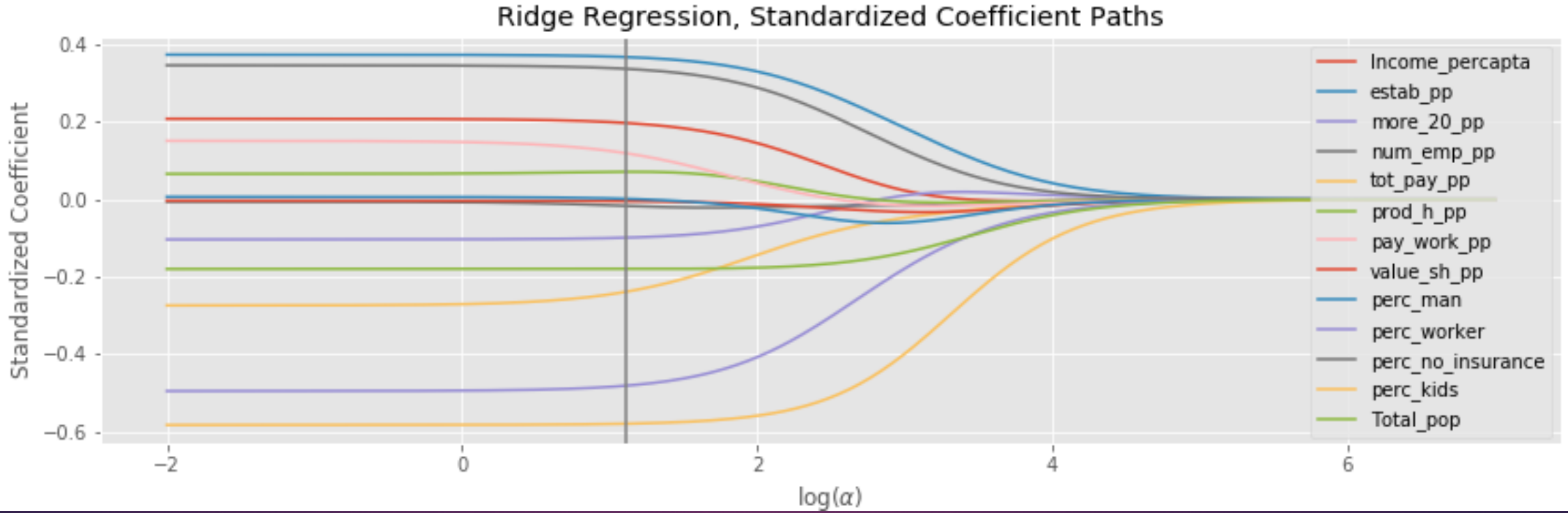
Separating data for training and testing

Training = 75%	Test = 25%

Ridge

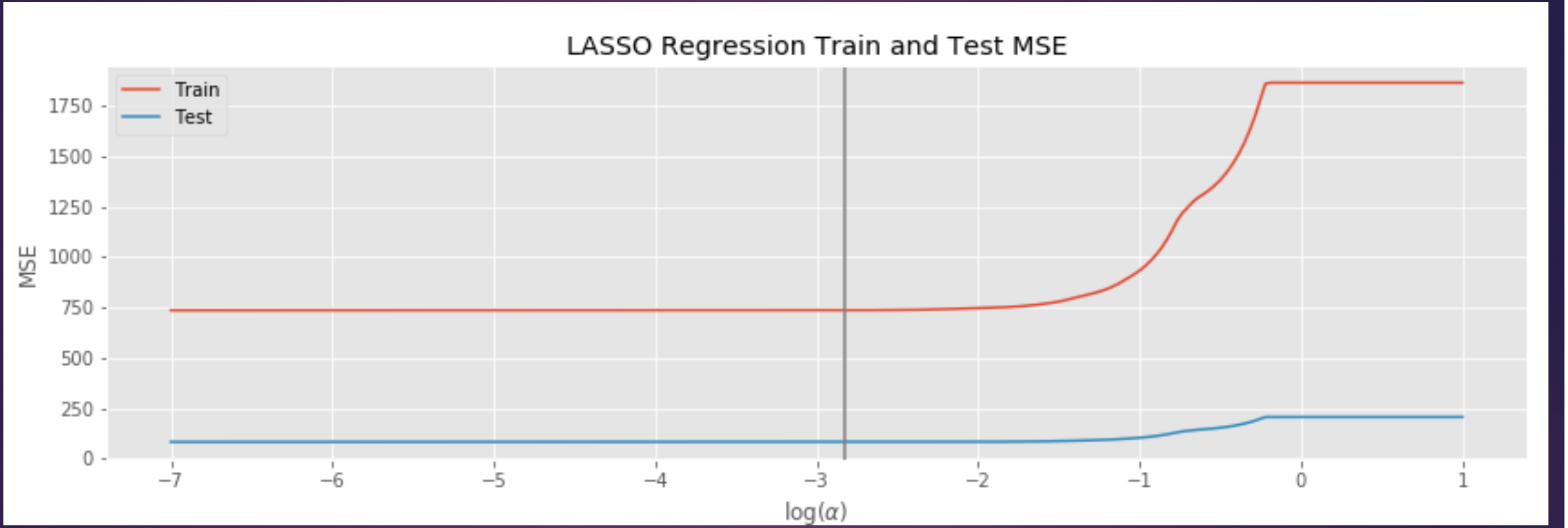

Ridge Regression Train and Test MSE
MSE
1750
1500
1250
1000
750
500
250
0
−2
0
2
4
6
log(α)

Ridge

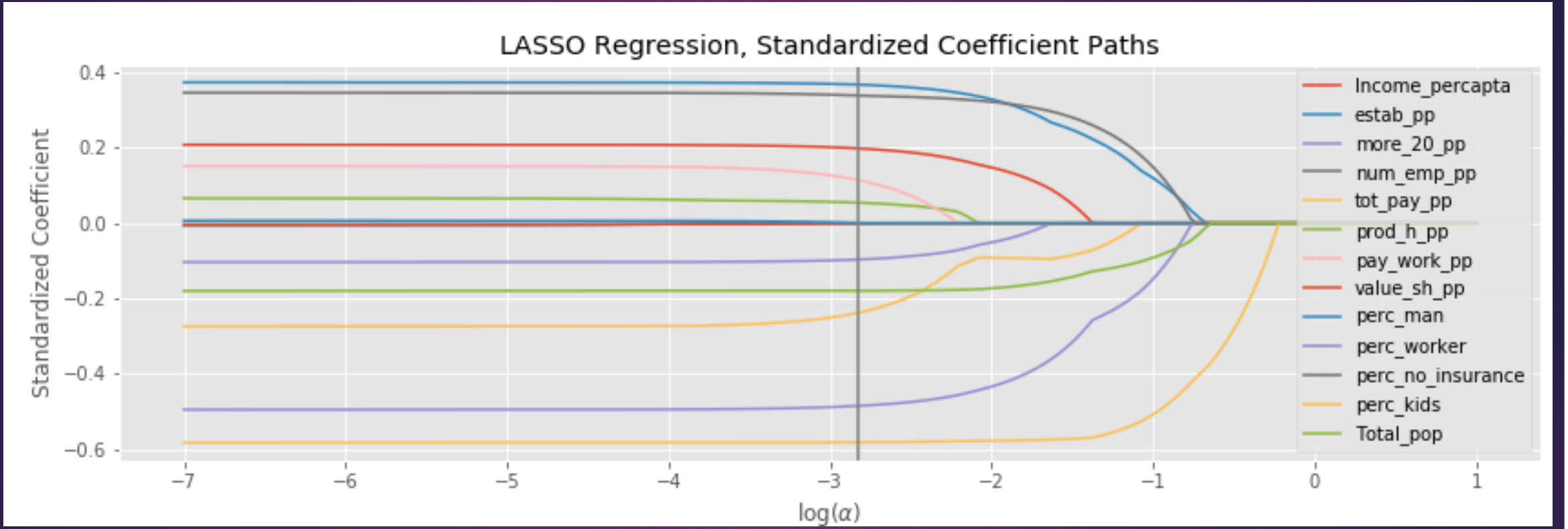


Log Ridge Optimal Alpha: 2.89

Lasso


LASSO Regression Train and Test MSE
Train
Test
MSE
1750
1500
1250
1000
750
500
250
0
−7
−6
−5
−4
−3
−2
−1
0
1
log(α)

Lasso



Log Lasso Optimal Alpha: -6.13

Linear Regression Coefficients

Name	Parameter Estimate
Income_percapta	0.000
estab_pp	4464.148
more_20_pp	-2881.472
num_emp_pp	-6.125
tot_pay_pp	-0.772
prod_h_pp	2.262
pay_work_pp	0.688
value_sh_pp	0.000
perc_man	0.078
perc_worker	-0.433
perc_no_insurance	0.592
perc_kids	-1.286
Total_pop	-0.000

Testing Cross Validation (Linear Regression)

N° folds = 10

CV - Linear Regression Coefficients

Name	Parameter Estimate
Income_percapta	0.000
estab_pp	4464.148
more_20_pp	-2881.472
num_emp_pp	-6.125
tot_pay_pp	-0.772
prod_h_pp	2.262
pay_work_pp	0.688
value_sh_pp	0.000
perc_man	0.078
perc_worker	-0.433
perc_no_insurance	0.592
perc_kids	-1.286
Total_pop	-0.000

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Comparing Errors

Model	Train Part (75%)	Test Part (25%)	All Data
Ridge	16.94	18.04	17.22
Lasso	16.84	17.89	17.11
Linear Regression	14.43	15.46	14.69
Linear Regression - CV	14.44	15.46	14.70

* Very similar errors

Conclusion:

- In this analysis, the Linear Regression showed better performance
- To improve the model, it would be necessary to include other information that may influence the variation in the percentage participation of seniors in the municipalities.

Learning :

- Search the data directly from a source;
- Organization and selection of relevant information;
- Application and comparison of models (Ridge, Lasso, LR and CV (LR));
- Need to better analyze the information available before selecting a subject for work.

Frustration:

- Not being able to get more data related to my theme to create a more effective model.