Unemployment and Economic Health effects on Energy Consumption

Problem?

- How can energy companies know the consumption needs of consumers?
- How can they adjust their pricing to drive consumption?
- Does unemployment affect consumption?
- What about GDP?
- Can energy companies predict how much each household will consume?

Consumption by Type

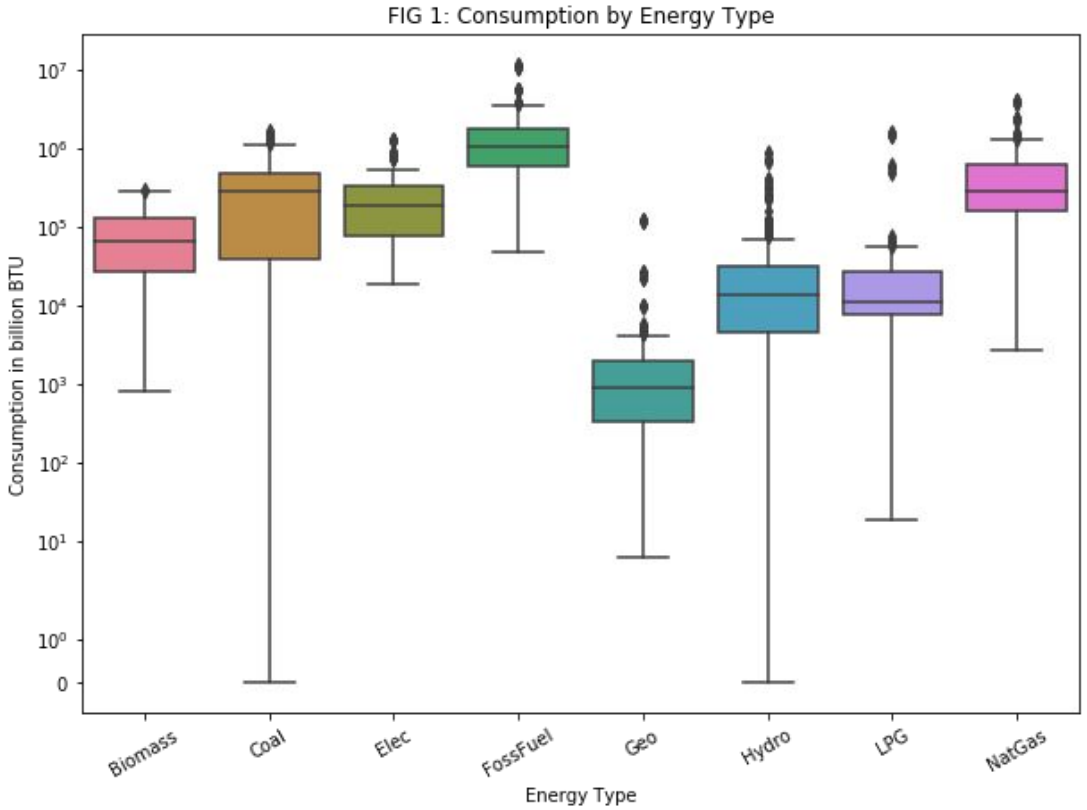
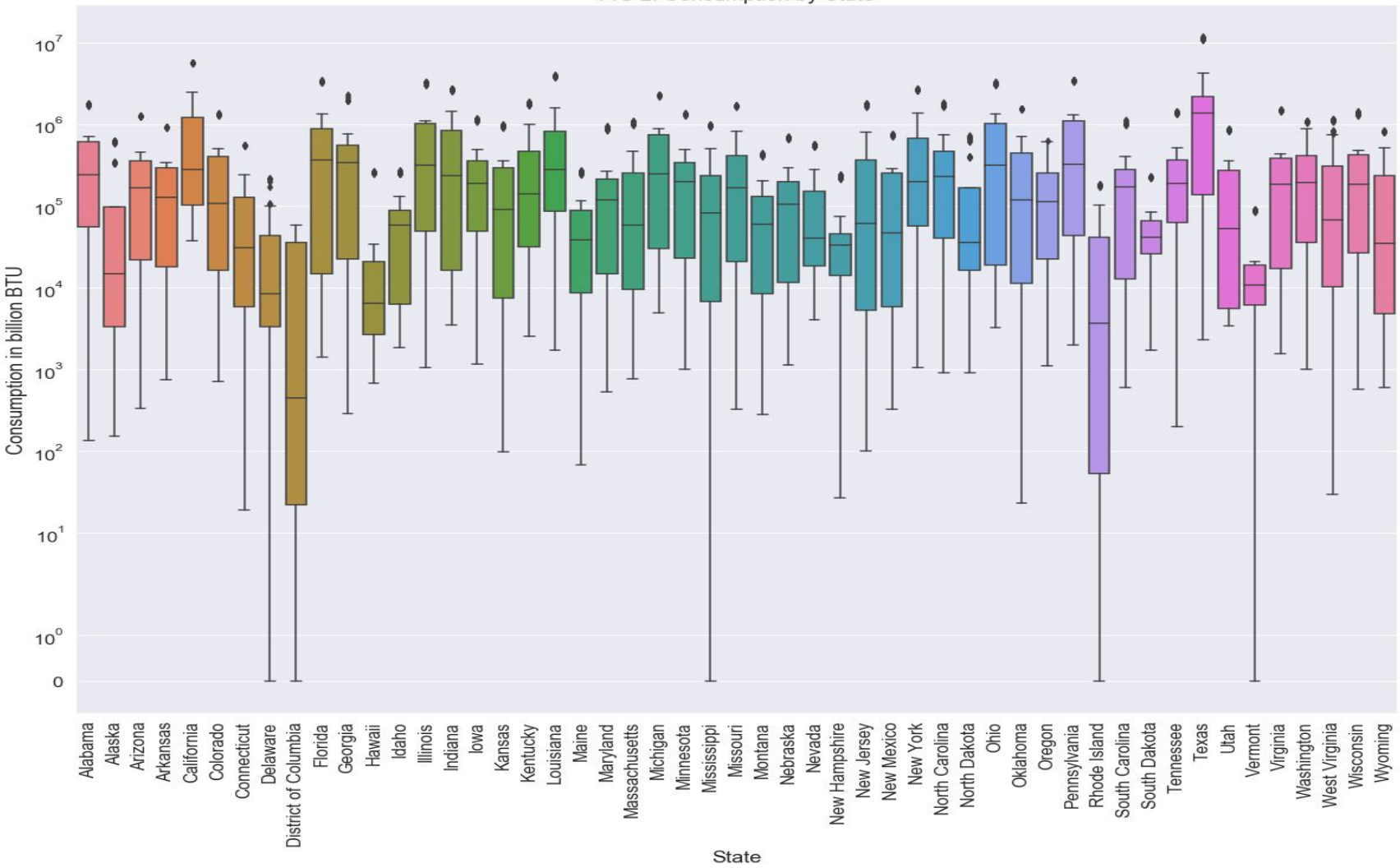
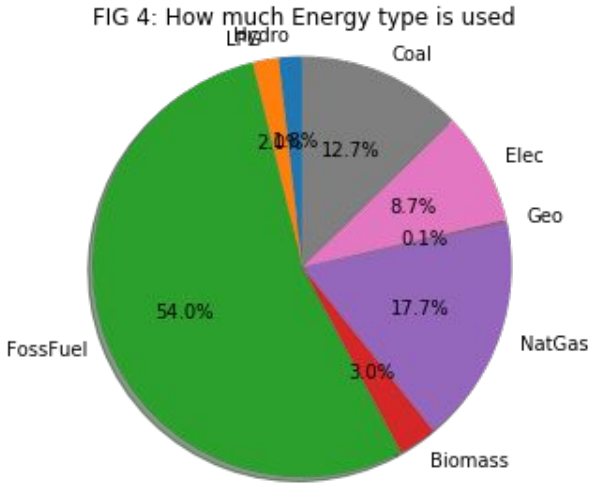


FIG 2: Consumption by State



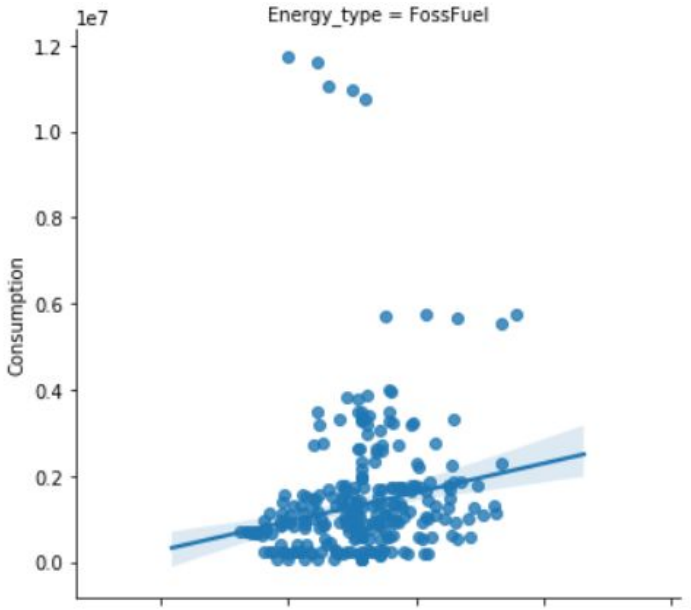
Further look at Energy usage by type

- Fossil fuels make up over half of all consumed energy
- Natural gases are second, but still a long way from fossil fuels



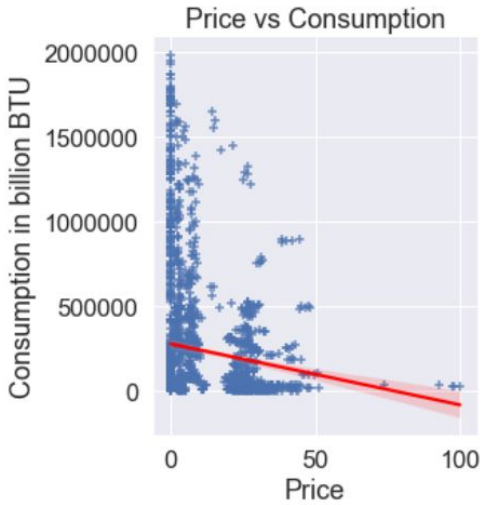
Unemployment vs Consumption

- Only looking at fossil fuels because they’re most used, and easiest to trends with
- Clear connection between unemployment rates and energy Consumption
- Upward trend from more time at home during daytime hours



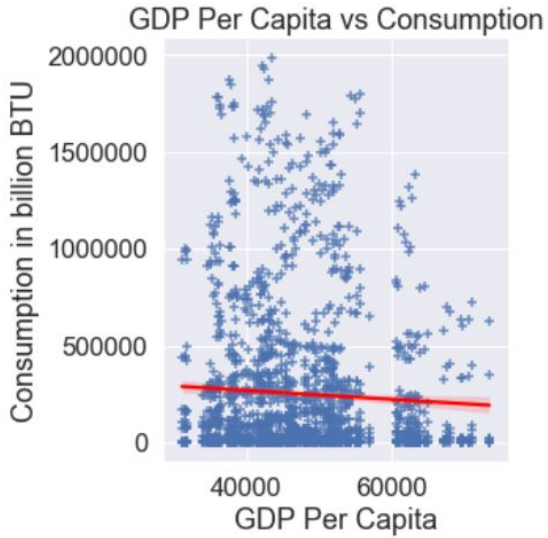
Price and Consumption

- Graph is subpart of pairplot (no labels)
- Price on horizontal, Consumption on vertical
- Clear trend; Increasing price directly correlates to less consumption
- The higher the price the less is consumed



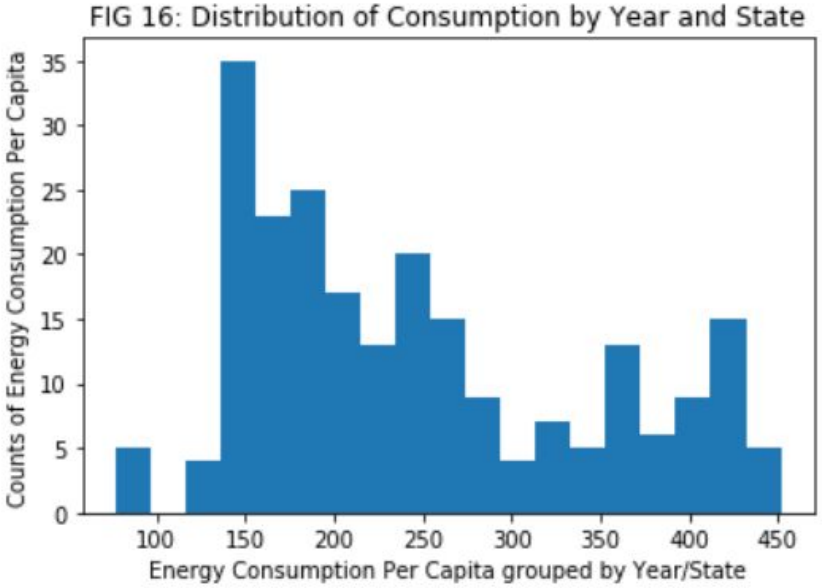
GDP Per Capita and Consumption

- Slight negative correlation between GDP per Capita and Consumption
- Lower GDP = Less consumption
- Could be because the lower the GDP the higher the prices, the more conservative people are



Consumption per capita

- After dropping ~10% of the columns (purely to see variation in low end of graph)
- Consumption in millions BTU per capita
- Not normally distributed



Energy per Capita

The U.S. Energy Information Administration (E.I.A.) reported the average energy usage per capita as 302 million BTU.

We will hypothesize that the true average Consumption per Capita is 302 million BTU.

- H0: mean(Consumption per Capita) = 302 million BTU
- H1: mean(Consumption per Capita) ≠ 302 million BTU

Predicting Usage

- Best model; tuned random forest regressor
- Energy types Fossil Fuel and Natural Gas both in top 10
- Price 4th on list
- Texas, surprisingly in top 10 (of ~90)
- GDP per cap in top 10

	Feature	Importance
13	TotalExpenditures	0.233136
84	FossFuel	0.192146
21	Expenditure	0.163043
23	Price	0.070228
3	POPESTIMATE	0.054274
4	TotalProduction	0.046416
22	Production	0.035414
66	Texas	0.032281
18	GDP_per_cap	0.017895
88	NatGas	0.010908

The models

- Three linear models performed almost identically
- K Neighbors was worst
- Random forest scored 98.7 on test data!
    - High number of predictors needed to be split into smaller groups for accuracy

	r2_train	r2_test	mse_train	mse_test
LinearRegression	0.544134	0.53622	3.20856e+11	3.48258e+11
Lasso	0.544119	0.53624	3.20866e+11	3.48243e+11
Ridge	0.544086	0.536131	3.20889e+11	3.48325e+11
RandomForestRegressor	0.995121	0.987111	3.43431e+09	9.6784e+09
KNeighborsRegressor	1	0.442412	0	4.187e+11

Conclusions

- Energy companies can easily use price to influence consumption of specific energy types
- Observing the unemployment rate and GDP for the quarter can be used to alter price to maximize consumption
  - The higher the unemployment rate, the more will be consumed
  - The higher the GDP, the less consumed
- Information especially important for energy companies in Texas
  - Data from Texas drastically influenced Random Forest model