Natural Gas Prices vs. Employment

Data Exploration

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Contents

HYPOTHESES

This section details the hypothesis regarding a potential relationship between natural gas prices and mining employment.

VARIABLES

This section describes the employment and natural gas price data sets. It explains why a specific natural gas price was used in favor of another.

HISTOGRAMS

This section includes histograms of the variable and illustrates the lack of concern regarding outliers.

Supplemental descriptive characteristics include:

- Mean
- Mode
- Std. Dev.

PMFs and CDFs

The section illustrates the variance of gas prices in different years with a Probability Mass Function.

A Cumulative Distribution Function of gas prices to its percentile.

Analytical distribution natural gas prices.

CORRELATION

Scatter plots compare the relationship between natural gas prices and total employment and mining employment.

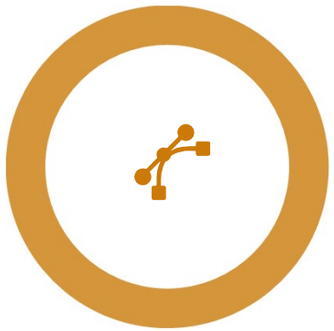
TEST and REGRESSION

Two regressions are attempted to expkain employment with respect to natural gas prices.

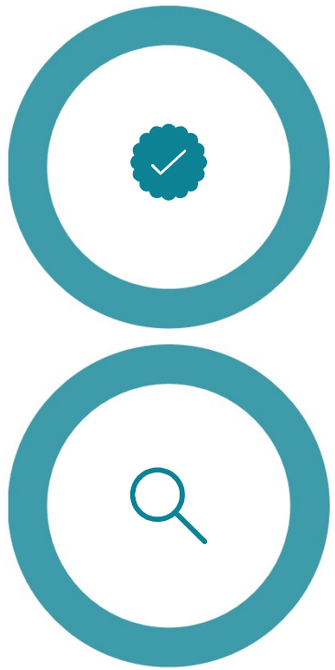
Pearson's correlation is also calculated.

Hypothesis

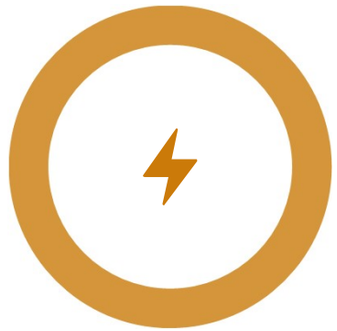
Fact 1) Coal mining jobs were slow to recover after the Great Recession.



Fact 2) Fracking drove natural gas prices lower during this same period.



Fact 3) Natural Gas and Coal are substitute products as they both are used in electricity generation.



Hypothesis) Lower natural gas prices decreased demand for coal and diminished mining employment.

Candidate Variables

GAS PRICES

2 VARIABLES

- Industrial Natural Gas Price reflects the wholesale price of Natural Gas. (It's called ng_price_ind in the dataset)
- Residential Natural Gas Price reflects the retail price of Natural Gas. (It's called ng_price_res in the dataset)

120 OBESERVATIONS

- Monthly data from January, 2009 to December, 2018.
- Monthly is the native frequency and no points are missing.

SOURCE

- U.S. Energy Information Administration (EIA)

EMPLOYMENT

VARIABLES

- Private reflects the employment at private firms.
- Nonfarm is considered total employment for this report.
- Goods reflects the employment in mining, manufacturing and construction.
- Service reflects the employment in the service industry.
- Mining and logging will act as a proxy for coal mining employment in this study.
- Leisure & Hospitality reflects includes the tourism industry.
- Manufacturing represents the creation of products.
- Government employment includes federal, state and local.
- Retail includes food, gas and consumer staples.
- Transportation and utility includes warehousing and passenger transportation.

120 OBESERVATIONS

- Monthly data from January, 2009 to December, 2018.
- Monthly is the native frequency and no points are missing.

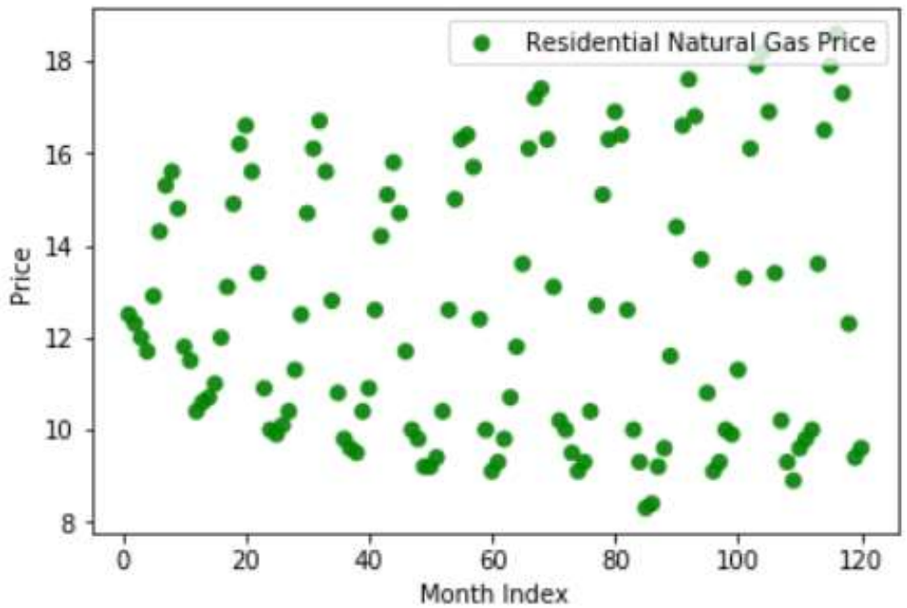
SOURCE

- Bureau of Labor Statistics

Which Natural Gas Price?

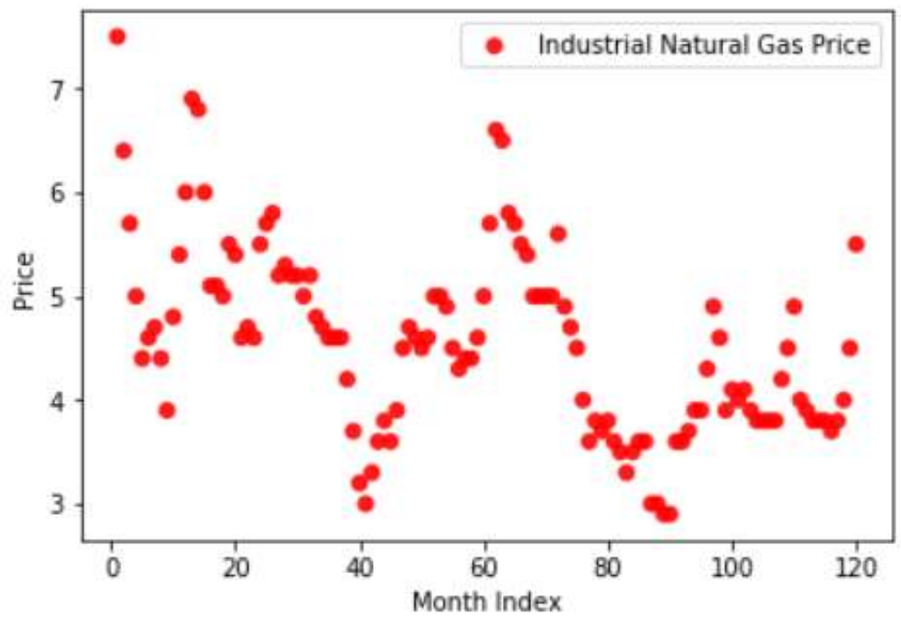
RESIDENTIAL

Rejected: Too much seasonality.



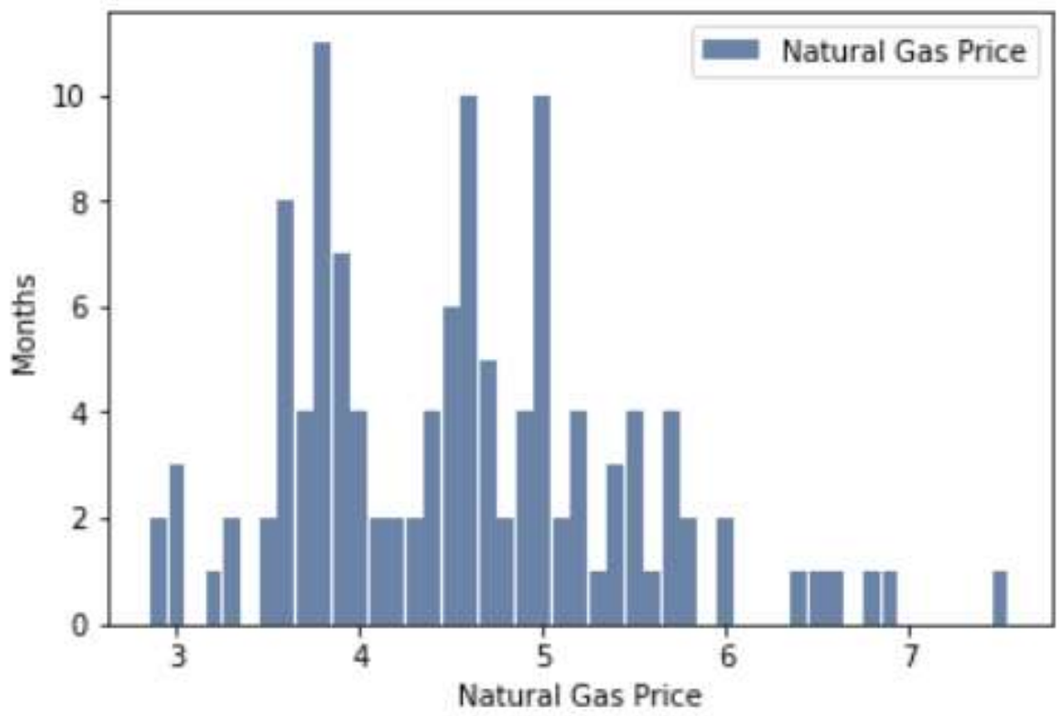
INDUSTRIAL

Utilized for project.



› Final scrubbed data available at: https://github.com/mattburns963/530

Natural Gas Price Histogram



Mean

4.55

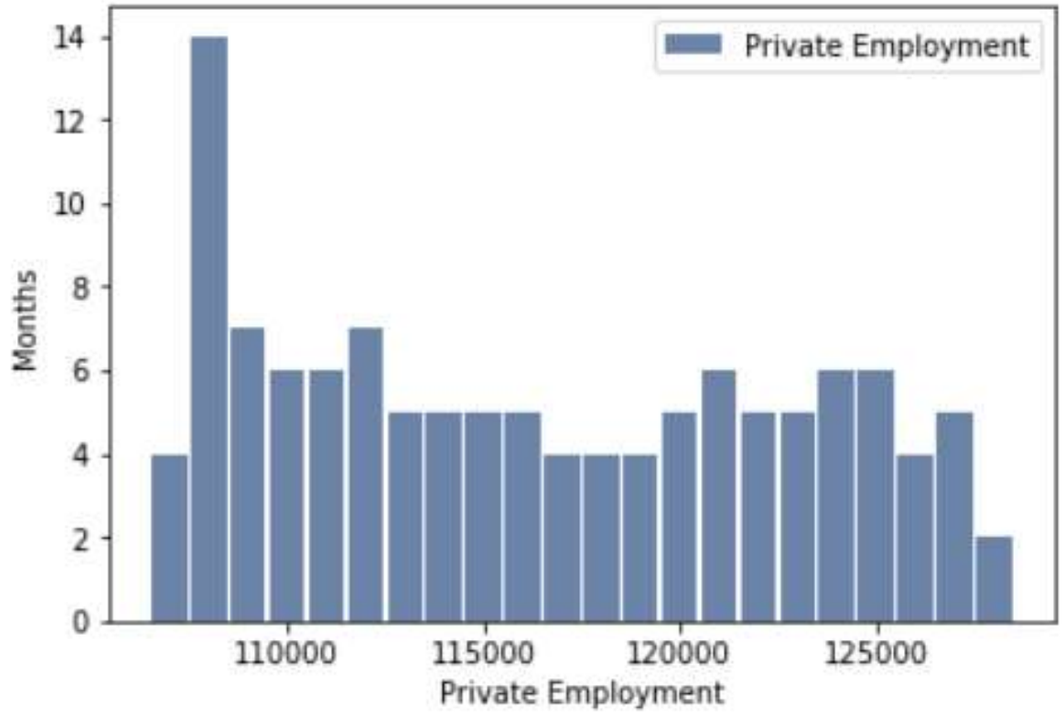
Mode

3.7

Standard Deviation

0.90

Private Employment Histogram



Mean

116,309

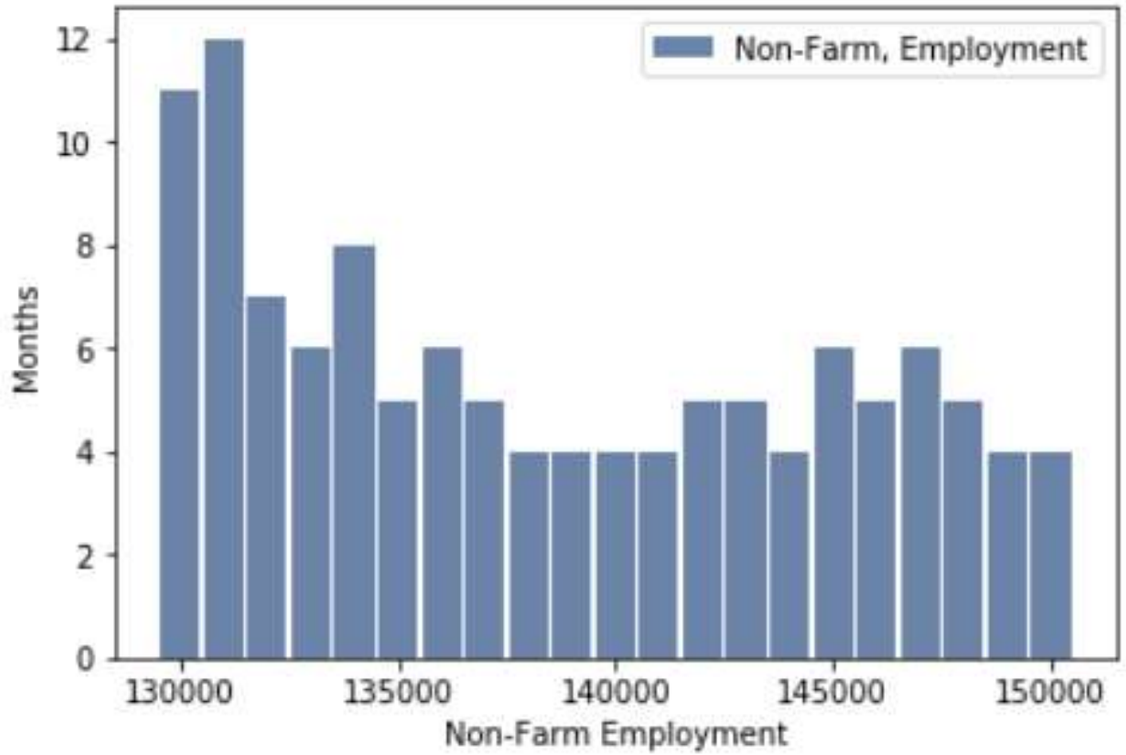
Mode

108,000

Standard Deviation

6,440

Non-Farm Employment Histogram



Mean

138,439

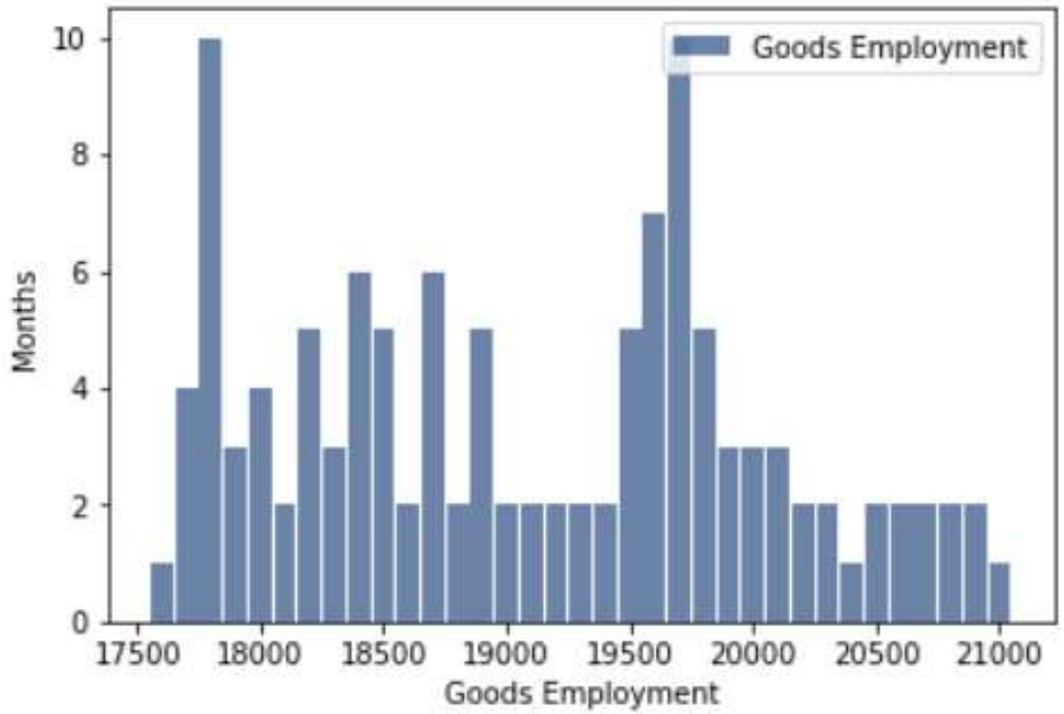
Mode

131,000

Standard Deviation

6,454

Goods Employment Histogram



Mean

19,088

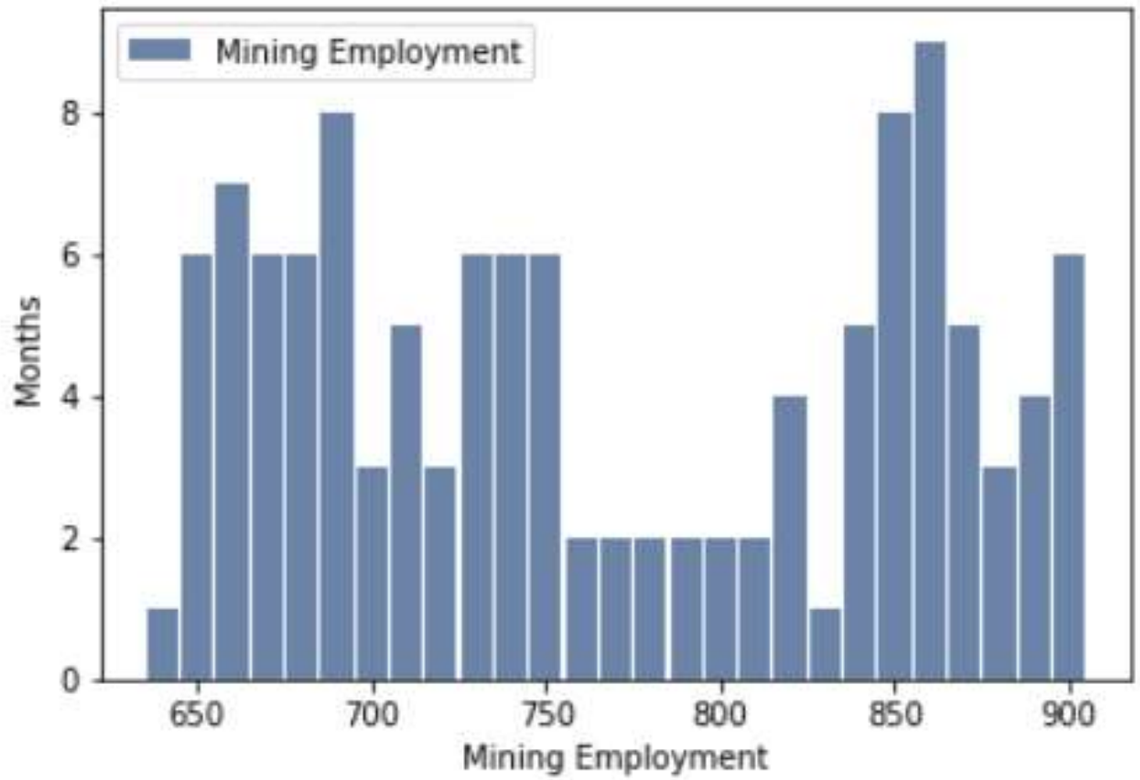
Mode

17,800

Standard Deviation

932

Mining Employment Histogram



Mean

767

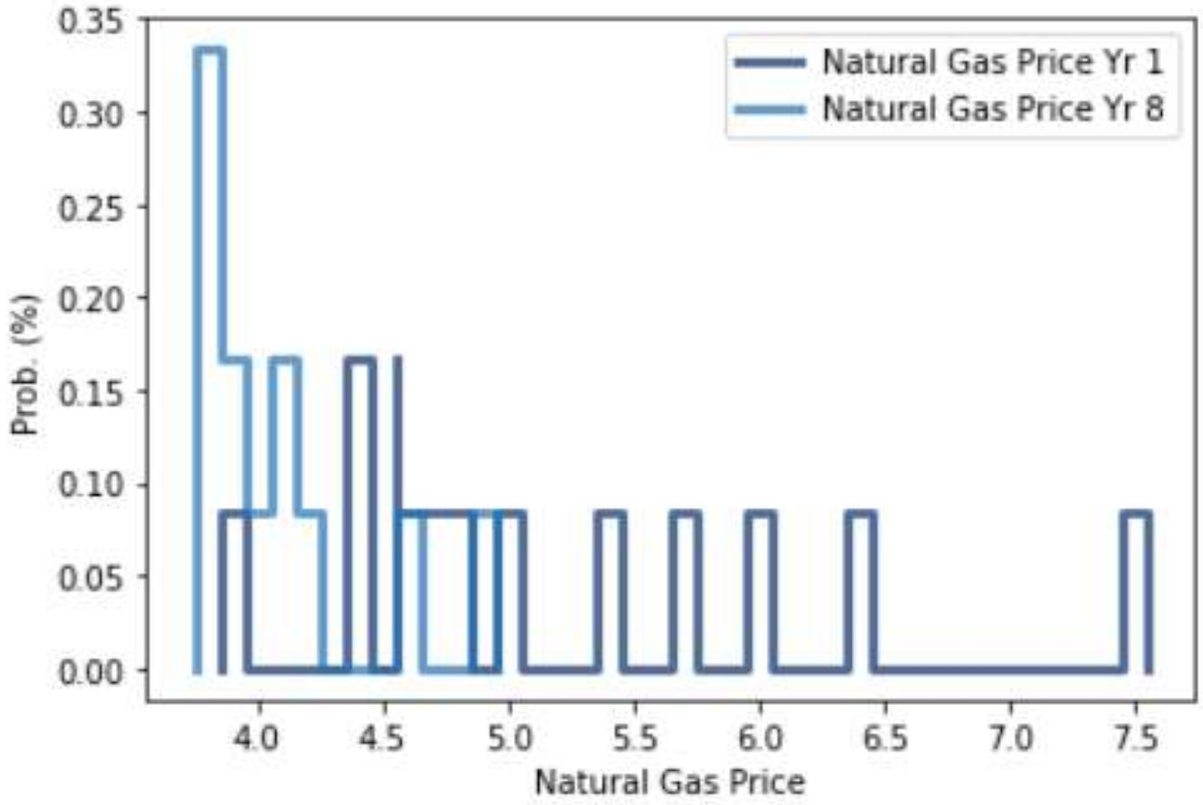
Mode

860

Standard Deviation

82

Natural Gas Price Probability Mass Function

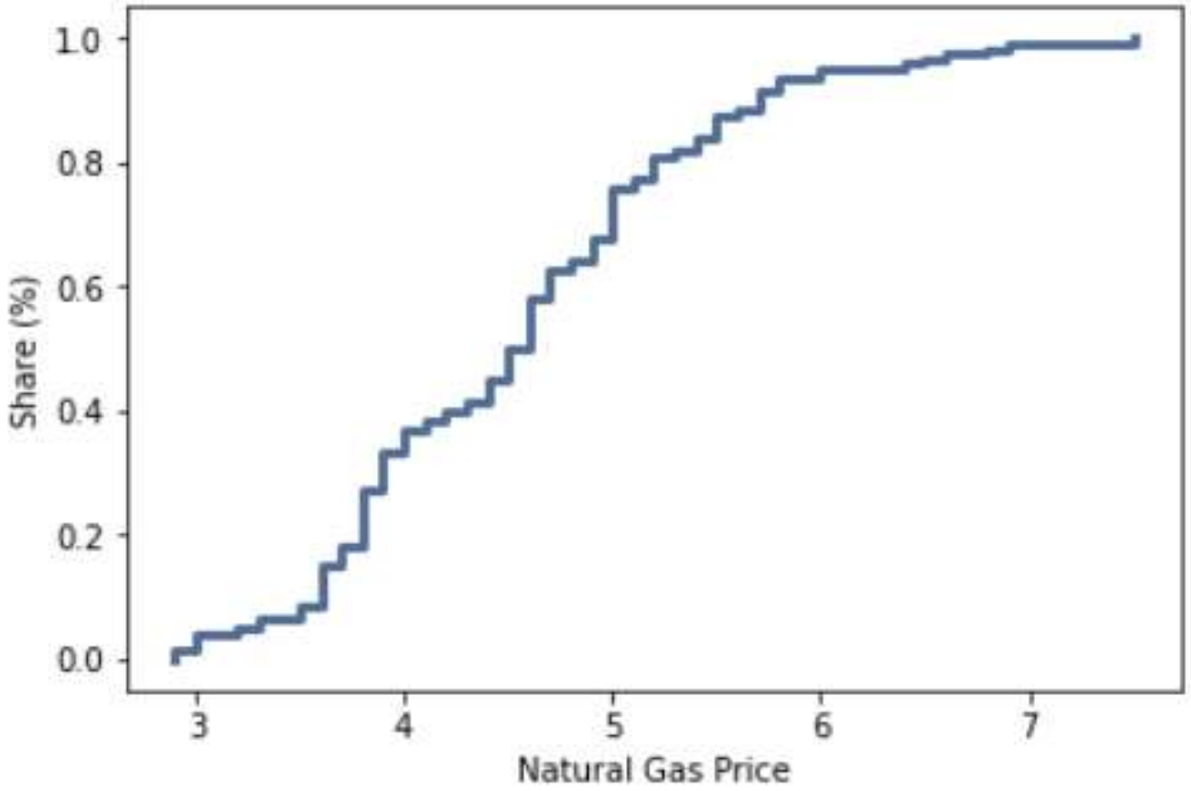


This illustration compares 2009 to 2017.

We can see that Natural Gas is cheaper in 2017, but I don't like PMFs for monthly data.

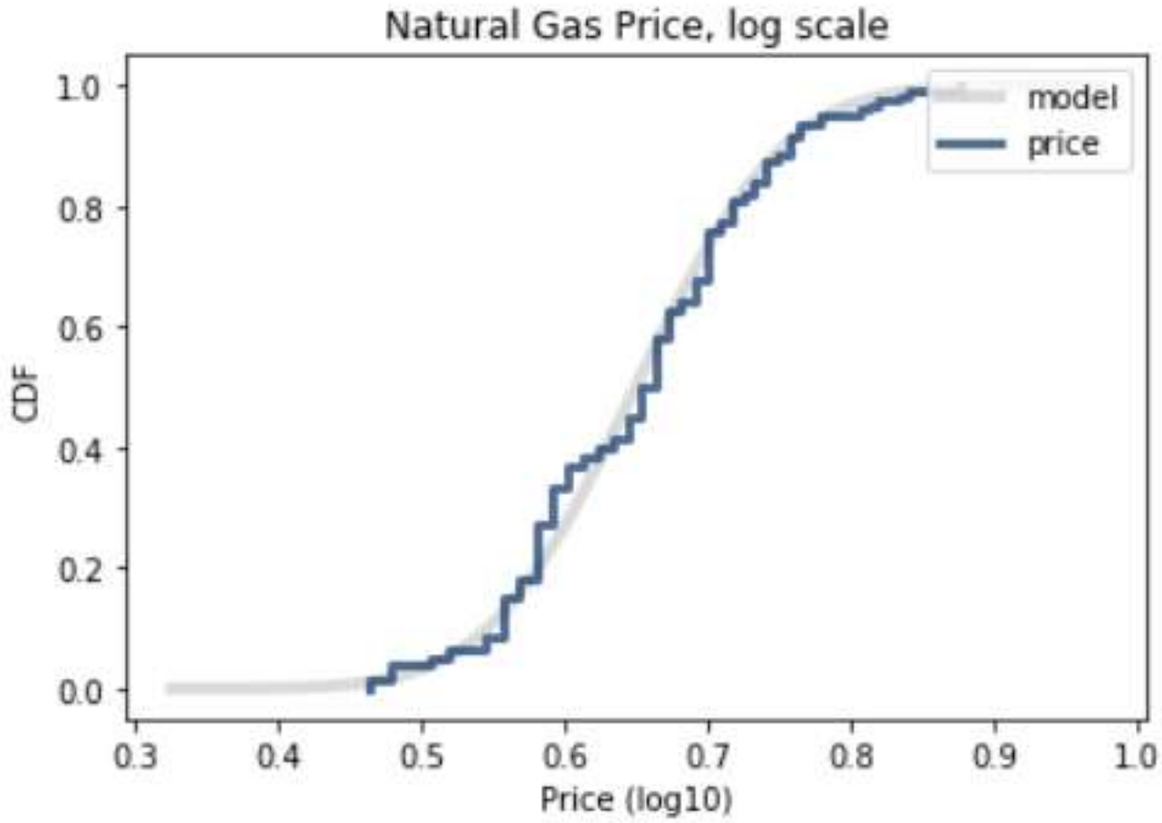
A good old fashioned line graph would be more informative.

Natural Gas Price
Cumulative Distribution Function



This graph illustrates that very few months have a gas price over 6 or less than 3.5. It is illustrating the tails.

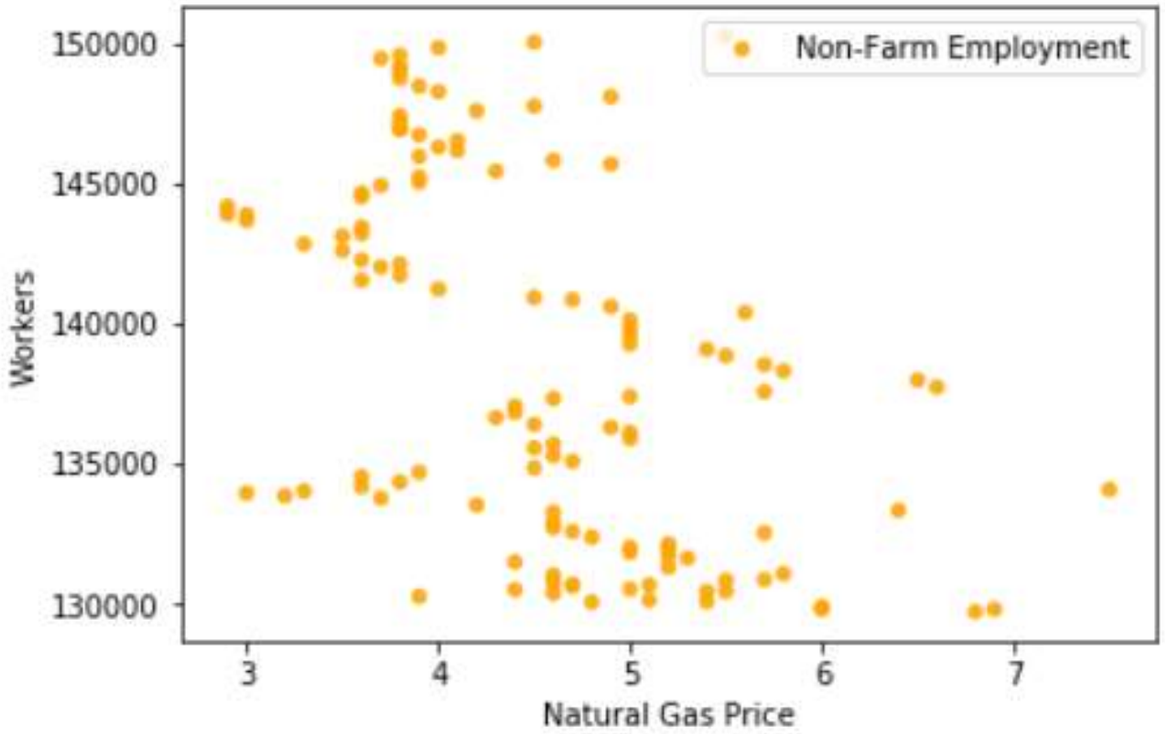
Natural Gas Price Lognormal Distribution

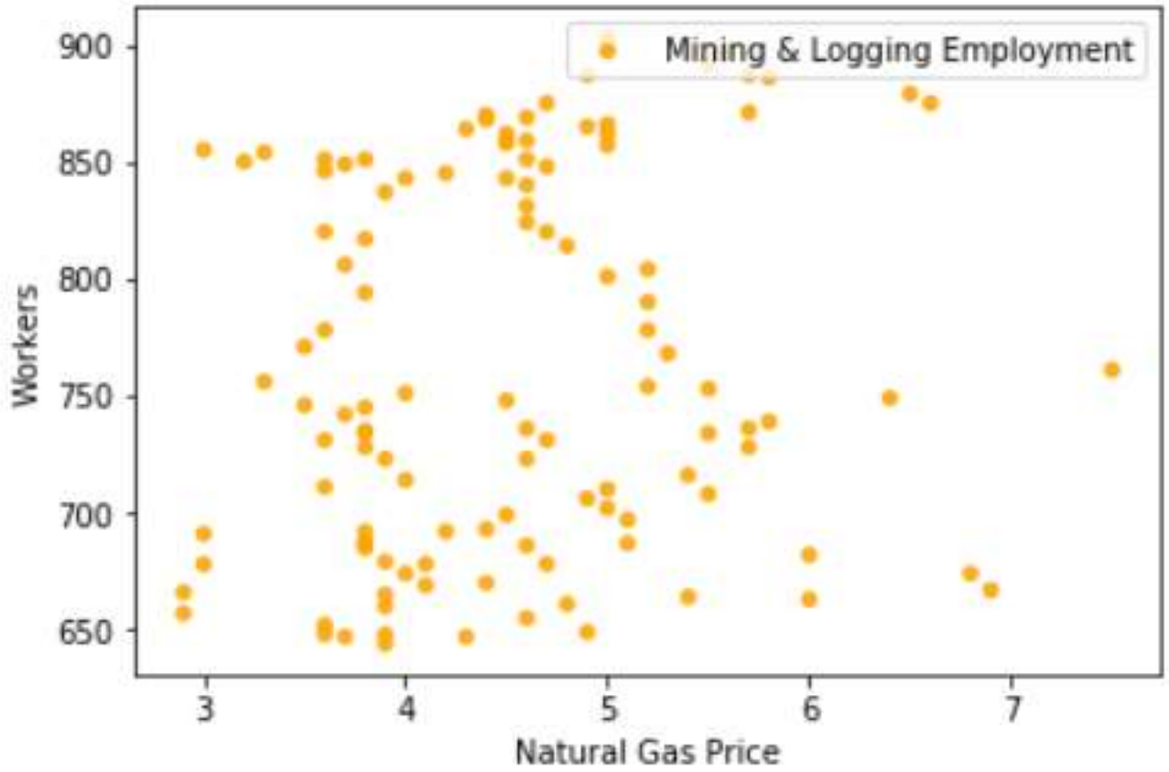


The lognormal Distribution fits nicely with the actual data.

That means that the logs of the natural gas prices have a normal distribution.

Scatter Plots





These graphs illustrate the relationship between two types of employment and Natural Gas Prices.

- Left is total employment vs. Natural Gas Prices.
- Right is sector employment vs. Natural Gas prices.

There's nothing going on here regarding correlation!

Regressions

GAS PRICE vs MINING EMPLOYMENT

OLS Regression Results

Dep. Variable:	mine_log	**R-squared:**	0.027
Model:	OLS	**Adj. R-squared:**	0.019
Method:	Least Squares	**F-statistic:**	3.273
Date:	Thu, 30 May 2019	**Prob (F-statistic):**	0.0730
Time:	22:32:58	**Log-Likelihood:**	-698.07
No. Observations:	120	**AIC:**	1400.
Df Residuals:	118	**BIC:**	1406.
Df Model:	1		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
Intercept	699.0139	38.615	18.102	0.000	622.546	775.481
ngp	15.0629	8.326	1.809	0.073	-1.424	31.550

GAS PRICE vs MINING EMPLOYMENT (CONTROLLING FOR TOTAL EMPLOYMENT)

OLS Regression Results

Dep. Variable:	mine_log	**R-squared:**	0.048
Model:	OLS	**Adj. R-squared:**	0.031
Method:	Least Squares	**F-statistic:**	2.932
Date:	Thu, 30 May 2019	**Prob (F-statistic):**	0.0572
Time:	22:32:58	**Log-Likelihood:**	-696.78
No. Observations:	120	**AIC:**	1400.
Df Residuals:	117	**BIC:**	1408.
Df Model:	2		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
Intercept	1027.2700	209.197	4.911	0.000	612.967	1441.573
ngp	7.5656	9.512	0.795	0.428	-11.273	26.404
nonfarm_emp	-0.0021	0.001	-1.596	0.113	-0.005	0.001

These regressions failed to explain mining employment as a result of Natural Gas Prices.
Also, Pearson's correlation to test had a p-value > 5%.

24Slides

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