

Predicting Economic Freedom

using electricity generation & water sanitation

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10 April 2024

Me and My Hypothesis

Software developer

Big Data™ and web stuff

Can we predict **changes in economic freedom** for a country based on trends in **sanitation and electricity** generation?

Why ask this question

Allocate international aid

Identify political trends

...

Complete a required MS course

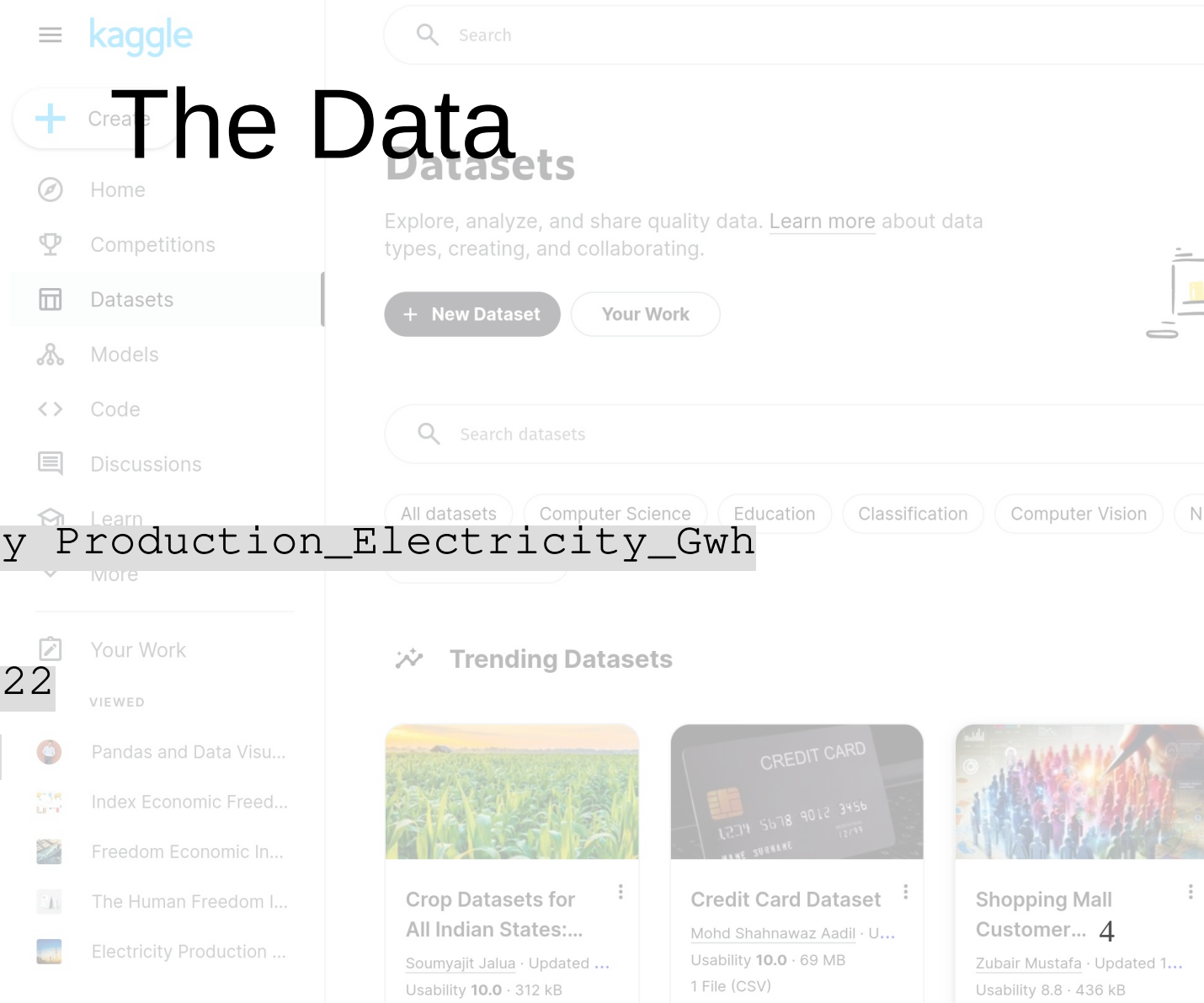
Kaggle

WS_PPL_W-SM

Net Electricity Production_Electricity_Gwh

Change from 2022

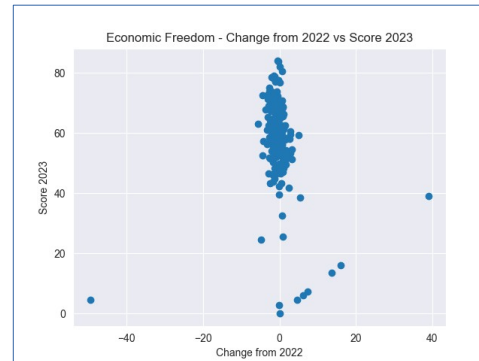
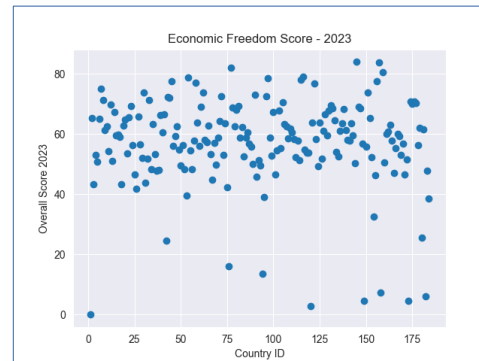
Govt Integrity



EDA

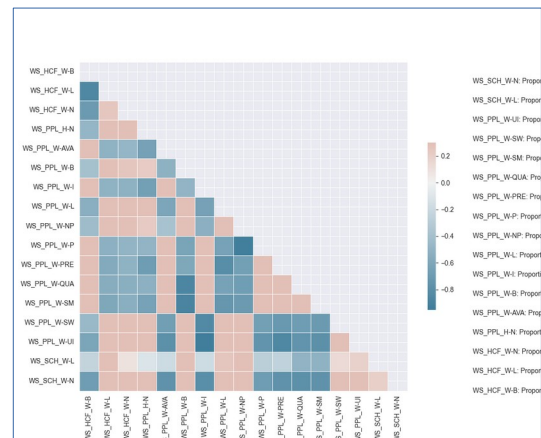
Decent variance in target

No real correlation between change and score

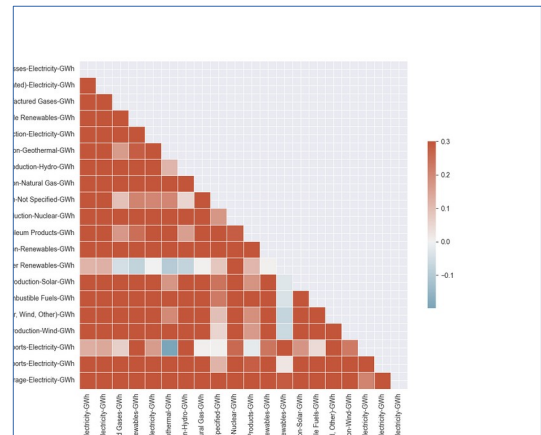


EDA

Some variables with water data were highly correlated



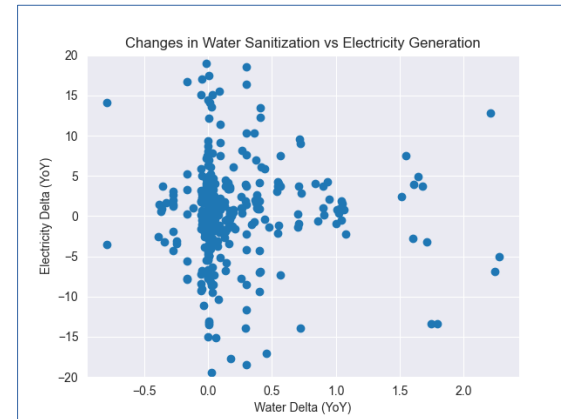
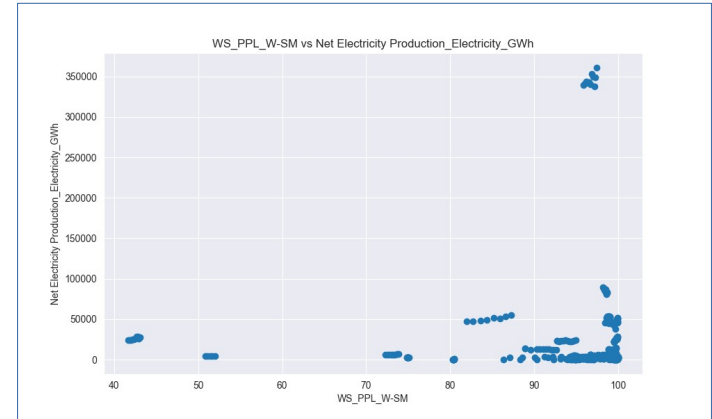
Less so with electricity generation



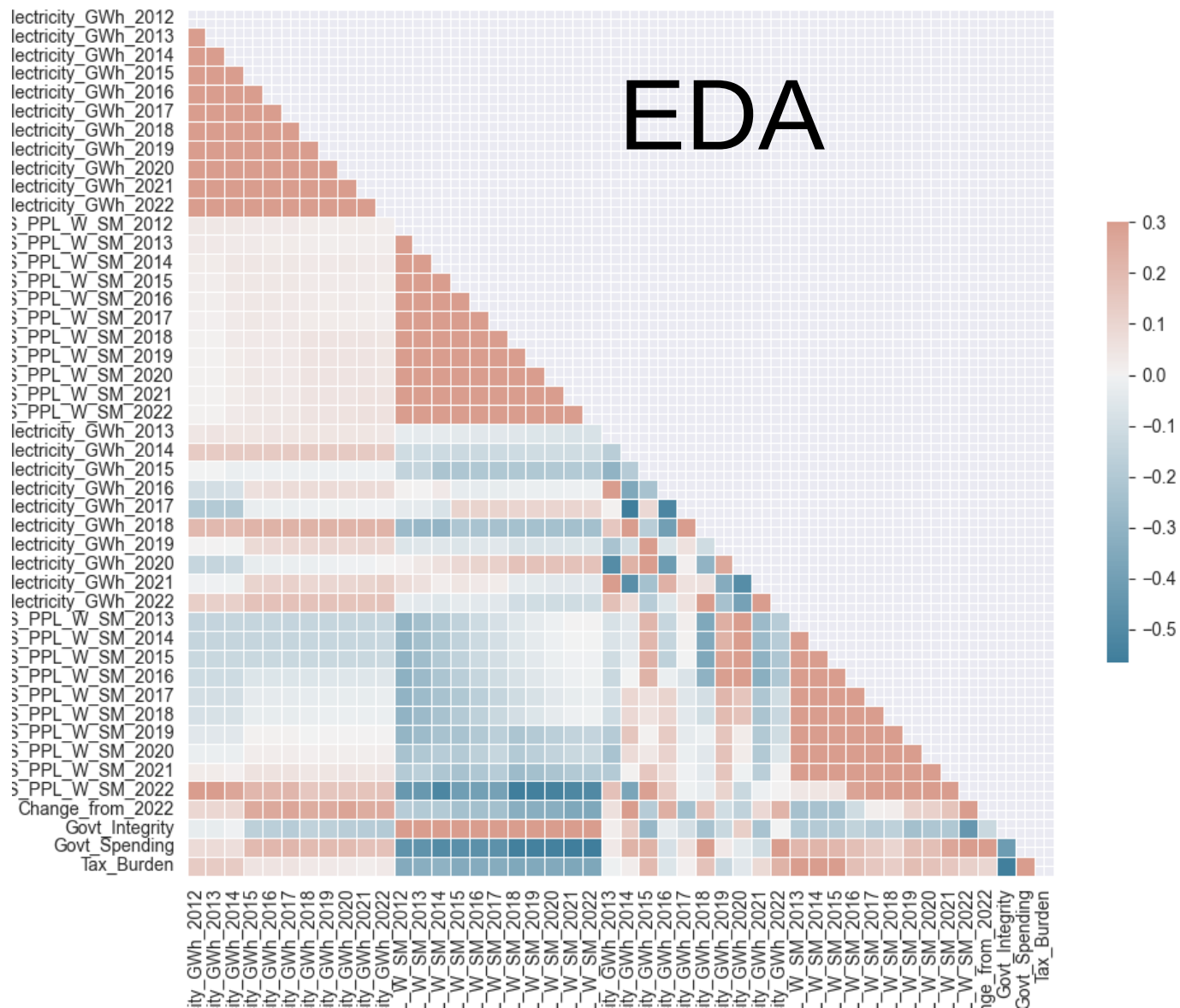
EDA

Raw scores are clustered
by country

Take YoY percent change



EDA



Models

Linear regression

Change from 2022

Government Integrity

Decision Tree Classifier

Is a country “economically free”?

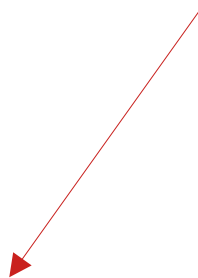
Models

Linear regression

Change from 2022

Government Integrity

Because regression
wasn't going so hot...



Decision Tree Classifier

Is a country “economically free”?

Models

Linear regression

Continuous prediction of a numerical variable

Directly uses available numerical data

Easy to understand

Models

Decision Tree Classifier

- Fast to train and use

- Conceptually simple

- Explainable with images

- Isn't another regression

Results

```

=====
                        OLS Regression Results
=====
Dep. Variable:      Change_from_2022      R-squared:      0.230
Model:              OLS                    Adj. R-squared:  0.134
Method:             Least Squares         F-statistic:    2.395
Date:               Wed, 10 Apr 2024       Prob (F-statistic): 0.0709
Time:               12:29:46              Log-Likelihood: -54.162
No. Observations:   37                   AIC:            118.3
Df Residuals:       32                   BIC:            126.4
Df Model:           4
Covariance Type:    nonrobust
=====

                                coef      std err          t      P>|t|      [0.025      0.975]
-----
Intercept                -1.8572         0.203       -9.145     0.000       -2.271      -1.443
delta_WS_PPL_W_SM_2021:elec_delta_10_yr    -72.8977        32.982       -2.210     0.034      -140.080      -5.715
delta_WS_PPL_W_SM_2021                73.2564        32.675        2.242     0.032         6.700      139.813
delta_WS_PPL_W_SM_2021:water_delta_10_yr:elec_delta_10_yr  2703.1654       954.508        2.832     0.008        758.895      4647.435
delta_WS_PPL_W_SM_2021:water_delta_10_yr   -2648.9719       933.953       -2.836     0.008     -4551.372     -746.571
=====

Omnibus:                0.382    Durbin-Watson:        2.213
Prob(Omnibus):           0.826    Jarque-Bera (JB):        0.442
Skew:                    -0.219    Prob(JB):                0.802
Kurtosis:                2.691    Cond. No.                7.30e+03
=====
```

Results

```

=====
                        OLS Regression Results
=====
Dep. Variable:          Govt_Integrity    R-squared:                0.450
Model:                  OLS              Adj. R-squared:           0.418
Method:                 Least Squares    F-statistic:             14.30
Date:                   Wed, 10 Apr 2024  Prob (F-statistic):      2.89e-05
Time:                   12:29:46         Log-Likelihood:          -155.88
No. Observations:       38              AIC:                    317.8
Df Residuals:           35              BIC:                    322.7
Df Model:                2
Covariance Type:        nonrobust
=====

```

	coef	std err	t	P> t	[0.025	0.975]
Intercept	58.6195	17.737	3.305	0.002	22.612	94.627
elec_delta_10_yr	-86.3707	25.246	-3.421	0.002	-137.623	-35.119
WS_PPL_W_SM_2021:elec_delta_10_yr	1.0592	0.198	5.345	0.000	0.657	1.462

```

=====
Omnibus:                1.564    Durbin-Watson:           1.850
Prob(Omnibus):           0.457    Jarque-Bera (JB):        1.415
Skew:                    -0.342    Prob(JB):                0.493
Kurtosis:                2.348    Cond. No.                1.02e+03
=====

```

Results

Is this country economically free?

`delta_WS_PPL_W_SM_2022`

Change in sanitation from 2021-2022

`water_delta_10_yr`

Change in sanitation from 2012-2022

`elec_delta_5_yr`

Change in electricity generation from 2017-2022

```
=====
| Decision Tree Results |
=====

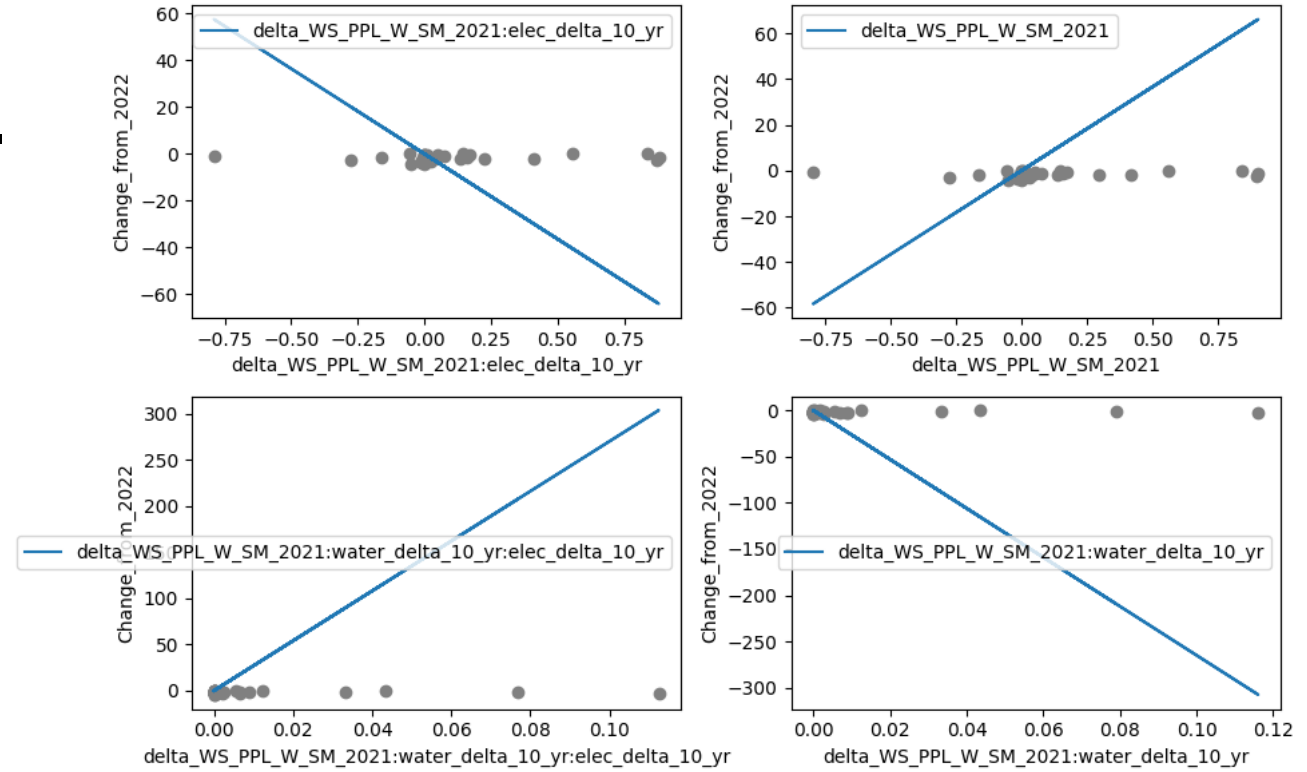
Accuracy : 0.889
Precision: 1.000
Recall    : 0.857
F1 Score  : 0.923
AUC       : 0.929
Confusion Matrix:
[[2 0]
 [1 6]]
```

It Worked!!

Right?

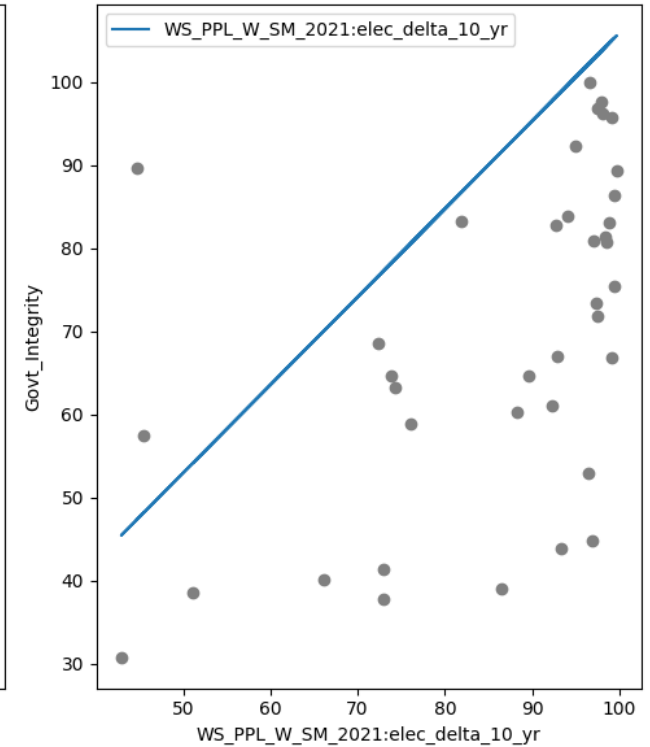
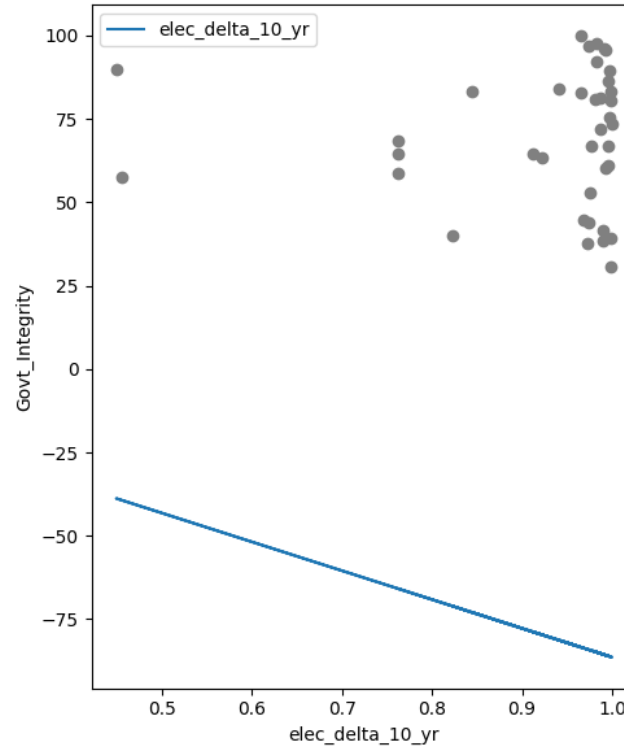
~~It Worked!!~~

Not really...



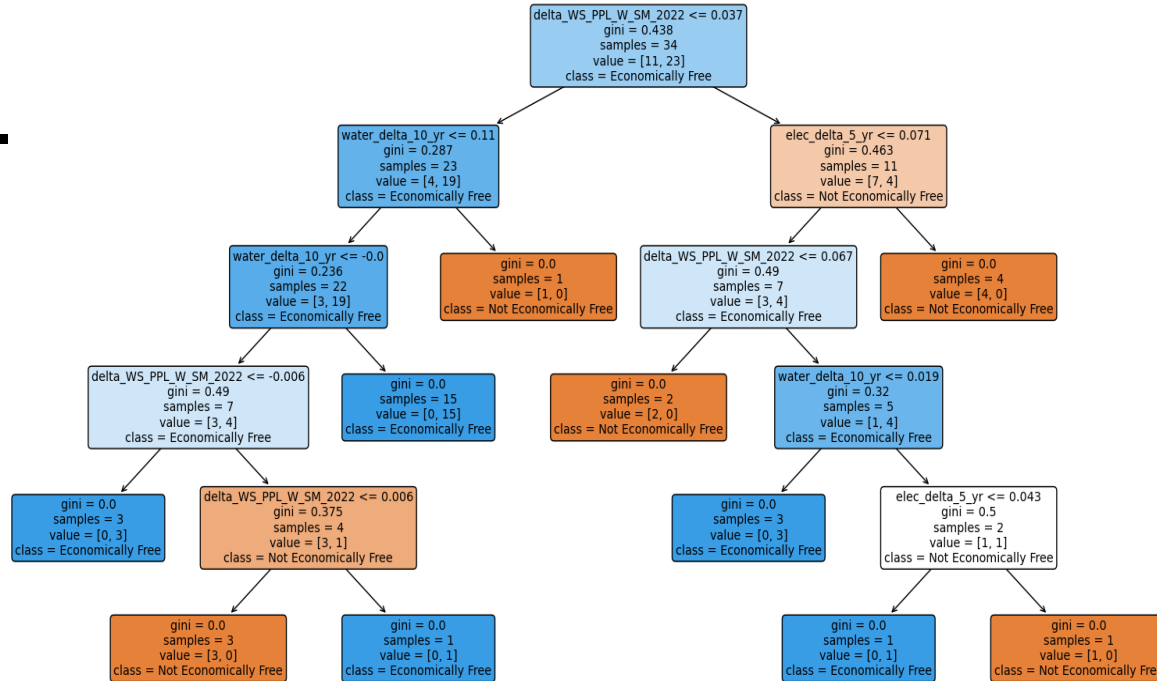
~~It Worked!!~~

Not really...



~~It Worked!!~~

Not really...



Future Work?

Need more data – previous econ scores

Use information on regions

Fin