What Predicts Economic Collapse Across Nations?

And how cool is that time series heat map 😎

Our research questio

Can Macroeconomics Predict Economic Collapse?

Our Hypothesis: Of course it will!

Meet the Data

gdp_growth
The growth of GDP of each country

gov_debt
Government debt as a percentage of GDP

inflation_rates
Annual rate of inflation as a percentage

interest_rates
Average national interest rates for that year

black_market
Percent of economy that is unmonitored by the government

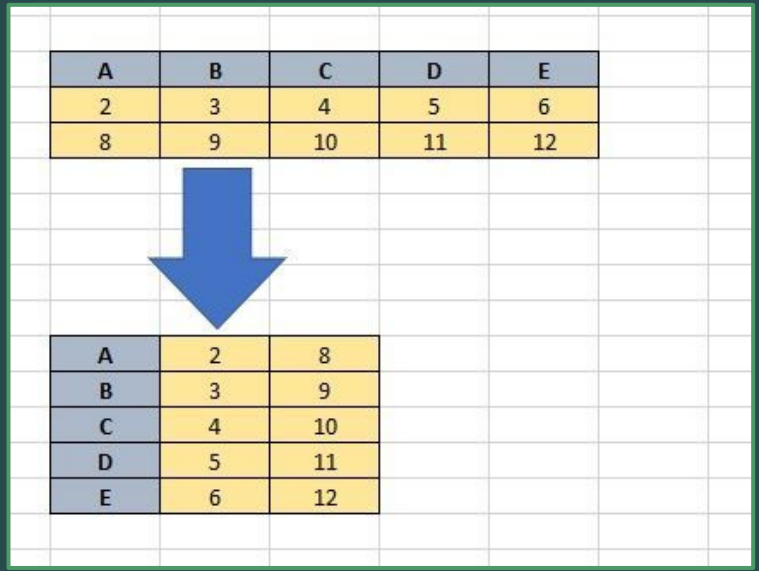
CPI
CPI for that country for that year

Wrangling the Chaos

To organize the mess, three main scripts were used:

- To organize the data
- To locate and redefine country names
- To combine them into one Dataframe

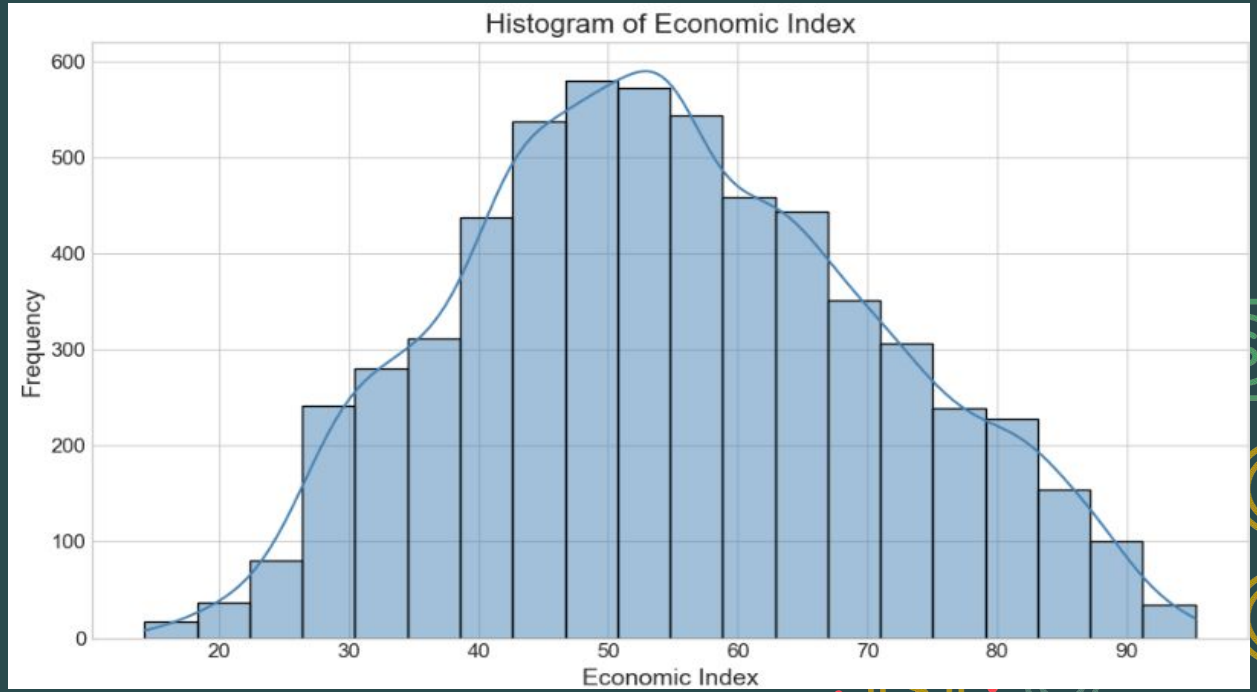
And then to handle missing values we simply removed rows that had more than 2 missing values.



A	B	C	D	E
2	3	4	5	6
8	9	10	11	12

A	2	8
B	3	9
C	4	10
D	5	11
E	6	12

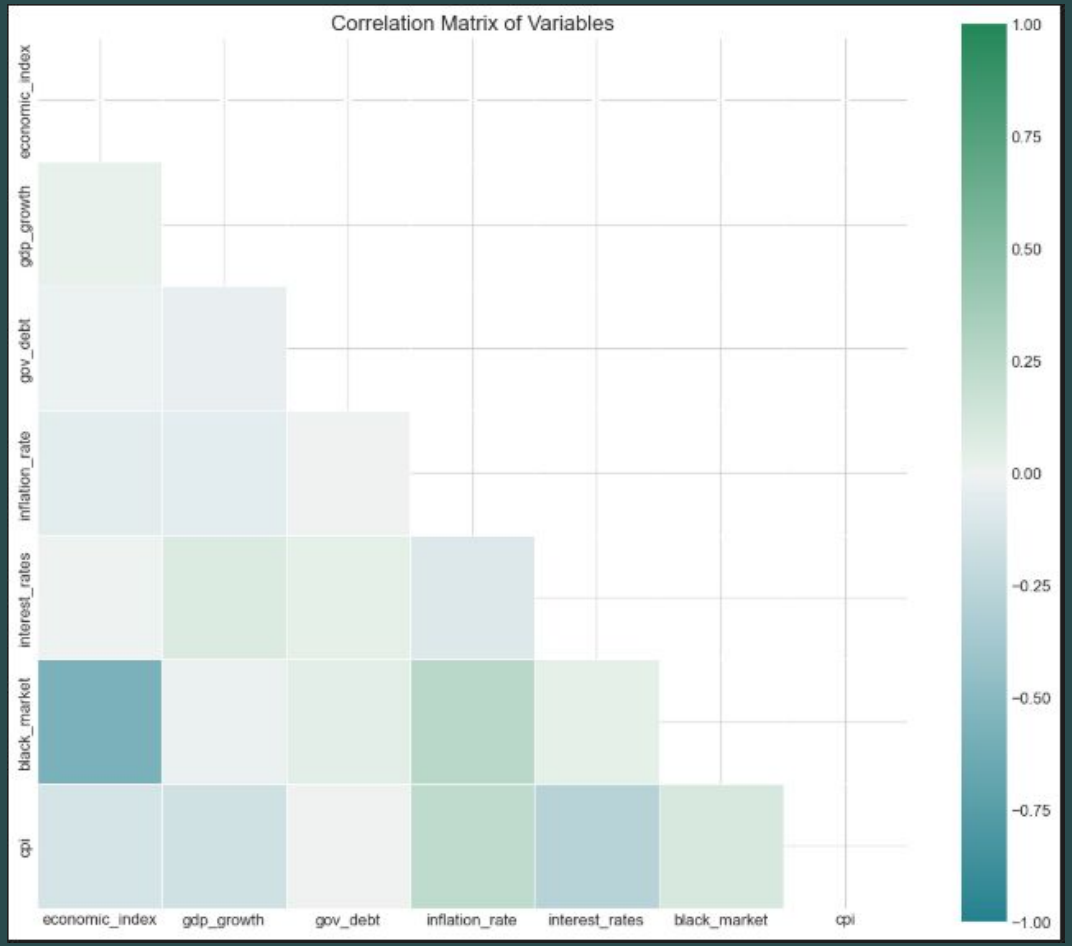
Economic Distribution Around the World



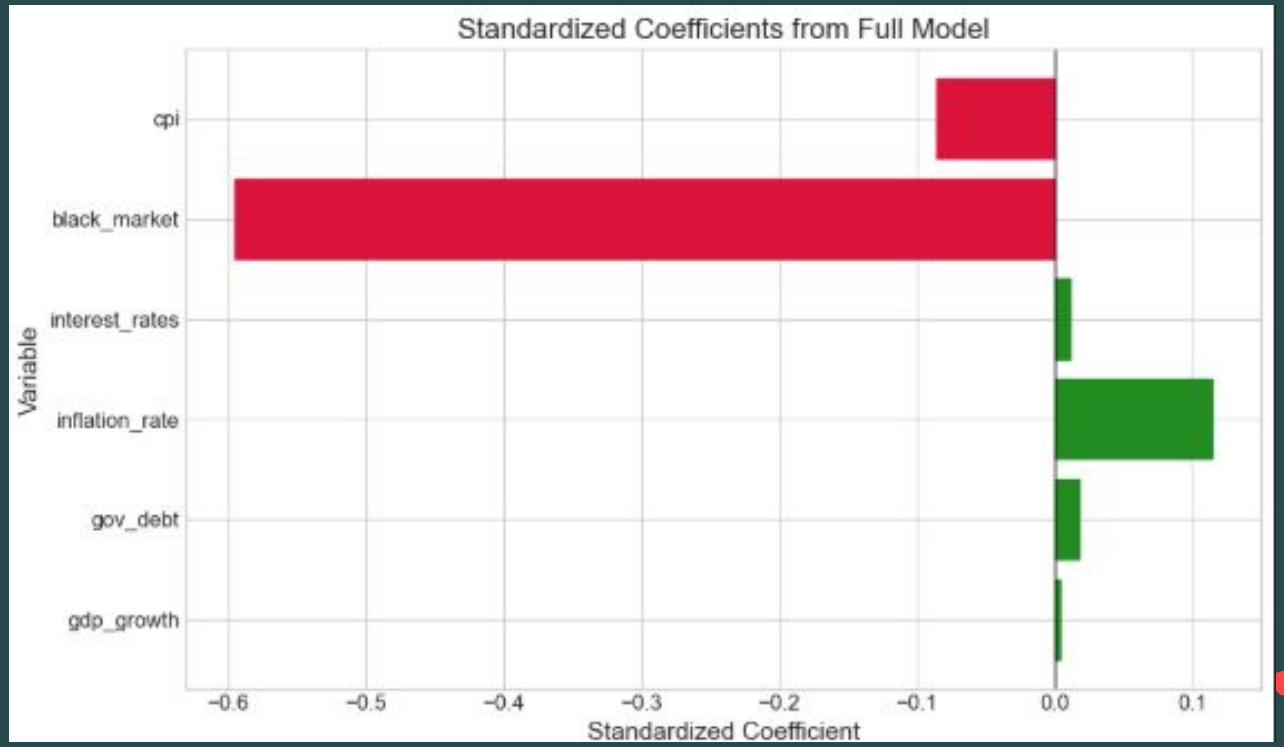
"The outliers are what we're looking for — collapse and success often live at the edges."

What Connects to What?

Black market activity stands out — it's the only strong, consistent signal.

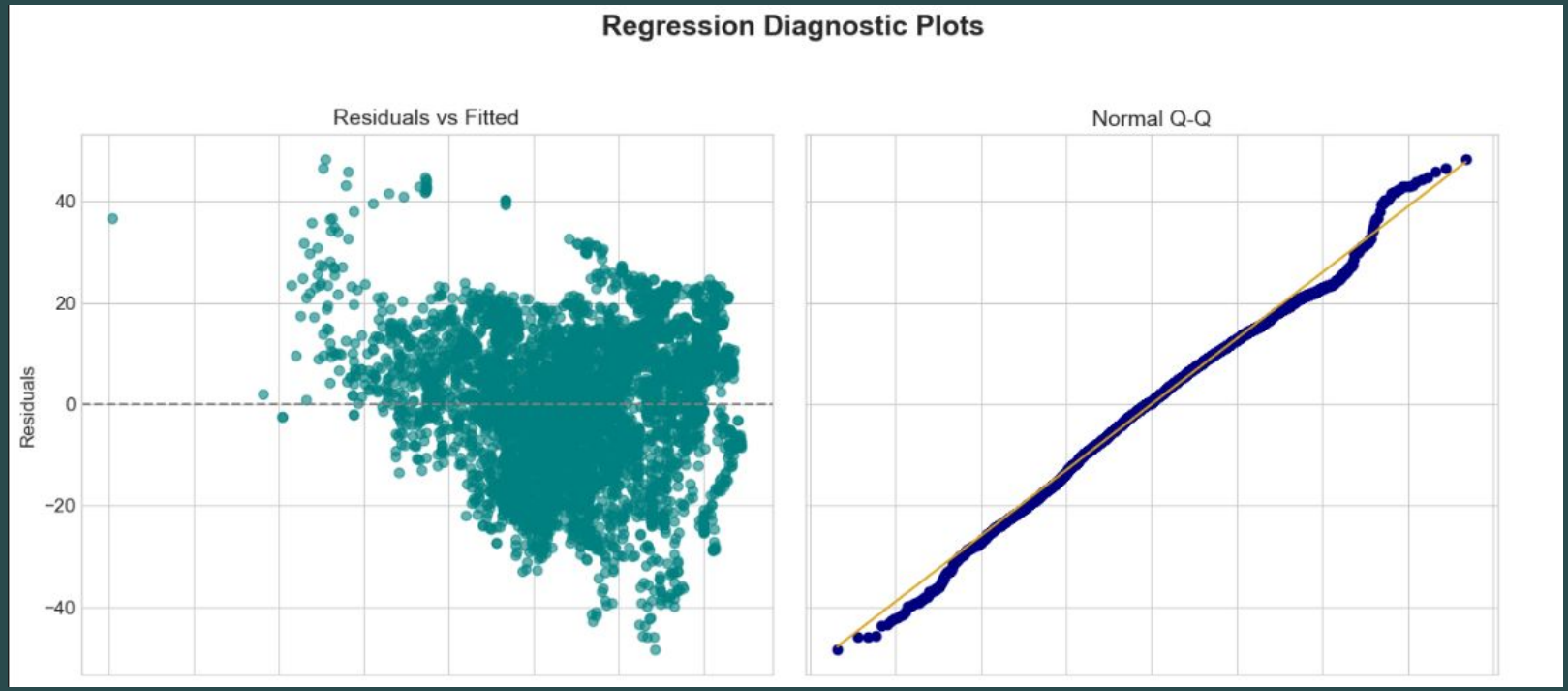


Modeling Economic Strength



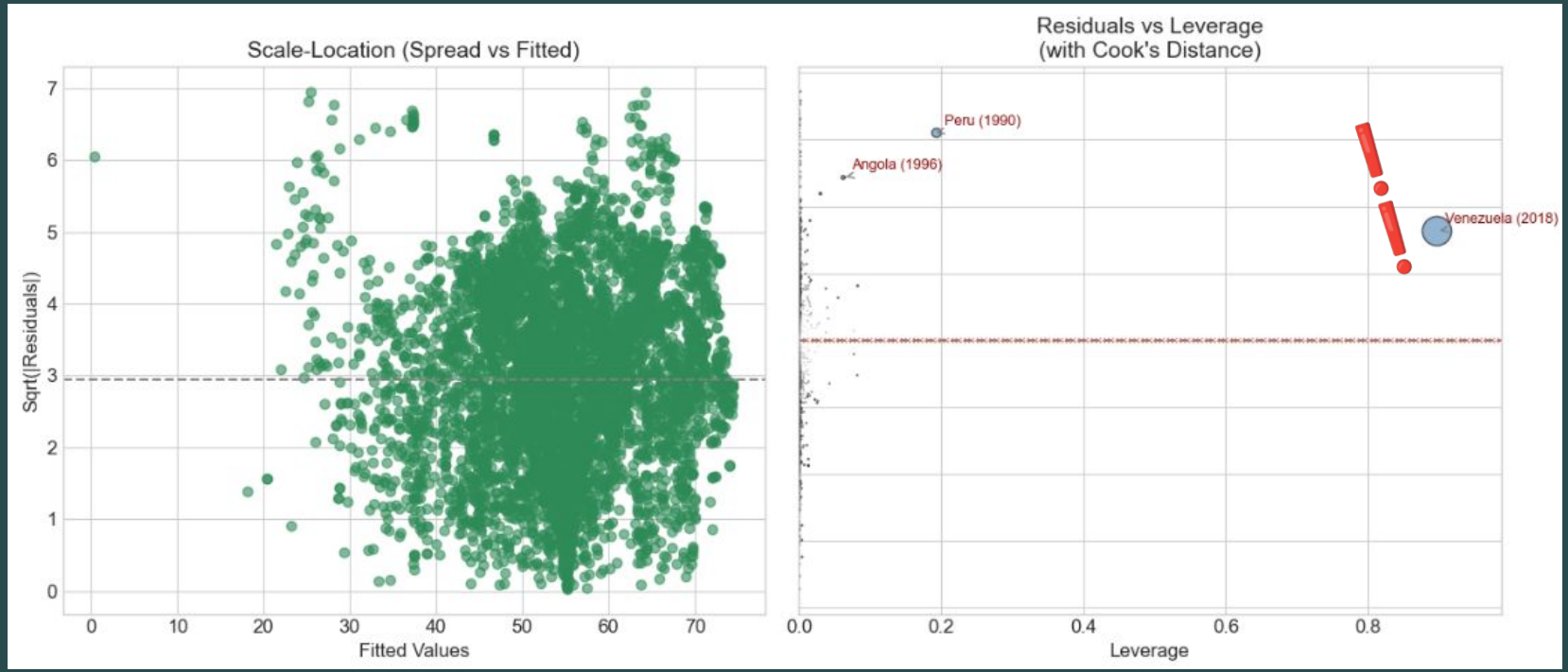
Even when standardized, shadow markets are clearly the most crucial predictor.

Residuals, Assumptions & Reality



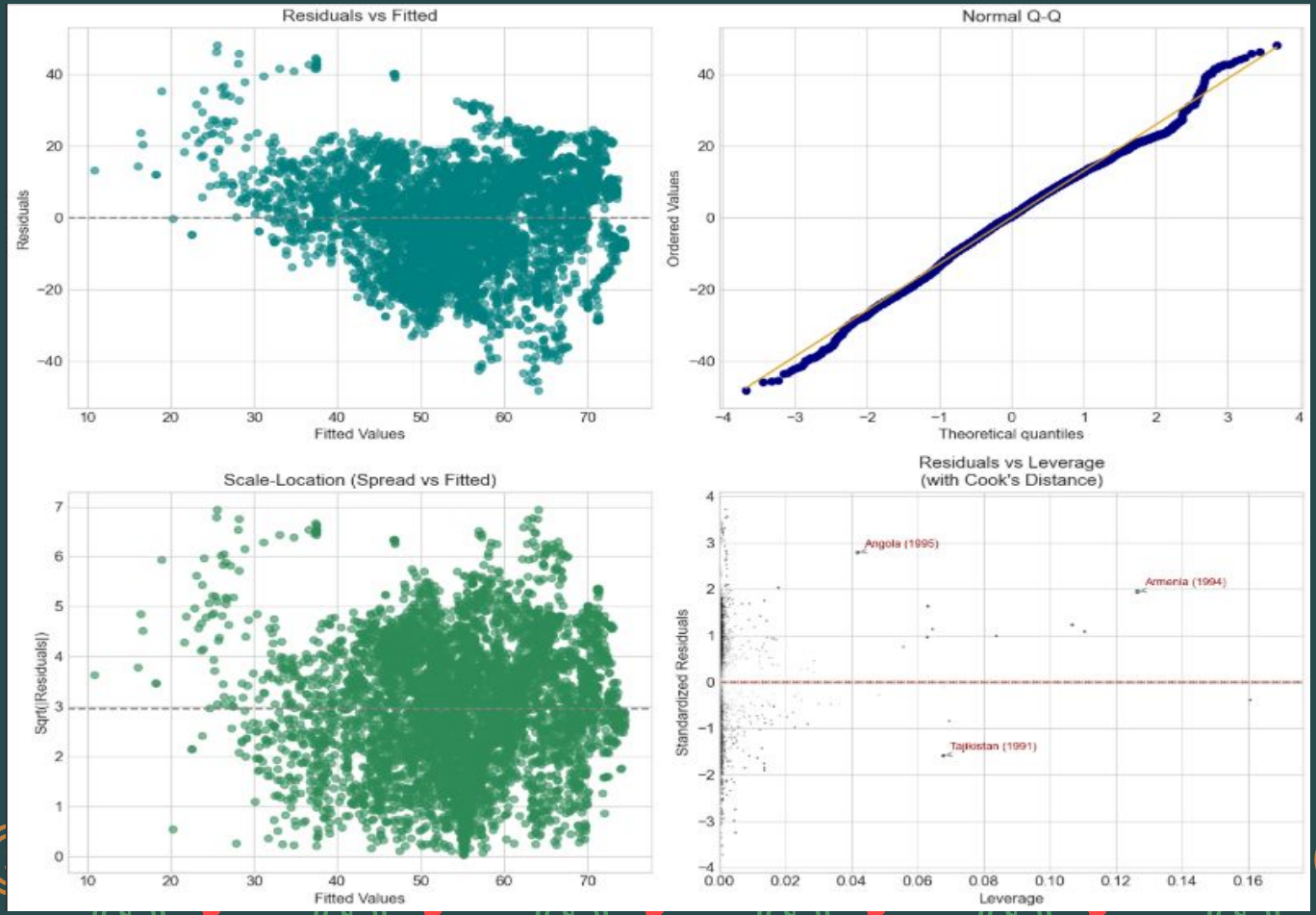
Residuals look mostly normal, but there are hints of tail risk and non-linearity.

Residuals, Assumptions & Reality (pt. 2)



Some countries are extreme, but crucial. Heteroscedasticity is present, but manageable.

Out With The **Out**liers



Is Less More?

```
Full Model R²: 0.3452
Reduced Model R²: 0.3450

F-test comparing models:
F-statistic: 0.5891
p-value: 0.5549
```

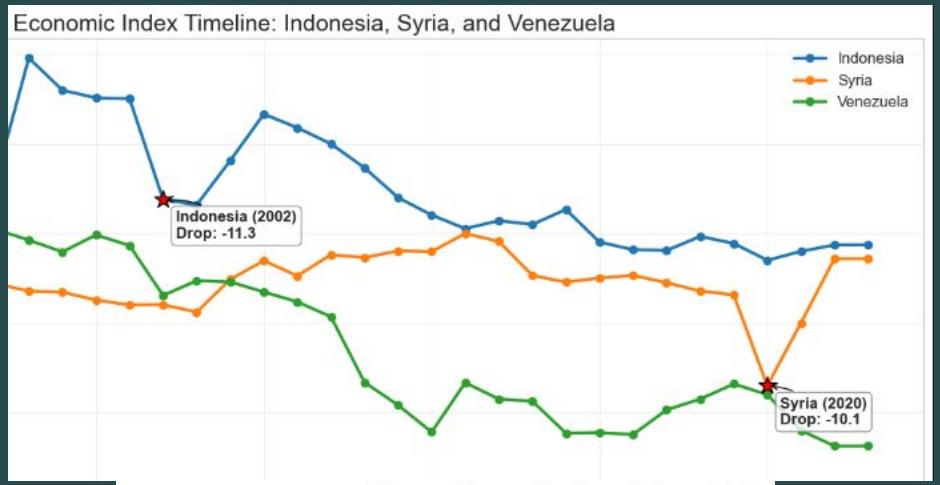
```
Full Model:
black_market: -0.5946
inflation_rate: 0.1163
cpi: -0.0853
gov_debt: 0.0178
interest_rates: 0.0110
gdp_growth: 0.0040
```

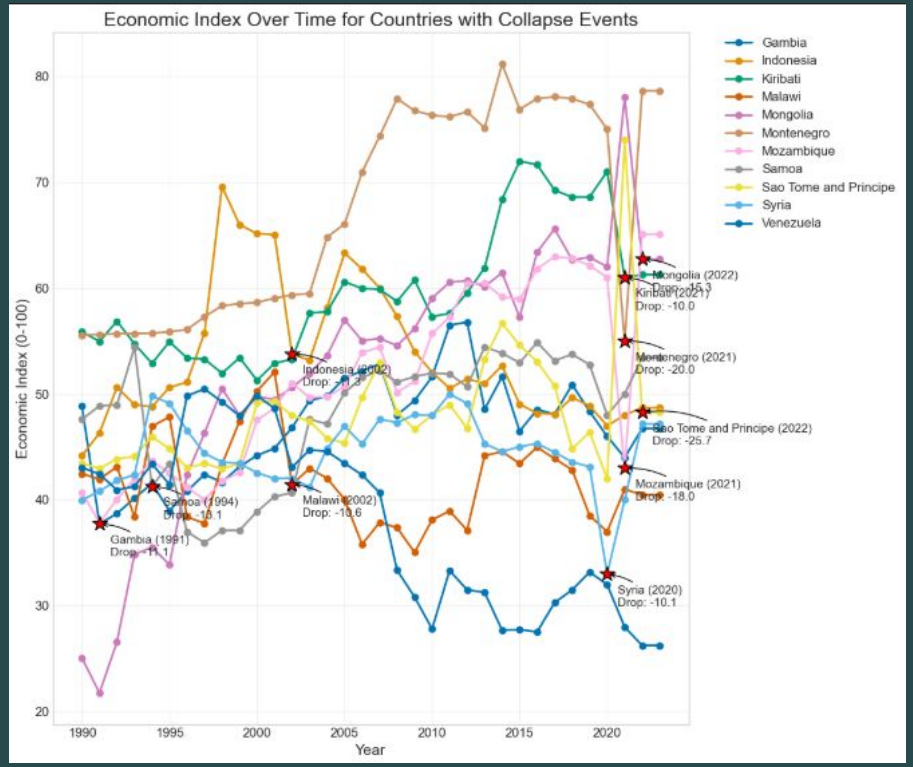
Simpler Model = Same Power.

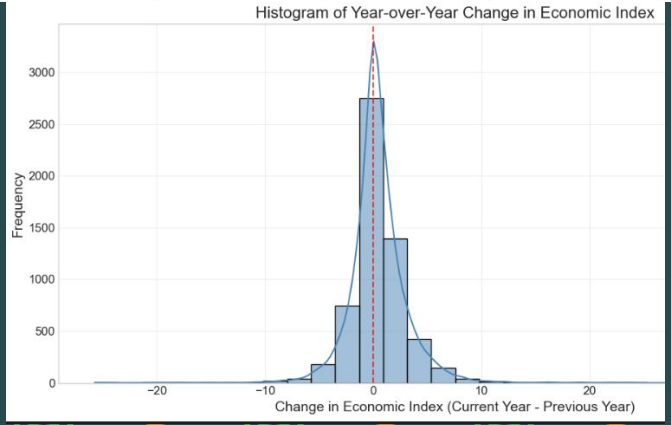
```
Key Findings After Removing Outliers:
Full Model R²: 0.3477
Reduced Model R²: 0.3473
F-test comparing models: (1.204041660495598, 0.306607326742445, 3.0)
```

```
Standardized Coefficients (Full Model):
gdp_growth: -0.0021
gov_debt: 0.0176
inflation_rate: -0.0270
interest_rates: 0.0088
black_market: -0.5760
cpi: -0.0574
```

Economic Collapse Is Rare — *but* **Real**







Why Can’t We Predict Change?

```
===== MODEL FOR PREDICTING CHANGE IN ECONOMIC INDEX =====
                            OLS Regression Results
==============================================================================
Dep. Variable:            delta_index   R-squared:                       0.004
Model:                            OLS   Adj. R-squared:                  0.003
Method:                 Least Squares   F-statistic:                     3.806
Date:                Tue, 29 Apr 2025   Prob (F-statistic):           0.000866
Time:                        15:54:25   Log-Likelihood:                -13821.
No. Observations:                5775   AIC:                         2.766e+04
Df Residuals:                    5768   BIC:                         2.770e+04
Df Model:                           6
Covariance Type:            nonrobust
```

- $ Macroeconomic models are statistically significant — but explain very little.
- $ Higher interest rates are linked to lower collapse risk (p = 0.002).
- $ Volatility is weakly predicted by inflation, but most variation remains unexplained.

```
Volatility Model Results:
                            OLS Regression Results
==============================================================================
Dep. Variable:             volatility   R-squared:                       0.102
Model:                            OLS   Adj. R-squared:                  0.070
Method:                 Least Squares   F-statistic:                     3.176
Date:                Tue, 29 Apr 2025   Prob (F-statistic):           0.00560
Time:                        15:43:37   Log-Likelihood:                -451.51
No. Observations:                 175   AIC:                             917.0
Df Residuals:                     168   BIC:                             939.2
Df Model:                           6
Covariance Type:            nonrobust
==============================================================================
```

	coef	std err	t	P>|t|	[0.025	0.975]
const	7.2687	0.919	7.905	0.000	5.454	9.084
gdp_growth	-0.1124	0.133	-0.848	0.398	-0.374	0.149
gov_debt	-0.0033	0.007	-0.467	0.641	-0.017	0.011
inflation_rate	0.0003	0.001	0.237	0.813	-0.002	0.003
interest_rates	0.0024	0.040	0.059	0.953	-0.076	0.081
black_market	-0.0083	0.024	-0.351	0.726	-0.055	0.038
cpi	0.0131	0.004	3.601	0.000	0.006	0.020

	coef	std err	z	P>|z|	[0.025	0.975]
const	-6.2377	0.942	-6.622	0.000	-8.084	-4.392
gdp_growth	0.0045	0.047	0.095	0.924	-0.088	0.097
gov_debt	0.0038	0.005	0.817	0.414	-0.005	0.013
inflation_rate	-0.0190	0.021	-0.888	0.374	-0.061	0.023
interest_rates	-0.0640	0.021	-3.102	0.002	-0.104	-0.024
black_market	0.0009	0.028	0.031	0.975	-0.053	0.055
cpi	-0.0029	0.010	-0.289	0.773	-0.023	0.017

What Shapes Economic Strength?

1

Most countries are economically stable

with small year-to-year changes and very few collapses.

2

The Black market is the strongest consistent negative predictor of economic strength.

3

Inflation of CPI is tied to volatility

where price instability, stability fades.

4

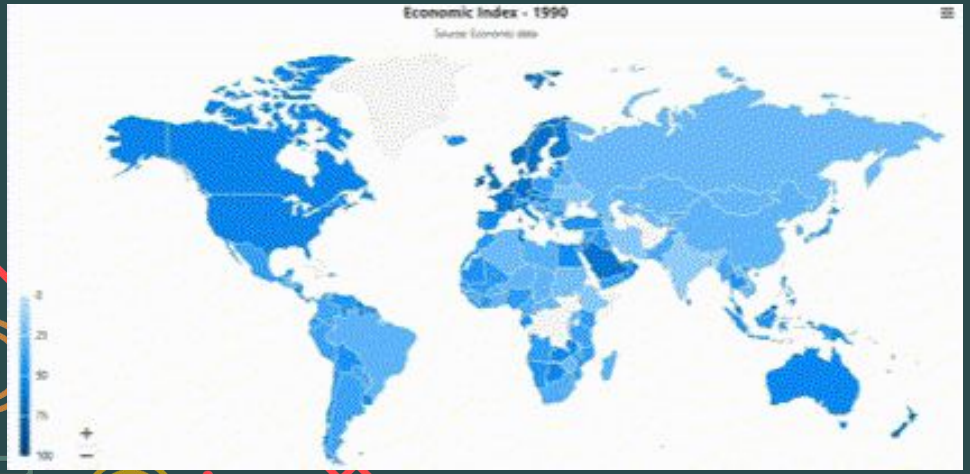
Traditional macro indicators explain patterns, not surprises

real economic shocks are structural or political.

5

Inflation & interest rates aren't black & white

It depends on how, what, and where



Thanks!

Hope you enjoyed!

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github.com/sushanthvk02/financial-collapse-indicators