Correlation between energy import and GDP for UK

Waqar Ahmed

Dataset(s)

The below dataset was used:

- World Development Indicators Dataset

  (https://www.kaggle.com/datasets/kaggle/world-development-indicators)

- Will analyse the correlation between data points for energy imports and GDP.
  - From Indicators file: **Energy imports, net (% of energy use)** (In cases this value is negative it is an indication of energy exports)
  - From Indicators file: **GDP at market prices (current US$)**

Motivation

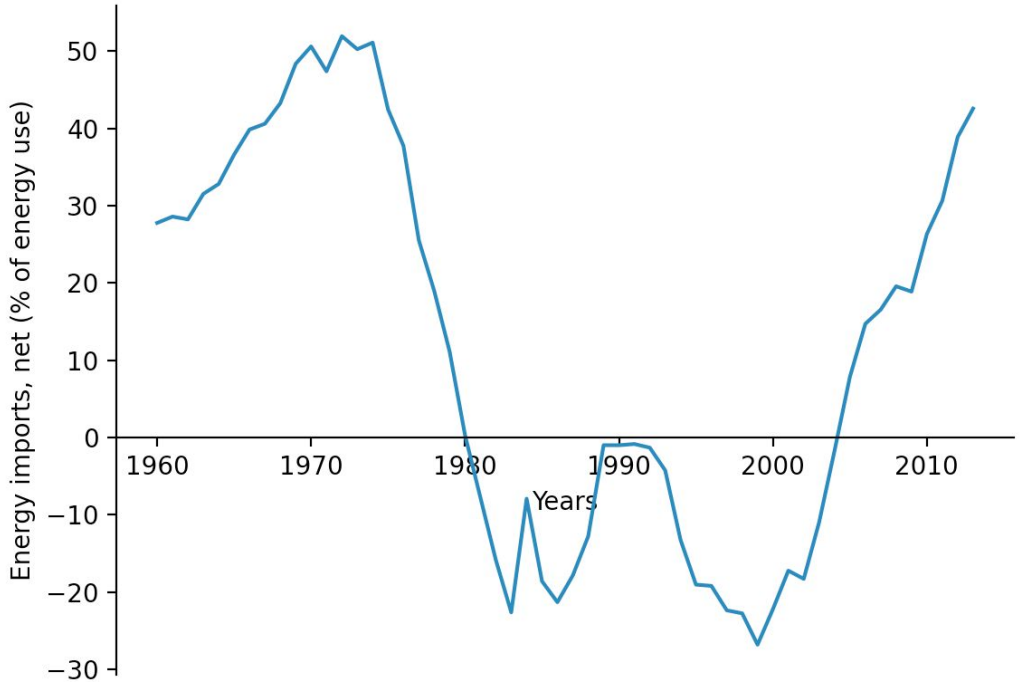
Aim to identify any correlation between energy imports and overall GDP and identify if energy self-sufficiency impacts GDP.

Given that in modern times ways of generating energy are many (renewable and non-renewable) and there is a large market for supplying energy between countries.

Research Question(s)

How much of a factor importing/exporting energy has on the overall GDP of UK and if there is any correlation.

Findings. Graph 1 - UK energy imports

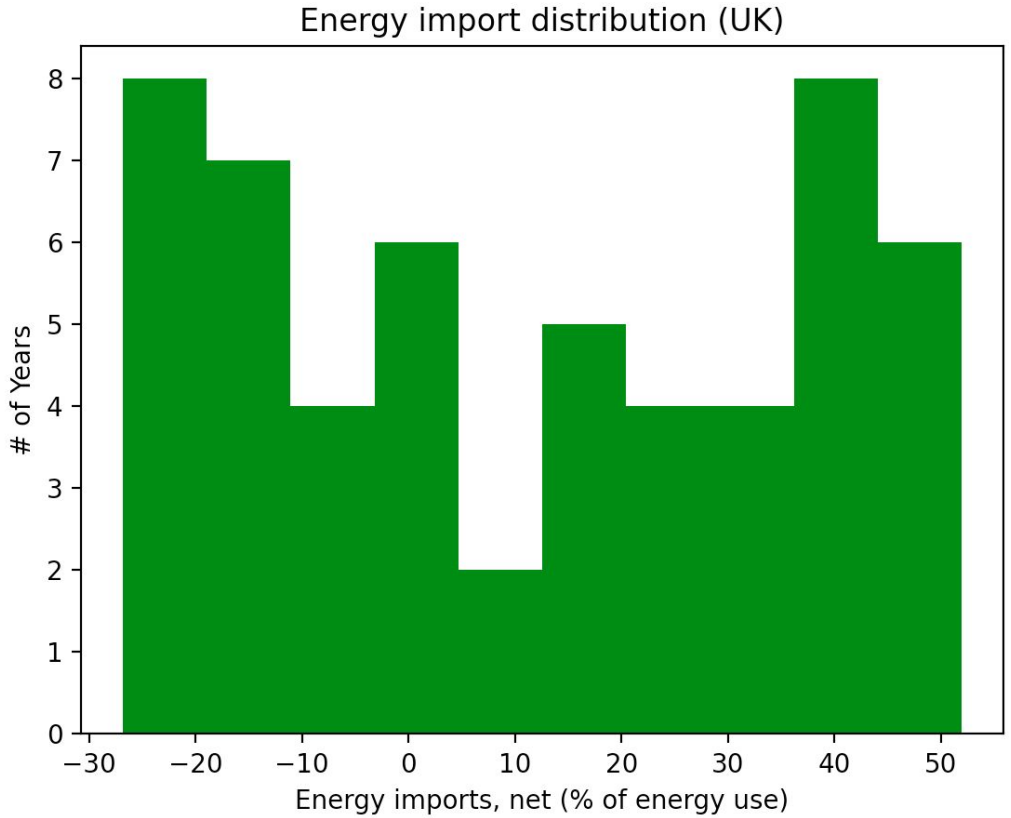


There is no steady growth/decline here. Rather we can see a period of high energy imports to start with over time with a period of energy exports and then a period of rising energy imports.

Energy import period - 1960 - 1980
Energy Export period - 1980 - 2004

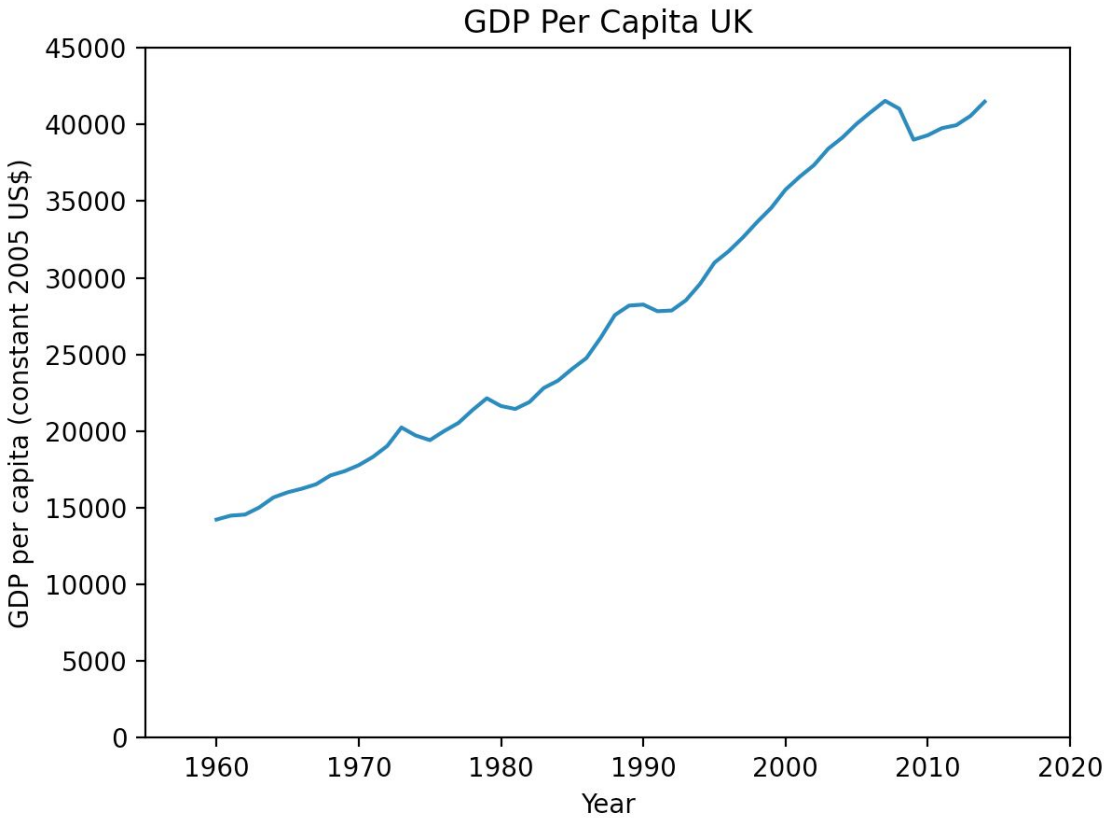
The overall period of energy exports doesn't seem to be sustained.

Findings. Graph 2 - UK energy imports , distribution



There is no meaningful distribution shown here as we have many years of both energy imports and many of exports with about ⅔ of period (1960 - 2004) of Energy imports.

Findings. Graph 3 - UK GDP



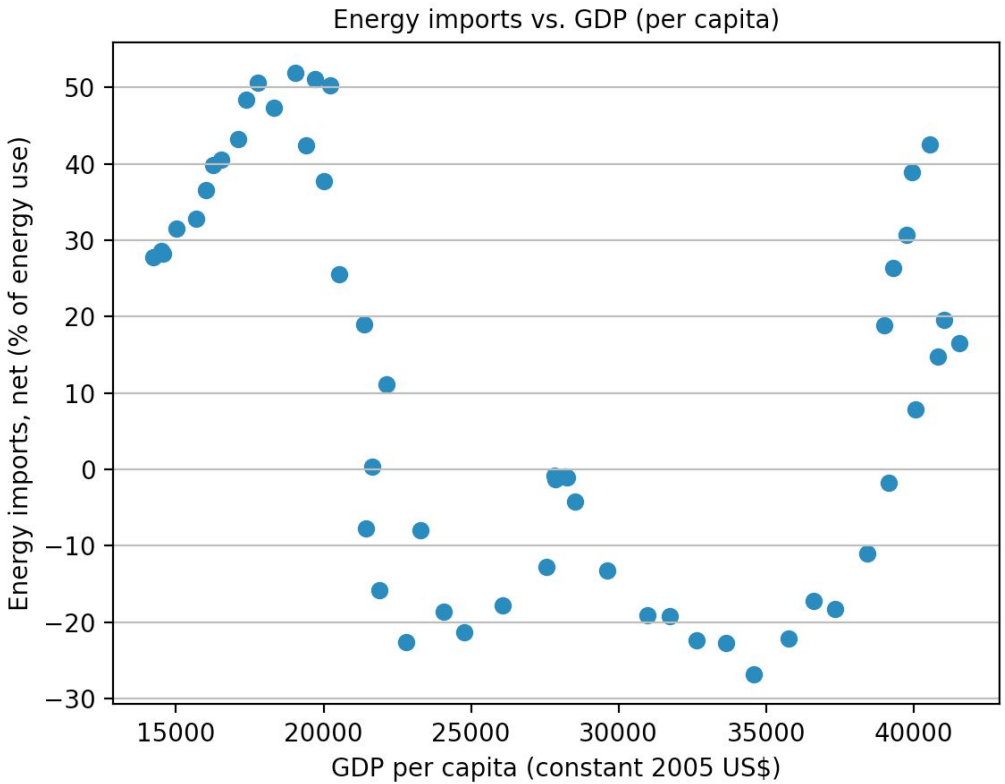
Whilst there is clear pattern of GDP growth for period (1960 -2014). It would be interesting to compare the rate of growth of GDP for years UK was importing energy and years UK was exporting energy.

From Graph 1.
Energy import period - 1960 - 1980
Energy Export period - 1980 - 2004

GDP growth:

1960 - 1980 ~ 5000
1980 - 2000 ~ 20000
(so the rate of growth is nearly four fold during the periods)

Findings. Graph 4 - correlation Energy imports V GDP



The graph shows neither positive nor negative correlation here. Further Energy imports are highest at points of highest and lowest GDP which would further negate any relationship.

Calculating the Pearson product-moment correlation coefficients we get: -0.4 which is deemed a moderate correlation

```
[[ 1.         -0.40858319]
 [-0.40858319  1.        ]]
```

Findings Summary

No strong correlation. Rather energy imports (Graph 1) have been highest at both areas of lowest (< 1970) and highest GDP (> 2000).

A substantive middle area (1980 - 2004) where the UK was exporting energy showed no substantive growth of GDP compared to areas where it was importing energy (Graph 4).

However comparing the rate of growth over two different periods , one of energy imports (1970 - 1980) and one of energy exports (1980 - 2000) showed that the GDP rate of growth was four fold higher during this period. Though the scatter graph clearly shows there is no correlation between the data points of increased exports and increased GDP.

Rather the data shows that GDP has increased during period (> 2000) of increased energy imports also.

In summary Energy imports/Exports whilst erratically changing between 1960 - 2004 show no substantial effect on UK’s steady GDP growth.

Acknowledgements

Did not get this reviewed so no feedback.

References

All work done on my own.

Code

```python
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt


def main():
    ############################## Line graph for Energy imports ##############################

    data = pd.read_csv('/Users/wagarahmed/Downloads/archive/Indicators.csv')
    print(data.shape)

    countries = data['CountryName'].unique().tolist()
    country_code = data['CountryCode'].unique().tolist()
    indicators = data['IndicatorName'].unique().tolist()
    years = data['Year'].unique().tolist()

    print(f'Number of indicators: {len(indicators)}')
    print(f'Number of countries: {len(countries)} and Number of country codes: {len(country_code)}')
    print(f'Years data from  {min(years)} till {max(years)} , over {len(years)} years')

    indicator_name = 'Energy imports'
    sample_country_code = 'GBR'

    mask1 = data['IndicatorName'].str.contains(indicator_name)
    mask2 = data['CountryCode'].str.contains(sample_country_code)
    stage = data[mask1 & mask2]

    years = stage['Year'].values
    energy = stage['Value'].values
    plt.plot(years,energy)
    plt.xlabel('Years')
    plt.ylabel(stage['IndicatorName'].iloc[0])

    ax = plt.gca()
    ax.spines["bottom"].set_position(("data", 0))
    ax.spines["top"].set_visible(False)
    ax.spines["right"].set_visible(False)
    plt.show()
```

```
40      ################################## Histogram for Energy imports ##################################
41
42      plt.hist(energy, 10, density=False, facecolor='green')
43      plt.xlabel(stage['IndicatorName'].iloc[0])
44      plt.ylabel('# of Years')
45      plt.title('Energy import distribution (UK)')
46      plt.show()
47
48      ################################## GDP for UK  ###################################
49
50      gdp_indicator = 'GDP per capita \(constant 2005'
51      mask_gdp = data['IndicatorName'].str.contains(gdp_indicator)
52      gdp_stage = data[mask_gdp & mask2]
53
54      plt.plot(gdp_stage['Year'].values, gdp_stage['Value'].values)
55      plt.xlabel('Year')
56      plt.ylabel(gdp_stage['IndicatorName'].iloc[0])
57      plt.title('GDP Per Capita UK')
58
59      plt.axis([1955, 2020,0,45000])
60      plt.show()
```

```
    ################################ Correlation Energy imports V GDP for UK ################################

    print(gdp_stage)
    print("GDP Min Year = ", gdp_stage['Year'].min(), "max: ", gdp_stage['Year'].max())
    print("Energy imports Min Year = ", stage['Year'].min(), "max: ", stage['Year'].max())

    gdp_stage_trunc = gdp_stage[gdp_stage['Year'] < 2014]

    fig, axis = plt.subplots()
    axis.yaxis.grid(True)
    axis.set_title('Energy imports vs. GDP (per capita)', fontsize=10)
    axis.set_xlabel(gdp_stage_trunc['IndicatorName'].iloc[0], fontsize=10)
    axis.set_ylabel(stage['IndicatorName'].iloc[0], fontsize=10)

    X = gdp_stage_trunc['Value']
    Y = stage['Value']

    axis.scatter(X, Y)
    plt.show()
    print(np.corrcoef(gdp_stage_trunc['Value'], stage['Value']))

if __name__ == "__main__":
    main()
```