

DOPP Presentation

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Datasets used

- Population Data: un.org
- GDP: [worldbank](http://worldbank.org)
- Nuclear Generation and Coal Consumption: BP
- Eurostat: Simplified Energy Balances

Development of Nuclear Energy

Development of Nuclear Energy

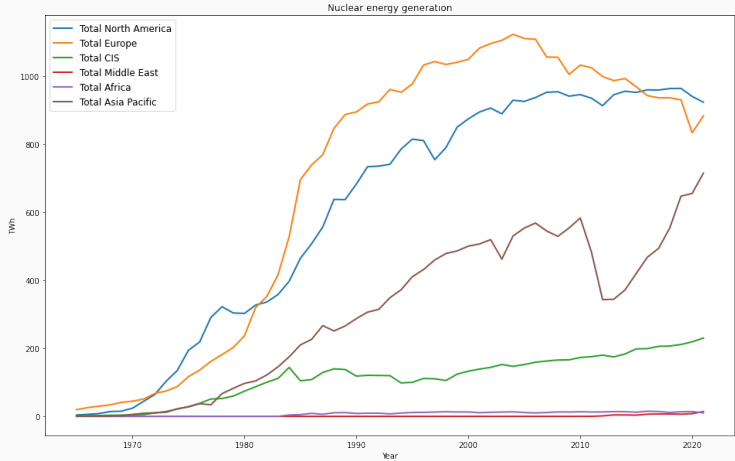


Figure 1: Time evolution of nuclear energy generation

Development of Nuclear Energy

Some observations:

- Boom in the second half of the 20th century - building of nuclear power plants not necessarily due to energy needs.
- Decline due to politics or disasters, but also sinking costs of fossil fuels and alternative energy sources.
- Production of nuclear energy only in very selected countries - cost of construction biases the data.

Nuclear energy as alternative to coal?

Nuclear energy as alternative to coal?

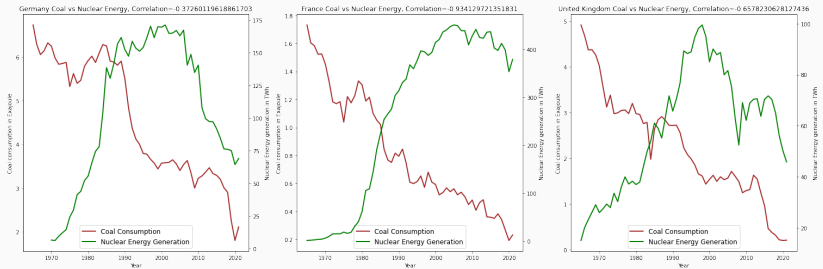


Figure 2: Some very suggestive plots

Nuclear energy as alternative to coal?

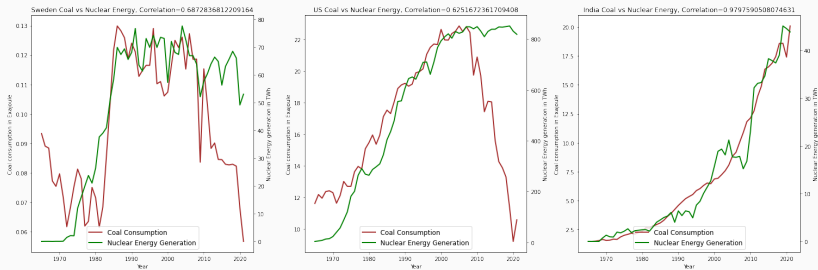


Figure 3: but here are some other plots

Nuclear energy as alternative to coal?

- Rise and fall of energy sources mostly due to need and cost.
- Decline of coal is also affected by climate and environment concerns.
- Politics and general trends again play a bigger role than nuclear energy as an impact factor.

Nuclear energy as a boost to GDP?

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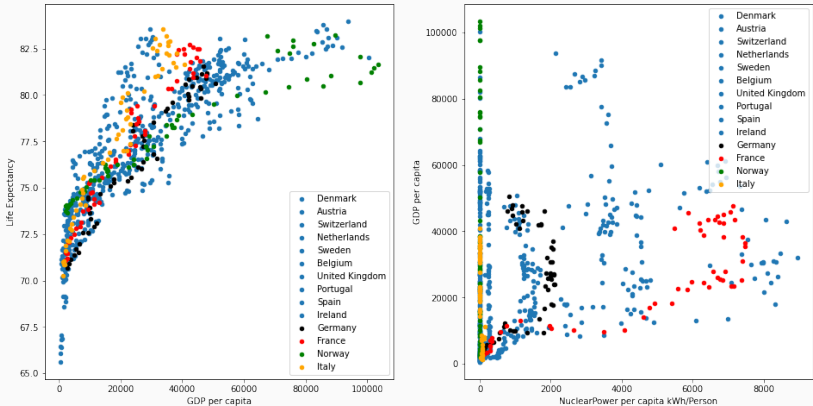


Figure 4: GDP per capita and nuclear energy production per capita

Nuclear energy as a boost to GDP?



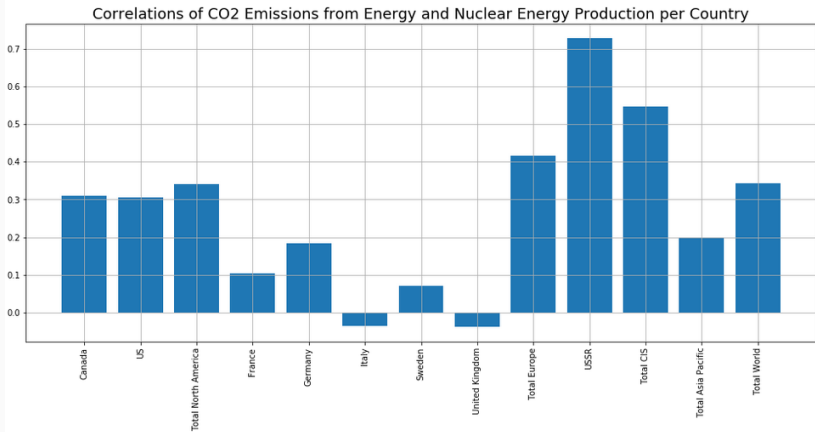
Figure 5: Italy's short story with nuclear energy

Nuclear energy as a boost to GDP?

- Literature research: small effects can be shown (with statistic methods beyond our scope)
- Effect of nuclear energy on GDP small in relation to other factors, strong correlation of GDP with time.

**How well nuclear energy
production correlates with
changes in carbon emissions?**

Sounds Like an Easy Question

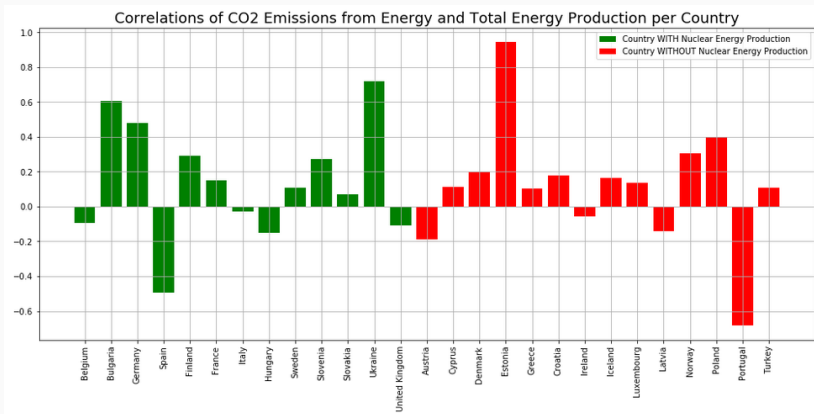


- Based on annually percentage changes starting from 1966 until 2021.
- But how trustful are these results?

Experimental Setup

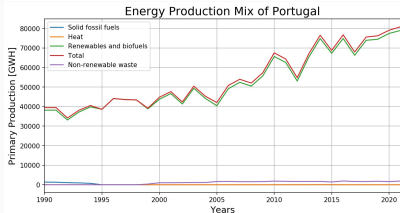
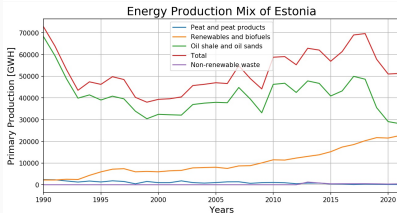
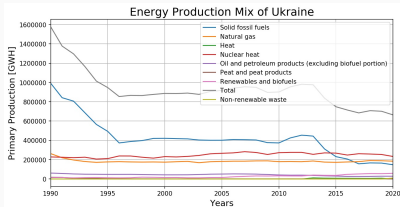
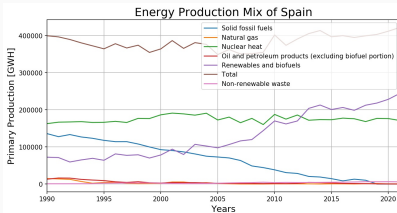
1. Consider 2 groups of countries:
 - Countries WITH nuclear energy production
 - Countries WITHOUT nuclear energy production
2. Define hypothesis:
 - Null hypothesis: There is no difference between the mean of the correlations from both groups.
 - Alternative hypothesis: There is a significant difference between the mean of the correlations from both groups.
3. Calculate the correlations between CO2 emissions from energy and total energy production for each country.
4. Make a two sample t-test (unpaired):
 - If p-value lower than alpha value: Reject null hypothesis.

Correlations for Both Groups of Countries



- Based on annually percentage changes starting from 1991 unit 2021 with focus on Europe.
- Two sample t-test ($\alpha = 0.05$):
 - p-value for two tailed: 0.83 \rightarrow We do not reject the null hypothesis!
 - p-value for one tailed: 0.42 \rightarrow We do not reject the null hypothesis!

Reasons for the Strongest Correlations



Industries Producing Highest amounts of CO₂ and alternative

Highest Producers of CO2

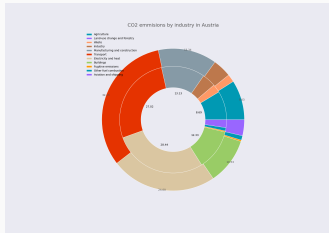


Figure 6: Austria

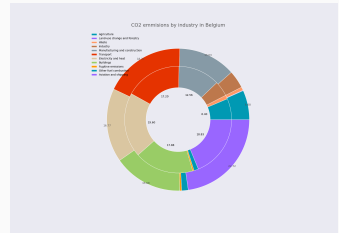


Figure 7: Belgium

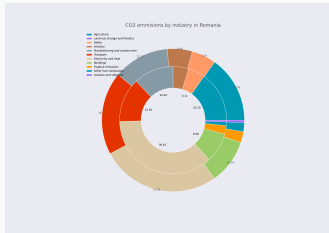


Figure 8: Romania

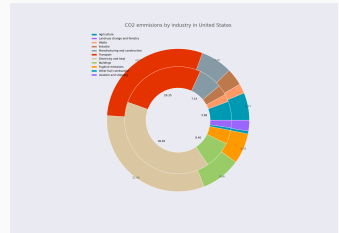


Figure 9: USA

Industries Producing Highest amounts of CO2 and alternative

Some observations:

- The main industries that contribute to CO2 production are also the ones that could benefit from Nuclear Energy Usage
- The said industries have had a growth in the past 10 year
- This can only lead to the demand of primary resources to grow, which can not be supported

Questions