Development Pathways (2011–2023): Poverty, Life Expectancy, Economic Capacity, and Renewable Electricity

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Motivation & Research Question

Why development pathways matter

How are poverty and life expectancy associated with economic capacity across countries, and how does renewable electricity use vary across these development pathways?

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Data Overview

Country-level indicators from global development datasets (2011–2023)

Datasets Cited

- **Population Estimates and Projections**
  Source: Our World in Data (United Nations World Population Prospects)
  URL: https://ourworldindata.org/grapher/population-with-un-projections

- **Life Expectancy at Birth**
  Source: Our World in Data (Human Mortality Database & UN World Population Prospects)
  URL: https://ourworldindata.org/grapher/life-expectancy-hmd-unwpp

- **Renewable Energy Consumption**
  Source: Our World in Data
  URL: https://ourworldindata.org/grapher/modern-renewable-energy-consumption

- **GDP per Capita (PPP)**
  Source: Our World in Data (World Bank)
  URL: https://ourworldindata.org/grapher/gdp-per-capita-worldbank

- **Share of Population Living in Extreme Poverty**
  Source: Our World in Data (World Bank)
  URL: https://ourworldindata.org/explorers/poverty-explorer

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Data Preparation

Cleaning, merging, and constructing comparable country–year measures

Methods & Data Wrangling

- Merged multiple global datasets at the country–year level (2011–2023)
- Standardized country identifiers and variable names
- Filtered to consistent temporal coverage and valid observations
- Constructed derived measures (e.g., renewable electricity per capita)
- Used descriptive and interactive visualizations for analysis

Libraries Utilized

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns

import altair as alt
import plotly.express as px
```

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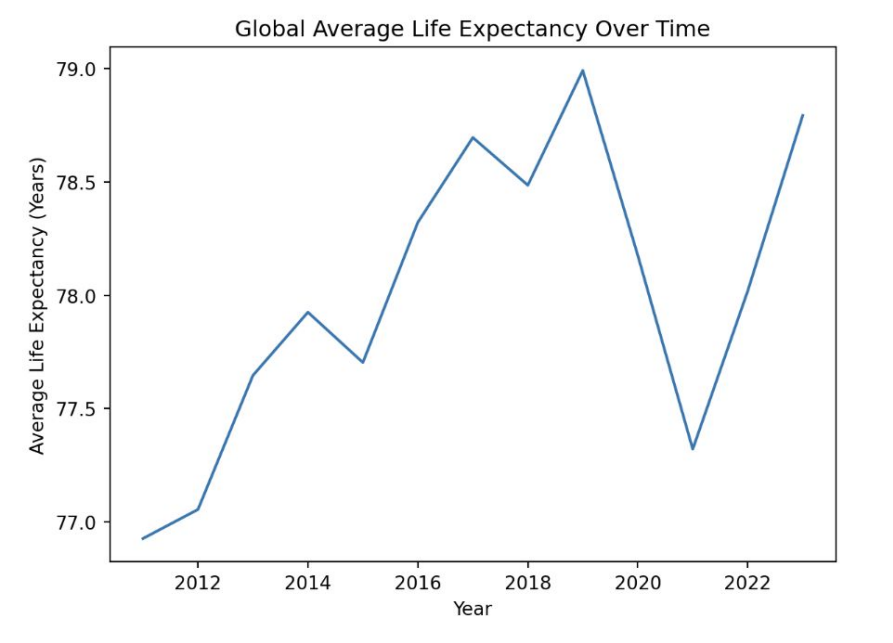
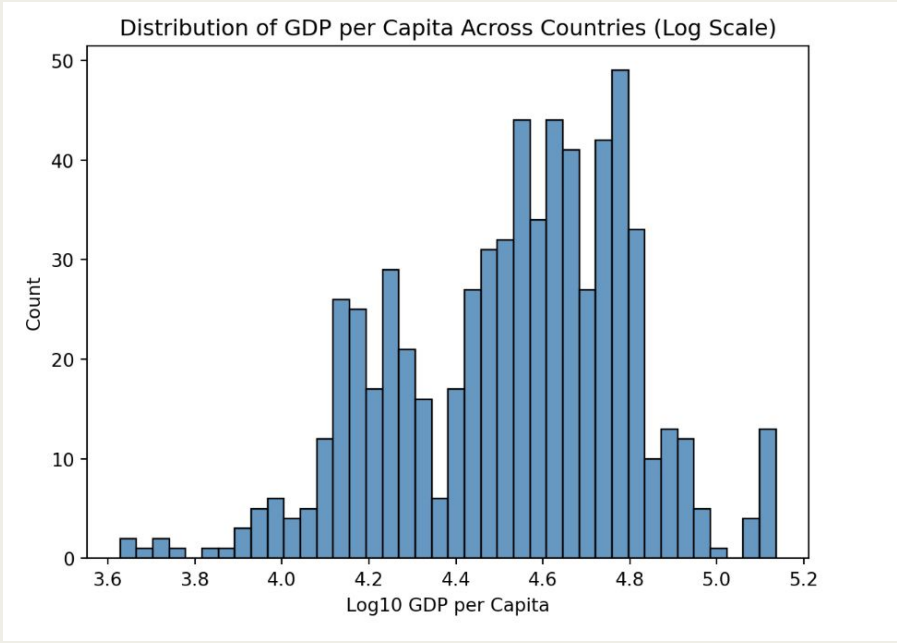
EDA: Exploratory Patterns in Global Development

Trends over time and cross-country variation

Exploratory Trends in Global Life Expectancy



Global life expectancy shows long-term improvement from 2011-2023, with a temporary decline during COVID-19



GDP per capita is highly skewed across countries, motivating log-scaled and country-level comparisons

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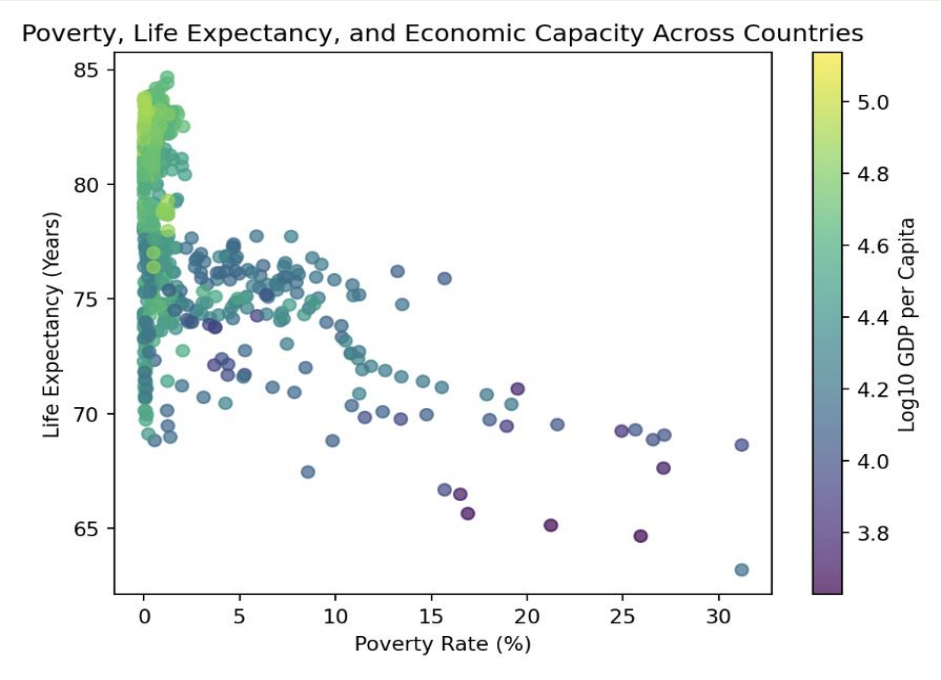
Results: Poverty vs Life Expectancy

Economic capacity as a stratifying factor

Poverty, Life Expectancy, and Economic Capacity

- Higher poverty rates are associated with lower life expectancy
- Countries with higher GDP per capita cluster at low poverty and high life expectancy



Economic gradients in health outcomes across countries

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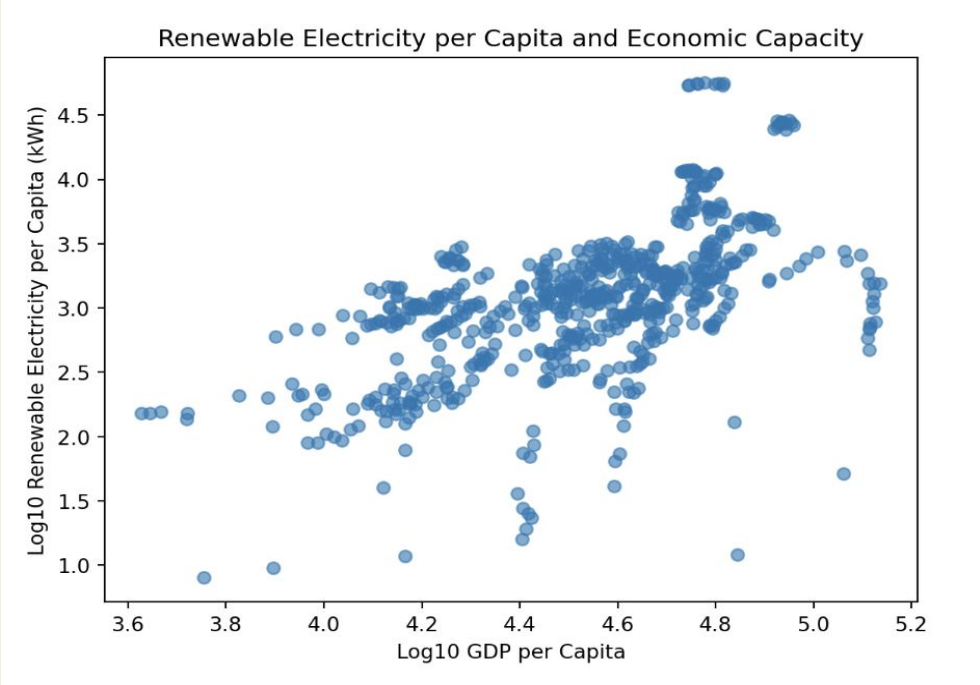
Results: Renewable Electricity Pathways

Sustainability patterns across different development trajectories

Renewable Electricity and Economic Capacity

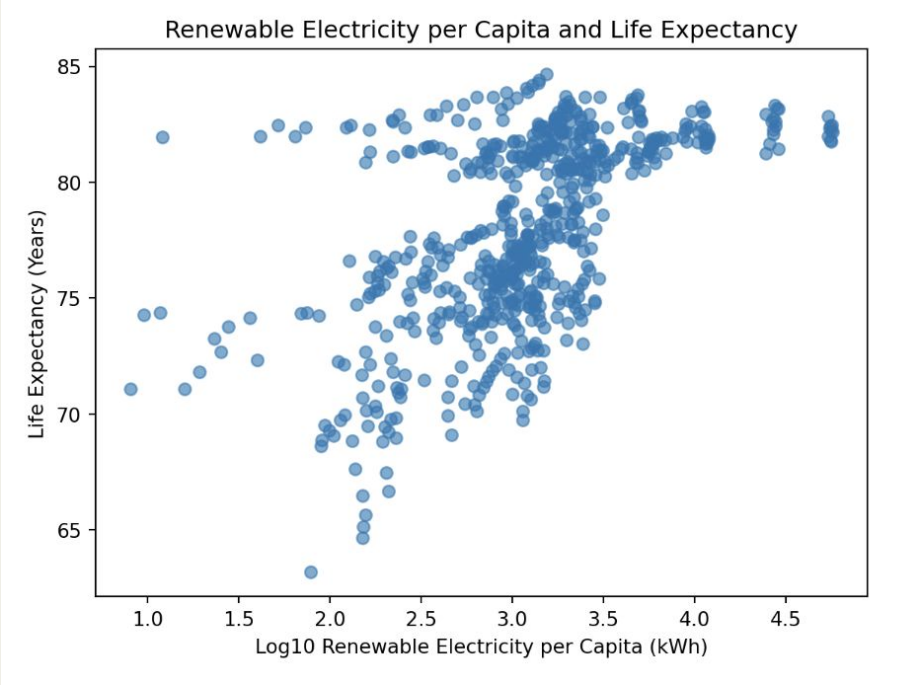
- Higher-income countries tend to generate more renewable electricity per capita
- Considerable variation suggests multiple development pathways



Higher GDP per capita is generally associated with greater renewable electricity generation per capita (outcomes vary widely across countries)

Renewable Electricity and Population Health

- Countries with higher renewable electricity per capita often exhibit higher life expectancy
- The relationship is less direct and more dispersed than for poverty or GDP



Higher renewable electricity per capita generally associated with higher life expectancy, though varies across countries

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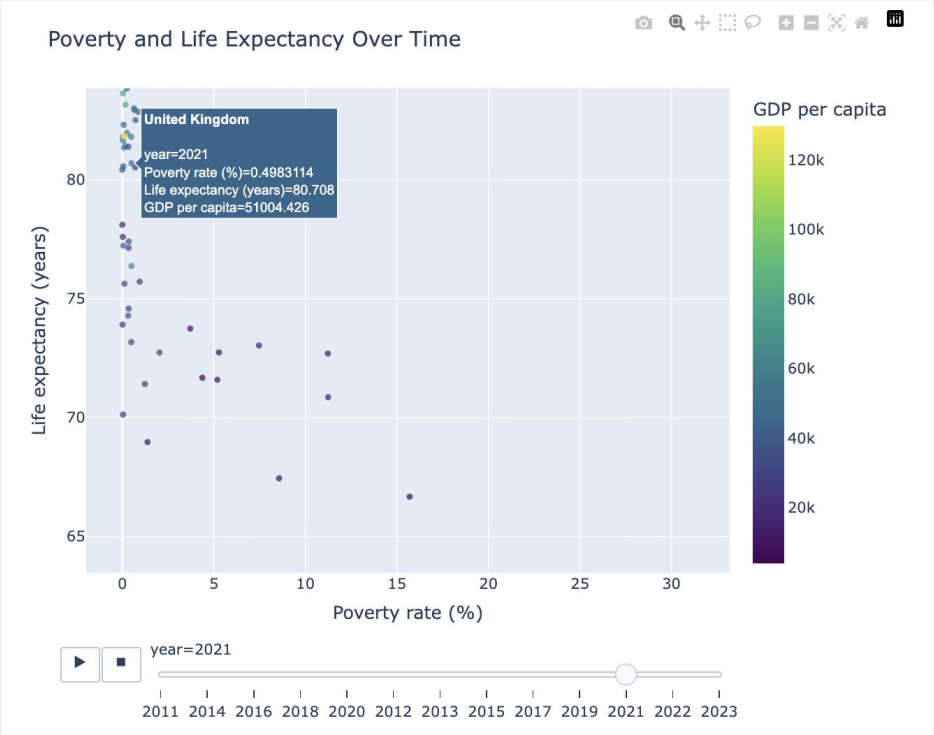
Interactive Mini-Dashboard

Exploring change over time with interactive visualizations

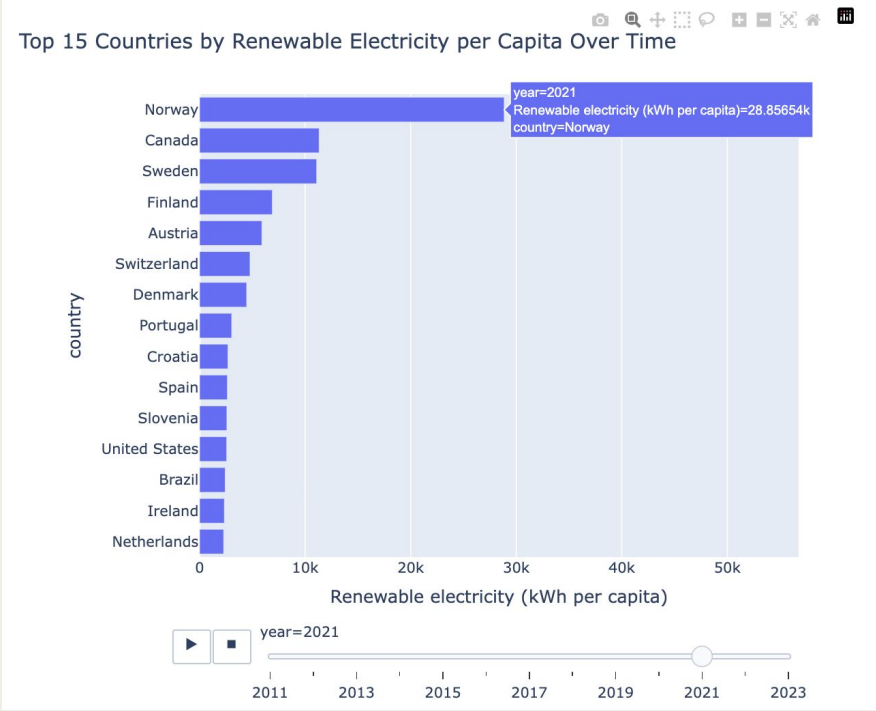
Poverty and Life Expectancy Across Countries (2011–2023)

- Countries with lower poverty rates exhibit higher life expectancy
- High-GDP countries cluster at low-poverty and high-health
- Most countries shift gradually rather, indicating slow changes in development outcomes rather than sudden transitions



Leaders in Renewable Electricity per Capita Over Time

- Small group of mostly high-income countries (Norway, Canada, and Sweden) consistently leads in renewable electricity generation per capita
- Rankings change modestly across years, but energy leadership remains concentrated among the same countries



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Limitations & Conclusion

What the results show—and what they do not

Limitations and Conclusions

Key Limitations

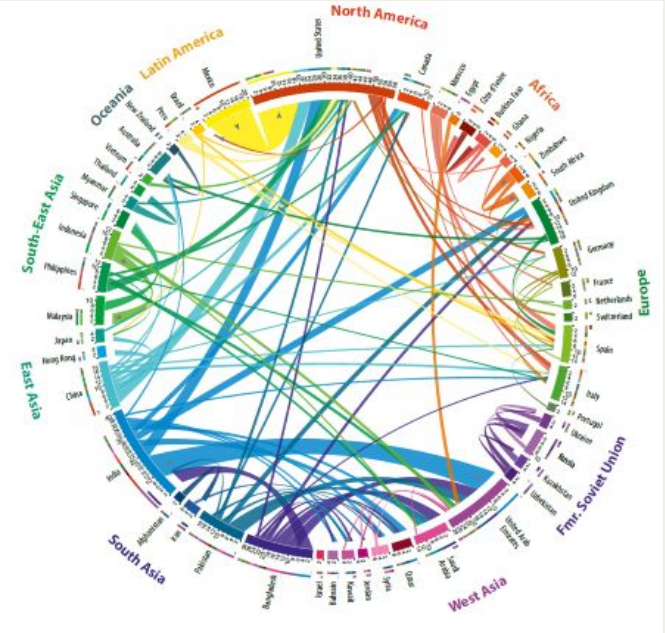
- Country coverage varies across indicators and years, which limits direct comparability and reduces sample size in some analyses

- All relationships shown are descriptive; the visualizations highlight associations rather than causal effects

Conclusions

- Higher economic capacity is generally associated with lower poverty, higher life expectancy, and adoption of renewable electricity, though variation exists across countries

- Examining economic, health, and energy indicators together reveals distinct development pathways, underscoring the value of multidimensional visual analysis in understanding global development trends.



Thanks!