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

Author: Daniel Choi

DATS 2101 - Junjun Yin

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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

Our World in Data

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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

```python
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
```
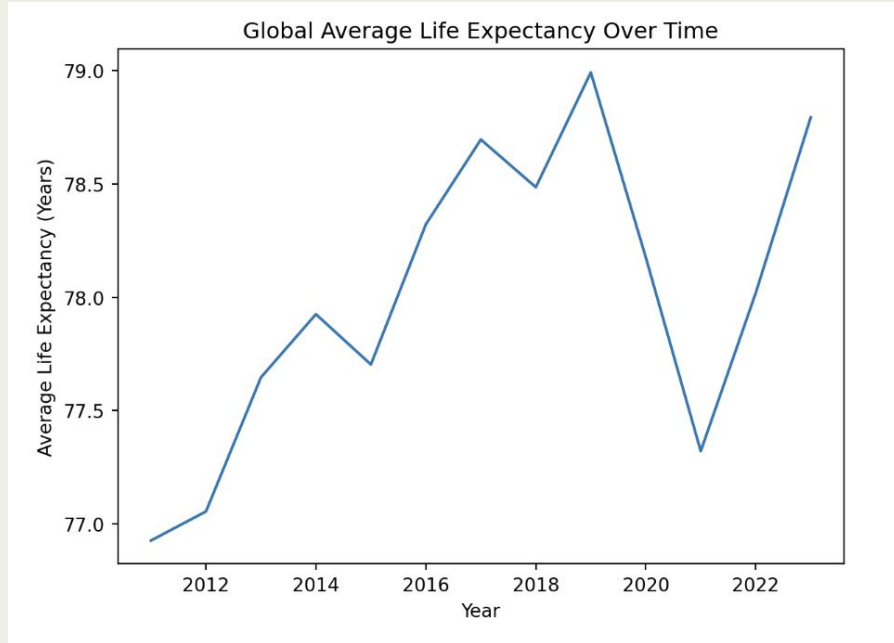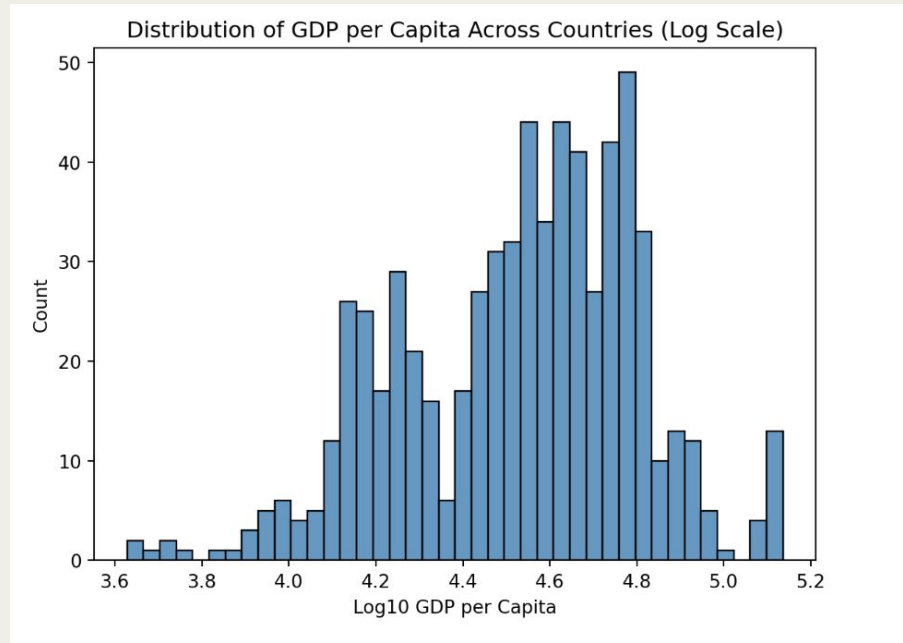
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EDA: Exploratory Patterns in Global Development

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
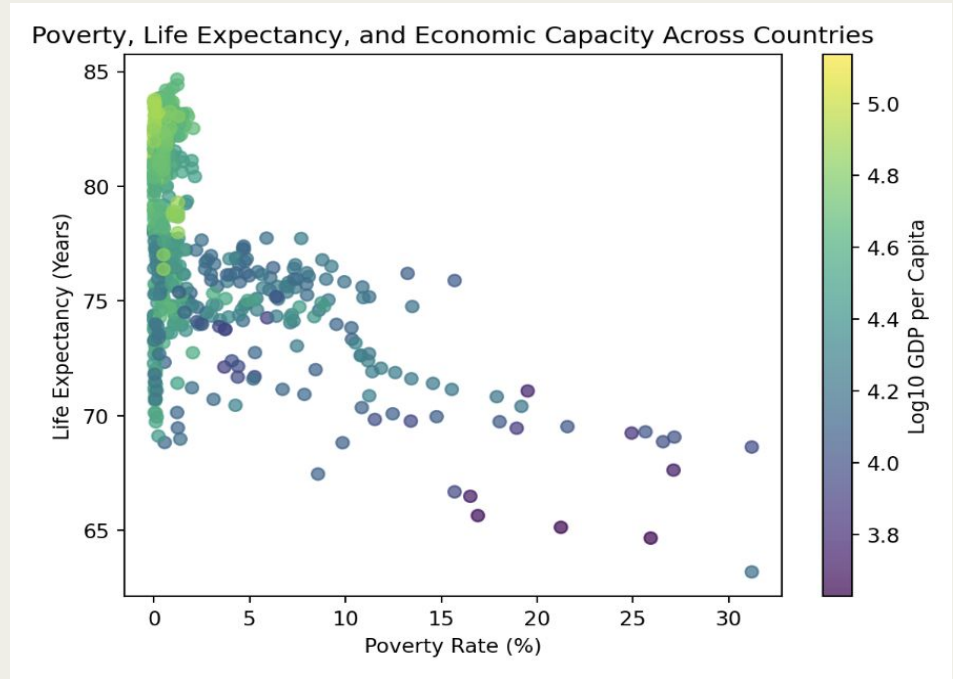
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Results: Poverty vs Life Expectancy

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

Renewable Electricity per Capita and Economic Capacity
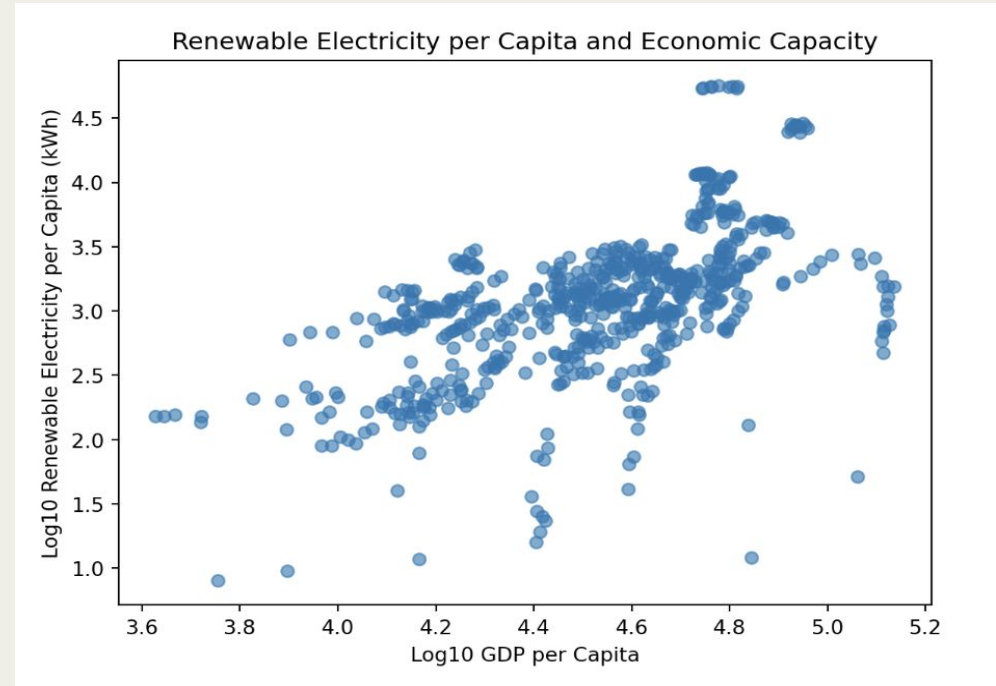
Higher GDP per capita is generally associated with greater renewable electricity generation per capita (outcomes vary widely across countries)

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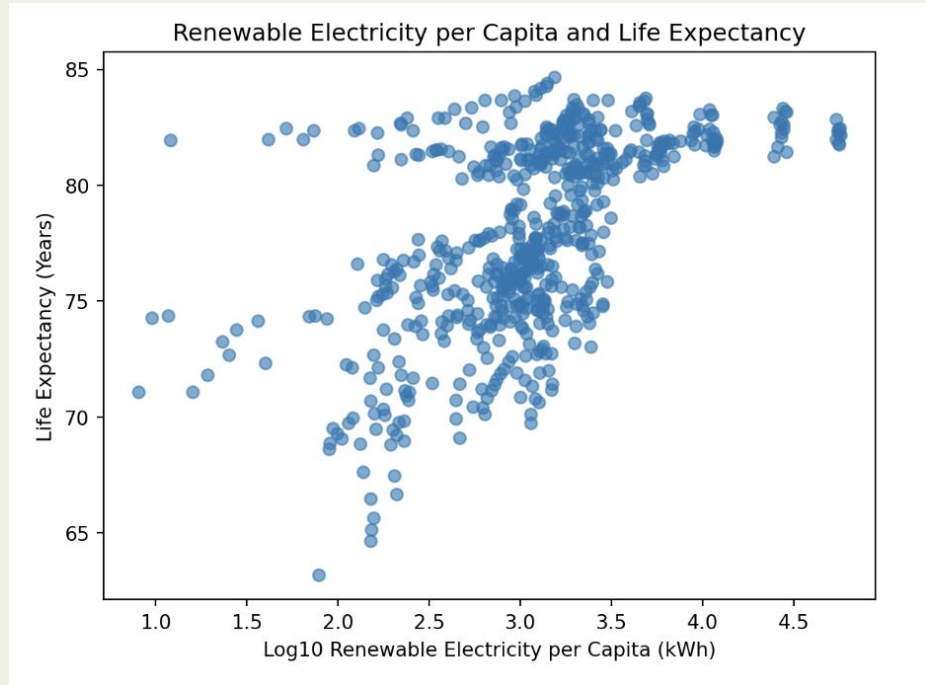
Higher renewable electricity per capita generally associated with higher life expectancy, though varies across countries

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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
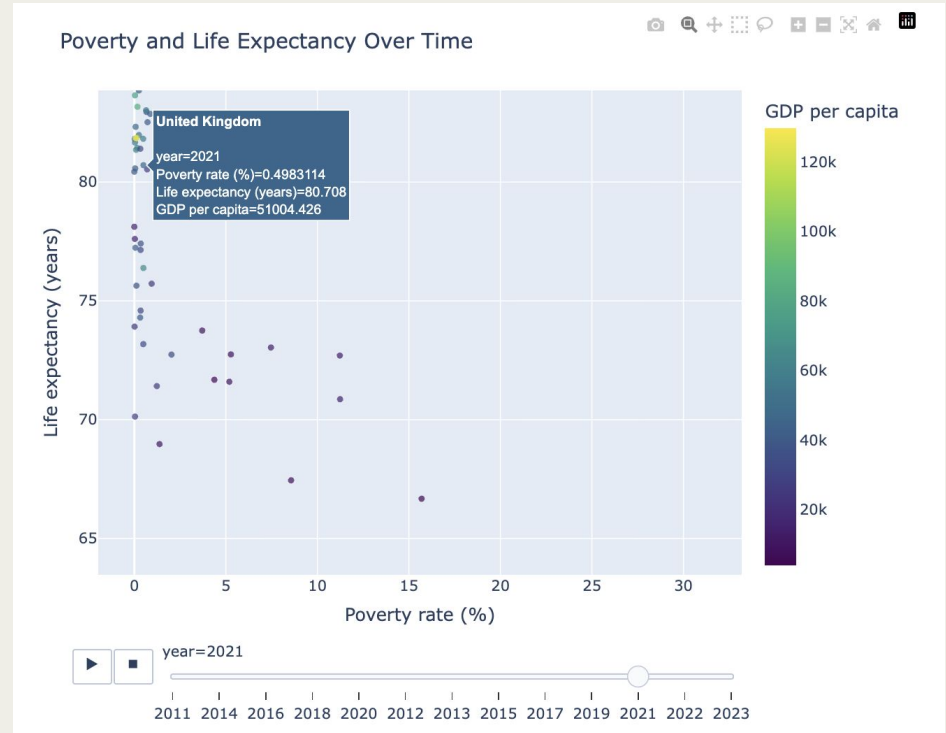
Leaders in Renewable Electricity per Capita Over Time

- 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
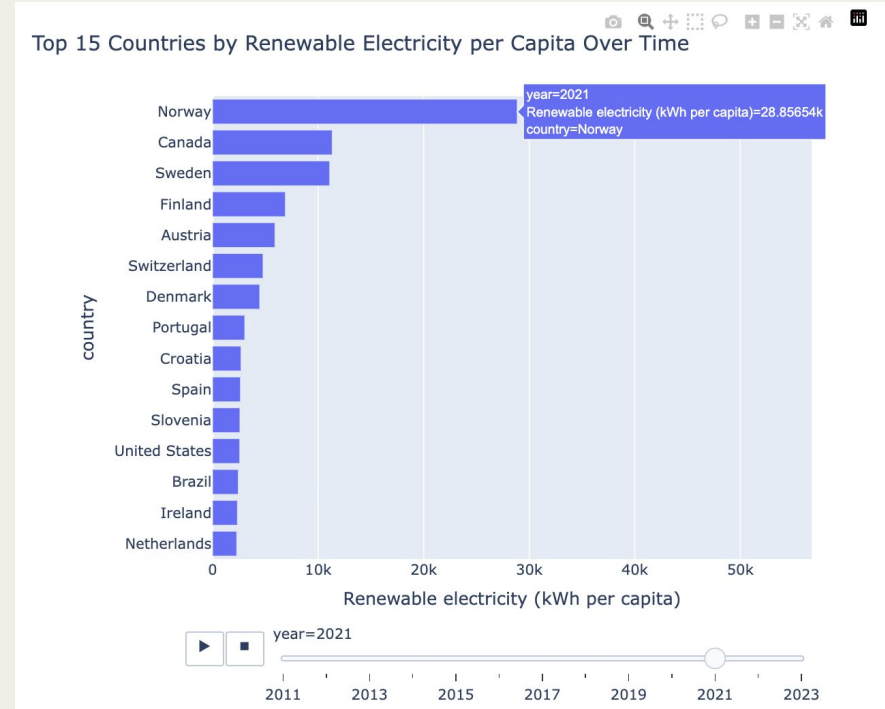
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Limitations & Conclusion

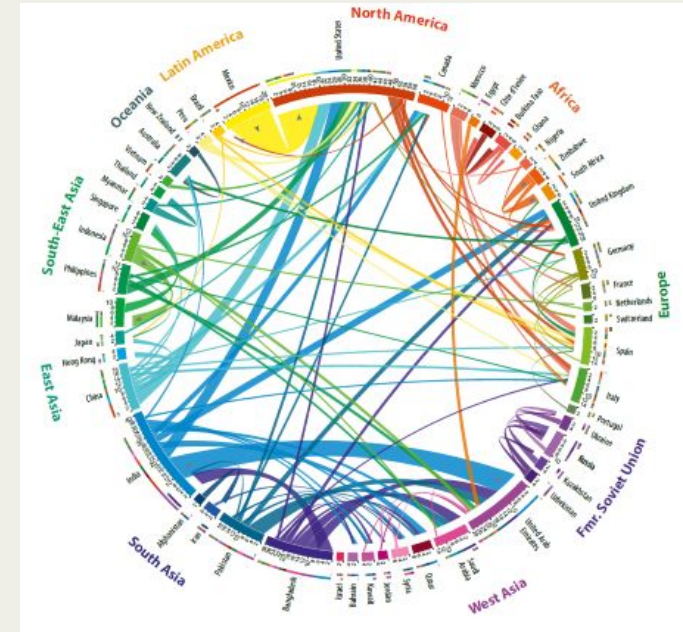What the results show—and what they do not

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!