Long-Term Development Indicators and Global Trends

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Introduction

Our final project explores the long-term trends and interrelationships between key development indicators across countries using data from the World Bank's World Development Indicators (WDI) database. Specifically, we focus on life expectancy, fertility rate, population growth, and school enrollment. These indicators are foundational in understanding the social and demographic evolution of countries from 1960 to 2023.

By analyzing these indicators longitudinally, we aim to reveal how population health, demographic transition, and education investment interact over time, and how they can collectively inform national and global development strategies.

Background

Development indicators are critical tools for understanding how societies progress over time. Measures such as life expectancy and fertility rate reveal how access to healthcare, education, and economic opportunities impact the quality of life and long-term population dynamics. In contrast, metrics like school enrollment and population growth highlight the importance of human capital and demographic pressure in shaping a country's future trajectory.

Longitudinal data allows us to move beyond snapshots and instead capture how these dynamics unfold over decades. For example, countries with declining fertility and increasing school enrollment often exhibit longer life expectancies, but this relationship may vary depending on region, income level, or development stage.

The World Development Indicators (WDI) database provides extensive historical data on these themes, making it an ideal resource for studying global development trends over time. Our project leverages this resource to analyze patterns from 1960 through 2023 across over 100 countries.

Research Questions

Our project addresses the following questions: 1. How has life expectancy evolved globally since 1960, and how is it associated with fertility and education trends? 2. What is the relationship between school enrollment and fertility rate across countries? 3. Do countries with rapid population growth face distinct development challenges in terms of life expectancy? 4. What insights can we derive from multivariable regression models that predict life expectancy using demographic and education indicators?

Objectives

The primary objectives of this project are to: - Analyze long-term trends in life expectancy, fertility, population growth, and school enrollment using WDI data. - Examine correlations among these indicators to understand global development patterns. - Use regression models to investigate how these factors jointly predict life expectancy. - Visualize global development trajectories using intuitive and informative charts.

Data and Methods

This project uses four key indicators from the WDI: - **Life Expectancy at Birth (years)** — SP.DYN.LE00.IN - **Fertility Rate (births per woman)** — SP.DYN.TFRT.IN - **Population Growth (annual %)** — SP.POP.GROW - **School Enrollment, Primary (% gross)** — SE.PRM.ENRR

The data were cleaned and reshaped from wide to long format, removing missing values and converting strings to numeric types. The final dataset includes annual observations from 1960 to 2023 for each country.

We used Python (Pandas, Seaborn, Matplotlib, Statsmodels) for data manipulation, visualization, and statistical analysis. A Quarto report was created to organize the narrative, visual, and quantitative results in a cohesive document.
