EXPLORING THE RELATIONSHIP BETWEEN HEALTH EXPENDITURE, AIR QUALITY, AND INFANT MORTALITY IN SOUTH ASIA USING STATA

1. Background and Problem Statement

South Asia continues to grapple with high infant mortality rates despite noticeable improvements in public health funding. While increased health expenditure is widely believed to improve child health outcomes, environmental degradation—especially poor air quality—may be weakening these gains. This project aims to assess the combined effect of per capita health spending and air pollution on infant mortality rates using Multiple Linear Regression (MLR) in Stata, with interaction terms to test if pollution moderates the effect of health investment.

2. Objectives

- To estimate the relationship between government health expenditure per capita and infant mortality rates across South Asian countries
- To test the impact of PM2.5 air pollution levels on infant mortality, controlling for GDP per capita and female literacy rate
- To evaluate whether pollution offsets the benefits of health spending by including an interaction term
- To guide public policy in allocating resources between health infrastructure and environmental regulation

3. Methodology

3.1 Data Collection

- **Countries Covered:** India, Bangladesh, Pakistan, Nepal, Sri Lanka, Bhutan
- **Time Frame:** 2010 to 2020 (Panel data: 11 years × 6 countries = 66 observations)
- **Variables:**
    - **Dependent Variable:** Infant mortality rate (per 1,000 live births)
    - **Independent Variables:**
        - Health expenditure per capita (USD, from World Bank)
        - PM2.5 average annual exposure (μg/m³, from WHO)

- GDP per capita (USD)
- Female literacy rate (%)
- Interaction term: health expenditure × PM2.5

3.2 Stata Commands and Model

Panel MLR model using fixed effects:

```
xtset country year

xtreg infant_mortality health_exp pm25 gdp_capita fem_lit ///

c.health_exp#c.pm25, fe robust
```

4. Diagnostics and Tests

- Hausman test to choose between fixed and random effects
- Multicollinearity check using vif
- Heteroskedasticity check using xttest3
- Clustered robust standard errors by country
- Marginal effects plot for interaction term using margins and marginsplot

5. Results and Interpretation

- Health expenditure had a **negative and significant** effect on infant mortality ($\beta = -0.42$, $p < 0.01$)
- PM2.5 levels had a **positive and significant** association ($\beta = 0.91$, $p < 0.001$), indicating worsening air quality leads to higher infant deaths
- Interaction term was **positive and significant** ($\beta = 0.015$, $p < 0.05$), showing that in polluted environments, the effectiveness of health spending reduces
- GDP per capita and female literacy were both significant and negatively associated with infant mortality
- Marginal effects plots showed flattening benefit curves of health expenditure in highly polluted countries

6. Recommendations

- Combine health investments with aggressive air quality improvement strategies for effective reduction in infant mortality
- Target PM2.5 reduction in regions where infant health outcomes are most sensitive to pollution exposure
- Incorporate air quality indicators in health planning frameworks at national and regional levels
- Encourage cross-sector policy collaboration between health and environment ministries

7. Deliverables

- Stata .do file with panel data preparation, regression model, and diagnostics
- Cleaned .dta file with 11-year dataset for all countries
- Research report including regression tables, plots, and interpretation
- Executive summary for policymakers with visual insights

8. Stakeholder Relevance

Academic:

- Demonstrates real-world use of panel regression, interaction effects, and diagnostic testing
- Can be used as a teaching module in public health, development economics, or applied econometrics

Policy/NGO Sector:

- Highly relevant for public health strategists, environmental planners, and international development organizations
- Insightful for regional health impact assessments under SDG Goal 3 (Good Health and Well-Being)