EVALUATING HEALTHCARE SPENDING EFFICIENCY USING SAS CROSS-SECTIONAL REGRESSION

1. Overview

Client:

A global health policy think tank conducting comparative studies on healthcare systems

Objective:

To evaluate the efficiency of healthcare spending across 36 OECD countries using cross-sectional regression in SAS. The model aimed to determine whether higher spending translates to better health outcomes and identify potential inefficiencies.

2. Background

Rising healthcare expenditures have triggered policy scrutiny in many developed economies. Policymakers require empirical models that evaluate whether countries achieve proportionate health outcomes for their healthcare investments. The client sought a statistically rigorous comparison using SAS.

3. Data Summary

Dataset:

OECD Health Statistics (2021 edition)
Observations: 36 countries

Variables Used:

Variable	Type	Description
Life_Expectancy	Continuous	Average life expectancy at birth (years) – dependent
Health_Expenditure_Per_Capita	Continuous	Total health spend per capita (USD, PPP adjusted)
Smoking_Prevalence (%)	Continuous	% of population aged 15+ who smoke
Obesity_Rate (%)	Continuous	% of adult population classified as obese
GDP_Per_Capita (USD)	Continuous	Controls for general income level

Doctors_Per_1000	Continuous	Proxy for health system capacity

4. Methodology

Software Used:

SAS 9.4

SAS Workflow:

1. **Data Cleaning:**
    - Imported .csv via PROC IMPORT
    - Standardized all continuous variables using PROC STANDARD
    - Verified completeness and outlier influence
2. **Exploratory Analysis:**
    - PROC CORR for initial associations
    - Scatterplot matrix to visualize collinearity and linear trends
3. **Regression Modeling:**
    - PROC REG used with forward selection method
    - Dependent variable: Life_Expectancy
    - Diagnostics: VIF, residual normality, Cook's D
4. **Robustness Checks:**
    - Ran alternate models excluding outliers (e.g., U.S., Mexico)
    - Re-estimated using log-transformed expenditure

5. Key Results

Predictor	**Coefficient (β)**	**p-value**	**Interpretation**
Health_Expenditure_Per_Capita	+0.018	0.005	$1,000 increase → 0.018-year gain in life expectancy
Obesity_Rate	–0.075	<0.001	Higher obesity → significantly lower life expectancy

Doctors_Per_1000	+0.41	0.021	More doctors linked to longer lives
GDP_Per_Capita	Not significant	0.17	Weak independent effect when health spending is controlled

Model Fit:

- $R^2 = 0.76$
- All VIF < 2.5 (no serious multicollinearity)
- Residuals approximately normal
- No influential observations (Cook's D < 0.5)

6. Visual Outputs (from SAS):

- Life expectancy vs. spending scatterplot with regression line
- Coefficient bar chart with confidence intervals
- Residual plot and normal Q–Q plot
- Country-level predicted vs. actual chart

7. Deliverables

- Clean .sas code for model estimation and diagnostics
- Econometric report (20 pages), including:
    - Variable rationale and correlation structure
    - Coefficient interpretations and model fit evaluation
    - Sensitivity analysis excluding outliers
    - Summary table ranking countries by efficiency (actual vs. predicted)
- 4-slide visual briefing deck:
    - Key findings
    - Policy recommendations
    - Benchmarking insights

8. Client Outcome & Application

- Shared with OECD partners to inform policy briefings
- Used in a comparative efficiency report for health ministries
- Informed strategic healthcare budgeting workshops in four countries

9. Strategic Value Delivered

- Quantified the **marginal health outcome per dollar spent**
- Enabled **international benchmarking of system efficiency**
- Delivered **evidence-based input** to health financing discussions