AN ECONOMETRIC ANALYSIS TO EXAMINE THE IMPACT OF FUEL PRICE FLUCTUATIONS ON FOOD INFLATION IN URBAN INDIA, USING MULTIPLE LINEAR REGRESSION IN MINITAB.

1. Background & Rationale

In India, urban food prices are highly sensitive to input costs, among which fuel (especially petrol and diesel) plays a central role. Transportation and energy costs directly affect the supply chain of essential food commodities. This study aims to quantify this dependency using econometric modeling to inform urban inflation management strategies and transport pricing policies.

2. Objectives

- To assess the relationship between monthly fuel price changes and food inflation in Indian urban centers.
- To test the hypothesis that rising fuel prices are significantly associated with higher food inflation.
- To estimate the strength of this association using a multiple linear regression model in Minitab.
- To produce an analytical report with diagnostic checks and policy-relevant recommendations.

3. Data Source and Structure

Data Period:

January 2018 – December 2023 (72 monthly observations)

Dataset Variables:

Variable	Type	Description
Food_Inflation (%)	Dependent	Monthly YoY change in food price index (Urban CPI)
Petrol_Price (INR/ltr)	Independent	Monthly average petrol price in metros
Diesel_Price (INR/ltr)	Independent	Monthly average diesel price in metros

Rainfall_Deviation (%)	Control	Monthly deviation from long-term average rainfall
Wholesale_Index (%)	Control	Monthly change in WPI of food grains

Data Cleaning:

- Missing values for 2 months filled via linear interpolation
- Petrol and diesel prices averaged across Mumbai, Delhi, Kolkata, Chennai
- Rainfall data sourced from IMD; WPI data from MOSPI

4. Econometric Methodology

Software Used:

Minitab 21

Model Specification:

Multiple Linear Regression Model:

$$\text{Food\_Inflation}_t = \beta_0 + \beta_1 \cdot \text{Petrol\_Price}_t + \beta_2 \cdot \text{Diesel\_Price}_t + \beta_3 \cdot \text{Rainfall\_Deviation}_t + \beta_4 \cdot \text{Wholesale\_Index}_t + \epsilon_t$$

Procedures in Minitab:

1. **Data Import and Variable Setup**
    - Imported .csv file
    - Assigned variable types and labels
2. **Regression Modeling:**
    - *Stat > Regression > Fit Regression Model*
    - Checked p-values, confidence intervals, and adjusted R^2
3. **Diagnostics Performed:**
    - Variance Inflation Factor (VIF)
    - Residual vs. Fitted plots
    - Normal Probability Plot
    - Durbin-Watson Test (for autocorrelation)

5. Results & Interpretation

Regression Coefficients:

Predictor	Coefficient (β)	p-value	Interpretation
Intercept	1.52	—	Base food inflation with other variables zero
Petrol_Price	0.16	0.002	1 INR increase in petrol → 0.16% rise in food inflation
Diesel_Price	0.21	0.001	Diesel has slightly stronger inflationary effect
Rainfall_Deviation	-0.05	0.038	Negative impact suggests better rainfall lowers inflation
Wholesale_Index	0.32	<0.001	Strong direct effect on consumer food inflation

Model Fit Metrics:

- $R^2 = 0.78$
- Adjusted $R^2 = 0.76$
- Durbin-Watson = 2.01 (no autocorrelation)
- VIF < 4 for all predictors (no multicollinearity)

6. Visualizations (Created in Minitab)

- Line chart of food inflation vs fuel prices (overlayed)
- Residual vs. fitted value plot
- Histogram of residuals
- Coefficient plot with 95% CI error bars

7. Recommendations

- Government food pricing policy should integrate fuel cost volatility as a structural factor
- Build a fuel-linked buffer system for food distribution cost estimation
- Urban logistics subsidies may be required during sustained fuel price hikes to control inflation

8. Future Research Directions

- Introduce lagged variables (e.g., fuel prices with 1–2 month lags) for stronger causal inference
- Expand model to include LPG and electricity tariffs
- Use segmented regression for pre- and post-COVID comparison
- Extend to a panel dataset across metro cities for spatial econometric modeling

9. Relevance and Applications

Academic Use:

- Excellent teaching case for econometric modeling in applied development economics
- Relevant for dissertations in public finance, urban economics, and energy policy

Corporate & Government Use:

- Helps policymakers forecast food inflation under volatile fuel pricing
- Aids FMCG and retail logistics teams in demand planning under cost fluctuation scenarios