Power Reliability and U.S. State-Level Economic Growth and Income Inequality

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Introduction and Motivation

Research Question: How do power interruptions impact economic growth and income inequality at the state level?

Importance:

- Power reliability is essential for economic stability.
- Interruptions disrupt business, impact households, and can increase income disparities.

Research Gap: Limited studies on these impacts within the U.S. context.

Research Objectives

Goal: Assess the impact of power reliability on state GDP and income inequality.

Key Indicators:

- Economic Growth: Measured by state-level GDP.
- Income Inequality: Measured by the Gini Index.

Data and Methodology

Data Sources:

- Power reliability data: U.S. Energy Information Administration (2013-2022)
- Economic and demographic data: Bureau of Economic Analysis

Methodology: Dynamic System Generalized Method of Moments (GMM)

- Addresses dynamic panel data and endogeneity.
- Uses lagged levels as instruments for greater efficiency with persistent variables.

Model Specification

Dynamic System GMM Model:

$$Y_{it} = \alpha Y_{i,t-1} + \beta X_{it} + \gamma Z_{it} + u_i + \epsilon_{it}$$

Explanation:

- Y_{it}: Dependent variable (e.g., GDP or Gini Index) for state i at time t.
- $Y_{i,t-1}$: Lagged dependent variable, capturing the dynamic nature.
- X_{it}: Power reliability metrics (SAIDI, SAIFI).
- Z_{it}: Control variables (e.g., population, unemployment rate).
- u_i: State-specific effects, accounting for unobserved characteristics of each state.

Purpose of Model:

- To assess the impact of power reliability on GDP and income inequality, controlling for state-specific characteristics.

Control Variables and Model Specifications

Control Variables:

- GDP, income inequality (Gini Index), unemployment rate, population.

Model Selection:

- System GMM chosen over Difference GMM for greater efficiency and robustness.
- Use of interaction terms for nuanced understanding.

Key Findings

Impact on GDP:

- A 1% increase in power interruptions leads to a 0.5% - 2.7% decrease in GDP.
- Short-term GDP loss of up to $883 billion.

Impact on Income Inequality:

- 1% increase in power interruptions raises Gini Index by 0.3% - 1.1%.
- Disproportionate effect on lower-income groups.

Marginal Effects Analysis

SAIFI (Frequency) Effects:

- Short-run GDP impact: \$883 billion loss.
- Long-run GDP impact: \$1.65 trillion loss.

Policy Implication: Frequency of interruptions has the most severe economic impact, suggesting policy should target frequent outages.

Conclusion and Policy Implications

Main Takeaways:

- Improving power reliability is essential for economic stability and reducing income inequality.
- High-frequency outages are particularly costly.

Policy Recommendations:

- Invest in resilient infrastructure.
- Target efforts on reducing both frequency and duration of outages.

Global Relevance: Insights applicable to other countries in enhancing energy infrastructure.

Q&A

Thank you for your attention!

Please feel free to ask any questions.