Geographic Disparities in Test Scores Across America:

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Introduction

Context: Geographic location is a significant factor in educational equity in the U.S.. Rural regions often face unique challenges (e.g., resource access) compared to urban areas.

Problem: A persistent educational gap exists between rural and urban schools. Challenges in rural settings might lead to lower standardized test scores.

Research Focus: This study investigates the relationship between school locale types (urban, suburb, town, rural) and student academic achievement (math test scores).

Approach: Uses proportions of students in various locales rather than a simple rural/non-rural split, viewing locales as proxies for resource access.

Hypothesis: Students in certain locales (potentially rural/remote) may show lower test performance compared to peers, influenced by socioeconomic factors..

Data & Methodology

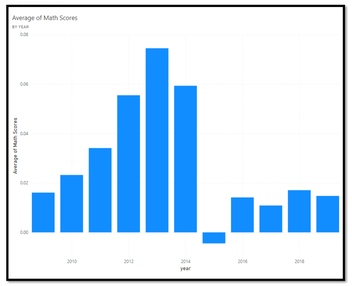
•**Data Source:** Stanford Education Data Archive (SEDA) v.5.0, providing nationally standardized math test scores (grades 3-8, 2009-2019) and demographic data at the district level.
•**Dataset:** Merged geographic and covariant data, resulting in 600,028 observations.
•**Key Variables:**
- Student Achievement: Math test scores (relative to the national average).
- Locale Categories: Urban, Suburb, Town, Rural (including sub-types like rural fringe, distant, remote).
- Control Variables: Socioeconomic factors like poverty rate, unemployment rate, % economically disadvantaged students.

•**Analysis Methods:**
- Descriptive Statistics: Summarize data characteristics.
- Correlation Analysis: Identify relationships between scores and locales.
- Regression Models: Quantify and predict the impact of locale types on test scores.
- Interquartile Range (IQR) Analysis: Examine score distribution within locale categories

Rural and Non-rural Disparities

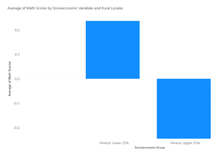
Overall Trend: A slight negative correlation (-0.0734) exists between test scores (relative to the national average) and the proportion of students in rural schools. Simple regression confirms that a higher proportion of rural students significantly predicts lower test scores relative to the national average.
- **Specific Locale Impacts (Regression):** Rural Fringe locales show a positive association with test scores (compared to the national average).
- Rural Distant and Rural Remote locales show negative associations with test scores.
- Urban and Town locales are also associated with lower test scores relative to the national average.
- **Achievement Patterns (IQR Analysis):** The impact of locale varies across the achievement distribution: **Rural Remote & Town Remote Areas:** Districts with the highest proportion (upper 25%) tend to have average test scores *below* the national average, suggesting challenges for higher achievers. For instance, in Rural Remote areas, the mean score for the upper 25% group was -0.07 (below national avg.), while the lower 25% was +0.047.
- **Large Suburban Areas:** Show the opposite pattern. Districts with the highest proportion (upper 25%) have average test scores *well above* the national average (e.g., +0.18 in Suburb Large), indicating these locales may better support high achievement relative to national standards.
- **Large City Areas:** Follow a pattern like rural/town remote, with the upper 25% scoring below the national average (-0.08).

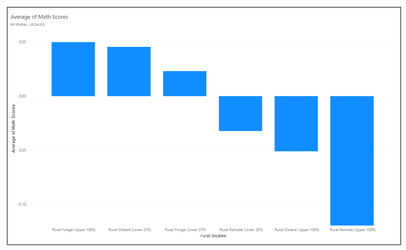
Core Finding: Geographic locale significantly impacts how student test scores compare to the national average, with distinct patterns for rural, town, city, and suburban areas. Challenges in rural/remote areas may disproportionately affect higher-achieving students



Average math scores by year

Upper and lower percentiles of the percentage economically disadvantaged along side test scores

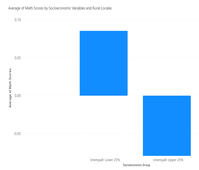




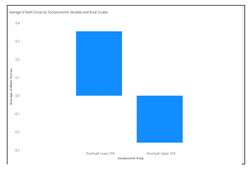
Average math scores across each rural locale group

Socioeconomic Effects on Test Scores

•**Context:** The study acknowledges that socioeconomic factors are intertwined with locale and impact student achievement. Analysis controlled for key socioeconomic variables at the district level.
Variables Examined:
•perecd: Percent Economically Disadvantaged
•povertyall: Poverty Rate
•unempall: Unemployment Rate
•**Correlation with Test Scores (cs_mn_all):** All examined socioeconomic factors show significant negative correlations with district average test scores (relative to the national average): Percent Economically Disadvantaged (perecd): -0.6643
•Poverty Rate (povertyall): -0.5509
•Unemployment Rate (unempall): -0.3881
•**Regression Analysis (Controlling for Locales):** In a model including detailed locale types, socioeconomic factors remained significant predictors of test scores (p<0.000 for all):
•perecd: Coefficient = -0.999
•povertyall: Coefficient = -0.443
•unempall: Coefficient = -1.410
•*Interpretation*: Higher rates of economic disadvantage, poverty, and unemployment are associated with significantly lower average test scores, even after accounting for the type of geographic locale.
•**Impact Across Distribution (Lower vs. Upper 25%):** Comparing districts in the lowest 25% versus the highest 25% for each indicator highlights the disparity:
•**Perecd:** Districts in the lowest 25% had average scores of +0.24, while those in the highest 25% averaged -0.25.
•**Povertyall:** Districts in the lowest 25% averaged +0.35, while the highest 25% averaged -0.26.
•**Unempall:** Districts in the lowest 25% averaged +0.09, while the highest 25% averaged -0.08.
Conclusion: Socioeconomic conditions within a district show a strong, negative relationship with student test scores relative to the national average.



Upper and lower percentiles of the unemployment rate along the test scores



Upper and lower percentiles of the poverty rate along side the test scores

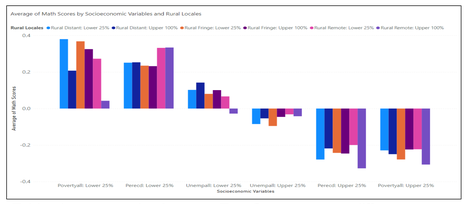


Table showcases the Average Test Scores across different Locale Groups as well as Socioeconomic Variables

Discussion:
Key Observation: Rural locales are negatively associated with test scores relative to the national average.
•**Nuanced Finding (IQR):** The negative impact in rural remote, town remote, and large city areas seems pronounced for higher-achieving students (upper 25% score below national average). This suggests potential limitations in supporting top performance.
•**Contrast:** Suburbs show the opposite trend, potentially better supporting high achievement relative to the national average.
•**Possible Explanations:** Disparities may stem from variations in resources, teacher expertise, funding, access to advanced courses, etc..
•**Implications:** Findings highlight challenges for high-achievers in certain locales and underscore the need for tailored interventions and policies to enhance equity. Specifically, rural remote areas may need investment to help students meet/exceed national benchmarks.
•**Future Research:** Deeper investigation needed into specific resources, support structures, and longitudinal impacts.

References

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