Rural-Urban Disparities in Student Achievement

Ashton Jaubert Ryan Orr Sal Patlan

A05134796, A04996761, A05109647

Texas State University

Rural-Urban Disparities in Student Achievement

Geographic location presents a significant dimension in understanding educational equity across the United States. While urban areas may contend with large class sizes, rural regions often face unique challenges stemming from lower population density and potentially limited access to resources. These challenges may affect the academic progress of students in rural settings, potentially manifesting as lower standardized test scores compared to their urban counterparts. Recognizing the persistent educational gap between rural and urban schools, this research investigates the relationship between living in different school locale types and student academic achievement. Instead of relying solely on a broad rural and non-rural categorization, we employ a more raw approach, using proportions of students attending schools in various locales . Framing these locale classifications as proxies for accessible educational resources and acknowledging the economic implications of resource availability and teacher quality, this study explores whether these locale types are associated with variations in student test scores. We hypothesize that students in certain locale types may exhibit lower test performance compared to their peers due to factors such as socioeconomic variables that may drive a strong negative impact on student achievement . To examine this, we will utilize data from the Stanford Education Data Archive (SEDA), which provides comprehensive information on student performance and demographic variables at the district level across the United States. We will employ regression analysis to quantify the relationship between school locale types and student test scores, controlling for key socioeconomic factors including poverty rate, unemployment rate,

and the percentage of economically disadvantaged students. This study aims to illuminate the relationship between geographic location and educational achievement, contributing to the ongoing dialogue concerning the enhancement of educational equity across diverse communities.

Rural-Urban Disparities in Student Achievement

Literature Review

Previous research on educational disparities has often focused on achievement gaps within urban and suburban areas, highlighting the impact of socioeconomic and racial-ethnic segregation. However, there is a growing body of research examining the unique challenges and opportunities in rural education. Studies have shown that rural schools often face challenges such as limited resources, geographic isolation, and specific demographic compositions. Drescher, Podolsky, Reardon, and Torrance (2022) used data from the Stanford Education Data Archive (SEDA) to explore the state of educational opportunity in rural America. Their study indicated that while there are modest differences in outcomes between rural and nonrural students overall, larger disparities exist for specific subgroups. Additionally, they found that socioeconomic status has a weaker relationship with achievement in rural areas compared to nonrural areas. This literature review will elaborate the existing findings on rural-urban disparities, identify gaps in knowledge, and establish the context for the present study's investigation into the intricate dynamics of educational achievement across diverse geographic locales.

Data and Methodology

This study uses data from one primary source to provide a comprehensive analysis of rural-urban disparities in student achievement.

1. Stanford Education Data Archive (SEDA) version 5.0 reports nationally standardized measures of student achievement for nearly all schools and districts in the United States. We then Merged the geographic district dataset to the corresponding covariant. The merged dataset comprises 600,028 observations and includes student assessment data along with locale classifications and demographic information.Key variables include math test scores (representing student achievement), locale categories such as urban, suburb, town, rural, demographic variables such as poverty rate, unemployment, and comparison percentages of different races and ethnicities. This dataset allows for detailed analysis of how student test scores vary across different geographic settings while including demographic. We used mathematical test scores to represent student achievement through grades 3-8 in records of years 2009-2019.

The methodological approach involves a combination of descriptive statistics, correlation analysis, regression models, and interquartile range analysis. Descriptive statistics are used to summarize key data characteristics. Correlation analysis helps identify relationships between test scores and locale variables. Regression models are employed to predict test scores based on various locale categories and to assess the statistical significance of these relationships.

Interquartile range analysis is used to examine how test scores are distributed across different quartiles within each locale category, providing insights into the consistency of achievement across different student groups.

Results

The analysis of the merged dataset reveals several key findings regarding student test scores, measured as differences from the national average, and their relationship with various geographic and demographic factors.

Descriptive Statistics:

- The dataset includes 600,028 observations with a mean test score of 0.0291226 and a standard deviation of 0.4168225, both relative to the national average. This indicates that, on average, the test scores in this dataset are slightly above the national average, with a fair amount of variability.
- The mean proportion of students in rural locale schools is 0.4955374, with a standard deviation of 0.4450304.
- The correlation between test scores (relative to the national average) and the rural variable is -0.0734. This suggests a slight tendency for test scores to be lower in areas with a higher proportion of rural students.

2. Regression Analysis:

   A simple linear regression demonstrates that the rural variable has a statistically significant negative coefficient of -0.0687087 when predicting test scores . This means that as the proportion of rural students increases, the predicted test scores tend to decrease relative to the national average.

   - Multiple regression analyses, including various rural metrics, show that locale rural fringe has a positive coefficient , while locale rural distant and locale rural remote have negative coefficients. These coefficients indicate how each specific rural locale type influences test scores compared to the national average, when other factors are held constant.
   - Including non-rural variables (urban and town) in the regression models further influences the relationship with test scores, with urban and town locales showing significant negative coefficients. This suggests that urban and town locales are also associated with lower test scores relative to the national average.
   - Socioeconomics are a heavy factor in the impact of test scores. With variables such as unemployment, percentage economic disadvantaged, and poverty rate, regression analysis shows the most significant variable being unemployment with a coefficient of (-1.410037) this indicates that districts with more unemployment must have the largest difficulties in achieving high test scores.

cs_mn_all	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
locale_city_large	.0584657	.0052451	11.15	0.000	.0481855	.068746
locale_city_midsize	0	(omitted)				
locale_city_small	.0966721	.0044976	21.49	0.000	.087857	.1054873
locale_suburb_large	.0843312	.0039958	21.10	0.000	.0764995	.0921629
locale_suburb_midsize	.0536275	.0047023	11.40	0.000	.044411	.0628439
locale_suburb_small	.0220498	.0049362	4.47	0.000	.0123749	.0317246
locale_town_fringe	.0286467	.0044109	6.49	0.000	.0200014	.0372919
locale_town_distant	.0602441	.0040487	14.88	0.000	.0523088	.0681794
locale_town_remote	.0551944	.00414	13.33	0.000	.0470802	.0633085
locale_rural_fringe	.0336092	.004056	8.29	0.000	.0256595	.0415589
locale_rural_distant	.0148598	.0039229	3.79	0.000	.0071711	.0225485
locale_rural_remote	.052188	.0039929	13.07	0.000	.044362	.0600139
perecd	-.9989874	.002637	-378.84	0.000	-1.004156	-.9938189
povertyall	-.4431305	.0106216	-41.72	0.000	-.4639486	-.4223125
unempall	-1.410037	.0176604	-79.84	0.000	-1.444651	-1.375423
_cons	.6282186	.0040702	154.35	0.000	.6202412	.6361961

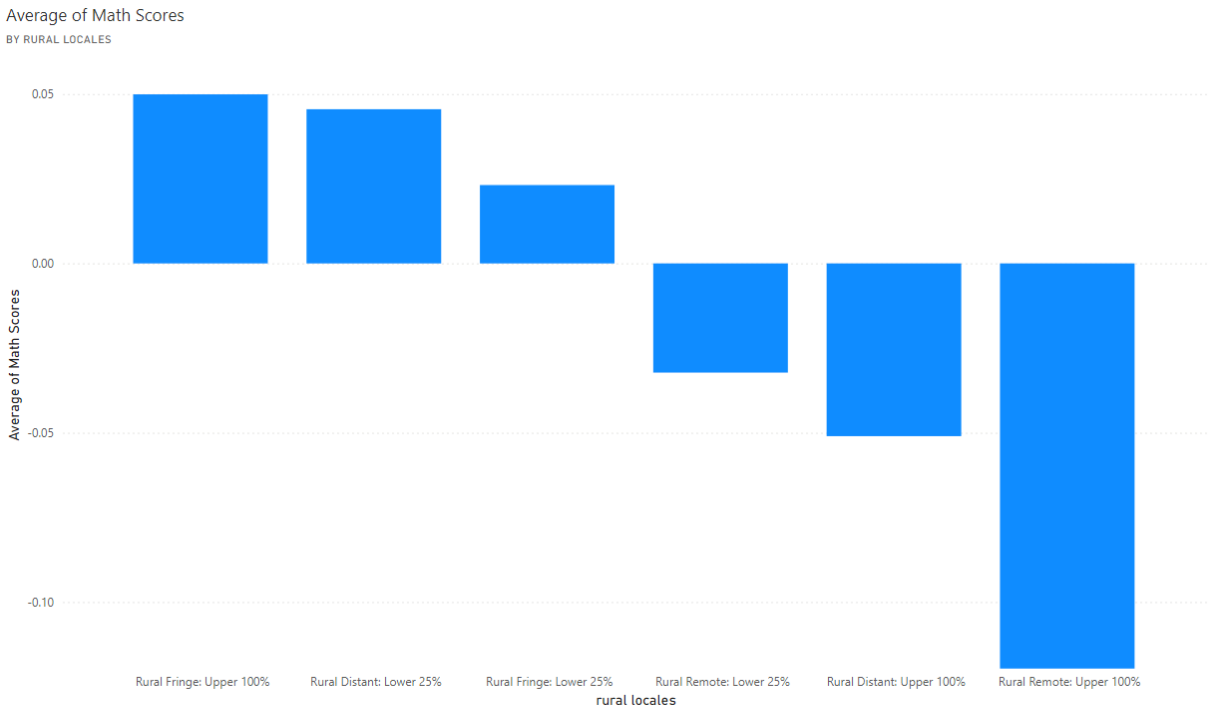
[1]**Figure 1: Regression of all locale types and socioeconomic variables, showcasing the strong negative impact unemployment rate and being economically disadvantaged towards student achievement**

3. Interquartile Range Analysis:

    - Analysis of mean test scores (relative to the national average) across interquartile ranges of locale variables reveals variations in how different locales deviate from the national average across the score distribution.
    - In rural remote areas, mean test scores are 0.0470435 for the lower 25% and -0.0717538 for the upper 25%. This shows that as the proportion of students in

1

rural remote areas increase , test scores, on average, tend to fall below the national average.

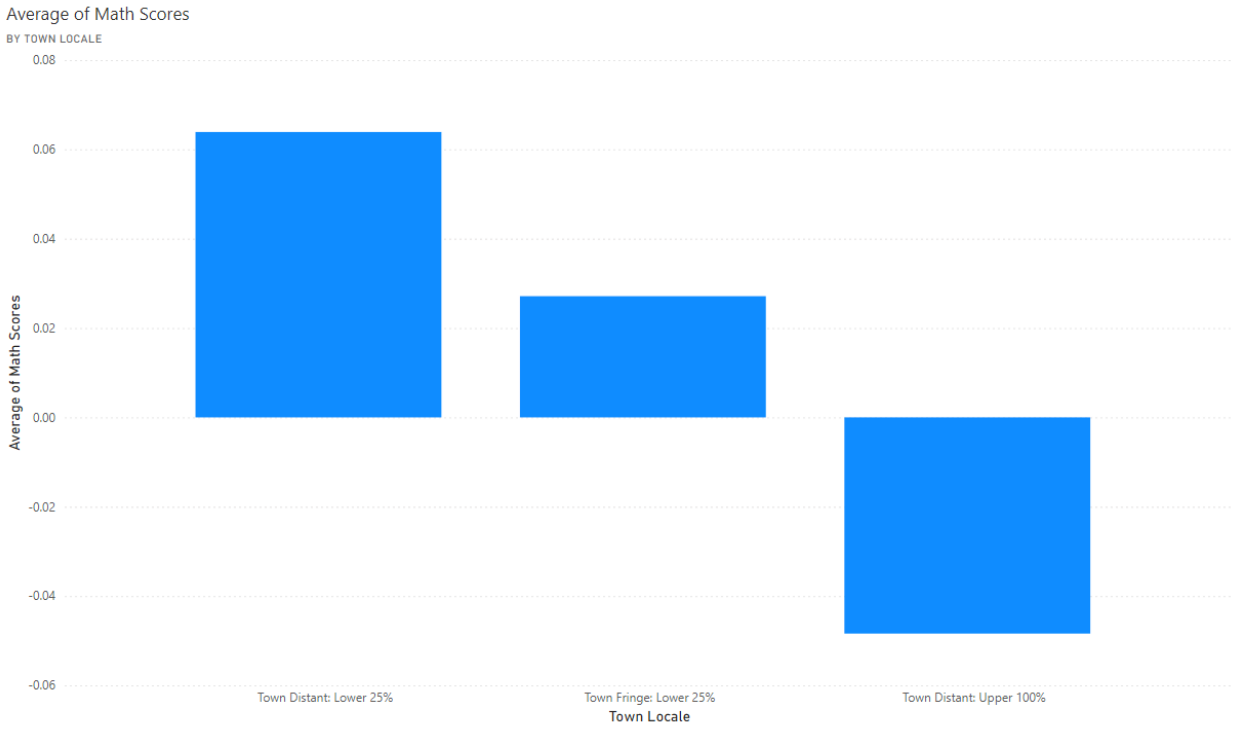


[2]**Figure 2: Shows the lower and upper proportions of distant, fringe and remote of rural areas.**

- A similar pattern is observed in town-remote areas, where mean test scores are 0.0406996 for the lower 25% and -0.0905929 for the upper 25%.

2

- In contrast, in suburban large areas, mean test scores are -0.0196279 for the lower 25% and 0.1840871 for the upper 25%. This indicates that as the proportion of students living in these areas increase so do their test scores.



[3]Figure 3: Different types of Town Locale compared to the national average math test scores:

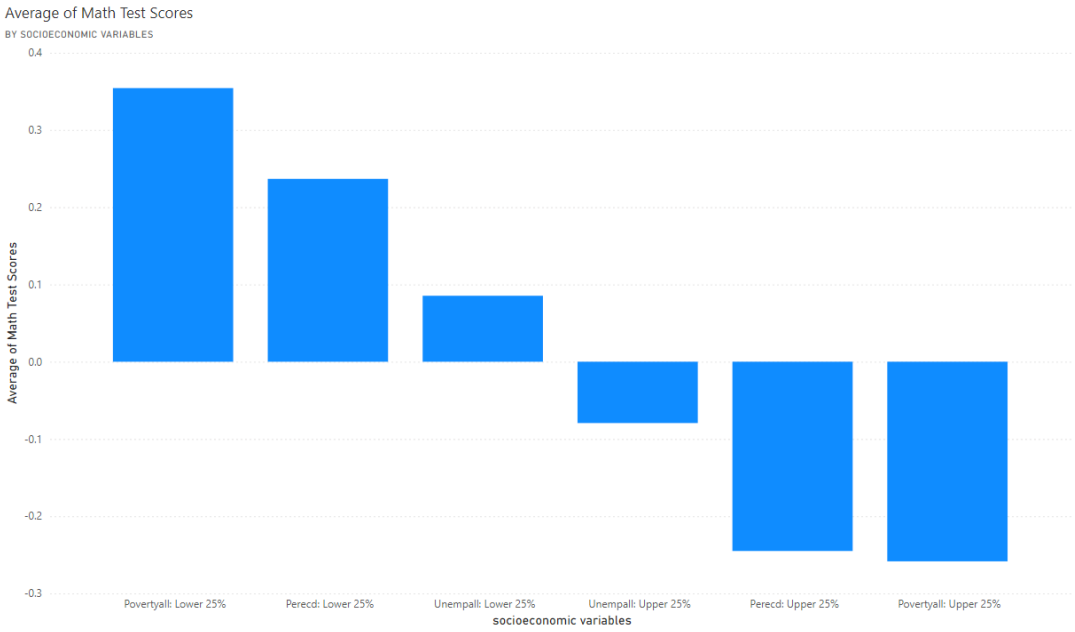
- City large areas also follow the same pattern as rural and town, with mean test scores of 0.0320795 for the lower 25% and -0.0820988 for the upper 25%.

3

These results underscore that locale has a significant impact on how student test scores compare to the national average, with rural ,town, and citylocales generally associated with lower scores, and suburban areas showing a different pattern.

As shown in the regression, socioeconomics were once again a prominent impact on test scores, with districts falling in the higher 25% of unemployment scoring -.0793757 against national average as the lower 25% scores .0854282 above. This pattern is followed with Poverty rate and the percentage of economically disadvantaged students with the lower 25% of poverty rate being below being above (.3542679) as well as percent economically disadvantaged (.2367397)

The top 25% of poverty rate was the biggest impact on the three with average scores of -2450415 below and economically disadvantaged was the second most impactful scoring -.2450415.



[4]Figure 4: The Lower and higher 25% of socioeconomic groups compared to national average math test scores.

Discussion

The findings of this research provide a detailed view of how student test scores, as deviations from the national average, vary across geographic locales. The descriptive statistics confirm that rural areas constitute a significant portion of the dataset, and there is a slight negative correlation between rural locale and test scores relative to the national average. This means that, on average, as the proportion of students in a district increases, the average test scores in that district tend to be slightly below the national average. This initial observation is further supported by regression

4

analyses, which consistently show a negative association between rural locales and test scores, even when controlling for other variables.

The interquartile range analysis reveals a critical insight: the way locale influences test scores is not uniform across the score distribution relative to the national average. In rural and town remote, city-large areas, districts in the upper 25% tend to have substantially lower test scores compared to those in the lower 25%, and in some cases, these scores are below the national average. This suggests that the challenges faced by students in these locales may disproportionately affect higher-achieving students, potentially limiting their ability to reach national benchmarks. In contrast, suburbs show the opposite trend, with higher test scores in the upper 25%, indicating that these locales may provide environments that better support high achievement relative to the national average.

These findings may reflect variations in the capacity of different locales to support student achievement relative to a national standard. Rural and remote areas may struggle to provide the resources, teacher expertise, specialized programs, and overall academic environment necessary to foster high achievement at the level of the top 25% of students nationally. Factors such as funding disparities, teacher shortages, and limited access to advanced courses may contribute to this pattern. Conversely, urban and suburban areas may, on average, have more resources that enable their top 25% to exceed the national average, but this may not be uniform across all students.

It is important to consider the policy implications of these findings, particularly in the context of national educational goals and standards. Interventions and support systems need to be tailored to the specific needs of students in different locales to ensure that all students have the opportunity to achieve at or above the national average. In rural remote areas, there may be a need for increased investment in resources and programs aimed at enabling students to meet and exceed national benchmarks. This could include initiatives to attract and retain qualified teachers, expand access to advanced coursework, and provide additional support for high-achieving students.

Further research is needed to explore the underlying factors contributing to these disparities and to develop effective strategies to address them. This research should include investigations into the specific resources and support structures available in different locales, and analyses of the impact of these factors on student achievement relative to national standards. Qualitative studies and longitudinal data could provide deeper insights into the complex interplay of locale, resources, and student outcomes.

Conclusion

This research paper provides a comprehensive analysis of how student test scores, as deviations from the national average, vary across rural and urban locales. Drawing on a large-scale dataset and rigorous statistical methods, the findings highlight the nuanced impact of locale on student achievement. Key insights include the challenges faced by high-achieving students in rural and

remote areas and the broader implications of locale for educational equity. The study underscores the need for targeted interventions and policies that address the specific needs of students in different geographic settings, ultimately striving to ensure that all students have the opportunity to succeed relative to national educational standards.

References

Drescher, J., Podolsky, A., Reardon, S. F., & Torrance, G. (2022). The geography of rural educational opportunity. *RSF: The Russell Sage Foundation Journal of the Social Sciences, 8*(3), 123-149. https://doi.org/10.7758/rsf.2022.8.3.05

Johnson, A., Kuhfeld, M., & Soland, J. (2021). The Forgotten 20%: Achievement and Growth in Rural Schools Across the Nation. *AERA Open, 7*(1), 1-17. https://doi.org/10.1177/23328584211052046

Reardon, S. F., Ho, A. D., Shear, B. R., Fahle, E. M., Kalogrides, D., & Saliba, J. (2024). *Stanford Education Data Archive (Version 5.0)*. Retrieved from https://purl.stanford.edu/cs829jn7849