

National ranking is influenced by spatial units' choices: Comment on Richard Florida's 2015 Segregated City Report

Summary: A 2015 report found the city of Tallahassee was the overall most economically segregated city in the United States. The report investigated 350 metropolitan areas in the US and its findings led to widespread concern about the validity of city-specific rankings. Ranking-based analysis is often used when developing local, regional, and national policies, and it can have broad social and political impacts on citizen satisfaction, turnover of public officials, and allocation of public resources. What is less well known is that rank-based equity analysis across geographic regions depends on the choice of spatial units. Our research team found the report's rankings were sensitive to the partitioning choice (i.e., census tract). **We recommend that datasets used for policy development in the City of Tallahassee:**

1. Be evaluated for their sensitivity to the choice of spatial partitions such as census blocks and census tracts.
2. Analyzed using the finest available spatial scale.

Background: Most studies in the U.S. are based on data aggregated from the U.S. Census Bureau. However, the studies often do not report the sensitivity of their results to the choice of spatial partitioning (e.g., census tract, census block group). This impacts policy development that relies on Census Bureau spatial data. For example, underestimation or overestimation of income inequality can affect policymaking related to economic development, social welfare, healthcare, and community sustainability and resilience that rely on geographically aggregated data. Knowing the sensitivity of income inequality values at different scales is useful to account for possible errors and assess the need for additional data collection (e.g., surveys) to reduce the error.

The research summarized in this brief shows that segregation measures (e.g., segregation index) diminish with an increase in the scale of partition (e.g., going from census block groups to census tracts). In addition, the rate of decrease is not uniform across different regions which may affect the comparative analysis (e.g., ranking) based on such measures. The findings apply to some inequality measures (e.g., Gini index, income quintile share ratio (IQSR)) as well. Policies that consider absolute values or regional rankings based on such measures derived from coarse-grain data may underestimate or overestimate the actual inequality in the region.

This concerns the city of Tallahassee because the city was ranked in 2015 as the most segregated city by Richard Florida's study on segregation [1]. The segregation analysis was performed on aggregated data at the census tract level. The high ranking of economic segregation made Tallahassee residents question the city's 30-year gentrification project for poor neighborhoods of the city. They also questioned whether the additional tax revenue that had been used to develop multi-use residential property in these neighborhoods should be shifted towards creating new job opportunities to reduce poverty and segregation [2, 3, 4]. However, through our study [1] we found that Tallahassee ranked 14th at the census tract level and ranked 92nd at the block group level (Appendix). The results indicate that the city is not nearly as segregated as the Richard Florida study indicated and the residents were given an inaccurate picture of the situation.

Methods of our case study: We used the index of dissimilarity (IOD) to conduct a small study on wealth segregation in the US at two different levels of analysis (i.e., census tract and census block group). We then compared our ranking results with the rankings from Segregated City: The Geography of Economic Segregation in America's Metros by Richard Florida and Charlotte

Mellander [1]. For this study, we used the 2010 American Community Survey (ACS) 5-Year Estimate data (2006-2010) [5] available in TIGER/Line shapefile format and metropolitan and micropolitan statistical areas (MMSA) shapefile [6]. The data analysis at two different scales (i.e., census block group and census tracts) generated two sets of rankings. The rankings were then used to calculate the changes in ranking across the two scales. We compared our census tract-based rankings with the ones in the study to validate the similarity between the two approaches.

Our research team analyzed one component of income segregation and found that Tallahassee's Income segregation is only one part of a city's overall segregation ranking in Florida's study. However, if a change in the scale of analysis changes the value of income segregation, then it must also change the rank based on overall segregation. Table 1 (Appendix) shows changes in rankings for large metro areas including Tallahassee where the Wealthy are Most Segregated. The results clearly show a sharp change in the rankings across different metropolitan regions when the data is re-analyzed at the census-block level.

Policy implications: Our research has broad implications for policy development based on aggregated spatial analysis. For example, knowing the range of a given measure across different scales of analysis can help calibrate policy decisions. Further, a large range indicates a high-value fluctuation which may require additional measures to better inform policy decisions. In addition, it also impacts the comparative analysis (e.g., ranking) across jurisdictions that is used to prioritize one area over another for fund allocation. When comparing cities or regions based on a measure, consider the rankings as a function of spatial scale and not the ground truth.

We broadly recommend that policy analysts provide additional sensitivity indicators for a given measure while performing aggregated spatial analysis and, depending on the availability of data and resources, prefer finer-scale spatial datasets for analysis. Similarly, policymakers need to have some understanding of sensitivity indicators and consider them while deriving conclusions.

Policy recommendations (for policymakers):

1. Consider sensitivity indicators of the analysis to derive conclusions (See "Implementation Considerations" below).
2. Consider comparative analysis at multiple spatial scales (e.g., census blocks vs census tracts vs counties and so on) as the analysis depends on spatial scale and may not reflect ground truth.

Policy recommendations (for policy analysts):

1. Provide additional sensitivity indicators for a given measure for aggregated spatial analysis.
2. Depending on availability, prefer finer-scale spatial datasets.

Implementation Considerations: To implement such policies, importance must be given to simple yet effective sensitivity indicators with meaningful interpretations. For example, indicators such as trends or bounds can be provided to explain the behavior of a measure and the range of values within which it can lie. Computational tools can be developed which can automatically generate such indicators along with any aggregated spatial analysis.

To compare cities or regions based on a measure, some of the indicators such as bounds can be used to identify the possibilities when one region may rank above (or below) another. In addition, instead of relying on a single measure a set of measures could be considered to derive conclusions.

Appendix

Table 1. Large Metros* where the Wealthy are Most Segregated**

Large Metro	Rank ¹	IOD ¹	Rank ²	IOD ²	Rank ³	IOD ³
Memphis, TN-MS-AR	5	0.582	5	0.582	54	0.648
Birmingham-Hoover, AL	8	0.576	8	0.576	58	0.645
Louisville-Jefferson County, KY-IN	9	0.575	9	0.575	47	0.650
San Antonio-New Braunfels, TX	10	0.567	10	0.567	49	0.650
Cleveland-Elyria-Mentor, OH	13	0.560	12	0.561	97	0.624
Tallahassee, FL	12	- ⁴	14	0.560	92	0.626
Detroit-Warren-Livonia, MI	17	0.552	16	0.555	79	0.632
Nashville-Davidson-Murfreesboro-Franklin, TN	23	0.549	21	0.549	145	0.605
Columbus, OH	25	0.547	24	0.547	93	0.626
Charlotte-Gastonia-Rock Hill, NC-SC	29	0.541	29	0.541	151	0.603
Miami-Fort Lauderdale-Pompano Beach, FL	31	0.540	54	0.522	122	0.616

¹According to study by R. Florida [3]

² Using aggregation at census tract. The ranking is also used to sort the table rows.

³ Using aggregation at census block group

⁴ Richard Florida's study does not provide actual values for the segregation of the wealth for the City of Tallahassee.

* Those with one million or more people

Author Biography

Jayant Gupta: Jayant Gupta is a Ph.D. candidate in the Department of Computer and Science at the University of Minnesota. His dissertation research investigates responsible data science for spatial data currently focusing on the issue of multi-scale spatial partitioning and spatial variability. He is also interested in broader issues such as fairness, accountability, transparency, and ethics (FATE) for societally important and computationally challenging responsible spatial data-science problems. His work appears at flagship spatial data science conferences and journals such as SSTD, SIGSPATIAL, GIScience, and TIST.

Tian Tang: Dr. Tian Tang is an assistant professor in the Askew School of Public Administration and Policy at the Florida State University and the Director of FSU's Sustainability and Governance Lab. Her research is at the intersection of environmental and energy policy, technology policy, and policy implementation through cross-sectoral collaboration in the context of climate change and sustainability. In addition, she also studies smart city technology innovation and their impacts on the efficiency and equity of public service provision. Her research on clean energy technology innovation and smart city technologies has been funded by the National Science Foundation, Department of Energy, The Solar Foundation, and Harvard Sustainability Science Program.

Shashi Shekhar: Shashi Shekhar, a McKnight Distinguished University Professor and a University Distinguished Teaching Professor, at the University of Minnesota and an U.C. Berkeley alumnus, is a leading scholar of spatial data science, spatial computing and Geographic Information Systems (GIS). He is serving on the Computing Research Association (CRA) board, and as a co-Editor-in-Chief of Geo-Informatica journal (Springer). Earlier, he served as the President of the University Consortium for GIS (UCGIS), and on many National Academies'

committees. Recognitions include IEEE-CS Technical Achievement Award, UCGIS Education Award, IEEE Fellow and AAAS Fellow. Contributions include algorithms for evacuation route planning and spatial pattern (e.g., colocation, linear hotspots) mining, an Encyclopedia of GIS, a Spatial Databases textbook, and a [spatial computing book for professionals](#).

Source

[1] Gupta, J., Long, A., Xu, C. K., Tang, T., & Shekhar, S. (2021, August). Spatial Dimensions of Algorithmic Transparency: A Summary. In the 17th *International Symposium on Spatial and Temporal Databases* (pp. 116-125).

Further Reading

[2] Florida, R., & Mellander, C. (2015). *Segregated city: The geography of economic segregation in America's metros*. Martin Prosperity Institute.

[3] Florida, R. America's Most Economically Segregated Cities. 02.23.2015. Bloomberg. <https://www.bloomberg.com/news/articles/2015-02-23/america-s-most-economically-segregated-cities>

[4] Eppers K. Report calls Tallahassee 'most economically segregated'. 02.25.2015. Tallahassee Democrat. <https://www.tallahassee.com/story/news/2015/02/25/report-calls-tallahassee-economically-segregated/24030153/>

[5] Nicholson, Joseph R. "Segregated City: The Geography of Economic Segregation in America's Metros." (2017): 454-458.

[6] U.S. Census Bureau. 2011. The 2006-2010 ACS 5-Year Summary File Technical Documentation.

https://www2.census.gov/acs2010_5yr/summaryfile/ACS_2006-2010_SF_Tech_Doc.pdf

[7] U.S. Census Bureau. 2011. TIGER/LinewithSelectedDemographicandEconomic Data. <https://www.census.gov/geographies/mapping-files/time-series/geo/tiger-data.2010.html>

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