MEASURING SEGREGATION WITH THE NORMALIZED EXPOSURE INDEX

Ann Owens, sean f. reardon, Demetra Kalogrides, Heewon Jang, and Thalia Tom

There are two broad approaches to measuring segregation: measures of *exposure* and measures of *evenness*. Exposure indices measure the school composition that the average student of a given racial group is "exposed" to — e.g., a White-Hispanic exposure value of 0.19 means that the average White student attends a school that is 19% Hispanic. Interpreting exposure measures as indicators of segregation is difficult without taking the population composition into account. In this example, an exposure value of 0.19 would suggest fairly high segregation in a population that is 40% Hispanic — Hispanic students are underrepresented in White students' schools by half their population share — while in a 10% Hispanic population, 0.19 would suggest racial integration — Hispanic students are *overrepresented* in White students' schools.

Evenness indices provide a solution to these interpretation challenges by incorporating population composition into the measurement of segregation. The normalized exposure index is an evenness index that measures the difference between two groups' exposure to one of the groups. The Hispanic-White normalized exposure index, for example, compares Hispanic and White students' exposure to Hispanic students (relative to White students — ignoring the presence of other groups). A Hispanic-White normalized exposure index of 0.5, for example, indicates that the proportion of Hispanic students (as a share of total Hispanic and White student enrollment) in the average Hispanic student's school is 0.5 points higher than in the average White student's school. The normalized exposure index ranges from 0 to 1. A value of 0 implies no

segregation — the two groups have equal exposure to one group (mathematically, this can only happen if the relative proportions of the two groups are the same in every school). A value of 1 implies complete segregation—all schools enroll students from only one group.

FIGURE 1: COMPARING EXPOSURE AND NORMALIZED EXPOSURE INDICES FOR HISPANIC-WHITE SEGREGATION
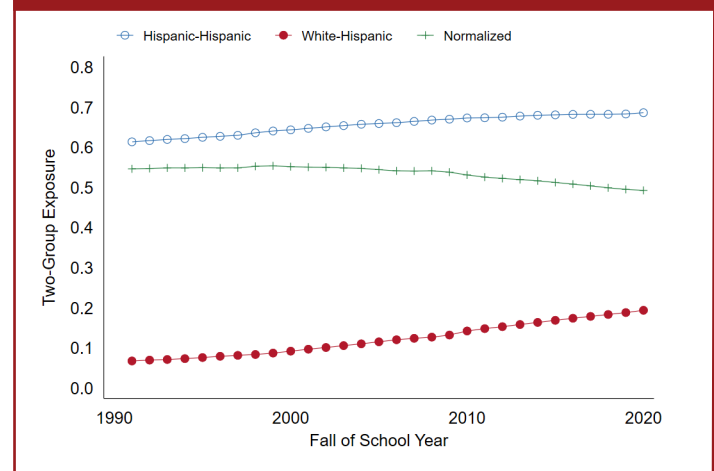
Figure 1 presents two exposure measures — White-Hispanic exposure and Hispanic-Hispanic exposure (exposure to one's own group is called isolation) — and the normalized exposure index. Hispanic isolation increased by 0.073 from 1991 to 2020 — the share of Hispanic students (as a fraction of the number of White and Hispanic students in a school) in the average Hispanic student's school increased from 61.3% to 68.6%. Based on exposure, one could conclude segregation increased — Hispanic students were increasingly isolated in schools with other Hispanic students.

---

[1] *The two-group normalized exposure index is equivalent to the relative diversity index, variance ratio index, and eta-squared.*

[2] *Exposure and normalized exposure measures can take the presence of students from all other racial groups into account or only consider the presence of the two groups of interest. All measures in this brief consider only Hispanic and White students' presence in schools. That is, the proportion of, e.g., Hispanic students in the average Hispanic student's school is estimated ignoring the presence of other groups (i.e., proportion Hispanic = Hispanic students/(Hispanic + White students)).*

However, the Hispanic student population increased substantially during this time, so the share of Hispanic students in White students' schools also increased. In fact, White-Hispanic exposure increased more sharply, by 0.126 — the share of Hispanic students (as a fraction of the number of White and Hispanic students) in the average White student's school grew from 6.7% to 19.3%.

The normalized exposure index measures the difference between Hispanic and White students' exposure to Hispanic students. Because Hispanic-Hispanic exposure increased less than White-Hispanic exposure, segregation, as measured by the normalized exposure index, declined from 1991 to 2020 (by 0.054 — the difference between the change in the two exposure components): Hispanic students' presence in White students' schools increased more quickly than Hispanic isolation. Evenness measures like normalized exposure provide a fuller picture of segregation dynamics by accounting for population changes to capture inequality between groups' contexts — how unevenly students are enrolled by race/ethnicity between schools.

Other types of evenness measures include the dissimilarity index, the relative diversity index, and the information theory index. The relative diversity index is equivalent to normalized exposure in the two-group case. Both the relative diversity index and the information theory index are useful for estimating multigroup segregation — how evenly students from all racial/ethnic groups in a population are enrolled across schools. We measure school segregation here, but both exposure and evenness measures can be used to measure segregation between any smaller unit (e.g., neighborhoods, occupations, firms) within a larger unit (e.g., metropolitan areas, states, industries).

RECOMMENDED RESOURCES

Massey, Douglas S., and Nancy A. Denton. 1988. "The Dimensions of Residential Segregation." *Social Forces* 67(2): 281-315. https://doi.org/10.1093/sf/67.2.281

reardon, sean f., and Glenn Firebaugh. 2002. "Measures of Multigroup Segregation." *Sociological Methodology* 32(1): 33-67. https://doi.org/10.1111/1467-9531.00110

reardon, sean f. and Ann Owens. 2014. "60 Years After Brown: Trends and Consequences of School Segregation." *Annual Review of Sociology* 40: 199-218. https://doi.org/10.1146/annurev-soc-071913-043152

reardon, sean f. and Joseph B. Townsend. 2018. "SEG: Stata module to compute multiple-group diversity and segregation indices." Statistical Software Components S375001, Boston College Department of Economics. https://ideas.repec.org/c/boc/bocode/s375001.html

www.segindex.org