

Measuring Neighborhood Opportunity with Opportunity Atlas and Child Opportunity Index 2.0 Data

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Abstract

Researchers have recently introduced two datasets measuring neighborhood opportunity: the Harvard University Opportunity Atlas data (Chetty et al., 2018b) and the Brandeis University Child Opportunity Index (COI) 2.0 data (Noelke et al., 2020).

The Opportunity Atlas data measure neighborhood opportunity longitudinally on the basis of children's outcomes in adulthood for the years 1989 to 2015. The COI 2.0 data measure neighborhood opportunity contemporaneously for the years 2010 and 2015 on the basis of 29 child welfare indicators categorized into three domains: (1) education, (2) health and environment, and (3) social and economic.

In this article we describe the two datasets and present a data analysis example estimating what the Part I crime distribution in Dallas would be if neighborhood opportunity distributions (based on both neighborhood opportunity data sources) in Dallas were more similar to those of Chicago. We adjust for neighborhood opportunity differences between the two cities using the nonparametric propensity score matching technique (Barsky et al., 2002). We conclude that neighborhood opportunity differences explain little of the crime differences between the two cities.

Introduction

This article introduces readers to and illustrates a practical application of two measures of neighborhood opportunity: the Chetty et al. (2018b) Opportunity Atlas data¹ and the Child Opportunity Index (COI) 2.0 data.²

The main difference between the Opportunity Atlas and COI 2.0 approaches to measuring neighborhood opportunity is that the Opportunity Atlas measures opportunity longitudinally, whereas the COI 2.0 measures are contemporaneous. The Opportunity Atlas also has a narrower focus than the COI 2.0 data. For example, the COI 2.0 data contain health and education measures, whereas the Opportunity Atlas does not. In practice, some of the Opportunity Atlas opportunity measures are highly correlated with the COI 2.0 overall index because the COI 2.0 weighting method is partially based on two Opportunity Atlas child outcome measures.

For a data analysis example, we explore the relationship between the COI 2.0 index, an Opportunity Atlas measure of children's income in adulthood, and Part I crime (defined in the next section) rates in two cities: Chicago and Dallas. We chose to analyze crime because crime was shown to be a major motivation to escape low-opportunity neighborhoods in the Moving to Opportunity experiment (Sanbonmatsu et al., 2011). We analyze census tract data for the cities of Chicago and Dallas because crime incident data were publicly available with the necessary geographic and Uniform Crime Reporting classification information.^{3,4} These cities also have fairly large differences in neighborhood opportunity distributions, which make the data analysis example more interesting and policy-relevant.

We estimate what the crime distribution in Dallas would be if Dallas' neighborhood opportunity distributions (based on both the Opportunity Atlas income measure and COI 2.0 index) were more similar to Chicago's, using Barskey et al.'s (2002) nonparametric propensity score matching technique. Our findings indicate that neighborhood opportunity differences explain little of the differences in crime between the two cities.

The remainder of this article is organized as follows: We discuss data sources in the next section. We then describe specific data used in our data analysis example, and next we report summary statistics and maps. We then present our data analysis example, and the final section includes concluding remarks.

Data Sources

Opportunity Atlas Data

The Opportunity Atlas data consist of 24 child outcome estimates, mainly for children in 1978–1983 birth cohorts, reported in exhibit 1. The outcomes were estimated by Chetty et al. (2018b) with panel microdata from 1989 to 2015; data from the 2000 and 2010 decennial censuses were linked to federal income tax return data and the 2005–2015 American Community Surveys to measure children's outcomes in adulthood, along with some parental characteristics.

¹ <https://www.census.gov/programs-surveys/ces/data/public-use-data/opportunity-atlas-data-tables.html>.

² <http://data.diversitydatakids.org/dataset/coi20-child-opportunity-index-2-0-database>.

³ <https://data.cityofchicago.org/>.

⁴ <https://www.dallasopendata.com/>.

Exhibit 1

Opportunity Atlas Child Outcome Measures

Number	Outcome
1	Fraction of children who have a male claimer in the year they are linked to parents
2	Fraction of children who have a female claimer in the year they are linked to parents
3	Fraction incarcerated on April 1, 2010
4	Mean percentile rank (relative to other children born in the same year) in the national distribution of household income
5	Baseline income measure (2014–2015 income) as defined above but restricted to children who live in one of their childhood commuting zones in adulthood
6	Probability of reaching the top 1 percent of the national household income distribution (among children born in the same year) in 2014–2015
7	Probability of reaching the top quintile of the national household income
8	Mean percentile rank (relative to other children in the same year) in the national distribution of household income, measured at ages 24, 26, and 29
9	Mean percentile rank (relative to other children born in the same year) in the national distribution of individual income measured as mean earnings in 2014–2015 for the baseline sample
10	Baseline income measure (2014–2015 income) as defined above but restricted to children who live in one of their childhood commuting zones in adulthood
11	Probability of reaching the top 1 percent of the national individual income distribution (among children born in the same year) in 2014–2015
12	Probability of reaching the top quintile of the national individual income distribution (among children born in the same year) in 2014–2015
13	Mean percentile rank (relative to other children born in the same year) in the national distribution of individual income, measured at ages 24, 26, and 29
14	Fraction of children who grew up in a given tract and end up living in a tract with a poverty rate of less than 10 percent (according to tract-level Census 2000 data) in adulthood (tracts where children live as adults are defined as the tract of the last non-missing address observed on tax returns)
15	Fraction of children who file their federal income tax return as “married filing jointly” or “married filing separate” in 2015
16	Fraction of children who file their federal income tax return as “married filing jointly” or “married filing separate” at ages 26, 29, and 32
17	Mean individual income rank in 2014–2015 for the spouses of children who grew up in the given tract (child’s spouse refers to the person to whom they are married in 2015)
18	Fraction of children who live in one of their childhood commuting zones in adulthood
19	Fraction of children who live at the same address as their parents in 2015
20	Fraction of individuals who live in one of their childhood census tracts in adulthood
21	Fraction of women who grew up in the given tract who ever claimed as a dependent at any point a child who was born when they were between the ages of 13 and 19
22	Fraction of children claimed by two people in the year they are linked to parents
23	Fraction of children with positive W-2 earnings in 2015
24	Fraction of children with positive W-2 earnings at ages 24, 26, 29, and 32

Source: OpportunityInsights.org

Chetty et al. (2018b) generated tract-level estimates of children’s outcomes in adulthood by race, gender, and parents’ income level (the 1st, 25th, 50th, 75th, and 100th percentiles). They also produced pooled estimates for all races, pooled estimates for both genders, and pooled estimates for all races and both genders. The Opportunity Atlas data also contain mean predictions unconditioned on parental income.

Children were assigned to census tracts in proportion to the amount of their childhood they spent in each tract. In each tract-by-gender-by-race cell, Chetty et al. (2018b) predicted the conditional

expectation of children’s percentile outcomes in adulthood, given their parents’ percentile in the household income distribution, using a univariate regression accounting for nonlinearity. Some outcomes are reported for different ages of children when they reach adulthood.

To protect privacy, Chetty et al. (2018b) added a small amount of random noise to each estimate; typically, the noise is less than one-tenth of the standard error of the estimate itself (Chetty et al., 2018b). The Opportunity Atlas data contain standard errors for each outcome, which account for both sampling error and the random noise added to the estimates for privacy protection.

The Opportunity Atlas data are available at the national, county, commuting zone, and census tract level.

Child Opportunity Index 2.0 Data

COI 2.0 data measure child neighborhood opportunity based on 29 indicators categorized into three domains: education, health and environment, and social and economic. We list the domains and factors in exhibit 2 (adopted from Noelke et al., 2020, table 2). More complete information, including data sources, is available in Noelke et al. (2020) and Acevedo-Garcia et al. (2020).

Exhibit 2

Child Opportunity Index (COI) 2.0 Indicators and Sources (1 of 2)	
Indicator	Description (Source)
Education Domain	
Early Childhood Education (ECE)	
ECE centers	Number of ECE centers within a 5-mile radius (Noelke et al.’s own data collection from state and federal sources)
High-quality ECE centers	Number of NAEYC-accredited centers within a 5-mile radius (authors’ data collection from state and federal sources)
ECE enrollment	Percentage of 3- and 4-year-olds enrolled in nursery school, preschool, or kindergarten (American Community Survey [ACS])
Elementary Education	
Third grade reading proficiency	Percentage of third graders scoring proficient on standardized reading tests (EDFacts, Great Schools [GS], and Stanford Education Archive [SEDA])
Third grade math proficiency	Percentage of third graders scoring proficient on standardized math tests (EDFacts, GS, and SEDA)
Secondary and Postsecondary Education	
High school graduation rate	Percentage of ninth graders graduating from high school on time (EDFacts and GS)
Advanced Placement (AP) course enrollment	Ratio of students enrolled in at least one AP course to the number of 11th and 12th graders (Civil Rights Data Collection [CRDC])
College enrollment in nearby institutions	Percentage of 18–24-year-olds enrolled in college within 25-mile radius (ACS)
Educational and Social Resources	
School poverty	Percentage of students in elementary schools eligible for free or reduced-price lunches, reversed ⁵ (National Center for Education Statistics, Common Core of Data)
Teacher experience	Percentage of teachers in their first and second year of teaching, reversed (CRDC)
Adult educational attainment	Percentage of adults aged 25 and older with a college degree or higher (ACS)

⁵ If a metric is 99 percent, it would be 1 percent reversed. This is so that all indicators can be in the same direction (a higher level indicates more opportunity).

Exhibit 2

Child Opportunity Index (COI) 2.0 Indicators and Sources (2 of 2)

Indicator	Description (Source)
Health and Environment Domain	
Healthy Environments	
Access to healthy food	Percentage of households without a car located further than one-half mile from the nearest supermarket, reversed (USDA)
Access to green space	Percentage of impenetrable surface areas, such as rooftops, roads, or parking lots, reversed (CDC)
Walkability	EPA Walkability Index (EPA)
Housing vacancy rate	Percentage of housing units that are vacant, reversed (ACS)
Toxic Exposures	
Hazardous waste dump sites	Average number of Superfund sites within a 2-mile radius, reversed (EPA)
Industrial pollutants in air, water, or soil	Index of toxic chemicals released by industrial facilities, reversed (EPA)
Airborne microparticles	Mean estimated microparticle (PM2.5) concentration, reversed (CDC)
Ozone concentration	Mean estimated 8-hour average ozone concentration, reversed (EPA)
Extreme heat exposure	Summer days with maximum temperature above 90 degrees F, reversed (CDC)
Health Resources	
Health insurance coverage	Percentage of individuals aged 0–64 with health insurance coverage (ACS)
Social and Economic Domain	
Economic Opportunities	
Employment rate	Percentage of adults aged 25–54 who are employed (ACS)
Commute duration	Percentage of workers commuting more than 1 hour, one-way, reversed (ACS)
Economic and Social Resources	
Poverty rate	Percentage of individuals living in households with incomes below 100 percent of the federal poverty threshold, reversed (ACS)
Public assistance rate	Percentage of households receiving cash public assistance or food stamps/ Supplemental Nutrition Assistance Program, reversed (ACS)
Homeownership rate	Percentage of owner-occupied housing units (ACS)
High-skill employment	Percentage of individuals aged 16 and older employed in management, business, financial, computer, engineering, science, education, legal, community service, health care, health technology, arts, and media occupations (ACS)
Median household income	Median income of all households (ACS)
Single-headed households	Percentage of family households that are single-parent headed, reversed (ACS)

CDC = Centers for Disease Control or Prevention. EPA = U.S. Environmental Protection Agency. NAEYC = National Association for the Education of Young Children. USDA = U.S. Department of Agriculture.
Source: Noelke et al. (2020).

The 29 indicators reported in exhibit 2 were combined into an overall index of child neighborhood opportunity using weights. Before combining the indicators, each indicator was standardized using 2010 means and standard deviations. Their weighting scheme combined unit weights with empirical weights based on how important a given factor was in predicting four child outcomes:

- Mean household income rank in adulthood for children whose parents' income was at the 50th percentile (median) of the income distribution (Chetty et al., 2018b).
- The probability of living in a low-poverty census tract in adulthood for children whose parents' income was at the 50th percentile (median) of the income distribution (Chetty et al., 2018b).
- Mental health not good for 14 or more days among adults aged 18 and older (CDC, 2017).
- Physical health not good for 14 or more days among adults aged 18 and older (CDC, 2017).

Noelke et al. (2020) estimated correlations among the 29 indicators and the four child outcomes, with stronger predictors of better child outcomes receiving greater weight. Some larger weights were shrunk to avoid giving too much influence to any one indicator. Average correlations between the 29 indicators and four child outcomes and the final weights are reported in table 5 of Noelke et al. (2020).

COI 2.0 data are available at the census tract level for 2010 and 2015. Besides raw indicators and z-scores, COI 2.0 index data are available as two metrics for applied users, Child Opportunity Levels and Child Opportunity Scores. Each metric is available normalized nationally, by state, and by metropolitan area.

Crime Data

Local police departments collect crime data as incident events. They report the data to the Federal Bureau of Investigation (FBI) as part of the Uniform Crime Reporting (UCR) program. Using an index developed by the FBI, the single crime considered the most severe during the criminal incident is used to classify the incident as a single event, although many other crimes may have been committed during the same incident. The classification of the crime(s) committed in an incident may differ between the local jurisdiction and the UCR description, but the use of the UCR classification allows for broad-level standardization among the thousands of police jurisdictions in the United States. Using UCR-classified data is important because it allows for comparison between different jurisdictions.

Part I crimes include major events such as criminal homicide, forcible rape, robbery, aggravated assault, and other highly serious crimes (FBI, 2004).

Data Description and Maps

In this section, we describe the data used for our data analysis example and report summary statistics along with maps.

Data Description

We analyze census tract data for the cities of Chicago and Dallas and an Opportunity Atlas income outcome for children whose parents' incomes were at the 25th percentile nationally within birth cohorts. The income outcome is measured by the income percentile of the children when they reach adulthood. This variable is defined as “mean household income rank for children whose parents were at the 25th percentile of the national income distribution. Incomes for children were measured as mean earnings in 2014–2015, when they were between the ages of 31 and 37 years old (Chetty et al., 2018a, 1). The income outcome estimates we analyze are pooled for all races and both genders.

We also analyze the nationally normed COI 2.0 index z-score for 2015 and Part I crime rates per 10,000 population for 2017. We used 2013–2017 American Community Survey 5-year population data for computing crime rates.

Summary Statistics

Summary statistics by city are reported in exhibit 3. The mean Opportunity Atlas income outcome is .371 in Chicago; this indicates that on average, a child born into a household at the 25th income percentile would be observed in the 37th percentile in adulthood. The corresponding mean in Dallas is slightly higher, at .388. The standard deviations in income outcomes are approximately equal in both cities.

Exhibit 3

Summary Statistics (1 of 2)

Variable	City	N	Mean	Std Dev	Min	Median	Max
Opportunity Atlas income outcome (percentile ranking)	Chicago	793	0.371	0.078	0.083	0.372	0.709
	Dallas	272	0.388	0.077	0.251	0.37	0.691
	Dallas, propensity score weighted based on Opportunity Atlas data	272	0.373	0.080	0.251	0.372	0.691
COI 2.0 nationally normed index	Chicago	792	-0.021	0.039	-0.106	-0.019	0.052
	Dallas	272	-0.012	0.035	-0.098	-0.016	0.06
	Dallas, propensity score weighted based on COI 2.0 data	272	-0.020	0.040	-0.098	-0.019	0.060
Tract population	Chicago	793	3,432.66	1,849.45	341	3,067	19,015
	Dallas	272	4,323.53	1,935.55	510	4,064	10,448
Part I crime count	Chicago	793	145.462	159.878	6	109	2,492
	Dallas	272	151.89	119.447	9	129	1,313

Exhibit 3

Summary Statistics (2 of 2)

Variable	City	N	Mean	Std Dev	Min	Median	Max
Tract Part I crime rate per 10,000 population	Chicago	793	474.909	395.003	33.241	362.641	4,502.68
	Dallas	272	377.245	268.613	52.57	301.598	1,725.60
	Dallas, propensity score weighted based on Opportunity Atlas data	272	413.016	302.364	52.570	315.582	1725.601
	Dallas, propensity score weighted based on COI 2.0 data	272	411.670	279.568	52.570	339.355	1725.601

COI = Child Opportunity Index. Dev = standard deviation. Max = maximum. Min = minimum. N = number of census tracts. Sources: U.S. Census Bureau 2013–2017 American Community Survey 5-year data; Dallas OpenData; Chicago Data Portal; OpportunityInsights.org; DiversityDataKids.org

The mean nationally normed COI 2.0 index is -0.021 in Chicago. The national standard deviation in this variable is .032, which implies that the average Chicago neighborhood is about .7 standard deviations below the national average. A typical Dallas neighborhood is approximately .4 standard deviations below the national average. The variance in the COI 2.0 index is about the same in both cities.

Mean Part I crime rates per 10,000 population are 475 in Chicago and 377 in Dallas, and the standard deviation is much larger in Chicago compared with Dallas.

Maps

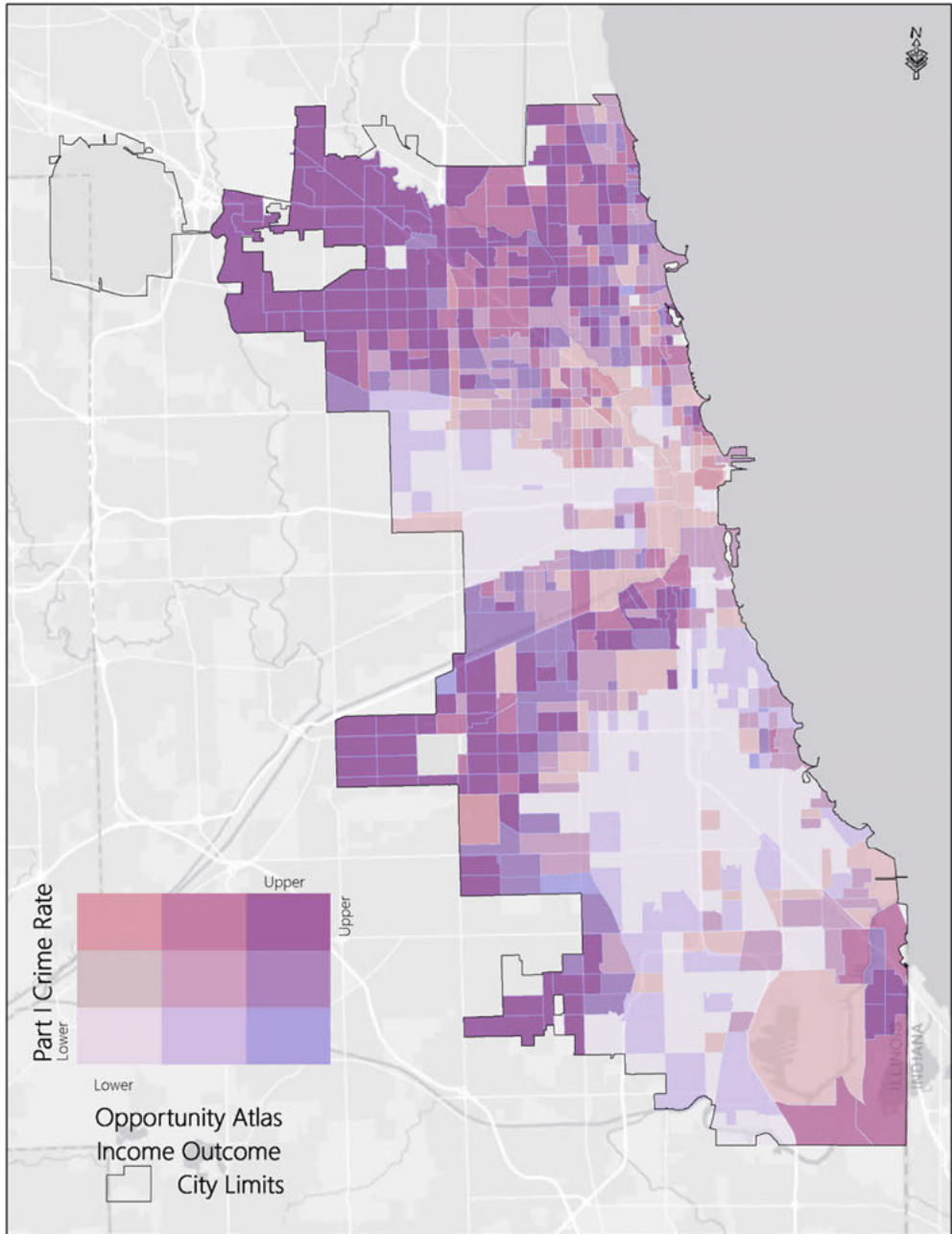
Exhibit 4 presents a bivariate map of the Opportunity Atlas income outcomes and Part I crime rates for Chicago, and exhibit 5 reports a bivariate map of COI 2.0 index values and Part I crime rates for Chicago. Corresponding Dallas maps are reported in exhibits 6 and 7.

Bivariate maps show two normalized variables. In each of our bivariate maps, a neighborhood opportunity measure (Opportunity Atlas income outcome or COI 2.0 index) and Part I crime rates are normalized into percentiles that are then categorized into tertiles. For the Opportunity Atlas income outcome and the COI 2.0 index, the upper tertile contains tracts with the greatest neighborhood opportunity. For the Part I crime rate, we reversed percentile rankings before categorizing into tertiles so that the upper tertile has tracts with the lowest crime rates. Neighborhoods in the lowest tertiles for both variables have the lowest neighborhood opportunity and highest crime rates.

The bivariate map in exhibit 4 shows Opportunity Atlas income outcome and Part 1 crime rate tertiles for Chicago. Census tracts with the darkest color, at the top right of the legend, are in the top third of income outcome values and bottom third of Part I crime rates. These are the areas traditionally thought to have the greatest opportunity. Census tracts in the lowest tertiles of income outcomes and Part I crime rates, at the bottom left of the legend, are shown with the lightest color and have the lowest income outcomes and highest crime rates.

Exhibit 4

Bivariate Map of Opportunity Atlas Income Outcomes and Part I Crime Rates for Chicago



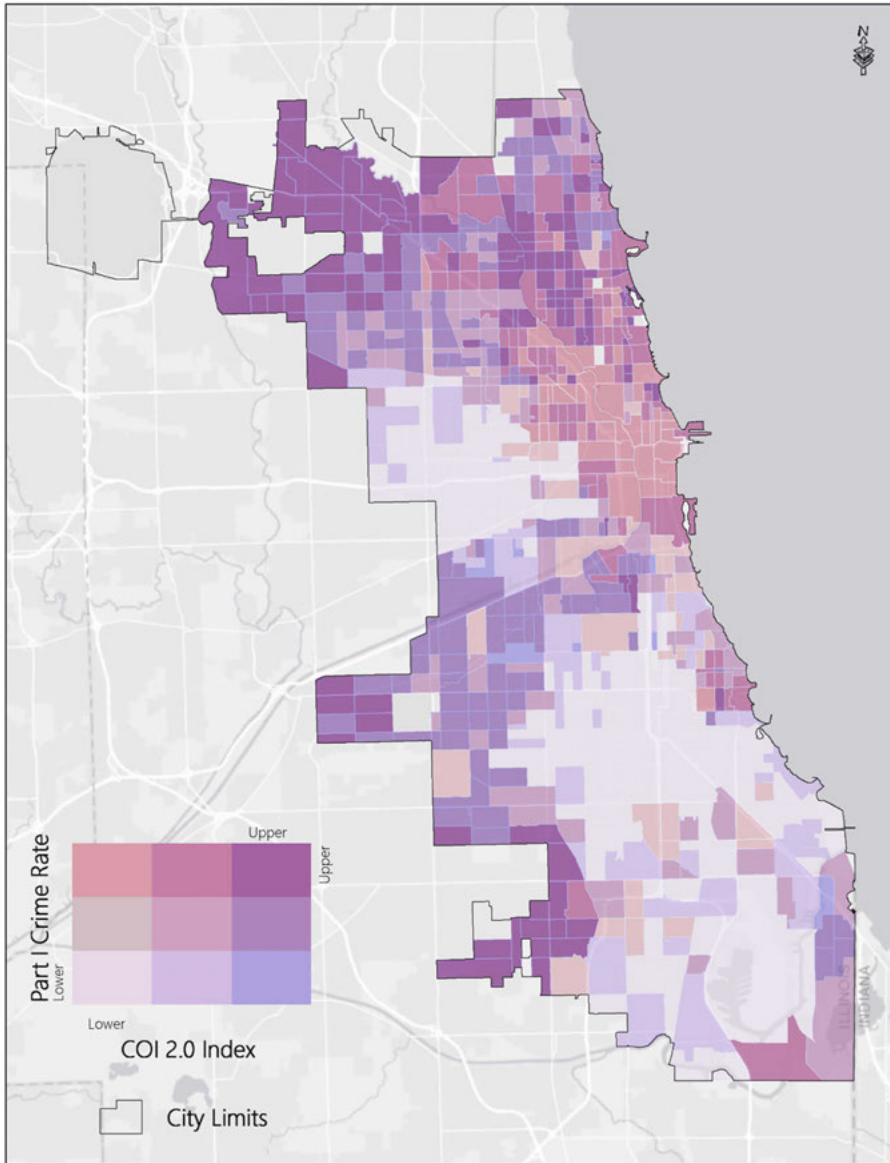
Sources: U.S. Census Bureau 2013–2017 American Community Survey 5-year data; Chicago DataPortal; OpportunityInsights.org

There are noticeable geographic patterns in the exhibit 4 map, such as areas of greater opportunity in northern and western Chicago and areas of less opportunity in the southern and upper-central western area of Chicago. Census tracts in the other seven categories have mixed Opportunity Atlas income outcome values and Part I crime rates; those areas are found throughout Chicago but seem concentrated in the transition areas, such as the far south side of Chicago, downtown, and along the shore of Lake Michigan.

Exhibit 5 reports a bivariate map of the COI 2.0 index and Part I crime rates in Chicago, which reveals similar geographic patterns to those in exhibit 4. In the north and southwestern areas of Chicago are areas of increased COI 2.0 index values and lower Part I crime rates. In the south and west of Chicago, there are areas of lower COI 2.0 index values and higher Part I crime rates. In the far south side of the city, downtown, and along the shore of Lake Michigan are primarily mixed opportunity areas. In particular, the area around downtown has higher crime rates but also has higher COI 2.0 index values.

Exhibit 5

Bivariate Map of Child Opportunity Index 2.0 Index and Part I Crime Rates for Chicago

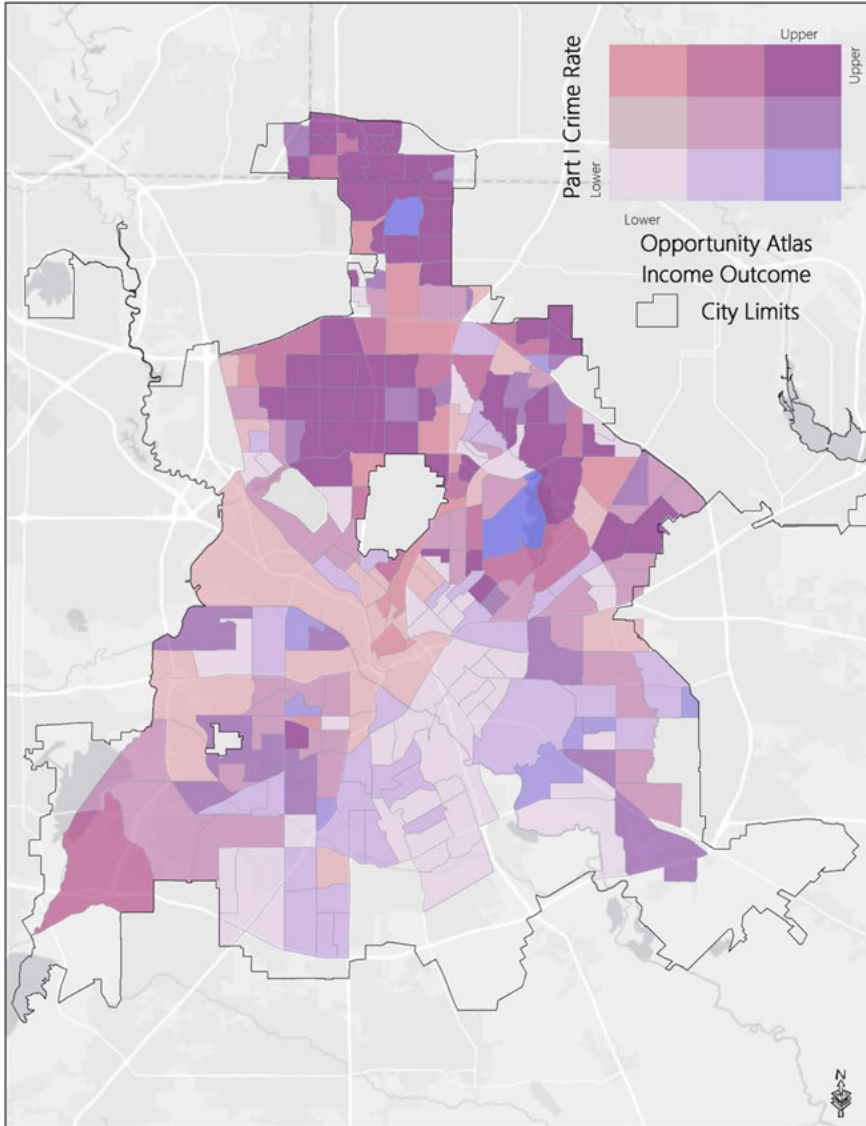


Sources: Chicago Data Portal; [DiversityDataKids.org](https://diversitydatakids.org); U.S. Census Bureau 2013–2017 American Community Survey 5-year data

The bivariate map in exhibit 6 reports Opportunity Atlas income outcome and Part I Crime rate tertiles for Dallas. Areas in northern and northwestern Dallas have most of the higher income outcome and lower Part I crime rate neighborhoods, whereas southern Dallas contains most of the lower income outcome and higher Part I crime rate neighborhoods. Areas in southwestern and eastern Dallas have mixed income outcome and crime rate neighborhoods.

Exhibit 6

Bivariate Map of Opportunity Atlas Income Outcomes and Part I Crime Rates for Dallas

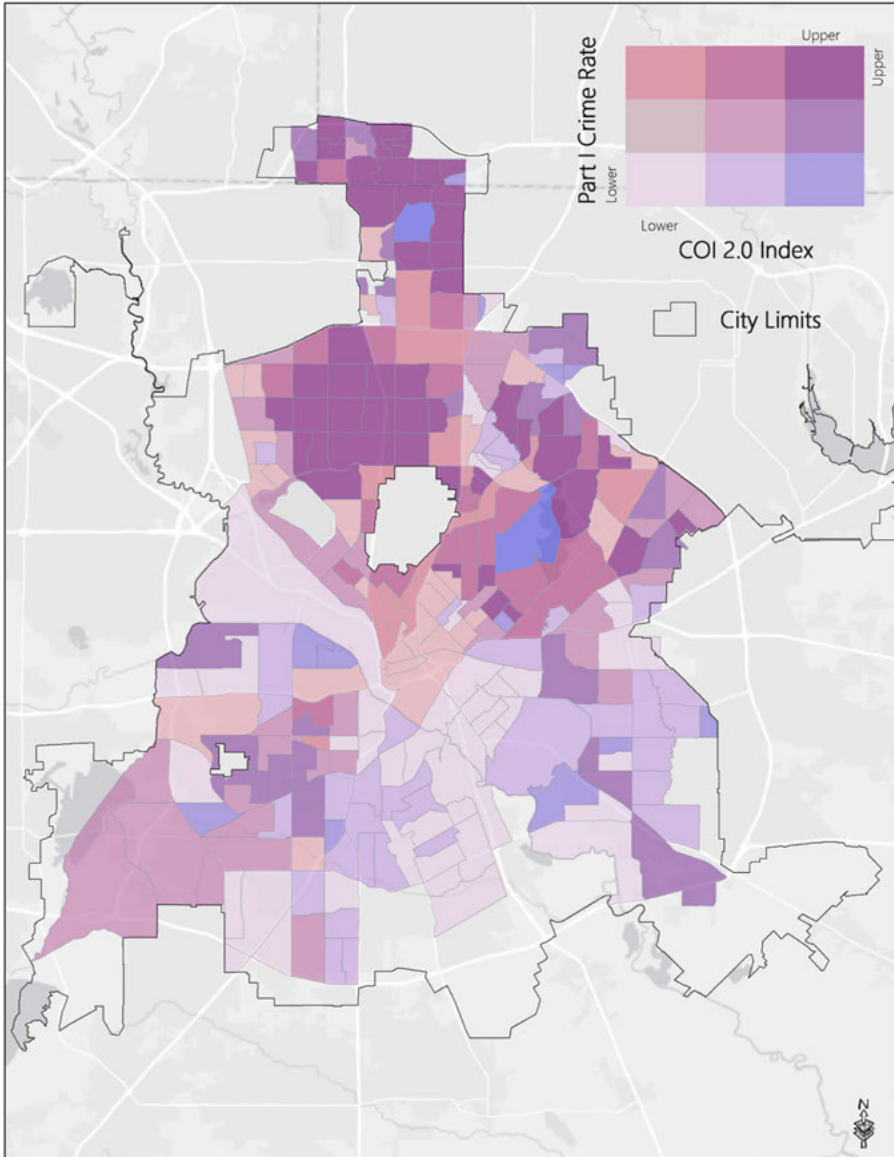


Sources: Chetty et al., 2018b; Dallas OpenData; U.S. Census Bureau 2013–2017 American Community Survey 5-year data

The bivariate map in exhibit 7 reports the COI 2.0 national index and Part I Crime rates tertiles for Dallas. Generally, the geographic patterns in exhibit 6 persist in exhibit 7 in areas of greatest and least opportunity, although mixed neighborhoods differ. Northern Dallas has greater COI 2.0 index values and lower Part I crime rates, whereas southern Dallas has lower COI 2.0 index values and greater crime rates. Neighborhoods in the west, southwest, and east sections of Dallas tend to have mixed COI 2.0 index values and crime rates.

Exhibit 7

Bivariate Map of Child Opportunity Index 2.0 Index and Part I Crime Rates for Dallas



Sources: Dallas OpenData; DiversityDataKids.org.; U.S. Census Bureau 2013–2017 American Community Survey 5-year data

Tabulations of census tract neighborhood opportunity tertiles and Part I crime rate tertiles that we mapped in exhibits 4–7 are presented in exhibit 8.

Exhibit 8

Tabulation of Census Tract Neighborhood Opportunity Tertiles and Part I Crime Rate Tertiles

Chicago

Part I Crime Rate	7	85	164	Upper Tertile
	73	12	71	Middle Tertile
	184	59	21	Lower Tertile
	Lower Tertile	Middle Tertile	Upper Tertile	

Opportunity Atlas Income Outcome

Part I Crime Rate	10	129	117	Upper Tertile
	74	98	92	Middle Tertile
	180	36	48	Lower Tertile
	Lower Tertile	Middle Tertile	Upper Tertile	

Child Opportunity Index 2.0 Index

Dallas

Part I Crime Rate	8	28	55	Upper Tertile
	34	38	19	Middle Tertile
	48	25	17	Lower Tertile
	Lower Tertile	Middle Tertile	Upper Tertile	

Opportunity Atlas Income Outcome

Part I Crime Rate	12	29	50	Upper Tertile
	36	32	23	Middle Tertile
	42	30	18	Lower Tertile
	Lower Tertile	Middle Tertile	Upper Tertile	

Child Opportunity Index 2.0 Index

Sources: Chicago Data Portal; Dallas OpenData; DiversityDataKids.org; OpportunityInsights.org; U.S. Census Bureau, 2013–2017 American Community Survey 5-year estimate data

Data Analysis

In this section, we estimate what the Part I crime rate distribution for Dallas would be if its neighborhood opportunity distribution were more equal to that of Chicago. We do so using both the Opportunity Atlas income outcome and COI 2.0 index as measures of neighborhood opportunity and then compare results.

Exhibit 9 presents frequency counts and percentages of census tracts in 20 categories of the Opportunity Atlas income outcome (roughly based on a histogram for Chicago with 20 categories)

for both cities. The lower bounds for the income outcome categories in exhibit 9 are percentiles (0th, 5th, ..., 95th) of the income outcome for Chicago, and the upper bounds are roughly the 5th, 10th, ..., 100th percentiles for Chicago.

Exhibit 9

Opportunity Atlas Income Outcome Frequencies and Propensity Score Weights

Range	Chicago		Dallas		Propensity Score Weight	Dallas, Propensity Score Weighted	
	Count	Percentage	Count	Percentage		Weighted Count	Weighted Percentage
0-0.264	40	5.0	2	0.7	6.800	13.6	5.0
0.265-0.276	42	5.3	4	1.5	3.400	13.6	5.0
0.277-0.282	39	4.9	2	0.7	6.800	13.6	5.0
0.283-0.291	38	4.8	6	2.2	2.267	13.6	5.0
0.292-0.300	37	4.7	12	4.4	1.133	13.6	5.0
0.301-0.312	41	5.2	5	1.8	2.720	13.6	5.0
0.313-0.327	40	5.0	22	8.1	0.618	13.6	5.0
0.328-0.342	39	4.9	27	9.9	0.504	13.6	5.0
0.343-0.360	40	5.0	35	12.9	0.389	13.6	5.0
0.361-0.372	42	5.3	24	8.8	0.567	13.6	5.0
0.373-0.384	39	4.9	23	8.5	0.591	13.6	5.0
0.385-0.396	43	5.4	18	6.6	0.756	13.6	5.0
0.397-0.405	36	4.5	5	1.8	2.720	13.6	5.0
0.406-0.414	41	5.2	8	2.9	1.700	13.6	5.0
0.415-0.426	38	4.8	8	2.9	1.700	13.6	5.0
0.427-0.438	40	5.0	9	3.3	1.511	13.6	5.0
0.439-0.456	39	4.9	12	4.4	1.133	13.6	5.0
0.457-0.474	40	5.0	12	4.4	1.133	13.6	5.0
0.475-0.498	40	5.0	14	5.1	0.971	13.6	5.0
0.499-1.000	39	4.9	24	8.8	0.567	13.6	5.0

Source: OpportunityInsights.org

The proportion of Dallas census tracts in income outcome category j in exhibit 9, p_j , can be used as a nonparametric estimate of the propensity score of being in the same income outcome category as a Chicago census tract. This nonparametric propensity score matching technique was introduced by Barskey et al. (2002).

We construct nonparametric propensity score weights based on the Opportunity Atlas income outcome equal to $.05/p_j$, which are presented in exhibit 9. The sum of weights is 272 (the number of Dallas census tracts), and exhibit 9 presents weighted counts and percentages of Dallas census tracts in each income outcome category. The weighted percentage of Dallas census tracts in each

income outcome category in exhibit 9 is 5 percent (roughly the same percentage as the census tracts in each category in Chicago).

After propensity score weighting Dallas census tracts, the distribution of income outcome categories in exhibit 9 is almost identical in Dallas and Chicago, and any remaining differences in income outcome distributions are due to differences within income outcome categories.

Propensity score-weighted income outcome summary statistics for Dallas are presented in exhibit 3. The weighted mean income outcome is .373, which is very close to the Chicago mean of .371. The standard deviations in income outcomes are very close in the two cities regardless of propensity score weighting.

Frequency counts and percentages for the COI 2.0 index are presented in exhibit 10, along with propensity score weights based on the COI 2.0 index and propensity score-weighted counts and percentages for Dallas.

Exhibit 10

Child Opportunity Index 2.0 Index Frequencies and Propensity Score Weights

Range	Chicago		Dallas		Propensity Score Weight		Dallas, Propensity Score Weighted	
	Count	Percentage	Count	Percentage	Weighted Count	Weighted Percentage	Weighted Count	Weighted Percentage
-1.000 to -0.087	41	5.2	9	3.3	1.511	13.6	5.0	
-0.086 to -0.075	35	4.4	15	5.5	0.907	13.6	5.0	
-0.074 to -0.069	40	5.0	13	4.8	1.046	13.6	5.0	
-0.068 to -0.060	40	5.0	26	9.6	0.523	13.6	5.0	
-0.059 to -0.051	38	4.8	13	4.8	1.046	13.6	5.0	
-0.050 to -0.042	44	5.5	23	8.5	0.591	13.6	5.0	
-0.041 to -0.036	35	4.4	22	8.1	0.618	13.6	5.0	
-0.035 to -0.030	42	5.3	10	3.7	1.360	13.6	5.0	
-0.029 to -0.024	40	5.0	18	6.6	0.756	13.6	5.0	
-0.023 to -0.018	37	4.7	4	1.5	3.400	13.6	5.0	
-0.017 to -0.015	42	5.3	7	2.6	1.943	13.6	5.0	
-0.014 to -0.009	37	4.7	5	1.8	2.720	13.6	5.0	
-0.008 to -0.003	41	5.2	2	0.7	6.800	13.6	5.0	
-0.002 to 0.003	43	5.4	9	3.3	1.511	13.6	5.0	
0.004 to 0.012	43	5.4	18	6.6	0.756	13.6	5.0	
0.013 to 0.018	36	4.5	18	6.6	0.756	13.6	5.0	
0.019 to 0.027	38	4.8	9	3.3	1.511	13.6	5.0	
0.028 to 0.033	44	5.5	11	4.0	1.236	13.6	5.0	
0.034 to 0.039	39	4.9	17	6.3	0.800	13.6	5.0	
0.040 to 1.000	37	4.7	23	8.5	0.591	13.6	5.0	

Source: DiversityDataKids.org

Propensity score-weighted COI 2.0 index summary statistics for Dallas are presented in exhibit 3. The Dallas weighted mean COI 2.0 index of -0.020 is almost identical to the Chicago mean of -0.021, and the standard deviations in the COI 2.0 index are also very similar in both cities when propensity score weighting the Dallas data.

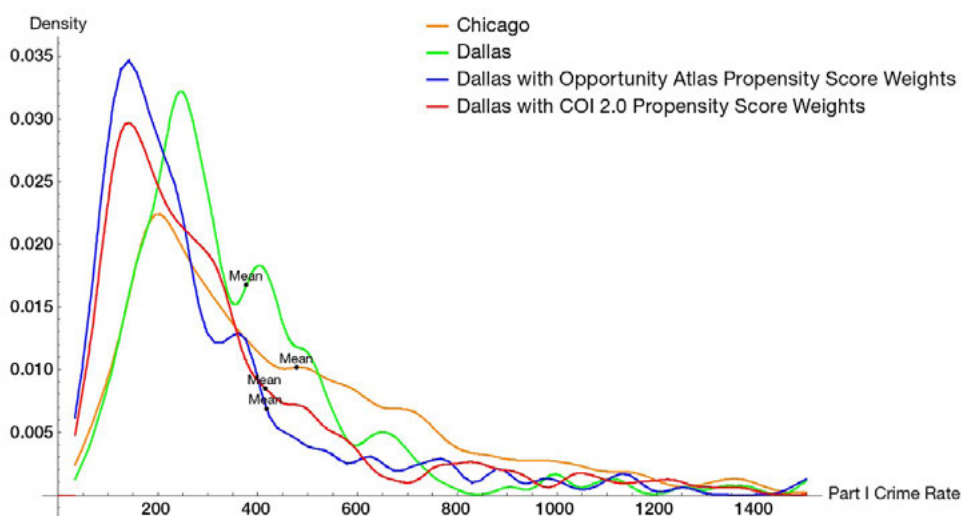
Propensity score-weighted Part I crime rate summary statistics are also presented in exhibit 3. Weighting by Opportunity Atlas-based weights, the mean crime rate is 413, and the standard deviation is 302. When weighted by COI 2.0-based weights, the mean crime rate is 412 and the standard deviation is 280. Although both weighted means are closer to the Chicago mean of 475 than the unweighted Dallas mean, both weighted means are still well below the Chicago mean.

Weighting by Opportunity Atlas-based weights, the standard deviation in Part I crime rates is 302 in Dallas, compared with 395 in Chicago. When weighted by COI 2.0-based weights, the standard deviation in crime rates in Dallas is 280, which is higher than the unweighted standard deviation of 269 but still much lower than the Chicago standard deviation.

Exhibit 11 presents kernel densities of the Part I crime rates in Chicago and Dallas, along with propensity score-weighted kernel densities for Dallas, weighting with both Opportunity Atlas and COI 2.0-based weights. Although the Dallas crime rate means and standard deviations are closer to those in Chicago when propensity score weighting, the weighted Dallas distributions are still far apart from the Chicago distribution. It is not obvious from visually inspecting the kernel density plots whether the Opportunity Atlas or COI 2.0 propensity score matching does a better job of explaining differences in the crime distributions in the two cities; the Part I crime rate distribution for Chicago has a much thicker upper tail compared with any of the Dallas kernel densities in exhibit 11.

Exhibit 11

Part I Crime Rate per 10,000 Persons Kernel Densities



Sources: Chicago Police Department; Dallas Police Department; DiversityDataKids.org; OpportunityInsights.org

We numerically compared the similarity of the Chicago and Dallas crime distributions by integrating⁶ the common areas under the Chicago kernel density and each of the Dallas kernel densities in exhibit 11. The common area under the Chicago kernel density and unweighted Dallas kernel density equals .807. The corresponding areas under the Chicago kernel density and the Dallas kernel densities weighted by the Opportunity Atlas and COI 2.0 propensity score weights, respectively, are .708 and .774. Thus, our results indicate that the unweighted Dallas crime rate distribution more closely matches the Chicago distribution than either of the propensity score-weighted Dallas distributions.⁷

In summary, although the Dallas crime rate means and standard deviations are closer to those in Chicago when propensity score weighting, the Dallas distribution more closely matches the Chicago distribution when the Dallas distribution is not propensity score weighted. Differences in neighborhood opportunity explain little of the differences in crime rates in the two cities, regardless of whether neighborhood opportunity is measured by Opportunity Atlas or COI 2.0 data.

Conclusion

In this article, we introduced readers to two datasets measuring neighborhood opportunity: the Opportunity Atlas data and the Child Opportunity Index (COI) 2.0 data. The Opportunity Atlas data measure neighborhood opportunity longitudinally, based on outcomes in adulthood for children in different neighborhoods.

As an example of how the data might be used, we analyze the relationship between the COI 2.0, an Opportunity Atlas measure of children's income in adulthood, and Part I crime rates in two cities: Chicago and Dallas. Opportunity Atlas and COI 2.0 neighborhood opportunity measures tend to be greater in Dallas compared with those in Chicago, and Part I crime rates tend to be much higher in Chicago compared with those in Dallas.

We estimate what the Part I crime rate distribution in Dallas would be if Dallas' neighborhood opportunity distributions (based on both the Opportunity Atlas and COI 2.0 data) were more similar to Chicago's, using Barskey et al.'s (2002) nonparametric propensity score-matching method.

Our results indicate that differences in neighborhood opportunity explain only a small portion of the differences in Part I crime rate means and standard deviations in the two cities, and whether the propensity score weighting used to account for differences in neighborhood opportunity was based on Opportunity Atlas or COI 2.0 data made little difference. The Dallas crime rate distribution more closely matched Chicago when the Dallas distribution was not propensity score weighted.

⁶ Our kernel densities and numerical integration were computed with Mathematica 12.1 software. Although the maximum crime rate for the kernel density plots in exhibit 11 is 1,500, the maximum used to compute and integrate the kernel densities was 4,550.

⁷ We could estimate whether the differences in our point estimates are statistically significant by computing bootstrap confidence intervals.

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