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# Residential Segregation by Income, 1970-2009

Kendra Bischoff  
*Cornell University*

Sean F. Reardon  
*Stanford University*

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Direct correspondence to Kendra Bischoff ([kbischoff@cornell.edu](mailto:kbischoff@cornell.edu)) or Sean F. Reardon ([sean.reardon@stanford.edu](mailto:sean.reardon@stanford.edu)). The research reported here was supported by the US2010 project of the Russell Sage Foundation and Brown University. We are grateful to John Logan for leading the US2010 project, Claude Fischer for helpful comments on earlier drafts, Brian Stults for providing us with data files, and Lindsay Fox for her outstanding research assistance.

Every city or metropolitan area in the U.S. has higher- and lower-income neighborhoods. The extent to which these neighborhoods differ in their average socioeconomic status, however, varies considerably. Moreover, this socioeconomic residential sorting has grown substantially in the last 40 years (Reardon and Bischoff 2011a; Reardon and Bischoff 2011b; Watson 2009); the bulk of that growth occurred in the 1980s and in the 2000s.

We refer to the uneven geographic distribution of families of different income levels within a metropolitan area as “family income segregation” or, more simply, “income segregation.” Our use of the term “segregation” is *descriptive*; it denotes the extent to which families of different incomes live in different neighborhoods; it does not imply any particular cause of these residential patterns.<sup>1</sup> We focus on the segregation of families by income primarily because children generally live in family households. Segregation is likely more consequential for children than for adults<sup>2</sup> for two reasons. First, most children spend a great deal of time in their neighborhood, making that immediate context particularly salient for them, while adults generally work and socialize in a larger geographic area. Second, for children, income segregation can lead to disparities in crucial public amenities, like schools, parks, libraries, and recreation.

We describe the patterns and trends in family income segregation over the last 40 years. We begin with a discussion of several different measures of income segregation; each provides insight into one aspect of the patterns. Second, we describe the trends in family income segregation from 1970 to 2009. Here we find clear evidence that income segregation has grown

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<sup>1</sup> In particular, it is not meant to imply that residential patterns result from forced separation of high- and low-income families. Unlike the legally-mandated racial segregation of schools in the South prior to the 1954 *Brown vs. Board of Education* decision, residential segregation of families with respect to income has never been an explicit legal or policy mandate, though it certainly may be exacerbated or ameliorated by housing, zoning, and lending practices.

<sup>2</sup> In U.S. Census data, not all persons are counted as members of “families.” Persons living alone or with unrelated individuals are counted as members of “households,” but not as members of “families.” Because children rarely live alone or with unrelated adults, they are generally members of Census-defined “families.”

rapidly, particularly in the last decade and particularly among black and Hispanic families.

Third, we describe the variation in income segregation among the 117 metropolitan areas with populations of at least 500,000 in 2009. We document considerable variation in income segregation among metropolitan areas - a variation systematically related to several key features of metropolitan areas, including their size, level of income inequality, age composition, and average educational levels. Fourth, we investigate the metropolitan area correlates of changes in income segregation, investigating whether changes in these characteristics over time are systematically related to changes in income segregation levels. Again, we find that segregation has grown most rapidly in metropolitan areas characterized by growing income inequality, growing proportions of children, and increasing average educational attainment levels. The longitudinal analyses also show that changes in unemployment and manufacturing jobs are inversely related to income segregation.

## **Why Does Socioeconomic Segregation Matter?**

As anyone who has bought or rented a home knows, housing prices and rental costs are spatially patterned. People choose their neighborhood in large part based on their ability to afford housing in that area and, conditional on that, their preferences for location (for instance, proximity to work) and neighborhood amenities, such as schools, parks, and safety. Because the ability to afford housing in a given neighborhood is generally tied to income, the fact that some families have more or less income leads to residential sorting by income: high-income families tend to live in neighborhoods with other high-income families; low-income families, with other low-income families. The linkage between a family's income and the income of its neighbors is not perfect, however. Many factors determine the income-segregation of a region, including the extent of income inequality in the region; patterns of family residential preferences (e.g.,

preferences for neighbors of a similar ethnicity); the location of cultural, institutional, and environmental amenities; patterns of suburbanization; the extent of family income volatility; variation in the type and quality of housing stock; topography and geography; school and municipal boundaries; and zoning and housing policies (Bischoff 2008; Cutler and Glaeser 1997; Jargowsky 1996; Reardon and Bischoff 2011b; Rothwell and Massey 2010; Watson 2009; Yang and Jargowsky 2006).

Income segregation may accentuate the economic advantages of high-income families and exacerbate the economic disadvantages of low-income families. It is useful to distinguish two categories of mechanisms: *neighborhood composition mechanisms* and *spatial resource distribution mechanisms*. Neighborhood composition effects —sociologists and economists call them *neighborhood effects* — stem from the demographic composition of neighborhoods; e.g., poverty rates, average educational attainment levels, and the proportion of single-parent families. Spatial resource distribution effects operate when segregation leads to the unequal distribution of collective resources (such as high-quality schools or public parks) and/or public hazards (such as pollution or crime) among neighborhoods.

This distinction is not sharp, but a stylized example will make it clearer. Suppose that poor neighbors hinder children's educational success because children observe fewer adults in their neighborhood with high educational attainment, and, by extension, fewer adults who have succeeded in school. Children in high-income neighborhoods observe just the opposite. In this case, income segregation would lead to educational inequality between high- and low-income children because it would produce large differences in children's access to adult role models. We consider this a neighborhood compositional effect.

Suppose instead that one's neighbors do not influence school success, but that it is largely

determined by the resources in the school; e.g., high-skill teachers. If high-income communities attract those high-skill teachers—for instance, by paying higher salaries—then residential income segregation will lead to unequal school resources among communities, which will in turn lead to inequalities in educational success among high- and low-income children. We consider this a spatial resource distribution effect. In practice, the effects of segregation may include both compositional and distributional components.

A considerable body of scholarship discusses neighborhood composition effects. In sociology, much of this literature predicts that neighborhood composition—particularly neighborhood poverty and concentrated economic disadvantage—affects residents’ social, economic, educational, psychological, and/or physical outcomes through a variety of mechanisms (for discussions of these mechanisms, see, for example, Burdick-Will, Ludwig, Raudenbush, Sampson, Sanbonmatsu, and Sharkey 2011; Jencks and Mayer 1990; Leventhal and Brooks-Gunn 2000; Sampson, Raudenbush, and Earls 1997).

The empirical evidence on the effects of neighborhood composition, however, is more mixed. A number of carefully-designed observational (non-experimental) studies find evidence that prolonged residence in very poor neighborhoods harms schooling outcomes (Burdick-Will et al. 2011; Harding 2003; Sampson, Sharkey, and Raudenbush 2008; Wodtke, Harding, and Elwert 2011), though other observational studies find smaller or insignificant neighborhood compositional effects (see, e.g., Jencks and Mayer 1990; Sampson, Morenoff, and Gannon-Rowley 2002). In addition, studies of the Moving to Opportunity (MTO) experiment, in which a random sample of low-income families were offered housing vouchers to encourage them move to low-poverty neighborhoods, show few significant or long-term impacts of reduced exposure to neighborhood poverty (Kling, Liebman, and Katz 2007; Ludwig, Duncan, Gennetian, Katz,

Kessler, Kling, and Sanbonmatsu 2013). Some of the discrepancies among the observational studies and the MTO experiment may arise from differences in the types of neighborhoods studied, differences in the duration of exposure to high-poverty neighborhoods experienced by families in each of the studies, or the observational studies' failure to account fully for family differences among those in high- and low-poverty neighborhoods.<sup>3</sup> There is, however, no clear consensus in the literature regarding the differences in estimated neighborhood compositional effects. In short, it is unclear if income segregation operates through neighborhood composition mechanisms to exacerbate social, economic, educational, and health disparities between high- and low-income families.

Does income segregation operate through spatial resource distribution mechanisms? The theory and evidence are even less well-developed. Mayer (2002) suggests that income segregation may lead to greater inequality in school funding: states with rising income segregation experienced rising disparities in educational attainment. More broadly, we might expect the local tax base and the involvement of the community in the maintenance and investment of shared public resources, such as parks and playgrounds, and local social institutions, such as schools, to influence the quality of those resources and institutions. Income segregation therefore may create disparities in these public resources and institutions among high- and low-income communities.

Another possibility is that income segregation concentrates political power and influence

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<sup>3</sup> In addition, there are important differences in the ways in which neighborhood effects are measured in different studies. In the MTO experiment, neighborhood effects were measured by moving some families into lower-poverty neighborhoods and comparing their outcomes to similar families who did not move. Observational studies sometimes rely on families who move; however, they often compare similar types of families who have selected into different kinds of neighborhoods, or examine individual families who do not change their residence, but experience changes in their neighborhood context over time (as a result of gentrification processes, social policy programs, law enforcement initiatives, or other factors that may alter a neighborhood environment). These differences across studies in the sources of variation in neighborhood context—people changing neighborhoods vs. neighborhoods changing around people—also make it difficult to compare the results of different studies.

in a small number of local areas; as a result, these communities will have undue influence in the distribution of collective goods (and hazards). Regional decisions about where to site train, subway, and bus lines, for example, or where to locate a new hospital or a new landfill all have potential implications for those who live near these amenities or hazards. If residents of high-income communities are collectively more effective at influencing these decisions than residents of low-income communities, income segregation may lead to unequal influence in regional decision-making. There is, however, little research that empirically investigates this possibility. More generally, there is little research examining the effects of segregation *per se*: although several studies credibly identify the effects of racial segregation on racial disparities in education and earnings (Ananat 2009; Card and Rothstein 2006; Cutler and Glaeser 1997), no similarly rigorous studies examine the effects of income segregation.

## Data and Measurement

This study uses decennial U.S. Census data from 1970-2000 (GeoLytics 2004; Minnesota Population Center 2004), as well as American Community Survey (ACS) data from 2005-2011. We use these data to compute measures of metropolitan-level income segregation as well as to construct measures of other metropolitan-level characteristics that are included in the multivariate analyses. We measure income segregation among neighborhoods within metropolitan areas, using census tract boundaries to approximate neighborhoods.<sup>4</sup> The 2000 Census marked the last available single-year estimates of tract-level income distributions; tract-level data from the ACS are available only as five-year moving averages, covering the years

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<sup>4</sup> Census tracts are small subdivisions of a county. They usually have between 2,500 and 8,000 persons and are designed to approximate neighborhoods. See [http://www.census.gov/geo/www/cen\\_tract.html](http://www.census.gov/geo/www/cen_tract.html).

2005-09, 2006-10, and 2007-11.<sup>5</sup> The interpretations of the ACS estimates, therefore, differ from the previous decennial estimates because they represent rolling averages instead of sharp cross-sections. To simplify our language in the remainder of this brief, we refer to the ACS estimates by the middle of the five-year time span. So “2007” refers to the 2005-09 period; “2008” refers to the 2006-2010 period; and “2009,” to the 2007-11 period.

We restrict our analyses to metropolitan areas with total populations of 500,000 or more in 2007. This creates a sample of 117 large- and moderate-sized metropolitan areas,<sup>6</sup> home to 197 million people in 2007, roughly 65 percent of the total U.S. population and 78 percent of the total population living in metropolitan areas.<sup>7</sup> Though we use all 117 metropolitan areas for our overall calculations of income segregation, we use fewer metropolitan areas in the racial/ethnic group-specific analyses.<sup>8</sup>

As we stated above, we focus on the income segregation of *families* rather than *households*. We do this for two reasons. First, income segregation is potentially particularly salient for children because neighborhood resources and neighborhood context are important for

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<sup>5</sup> The 2005-09 estimates are the first available from the ACS.

<sup>6</sup> Reardon and Bischoff (2011b) show that income segregation was lower and grew less from 1970-2000 in small metropolitan areas than in large ones. Because there is less geographic area in small metropolitan areas, the possibility for spatial separation between high and low-income families is more constrained. We focus on the largest metro areas as defined by their 2007 populations (rather than more recent years) for consistency with our earlier published report (Reardon and Bischoff 2011a).

<sup>7</sup> We use the OMB June, 2003 metropolitan area definitions, the first definitions based on the 2000 Census, to define metropolitan areas (see <http://www.census.gov/population/metro/index.html>). We use these same definitions in each year 1970-2009, to ensure comparability over time. In cases where a metropolitan area is comprised of multiple metropolitan divisions, we treat each division as a distinct metropolitan area (e.g., the New York-Newark-Edison, NY-NJ-PA metropolitan area is made up of four metropolitan divisions: the New York-Wayne-White Plains NY-NJ; Newark-Union NJ-PA; Edison, NJ; and Suffolk County-Nassau County, NY metropolitan divisions, each of which we treat as a separate metropolitan area). The 117 metropolitan areas with population of at least 500,000 in 2007 range in population from 11.6 million (New York-White Plains, NY-NJ) to 505,000 (Modesto, CA).

<sup>8</sup> We exclude metropolitan areas with small black or Hispanic subpopulations because the income segregation measures we use require moderately large populations to compute income segregation accurately. Specifically, following Jargowsky (1996), we include in our within-racial/ethnic group income segregation analyses only metropolitan areas in which there were at least 10,000 black or Hispanic families in each Census from 1970-2009 (or from 1980-2009 for Hispanic families, as the Census did not provide data for a Hispanic category in 1970). This creates a stable sample of metropolitan areas to compare over time. Of the 117 metropolitan areas with 500,000 or more residents in 2007, 65 had at least 10,000 black families in each year from 1970-2009 and 37 had at least 10,000 Hispanic families in each year from 1980-2009.



early development (Leventhal and Brooks-Gunn 2000; Wodtke, Harding, and Elwert 2011). In Census tabulations, children are embedded in families whereas households may contain just one adult or groups of unrelated adults. Because we are particularly interested in children's experiences, families are the relevant unit. The second reason is pragmatic: family income by race/ethnicity is available for all Census years, while income for households by race/ethnicity is not.

Income segregation – the extent to which high- and low-income families live in separate neighborhoods – can be measured in several ways. We report four different measures, each of which has a different interpretation.

**a) Proportion of families in poor and affluent neighborhoods: neighborhood median income as base**

We compute the proportions of families who live in high-, moderate-, or low-income neighborhoods. Specifically, for each neighborhood (census tract) in each metropolitan area, we compute the ratio of the neighborhood median family income to the metropolitan area median income. We use this ratio to classify neighborhoods as *poor* (median income ratio < 0.67), *low income* (ratio between 0.67 and 0.80), *low-middle income* (ratio between 0.80 and 1.0), *high-middle income* (ratio between 1.0 and 1.25), *high income* (ratio between 1.25 and 1.5), or *affluent* (ratio > 1.5). We then compute the proportion of families in each metropolitan area who live in each of these six categories of neighborhoods. In a highly-segregated metropolitan area, many families will live in *poor* or *affluent* neighborhoods and relatively few will live in middle-income neighborhoods. Thus, we add together the proportion of families living in poor and affluent neighborhoods to construct a measure of income segregation.

Note that this definition of neighborhood poverty and affluence is defined relative to the median income of the metropolitan area. A typical metropolitan area in 2009 had a median

family income of roughly \$75,000; in a poor neighborhood (by our definition) more than half the families would have incomes below \$50,000; in an affluent neighborhood, more than half the families would have incomes above \$112,500. The advantage of this measure is that it is relatively intuitive and readily interpretable. Two disadvantages are: 1) it relies on somewhat arbitrary definitions of neighborhood poverty and affluence, and 2) it may confound changes in income inequality with changes in segregation. If every family stayed in the same neighborhood but income inequality grew (high-income families' incomes rose while low-income families' incomes declined), the number of poor and affluent neighborhoods would increase, simply because median incomes would rise, on average, in higher-income neighborhoods and decline in lower-income neighborhoods.

#### **b) Rank-order information theory index**

The second measure of income segregation —the *rank-order information theory index* (denoted  $H$ )—is less intuitive than the first, but does not confound changes in income inequality with changes in income segregation (Reardon 2011; Reardon and Bischoff 2011b). This measure compares the variation in family incomes within census tracts to the variation in family incomes in the metropolitan area. It can range from a theoretical minimum of 0 (no segregation) to a theoretical maximum of 1 (total segregation). In a hypothetical metropolitan area in which the income distribution among families within every census tract was identical—and therefore identical to the overall metro income distribution—the index would equal 0, indicating no segregation by income. In such a metropolitan area, a family's income would have no correlation with the average income of its neighbors. In contrast, in a hypothetical metropolitan area in which each tract contained families of only a single income level, the index would equal 1. In such a metropolitan area, segregation would be at its absolute maximum; no family would

have a neighbor with a different income than its own. Although the magnitude of  $H$  does not have a particularly intuitive meaning, differences in  $H$  between metropolitan areas or changes over time indicate where and when segregation is higher or lower. Moreover, the level of income inequality in a metropolitan area does not influence  $H$ , so it more accurately measures the extent to which families of different incomes are sorted among neighborhoods than does our first measure.<sup>9</sup>

### c) Segregation of poverty, segregation of affluence

The third and fourth measures describe the extent to which either low- or high-income families are segregated from all other families. The *segregation of poverty* (denoted  $H10$ ) is measured by using a variant of  $H$  that describes the extent to which the lowest-earning families (the bottom 10 percent) in a metropolitan area live in separate neighborhoods from all other, higher-earning families (the remaining 90 percent). Likewise, the *segregation of affluence* (denoted  $H90$ ) describes the extent to which the highest-earning families (the top 10 percent) in a metropolitan area live in separate neighborhoods from all other, lower-earning families (the remaining 90 percent). For instance, if  $H10$  is close to 0, it means that the poorest families are scattered fairly evenly throughout the area; in theory, as  $H10$  approaches 1, those families are increasingly clustered.

Together, these four measures provide a detailed picture of variations in income segregation among metropolitan areas and the changes over the last four decades.

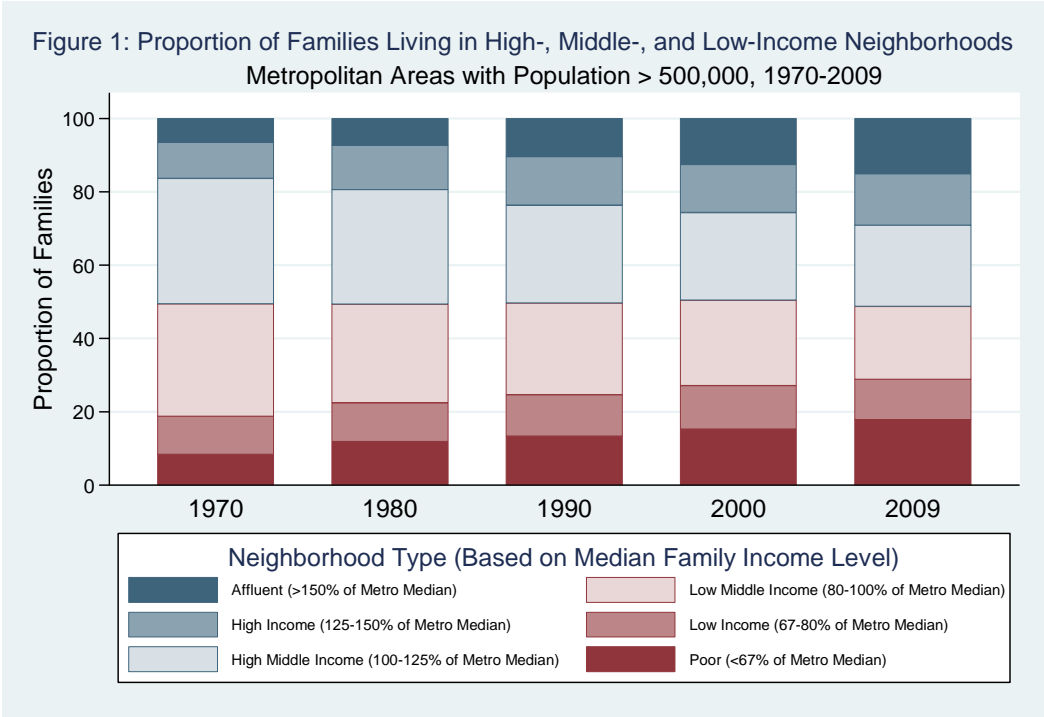
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<sup>9</sup> A brief description of the rank-order information theory index is in the Appendix. The technical details of calculating the index are described elsewhere (Reardon 2011; Reardon and Bischoff 2011a; Reardon and Bischoff 2011b).

# Income Segregation Trends

We now turn to the results of our analyses. We begin by describing trends in the proportions of families who lived in neighborhoods with high-, moderate-, or low-income neighborhoods from 1970-2009. We then describe trends in overall and racial/ethnic group-specific income segregation from 1970-2009 using the rank-order information theory index. Third, we report the trends in the segregation of affluence and poverty.

Figure 1 shows the proportion of families that reside in six categories of high-, middle-, and low-income neighborhoods from 1970-2009. The figure shows a steady decline in the proportion of families living in middle-income neighborhoods from 1970-2009, and a corresponding increase in the number of families in neighborhoods at the extremes of the



neighborhood income distribution. In 1970, 65 percent of families lived in middle-income neighborhoods (neighborhoods in one of the two middle categories); by 2009, only 42 percent of families lived in such neighborhoods. The proportion of families living in affluent

neighborhoods more than doubled from 7 percent in 1970 to 15 percent in 2009. Likewise, the proportion of families in poor neighborhoods doubled from 8 percent to 18 percent over the same period. Thus, in 1970 only 15 percent of families lived in the one of the two extreme types of neighborhoods; by 2009 that number had more than doubled to 33 percent of families.

By this measure, income segregation grew significantly from 1970-2009. Moreover, family income segregation grew in every decade from 1970-2009. The proportion in poor or affluent neighborhoods increased by 4.1 percentage points in the 1970s, by 4.6 percentage points in the 1980; by 4.2 percentage points in the 1990s, and by 5.1 percentage points from 2000-2009 (see Appendix Table A1 for details). The rate of growth in segregation in the 2000s was faster than in any of the three prior decades. Although Americans may still have believed in middle-class communities, our metropolitan areas were dividing by income.

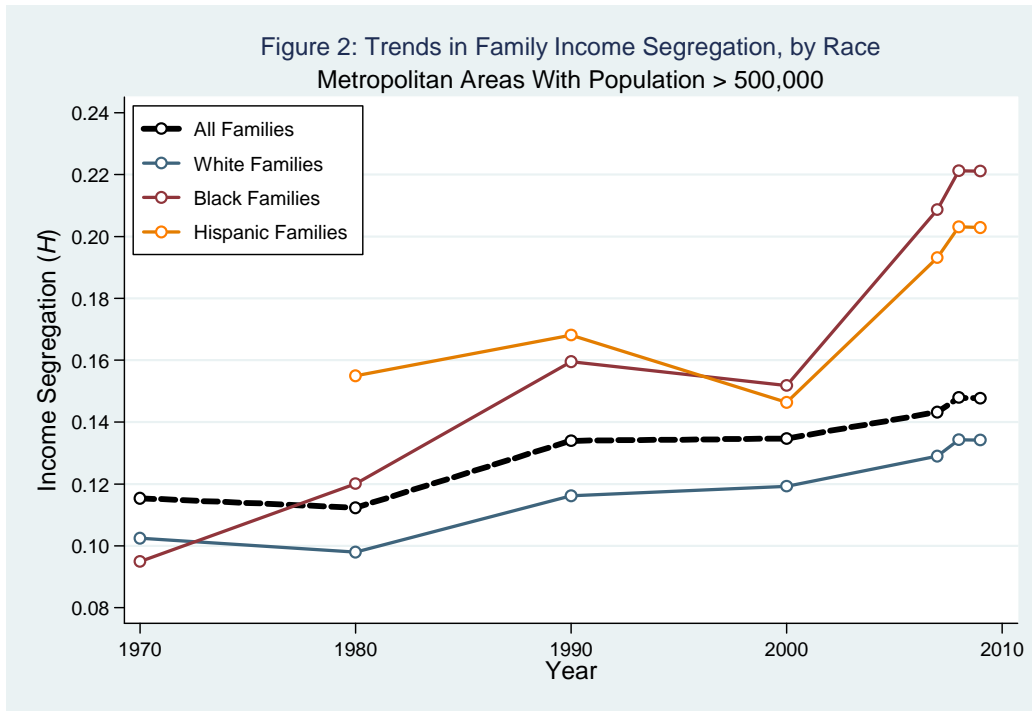
The trends in average income segregation, the segregation of poverty, and the segregation of affluence repeat the pattern of residential cleavage. Table 1 presents descriptive statistics on levels and changes in  $H$ , the segregation of poverty, and the segregation of affluence from 1970-2009 in the 117 large- and moderate-sized metropolitan areas in this study.

|   | <b>1970</b>      | <b>1980</b>      | <b>1990</b>      | <b>2000</b>      | <b>2007</b>      | <b>2008</b>      | <b>2009</b>      |
|---|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| <b>Overall Segregation (<math>H</math>)</b>           | 0.115<br>(0.027) | 0.112<br>(0.027) | 0.134<br>(0.029) | 0.135<br>(0.027) | 0.143<br>(0.028) | 0.148<br>(0.027) | 0.148<br>(0.027) |
| <b>Segregation of Poverty (<math>H_{10}</math>)</b>   | 0.112<br>(0.023) | 0.124<br>(0.030) | 0.153<br>(0.038) | 0.146<br>(0.031) | 0.158<br>(0.031) | 0.163<br>(0.029) | 0.163<br>(0.029) |
| <b>Segregation of Affluence (<math>H_{90}</math>)</b> | 0.173<br>(0.037) | 0.156<br>(0.037) | 0.189<br>(0.039) | 0.185<br>(0.036) | 0.195<br>(0.038) | 0.202<br>(0.037) | 0.200<br>(0.036) |

Standard deviations in parentheses.

Segregation by income among all families rose from 0.115 in 1970, to 0.148 in 2009, an increase of 0.033. In the metric of  $H$ , this is a substantial change, roughly equal to a 1.2 standard deviation increase. Put differently, overall income segregation increased by approximately 29

percent over this 40-year period. Figure 2 shows the trend in average segregation, as measured by  $H$ , from 1970 to 2009. Note that, by this measure, segregation of families by income changed little in the 1970s or 1990s but grew substantially in the 1980s (from 0.112 in 1980 to 0.134 in



**Source:** Authors' tabulations of data from U.S. Census (1970-2000) and American Community Survey (2005-2011). Averages include all metropolitan areas with at least 500,000 residents in 2007 and at least 10,000 families of a given race in each year 1970-2009 (or each year 1980-2009 for Hispanics). This includes 116 metropolitan areas for the trends in total and white income segregation, 65 metropolitan areas for the trends in income segregation among black families, and 37 metropolitan areas for the trends in income segregation among Hispanic families. Note: the averages presented here are unweighted. The trends are very similar if metropolitan areas are weighted by the population of the group of interest.

1990) and grew again in the 2000s (from 0.135 to 0.148). One reason the trend in income segregation, as measured by  $H$ , differs from the trend based on the proportion of families in poor and affluent neighborhoods is that the proportion of families living in these neighborhoods is affected by *both* the level of income inequality and the degree to which families of different incomes are sorted among neighborhoods. The rank-order index ( $H$ ), in contrast, is not affected

by changes in income inequality, so it is a clearer measure of the degree of sorting alone.<sup>10</sup>

Black and Hispanic families lived in increasingly income-segregated communities. In addition to showing the trend in income segregation for the full population of families, Figure 2 presents trends in within-race income segregation among white, black, and Hispanic families separately. The line for black families represents the trend in residential segregation among black families of differing income levels (not the trend in segregation between white and black families). The different lines in the figure compare trends in within-group income segregation across racial/ethnic groups. These trend lines can be thought of as describing the extent to which families' exposure to same-race neighbors of varying income levels has changed over time. Increasing income segregation among black families means that poor black families have fewer middle-class black neighbors in 2009 than in 1970.

The rapid rise in black income segregation in the 1970s and 1980s may stem in part from changes in housing legislation,<sup>11</sup> increases in black suburbanization (see, for example, Logan and Schneider 1984; Schneider and Phelan 1993), and the emergence of a more substantial black middle class (Landry 1987; Pattillo-McCoy 2000). The combination of these forces created opportunities for black families of differing socioeconomic statuses to live in a variety of places throughout the metropolitan area.<sup>12</sup> The interaction among racial segregation, between-group

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<sup>10</sup> Because  $H$  relies only on information about each family's *rank* in the metropolitan area income distribution, changes in income inequality that leave each family's rank and residential location unchanged will not alter  $H$ . Such changes would, however, alter the proportion of neighborhoods of each type. To see this, suppose the incomes of all families with above median income are doubled and the incomes of all below-median income families are cut in half, but all families remain in their original neighborhoods. This would change income inequality, but leave each family's rank in the income distribution unchanged, so  $H$  would be unchanged. However, because each neighborhood's median income would be either doubled or halved (depending on whether the median resident of the neighborhood had an income above or below the metropolitan median), *all* neighborhoods would now be poor or affluent by our definitions above. This would register as a large increase in income segregation as measured by the proportion of families living in poor or affluent neighborhoods.

<sup>11</sup> For a history of fair housing regulations, see U.S. Department of Housing and Urban Development: [http://portal.hud.gov/hudportal/HUD?src=/program\\_offices/fair\\_housing\\_equal\\_opp/FHLaws](http://portal.hud.gov/hudportal/HUD?src=/program_offices/fair_housing_equal_opp/FHLaws).

<sup>12</sup> Although there were great strides made in fair housing legislation from the late 1960s through the 1990s, there have been serious and ongoing issues regarding enforcement of these laws (see Massey and Denton (1993) for a

differences in income, and within-group income segregation complicates straightforward implications of these trends for individual- and group-level outcomes.<sup>13</sup> William Julius Wilson argued in *The Truly Disadvantaged* (1987) that formerly mixed-income black neighborhoods in inner cities became impoverished during this period, at least in part, because of high levels of racial segregation coupled with the outward migration of the black middle class.

The trends in income segregation among black and Hispanic families are much more striking than those among white families. Segregation by income among black families was lower than among white families in 1970, but grew four times as much between 1970 and 2009. By 2009, income segregation among black families was 65 percent greater than among white families. Although income segregation among blacks grew substantially in the 1970s and 1980s, it grew at an even faster rate from 2000 to 2009, after declining slightly in the 1990s. Indeed, in the nine years from 2000 to 2009, income segregation among black families grew by almost 2 standard deviations (the 2000 standard deviation of income segregation among blacks was 0.036; the change from 2000-2009 was 0.069).

The trend in income segregation among Hispanic families is similar to that among black families, though the growth of Hispanic income segregation in the 1980s and 2000s was less than the growth for black families during those time periods. In the 1990s the decline of segregation was greater among Hispanic families than among black families. In the 2000s, income segregation among Hispanic families grew more than one standard deviation (by 0.057 points, compared to a 2000 standard deviation of 0.044). The trends presented in Figure 2 highlight the growing socioeconomic diversity within historically disadvantaged groups, and their

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thorough discussion of these issues), and recent evidence suggests that discrimination in the housing market has not been eliminated (Ross and Turner 2005; Turner 2008).

<sup>13</sup> Discussions of these interactions are beyond the scope of this chapter. See Bruch (forthcoming) for a more extensive discussion.



corresponding spatial separation. This pattern among black and Hispanic families may exacerbate “concentrated disadvantage” when coupled with the persistent racial segregation that pervades most American metropolitan areas.<sup>14</sup> In short, racial segregation coupled with income segregation means that low-income black and Hispanic families will tend to cluster in communities that are disadvantaged along a number of dimensions, such as average educational attainment, family structure, and unemployment. In contrast, low-income white families, although affected by income segregation as well, tend to live in neighborhoods with higher average incomes than even middle-class black and Hispanic families (Logan 2011). Thus, white families are able to “buy-up” while black and Hispanic families “buy down.” Longstanding racial wealth differentials may explain some of this disparity in neighborhood attainment (Oliver and Shapiro 1995; Taylor, Fry, and Kochhar 2011), though it is likely that racial discrimination in the housing market, individual preferences, and white flight also contribute to the creation of neighborhoods characterized by concentrated disadvantage.

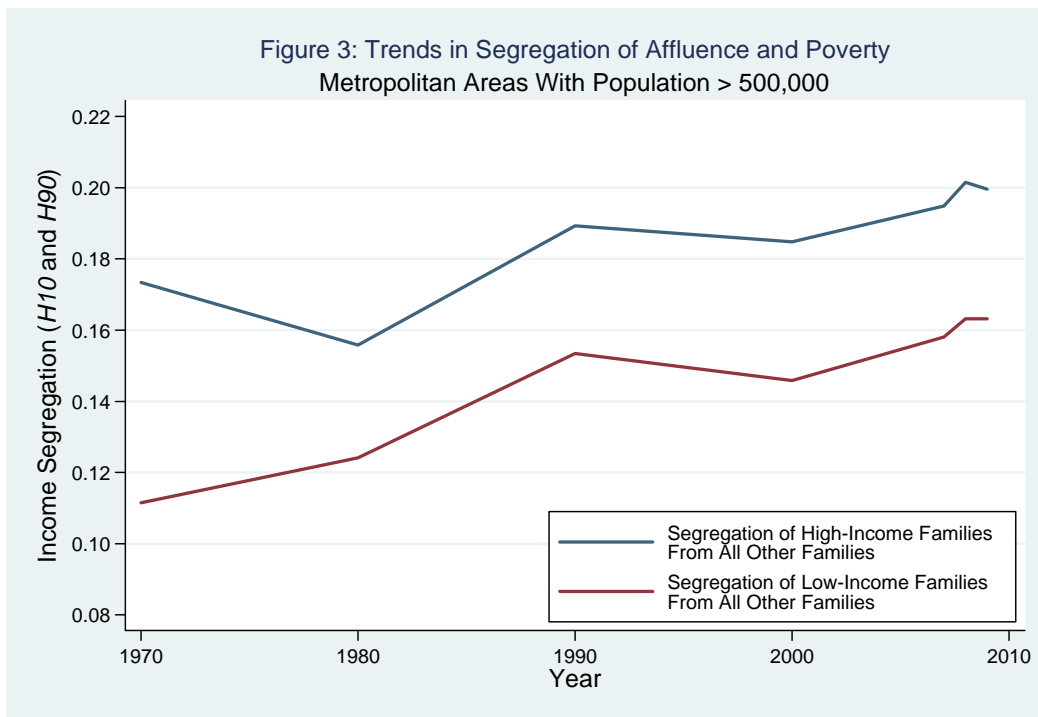
Consider the extent to which very high-income or very low-income families are isolated from other families within a metropolitan area. Table 1 shows that between 1970 and 2009, the segregation of poverty (the extent to which the 10 percent of families with the lowest incomes in a metropolitan area are isolated from all higher-income families) increased by 0.051 and the segregation of affluence (the extent to which the 10 percent of families with the highest incomes in a metropolitan area are isolated from all lower-income families) increased by 0.027. Although the rise in the segregation of poverty is greater than that for the segregation of affluence, in all years, the level of the segregation of affluence is considerably higher than level of the segregation of poverty. Figure 3 displays trends in the segregation of affluence (*H90*) and the

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<sup>14</sup> Although racial segregation has declined some in recent decades, evidence from the 2010 Census shows that the changes are slow, and the historical patterns entrenched (Logan and Stults 2011).

segregation of poverty (*H10*) from 1970 through 2009.

Although the segregation of poverty grew rapidly in the 1970s while the segregation of affluence declined substantially, Figure 3 clearly shows that the trends in both the segregation of poverty and affluence have followed a similar pattern for the last 30 years. In the 1980s, segregation levels rose substantially; in the 1990s, they declined slightly. Jargowsky (1996) also found increases in the isolation of poverty through the 1980s and reported significant declines in concentrated poverty in the 1990s. He attributed the declines in concentrated poverty in the 1990s largely to the strong economic upswing the nation experienced through much of the decade (Jargowsky 2003). Predictably, in the 2000s both high- and low-income families became increasingly isolated from all other families, reversing the pattern of declining isolation through the 1990s. Macro-economic conditions surely played a role in this sharp increase in economic segregation over the past decade, with the Great Recession likely shaping the decade-long trends. We discuss possible reasons for these shifting trends below.



## Metropolitan Characteristics and Income Segregation

We have shown the increasing income segregation in American metropolitan areas; but those trends (Figures 2 and 3) mask a substantial variation among metropolitan areas. In any given year, segregation is two to three times as high in the most segregated 10 percent of metropolitan areas as in the least segregated 10 percent.

We next examine whether this variation is systematically associated with demographic and structural features of metropolitan areas. This section explores the relationship between selected metropolitan characteristics and three measures of income segregation—overall income segregation ( $H$ ), the segregation of poverty ( $H10$ ), and the segregation of affluence ( $H90$ ). Consistent with the previous analyses in this chapter, we present estimates only for the most populous 117 metropolitan areas in 2007.

Although there are many hypotheses regarding the metropolitan characteristics most strongly associated with income segregation, we focus on a small set of characteristics that theory and/or prior research suggest may be strongly related to income segregation. First is metropolitan family income inequality. Although income inequality is a necessary condition for income segregation, it is not sufficient. In theory, families of different income levels can spread equally across a metropolitan area, to create mixed-income neighborhoods. However, prior research has established a strong—and arguably causal—link between the rise in income inequality and the rise in income segregation from 1970-2000 (Reardon and Bischoff 2011b; Watson 2009). We expect the same positive relationship to persist through the 2000s as both inequality and income segregation increased in the past decade.

Second, because the potential for residential sorting is greater in larger metropolitan areas, we expect income segregation to be higher in larger metropolitan areas, a pattern found in prior research (Jargowsky 1996; Reardon and Bischoff 2011b; Watson 2009).

Third, based on the argument that residential location is more consequential for children than for adults, we expect that families with children will be more segregated by income than families and households without children. Residential location often determines the school a child attends. In addition, residential location may affect other factors important to parents, including access to parks and playgrounds, and exposure to crime and violence. If parents care more about these factors than do non-parents, they may be willing to pay more to live in neighborhoods with better schools and parks, and lower crime rates; this in turn will increase levels of income segregation. If this pattern holds, we would expect higher levels of income segregation in metropolitan areas with a larger proportion of children than in those with fewer children.

Fourth, we expect income segregation to be higher in metropolitan areas with higher levels of educational attainment inequality. As the returns to education have increased in recent decades (Goldin and Katz 2008; Oreopoulos and Petronijevic 2013), the income gap between those with college degrees and those with high school degrees or less has grown. In addition, as average education levels continue to rise, those without a high school diploma struggle to find well-paying, stable jobs. As a result, income segregation is likely increasingly correlated with educational segregation. Though we do not test this hypothesis explicitly, we do examine whether income segregation is higher in metropolitan areas with larger shares of both college graduates and high school dropouts than in metropolitan areas with less inequality in educational attainment.

Fifth, we want to understand recent changes in income segregation. Since unemployment rose dramatically during the Great Recession, we examine the association between metropolitan area unemployment rates and income segregation. Watson (2009) found that higher *employment* rates are associated with lower levels of income segregation: unemployment among less skilled men is associated with an exodus of middle- and upper-income families from central cities, thereby increasing income segregation. However, it is also possible that unemployment could decrease income segregation if it is spread across the income distribution instead of hurting mostly low-wage workers. In this case some high- and middle-income families would suffer a loss of income, even as they stay put in their neighborhoods. Since our last data point coincides with the end of a major economic recession, it is possible that unemployment in 2009 affected families across the income distribution and therefore decreased income segregation.

Finally, we examine the association between income segregation and the percent of workers in a metropolitan area employed in the manufacturing sector. Traditionally, that sector has paid relatively high wages for those with low educational attainment, leading to lowered income inequality (Cloutier 1997) and so, perhaps, to lowered income segregation. Moreover, manufacturing industries often cluster within metropolitan areas, with workers living nearby. Over the last forty years, manufacturing in this country has declined. When a plant closes, the incomes of families living relatively near each other may decline. As formerly mixed-income neighborhoods become low-income neighborhoods, income segregation increases. Thus, we expect declines in manufacturing to be associated with increases in income segregation.

In addition to these explanatory variables of theoretical interest, we also include in our analyses a small number of metropolitan-level covariates that are related to both income segregation and the other explanatory variables: per capita income, percent black, percent

Hispanic/Latino, percent foreign-born, percent female-headed families (no husband present), and percent of the population 65 years old and above.

Although the measurement of some of the metropolitan-level factors is straightforward, others may require clarification. We measure income inequality with the Gini index, which measures the extent to which the actual income distribution deviates from a hypothetical distribution in which each family receives an equal proportion of total income. The measure ranges from 0 (perfect equality) to 1 (maximum inequality).<sup>15</sup> Population size is logged in the analyses to correct for positive skew in the distribution of population size among metropolitan areas. Average educational attainment is measured among adults age 25 and older, and unemployment is measured among individuals in the labor force age 16 and older.<sup>16</sup> Per capita income, adjusted for inflation, is presented in 2009 dollars. Finally, our measure of female-headed families includes all families headed by women with no husband present. These families can include the woman's own children, but can also include other children who live with her (for example, a grandmother caring for a grandchild).

### **Correlates of Metropolitan Area Family Income Segregation**

Table 2 presents simple bivariate correlations between three measures of metropolitan income segregation and the metropolitan-level characteristics in 2009. First, note that income inequality is moderately positively correlated with  $H$  (overall income segregation), highly positively correlated with the segregation of affluence, and uncorrelated with the segregation of poverty. This is consistent with Reardon and Bischoff's (2011b) finding that income inequality is most strongly associated with the spatial separation of affluent families from all other families,

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<sup>15</sup> Because individual-level data are unavailable from publicly available Census files, we use a procedure described in detail in Nielsen and Alderson (1997).

<sup>16</sup> To obtain the most accurate measure of unemployment, it may be optimal to calculate unemployment only among those of prime working age, and perhaps only among men. But to maintain consistency over our five time points, we use the entire universe of those in the labor market who are of working age.

as opposed to the spatial isolation of the poor. Second, income segregation is higher, on average, in larger metropolitan areas, though this appears to be due primarily to the high correlation between metropolitan area size and the segregation of affluence. Income segregation is only weakly correlated with most of the other key characteristics of interest—age composition, educational attainment levels, unemployment rates, and the percent of workers in the manufacturing sector.

| <b>Table 2: Bivariate Correlations between Metropolitan Characteristics and Measures of Income Segregation, 2009</b> |                        |                               |                                 |
|--|------------------------|-------------------------------|---------------------------------|
|  | <b>Segregation (H)</b> | <b>Segregation of Poverty</b> | <b>Segregation of Affluence</b> |
| <b>Income Inequality (Gini)</b>  | 0.46*                  | -0.07                         | 0.63*                           |
| <b>Population (log)</b>  | 0.54*                  | 0.21*                         | 0.63                            |
| <b>% Age 18 and Under</b>  | 0.16                   | -0.17                         | 0.11                            |
| <b>% with BA or Higher</b>   | 0.28*                  | 0.25*                         | 0.29*                           |
| <b>% with Less than a HS Degree</b>  | 0.09                   | -0.29*                        | 0.18                            |
| <b>% Unemployed</b>  | 0.05                   | -0.11                         | 0.08                            |
| <b>% of Workers in Manufacturing</b>   | -0.02                  | 0.22*                         | -0.15                           |
| <b>Per Capita Income (2009 Dollars)</b>  | 0.26*                  | 0.28*                         | 0.26*                           |
| <b>% African-American</b>  | 0.33*                  | 0.26*                         | 0.33*                           |
| <b>% Hispanic/Latino</b>   | 0.12                   | -0.37*                        | 0.24*                           |
| <b>% Foreign Born</b>  | 0.21*                  | -0.25*                        | 0.38*                           |
| <b>% Female-Headed Families</b>  | 0.36*                  | 0.23*                         | 0.33*                           |
| <b>% Age 65 and Older</b>  | -0.33*                 | -0.04                         | -0.25*                          |

\*p<.05

The bivariate associations between income segregation and metropolitan area characteristics do not take into account the relationships among the metropolitan-level characteristics. Many of these characteristics are correlated with one another, which confounds interpretation of their independent associations. To isolate the independent association (holding all of the other characteristics constant) between the metropolitan area characteristics and income segregation levels, we estimate three ordinary least squares (OLS) regression models using metropolitan area data from 2009. These models estimate the cross-sectional associations

between income segregation and each metropolitan characteristic, net of the other factors in the model. Table 3 presents results from these three models.

| <b>Table 3: Estimated Partial Associations between Selected Metropolitan Characteristics and Income Segregation, 2009</b> |                               |         |                               |         |                                 |         |
|---|-------------------------------|---------|-------------------------------|---------|---------------------------------|---------|
|   | <b>Segregation (<i>H</i>)</b> |         | <b>Segregation of Poverty</b> |         | <b>Segregation of Affluence</b> |         |
| <b>Income Inequality (Gini)</b>   | 0.734***                      | (0.142) | -0.115                        | (0.187) | 1.290***                        | (0.161) |
| <b>Population (log)</b>   | 0.025***                      | (0.006) | 0.022*                        | (0.009) | 0.038***                        | (0.007) |
| <b>% Age 18 and Under</b>   | 0.467***                      | (0.124) | 0.439**                       | (0.163) | 0.391**                         | (0.140) |
| <b>% with BA or Higher</b>  | -0.041                        | (0.074) | 0.104                         | (0.097) | -0.047                          | (0.084) |
| <b>% with Less than a HS Degree</b>   | -0.287**                      | (0.090) | -0.025                        | (0.118) | -0.386***                       | (0.102) |
| <b>% Unemployed</b>   | -0.032                        | (0.116) | -0.008                        | (0.153) | -0.103                          | (0.132) |
| <b>% of Workers in Manufacturing</b>  | 0.06                          | (0.048) | 0.098                         | (0.064) | 0.037                           | (0.055) |
| <b>Per Capita Income (2009 Dollars)</b>   | 0.003***                      | (0.001) | 0.003**                       | (0.001) | 0.003**                         | (0.001) |
| <b>% African-American</b>   | -0.039                        | (0.031) | -0.129**                      | (0.041) | 0.033                           | (0.035) |
| <b>% Hispanic/Latino</b>  | 0.029                         | (0.029) | -0.047                        | (0.038) | 0.061                           | (0.032) |
| <b>% Foreign Born</b>   | -0.093*                       | (0.040) | -0.138**                      | (0.052) | -0.077                          | (0.045) |
| <b>% Female-Headed Families</b>   | 0.401***                      | (0.098) | 0.796***                      | (0.129) | 0.12                            | (0.111) |
| <b>% Age 65 and Older</b>   | -0.042                        | (0.111) | 0.207                         | (0.146) | -0.026                          | (0.126) |
| <b>Adjusted R<sup>2</sup></b>   | 0.64                          |         | 0.459                         |         | 0.734                           |         |
| <b>N</b>  | 117                           |         | 117                           |         | 117                             |         |

Standard errors in parentheses. \*p<.05; \*\*p<.01; \*\*\*p<.001.

The first model, which regresses overall income segregation (*H*) on metropolitan area characteristics, produces a large and highly statistically significant estimated association between income inequality and income segregation of 0.734 (SE = 0.142;  $p < .001$ ), controlling for the other metropolitan characteristics. A difference of one point in income inequality is associated with a difference of approximately three quarters of a point in income segregation. This pattern is consistent with prior findings that metropolitan areas with high levels of income inequality also have high levels of income segregation. The first model also confirms our hypotheses regarding population size and age structure. Metropolitan population size is positively and significantly associated with income segregation ( $\beta = 0.025$ ; SE = 0.006;  $p < .001$ ), as is the share of the population 18 years old or younger ( $\beta = 0.467$ ; SE = 0.124;  $p < .001$ ). A one-point



difference in the proportion of children in a metropolitan area is associated with a roughly half-point difference in income segregation. The results of this cross-sectional model do not support our hypothesis regarding the association between the diversity in educational attainment and segregation: the proportion of the population with a college degree is not significantly associated with segregation, and the proportion with less than a high school degree is negatively associated with income segregation. Finally, these models show no significant association between income segregation and unemployment or between income segregation and percentage of workers in manufacturing.

The second and third models present results for the estimated associations between the metropolitan characteristics and the segregation of poverty and of affluence. In general, the same patterns evident in the first models hold here, with several key exceptions. Most notably, income inequality is not significantly associated with the segregation of poverty, but is strongly associated with the segregation of affluence ( $\beta = 1.290$ ;  $SE = 0.161$ ;  $p < .001$ ), a pattern that mirrors Reardon and Bischoff's (2011b) analysis of 1970-2000 income segregation. Reardon and Bischoff (2011b) argue that this may be because the segregation of affluence is more responsive to upper-tail income inequality, which comprises a larger component of overall income inequality, or perhaps because segregation of poverty is affected more by housing policy than by income inequality.

### **Correlates of Changes in Income Segregation, 1970-2009**

The cross-sectional associations between metropolitan area characteristics and income segregation levels in 2009 give only a partial picture; they should not be interpreted as causal relationships. To gain a more complete picture, we investigate the impact of changes over time

on high-income segregation, high-income inequality, and high proportions of children of children in the population.

Other unobserved features of metropolitan areas may lead to both high-income segregation and high inequality, or high proportions of children in the population. To address this possibility, we use multiple years of data from each metropolitan area to estimate the average within-metropolitan area associations between changes in metropolitan characteristics and changes in income segregation levels. Because this strategy focuses only on changes over time within metropolitan areas, it has a stronger causal warrant than the cross-sectional models. Nonetheless, the estimates from these models may still not represent causal relationships if there are unobserved time-varying features of metropolitan areas that are both correlated with the metropolitan area characteristics of interest and that affect income segregation. That said, the estimates from these within-metropolitan area models are useful for understanding how changes in metropolitan area characteristics are associated with changes in income segregation.

To begin, we examine the substantial changes in the key metropolitan area characteristics between 1970 and 2009 (Table 4). Average family income inequality rose 15 percent in the 117 largest metropolitan areas, while the proportion of the population under age 19 declined by 28 percent. As for educational attainment, the share of college graduates increased by more than 150 percent. Unemployment nearly doubled, though this is partly an artifact of the timing of our initial and final time points: unemployment was historically low in 1970 and unusually high in 2009. Moreover, the share of workers employed in manufacturing declined by nearly 60 percent during this period, a result of the general deindustrialization in American cities over the

last four decades. Notable among the control variables, the Hispanic population tripled, and the percent of female-headed families grew by 80 percent. Taken as a whole, this table depicts a broadly changing metropolitan landscape during the last 40 years.

|   | <b>1970</b>       | <b>1980</b>       | <b>1990</b>       | <b>2000</b>       | <b>2009</b>       | <b>Unit Change</b> | <b>% Change</b> |
|---|-------------------|-------------------|-------------------|-------------------|-------------------|--------------------|-----------------|
| <b>Income Inequality (Gini)</b>         | 0.352<br>(0.029)  | 0.360<br>(0.023)  | 0.383<br>(0.026)  | 0.399<br>(0.025)  | 0.405<br>(0.022)  | 0.05               | 15%             |
| <b>Population (log)</b>                 | 5.868<br>(0.352)  | 5.941<br>(0.324)  | 6.001<br>(0.313)  | 6.051<br>(0.307)  | 6.108<br>(0.304)  | 0.24               | 4%              |
| <b>% Age 18 and Under</b>               | 0.339<br>(0.027)  | 0.272<br>(0.030)  | 0.256<br>(0.033)  | 0.266<br>(0.030)  | 0.245<br>(0.028)  | -0.09              | -28%            |
| <b>% with BA or Higher</b>              | 0.119<br>(0.033)  | 0.176<br>(0.044)  | 0.22<br>(0.055)   | 0.263<br>(0.064)  | 0.303<br>(0.070)  | 0.18               | 155%            |
| <b>% with Less than a HS Degree</b>     | 0.446<br>(0.083)  | 0.307<br>(0.072)  | 0.226<br>(0.060)  | 0.179<br>(0.057)  | 0.134<br>(0.049)  | -0.31              | -70%            |
| <b>% Unemployed</b>                     | 0.042<br>(0.015)  | 0.061<br>(0.019)  | 0.06<br>(0.017)   | 0.055<br>(0.017)  | 0.086<br>(0.019)  | 0.04               | 105%            |
| <b>% of Workers in Manufacturing</b>    | 0.242<br>(0.099)  | 0.212<br>(0.081)  | 0.167<br>(0.056)  | 0.131<br>(0.049)  | 0.103<br>(0.038)  | -0.14              | -57%            |
| <b>Per Capita Income (2009 Dollars)</b> | 19.419<br>(2.966) | 22.333<br>(3.121) | 26.109<br>(5.011) | 29.134<br>(5.422) | 29.043<br>(5.565) | 9.62               | 50%             |
| <b>% African-American</b>               | 0.106<br>(0.092)  | 0.112<br>(0.094)  | 0.116<br>(0.095)  | 0.122<br>(0.100)  | 0.127<br>(0.100)  | 0.02               | 20%             |
| <b>% Hispanic/Latino</b>                | 0.053<br>(0.098)  | 0.07<br>(0.119)   | 0.09<br>(0.135)   | 0.123<br>(0.151)  | 0.159<br>(0.161)  | 0.11               | 200%            |
| <b>% Foreign Born</b>                   | 0.046<br>(0.039)  | 0.062<br>(0.054)  | 0.075<br>(0.074)  | 0.11<br>(0.092)   | 0.127<br>(0.089)  | 0.08               | 176%            |
| <b>% Female-Headed Families</b>         | 0.108<br>(0.019)  | 0.14<br>(0.025)   | 0.161<br>(0.031)  | 0.182<br>(0.034)  | 0.194<br>(0.034)  | 0.09               | 80%             |
| <b>% Age 65 and Older</b>               | 0.091<br>(0.030)  | 0.104<br>(0.035)  | 0.121<br>(0.035)  | 0.125<br>(0.034)  | 0.125<br>(0.029)  | 0.03               | 37%             |

N=117 Metropolitan Areas. Standard deviations in parentheses.

Table 5 offers yet another perspective on the changing metropolitan landscape, reporting estimates from a series of regression models where data are pooled across decades 1970-2009. These models include metropolitan fixed-effects and therefore control for any time-invariant

characteristics of metropolitan areas. One way to think about the coefficients from these models is as estimates of the average within-metropolitan area associations (over time) between the metropolitan covariates and income segregation. For example, a coefficient of 0.443 (the coefficient of income inequality in the first model) means that, on average, each unit of change in the gini index within a metropolitan area is associated with a contemporaneous 0.443 unit change in segregation.<sup>17</sup> We also include a set of indicator variables that capture the average metropolitan change in income segregation within each decade across the nation, net of changes in the covariates in the models.<sup>18</sup>

The first model shows that changes in income inequality are positively related to changes in overall income segregation ( $H$ ), net of other time-varying metropolitan area factors and decade fixed effects ( $H=0.443$ ,  $SE = 0.090$ ;  $p<.001$ ). This effect accounts for approximately 70 percent of the average change in overall income segregation. In terms of effect size, a one-standard deviation change in inequality leads to a roughly 0.40 standard deviation change in income segregation.<sup>19</sup> Similar to the cross-sectional results, the association between inequality and segregation is much larger for the segregation of affluence ( $H = 0.658$ ;  $SE = 0.085$ ;  $p<.001$ ) than it is for overall segregation; there is no significant association between changes in inequality and changes in the segregation of poverty.

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<sup>17</sup> We use bootstrapped standard errors in all of the regression models to take into account the clustered nature of the observations. We are missing data for one moderately sized metropolitan area in 1970 (Cape Coral / Ft. Meyers, FL). This reduces our sample size from 585 (117 metropolitan areas x 5 times points) to 584.

<sup>18</sup> These indicator variables are constructed as follows: the “1970s” variable is coded 0 in 1970 and 1 in each year from 1980 onward. The “1980s” variable is coded 0 in 1970 and 1980, and 1 in each year following, and so on. By coding the year fixed effects in this way, their coefficients can be interpreted as the average change in segregation in a given decade, net of changes in segregation associated with changes in the other covariates in the models.

<sup>19</sup> These are computed from the changes in inequality and segregation from 1970-2009. Inequality grew by 0.053, and segregation grew by 0.033, from 1970-2009. The effect of income inequality on income segregation is 0.443, and thus the change in income segregation over this time period is  $0.443 * 0.053 = 0.023$ . This accounts for approximately 70% of the total change in income segregation (0.033). In addition, the standard deviation of income inequality within a given year is 0.025, on average, while the standard deviation of income segregation is roughly 0.027, on average. This implies that an effect of 0.443 corresponds to an effect size of 0.41.

**Table 5: Effects of Change in Metropolitan Characteristics on Change in Income Segregation, 1970-2009**

|   | Change in Segregation ( <i>H</i> ) |         | Change in Segregation of Poverty |         | Change in Segregation of Affluence |         |
|---|------------------------------------|---------|----------------------------------|---------|------------------------------------|---------|
| <b>Decadal change in:</b>               |                                    |         |                                  |         |                                    |         |
| <b>Income Inequality (Gini)</b>         | 0.443***                           | (0.090) | 0.104                            | (0.082) | 0.658***                           | (0.085) |
| <b>Population (log)</b>                 | 0.028*                             | (0.012) | 0.022                            | (0.019) | 0.038***                           | (0.010) |
| <b>% Age 18 and Under</b>               | 0.252***                           | (0.040) | 0.270***                         | (0.054) | 0.129*                             | (0.065) |
| <b>% with BA or Higher</b>              | 0.226***                           | (0.064) | 0.286***                         | (0.061) | 0.172*                             | (0.069) |
| <b>% with Less than a HS Degree</b>     | 0.025                              | (0.030) | 0.135***                         | (0.040) | -0.096*                            | (0.040) |
| <b>% Unemployed</b>                     | -0.128**                           | (0.046) | -0.047                           | (0.065) | -0.176**                           | (0.065) |
| <b>% of Workers in Manufacturing</b>    | -0.060*                            | (0.030) | -0.151***                        | (0.045) | 0.061                              | (0.035) |
| <b>Per Capita Income (2009 Dollars)</b> | -0.001                             | (0.001) | 0.000                            | (0.001) | -0.001                             | (0.001) |
| <b>% African-American</b>               | 0.027                              | (0.072) | 0.037                            | (0.092) | 0.005                              | (0.090) |
| <b>% Hispanic/Latino</b>                | 0.118**                            | (0.041) | 0.119*                           | (0.049) | 0.107*                             | (0.044) |
| <b>% Foreign Born</b>                   | -0.185***                          | (0.035) | -0.312***                        | (0.055) | -0.077                             | (0.047) |
| <b>% Female-Headed Families</b>         | 0.094                              | (0.100) | 0.213                            | (0.120) | 0.109                              | (0.088) |
| <b>% Age 65 and Older</b>               | -0.061                             | (0.083) | 0.041                            | (0.090) | -0.059                             | (0.092) |
| <b>National metro change 1970s</b>      | 0.000                              | (0.008) | 0.023**                          | (0.008) | -0.035***                          | (0.009) |
| <b>National metro change 1980s</b>      | 0.006                              | (0.005) | 0.020***                         | (0.006) | 0.007                              | (0.005) |
| <b>National metro change 1990s</b>      | -0.018***                          | (0.004) | -0.021***                        | (0.005) | -0.028***                          | (0.004) |
| <b>National metro change 2000s</b>      | 0.006                              | (0.005) | 0.011*                           | (0.005) | 0.003                              | (0.005) |
| <b>Metropolitan Area Fixed Effects</b>  | included                           |         | included                         |         | included                           |         |
| <b>Adjusted R<sup>2</sup></b>           | 0.905                              |         | 0.875                            |         | 0.912                              |         |
| <b>N</b>                                | 584                                |         | 584                              |         | 584                                |         |

Bootstrapped standard errors in parentheses. \*p<.05; \*\*p<.01; \*\*\*p<.001.

Children, like income inequality, emerge as key factors. As predicted, changes in the proportion of children in metropolitan areas strongly predict changes in income segregation at all points in the income distribution. The estimated association between percentage of children and overall segregation is 0.252 (SE = 0.040; p<.001). In other words, a decrease in the percent of children of 10 percentage points (roughly the average change from 1970 to 2009) is associated with a corresponding decrease in income segregation of 0.025, or approximately one standard deviation. Given that income segregation increased, on average, by 0.033 points from 2009, it appears that this growth was less than it might have been had the proportion of children not declined so sharply. As described above, this relationship provides evidence that the presence of

children makes residential location more important, and thereby aggravates residential sorting by income.

In addition, the estimated association between changes in education attainment inequality and changes in income segregation is positive and significant. That is, the models indicate that, holding constant the proportion of the population without a high school diploma, increases in the proportion of the population with a college degree are positively associated with increases in income segregation. This may be because families tend to segregate by educational attainment levels as well as by income. Given the correlation between educational attainment and income, greater educational attainment inequality may lead to more segregation by education levels, which in turn produces greater segregation by income. This is a speculative explanation, however, because we have no evidence regarding the relationships among educational inequality, educational segregation, and income segregation. The models also provide estimates of the association between the proportion of adults without high school diplomas and income segregation. These estimates differ considerably across the three models and are difficult to interpret.

Although the cross-sectional results show no significant association between unemployment levels and income segregation, the longitudinal models in Table 5 show a negative, statistically significant association between changes in unemployment rates and changes in both overall income segregation ( $H=-0.128$ , SE = 0.046;  $p<.01$ ) and changes in the segregation of the affluent ( $H=-0.176$ ; SE = 0.065;  $p<.01$ ). It is possible that within-

metropolitan area increases in unemployment reduce income among some middle- and high-income families, thereby creating mixed-income neighborhoods, at least in the short-term.<sup>20</sup>

Similarly, the cross-sectional models reveal no significant association between income segregation and the percent of the labor force in the manufacturing sector. The panel models, however, show significant negative associations between changes in manufacturing and changes in both overall segregation ( $\beta = -0.060$ ;  $SE = 0.030$ ;  $p < .05$ ) and changes in the segregation of poverty ( $\beta = -0.151$ ;  $SE = 0.045$ ;  $p < .001$ ). Consistent with our predictions, these findings suggest that declining local manufacturing sectors may not only lead to increases in inequality (by reducing the size of the middle class), but also to increases in income segregation, net of changes in income inequality. The effect is especially pronounced for the segregation of the poor, a finding consistent with Wilson's (1987) hypothesis that deindustrialization harmed minority and low-education workers the most and caused high- and middle-income families to leave urban centers for the suburbs.

Finally, consistent with previous studies, we also find a significant positive relationship between changes in population size and changes in both overall income segregation ( $\beta = 0.028$ ;  $s.e = 0.012$ ;  $p < .05$ ) and the segregation of the affluent ( $\beta = 0.038$ ;  $SE = 0.010$ ;  $p < .001$ ), though the coefficients are modest. Metropolitan areas with population growth experienced moderate increases in overall income segregation, and slightly larger increases in the segregation of affluence. This may be due to the construction of gated communities and other outlying enclaves as middle- and high-income families moved away from city centers during this period.

In sum, the multivariate regression results show that, in 2009, income segregation was strongly associated with income inequality, population size, proportion of children in a

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<sup>20</sup> Alternatively, it is possible that there is some other time-varying metropolitan characteristic that is correlated with unemployment, and that is not included in our models, that is leading to a reduction in income segregation. The fixed effects models do not control for this possibility.

metropolitan area, and average educational attainment, but had no relationship with unemployment or percent of workers in manufacturing. The panel models, which control for time-variant confounding characteristics of metropolitan areas, largely corroborate the cross-sectional results: income segregation grew in metropolitan areas with growing income inequality, with increasing proportions of children, and increasing average educational attainment levels. These models also reveal, however, that areas with decreasing unemployment (hence, rising employment) experienced growth in income segregation, as did areas with decreasing proportions of workers in manufacturing.

Recall that the descriptive trends presented earlier showed a rapid rise in income segregation in the 1980s and 2000s, and stagnation in the 1990s. We examine the decade-specific indicators included in the longitudinal models to assess the capacity of our models to account for these trends. These indicators can be interpreted as the average within-metropolitan area change in income segregation in each decade, net of the changes associated with the time-varying covariates included in the model. In the first model, in which overall segregation is the dependent variable, the coefficients for the 1970s, 1980s, and 2000s are not statistically significant and are close to zero. This implies that our models explain most of the change in overall income segregation in these decades. The coefficient for the 1990s, however, is -0.018, and is statistically significant ( $SE = 0.004$ ;  $p < .001$ ), indicating that the processes driving the stagnation in income segregation during this decade are not well-represented in this model. Our model would have predicted that income segregation would have continued to rise in the 1990s at about the same rate as the 1980s, but this was not the case. Similarly, in the second and third models, in which the segregation of poverty and affluence are the dependent variables, respectively, the coefficients for the 1990s are both negative and significant. Again, this shows a



lower rate of change for the segregation of poverty and affluence in the 1990s than our models would have predicted. Although previous research has also found declines in concentrated poverty in the 1990s (Jargowsky 2003; Reardon and Bischoff 2011b), the cause is not clear. Because the factors included in our models do explain much of the trend in income segregation in the other decades, the temporary flattening of the trend in the 1990s remains somewhat of a puzzle. One possibility is that the destruction of some large public housing projects, and the subsequent growth in scattered site public housing and Section 8 vouchers, may have contributed to this trend.

The increases in income segregation that occurred in the 2000s are largely explained by the covariates included in our models, as evidenced by the insignificant coefficients for the 2000 indicator when predicting overall segregation and the segregation of affluence (models 1 and 3). The coefficient is small but significant in the second model ( $\beta = 0.011$ ;  $SE = 0.005$ ;  $p < .05$ ), however, indicating that our model slightly underestimates the increase in the segregation of poverty in the 2000s. It may be that the housing bubble led to an increase in segregation of the poor by pricing them out of middle-income neighborhoods, where the availability of low-interest mortgages led to inflated home prices.

## Conclusion

By any of the measures we examine, segregation of families by socioeconomic status has grown significantly in the last 40 years. The proportion of families living in poor or affluent neighborhoods doubled from 15 percent to 33 percent and the proportion of families living in middle-income neighborhoods declined from 65 percent to 42 percent. Similarly, income segregation as measured by  $H$  rose by 1.2 standard deviations between 1970 and 2009. This increase marked the increasing segregation of both low- and high-income families. In addition,

we find a strong and consistent positive association between income inequality and income segregation. In both the cross-sectional and longitudinal models, income inequality is significantly associated with both overall income segregation, as well with the segregation of affluence. Also, metropolitan areas with larger proportions of children tended to have higher levels of income segregation, on average, a pattern consistent with the idea that parents are more sensitive to neighborhood context and place-based amenities, such as schools, when making residential decisions than are non-parents. Finally, the deindustrialization of American cities over the past 40 years was associated with increases in income segregation.

Three of the measures (*H* the segregation of poverty (*H10*) and the segregation of affluence (*H90*)) indicate that income segregation did not grow in the 1990s, but began to grow again after 2000. Although the recent growth of income segregation in the 2000s has not been as rapid as the increase during the 1980s, it nonetheless represents a significant reversal from the flattening of the trend in the 1990s. The increase in segregation occurred at both ends of the income distribution: both high- and low-income families became increasingly residentially isolated in the 2000s, resulting in greater polarization of neighborhoods by income. The fourth measure—the proportion of families in affluent or poor neighborhoods—differs from the *H* measure in that it captures absolute differences in median incomes among neighborhoods rather than only the sorting of families by their rank in the income distribution. As a result, it is sensitive to changes in income segregation that are due both to increased income inequality and to increased residential sorting by income. By this measure, income segregation grew in every decade, with the fastest growth in the last decade.

During the last four decades, the isolation of the rich has been consistently greater than the isolation of the poor. Although much of the scholarly and policy discussion about the effects

of segregation and neighborhood conditions focuses on the isolation of poor families in neighborhoods of concentrated disadvantage, it is perhaps equally important to consider the implications of the substantial, and growing, isolation of high-income families. In 2010, the 10 percent of families with the highest incomes controlled approximately 46 percent of all income in the United States (Saez 2012). The increasing geographic isolation of affluent families means that a significant proportion of society's resources are concentrated in a smaller and smaller proportion of neighborhoods. This has consequences for low- and middle-income families: the isolation of the rich may lead to lower public and private investments in resources, services, and amenities that benefit large shares of the population, such as schools, parks, and public services.

One additional and striking pattern evident in the Census and ACS data is the very large increase in income segregation among black and Hispanic families over the last four decades, particularly in the 2000s. Low-income black and Hispanic families are much more isolated from middle-class black and Hispanic families than are low-income white families from middle- and high-income white families. The rapid growth of income segregation among black families has exacerbated the clustering of poor black families in neighborhoods with very high poverty rates. And while middle class black families were less likely to live in neighborhoods with low-income black families, this does not mean that middle-class blacks gained access to middle-class white neighborhoods: middle-class black families are much more likely to live in neighborhoods with low-income white neighbors than are comparable middle-class white families (Logan 2011; Sharkey 2011).

The reasons for the rapid increase in income segregation among black and Hispanic families are not entirely clear. Prior research on trends from 1970-2000 (Reardon and Bischoff, 2011), as well as the multivariate analyses presented in this chapter which extend through 2009,

show that increases in income inequality are responsible for a significant portion of the growth in income segregation from 1970-2009. The growth of the black middle class led to a rapid rise in income inequality *among* black families from 1970-1990; in short, the difference in incomes between high- and low-income black families grew during this time period. At the same time, reductions in housing discrimination opened up new opportunities for middle-class black families to live in a wider range of neighborhoods. The combination of the growth in income inequality among black families and the decline in housing discrimination was likely the primary reason that income segregation among black families grew so rapidly in the 1970s and 1980s.

The same explanation, however, does not hold for the 2000s. In analyses not shown here, we find that metropolitan area income inequality among black families did not grow from 1990-2009; for Hispanic families, income inequality grew slightly in the 1990s, but not at all in the 2000s. Thus, we cannot attribute the rapid growth in income segregation among black and Hispanic families to rising within-group income inequality. One possible explanation for the growth is the lenient mortgage lending practices that were common in the early part of the 2000s. These practices provided many moderate-income families with increased access to homeownership, and therefore may have increased the residential distance between low- and middle-income families. Although many moderate income families of all races/ethnicities were affected by this practice, evidence suggests that the sub-prime mortgage market disproportionately affected black and Hispanic families by (Armstrong, Been, Ellen, and Mada 2009). In addition, a large percentage of Hispanic families live in the so-called “sand states” (California, Florida, Nevada, and Arizona), where the housing bubble was most pronounced. Hispanics in these states likely had increased access to homeownership in the early part of the decade, but then also suffered the biggest losses in assets as a result of the housing crisis

beginning in 2007 (Taylor, Fry, and Kochhar 2011). These patterns suggest that the rise in income segregation among black and Hispanic families may be at least partly a result of the disproportionate effects of these mortgage lending and housing market forces.

The impacts of increasing socioeconomic segregation may be substantial. Much of the research on the impact of neighborhood context has focused on how income-segregation shapes the neighborhood contexts of children from low-income families, affects their access to high-quality schools and to adults with high levels of education, and influences their social and educational development. But perhaps equally important is the impact of segregation on the attitudes, actions, and investments of the most-advantaged families. If socioeconomic segregation means that more advantaged families do not share social environments and public institutions (schools, public services, parks, etc) with low-income families, advantaged families may hold back their support for investments in shared resources. Such a shift in commitment may have far-reaching consequences for the rest of society. Understanding the connection between income segregation and social attitudes, and the willingness to support investment in public goods, is an important topic for future research.

## References

- Ananat, Elizabeth Oltmans. 2009. "The wrong side(s) of the tracks: The causal effects of racial segregation on urban poverty and inequality." *American Economic Journal: Applied Economics* 3:34-66.
- Armstrong, Amy, Vicki Been, Ingrid Gould Ellen, and Josiah Mada. 2009. "The High Cost of Segregation: Exploring the Relationship Between Racial Segregation and Subprime Lending." The Furman Center for Real Estate and Urban Policy, New York University, New York.
- Bischoff, Kendra. 2008. "School District Fragmentation and Racial Residential Segregation: How Do Boundaries Matter?" *Urban Affairs Review* 44.
- Bruch, Elizabeth. forthcoming. "Neighborhood Sorting by Race and Income." *American Journal of Sociology*.
- Burdick-Will, Julia, Jens Ludwig, Stephen W. Raudenbush, Robert J. Sampson, Lisa Sanbonmatsu, and Patrick Sharkey. 2011. "Converging Evidence for Neighborhood Effects on Children's Test Scores: An Experimental, Quasi-experimental, and Observational Comparison." Pp. 255-276 in *Whither Opportunity? Rising Inequality and the Uncertain Life Chances of Low-Income Children*, edited by G. J. Duncan and R. J. Murnane. New York: Russell Sage Foundation.
- Card, David and Jesse Rothstein. 2006. "Racial segregation and the black-white test score gap." National Bureau of Economic Research, Cambridge, MA.
- Cloutier, Norman R. 1997. "Metropolitan Income Inequality During the 1980s: The Impact of Urban Development, Industrial Mix, and Family Structure." *Journal of Regional Science* 37:459-478.
- Cutler, David M. and Edward L. Glaeser. 1997. "Are ghettos good or bad?" *Quarterly Journal of Economics* 112:827-871.
- GeoLytics. 2004. "Neighborhood Change Database." East Brunswick, NJ: GeoLytics, Inc.
- Goldin, Claudia and Lawrence F. Katz. 2008. *The Race Between Education and Technology*. Cambridge, MA: Harvard University Press.
- Harding, David J. 2003. "Counterfactual models of neighborhood effects: The effect of neighborhood poverty on dropping out and teenage pregnancy." *American Journal of Sociology* 109:676-719.
- James, David R. and Karl E. Taeuber. 1985. "Measures of segregation." *Sociological Methodology* 14:1-32.
- Jargowsky, Paul A. 1996. "Take the money and run: Economic segregation in U.S. metropolitan areas." *American Sociological Review* 61:984-998.
- . 2003. "Stunning progress, hidden problems: The dramatic decline of concentrated poverty in the 1990s." Brookings Institution, Washington, DC.

- Jencks, Christopher and Susan Mayer. 1990. "The social consequences of growing up in a poor neighborhood." Pp. 111-186 in *Inner-city poverty in the United States*, edited by L. E. Lynn, Jr. and M. G. H. McGeary. Washington, DC: National Academy Press.
- Kling, Jeffrey R., Jeffrey B. Liebman, and Lawrence F. Katz. 2007. "Experimental Analysis of Neighborhood Effects." *Econometrica* 75:83-119.
- Landry, Bart. 1987. *The New Black Middle Class*: University of California Press.
- Leventhal, Tama and Jeanne Brooks-Gunn. 2000. "The neighborhoods they live in: The effects of neighborhood residence on child and adolescent outcomes." *Psychological Bulletin* 126:309-337.
- Logan, John R. 2011. "Separate and Unequal: The Neighborhood Gap for Blacks, Hispanics and Asians in Metropolitan America." US2010 Project, Brown University.
- Logan, John R. and Mark Schneider. 1984. "Racial segregation and racial change in American suburbs, 1970-1980." *American Journal of Sociology* 89:874-888.
- Logan, John R. and Brian Stults. 2011. "The Persistence of Segregation in the Metropolis: New Findings from the 2010 Census." US2010 Project, Brown University.
- Ludwig, Jens, Greg J. Duncan, Lisa A. Gennetian, Lawrence F. Katz, Ronald C. Kessler, Jeffrey R. Kling, and Lisa Sanbonmatsu. 2013. "Long-Term Neighborhood Effects on Low-Income Families: Evidence From Moving To Opportunity." *NBER working paper* 18772.
- Massey, Douglas S. and Nancy Denton. 1993. *American Apartheid: Segregation and the Making of the Underclass*. Cambridge, MA: Harvard University Press.
- Mayer, Susan E. 2002. "How economic segregation affects children's educational attainment." *Social Forces* 81:153-176.
- Minnesota Population Center. 2004. "National Historical Geographic Information System: Pre-release Version 0.1.". Minneapolis, MN: University of Minnesota. <http://www.nhgis.org>.
- Nielsen, Francois and Arthur S. Alderson. 1997. "The Kuznets curve and the great u-turn: Income inequality in U.S. counties, 1970 to 1990." *American Sociological Review* 62:12-33.
- Oliver, Melvin L. and Thomas M. Shapiro. 1995. *Black wealth/white wealth: a new perspective on racial inequality*. New York: Routledge.
- Oreopoulos, Philip and Uros Petronijevic. 2013. "Making College Worth It: A Review of Research on the Returns to Higher Education." *NBER working paper* 19053.
- Pattillo-McCoy, Mary. 2000. *Black Picket Fences: Privilege and peril among the black middle class*. Chicago: University of Chicago Press.
- Pielou, Evelyn C. 1977. *Mathematical ecology*. New York: John Wiley & Sons.
- Reardon, Sean F. 2011. "Measures of Income Segregation." in *CEPA Working Papers*. Stanford, CA: Stanford Center for Education Policy Analysis.
- Reardon, Sean F. and Kendra Bischoff. 2011a. "Growth in the residential segregation of families by income, 1970-2009." US2010 Project, Brown University.

- . 2011b. "Income Inequality and Income Segregation." *American Journal of Sociology* 116:1092-1153.
- Ross, Stephen L. and Margery Austin Turner. 2005. "Housing Discrimination in Metropolitan America: Explaining Changes Between 1989 and 2000." *Social Problems* 52:152-180.
- Rothwell, J. T. and D. S. Massey. 2010. "Density Zoning and Class Segregation in U.S. Metropolitan Areas." *Social Science Quarterly* 91:1123-1143.
- Saez, Emmanuel. 2012. "Striking it Richer: The Evolution of Top Incomes in the United States (Updated with 2009 and 2010 estimates)." <http://emlab.berkeley.edu/~saez/saez-UStopincomes-2010.pdf>.
- Sampson, Robert J., Jeffrey D. Morenoff, and Thomas Gannon-Rowley. 2002. "Assessing "Neighborhood Effects": Social Processes and New Directions in Research." *Annual Review of Sociology* 28:443-478.
- Sampson, Robert J., Stephen W. Raudenbush, and Felton Earls. 1997. "Neighborhoods and violent crime: A multilevel study of collective efficacy." *Science* 277:918-924.
- Sampson, Robert J., Patrick Sharkey, and Stephen W. Raudenbush. 2008. "Durable effects of concentrated disadvantage on verbal ability among African-American children." *Proceedings of the National Academy of Sciences* 105:845-852.
- Schneider, Mark and Thomas Phelan. 1993. "Black suburbanization in the 1980s." *Demography* 30:269-279.
- Sharkey, Patrick. 2011. "Spatial Disadvantage and Downward Mobility Among the (New?) Black Middle Class." *Department of Sociology*: New York University.
- Taylor, Paul, Richard Fry, and Rakesh Kochhar. 2011. "Wealth Gaps Rise to Record Highs Between Whites, Blacks, Hispanics." Pew Research Center., Washington, DC.
- Theil, Henri. 1972. *Statistical decomposition analysis*, vol. 14, Edited by H. Theil. Amsterdam: North-Holland Publishing Company.
- Theil, Henri and Anthony J. Finezza. 1971. "A note on the measurement of racial integration of schools by means of informational concepts." *Journal of Mathematical Sociology* 1:187-194.
- Turner, Margery Austin. 2008. "Limits on Housing and Neighborhoods Choice: Discrimination and Segregation in U.S. Housing Markets." *Indiana Law Review* 41:797-816.
- Watson, Tara. 2009. "Inequality and the Measurement of Residential Segregation by Income." *Review of Income and Wealth* 55:820-844.
- Wilson, William Julius. 1987. *The truly disadvantaged: The inner city, the underclass, and public policy*. Chicago: University of Chicago Press.
- Wodtke, Geoffrey T., David J. Harding, and Felix Elwert. 2011. "Neighborhood Effects in Temporal Perspective: The Impact of Long-Term Exposure to Concentrated Disadvantage on High School Graduation." *American Sociological Review* 76:713-736.
- Yang, Rebecca and Paul A. Jargowsky. 2006. "Suburban development and economic segregation in the 1990s." *Journal of Urban Affairs* 28:253-273.



Zoloth, Barbara S. 1976. "Alternative measures of school segregation." *Land Economics* 52:278-298.

## Appendices

|                           | 1970  | 1980  | 1990  | 2000  | 2007  | 2008  | 2009  |
|---------------------------|-------|-------|-------|-------|-------|-------|-------|
| <b>Poor</b>               | 8.4%  | 11.8% | 13.3% | 15.2% | 17.0% | 17.5% | 17.9% |
| <b>Low-Income</b>         | 10.4% | 10.6% | 11.3% | 11.9% | 11.1% | 11.1% | 10.9% |
| <b>Low-Middle Income</b>  | 30.6% | 26.9% | 25.0% | 23.2% | 20.6% | 20.2% | 19.8% |
| <b>High-Middle Income</b> | 34.1% | 31.3% | 26.7% | 23.9% | 22.9% | 22.6% | 22.2% |
| <b>High-Income</b>        | 9.9%  | 12.2% | 13.3% | 13.1% | 14.3% | 13.9% | 14.0% |
| <b>Affluent</b>           | 6.6%  | 7.3%  | 10.4% | 12.7% | 14.1% | 14.6% | 15.1% |
| <b>Middle Income</b>      | 64.7% | 58.2% | 51.7% | 47.1% | 43.5% | 42.8% | 42.0% |
| <b>Poor + Affluent</b>    | 15.0% | 19.1% | 23.7% | 27.9% | 31.1% | 32.1% | 33.0% |

### Measuring Income Segregation

The Census Bureau provides counts of families/households within income categories in each decennial census. For the total population there are 15 income bins in 1970, 17 in 1980, 25 in 1990, and 16 in both 2000 and 2005-2009. The income-by-race bins are the same except for in 1980 when there are only nine income bins by race. Our approach to measuring income segregation is insensitive to these differences (Reardon 2011).

To measure income segregation, we use the *rank-order information theory index* (Reardon 2011), which measures the ratio of within-unit (tract) income rank variation to overall (metropolitan area) income rank variation. For any given value of  $p$ , we can dichotomize the income distribution at  $p$  and compute the residential (pairwise) segregation between those with income ranks less than  $p$  and those with income ranks greater than or equal to  $p$ . Let  $H(p)$  denote the value of the traditional information theory index (James and Taeuber 1985; Theil 1972; Theil and Finezza 1971; Zoloth 1976) of segregation computed between the two groups so defined. Likewise, let  $E(p)$  denote the entropy of the population when divided into these two

groups (Pielou 1977; Theil 1972; Theil and Finezza 1971). That is,

$$E(p) = p \log_2 \frac{1}{p} + (1-p) \log_2 \frac{1}{(1-p)}$$

and

$$H(p) = 1 - \sum_j \frac{t_j E_j(p)}{TE(p)}$$

where  $T$  is the population of the metropolitan area and  $t_j$  is the population of neighborhood  $j$ .

Then the rank-order information theory index ( $H^R$ ) can be written as

$$H^R = 2 \ln(2) \int_0^1 E(p) H(p) dp$$

Thus, if we computed the segregation between those families above and below each point in the income distribution and averaged these segregation values, weighting the segregation between families with above-median income and below-median income the most, we get the rank-order information theory index. The rank-order information theory index ranges from a minimum of 0, obtained in the case of no income segregation (when the income distribution in each local environment (e.g. census tract) mirrors that of the region as a whole), to a maximum of 1, obtained in the case of complete income segregation (when there is no income variation in any local environment). In order to obtain estimates of income segregation at points in the income distribution for which we do not have exact data (because we only have counts of families in certain income ranges), we can use an estimate of the function  $H(p)$  to obtain a measure of segregation at any threshold. For instance, to compute the level of income segregation between those families above and below the 90th percentile of the income distribution ( $H_{90}$ ), we calculate  $H(0.9)$  from our estimated parameters of the function  $H(p)$ . Likewise, to compute the level of income segregation between those families above and below

the 10th percentile of the income distribution ( $H_{10}$ ), we calculate  $H(0.1)$  from our estimated parameters of the function  $H(p)$ . To compare the levels of within-group income segregation among racial groups, we compute the rank-order information theory index for each racial group separately. A more thorough explanation of our technique (and its rationale) is provided elsewhere (Reardon 2011; Reardon and Bischoff 2011b).