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Working Paper: Comments Welcome

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## **Distinguishing the Geographic Levels and Social Dimensions of U. S. Metropolitan Segregation, 1960-2000<sup>1</sup>**

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# **Distinguishing the Geographic Levels and Social Dimensions of U. S. Metropolitan Segregation, 1960-2000**

## **Abstract**

We assess trends in residential segregation in the United States from 1960 to 2000 along several dimensions of ancestry, class, and life cycle, presenting a method for attributing segregation to nested geographical levels. Segregation for metropolitan America is measured using the Theil index which is additively decomposed into contributions of regional, metropolitan, center city-suburban, place, and tract segregation. This procedure distinguishes whether groups live apart because members cluster in different neighborhoods, communities, metropolitan areas, or regions. Substantively, we find that segregation of blacks decreased considerably after 1960 largely because neighborhoods became more integrated, but the foreign-born became more segregated largely because they concentrated in particular metropolitan areas. Class segregation increased between 1970 and 1990, mainly because the affluent increasingly clustered in specific metropolitan areas and in specific municipalities within metropolitan areas. The unmarried increasingly congregated in center cities. The main purpose of this paper is to describe and illustrate this multi-level approach to studying segregation.

In 1996, Douglas Massey dramatized a concern shared by many scholars of urban inequality: that Americans are moving into an “age of extremes” in which disparities of wealth and power increasingly produce and are reinforced by spatial separation. With the growth of gated communities for the affluent and the further ghettoization of the poor, the United States is becoming more and more fragmented, he argued. An even wider concern is that, across various dimensions of difference, such as racial and ethnic ancestry, class, and life cycle, Americans were withdrawing, willingly or not, into homogenous and defensive enclaves.<sup>2</sup>

To the discussion of this issue, we add an enriched historical record: We trace changes in residential segregation over four decades along several social dimensions, including race, income, and family status, and across several geographical levels: regional, metropolitan, the center city-suburb division, municipality, and tract. Studies of segregation often focus on only one social dimension, race or income groups, for example, and typically only one geographic level of separation, that between neighborhoods. However, we know that racial, class-based, and other types of separation often overlap in important ways. We also know that this separation can happen because people of different races, classes, or ages cluster in different neighborhoods within a community, but also because they cluster in different communities, or metropolitan areas, or even regions. This paper presents all of these dimensions and levels simultaneously, creating a comprehensive picture of segregation in the United States.

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<sup>2</sup> On the wider concern, see, for example, Bellah et al.’s (1985) description of “life-style enclaves;” the literature on gated communities (e.g., Blakeley and Snyder 1997); and ghettoization of the poor (e.g., Jargowsky 1997; 2003). Research also points to the further consequences of segregation, for example, intensifying social problems (e.g., Shihadeh and Flynn 1996; Krivo and Petersen 1996; Oliver 2001; Jargowsky 2002).

Scholars and citizens alike care about segregation because the concentration of disadvantage can accentuate problems such as academic failure and early pregnancy (see, e.g., Sampson, Morenoff, and Gannon-Rowley 2002), because geographic and political barriers can impede regional solutions to common problems (see, e.g., Orfield and Katz 2002), and because – as Massey and others suggest – the withdrawal of citizens into separate enclaves challenges the foundation of a democratic society (see, e.g., Putnam 2000). But our understanding of the dynamics of segregation is still limited; distinguishing among the dimensions and levels of segregation can help.

Take the literature on racial segregation: Some (e.g., Massey and Denton 1993; Massey and Gross 1991) have stressed the increasing “hypersegregation” of African Americans, pointing largely to inner-city neighborhoods; others (e.g., Farley and Frey 1994) have claimed that black segregation is not so “hyper” and is declining; they point largely to newer, smaller metropolitan areas where neighborhoods are more integrated. Frey (1996) has added to the complexity by presenting evidence of increasing racial and ethnic segregation by region: whites leaving the coastal regions for whiter inland regions. To understand what has happened, it would be useful to know, for example, whether whites in the Northeast and Midwest were initially separated from African Americans by region and later, after the arrival of blacks in the North, by neighborhood, and perhaps even later by the city-suburban border. Generalizing the question, we can ask whether Americans have become more or less segregated by various traits, such as stage in the life cycle and wealth, and at what level of spatial organization the changes occurred. Identifying the locus of segregation carries implications for policy: where is racial segregation or integration occurring? In the twentieth century, it seems to have shifted from region to neighborhood to the city-suburb line and, now, perhaps to municipality.

In a related literature on urban politics, scholars have long been concerned that the political boundaries between central cities and their suburbs have reinforced class and racial segregation and, moreover, that boundaries among suburbs have done so as well (e.g., Swanstrom et al. 2002; Cutler and Glaeser 1997; Dolan 1990), perhaps because such lines coincide with school systems (e.g., Reardon and Yun 2001). Indeed, much of the “urban crisis” literature of the 1970s and 1980s stressed the way cities and their suburban regions divided along racial lines – white “donuts” around black holes – and income differences (see, e.g., Hawley and Rock 1974; Petersen 1985; Jackson 1985). The new question is whether that line of separation became increasingly or decreasingly important compared to other bases of segregation. It may be, for instance, that segregation among municipalities, even within suburban rings, is the emerging basis of separation, overriding the city-suburb line (Logan and Schneider 1984; Fitzpatrick and Logan 1985; Stahura, 1988; Alba et al. 1999). Jargowsky (2003), for example, recently found that during the 1990s pockets of poverty concentration shrank in major urban centers but emerged in particular suburban communities.

In a third literature, on urban economics, students of “world cities” and “dual cities” (e.g., Sassen, 1991; Castells, 1989: 216ff; Waldinger 1996) focus attention on inter-metropolitan differences and link those to intra-metropolitan differentiation. A key argument is that economic elites and the low-income workers who provide them services, typically immigrants, cluster in particular metropolitan areas – in the New Yorks and Miamis, not the Pittsburghs and Detroit – and within the metropolitan areas, each group clusters in distinct neighborhoods. That process should be revealed by trends in class and foreign-born segregation by metropolitan area and by neighborhood.

Additionally, looking simultaneously at several social dimensions with the same metric

and procedure permits the analyst to weigh the relative weight of factors in shaping the urban social landscape. In the substantive results presented below, we find that segregation by racial and ethnic ancestry is much higher than segregation by economic class, which is, in turn, higher than segregation by stage in the life cycle, which informs us about the hierarchy of criteria Americans use when they decide where to live. By disaggregating segregation according to level of geography, we find that the segregation of blacks from nonblacks (and non-Hispanic whites from others) decreased substantially over the 40 years, largely because neighborhoods became much more integrated, but that segregation of the foreign-born increased greatly, largely because they concentrated in particular metropolitan areas. Segregation of Hispanics changed little. Class segregation increased after 1970, mainly because the affluent clustered together more in both specific metropolitan areas and in specific municipalities within metropolitan areas. Changes in segregation by life cycle were far more modest, but young adults and the unmarried increasingly clustered in center cities rather than suburbs.

Although our findings speak to concerns about trends in racial segregation, urban politics, and sharpening class divisions, our main purpose in this paper is to describe and illustrate an approach to the study of segregation. We first introduce a relatively new procedure that allocates changes in residential segregation by level: region, metropolitan area, urban core versus suburban ring, urban place, and census tract.<sup>3</sup> Second, we present preliminary findings on the historical trends in segregation by racial and ethnic ancestry, class, and life cycle disaggregated

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<sup>3</sup> Massey has analyzed class and racial segregation at regional, state, metropolitan and tract levels (Massey and Fischer 2002; Massey and Hajnal 1995; see also Glaeser and Vigdor 2003). However, his procedure entailed separate calculations of dissimilarity and isolation at each level, not the nested and cumulative technique described in this paper.

by geographical level. And, third, we close by suggesting further directions for analyzing the components of residential segregation.

### **Disaggregating Segregation**

*Social dimensions.* The major concern in segregation research has for decades been, of course, race – specifically the geographic isolation of African Americans. But classical urban studies included a larger program to understand the social bases of urban ecology. Studies, notably those in the “factorial ecology” literature, identified three basic axes of residential differentiation common to most American cities. Scholars classified tracts simultaneously by the socioeconomic status of their residents, by their family or life cycle stage, and by their race or ethnicity.<sup>4</sup> (In other societies, the third factor is often different – e.g., religion in Northern Ireland.) We return to this three-dimensional approach. It allows us also to address the increasing interest in class-based segregation and the occasional interest in the segregation of the elderly or young families.

*Geographic levels.* The lowest level of “neighborhood” we explore is the census tract. We can define the total national level of segregation for Americans living in metropolitan areas as the degree to which tracts<sup>5</sup> across the country are homes to different types of people – for example, the degree to which the elderly live in different tracts than do the nonelderly – irrespective of region or specific metropolitan area. Thus, the concentration of the elderly in

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<sup>4</sup> This literature burgeoned a few decades ago but seems to have petered out since. See, for example, White (1987), Janson (1980), Schwirian (1974), and Rees (1972).

<sup>5</sup> A more ambitious project could begin with the block cluster or even the block level. Tracts are the most common – and easiest – micro-level to use and suffice for the purposes of presenting this procedure.

Miami Beach, Florida, and of young adults in Santa Monica, California, both contribute to the national level of urban age segregation. We then want to disaggregate this total segregation into the segregation that occurs because of segregation by region, metropolitan area within region, city-suburban division within the metropolitan area, “place” (which is usually the same as municipality)<sup>6</sup>, and by the residual, the census-tract level itself. To what extent, for example, are the elderly segregated from the nonelderly by living in distinctive regions, metropolitan areas, central cities, particular towns, or in distinct neighborhoods? The measure of segregation we describe below, Theil’s H index, allows us to calculate such partitions. (Although there are precedents for using H, this is, to our knowledge, the first systematic, multilevel analysis of segregation.<sup>7</sup>)

Region has been historically and visibly important in contributing to segregation in America. For example, African Americans were still concentrated in the South in 1960, albeit less than they were around 1900 (Lieberson 1980). Similarly immigrants originally settled in the Northeast and were still concentrated there in 1960. Southerners were for decades poorer than Americans in other regions, and retirement migration has presumably led the elderly to congregate in the Sunbelt. We can ask what contribution regional differences make compared to other levels of geography and how much that contribution has changed in recent decades. We can pose a similar question for metropolitan areas. Historically, some metropolises have, for

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<sup>6</sup> Places, as defined by the census bureau, refer to concentrations of population that are either legally incorporated – cities, town, villages, or boroughs – or reflect dense settlements locally identified by name (census designated places).

<sup>7</sup> Mayer (2001) compares within-metro segregation to total within-state segregation. Reardon and Yun (2001) contrast between-school district to within-school district segregation.

example, been gateways for immigrants (Boston and New York, classically, and more recently, Los Angeles and Miami). Economic specialization leads to somewhat different labor forces, income levels, housing patterns, and age structures from one metropolis to another, even in the same regions (e.g., Berry 1972). The high-tech industry concentration in the San Francisco Bay area and the garment and toy industries in Los Angeles sharpen economic and labor force differences within the West, for example.

The division between city and suburb has been familiar to generations of urban scholars. Most pointedly, races, but also classes and family types, have separated across central cities' borders. The sociological importance of these lines is evident, for example, in the extent to which official data are gathered according to this distinction. An important question is whether and to what extent the significance of this boundary has waned in recent decades as, for example, inner suburbs age and take on some traits of center cities (e.g., Stahura 1988; Orfield and Katz 2002; Jargowsky 2003). Researchers have increasingly become attuned to the social implications of political divisions among suburbs. Many critical institutions in America are determined by specific municipality laws and regulations – housing and zoning codes, school finances and policies, tax rates, policing, and infrastructure maintenance, to name some. Therefore, many people sort themselves out by municipality (for example, in seeking out preferred school systems; James 1989) and others are sorted out by municipality (for example, priced or discriminated out of some towns; e.g., Alba and Logan 1993), leading to distinctive between-place compositions within the same suburban ring.<sup>8</sup>

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<sup>8</sup> Some of the literature on suburban distinctiveness by municipality includes Logan and Schneider (1984), Fitzpatrick and Logan (1985), Stahura (1988), James (1989), Logan and Alba (1993), Reardon and Yun (2001), and Orfield and Katz (2003).

Finally, the lowest, most finely grained level of segregation is the one of classic concern, the neighborhood, here represented by census tract variation within places. (Going yet further down, to the block or block group level would be ideal, but much less data are available at that level, particularly in earlier years.) Since we begin with the national differentiation by all census tracts, the segregation that cannot be attributed to region, metropolitan area, city/suburb, or place is, then, the residual attributable to inter-tract segregation.

The underlying model in segregation studies typically assumes that families make housing decisions under constraints (such as ability to pay and discrimination) in a specific housing market, usually defined as a commute-to-work region and measured as a census metropolitan area (e.g., Rossi 1956; South and Deane 1993). One conceptual implication of our multilevel approach is to extend and elaborate this model. The standard analysis assumes that families choose the package of homes, amenities, and costs at the neighborhood – operationally, census tract – level. But, families also make decisions about metropolitan areas when, for example, immigrants follow chain migration into specific metropolises, retirees choose states on cultural grounds (e.g., Frey 2002; 1995), or professionals participate in national labor markets. (Those of us who have been involved in academic recruiting can testify to the role that area-wide housing costs have on migration selectivity.) Families also make decisions based on the package presented to them by specific political units – schools, taxes, zoning laws, and the like. Resultant segregation, then, occurs at various levels as a result of various choices.<sup>9</sup>

*Measures of segregation.* There are many ways to measure the tendency of people with

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<sup>9</sup> As one auditor of this paper pointed out, some segregation will also develop because of geographically differential rates of fertility, mortality, marriage and divorce.

differing traits to cluster together (Reardon and Firebaugh 2002; Massey and Denton 1988; James and Tauber 1985). Probably the most common is the dissimilarity index,  $D$ , which can be interpreted as the smallest proportion of the population of interest,  $i$  (e.g., blacks) that would have to move in order to equalize its distribution across spatial categories with the other group,  $\sim i$  (e.g., nonblacks).<sup>10</sup> Another common one is the isolation index,  $iP_i^*$ , which is the probability that a random member of group  $i$  shares an area with other members of group  $i$  (see Lieberson 1980, for extensive use of this measure). As each measure of segregation has its distinct advantages and interpretations, each researcher justifies the choice by reference to one property or another of the chosen measure.

For our purposes, Theil's  $H$  has a particularly advantageous feature; it is an additive measure that allows us to add up results for separate metropolitan areas to calculate segregation between regions and for the nation as a whole and also to subdivide metropolitan areas into their constituent parts. Detailed comparisons among the available measures indicate that  $H$  has all the advantages of other widely used measures plus this one (James and Taueber 1985).<sup>11</sup> We use this additive feature of  $H$  to calculate (a) the overall level of segregation of the nation's metropolitan population for each census year since 1960 and (b) how much each of the nested geographical levels – tracts, cities and suburbs, municipalities and places within the suburban ring, metropolitan areas, and regions – contributed to the nation's total in that year.

To see how this property is an advantage, take, for example, the segregation of

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<sup>10</sup> The same proportion of  $\sim i$  would also have to move.

<sup>11</sup> Theil's  $H$  also permits calculations with more than two categories (e.g., Iceland 2002; Reardon and Firebaugh 2002). In this paper, however, we will use only dichotomies in order to unveil more clearly who is separated from whom.

immigrants. The foreign-born and the native-born tend to live in different census tracts across the country but also cluster in other ways as well. With H we can answer each of these questions: “Of the total, national level of tract segregation, how much is a result of separation by region of the country (immigrants being disproportionately in the West and East rather than South and Midwest)?”, “How much by metropolitan areas (immigrants being drawn more to Los Angeles than to Seattle)?”, “How much by the divide between city and suburb (immigrants being drawn to central cities)?”, “How much by specific town (immigrants clustering in certain towns within suburban areas)?”, and “How much at the level of tracts themselves (neighborhood by neighborhood segregation inside towns)?”.

Formally, the calculation of H begins with entropy (E) which is defined as  $\sum_i p_i \ln(1/p_i)$ , for  $i=1, \dots, I$ , where there are  $I$  different groups, and  $\sum_i p_i = 1$ . With just two groups ( $i$  and  $\sim i$ ),  $p_{\sim i} = 1 - p_i$  so the formula for E simplifies to:

$$E = p_i \ln\left(\frac{1}{p_i}\right) + (1 - p_i) \ln\left(\frac{1}{1 - p_i}\right) \quad [1]$$

If  $p_i = 1$  or  $p_i = 0$ , let  $E = 0$  by definition to avoid division by zero. The maximum value of E is 0.69 which is achieved when  $p_i = p_{\sim i} = 0.5$ .

We move from E, a measure of the diversity of the population in a given area (e.g., a metropolitan area), to H, our segregation measure, by comparing all the E’s for the sub-areas (labeled  $E_s$  for  $s=1, \dots, S$ ) to the overall E for the larger area. Specifically, H is the average difference between the sub-areas’ E’s and the overall E, expressed as a proportion of overall E and weighted by the sub-area’s share of the total population:

$$H = \sum_{s=1}^S \frac{T_s}{T} \left( \frac{E - E_s}{E} \right) \quad [2]$$

where  $T$  is the total population of the larger area,  $T_s$  is the population in sub-area  $s$ ,  $E$  is overall entropy, and  $E_s$  is the entropy in sub-area  $s$ .

Intuitively we think of a place as segregated if the subparts have either many or few members of a population, say immigrants, relative to the prevalence of immigrants in the whole. Similarly, we think of a place as integrated if the subparts all have about the same concentration of immigrants.  $H$  works exactly as our intuition does.  $H$  is maximized when each sub-area within the whole has only one group living there (the population is either all immigrants or all natives, no mixing). Conversely,  $H$  is minimized when all of the sub-areas have the same distribution of groups  $i$  and  $\sim i$  as the larger area they are part of. For example, if a place is 10 percent immigrant and 90 percent native, its  $E$  is .325. If, each of the four tracts within the town is also split 10:90, then  $H$ , the segregation index, would be calculated as .00; population distributions in the sub-areas mimic those in the larger area. If, however, one of the tracts was all immigrant and the other three were all native, then  $H$  would be 1.00.<sup>12</sup>

In this paper we go beyond the usual practice of measuring segregation at the metropolitan level and aggregate the metropolitan areas to the regional level and regions to the (metropolitan part of) the nation as a whole. We also disaggregate metropolitan segregation into even smaller units. This is possible because  $H$  is perfectly additive up and down a nested set of geographical distinctions (Firebaugh and Reardon 2002). Importantly, for our purposes, we can unambiguously identify the degree of segregation for the nation's metropolitan population and apportion that total segregation across nested levels of geography. We calculate  $H$  for the

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<sup>12</sup> Theil's measure is based on the difference between the proportion of interest and one-half. A better analogy to the index of dissimilarity might be to take some function of the difference between the proportion of interest and its average. Right now, though, Theil-like measures that use bases other than one-half are not part of the literature, so we use one-half as well.

metropolitan United States divided into regions, regions divided into metropolitan areas, for metropolitan areas divided into their central cities and suburban rings, for central cities or suburban rings divided into places, and, finally, for places divided into tracts. (All metropolitan residents end up in this nested structure.<sup>13</sup>) Each level contributes to the total H index, summing to the total metropolitan inter-tract segregation,<sup>14</sup> and indicating what portion of total segregation is attributable to each level of geography.

We are, in the end, interested in comparing H indices between traits (for example, how segregated are blacks compared to Hispanics or compared to the poor?), across levels (how much black-nonblack segregation is neighborhood-based or place-based?), and over time (how much has black segregation changed since 1960?). H is calibrated in a way that allows all of these types of comparison.

Some of our measures are based on the full enumeration in the Census (age, race, and marital status); others are based on samples that received the Census “long form” (nativity and income). Given the huge numbers of cases, almost any result is statistically significant, but we need some sense of what a large difference in H might be. By asking how large would an exchange of population between two sub-areas have to be in order to register a change in H, we calculated that differences in H of .02 or more are substantively significant (see appendices available from the authors).

Our work has some limitations. For one, we do not take into account proximity and its

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<sup>13</sup> Below we discuss the problem of people living in metropolitan America but outside of defined tracts or in defined tracts that are not nested in defined places.

<sup>14</sup> When adding, each H is weighted by the ratio of the population of the sub-area to that of the larger area. Thus, H gives more weight to larger than smaller places. The main implication of this feature is that inferences properly refer to residents rather than places.

effects on tracts' segregation (as in Beggs et al. 1997). We do analyze a tract's composition within higher levels of geography, but we do not, for example, assign a heavily-black tract a yet higher segregation score if it is also surrounded by heavily black tracts. This is certainly doable, albeit with intense data work, but beyond the scope of this first study. We do not include non-metropolitan places, because they were not tracted prior to 2000.<sup>15</sup> Finally, the tract is our smallest geographical unit, although certainly important within-tract segregation occurs. Many of these matters are suitable for later extensions.

## Data

We draw our data from tabulated census tract statistics for metropolitan areas, 1960 through 2000. In principle, we would prefer to use individual-level data that would permit coverage of the entire country and more sophisticated analyses, but confidentiality rules prevent connecting individuals to small geographical units such as tracts. The expansion in number and size of metropolitan areas from 1960 to 2000, migration of the population into metropolitan areas (from overseas and non-metro areas), and improvements in how well tracts cover metropolitan areas serve to extend our coverage from 59% of the American population in 1960 to 80% in 2000. Technical complexities in analyzing the tract data are discussed in appendices available on our web site or from the authors. We conducted many robustness tests for the implications of the analytical decisions we made and report the results where relevant (see below). In the end, the data reliably describe the changing patterns of segregation for the overwhelming majority of metropolitan Americans.

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<sup>15</sup> Delineating the data for *urbanized* areas yields comparable results to these analyses of metropolitan areas.

Prior to 1960 the Census's tracting of metropolitan America was too incomplete to use. Even within the time period we cover we face some formidable data challenges. The number of urban areas that qualify as "metropolitan" and that are tracted grew from 175 in 1960 (with 23,625 tracts) to 331 in 2000 (with 51,297 tracts). The "younger" metropolitan areas added since 1960 tend to be smaller, concentrated in the Sunbelt, and have both spatial and segregation patterns different from older ones. We examined whether our findings varied by the "birth cohort" of the metropolitan areas and by their sizes. There are indeed differences in some levels of segregation by cohort – notably, newer metropolitan areas were less segregated by ancestry and homeownership – but the trend lines are substantively similar. Some of the trends we note below are a bit sharper if we look only at large metropolitan areas. We assess segregation contemporaneously, using the metropolitan areas as they are defined in each decade and using the tract divisions of each decade. In doing so, we explicitly treat metropolitan Americans, not tracts or metropolitan areas, as the universe of interest. The alternative would be to fix the boundaries and only analyze those tracts that were already defined in 1960. That only makes sense if locality itself is the object of study. We want to assess whether the average American experienced more or less segregation in 2000 than in 1960 (and in what ways). If, for example, a Sunbelt metropolitan area covers twice as many counties in 2000 as in 1960, each year's definition roughly corresponds to the population of its residents in that year.

One of our innovations is to look at all metropolitan tracts that are identified in the Census. Many researchers over the years have looked at selected tracts– usually those in the largest metropolitan areas. Including all tracts presents three difficulties. First, some tracts are in more than one census-defined "place." Fortunately we know the share of the population in each place for tracts that overlap more than one place, although we may not have that information for

the subpopulations within the tract (e.g., the number of immigrants in place 1 and place 2 within the tract). Our solution is to assign the tract to the place that contains the largest number of residents. The second difficulty is that there may be people living in untraced or “unplaced” areas. We combine people not in a specific tract into a “remainder” tract. Similarly, some tracts that are not identified with a place are combined into a “remainder” place. Because these units tend to be small, homogeneous, and peripheral, the procedures we use with them make little difference in the results. A third difficulty is that place identifiers are not available in 1960 for places with a population below 25,000, but are provided for places down to a population of 2,500 for later years. Preserving our ability to measure place-level segregation is important, because much of it occurs at that lower level.<sup>16</sup> Consequently, we statistically modeled what the H scores would have been for tract-level and place-level segregation in 1960 if we had had tracts linked to places 2,500 and above by using our estimates for tracts in places 25,000 and above and use the extrapolated H scores for our analysis (see the discussion in the appendices available from the authors).

We assess segregation across ancestry, life cycle, and class by examining these specific groupings (see Appendix to this paper for more details).

(A) racial and ethnic ancestry<sup>17</sup>:

(1) proportion African American versus all others,

<sup>16</sup> For example, in 1990, of the 20 richest places in the United States, 14 were between 2,500 and 25,000 in population (places such as Portola Valley, California, and Oyster Bay Cove, New York); 16 of the 20 places with the highest percentage of blacks were also in this category (e.g., Lawnside, Pennsylvania, and Bunche Park, Florida).

<sup>17</sup> The term “ancestry” is used by the census to refer to how respondents label themselves by national origins. We use it more generally as a cover term for race, Hispanic ethnicity, and nativity.

- (2) proportion non-Hispanic white versus all others,
- (3) proportion Hispanic 18 versus all others, and
- (4) proportion foreign-born versus native-born.

(B) class:

- (1) proportion of households in the top quintile of income for the year versus all others,<sup>19</sup>
- (2) proportion in the bottom quintile of income versus all others, and
- (3) proportion of households that own their dwellings versus non-owners.

(C) life cycle:

- (1) proportion of (adult) residents who are married versus all others,
- (2) proportion of residents who are 0 to 14 years old versus all others,
- (3) proportion who are 18 to 29 years old versus all others,<sup>20</sup> and

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<sup>18</sup> The definition of Hispanic has shifted over all the censuses, although from 1980 through 2000, the key probes were similar (“Is this person Spanish/Hispanic...?”). The 1960 procedure was especially different from the others and the 1960 data cannot be reliably spliced with the others. For 1970, using either a self-definition item (for the 5% sample) or a mother-tongue definition (in the 15% sample) yield very similar results. For continuity, we used the former measure.

<sup>19</sup> For income segregation, we report the residential segregation of families in the top and bottom fifths of family income in each year. Choosing other cut-points – at the fifth, fiftieth, or ninety-fifth percentiles – would clearly yield different overall levels of segregation, some of which differ more between the decades than others. Our sensitivity analyses suggest that changes between decades in the segregation of those with lower incomes would be greater if lower percentile thresholds were chosen, but changes in the segregation of higher earners would differ little if higher thresholds were used.

<sup>20</sup> Cutting age at 14 and at 65 is consistent with most historical data. We separate the 18- to 29-year-olds to

(4) the proportion who are over 64 years old versus all others.

We report H indices for each defined group against all those outside the group (e.g., blacks versus all nonblacks), but we also calculated indices for specific pairings (e.g., blacks versus non-Hispanic whites, blacks versus Hispanics) and report those where useful.

## Results

### Overview: 2000

Table 1 illustrates some simple results for 2000. For each dimension of difference, it shows (a) the total, national level of metropolitan tract segregation as measured by H and (b) the percentage of that segregation that can be attributed to between-tract segregation within places rather than to between-place, city-suburb, between-metropolitan area, or between-region segregation. (The detailed tabular data with the remaining numbers are presented in the Appendix Table.) Among the most evident findings are these: Segregation by ancestry, especially by black versus nonblack, was greatest, by class next largest, and by life cycle least severe; the well-off were more secluded residentially than the poorly-off (.156 versus .127); tract-level segregation was especially significant for children – i.e., family households separated from nonfamily ones largely by neighborhood (64% of national segregation was at the tract level) – and it was least important for Hispanic and foreign-born segregation (25% and 24%; residential differences by region and metropolitan area, not shown, largely explain their separate locations). Our major interest is the four-decade changes both in total levels of segregation and,

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pursue the issue, raised by Mark Stern and Michael Katz (Department of History, University of Pennsylvania), about the historical rise of “youth” neighborhoods.

especially, in its components.

(Table 1 about here)

### **Trends in Segregation by Ancestry**

We focus on the change in segregation and its locus from 1960 to 2000. For purposes of exposition and because some levels of segregation are so much greater than others, we begin with and use the findings on ancestry to illustrate the analysis, specifically the case of black versus nonblack segregation. Figure 1 shows the trends. The entire shaded-in area is the total amount of black-nonblack segregation across census tracts in all metropolitan areas of the nation combined. The segments below decompose that national segregation into, from the bottom up: (a) segregation by region within the metropolitan United States; (b) segregation between metropolitan areas within regions; (c) segregation between center city (or cities) and the suburbs within metropolitan areas; (d) segregation between places within the suburbs and multiple center cities; and (e) inter-tract segregation within places – essentially, neighborhood segregation.

(Figure 1 about here)

The trend for black segregation is dramatic: total between-tract level – the cumulation of all the components – declined sharply in the United States, from  $H = .631$  in 1960 to  $H = .429$  in 2000, a 32% decline. (Exact numbers are in the Appendix Table.) This is consistent with other reports of declining black segregation nationwide since 1970 (e.g., Cutler et al. 1999; Iceland et al 2002); by one estimate, black segregation was lower in 2000 than it had been since 1920 (Glaeser and Vigdor 2003). Paired comparisons show that blacks became less segregated from

non-Hispanic whites and from Hispanics.<sup>21</sup> Our partitioning of H reveals that total segregation declined because neighborhood-level segregation (tracts within places – the top shaded area) dropped sharply, from  $H = .431$  in 1960 to  $.173$  in 2000, a reduction of 60%. At the same time, there were modest increases in segregation at other levels, notably among places within suburbs and central cities (the second layer), from  $H = .035$  in 1960 to  $.082$  in 2000, a 134% increase. Put another way, in 1960, tract-to-tract segregation within places accounted for 68% of the national segregation of urban blacks, but only 40% of it in 2000; between-place segregation accounted for 6% of black segregation in 1960 and 19% in 2000. The distinction between central cities and their suburbs became much more important between 1960 and 1970, consistent with impressions of the day, but did not expand afterwards. Substantively, these results are consistent with descriptions of nonblacks retreating to segregated suburban municipalities in the face of increasingly integrated neighborhoods.

Having walked through the biggest change – the decline in black segregation – in detail, we present the rest of the data more concisely. Ancestry. Figure 2 displays the trend lines for the segregation of blacks, non-Hispanic whites, Hispanics, and the foreign-born. The historical pattern of overall non-Hispanic white residential segregation (bottom-left panel) is roughly similar to that of African-American segregation (top-left panel): rapidly declining, especially because tract-by-tract segregation declined precipitously (from  $H = .30$  in 1970 to  $H = .12$  in 2000). The city-suburb component declined by about a third by 2000 (from  $H = .09$  to  $.06$ ). Place-based segregation increased slightly (from 9 to 18 percent of total segregation), as in the

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<sup>21</sup> Glaser and Vigdor (2003: 220) report that most of the integration is a result of more blacks living in minority black neighborhoods (rather than whites integrating black neighborhoods).

case of blacks. Distinctively, however, non-Hispanic whites became considerably more segregated by metropolitan area (from  $H = .07$  to  $H = .09$ , from 13 to 27 percent of total segregation) through 1990. This last finding may, in part, reflect the segregation pattern of Hispanics, which is heavily metropolitan-based. It is also consistent with Frey's (1996) argument that non-Hispanic whites have retreated to inland areas. The trend from 1990 to 2000 diminished this as Hispanics, especially Mexicans, spread throughout the country. It is fair to conclude that non-Hispanic whites are now much more exposed to others at the level of neighborhood, but some have found more exclusive metropolitan areas and municipalities within metropolitan areas.

(Figure 2 about here)

The comparison of black-nonblack to Hispanic-nonHispanic segregation in the top two panels of Figure 2 tells a few stories. (Note: we cannot accurately assign residents to the Hispanic and non-Hispanic categories using the questions from the 1960 Census; see notes on Hispanic definition in Appendix.) Historically, black segregation has been much higher than Hispanic segregation, but converged between 1970 and 2000. However, black and Hispanic segregation – though both rooted in neighborhoods – differ in their details. Hispanics tend to be concentrated in particular regions and metropolitan areas, while blacks were more evenly spread throughout the country by 1960. Hence, segregation by neighborhood is more important in isolating blacks. All the black-Hispanic convergence is due to the declining segregation of blacks. The total national segregation of Hispanics was the same in 2000 as it was in 1970. That stasis was largely the net result of countervailing trends: a drop in between-neighborhood (i.e., tract-within-place) segregation of about 5 points and a rise in between-region, between-metropolitan area, and between-place segregation of about 2 points each. We see these trends as

the product of Hispanic growth and dispersion. As Hispanics increased their share of the population, Hispanic families found neighborhoods to live in that traditionally had few residents of their group. But, given high rates of immigration, they remained concentrated in specific gateway metropolises such as Los Angeles and New York. Indeed, Hispanic segregation increased in such metropolises and in specific places within those metropolitan areas.<sup>22</sup>

Consistent with that speculation is the trend in the segregation of the foreign-born, shown in the fourth panel, which increased 67% between 1960 and 2000; the great bulk of that increase is attributable to segregation by metropolitan area.<sup>23</sup> In this same period, the character of the foreign-born changed – from elderly European immigrants who had made their way across much of America to young Hispanic and Asian immigrants who had just arrived in certain portal cities.<sup>24</sup>

This detailed look at ancestry patterns illustrates how we can read complex changes in segregation by this method and obtain clues about the substantive changes not only in the degree

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<sup>22</sup> Logan et al. (2002) report a small increase in average within-metropolitan area Hispanic segregation from 1990 to 2000, while we show effectively no change in Hispanic segregation below the metropolitan level (city-suburb + place + tract). The differences can be accounted for by the fact that Logan et al. measure Hispanic versus non-Hispanic white segregation; we measure Hispanic versus non-Hispanic segregation. Increasing co-residence of Hispanics with blacks would line up the two results.

<sup>23</sup> Another way to see the change is that, in 1960, between-tract and between-metropolitan area segregation each contributed 30% to the total segregation of the foreign-born, but in 2000, between-metropolitan area segregation accounted for 45% of it versus 24% for tracts. Consistent with Alba et al. (1999), the city-suburban distinction became relatively less important, accounting for 8% of foreign-born segregation in 1960 and 4% in 2000.

<sup>24</sup> Looking at specific nationalities reveals that the Mexican-born were less segregated in total in 2000 than in 1980, while those born in Eastern Europe, East Asia, and Central America were more segregated.

but also in the nature of segregation.

### **Trends in Segregation by Class**

Figure 3 displays our results for the three indicators of social class. Note, first, that the scale for  $H$  is considerably lower than it was for ancestry, going up only to .30. Americans are much less segregated by income and homeownership than by ancestry. (We suspect that a wealth measure would yield higher levels of segregation, but that is unavailable by geography.)

(Figure 3 about here)

White (1987) reported that class-based segregation at the tract level in several American metropolitan areas had declined between 1940 and 1980. Our results are moderately consistent with his, showing small declines in tract-within-place income segregation (top layer of the first two panels) from 1960 to 1980, but they tell a more complex story across time and levels of segregation. The total segregation of Americans in the top quintile of household income from other Americans increased from 1970 to 1990 by 0.043, or by 36%, and leveled out in the 1990s. The rise is consistent with descriptions of widening economic inequality in those 20 years and suggestions that this inequality expressed itself in geographic isolation (e.g., Mayer 2001; Massey and Hajnal 1995), although the fact that there was no increase in the 1990s when income inequality continued to rise is a little puzzling. The increase in the segregation of the affluent largely occurred between metropolitan areas and between places within center cities and suburbs; rising between-tract segregation contributed less to the trend.<sup>25</sup> The first suggests that the decades since 1970 witnessed an increasing economic differentiation of metropolitan areas; some became

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<sup>25</sup> Of the .038 increase in  $H$  between 1970 and 2000, 29% is due to the .011 increase in between-metropolitan area segregation, 51% to between-place increases, and 17% to the between-tract increases.

especially affluent, consistent with theories about “global cities.”<sup>26</sup> The second trend supports arguments that affluent Americans have used the political boundaries around suburban communities as a device for class sequestration. The segregation of low-income Americans was somewhat lower throughout the same period and increased less, by 0.026, or 24%, from 1970 to 1990. Tract-level segregation accounts for most of the isolation of the poor, but the modest increase is attributable to small increases at the metropolitan, city-suburb and place levels.<sup>27</sup> We examined, as well, specifically the segregation of the richest quintile from the poorest quintile. Total segregation between the two ends of the income distribution was both higher and increased more, from  $H = .266$  in 1960 to  $H = .329$  in 2000. The increase in the segregation of the wealthy from poor occurred at the metropolitan area and especially the place levels.<sup>28</sup>

On the other hand, the segregation of homeowners from renters declined sharply between 1960 and 1990. The decline may be accounted for by the expansion of rental housing into

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<sup>26</sup> Costa and Kahn (2000) describe one dynamic that operates at the metropolitan-area level: the tendency of college-educated couples to cluster in larger metropolitan areas so as to maximize their chances of establishing two careers.

<sup>27</sup> Regional-level segregation actually declined, probably because Southerners were not as distinctively poor in 2000 as they had been in 1970.

<sup>28</sup> The  $H$  for between-metropolitan area segregation of the top and bottom quintiles increased .026 between 1960 and 2000, while the between-place  $H$  increased .041 (with negligible changes in the city-suburb and tract-level  $H$ 's). The great bulk of the increase occurred in the 1980s. We also explored the implications of using other cut-points for the income analysis. At the upper end, we can observe more historical shift toward segregation by dividing families somewhere between the top 20<sup>th</sup> to top 40<sup>th</sup> percentile; little change occurred for the top 5<sup>th</sup> percentile, probably because this group was highly segregated throughout. At the lower end, using the poorest tenth shows more change, perhaps because in the earlier decades it included many elderly people.

outlying urban and suburban neighborhoods that had been previously all owner-occupied housing and by increasing condominium ownership in center cities. The steepest drops in the Theil index are for city-suburban and for tract segregation. The city-suburban contribution to overall homeowner segregation dropped.<sup>29</sup>

In sum, these data show, as others' data have, that income-based segregation increased in the United States after 1970, but they additionally show that the increased segregation developed at two levels – economic differentiation of metropolitan areas slightly and “place-shopping” within suburban rings more substantially – and that it leveled off in the 1990s.

### **Trends in Segregation by Life Cycle**

Figure 4 displays the results for the segregation by stage in the life cycle, specifically of the married, of children, young adults, and the elderly. As we noted earlier, total segregation by life cycle is considerably less than on the other dimensions; our scale of Theil's H thus goes only to .10.

(Figure 4 about here)

The married and unmarried lived increasingly apart (total H increased by .034, almost doubling) and the center city versus suburban distinction contributed the most to that segregation (an increase of .012, going from 16% to 26% of total segregation). The implication is that cities became more distinctively homes to the unmarried and suburbs to the married (see also Frey and Berube 2003; Frey and Kobrin 1982). Between 1960 and 2000, the difference in the proportion

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<sup>29</sup> Overall, homeowner-renter segregation dropped .065 points, from a total of .266 in 1960 to .201 in 2000. The city-suburb component dropped .027 points (from 23% to 17% of the total) and the tract-within-place component dropped .033 points (a steady 52% of the total).

of central city adults and suburban adults who were married widened from about 7 points (65% versus 72%) to about 12 points (48.5% versus 60%). The difference in the proportion never-married also widened, from 3 points to about 11 points. (The key distinction here is between the married and the never-married.) Consistent with this pattern and in line with speculations about the emergence of young adult subcultures, young adults became increasingly segregated from everyone else – total H rose from .02 to .05. Every component except region contributed to this increase, but the fastest increase involved the city-suburb division. (The city/suburb share of total segregation for 18-to-29-year-olds increased from 6 to 13%.) Unlike the case of other dimensions of segregation, the city-suburb distinction seems to be notably sharpening for both younger people and for unmarried people.

Finally, changes in the segregation of the elderly fall below our rule-of-thumb standards for significance. We do not see what conventional wisdom would suggest, an expansion of the regional segregation of the elderly. Perhaps four regions are too large to capture the movement of retirees to specific states (e.g., Florida and Arizona) or to specific metropolitan areas (e.g., Fort Lauderdale versus Tallahassee). Another possibility may be that many elderly retired to non-metropolitan areas, outside of our sample, and yet another that many maintain two homes.

In sum, life cycle segregation was both lowest in magnitude and changed the least in the three decades we have examined. There are modest indications that metropolitan areas became slightly more differentiated by stage in the adult life cycle – marital status and young adulthood.

Robustness. We tested the robustness of our findings with respect to a few possible artifacts. The major one concerned using contemporary lists of metropolitan areas. As discussed earlier, for conceptual reasons we prefer to use contemporary definitions of the metropolitan population. But it is worthwhile seeing what difference that decision makes. It is true that

younger metropolitan areas, ones introduced later in the sample, tend to be less segregated and therefore push segregation trends down. But when we examined our trends for only those metropolitan areas in the sample in all five decadal years, the trend lines were barely different than those reported here. Similarly, we compared decade-to-decade changes, using a constant list of metropolitan areas. Again, no substantial difference on findings emerged. The declines in ancestry segregation between 1960 and 1980 or 1990 were slightly less steep using constant metro-area comparisons.

The boundaries of specific metropolitan areas also change over time, as the Census adds counties or subdivides areas. Holding metropolitan areas to constant boundaries does not yield notably different results. A related concern is the change in tract boundaries and the areas tracted over time (see appendices available from the authors). We compared results using constant and contemporary tract lines. The only notable difference was that homeowner versus renter segregation declined slightly more sharply using constant tract lines.<sup>30</sup> Another tract concern was that in some years in some places, we created large “remainder” tracts, which lump together dispersed and disparate neighborhoods not otherwise clustered into tracts. We examined those pseudo-tracts and concluded that they were not distorting our results.

Another question (raised by a reviewer) was whether the difference between data based on full enumerations and those based on long-form samples may have distorted our results. Comparisons of results based either on samples or full counts show only trivial differences.<sup>31</sup>

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<sup>30</sup> We suspect that the difference is explainable in terms of the criteria used for subdividing tracts, criteria tied to housing types.

<sup>31</sup> The concern is warranted. When the Bureau of the Census calculates tract-level data from long-form samples (income, for example), it adjusts the results in each tract using data from neighboring tracts – because the

## Conclusion

We have been able, by using the Theil index, to describe levels and trends in urban residential segregation and, most importantly, to divide the national total into the cumulative contributions of geographical subparts. This procedure adds another perspective to our view of segregation. For example, we not only document the decreasing segregation of black Americans, but also find additional, important details: Segregation between specific neighborhoods has abated substantially since 1970, suggesting that personal, block-level resistance to integration has weakened or been overcome in the last generation. (And, as noted earlier, blacks have integrated with non-Hispanic whites; this is not an artifact of growing Latino populations.) Yet, we also find that this trend was partly offset, especially during the 1970s, by growing racial segregation between suburban municipalities. The city-suburb barrier became relatively less important as blacks increased their numbers in the suburban ring, but differences among suburbs sharpened. Scholarly and policy focus might rightly shift toward the institutions – tax authorities, zoning districts, school precincts, etc. – that make town lines attractive to movers and barriers to integration (Swanstrom et al. 2002). Black segregation and non-Hispanic white segregation by place increased slightly as towns became more distinctly black or white (and non-Hispanic whites concentrated in certain metropolitan areas). The foreign-born became more segregated, largely because they concentrated more than before in specific metropolitan areas. Class segregation, although much lower than segregation by ancestry, increased between 1970 and

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sample sizes in each tract are often too small (Bureau of the Census 2000). This would seem to smooth out between-tract differences. In this study, we use 100% count data for 2000 on some variables (ancestry, homeownership, and age), but sample data for the previous years. And on other variables, we can only use sample data. Comparing 2000 results of the  $H$  index for 100% and sample data showed minor differences.

1990, largely because the well-to-do concentrated more in specific metropolitan areas and, even more, in specific places within metropolitan areas. Americans segregated themselves by life cycle considerably less than by class or ancestry and there were only modest changes over the period, most notably greater segregation of the unmarried and of young adults within center cities and specific suburban neighborhoods. Such findings, although only illustrative of what this approach might yield, nonetheless add to our understanding of important urban processes. They support the contentions that black-white segregation has, in total, been in decline, that the foreign-born are geographically concentrated, that class segregation increased at least among the affluent, and that we may be seeing the emergence of young adult neighborhoods in the center cities. The results also underline the importance of place differences within metropolitan areas – that political boundaries are increasingly marking segregation by class and race, that by inference advantaged groups are increasingly using municipal lines to sequester themselves. It may be that the city-suburban distinction seen as so critical in the 1960s and 1970s is waning in importance for class and race, while distinctions among suburbs grow in importance. Finally, the findings support some of the “world cities” literature on metropolitan specialization. Differences among metropolitan areas show up as increasing segregation by class and ancestry (while regional segregation is largely small and declining).

We present these findings as illustrative of what could be done by disaggregating segregation in this manner. There are several directions that future work can take. Certainly, researchers could explore segregation along other dimensions of interest, say, by occupation and education. And they could examine segregation by combinatorial categories, for example, the segregation of low-income blacks from middle-class blacks, of native-born Hispanics from native-born non-Hispanics, or single mothers from married mothers. They could pursue results

such as Logan et al.'s (2001) finding that gross segregation by ancestry declined for adults but increased for children between 1990 and 2000. (Some of this potential research is limited, however, by confidentiality rules.<sup>32</sup>) Researchers could, of course, explore n-category measures, rather than the dichotomies we employed – although we would note that the dichotomies can reveal the dynamics underlying n-category analyses. Future work could also pursue more or different levels of geography, for example, block clusters or 11 rather than four regions. And researchers could recalculate indices to take into account the influence of neighboring units.

Another step would be to pursue explanatory models. The Theil measures can become dependent variables in studies of what determines segregation (as in Jargowsky 1996; Logan et al. 2002; Iceland 2002). For example, individual metropolitan areas can be coded for the degree to which their segregation is between city and suburb, among jurisdictions, or among tracts, and researchers can ask what about metropolitan areas' population compositions, economies, locations, and histories accounts for the variations. Conversely, the Theil measures can be independent variables in studies of the consequences of segregation. One could ask whether, for example, levels of economic inequality, violence, or political turmoil are most affected by city-suburb, place, or neighborhood levels of segregation (as some researchers do with gross measures of segregation – e.g., Beggs et al. 1997; Massey 1995; Cutler and Glaeser 1997).

Whichever direction is pursued, this technique opens up possibilities of sharply refining our understanding of metropolitan segregation.

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<sup>32</sup> Our analysis is based on the summary files. To look at more detailed categories requires going to the Public Use individual-level data. But location indicators are masked.

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## Appendix: Data Sources, Definitions, and Matching Issues

Data for these analyses were drawn from summary files produced by the Bureau of the Census.<sup>33</sup> The requirements of our analyses demanded two things of the data. First, it required the existence of cell counts which were defined for a) common characteristics which captured the elements of ancestry, class, and life cycle, over b) the entire period from 1960 through 2000,<sup>34</sup> for c) equivalent universes of individuals or households. The second principal requirement was that these counts were available for units of geography and levels of geography that were consistent over the same period.

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<sup>33</sup> For 1960, we used Census Tract-Level Data obtained from DUALabs, Inc. and redistributed by ICPSR. For 1970, tract-level data was drawn from the *Fourth Count A* tallies for sample data (for all states except New Jersey, which was generously provided to us by Anne Gray from the Princeton Population Lab). For 1980 and 1990, we used the Summary Tape File 3A data, provided on the internet by CIESIN. Finally, for 2000, we are using the SF1 counts for the data items which can be drawn from the short form, which have been supplemented with SF3 for items drawn from the long-form. Some researchers have found large discrepancies between segregation measures based on sample data (e.g., SF3) and those drawn from full count files (e.g., SF1) for individual metropolitan areas with small (1%-2%) minority populations. We compared our results for 1980, 1990, and 2000 for measures available from both full count and sample tabulations. The resulting segregation measures were virtually identical for the two sources.

<sup>34</sup> Originally, we addressed a longer span of censuses by employing the Elizabeth Mullen Bogue files for 1940, 1950, and 1960. Use of these files permit, after creating a map between metropolitan area codes, the tracing of segregation levels for selected MAs much further back. Unfortunately, because the extent of tracting within an area changed substantially over time and the coverage of MAs was incomplete, the years prior to 1960 were unsuitable for the types of analyses we used. (In 1940, for example, only tracted cities are included, while in 1950, only 59 of the 114 tracted areas are represented in the files).

Each of these requirements appears simpler on the surface than in practice. Our first concern is with the availability and consistency of our measures. The most obvious way in which one of our measures will be inconsistent is if the cells of the table from which it was collected are chosen differently in different periods. Alternatively, the same cells may be collected, but the universe they are collected for may differ in some way. A third issue which can give rise to inconsistencies occurs when both the cells collected and the universe remain the same, but the underlying distribution changes in a way that the “same” cells now represent an analytically distinct group.

By and large, we selected measures for which the first problem either does not arise or can be handled by collapsing the data. In some cases, we wind up having to collapse into categories we might not prefer, but the final categories are consistent if not ideal. (One notable exception to this is the occupational categories, which were extensively revised between 1970 and 1980, and which, despite their centrality to social class, had to therefore drop from analyses.)

The second case arises for marital status variables. In both cases, the universe in earlier periods includes persons at younger ages than those in later periods. The exclusion of 14 year olds from the numerator and denominator for whom marital status is determined in later years would increase the percent never-married, but more-or-less universally across all areas. Hence, segregation measures which are not affected by prevalence (like entropy or dissimilarity) should not be unduly affected by this problem.

The final issue may arise for items like income. Clinging to specific dollar ranges for income measures may ignore or misstate the effects of inflation and will miss the effects of across-the-board increases in income which place similar dollar amounts at different locations in the income distribution over time. We chose to emphasize distributional issues, and examined

the 20% at the top and bottom of the distribution.

The second broad requirement of our analyses is consistently available geographies – regions, metro areas, central cities, suburban places, and tracts. The tract issues are possibly the most complex and are discussed separately in Appendix 4 available from our web site and the authors; inconsistencies in place availability required an estimate-based solution, which is documented in Appendix 3 available from the authors. Here we discuss only the decisions we made regarding definitions of comparable geographic units and the attribution of geographic identifiers.

Metropolitan areas are, Census Bureau definition, intended to be composed of a “core area containing a large population nucleus, together with adjacent communities that have a high degree of economic and social integration with that core.” Metropolitan areas (as their first incarnations as SMAs) were first defined for the 1950 census. The number of MAs grew from 169 in that year to 331 in 2000. During the same period, the proportion of the U.S. population that lived in such areas rose from 56% to 80%. Changes in segregation of the metropolitan population may reflect both changes in the population in particular areas, but also differences between established MAs and newly defined MAs. As discussed in the text, we examined the robustness of our results with respect to the differences by age of metropolitan area and size of metropolitan area.

In addition to newly created MA’s, existing MAs may add population either through the addition of population within previously defined boundaries, or through the incorporation of new counties or areas into the MA. We chose to regard the contemporary boundaries of metropolitan areas as definitive of the analytically appropriate boundaries: we are examining the segregation of persons, not of territory. As stated in the text, analyzing the data with constant boundaries

yields similar findings.

## **Measures**

*Ancestry.* We explore three measures – race, Hispanic origin, and nativity – of segregation based on ancestry. For the period from 1960 through 2000, we use three mutually exclusive race categories – white, black, and other. We draw additional distinctions within and across racial categories by Hispanic origin for the period from 1970 through 2000. Finally, we take population counts for native- and foreign-born persons from 1960 on. Idiosyncrasies in measures for selected years are discussed below.

In 1960, the three base race categories were directly reported. We formed the same three categories for 1980 and 1990 by simply collapsing more detailed categories. In 1970, a substantial proportion of race counts were suppressed at the tract level; for those tracts, we imputed counts by applying the proportional shares by race identified prior to the census-performed allocations and substitutions to the total population counts. In 2000, when the questionnaire permitted the identification of multiple races, we used the single race counts for calculations, and verified trends using racial identifications in “alone-or-in-combination.” The identification of Hispanic-origin persons in 1960, based on surname and parentage, was incomparable with the self-identification available in later years, and we excluded it from our analyses. The 1970 instrument offered multiple modes for identification of the Hispanic population – parentage, surname, self-identification, and mother tongue; we used the counts generated from the self-identification item on the 5% long-form questionnaire.

*Class.* We use two measures – family income and homeownership – as our indicators of segregation by class. (We also considered two additional measures of class – educational

attainment and occupation – but set them aside, the former because its close correlation with age makes it difficult to separate from the effects of life cycle and the latter because the way that occupational categories are constituted changed substantially over the period.)

Income categories for our analyses are tabulated at a family level. For 1960, family income is provided in 13 categories; in 1970, 1980, 1990, and 2000, family income is reported, respectively, in 15 categories, 17 categories, 25 categories, and 16 categories. In order to provide a more consistent measure over time of counts of the well-off and the poor, we estimated the dollar figures which establish the 20th and 80th percentiles of family income for families in each year's sample, assuming an even distribution of families within each income category. This linear interpolation which we used to estimate the top and bottom quintiles we also applied at the tract level to apportion families to one of the three income strata formed. (Thus, for example, a set proportion of counts for a category which straddles the 20th percentile would be allocated to the bottom 20th percentile, and the remainder allocated to the middle 60%). In each year, the primary distinction between housing units which are owned, regardless of mortgage status, and those which are rented, with or without cash rent, is the basis for our measure of homeownership.

*Life Cycle.* We captured life cycle effects by counts of population according to age and marital status. Individual cell counts, reported in categories ranging from single years to 10 year age groups, were collapsed into counts of those 14 and younger, 18 to 29 year-olds, and persons aged 65 and older (as well as the complementary groups, e.g., persons 15 and older, or those 64 and younger). We identified marital status for men and women aged 14 and older before 1980, and for those 15 and older after that point.

Table 1. Total National Segregation (Theil's H) and the Proportion Attributable to Tract-Within-Place Segregation, 2000, by Trait.

| Dimension  | Trait:<br>Percent Who Are...  | Theil's H for<br>Total National<br>Segregation<br>Among Tracts | Decomposition:<br>Percent Due to<br>Tract-within-<br>Place Segregation |
|------------|-------------------------------|--|--|
| Ancestry   | African American              | .429   | 40%  |
|            | Non-Hispanic White            | .355   | 34   |
|            | Hispanic                      | .357   | 25   |
|            | Foreign-Born                  | .207   | 24   |
| Class      | In highest quintile of income | .156   | 47   |
|            | In lowest quintile of income  | .127   | 48   |
|            | Home owner                    | .201   | 52   |
| Life Cycle | Aged 0 to 14                  | .021   | 64   |
|            | Aged 18-29                    | .054   | 58   |
|            | Aged 65+                      | .058   | 52   |
|            | Married                       | .072   | 48   |

Table A

Theil's H by Dimension of Segregation, Level of Geography, and Year

| Year                                       | TOTAL               | ADDITIVE DECOMPOSITION |                  |                   |                      |                      | PROPORTIONAL DECOMPOSITION |                  |                   |                      |                      |
|--|---------------------|------------------------|------------------|-------------------|----------------------|----------------------|----------------------------|------------------|-------------------|----------------------|----------------------|
|  | Tracts within Total | Region within Total    | MA within Region | CC/Sub within MAs | Places within CC/Sub | Tracts within Places | Region within Total        | MA within Region | CC/Sub within MAs | Places within CC/Sub | Tracts within Places |
| ANCESTRY: African American versus Others   |                     |                        |                  |                   |                      |                      |                            |                  |                   |                      |                      |
| 1960                                       | .631                | .037                   | .050             | .077              | .035                 | .431                 | .059                       | .080             | .122              | .056                 | .684                 |
| 1970                                       | .636                | .026                   | .061             | .107              | .061                 | .380                 | .041                       | .096             | .168              | .096                 | .598                 |
| 1980                                       | .561                | .025                   | .073             | .083              | .097                 | .284                 | .044                       | .130             | .148              | .173                 | .505                 |
| 1990                                       | .493                | .026                   | .072             | .087              | .082                 | .225                 | .053                       | .145             | .178              | .166                 | .458                 |
| 2000                                       | .429                | .033                   | .067             | .074              | .082                 | .173                 | .078                       | .156             | .172              | .191                 | .403                 |
| ANCESTRY: Non-Hispanic White versus Others |                     |                        |                  |                   |                      |                      |                            |                  |                   |                      |                      |
| 1960                                       | --                  | --                     | --               | --                | --                   | --                   | --                         | --               | --                | --                   | --                   |
| 1970                                       | .512                | .013                   | .066             | .088              | .047                 | .299                 | .024                       | .128             | .172              | .092                 | .584                 |
| 1980                                       | .439                | .014                   | .090             | .064              | .071                 | .199                 | .032                       | .205             | .147              | .162                 | .454                 |
| 1990                                       | .399                | .018                   | .099             | .067              | .059                 | .156                 | .045                       | .249             | .167              | .148                 | .391                 |
| 2000                                       | .355                | .021                   | .094             | .056              | .064                 | .121                 | .058                       | .265             | .157              | .180                 | .340                 |
| ANCESTRY: Hispanic versus Others           |                     |                        |                  |                   |                      |                      |                            |                  |                   |                      |                      |
| 1960                                       | --                  | --                     | --               | --                | --                   | --                   | --                         | --               | --                | --                   | --                   |
| 1970                                       | .358                | .033                   | .128             | .021              | .033                 | .142                 | .091                       | .358             | .060              | .093                 | .398                 |
| 1980                                       | .376                | .049                   | .164             | .016              | .042                 | .105                 | .131                       | .437             | .042              | .112                 | .278                 |
| 1990                                       | .381                | .055                   | .170             | .020              | .041                 | .096                 | .144                       | .445             | .053              | .107                 | .251                 |
| 2000                                       | .357                | .050                   | .150             | .017              | .051                 | .090                 | .139                       | .419             | .047              | .143                 | .252                 |

Table A (continued)

| Year   | TOTAL                     | ADDITIVE DECOMPOSITION    |                         |                         |                            |                            | PROPORTIONAL DECOMPOSITION |                         |                         |                            |                            |
|--|---------------------------|---------------------------|-------------------------|-------------------------|----------------------------|----------------------------|----------------------------|-------------------------|-------------------------|----------------------------|----------------------------|
|  | Tracts<br>within<br>Total | Region<br>within<br>Total | MAs<br>within<br>Region | CC/Sub<br>within<br>MAs | Places<br>within<br>CC/Sub | Tracts<br>within<br>Places | Region<br>within<br>Total  | MAs<br>within<br>Region | CC/Sub<br>within<br>MAs | Places<br>within<br>CC/Sub | Tracts<br>within<br>Places |
| ANCESTRY: Foreign-Born versus Native-Born      |                           |                           |                         |                         |                            |                            |                            |                         |                         |                            |                            |
| 1960   | .124                      | .031                      | .037                    | .010                    | .008                       | .037                       | .250                       | .300                    | .081                    | .067                       | .302                       |
| 1970   | .157                      | .023                      | .054                    | .010                    | .013                       | .056                       | .149                       | .344                    | .066                    | .084                       | .357                       |
| 1980   | .174                      | .026                      | .079                    | .007                    | .018                       | .045                       | .147                       | .453                    | .037                    | .105                       | .258                       |
| 1990   | .215                      | .036                      | .103                    | .009                    | .020                       | .048                       | .167                       | .477                    | .040                    | .095                       | .222                       |
| 2000   | .207                      | .028                      | .094                    | .009                    | .027                       | .050                       | .136                       | .454                    | .042                    | .128                       | .240                       |
| CLASS: Top Quintile of Income versus Others    |                           |                           |                         |                         |                            |                            |                            |                         |                         |                            |                            |
| 1960   | .123                      | .003                      | .014                    | .010                    | .022                       | .075                       | .026                       | .110                    | .080                    | .178                       | .606                       |
| 1970   | .118                      | .003                      | .016                    | .011                    | .021                       | .066                       | .025                       | .139                    | .094                    | .181                       | .561                       |
| 1980   | .128                      | .002                      | .020                    | .010                    | .032                       | .065                       | .017                       | .155                    | .074                    | .248                       | .505                       |
| 1990   | .161                      | .006                      | .031                    | .013                    | .037                       | .073                       | .038                       | .193                    | .084                    | .230                       | .456                       |
| 2000   | .156                      | .003                      | .027                    | .012                    | .041                       | .073                       | .019                       | .176                    | .079                    | .261                       | .466                       |
| CLASS: Bottom Quintile of Income versus Others |                           |                           |                         |                         |                            |                            |                            |                         |                         |                            |                            |
| 1960   | .113                      | .011                      | .011                    | .013                    | .010                       | .068                       | .099                       | .100                    | .117                    | .085                       | .599                       |
| 1970   | .110                      | .007                      | .012                    | .017                    | .012                       | .063                       | .066                       | .105                    | .152                    | .107                       | .570                       |
| 1980   | .111                      | .003                      | .011                    | .016                    | .021                       | .060                       | .027                       | .102                    | .140                    | .190                       | .541                       |
| 1990   | .136                      | .003                      | .019                    | .024                    | .021                       | .069                       | .024                       | .141                    | .178                    | .151                       | .506                       |
| 2000   | .127                      | .002                      | .019                    | .022                    | .022                       | .062                       | .017                       | .147                    | .176                    | .176                       | .483                       |
| CLASS: Homeowners versus Others                |                           |                           |                         |                         |                            |                            |                            |                         |                         |                            |                            |
| 1960   | .266                      | .006                      | .033                    | .061                    | .029                       | .137                       | .024                       | .122                    | .229                    | .108                       | .517                       |
| 1970   | .216                      | .005                      | .025                    | .044                    | .028                       | .114                       | .021                       | .115                    | .202                    | .132                       | .529                       |
| 1980   | .210                      | .005                      | .029                    | .028                    | .040                       | .108                       | .023                       | .140                    | .134                    | .190                       | .514                       |
| 1990   | .190                      | .003                      | .024                    | .032                    | .032                       | .100                       | .016                       | .126                    | .167                    | .167                       | .524                       |
| 2000   | .201                      | .004                      | .023                    | .034                    | .036                       | .105                       | .019                       | .113                    | .170                    | .177                       | .521                       |

Table A (continued)

| Year  | TOTAL                     | ADDITIVE DECOMPOSITION    |                         |                         |                            |                            | PROPORTIONAL DECOMPOSITION |                         |                         |                            |                            |
|---|---------------------------|---------------------------|-------------------------|-------------------------|----------------------------|----------------------------|----------------------------|-------------------------|-------------------------|----------------------------|----------------------------|
|   | Tracts<br>within<br>Total | Region<br>within<br>Total | MAs<br>within<br>Region | CC/Sub<br>within<br>MAs | Places<br>within<br>CC/Sub | Tracts<br>within<br>Places | Region<br>within<br>Total  | MAs<br>within<br>Region | CC/Sub<br>within<br>MAs | Places<br>within<br>CC/Sub | Tracts<br>within<br>Places |
| LIFE CYCLE: Married versus Others                 |                           |                           |                         |                         |                            |                            |                            |                         |                         |                            |                            |
| 1960  | .037                      | .000                      | .001                    | .006                    | .004                       | .025                       | .010                       | .040                    | .161                    | .112                       | .677                       |
| 1970  | .043                      | .000                      | .002                    | .007                    | .006                       | .028                       | .006                       | .042                    | .167                    | .138                       | .647                       |
| 1980  | .049                      | .001                      | .004                    | .009                    | .010                       | .026                       | .012                       | .074                    | .178                    | .200                       | .536                       |
| 1990  | .060                      | .000                      | .005                    | .015                    | .009                       | .031                       | .008                       | .079                    | .247                    | .152                       | .514                       |
| 2000  | .072                      | .001                      | .006                    | .018                    | .013                       | .034                       | .010                       | .078                    | .255                    | .179                       | .477                       |
| LIFE CYCLE: Children 0-14 Years Old versus Others |                           |                           |                         |                         |                            |                            |                            |                         |                         |                            |                            |
| 1960  | .030                      | .001                      | .001                    | .003                    | .005                       | .020                       | .034                       | .047                    | .116                    | .152                       | .652                       |
| 1970  | .028                      | .000                      | .001                    | .002                    | .005                       | .019                       | .016                       | .050                    | .078                    | .168                       | .688                       |
| 1980  | .026                      | .000                      | .002                    | .001                    | .005                       | .017                       | .015                       | .082                    | .051                    | .210                       | .642                       |
| 1990  | .024                      | .001                      | .002                    | .001                    | .004                       | .016                       | .026                       | .102                    | .045                    | .186                       | .642                       |
| 2000  | .021                      | .000                      | .002                    | .001                    | .004                       | .014                       | .014                       | .097                    | .051                    | .201                       | .637                       |
| LIFE CYCLE: Persons 18-29 Years Old versus Others |                           |                           |                         |                         |                            |                            |                            |                         |                         |                            |                            |
| 1960  | .019                      | .001                      | .001                    | .001                    | .003                       | .013                       | .032                       | .073                    | .057                    | .167                       | .671                       |
| 1970  | .029                      | .001                      | .003                    | .001                    | .006                       | .018                       | .024                       | .092                    | .046                    | .215                       | .623                       |
| 1980  | .028                      | .000                      | .003                    | .002                    | .006                       | .017                       | .018                       | .100                    | .066                    | .208                       | .608                       |
| 1990  | .032                      | .000                      | .003                    | .003                    | .006                       | .020                       | .004                       | .098                    | .085                    | .195                       | .617                       |
| 2000  | .054                      | .000                      | .005                    | .007                    | .011                       | .031                       | .009                       | .086                    | .126                    | .196                       | .582                       |
| LIFE CYCLE: Seniors 65+ Years Old versus Others   |                           |                           |                         |                         |                            |                            |                            |                         |                         |                            |                            |
| 1960  | .050                      | .002                      | .004                    | .006                    | .009                       | .029                       | .031                       | .087                    | .121                    | .183                       | .578                       |
| 1970  | .064                      | .001                      | .007                    | .007                    | .013                       | .036                       | .021                       | .102                    | .107                    | .210                       | .561                       |
| 1980  | .067                      | .001                      | .009                    | .003                    | .018                       | .035                       | .018                       | .138                    | .051                    | .274                       | .518                       |
| 1990  | .063                      | .002                      | .010                    | .003                    | .017                       | .032                       | .024                       | .155                    | .040                    | .271                       | .509                       |
| 2000  | .058                      | .001                      | .009                    | .002                    | .016                       | .030                       | .023                       | .160                    | .026                    | .272                       | .519                       |

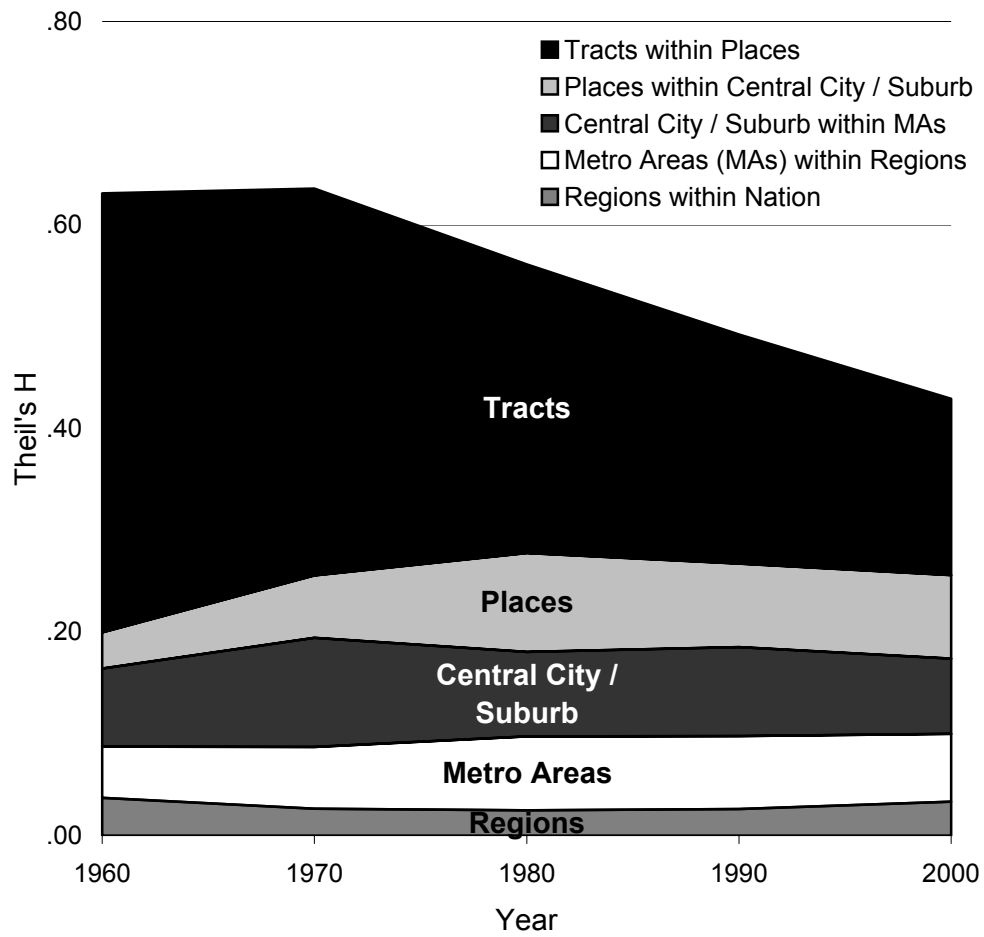


Figure 1. Segregation of Blacks versus Nonblacks (Theil's H) by Year and Level of Geography

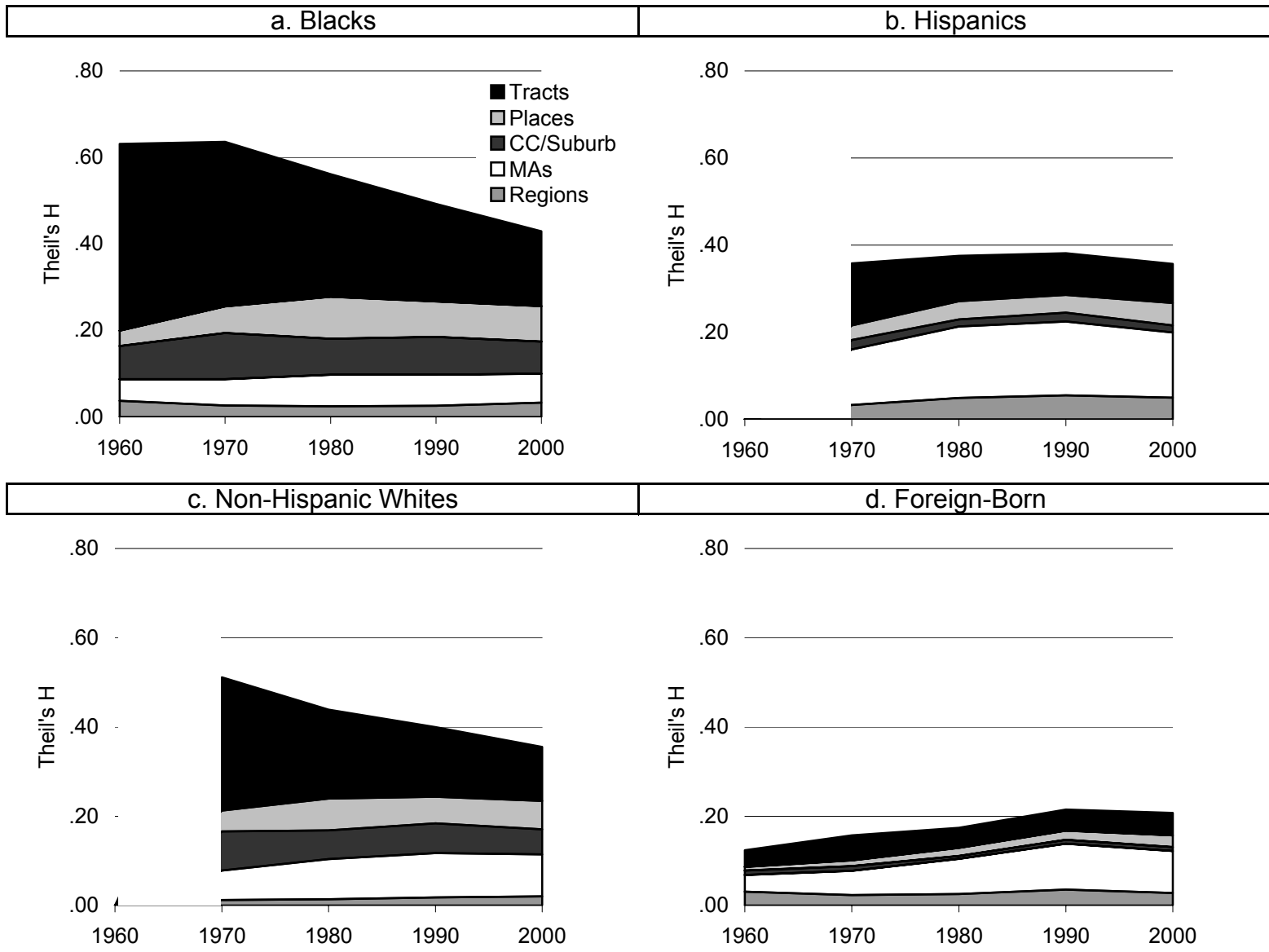


Figure 2. Segregation of Ancestry Groups (Theil's H) by Group, Year, and Geography

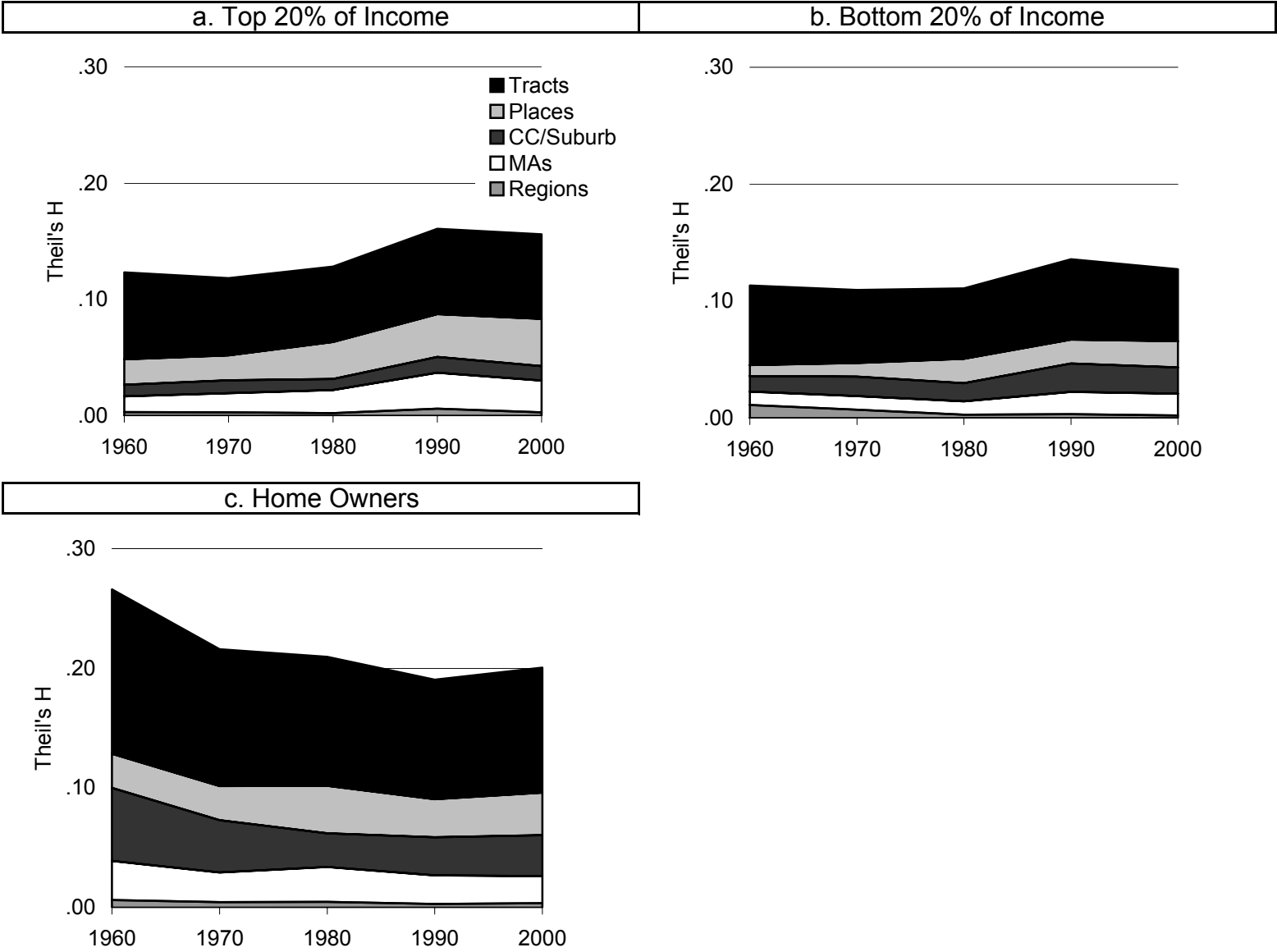


Figure 3. Segregation of Socioeconomic Groups (Theil's H) by Type, Year, and Geography

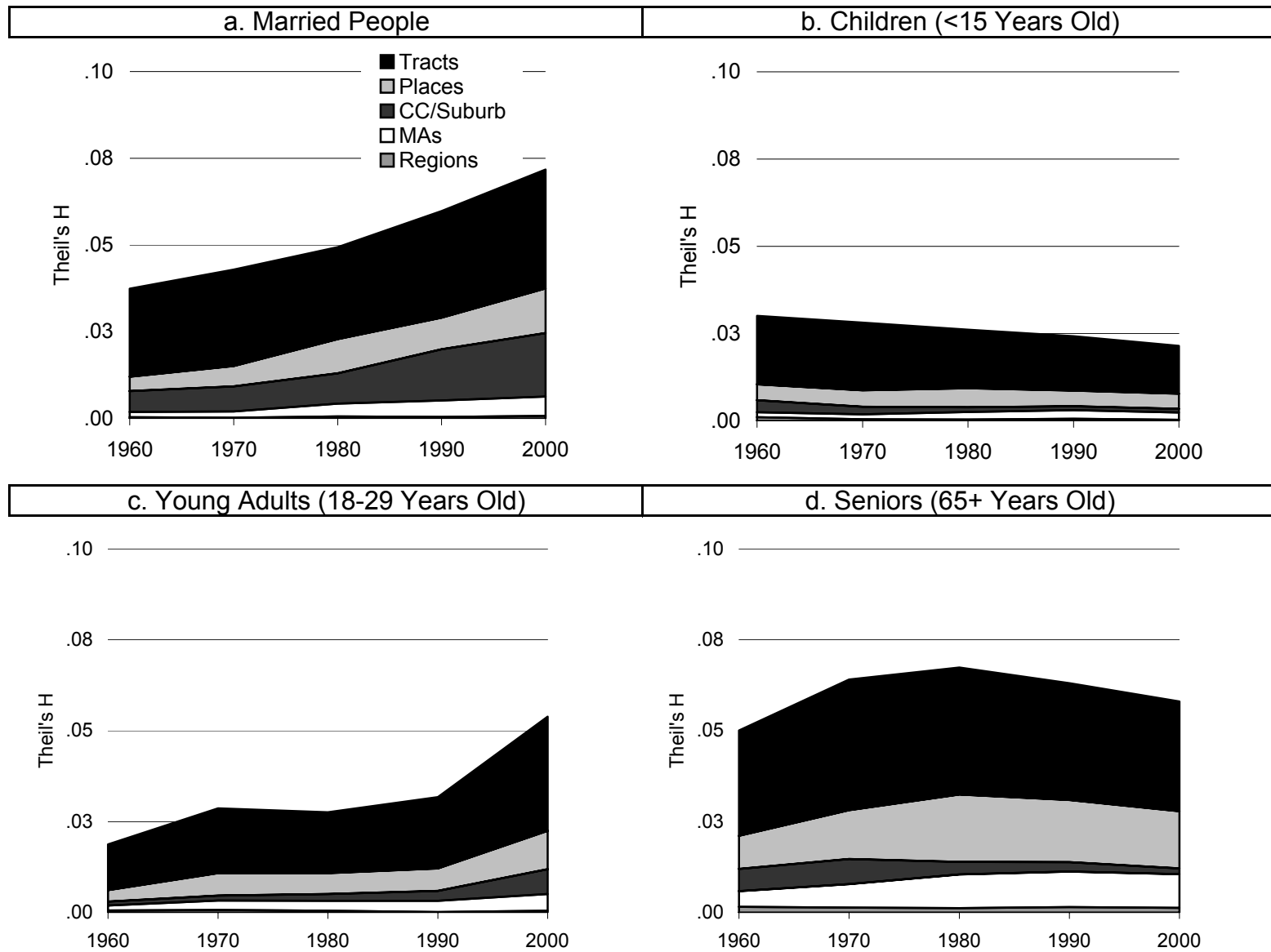


Figure 4. Segregation of Lifecycle Groups (Theil's H) by Phase, Year, and Geography

*Methodological Appendices to*

**Distinguishing the Geographic Levels and Social Dimensions of U. S.**

**Metropolitan Segregation, 1960-2000**

{ authors and affiliations }

1. *The Significance of Differences in the Theil Index.*

To interpret our measure of segregation – H – we need to know the effect of some reasonable changes in population on H. James and Tauber (1985, eq. 9) provide an equation that contains the answer, but it is so complex that some explication might be useful. First, consider these definitions:

$T_s$  = size of population in tract  $s$ ,

$T$  = total population,<sup>1</sup>

$p_{is}$  = proportion of the population in tract  $s$  that is in the segregated group  $i$  (blacks, Latinos, poor people, etc.),

$p_i$  = proportion of the total population that is in the segregated group  $i$ ,

$p_{\sim i,s}$  = proportion of the population in tract  $s$  that is NOT in the segregated group  $i$  (nonblacks, non-Latinos, non-poor, etc.),

$p_{\sim i}$  = proportion of the total population that is NOT in the segregated group,

$E_i = p_i \ln(1/p_i) + p_{\sim i} \ln(1/p_{\sim i})$ ,

$E_{is} = p_{is} \ln(1/p_{is}) + p_{\sim i,s} \ln(1/p_{\sim i,s})$ , and

$x$  = the population exchange – the movement of  $x$  people of the segregated group from one tract ( $i$ ) to another ( $j$ ) and an equal number of people of the other group from  $j$  to  $i$ .  $H$  is defined in equation [2] above.

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<sup>1</sup> Our national statistics refer to the metropolitan population. These results also apply to specific geographical units, for example, the segregation in one region or metropolitan area.

James and Tauber work out the derivative of H with respect to  $x$ . Remember that the derivative is the generalization of the slope – it gives the amount of change in H for a small change in  $x$ . In a population of millions, we can think of it as the amount of change in H for a one-person exchange between tracts  $s$  and  $\sim s$ . Their equation is:

$$\frac{dH}{dx} = \frac{1}{T} \ln \left( \frac{p_{i,\sim s} / p_{\sim i,\sim s}}{p_{is} / p_{\sim i,s}} \right) / E_i . \quad [\text{A.1}]$$

Since we are mainly interested in the consequences of  $dx$  for H, we move  $dx$  over to the right-hand side by multiplying both sides of equation [A.1] by  $dx$ , i.e.,

$$dH = \frac{1}{E_i} \ln \left( \frac{p_{i,\sim s} / p_{\sim i,\sim s}}{p_{is} / p_{\sim i,s}} \right) \frac{dx}{T} . \quad [\text{A.2}]$$

We have rearranged terms slightly for convenience. As T is total population, the term  $dx/T$  re-expresses the exchange of people as a proportion of the total population instead of as a raw number of people.<sup>2</sup>  $E_i$  is a constant that depends on the relative sizes of the segregated group and the rest of the population.  $E_i$  reaches its maximum – and  $1/E_i$  reaches its minimum – when the segregated group is exactly one-half of the population. If the segregated group is either very small or very large, then  $E_i$  will be small, too. Thus, all else being equal, an exchange has a bigger impact on H if the number of people being exchanged is a non-trivial proportion of either the segregated group or the rest of the population than if the segregated group is about as big as the rest of the population.

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<sup>2</sup> It will prove important later that the number of people moving is  $x$  from one group and  $x$  from another or  $2x$  altogether.

To interpret the middle term – what we call the “exchange accelerator” – of equation [A.2], think of three kinds of neighborhoods: “ghettos,” “proportionally mixed,” and “isolated majority” neighborhoods. To quantify these distinctions, let’s use the numbers that stem from the segregation of African Americans in the 1990s. At that point in American history, African Americans were about 12 percent of the U.S. population, so  $p_i = .12$  and  $p_{-i} = .88$  in a “proportionally mixed” neighborhood. We can think of a “ghetto” neighborhood as one in which  $p_i = .95$  and  $p_{-i} = .05$ . Finally let us say that a neighborhood is “isolated majority” if  $p_i = .05$  and  $p_{-i} = .95$ . With these kinds of neighborhoods in mind, we can calculate the exchange accelerator for exchanges between each possible pair involving different kinds neighborhoods; Table B.1 shows the results. All three kinds of exchange involve integration, so they all reduce segregation (i.e., have a negative sign with respect to  $dH$ ). An exchange that integrates both neighborhoods (an exchange between a ghetto and an isolated majority neighborhood) reduces segregation more than exchanges between segregated and proportionally mixed neighborhoods. Because African Americans are in the minority, an exchange between a ghetto neighborhood and a proportionally mixed neighborhood represents more integration than an exchange between a proportionally mixed neighborhood and an isolated majority one. We only have to consider changes between different types of neighborhoods because an exchange between a pair of neighborhoods with identical distributions results in an accelerator of zero and no change in  $H$ .<sup>3</sup>

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<sup>3</sup> In the formula for the exchange accelerator –  $\ln((p_{i,-s}/p_{-i,-s}) / (p_{i,s}/p_{-i,s}))$  – exchanges between neighborhoods of the same type mean that  $p_{i,s} = p_{i,-s}$  and  $p_{-i,s} = p_{-i,-s}$  so the numerator equals the denominator and the ratio equals 1;  $\ln(1) = 0$ . Thus exchanges between neighborhoods of the same type produce exchange accelerators of 0 and that results in  $dH = 0$ .

So now we are in a position to say what we expect from an exchange involving two percent of the total population – a group of people from the segregated population equal to one-percent of the total population moving to a new neighborhood and an equal number of people from the other group moving the other way. As we are talking about racial segregation,  $p_i$  is the proportion of the total population that is African American (.12) which implies that  $E_i = .367$ . Exchanges between proportionally mixed and ghetto neighborhoods would lower H by  $(-4.937/.367) \times .01 = -.13$ . Exchanges between ghettos and isolated majority neighborhoods would reduce segregation even further:  $dH = (-5.889/.367) \times .01 = -.16$ . African Americans from proportionally mixed neighborhoods who exchange with nonblacks in isolated majority neighborhoods further reduce segregation (though not nearly as much as African Americans who move out of isolated minority neighborhoods)  $dH = (-.952/.367) \times .01 = -.03$ .

Three considerations suggest that very modest changes in H probably have substantive significance. First, a one-percent-point exchange refers to one percent of the total population; a group of African Americans equal to one percent of the total U.S. population is about 8.3 percent of the African American population. That is a very large population redistribution. The consequences of such a large population shift can be as great as .16 or as small as zero, depending on the concentration of African Americans at the source and at the destination. Second, moves from ghettos to isolated majority neighborhoods are probably pretty rare. Exchanges between more similar neighborhoods get less acceleration, and have less impact on overall segregation. Together, these two considerations suggest that observed changes in H as small as .02 or .03 represent substantively significant reductions in segregation. Third, while we are talking about a rather small fraction of moves that nonblacks make every year, we are

supposing that they make different choices than the typical black mover makes. About 20 percent of Americans move in a given year. We are supposing in these calculations that about 10 percent of the nonblacks who are moving choose to live in either a proportionally mixed neighborhood or a ghetto. We are also supposing that over 40 percent of the African Americans who move leave ghetto neighborhoods for proportionally mixed or isolated majority neighborhoods. In other words, the scenarios behind the forgoing calculations assume some atypical behaviors.

The other segregated groups we work with involve minority populations with shares of the total population that resemble the African American population's share. Those living below the poverty line are 12 to 14 percent in most years, the richest and poorest fifths are 20 percent by definition, children have been about 22 percent of the population in recent years, and seniors are about 8 percent of recent years' populations. So changes of H that range from .05 to .10 must be thought of as large shifts in the distribution of the population. Changes in H as small as .02 and .03 are probably changes worth discussing.

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Appendix Table 1  
 Values of the Exchange Accelerator for Exchanges Between Pairs of Neighborhoods,  
 By Neighborhood Types

| Minority originates in: | Minority moves to:   | Formula                      | Value  |
|-------------------------|----------------------|------------------------------|--------|
| Ghetto                  | Proportionally mixed | $\ln((.12/.88) / (.95/.05))$ | -4.937 |
| Ghetto                  | Isolated majority    | $\ln((.05/.95) / (.95/.05))$ | -5.889 |
| Proportionally mixed    | Isolated majority    | $\ln((.05/.95) / (.12/.88))$ | -.952  |

## 2. Data Sources, Definitions, and Matching Issues

Data for these analyses of segregation were drawn from summary files produced by the Bureau of the Census.<sup>4</sup> The requirements of our analyses demanded two things of the data. First, they required the existence of cell counts which were defined for a) common characteristics which captured the elements of ancestry, class, and life cycle, over b) the entire period from 1960 through 2000,<sup>5</sup> for c) equivalent universes of individuals or households. The second principal requirement was that these counts were available for units of geography and levels of geography that were consistent over the same period.

Each of these requirements appears simpler on the surface than in practice. Our first concern is with the availability and consistency of our measures. The most obvious way in which one of our measures will be inconsistent is if the cells of the table from which it was collected

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<sup>4</sup> In 1960, we used Census Tract-Level Data obtained from DUALabs, Inc. and redistributed by ICPSR. In 1970, tract-level data was drawn from the *Fourth Count A* tallies for sample data (for all states except New Jersey, which was generously provided to us by Anne Gray from the Princeton Population Lab). In 1980 and 1990 we used the Summary Tape File 3A data, provided on the internet by CIESIN. Finally, in 2000, we are using the SF1 counts for the data items which can be drawn from the short form, which have been supplemented with SF3 for items drawn from the long-form.

<sup>5</sup> Originally, we addressed a longer span of censuses by employing the Elizabeth Mullen Bogue files for 1940, 1950, and 1960. Use of these files permit, after creating a map between metropolitan area codes, the tracing of segregation levels for selected MAs much further back. Unfortunately, because the extent of tracting within an area changed substantially over time and the coverage of MAs was incomplete, the years prior to 1960 were unsuitable for the types of analyses we used. (In 1940, for example, only tracted cities are included, while in 1950, only 59 of the 114 tracted areas are represented in the files).

are chosen differently in different periods. Alternatively, the same cells may be collected, but the universe they are collected for may differ in some way. A third issue which can give rise to inconsistencies occurs when both the cells collected and the universe remain the same, but the underlying distribution changes in a way that the “same” cells now represent an analytically distinct group.

By and large, we selected measures for which the first problem either does not arise or can be handled by collapsing the data. In some cases, we wind up having to collapse into categories we might not prefer, but the final categories are consistent if not ideal. One notable exception to the generally good consistency of measurement over time is occupation. Occupational categories were extensively revised between 1970 and 1980 and, again, between 1990 and 2000. The Census Bureau undertook these revisions without concern for maintaining comparability and with minimal consultation with data users. The result is three non-commensurable coding schemes that are useless for the analysis of trends in occupational composition or segregation. Thus, despite the centrality of occupation to social class, we had to drop it from our analyses.

The second case arises for marital status variables. In both cases, the universe in earlier periods includes persons at younger ages than those in later periods. The exclusion of 14 year olds from the numerator and denominator for whom marital status is determined in later years would increase the percent never-married, but more-or-less universally across all areas. Hence, segregation measures which are not affected by prevalence (like entropy or dissimilarity) should not be unduly affected by this problem. Similarly, the inclusion of 14- and 15-year-olds in earlier employment universes will decrease employment rates, but should affect only

interaction/isolation indices for segregation comparisons. (We chose to focus on income and homeownership as measures of class in preference to labor force measures at this time).

The final issue may arise for items like income or educational attainment. Clinging to specific dollar ranges for income measures may ignore or misstate the effects of inflation and will miss the effects of across-the-board increases in income which place similar dollar amounts at different locations in the income distribution over time.

Educational attainment, while collected in categories which can be made fairly consistent by collapsing more detailed categories, will similarly reflect a changing distribution over the period. For income, we chose to emphasize distributional issues, and examined the 20% at the top and bottom of the distribution, while for education we focused on the specific credentials. (Because of the difficulty in separating age and education effects, trends in educational segregation are not included in this paper.)

The second broad requirement of our analyses is that we have geographical distinctions – regions, metro areas, central cities, suburban places, and tracts – that are comparable over time. The tract issues are possibly the most complex and are discussed separately in Appendix 4; inconsistencies in the availability of detailed place names required us to estimate counts for some small places, and we document in Appendix 3. Here we discuss only the decisions we made regarding definitions of comparable geographic units and the attribution of geographic identifiers.

Metropolitan areas are intended – according to the Census Bureau – to be composed of a “core area containing a large population nucleus, together with adjacent communities that have a high degree of economic and social integration with that core.” Metropolitan areas (as their first

incarnations as SMAs) were first defined for the 1950 census. The number of MAs grew from 169 in that year to 331 in 2000. During the same period, the proportion of the U.S. population that lived in such areas rose from 56% to 80%.

By and large, as Appendix Table 2 illustrates, growth in the percent of population covered is drawn from the creation of new areas rather than population growth in the previously defined areas. For each of the contemporary definitions of metropolitan areas for 1950 through 1980, population shares in the year of definition and 1998 are virtually identical. Furthermore, if we look at those areas prior to their definition as an MA, are population shares greatly lower.

| Percent of US Population Living in: | 1960        | 1970        | 1980        | 1990        | 1998        |
|-------------------------------------|-------------|-------------|-------------|-------------|-------------|
| MAs as defined in 1950              | 59.3        | 60.1        | 56.9        | 56.2        | 54.9        |
| MAs as defined in 1960              | <b>63.0</b> | 64.4        | 62.1        | 62.4        | 61.6        |
| MAs as defined in 1970              | 66.7        | <b>68.6</b> | 66.9        | 67.5        | 67.1        |
| MAs as defined in 1980              | 73.2        | 75.6        | <b>74.8</b> | 75.9        | 76.0        |
| MAs as defined in 1990              | 74.3        | 76.8        | 76.2        | <b>77.5</b> | 77.7        |
| MAs as defined in 1999              | 76.3        | 78.7        | 78.4        | 79.8        | <b>80.1</b> |

*Source:* Statistical Abstract of the United States, 2000. Population counts based on the territory bounded by each decennial census years' defined metropolitan boundaries; these counts divorce territory changes from shifts of population to or from metropolitan areas. This source does not list the percent of the population living in 1950 MAs, but Bogue (1959) indicates that that the figure is 56.8%, virtually the same as for those areas in 1998.

Table 2 suggest that changes in segregation of the metropolitan population may reflect not only changes in the population in particular areas, but also differences between established MAs and newly defined MAs. The entries indicate the estimates based on contemporary boundaries – the ones we used in our statistical analysis. All definitions show the strong trend toward concentration of more and more of the nation' population in metropolitan areas; they only differ in the precise estimates of the magnitude of that trend. As discussed in the text, we

examined the robustness of our results with respect to the differences by age of metropolitan area.

In addition to newly created MAs, existing MAs may add population either through the addition of population within previously defined boundaries, or through the incorporation of new counties or areas into the MA. (For example, the Atlanta MA grew from 3 counties in 1950, to 5 in 1960, to 15 counties in 1980, to 18 in 1990, to 20 counties in 2000). We chose to regard the contemporary boundaries of metropolitan areas as definitive of the analytically appropriate boundaries: we are examining the segregation of persons, not of territory.

### *Measures*

*Ancestry.* We explore three measures – race, Hispanic origin, and nativity – of segregation based on ancestry. For the period from 1960 through 2000, we use three mutually exclusive race categories: white, black, and other. We draw additional distinctions within and across racial categories by Hispanic origin for the period from 1970 through 2000. Finally, we take population counts for native- and foreign-born persons from 1960 on. Idiosyncrasies in measures for selected years are discussed below.

In 1960, the three base race categories were directly reported. We formed the same three categories for 1980 and 1990 by simply collapsing more detailed categories.<sup>6</sup> In 1970, a substantial proportion of race counts were suppressed at the tract level; for those tracts, we

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<sup>6</sup> In 1980 they were collapsed from 17 reported categories, and in 1990 from 25 racial categories. The growth in new detail was principally driven by new distinctions among Asians and Pacific Islanders, although native Americans were also identified.

imputed counts by applying the proportional shares by race identified prior to the census-performed allocations and substitutions to the total population counts. In 2000, when the questionnaire permitted the identification of multiple races, we used the single race counts for calculations, and verified trends using racial identifications in “alone-or-in-combination.” The identification of Hispanic-origin persons in 1960, based on surname and parentage, was incomparable with the self-identification available in later years, and we excluded it from our analyses. The 1970 instrument offered multiple modes for identification of the Hispanic population – parentage, surname, self-identification, and mother tongue; we used the counts generated from the self-identification item on the 5% long-form questionnaire.

*Class.* We use two measures – family income and homeownership – as our indicators of segregation by class. (We also considered two additional measures of class – educational attainment and occupation – but set them aside, the former because its close correlation with age makes it difficult to separate from the effects of life cycle and the latter because the way that occupational categories are constituted changed substantially over the period.)

Income categories for our analyses are tabulated at a family level. For 1960, family income is provided in 13 categories; in 1970, 1980, 1990, and 2000, family income is reported, respectively, in 15 categories, 17 categories, 25 categories, and 16 categories. In order to provide a more consistent measure over time of counts of the well-off and the poor, we estimated the dollar figure which establish the 20th and 80th percentiles of family income for families in each year’s sample, assuming an even distribution of families within each income category. This linear interpolation which we used to estimate the top and bottom quintiles we also applied at the tract level to apportion families to one of the three income strata formed. (Thus, for example, a

set proportion of counts for a category which straddles the 20th percentile would be allocated to the bottom 20th percentile, and the remainder allocated to the middle 60%). In each year, the primary distinction between housing units which are owned, regardless of mortgage status, and those which are rented, with or without cash rent, is the basis for our measure of homeownership.

*Life Cycle.* We captured life cycle effects by counts of population according to age and marital status. Individual cell counts, reported in categories ranging from single years to 10 year age groups, were collapsed into counts of those 14 years and younger, 18 to 29 years old, and 65 years or older (as well as the complementary groups, e.g., persons 15 years and older, or those 64 years and younger). We identified marital status for men and women aged 14 and older before 1980, and for those 15 and older after that point. The categories reported varied over time, with presence or absence of the spouse detailed for married couples in 1970 and 1990, but were collapsed into the comparable groups of single, married (not separated), separated, widowed, and divorced for analysis.

### *3. Statistical Estimation of Small Place Segregation in 1960*

The analyses in this paper draw on decennial census data from 1960 to 2000. From 1970 through 2000, the census linked tracts to the places in which they were located when those places had populations of at least 2,500. But in 1960, the census identified places for tracts only when the places were 25,000 or larger in population. As a result, the percent of individuals in our metropolitan universe who live in identifiable places jumps from 69% in 1960 to 79% in 1970. Since we are seeking to apportion segregation between different geographic levels over the period since 1960, this place identification change presents two problems. First, segregation can only be apportioned to place to the extent that places are identifiable in our data. Thus, the

smaller proportion of places uniquely defined in 1960 artificially decreases segregation apportioned to place (versus tracts within places) in 1960 compared to the other decades. Second, the data from 1970 onwards indicate that most of the between-place segregation occurs in places with fewer than 25,000 persons. Thus we fail to pick up on an important source of place-level segregation in 1960 that is observed in the other decades.

For these reasons, we implement a procedure to estimate place-level segregation in 1960 so that it is consistent with the other decades. The time trend in the proportion of between-place segregation attributable to small places (those with a population of less than 2,500) is stable or approximately linear for the characteristics we analyze. As a result, we can estimate the proportion of segregation attributable to small places for 1960 using the trends derived from the years in which more detailed place identifiers were available. The dependent measure we use is the *difference* between the proportion of segregation attributable to all places with a population of 2,500 or more and that attributable only to large places with a population of 25,000 or more. Observed values are then fitted using a linear time trend and dummies for size of the metropolitan area, and extrapolated to 1960.

The purpose of the metropolitan area size dummies is to increase accuracy. Three groups are defined by metropolitan area population size: over 4 million persons, 1 to 4 million, and less than 1 million. The rationale for this is that metropolitan areas of different sizes tend to have consistent differences in the apportionment of segregation by geographical level. Thus,

performing the procedure in three separate groups and then recombining those results increases the overall accuracy.<sup>7</sup> The entire procedure is recapitulated in symbolic form below.

Indices:

- $i$  = 1,2. Index of place definition. (1: places of >2,500, 2: places of >25,000)  
 $j$  = 1,2,3. Index of group by population of metropolitan area. (1: metro areas of >4 million, 2: metro areas between 1 and 4 million, 3: metro areas of <1 million)  
 $k$  = 1960, 1970, 1980, 1990, 2000. Index of decade.

Known:

- $H_{jk}^{T+P}$  = Total segregation due to tract and place for group  $j$  in decade  $k$  (for all  $k$ ).  
 $P_{ijk}$  = Proportion of  $H_{jk}^{T+P}$  due to place, with place definition  $i$  for group  $j$  in decade  $k$  (for  $k \neq 1960$  when  $i = 1$ ; for all  $k$  when  $i = 2$ ).  
 $D_{jk}$  =  $P_{1jk} - P_{2jk}$  (for  $k \neq 1960$ ).

Estimates:

- $\hat{D}_{j,1960}$  = Estimate from OLS regression line of model  $D_{jk} = b_0 + kb_1$ .  
 $\hat{P}_{1,j,1960} = \hat{D}_{j,1960} + P_{2,j,1960}$ .  
 $\hat{H}_{1,j,1960}^P = H_{1,j,1960}^{T+P} \times \hat{P}_{1,j,1960}$ .  
 $\hat{H}_{1,1960}^P$  = Population-weighted average of  $\hat{H}_{1,1,1960}^P, \hat{H}_{1,2,1960}^P, \hat{H}_{1,3,1960}^P$   
 $\hat{H}_{1,1960}^T = H_{1,1960}^{T+P} - \hat{H}_{1,1960}^P$ .

#### 4. Handling Changes in Tracts

For 1960, tract data are available from 172 Metropolitan Areas (MAs), but only 133 were completely tracted. Nonetheless, tracted populations in that year include 92% of the total

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<sup>7</sup> This procedure assumes that there is no major discontinuity from 1960 to 1970 in the trend of segregation in small places versus large places.

population of MAs and about 59% of the national population. For the remaining years, coverage of metropolitan areas is complete, but there is incomplete coverage outside metropolitan areas.

Tracts are intended to represent roughly equal chunks of the population – with somewhere between 2,500 and 8,000 inhabitants – which make them a suitable unit for identifying a “neighborhood,” and the historical coverage of the tracted population permits reasonable estimates of changes in neighborhood characteristics for metropolitan areas since 1960. However, maintaining consistent geographical size conflicts with maintaining roughly comparable population sizes. As population and density increase, the census alters tract boundaries. The principal alteration is splitting existing tracts into multiple tracts, although sometimes the census merges tracts or forms new ones by a complex mix of splitting and merging. Depending on their needs, researchers interested in segregation have either chosen to hold historic boundaries constant and re-combine separated tracts for later years, or alternatively, to keep tracts at a roughly constant population size, using more finely divided geographies over time.

Following the logic of the decisions we made about metropolitan boundaries, we use tract boundaries as they were contemporaneously defined. These boundaries more appropriately define a local neighborhood than do out-of-date physical boundaries when there has been much growth. However, by using the tract equivalency files for 1970-1980, 1980-1990, and 1990-2000, we also examined trends in levels of segregation using constant boundaries.<sup>8</sup> Those

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<sup>8</sup> Areas not tracted in previous censuses were treated as residuals of the metro-state-county unit. Areas previously tracted were assigned the tract identification number from the prior census in which most of its population resided. We assigned earlier tract identifications by chaining these year-to-year equivalencies. We used

analyses suggest that our findings are robust to changes in the definition of our tract neighborhoods.

The decomposition of segregation across geographic levels also requires that smaller geographies “nest” within larger geographies. However, while tracts nest within counties and metropolitan areas, they can be split by place boundaries. Use of split tracts rather than full tracts will result in higher estimates of segregation, since the base geographic unit will be finer. To maintain consistency with the full-tract data available in 1960 and 1970, and to retain more comparable tract sizes and definitions, we aggregated split-tracts counts to the full-tract level, and attributed the tract-counts to the place, if any, which contained the largest proportion of the total population of that full tract.

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the tract equivalency files provided by ICPSR: Census of Population and Housing, 1980 (United States): 1970-Pre-1980 Tract Relationships (ICPSR 7913); *idem.*, 1990: Tiger / Census Tract Comparability File (ICPSR 9810); *idem.*, Census Tract Relationship Files (CTRF) (ICPSR 13287).