RACE, ETHNICITY, AND INCOME SEGREGATION
IN LOS ANGELES

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ABSTRACT

There is a disagreement amongst scholars about how much income differences play in generating residential segregation. While most social scientists point to individual prejudices and institutional racism, others counter that segregation is a byproduct of systematic economic differences. For example, some minority groups are poorer and are thus disproportionately concentrated in low-income neighborhood. This paper examines 1) the demographic and socio-economic transformation of Los Angeles from 1960 and onward 2) the role of race and ethnicity in the spatial geographic housing patterns, with a specific focus on levels of segregation, and 3) whether racial segregation could be explained by systematic differences in income across racial/ethnic groups. The findings indicate that although black-white segregation has been decreasing steadily, segregation remains high while increasing amongst Hispanics. From comparing these observed dissimilarity indices and census tract majority groups with simulated numbers based on income, this study also finds that income differences alone do not explain residential segregation and that many other factors (including race) come into play.

INTRODUCTION

One of the most visible features of the urban landscape is residential segregation. We recognize residential segregation in common vernacular of neighborhood types: ghettos, barrios and enclaves, and assign to each demographic attributes, such as black ghettos, Latino barrios, and Asian enclaves. Additionally, we also assign socioeconomic attributes (e.g. rich, middle class and poor) and social order/disorder (e.g. safe, chaotic, and dangerous). Segregation is not surprising since the social distance among race/ethnic groups are considerably greater than the social distances among other demographic groupings. Segregation is historically and socially constructed, reinforced by culture differences and anchored in economics disparities. Race is shaped strongly by ascriptive exclusionary factors external to the group, and ethnicity is bound by internal commonalities (Yang, 2000). Moreover, audit studies find that home buyers and those seeking rental units are treated differently along racial and ethnic lines (Turner et al., 2013).

Race and ethnicity overlap, with some ethnic groups becoming racialized and some racial groups manufacturing a social-cultural identity. An example of a racialized ethnic group is Mexicans, who are further ascribed to a Hispanic or Latino ethnic category. An example of an ethnicized racial group is African Americans, which over time produce what some consider as a unique black culture. A useful concept for this analysis is the term "ethnorace" or "ethnoracial," a hybrid typology that includes America's four major demographic groups (non-Hispanic whites, blacks, Asians, and Hispanics), and the residual population ("others") (Lee & Zhou, 2015).

The categories used in the analysis have limitations because of internal heterogeneity and overlapping subpopulations. For example, Asians are comprised of dozens of nationalities with distinct languages, culture and history. Many individuals are both Hispanic and black. Despite these problematic aspects, the typology has theoretical and analytical power because they capture critical societal divisions and outcomes. Membership in one of these groups strongly influences one's opportunities, life experiences, and socioeconomic status (Oliver & Shapiro, 1995; Omi & Winant, 2014). The grouping also captures interpersonal interactions, social psychological perceptions and prejudices, and collective behavior and action (Espiritu, 1992).

Other factors contribute to segregation. While most social scientists points to individual prejudices and institutional racism, others counter that segregation is a byproduct of systematic income differences. Blacks and Latinos are poorer than non-Hispanic whites (whites), and thus are more concentrated in low-income neighborhoods.[1]

Previous research shows that income differences explain a small proportion of ethnoracial residential segregation. To the best of our knowledge, there is no existing study on the impact of income inequality on residential segregation in Los Angeles, which differs from other metropolitan areas in its demographic trajectory. This paper has three purposes: 1) to examine

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[1] A more fundamental problem with this explanation is that it does not acknowledge that income disparities are partially socially constructed along ethnoracial lines. This critical-race framing of not accepting observed income as given is conceptually correct, but there is another problem with the segregation-cum-income explanation.

the demographic and socio-economic transformation of Los Angeles from 1960 and onward; 2) to analyze the role of race and ethnicity in spatial geographic housing patterns with a specific focus on levels of segregation; and 3) to examine whether racial segregation could be explained by systematic differences in income across racial/ethnic groups.

The organization of this paper is as follows. First, we examine the existing literature on residential segregation on the basis of race and socioeconomic status. In Section 2, we present our analyses, including our data sets utilized, findings, and implications. Our findings indicate that it is insufficient to rely on income and adjusted income to capture observed residential segregation patterns. Income differences explain only a small part of what we observed as racial/ethnic segregation, with a number of other factors coming into play. Ignoring these patterns would limit the ability to understand how neighborhood change can have a systematic differential impact on residents, and the ability to address fair-housing requirements.

LITERATURE REVIEW

Scholars have developed several theories about residential segregation. Many use locational attainment, positing that individual characteristics impact or help predict where people live (Logan et al., 1996). Within this category, there are race-based and class-based theories that link either characteristic to housing patterns. While these theories are discussed independently, some of these theories overlap depending on what ethnoracial group is examined. However, there is debate about which has a greater effect on inequalities, particularly in concentrated poverty areas.

Much of the existing literature on residential segregation posits that U.S. metropolitan areas are highly segregated by race (Farley et al., 1978; Farley & Frey, 1994; Massey & Denton, 1988). For example, Massey and Denton (1988) found that blacks were highly segregated from whites, regardless of their socioeconomic status; more than 60 percent of blacks on average would have to move to another tract to lead to even white-black residential distribution.

These race-based theories on residential segregation are often described in three major theories: racial preference, place-stratification model, and racial proxy. These studies focus on the enduring effects of ethnoracial identity as the primary reason for segregation and disparities in access to neighborhood resources.

Racial preference studies have examined a number of geographies and ethnoracial groups. Schelling's (1971) seminal work modeled how individual discriminatory behavior can lead to unstable neighborhood dynamics that leads to the equilibrium condition of all-white and all-black segregation. Schelling (1971) also described a neighborhood "tipping point," in which white residents decide to move out of a neighborhood because there is a recognizable new minority that enters the neighborhood.

Similarly, Farley et al. (1978) noted that whites in Detroit were resistant to minimal levels of integration—25% said 1 black neighbor would make them uncomfortable and 40% would try to

leave the neighborhood if their neighborhood became one-third black. Similarly, Clark (1991) used telephone surveys and tracked residential moving patterns in Los Angeles and found that whites preferred to live in neighborhoods with at least 70% white, Latinos preferred living in areas with either high or low concentrations of Latinos, Blacks preferred neighborhoods with 50% whites and 50% blacks, and Asians preferred neighborhoods with 50% whites and 50% Asians. This pattern also applies to smaller populations. For example, Zhou (1992) measured Chinese segregation in New York City and noted that Chinese lived in enclaves, regardless of socioeconomic status.

While racial preference studies focus on individual household choices, the place-stratification model argues that minorities are residentially sorted based on the group's relative position in society. Massey and Denton (1993) claim that whites self-segregate to maintain their social distance from blacks and preserve the status of whites and white neighborhoods. Charles (2003) argues that there are structural forces that use discrimination to preserve the status of whites. She found that whites lived in more affluent neighborhoods than other racial groups, even after controlling for socioeconomic status. Additionally, Alba and Logan (1993) focused on determinants to racial group proximity to white neighborhoods. They found that Asians and Latinos in more affluent areas lived closer to whites; on the other hand, black distance to whites remained the same, regardless of socioeconomic status.

Residential segregation is in large part caused by historic government policies that sanctioned segregation and racial discrimination. The National Housing Act of 1934 established the Federal Housing Administration (FHA). While promoting homeownership, the FHA also created criteria that tied mortgage insurance risk to the racial composition of neighborhoods, or redlining (Immergluck, 2004).[2] Even though the Fair Housing Act of 1968 outlawed housing discrimination, Turner et al. (2013) found that minority homeowners, particularly those readily identifiable through name or speech, were shown fewer homes and apartments than whites. Also, as minorities become homeowners, Schwartz (2010) described how homes in minority neighborhoods appreciate less than homes in white neighborhoods.

The third theory, racial proxy, focuses on race-based stereotypes that are tied to social class. For example, other racial groups presume that blacks are of lower socioeconomic status, which contribute to their aversion of having black neighbors (Charles, 2003). In Charles's (2006) survey of ethnoracial groups, she noted that Asian and Latino immigrants perceived blacks to be economically disadvantaged. However, Charles (2006) did not find these assumptions to be as prevalent among native-born Latinos and Asians. Also, Ellen (2000) described how whites did not mind living with racial minorities as long as these groups comprised a relatively small and fixed percentage. However, white homeowners with children who attended public schools who were more likely to move in response to a growth in the black population because of their concern that school quality is tied to neighborhood racial composition.

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[2] Areas with a higher concentration of minorities were marked in red zones to indicate they were riskier neighborhoods, which justified financial institutions' decisions to not provide home loans to minority households. While the FHA did not create redlining, it nevertheless perpetuated standard real estate practices at the time (Schwartz, 2010).

While these three theories describe individual prejudices and institutional racism, other studies counter that segregation is a byproduct of systematic income differences. Wilson's (1987) seminal work asserts that over time, with deindustrialization and middle-class black suburbanization, class rather than class has become more important in understanding segregation patterns. Jargowsky (1997) built upon his work and argued that ghettos and barrios formed and evolved because of broader metropolitan economic conditions and market dynamics. For example, metropolitan differences in mean income accounted for 72% differences in ghetto poverty between 1980 and 1990 (Jargowsky, 1997, p. 162).

Class-based arguments commonly use spatial assimilation theory. This theory assumes that immigrants who live longer in their host society will increase their economic resources and eventually move out of enclaves into neighborhoods with greater social capital and higher socioeconomic status (Massey & Denton, 1985). Thus, households with a similar socioeconomic level should be able to live in the same neighborhoods with similar educational attainment, income, schools, and other public goods. Spatial assimilation also assumes that households will move to white suburbs because of the improved resources typically found in these neighborhoods (Alba et al., 1999).

Massey and Denton (1988) found that racial segregation decreased between immigrant and native-born Latinos and Asians. Also, Alba and Logan (1993) found that Asians and Latinos with a higher percentage of homeownership, greater household income, and more educational attainment lived in neighborhoods with more whites. In a more recent study, Charles (2003) similarly found that socioeconomic gains translated to higher housing quality and mobility into whiter neighborhoods for some Latinos and Asians.

Understanding class-based theories are important because income disparity in the Los Angeles metropolitan area has grown, driven by an expanding lower bottom. Studies have documented these trends before the turn of the century (Ong, et al., 1989; Bobo, et al., 2000), and more recently with data from the U.S. Bureau of the Census. These economic disparities also have a spatial dimension, in that income segregation has also increased over time—there is a decline in the number of households living in middle-income neighborhoods, with a corresponding increase in the number in poorer and richer neighborhoods. In 1980, 44% of households lived in middle-income neighborhoods, but by 2012 only 36% of households lived in such neighborhoods. The share of households living in poor neighborhoods increased from 17% in 1980 to 19% in 2012. Likewise, the proportion of households in affluent neighborhoods rose from 15% to 19% over the same period. This trend has been consistent over time, with household income segregation growing every decade from 1980 to 2012 (Center for the Study of Inequality, 2015).

Income segregation often interacts with racial segregation, but the extent of this interaction is still in debate. Analyzing the relative contribution of income disparity to residential segregation can provide insights to guide housing policy and housing choices. The Fair Housing Act of 1968 had two goals: (1) to end housing discrimination, and (2) to promote diverse, inclusive

communities. More recently, the Affirmatively Furthering Fair Housing (AFFH) Rule set "a framework for local governments, states, and public housing agencies to take meaningful actions to overcome historic patterns of segregation, promote fair housing choice, and foster inclusive communities that are free from discrimination" (HUD, 2013). In 2015, the Department of Housing and Urban Development (HUD) announced a new policy aimed at promoting fair housing: "HUD will provide open data to grantees and the public on patterns of integration and segregation, racially and ethnically concentrated areas of poverty, disproportionate housing needs, and disparities in access to opportunity" (HUD, 2013). Implementing this policy requires an empirical analysis to assess the existing patterns of residential segregation and the contributing factors.[3] By examining the contributions of income equality, we are better able to identify the causes of segregation and create effective housing policies.

Identifying these patterns is important because housing and residential patterns are tied to socioeconomic status and mobility. Neighborhoods may or may not offer public goods (e.g., schools, libraries, parks, public safety, public infrastructure), which can serve as resources or negatively affect the well-being of its residents (Sampson, 2012). The following study thus explores the role of income segregation, specifically in Los Angeles County.

ANALYSES

Data

To understand the patterns and trends in ethnoracial segregation in Los Angeles, we conduct analyses using the following data sets. The data for this analysis are drawn from both published and micro samples from the 1970, 1980, 1990 and 2000 decennial census, and from the 2010-2014 American Community Survey (ACS), here on after we refer to as 2014 estimates. From 1970 to 2000, the Bureau of the Census conducted a "long-form" survey at the same time as the decennial enumerations, and the survey collected detailed housing, demographic and socioeconomic data. The decennial survey was discontinued after 2000, and it has been replaced by the ACS, a continuous survey that collects similar housing, demographic and socioeconomic information. The project utilizes tract-level and associated public-use micro-level (PUMS) data of the decennial surveys and ACS. Depending on the year, the size of the sample ranges from 1% to 5% of all households and individuals in Los Angeles County, more than sufficient to conduct the analysis.

*LA Demographic and Socioeconomic History*

As America's modern immigration gateway, Los Angeles has experienced significant changes in its ethnic and racial composition over the last five decades, with many neighborhoods undergoing sweeping transformations. Since 1960, the county's white population has fallen by about three-fourths (81% to 27%) while the black population has remained relatively stable (8%). The Asian population has rapidly grown from 2% to 14% and the rapidly growing Hispanic

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[3] To see an example of how this can be done, see the state of California's Department of Housing and Community Development (HCD) report "Analysis of Impediments to Fair Housing" (2012)

population has expanded, comprising nearly half of the county's total population (increasing from 11% to 48%) and even surpassing the percentage of the whites after 1990 (see Figure 1).

Figure 1. Distribution by Ethnorace
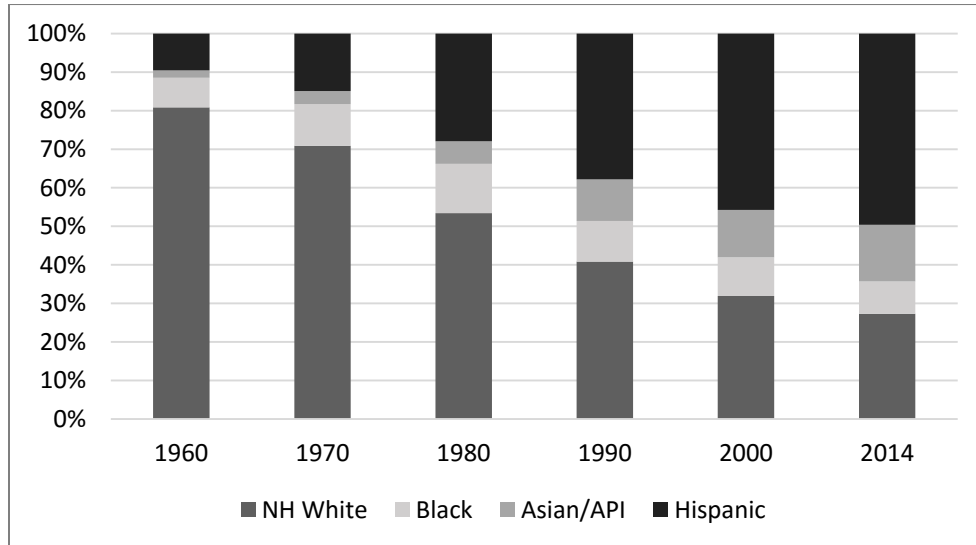
Source: 1960-2000 Decennial Censuses, 2014 ACS

A major reason for this demographic shift is due to the influx of immigrants to Los Angeles County. In the 1970s, about 89 percent of the population was native-born while only 11 percent were foreign-born (see Figure 2). By about 1980, immigrants comprised about a quarter of the population (22% foreign born) and now comprise about 35% of the population in LA county. Along with this increase in the foreign-born population has been an increase in California-born natives, who now comprise about half of the population in Los Angeles County today. This, along with the slight decline in foreign born population from 2000 to 2014 and the decline in non-California born natives (from 49% in 1970 to 15% today), suggests that the current population trend in Los Angeles County is being driven by a growth in native-born Angelenos/Californians. Nonetheless, the immigrant population still makes up a high percentage in Los Angeles County.

Figure 2. Distribution by Nativity
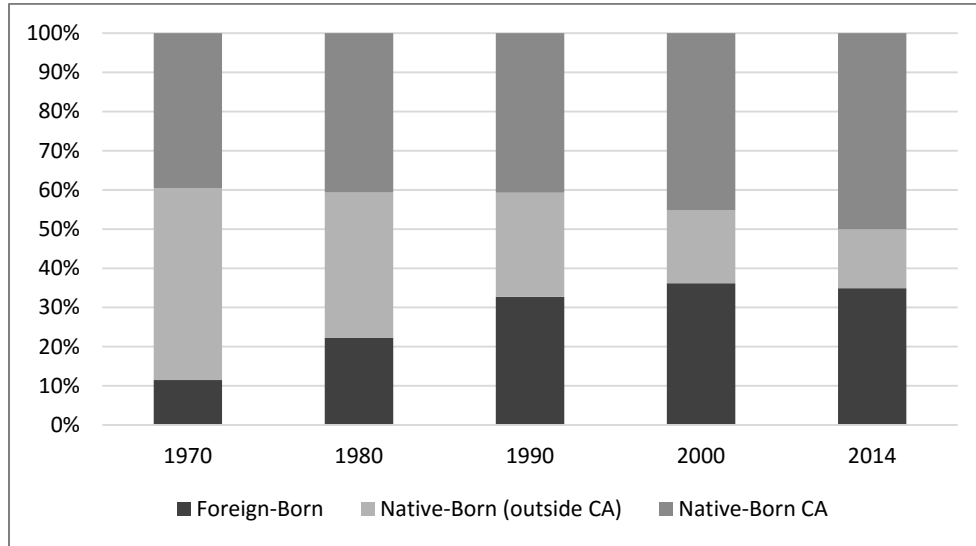
Source: 1960-2000 Decennial Censuses, 2014 ACS

The increase in foreign-born population since the 1960s has been more prevalent amongst the Asian and Hispanic communities in Los Angeles county – growing at a rate greater than the total foreign-born population. By the 1960s, 35% of the Asian population in Los Angeles County were immigrants while 19% of Hispanics were foreign born. This can be attributed in large part to job prospects from WWII that brought about the migration of many Mexicans. By the 1980s, these figures nearly doubled as Asians were 62% foreign-born and Hispanics 45% foreign-born. The 1965 Immigration and Nationality Act brought about an influx of Asian immigrant workers, and the 1980s brought about many Southeast Asian refugees escaping political persecution and war-torn countries to the United States, including in Los Angeles County. Even today, these figures remain at 67% and 41%, respectively. The percentages for foreign-born population for whites and blacks also increased from 1960, although at a much slower pace compared to Asians and Hispanics. In the 1960s, only 2% of non-Hispanic whites were foreign-born, today 18% are foreign-born. In the 1960s, only 1% of Blacks were foreign-born; today 7% are foreign-born. We see this trend in Figure 3, where from 1960 to today we see a large increase in the foreign-born population being driven by Asians and Hispanics. In 1960, non-Hispanic whites made up about a three quarters of the foreign born population (76%), but by 1980 Hispanics became the majority group (at 56%) and still are today. We also see an increase in Asians from 2% to 27% of the foreign-born group.

Figure 3. Ethnoracial Composition of Foreign-Born Population
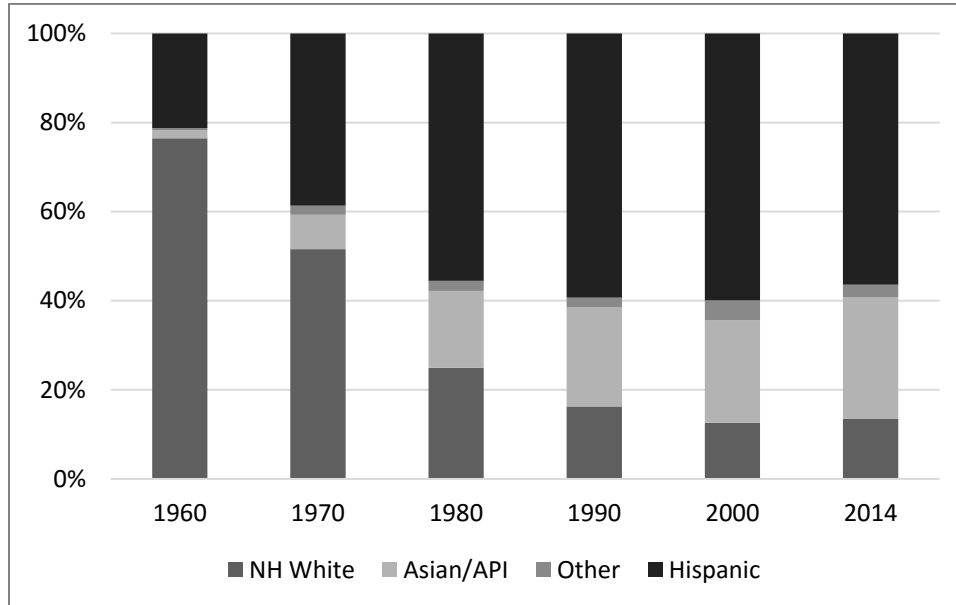
Source: 1960-2000 Decennial Censuses, 2014 ACS

Along with the shifts in demographics have been shifts in the income trends in LA County from the 1970s onward. Amongst all groups in LA County, there is an increase in incomes from 1980 to 1990, and then a decrease from 1990 onward (Figure 4). This decrease from 1990 onward can be due to the economic restraints from the collapse of the aerospace industry after the end of the cold war (Ong and Lawrence, 1995), exacerbated years later by the Great Recession. Furthermore, there has also been a growth in income inequality in both the United States and Los Angeles County. Studies use the Gini Index as a measurement of income distribution for a given population. Ranging from 0 to 1, a Gini Index with 0 indicates perfect equality and 1 represents perfect inequality. In Los Angeles county, the Gini Index grew steadily from 0.409 in 1970 for all households to 0.496 in 2000, although only slightly decreasing in 2012 to 0.493 (Ong et. al, 2014). This growth in Gini Index over the decades indicates a growing gap between the rich and poor in Los Angeles. Implications include the ethnoracial stratifications we see in Figure 4.

Figure 4 provides income statistics for the four major ethnoracial groups from 1970 to 2014, adjusted to 2014 dollars. Throughout these years, we see a consistent stratification amongst different ethnoracial groups in median household income, with the gaps widening between ethnoracial group (except between Hispanics and blacks). Except for in 1980 when the median household income for Asians is slightly higher ($65,722), whites have the highest median income throughout the years in LA county. This number peaks at 1990 with about $75,254. Asians have the next highest income, although by 2014 their median incomes are about $8,000 less than whites. Hispanics have a median income ($45,128) even about $10,500 less than the total LA county population and $25,500 less than whites; even at its peak in 1990 its figures are

still similarly less. Blacks fall at the lowest stratification, with their median incomes in 1980 being $39,658 (about $25,000 less than whites) and remaining at $40,939 even today.

Figure 4. Median Household Income (2014 Dollars) in LA County, 1970-2014
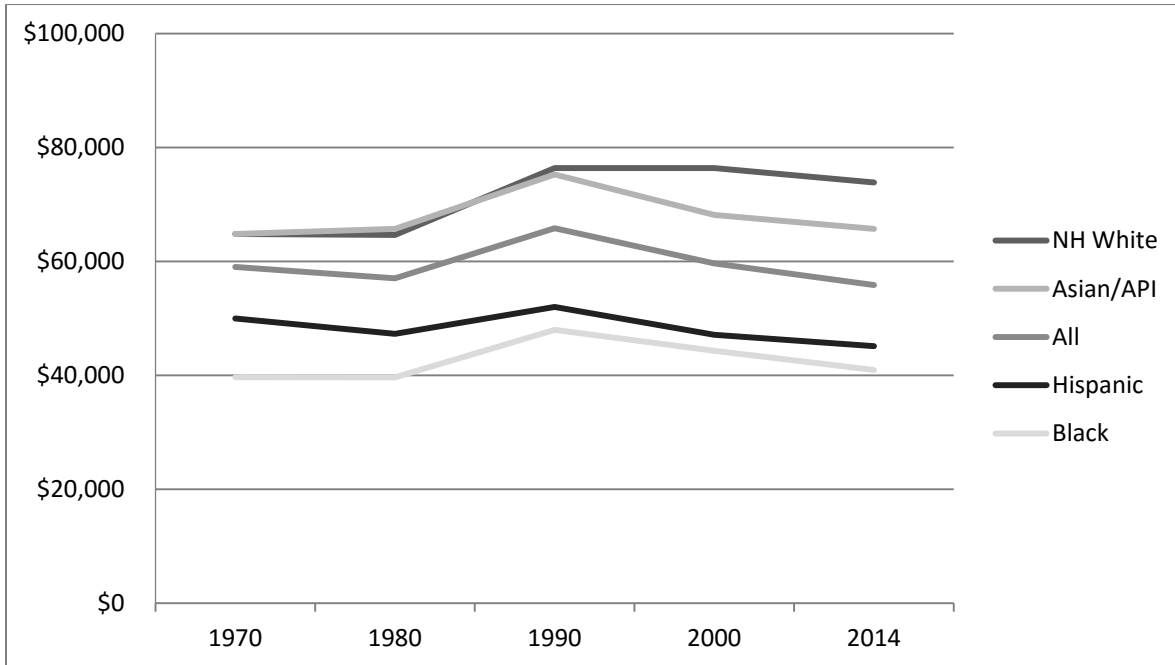
Source: 1970-2000 Decennial Censuses, 2014 ACS

This growth in economic inequality is further shown in Figure 5. Figure 5 shows the distribution by more detailed income categories from the 2014 ACS, by ethnic/racial groups as a parity of NH Whites. To calculate the parity index, we first use the following formula, were S is the % of an ethnoracial group "j" in income bracket "i."

$$ S_i^j = \frac{I_i^j}{\sum_{i=1}^{n} I_i^j} $$

The parity index of group "j" to group "k" in income bracket "i" is:

$$ P_i^{j,k} = \frac{S_i^j}{S_i^k} $$

What this parity index means is that for groups that have an index at 1, they are represented at proportions that are the same for NH Whites. Parity indices over 1 indicate that a group is disproportionately overrepresented in that income category relative to the proportion of NH Whites in that category, while less than 1 indicates underrepresentation. The distribution of

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Asian households by income categories is very similar to that for NH White, except at the two extremes, with Asians more likely to be among the very poor and less likely to be among the very affluent. Blacks are relatively more concentrated in the two bottom categories, with over twice as many Blacks than NH Whites in these categories. Additionally, less than half of Blacks compared to NH Whites have the top two highest income categories. Hispanics are relatively more concentrated in the brackets dominated by the working poor, having higher proportions than NH Whites in income categories less than $75,000. All groups (Blacks, Hispanics, and Asians) are overrepresented compared to NH Whites in income brackets below the median household income, which was $55,870 in 2014.

Figure 5. Parity Index of Household Income by Race/Ethnicity in LA County, 2010-2014
(Parity = NH White)
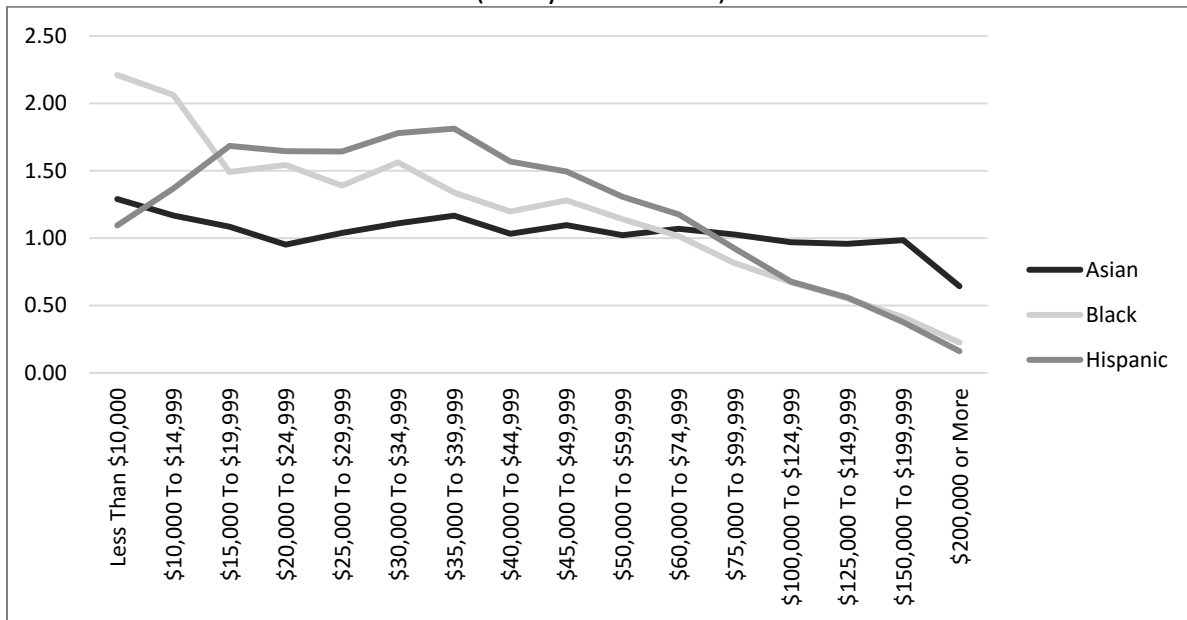
Source: 2010-14 ACS

Observed Ethnoracial Segregation

Along with the changes in demographics and income, there has been a change in the level of housing segregation. The widely used index of dissimilarity can be used to measure segregation between two groups in Los Angeles. This is the most common index in the segregation literature, which is calculated using the following formula:

$$DI = \frac{1}{2} \sum_{i=1}^{n} |\frac{P_{1i}}{P_1} - \frac{P_{2i}}{P_2}|$$

where P_1 = countywide population of Group 1
P_2 = countywide population of Group 2
P_{1i} = census tract i population of Group 1

The index ranges from 0.0 (complete integration) to 1.0 (complete segregation). One interpretation of the DI is the percent of a population that would have to move from areas where it is concentrated to less concentrated places in order to achieve full integration. For example, if the DI for blacks and whites is .50, then half of the blacks (or whites) would have to relocate to achieve integration.

Table 1 summarizes DI indices for each of the major ethnoracial group in the country from 1970 to 2014. The table shows that the black-white household segregation reached a high of 89.6 in 1970, and has been on the decline since then. From 1970 to 1990, the level of segregation, as measured by the DI score, declined well over five points in each consecutive decade up until 1990. This decline, however, has since slowed; with DI levels dropping below five points following 1990. Even with this decline, the county's current black-white DI score of over 66.0 is still considered extreme.

Between Hispanics and whites, the level of segregation has actually increased and has been increasing since the 1980s. The DI scores currently measures at around 60.0 and have remained relatively the same within the last decade. The gradual increase in the DI score for Hispanics beginning in the 1980s coincide with the group's growing population in the county during this time and the tendency to reside in their ethnic enclaves. Asians, on the other hand, are less segregated with whites among the major ethnoracial groups, with DI scores staying below or near 50.0 for the last forty decades.

Amongst minority groups, the level of segregation has decreased but still remains high today. Amongst Asians and blacks, the DI score has decreased from 76.5 in 1970 to 66.2 in 2014 (close to levels amongst black-white segregation). Amongst Asians and Hispanics, their DI dropped from 60 in 1970 to 46.7 in the next decade, but has slightly steadily increased to 53.0 in 2014. The quickest DI drop has occurred between blacks and Hispanics, with about 34 points dropping since 1970, although it still remains high at 53.5 today. One interesting thing to note is that amongst all groups, the lowest DI score is between Asians and whites.

Table 1. Household Dissimilarity Indices

	1970	1980	1990	2000	2014
Black–NHW	89.7	79.3	72.4	68.9	66.4
Hispanic–NHW	60.9	54.5	57.3	60.6	60.1
Asian–NHW	52.1	46.6	46.2	49.2	48.6
Asian–Black	76.5	74.0	68.6	68.4	66.2
Asian–Hispanic	60.0	46.7	47.0	53.2	53.0
Black–Hispanic	87.9	72.4	61.3	56.4	53.5

Source: 1970-2000 Decennial Censuses, 2010-14 ACS

Another method by which we look at residential segregation is through examining census tracts with ethnoracial majorities. Figure 6 below shows the percentages of ethnic/racial groups living in tracts with a majority (50 - 69%) and supermajority (70% or more) of their co-ethnics. In 1970, we see that 89% of whites lived in neighborhoods (tracts) with a supermajority of whites, but by 2014 this has at least declined to 37%. Similarly, in 1970, 69% of blacks lived in supermajority black neighborhoods, but has since decreased to 16%. Thus, over these years we have seen a decrease in segregation amongst blacks and whites.

For Asians and Hispanics, however, we see an increase in segregation. Only 1% of Asians lived in Asian majority neighborhoods in 1970; however, this figure has increased to about 20% by 2014. Similarly, Hispanics living in Hispanic majority neighborhoods has increased from 28% in 1970 to 59% in 2014 while the percentages for those living in supermajority tracts has more than doubled. These figures thus follow similar patterns shown in the observed DI scores, with the exception of Asians whose majority patterns may partially be driven by growth in population. Nonetheless, from these figures we see that whites still remain the most segregated (67% live in majority white neighborhoods).

Figure 6. Distribution of Ethnoracial Groups Living in Co-ethnoracial Majority Tracts
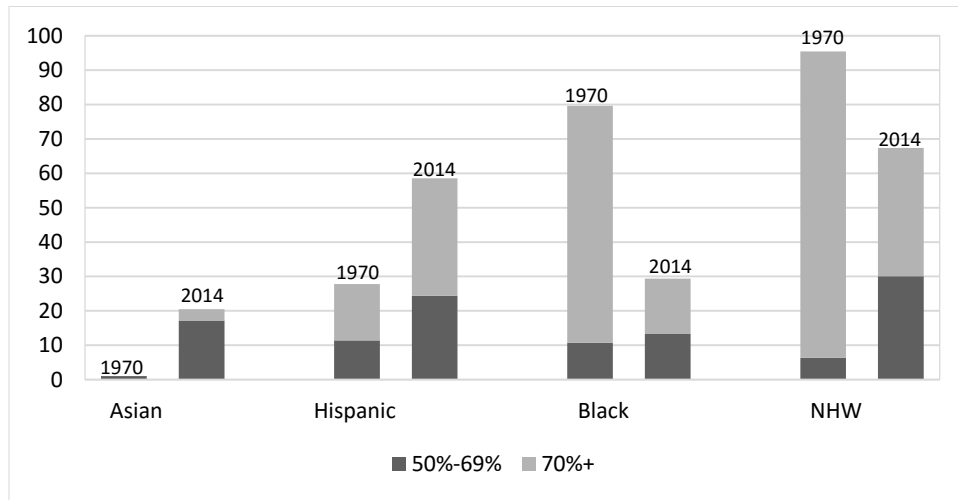
Source: 1970-2000 Decennial Censuses, 2010-14 ACS

Figure 7. Tracts with Ethnoracial Majorities in LA County, 1970
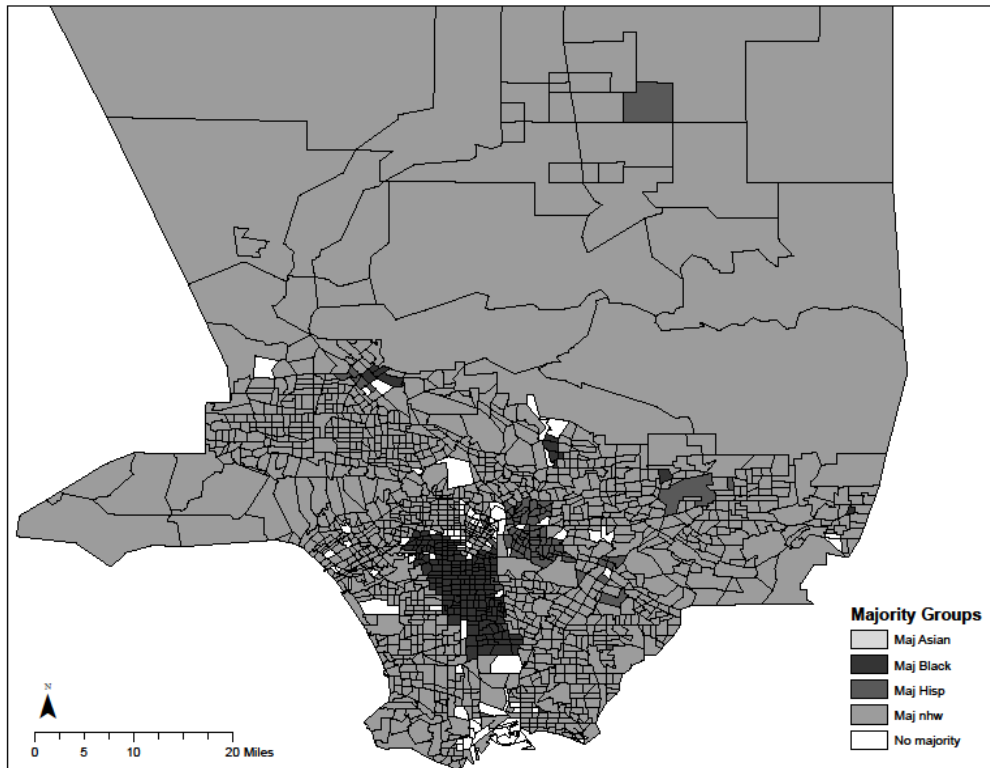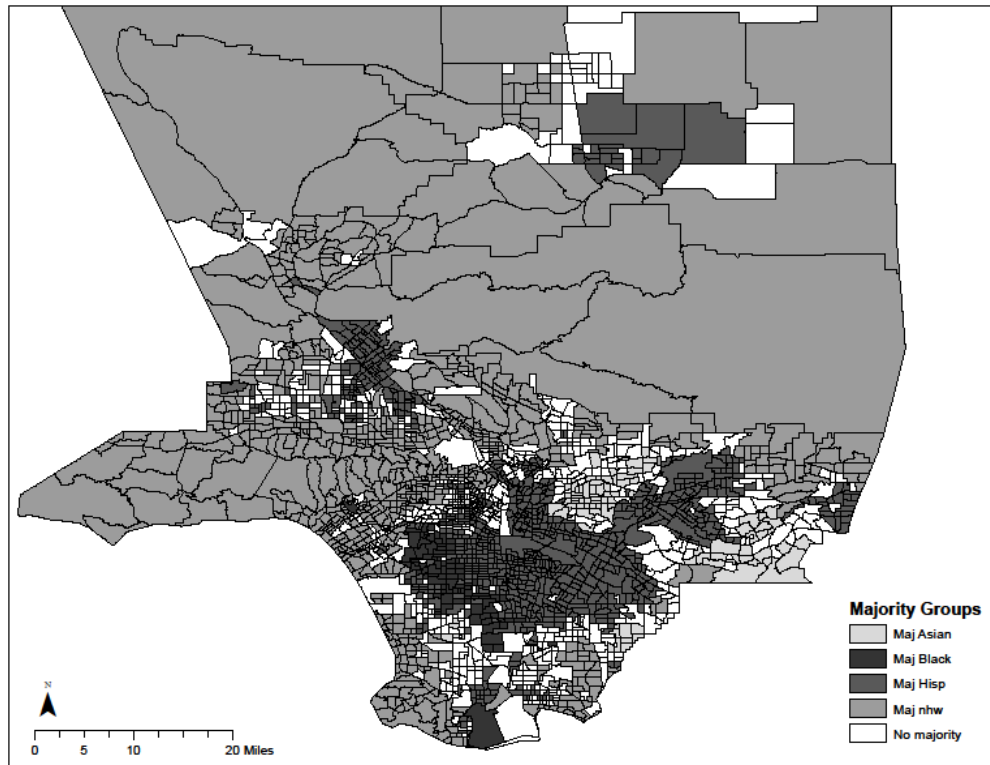

Figure 8. Tracts with Ethnoracial Majorities in LA County, 2014

We can see these trends visually in Figures 7 and 8. In these maps, only census tracts with majority (50%+) of one single racial/ethnic group are presented on the map. In 1970, we see a very high percentage (79%) of tracts being majority non-Hispanic white. 11% of tracts are majority black, 5% of tracts are majority Hispanic, and only 1 tract is majority Asian.

By 2014, the percentage of majority white tracts has decreased to 30% and percentage of majority black tracts has decreased to 4%. For Asians, the percentage has increased to about 5%. Majority Hispanic tracts have increased to 36%, even surpassing the amount of non-Hispanic white tracts. Although we see a decrease in the white-black segregation, nonetheless only about a quarter of tracts contain no single ethnic/racial majority.

Simulated Ethnoracial Segregation

To test whether income differences alone can explain ethnoracial residential segregation, this study performs two simulations, one of which is not reported because its results are similar to the first simulation. For each of the simulation, we calculate the DIs. The first simulation produces a hypothetical spatial distribution based on observed income. The following formula is used. $I_{i,,j}$ is the number of households in income category "i" in tract j for 1 to n income categories. P_i^k is group (ethnoracial). "k" is proportion of income category "i" for metropolitan area. The calculation is repeated for all tract from 1 to n and for all groups 1 to O.

$$\hat{P}_j^k = \sum_{i=1}^{m} I_{i,j} * P_i^k$$

Table 2 shows a step by step calculation using Asian households as an example for census tract A. We start off by looking at the ethnoracial composition at the metropolitan level by household income categories. For example, in 2014, NH white make up 31% of households with less than $10,000 in annual income, Asians comprise 15% of the households, Hispanics 33%, and Blacks 18%. NH whites are underrepresented in this bracket relative to their share of all households (31% of the income category and 37% of the county). Hispanics and blacks, however, are over-represented (33% versus 37% overall, and 18% versus 10%, respectively). For each tract, we use the county percentages for those with less than $10,000 to estimate a hypothetical ethnoracial distribution for that income bracket.

For example, tract A has 101 households in the LT $10,000 category. The observed household ethnoracial distribution in this income bracket is 4% NH White, 0% Black, 5% Hispanic, and 6% Asian. If the composition of the tract's income class reflected the composition of county's composition, then the hypothetical distribution would be approximately 31 NH White, 19 Black, 34 Hispanic, and 15 Asian.

Table 2. Hypothetical number of ethnoracial households in a tract based on income distribution

County	% NH White	% Black	% Hispanic	% Asian
Income Level				
Less Than $10,000	31%	18%	33%	15%
$10,000 To $14,999	29%	16%	39%	13%
$15,000 To $19,999	28%	11%	47%	12%
$20,000 To $24,999	29%	12%	47%	11%
$25,000 To $29,999	29%	11%	47%	12%
$30,000 To $34,999	27%	12%	48%	12%
$35,000 To $39,999	27%	10%	49%	12%
$40,000 To $44,999	30%	10%	46%	12%
$45,000 To $49,999	30%	10%	45%	13%
$50,000 To $59,999	33%	10%	42%	13%
$60,000 To $74,999	34%	9%	40%	14%
$75,000 To $99,999	39%	8%	35%	15%
$100,000 To $124,999	44%	8%	29%	16%
$125,000 To $149,999	47%	7%	26%	17%
$150,000 To $199,999	52%	6%	19%	20%
$200,000 or More	67%	4%	11%	16%
Census Tract A	*Total # HHs*	*County % Asian*	*Est. # of Asian HHs*	*Obs. # of Asian HHs*
Income Level				
Less Than $10,000	101	15%	15	60
$10,000 To $14,999	242	13%	32	102
$15,000 To $19,999	192	12%	23	75
$20,000 To $24,999	208	11%	22	90
$25,000 To $29,999	178	12%	21	91
$30,000 To $34,999	189	12%	22	53
$35,000 To $39,999	89	12%	11	46
$40,000 To $44,999	155	12%	18	64
$45,000 To $49,999	127	13%	16	88
$50,000 To $59,999	77	13%	10	12
$60,000 To $74,999	157	14%	22	91
$75,000 To $99,999	198	15%	30	92
$100,000 To $124,999	63	16%	10	63
$125,000 To $149,999	13	17%	2	0
$150,000 To $199,999	35	20%	7	20
$200,000 or More	7	16%	1	7

Source: 2010-14 ACS

The same set of calculations is done for each of the income categories for that tract to estimate the hypothetical ethnoracial distribution. The final step is summing up the estimated numbers for all income brackets for this tract, and the total is the hypothetical number of households by groups for the tract as a whole. The process is repeated for all tracts, resulting in a tract-level dataset of hypothetical spatial distribution by race/ethnicity for the whole region. We then calculate the hypothetical DI using the following formula.

$$\widehat{DI} = \frac{1}{2} \sum_{i=1}^{n} \left| \frac{\hat{P}_{1i}}{\hat{P}_1} - \frac{\hat{P}_{2i}}{\hat{P}_2} \right|$$

Where $\hat{P}_1$ = countywide population of Group 1
$\hat{P}_2$ = countywide population of Group 2
$\hat{P}_{1i}$ = census tract i population of Group 1
$\hat{P}_{2i}$ = census tract i population of Group 2
n = number of census tracts in the county

An argument that is often made is that people are segregated because of their income class. For example, blacks and Latinos are poor and therefore segregated from whites who generally have higher income. Two simulations, described earlier in the methodology section, are performed to test this hypothesis. Table 3 reports the DIs based on one of the simulations, income-based, as well as that based on the actual observed spatial patterns.

Table 3. Dissimilarity Indices, Observed & Simulation

	Black	Hispanic	Asian
1970			
Observed	89.7	60.9	52.1
Income-Based	9.2	6.6	1.2
1980			
Observed	79.3	54.5	46.6
Income-Based	8.9	7.3	1.1
1990			
Observed	72.4	57.3	46.2
Income-Based	9.3	8.9	1.5
2000			
Observed	68.3	63.1	50.0
Income-Based	10.1	9.9	3.3
2014			
Observed	66.4	60.1	48.6
Income-Based	10.6	10.2	2.7

Source: 1970-2000 Decennial Censuses, 2010-14 ACS
Note: Qualitatively, the adjusted income-based DIs are the same as the income-based DIs.

The simulated DIs indicates what the segregation level would be if people were to be distributed into tracts (neighborhoods) solely based on their income. One important fact is that the level of income dissimilarity is considerably lower than for residential segregation, suggesting that income differences would not totally explain residential segregation. We do see slight increases in income DI scores from 1970 to 2014, suggesting that the growth in income inequality over the decades has been contributing to a small growth in ethnoracial segregation. Nonetheless, using income to estimate the racial/ethnic distribution results in very low DI values, indicating that income differences explains only a small fraction of the observed

segregation. The gap between the observed and income-based DIs gives us a rough approximation of what the racial contribution is. These results are consistent across decades.

Using the second method by which we look at residential segregation, we examine the percentages of ethnic/racial groups living in tracts with a majority (50 - 69%) and supermajority (70% or more) of their co-ethnics, if the population was distributed by income. In 1970, we see that about 100% of whites lived in neighborhoods with a supermajority of whites, while for Asians, Blacks, and Latinos, 0% live in majority and supermajority neighborhoods. This can be explained by the population in 1970, when 71% of the population were non-Hispanic whites. However, these numbers stand distinctly for our observed percentages, whereby about 80% of blacks and 28% of Hispanics lived in tracts with at least 50% of their co-ethnics/racial.

The simulated results also indicate that in 2014, if the populations were distributed by income, none of the ethnoracial groups would be living in tracts with a majority of their co-ethnics (with the exception of about 2% of whites living in tracts with other white majorities). This distribution differs heavily from our previous observed values (shown in Figure 6), whereby about 20% of Asians, 29% of blacks, 59% of Hispanics, and 67% of whites live in neighborhoods with at least 50% of their co-ethnics/racial. The tremendous gap between the observed distribution and the income-based simulated distribution shows how income alone does not drive residential segregation and affirms that other factors are at play.

CONCLUSION

Over the last few decades, Los Angeles County has gone through tremendous demographic transformations, driven largely by Hispanic and Asian immigration. Along with these demographic changes have been changes in residential segregation. While black-white segregation has been declining steadily, albeit slowly, it still remains relatively high compared to other groups. Hispanic-white segregation falls second highest and has been increasing over the last few decades; while Asian-white segregation is lowest among the groups. Nonetheless, a high percent of Asians, and other groups, are spatially concentrated and isolated in segregated neighborhoods. Even today, about three-quarters of census tracts in Los Angeles County have an ethnic/racial majority. Non-Hispanic whites, however, remain the most segregated. While many scholars have argued that residential segregation is due to factors related to race and ethnicity, such as racial preference and institutional racism, some scholars have argued that residential segregation can be explained by differences in income. After simulating dissimilarity indices based on income, we find a large gap between what segregation should look like based on income and what it actually looks like in Los Angeles County. Income-based dissimilarity is considerably lower than for observed residential segregation, hence suggesting that income differences are only a small fraction in generating ethnoracial residential segregation and that segregation is largely driven by ethnic/racial differences.

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