Migration and Changes in Segregation between Hispanics, Blacks, and Whites in the United States

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Abstract

The spatial concentration of Hispanics and blacks in certain regions results in relatively high levels of interstate race and ethnic segregation in the U.S. Nonetheless, recent migration patterns suggest a change in the underlying pattern of regional segregation. The increases in the Hispanic population in nontraditional areas, particularly the South, combined with Black migration to the South raise questions about trends in spatial segregation. In this paper, we use migration data at the PUMA level from the 2005 American Community Survey to estimate the change in residential segregation implied by current migration patterns. We propose a new method for studying trends in segregation using migration data at a disaggregated level of geography, by race, nativity, and under varying assumptions about immigration. Results show that race/ethnic differences in migration patterns--not high levels of immigration per se or differences in migration patterns among foreign and native born Hispanics--are the cause of continued high levels of geographic segregation among Hispanics, blacks, and whites.

Introduction

Is geographic segregation increasing or decreasing in the United States? In the past twenty five years the rapid increase in the size of the Hispanic population has dramatically changed the overall race and ethnic composition of the population, suggesting that the United States is now—or soon will be—a truly "multiethnic" society. At the same time, however, existing levels of race and ethnic segregation—both at a regional and metropolitan level--suggest continuing fault lines that divide American society. Hispanics and blacks are spatially concentrated in certain states and regions in the United States: Hispanics tend to live in the West and Southwest, while blacks are overrepresented in the South.

Three recent trends suggest that it is important to consider changes in overall levels of geographic segregation in the U.S. First, while Hispanics have historically concentrated in a handful of states, since 1990 there has been a rapid increase in the Hispanic population in nontraditional states, particularly in the south (Fischer 2005). Singer (2004) documents the rise of "new immigrant gateways" in cities such as Raleigh, which experienced a 709% increase in its foreign born population between 1980 and 2000. Overall, six southern states, North Carolina, Arkansas, Georgia, Tennessee, South Carolina, and Alabama had the highest percent increases in their Hispanic population between 1990 and 2000, with an average increase of 308% (Kochar, Suro and Tafoya 2005). Clearly, this diffusion of Hispanics into other regions of the country suggests a decline in their spatial segregation with respect to other race and ethnic groups in the United States. At the same time, however, the widely cited statistics of large percent increases are misleading because the base population was so low to begin with. This raises the question of whether the migration of Hispanics to new regions has actually had a measurable impact on their segregation from whites and blacks.

Second, migration is also affecting the geographic distribution of blacks in the U.S. Reversing the direction of the "Great Migration" of blacks from the South to the North that began in the 1890s, there is now a net positive flow of black migrants back to the South (Fuguitt, Fulton and Beale 1999). While this is a significant change in migration patterns, it is unclear what affect this is having on national level measures of segregation, as the net flow of white migrants to the South is also large; hence it could be that there is no net effect on overall levels of segregation.

Third, evidence on neighborhood level segregation within metropolitan areas indicates that residential segregation between blacks and whites has been declining since the 1980s (Logan, Stults, and Farley 2004; Iceland, Weinberg, and Steinmetz 2002). The rate of decline has been modest—a 4.6% decline from 1980-1990 (Logan, Stults and Farley 2004)—but a significant reversal from the earlier trend towards increasing segregation from 1900-1980 (Massey and Denton 1993). At the metropolitan level, Hispanic immigration was associated with an increase in Hispanic-white segregation, and Hispanic-white segregation rose on average in the 1990s but was counterbalanced by a move by Hispanics to metropolitan areas with lower segregation (Logan, Stults and Farley 2004). However, measures of within-metropolitan segregation do not address the question of spatial segregation at larger levels of geography. As shown below, the level of state-level segregation between blacks and whites has been remarkably stable over the same time, raising questions about whether the metropolitan level data truly reflects a trend towards desegregating American society.

In this paper we attempt to answer these three questions about trends in geographic segregation by using data on race and ethnic differences in migration patterns from the 2005 American Community Survey (ACS). The 2005 round of the ACS is the first ACS that includes detailed geographic information on area of residence and migration at the PUMA (Public Use Micro Area) which roughly corresponds to a county in terms of size. Using the actual flow of internal migrants from 2004-2005 from this data, we show that unequal spatial patterns of migration between Hispanics, blacks, and whites are maintaining high levels of segregation between these three groups. We also show that there is no evidence of more rapid "spatial assimilation" among native-Hispanics, and that the location decisions of incoming immigrants--rather than subsequent internal migration of Hispanics is--reducing the level of spatial segregation between whites and Hispanics.

Literature review: Migration Patterns and Spatial Segregation

Spatial Assimilation

One way to think about residential segregation among immigrant groups is to consider what has been called "spatial assimilation theory" (Massey 1986). This theory extends the notion of assimilation to include neighborhood location as an additional dimension indicating the degree of adaptation to American society. Upward economic mobility and social and cultural adaptation, according to the theory, would lead to greater geographic integration with the non-immigrant population. For a review and critique of the normative nature of this theory, see Ellis and Goodwin-White (2006).

Frey and Liaw (2005) provide a good review of the literature on spatial assimilation as well as a useful descriptive analysis of interstate domestic migration by race and ethnicity. In their multivariate analysis, they test a "cultural constraints" hypothesis, where the presence of co-ethnic peers is assumed to affect migration patterns due to the need for support as well network distributed information about opportunities. They argue that overall there is evidence of spatial assimilation as the effect of coethnic population density on migration choices declines among higher education Asians, Hispanics, and Blacks. While this may be true, it is unclear from their statistical models what the net impact of interstate migration is on overall segregation levels, if any.

Ellis and Goodwin-White (2006) use PUMS data from the 2000 Census to estimate the probability of interstate migration by generation since immigration and find that the 1.5 generation immigrants are less likely to migrate when they are living in states with high immigrant populations. In contrast to Frey and Liaw (2005) they conclude that regional persistence among 2nd and 3rd generation immigrants is likely. This is an important finding. At the same time, however, their analysis is limited because they only model the probability of migrating, not the destination location of the migrants. As such, we cannot evaluate the overall impact of migration patterns on population redistribution and inter-group segregation.

Ellis and Wright (2005) use March CPS data to calculate state-level segregation measures by generation since immigration. Because the March CPS includes the birthplace of the respondent's parent, this data allows for coding of first, second, and third generation immigrants. In contrast to Ellis and Goodwin-White (2006), these results indicate that segregation declines as generation since immigration increases.

As evidence of the use of PUMA level data on local measures of segregation, Clark and Patel (2004) use 2000 PUMS data to study the residential concentration of recent immigrants to Los Angeles. They find that the spatial patterns of residential location at the PUMA level are more complex than in the past, at least in the Los Angeles metropolitan area, suggesting mixed evidence with respect to the spatial assimilation hypothesis. Also see Allen and Turner (1996).

South, Crowder, and Chavez (2005) use longitudinal data on residential mobility from the Panel Study of Income Dynamics (PSID) to test the spatial assimilation hypothesis. Although they find evidence of spatial assimilation, particularly among Mexican immigrants, they show that the results are contingent upon the ethnic composition of the local urban area. Spatial assimilation is much more rapid in cities where non-Hispanic whites comprise a larger percentage of the population.

Migration Patterns

There is a large literature on the modeling of migration data. For our purposes in this paper, we are interested in the statistical modeling of differences in migration patterns and in projecting population redistribution as the result of migration. Rogers (2007) discusses the trends in this literature of the past several decades. A popular model in the literature in geography is the "gravity model" which analyzes the migration flow between two regions as a function of distance (for an example, see Pellegrini and Fotheringham (2002). While this approach demonstrates the spatial nature of migration data, we seek to understand group differences in migration rates, not model the spatial dependence of the flow itself.

Another way to study migration patterns is illustrated in Tarver and Gurley (1965) who use a Markov model to project the population redistribution due to migration. In a similar approach, Raymer, Bonaguidi and Valenti (2004) use a cohort-component method to project migration and the age distribution of the population across regions in Italy. Plane and Mulligan (1997) use the Gini index to calculate the degree of "spatial focusing" among the in- and out-flow of migrants to states. Note that this approach essentially looks at segregation among states in the pattern of internal migration.

Herting, Grusky, and Van Rompaey (1997) and Lin and Xie (1998) are a recent example of using loglinear models to study the interregional or interstate pattern of migration. Similarly, Rogers (2002) analyzes differences in the interregional pattern of migration across different age groups using a loglinear model. Lin (1999) departs from the conventional Markov approach by using a loglinear model to analyze the change in the age and region pattern of migration over time using a loglinear approach. Plane and Rogerson (1986) also study change in the migration matrix. See also Rogers (1999), Chi and Voss (2005), Fan (2005), and Bijak (2006).

Klaff (1977) comes closest to the approach we use in this paper. She uses information on migration patterns by ethnicity in Israel to project the eventual population under the assumption of a fixed migration matrix. Under the assumption of a stationary Markov-chain process, the equilibrium distribution of the population depends only on the migration rates, not the initial population distribution. She then calculates the resulting level of ethnic segregation. While this is, as described below, very similar to the approach we take in this paper, Lin (1999) and Plane and Rogerson (1986) argue that the assumption of a stationary migration matrix is misleading, as migration patterns are likely to be changing over time.

Data

The data for this paper comes from the 2005 American Community Survey (ACS). The ACS is an annual survey of the U.S. population, which replaced the long form of the census as the source of Public Use Micro Sample data (PUMS). Starting in 2005, the ACS was expanded to comprise a 1% sample of the U.S., and the Census Bureau began releasing detailed geographic location at the Public Use Micro Area (PUMA) level. PUMAs are geographic areas of at least 100,000 people that correspond roughly to counties in size. The PUMAs used in the 2005 ACS are the PUMAs from the 2000 Census. There are 2,071 PUMAs in the data.

The migration data in the ACS refers to respondents who moved in the past year. For those who moved residences, there is data on where they moved from. The “migration PUMA” (MPUMA) refers to the PUMA where the respondent lived last year. In counties with multiple PUMAs, such as Los Angeles County, which had 19 PUMAs, the PUMAs are collapsed together to form migration PUMAs. Hence, in urban areas MPUMAs represent metropolitan counties and are larger than PUMAs. In rural areas where several counties may be combined to form a PUMA, there is no difference between the two units. As a result of the aggregation of within-county urban PUMAs, there are a total of 1,024 MPUMAs in the 2005 ACS data.

How much information about race and ethnic segregation is lost by moving from PUMAs to migration PUMAs? Table 1 shows the value for the index of dissimilarity (D) for blacks, whites, and Hispanics calculated at the PUMA, MPUMA, and State level for the 2005 ACS data. As the geographic size of the units increase, D will decline as sub-units with unequal populations distributions are merged together. For example, a MPUMA that combines two PUMAs that are completely segregated—one all Hispanic and one all white—will appear to be more integrated only because the level of geographic detail is coarser. What is striking about Table 1 is that there is only a small reduction in D as we move to the migration PUMAs. Hispanic-white segregation declines by 4 points, from 58.1 to 54.2, while black-white segregation declines by 10 points, from 57.6 to 47.8. This is in sharp contrast to the level of black-white segregation calculated at the state level, 27.6. A comparison of Hispanic-white and black-white segregation levels indicates that both groups appear to be equally segregated at the PUMA level, but that much of the imbalance between Hispanics and whites exists at the state level, as the state level D is 44.3, compared to 27.6 for blacks and whites.

As discussed above, most research on segregation in the United States focuses on neighborhood—i.e., tract-level—segregation within urban areas. Typically, these studies assess the overall, national level of segregation by averaging the indices of segregation across cities. This omits the role that differences in demographic composition across cities plays in the overall level of race/ethnic imbalance at the national level. Certainly, metropolitan measures of segregation are important and reflect the role that race and ethnicity play in local social interaction. However, the results for Table 1 indicate the level of segregation across county-level geographic units—the MPUMAs—is similar in size to the average level of segregation reported in metropolitan areas. Logan, Stults, and Farley (2004) report an average index of dissimilarity of 65.1 for blacks and 51.6 for Hispanics using tract level data from the 2000 census. As discussed above, this average measure does not take segregation across metropolitan areas—or non-metropolitan areas—into account. The level of segregation reported across PUMAs in the ACS data suggests that this level of segregation—across rather than within counties/PUMAs—is of the same order of magnitude as the average level of metropolitan segregation. Although some of the segregation between blacks and whites in the MPUMAs represents segregation across counties within urban areas (i.e., among the 5 counties that make up the Los Angeles metropolitan area) most of this is due to broader geographic patterns of distribution by race throughout the United States.

For the purposes of this paper, however, we suggest that it is reasonable to consider the level of segregation measured at the MPUMA level of geography, which enables us to make use of the migration data in the ACS.

Maps 1-2 show the geographic distribution of Hispanics and black in the United States. Maps 1 and 1b shows the proportion Hispanic and black by county group in 1980 using the 1980 PUMS data, and Maps 2 and 2b repeat this for 2005 using the 2005 ACS data and the MPUMAs as the unit of geography. Two things are evident from these maps. First, as noted above, there are clear spatial patterns evident in these maps. As a result, measures of segregation that only look at average within-metropolitan levels will miss the degree of segregation across states, regions, and counties in the U.S. In addition, aspatial measures of segregation will miss the clear evidence of clustering evident in the maps. The regional clustering evident in Maps 1-2 is quite different from a hypothetical "checkerboard" pattern of segregation, with alternating pockets of white and black or Hispanic areas.

A second observation that is evident in comparing Maps 1 and 2 is the spatial diffusion of the Hispanic population. There appears to be a general increase in the proportion Hispanic throughout large portions of the map, as well as a pronounced increase in states in the Southeast. This population movement has affected the exposure of whites and blacks in these regions of the country to Hispanics (see the results below), and has increased the number of PUMAs with at least modest numbers of Hispanics (i.e., 1%). At the same time, however, the increase in the size of Hispanic populations in traditional areas of settlement in California and the Southwest continues to go up. As a result, the question we pursue here in this paper is whether this pattern of internal migration to new regions is likely to have an appreciable effect on overall measures of race/ethnic segregation.

Methods

Measures of Segregation

We use both spatial and aspatial measures of segregation in this paper. The index of dissimilarity (D) has a convenient interpretation as the percentage of the population (of one the groups) that would have to move in order to result in integration:

(1) $$D = 100 * .5 * \sum_j \left| p_{aj} - p_{bj} \right| ,$$

where $p_{ij} = \frac{pop_{ij}}{\sum_j pop_{ij}}$ for $i = a, b$ and j indicates the geographic unit. In this notation, p_{ij} represents to proportion of the total population of group i that resides in geographic area j.

The exposure index is the average proportion of group *a* for members of group b.

(2) $$E_{ab} = \sum_j \left(\frac{pop_{aj}}{pop_{aj} + pop_{bj}} \right) p_{bj}$$

In this sense, it represents the average "exposure" of members of group b to members of group a.

As depicted in Maps 1-2, the distribution of Hispanics and blacks in the U.S., as percentage of the local population, has clear spatial pattern. Measures of segregation that fail to take these broader patterns into account, such as D and E as defined above, will underestimate the overall level of segregation. Reardon and Matthews (2004) provide a useful discussion of calculating spatial segregation measures, as well as a critical evaluation of the relative merits of different measures that have been proposed. The key concept of a spatial measure of segregation is that the measure of the population distribution should reflect not just the local unit (i.e. tract, PUMA, or State), but the units nearby it. One way to do this is to calculate local averages of the population distribution using spatial weights that give more weight to nearby geographic units than to distant units. In this paper we use a spatially weighted index of dissimilarity.

First, define a weight function W, a declining function of distance between the two units. Here we use the inverse distance, but other weighting schemes are possible.[1]

(4) $$W(a,b) = F(\text{distance between a and b}) = 1/\text{distance}_{\text{ab}}$$

Next, define the spatially weighted population average of group i in geographic unit k as

(5) $$s\_pop_{ik} = \sum_j pop_{ij} * W(k,j) \text{ for all groups i=(a,b)}$$

A spatial index of dissimilarity can be defined by using the spatially weighted population measures with the formula for the aspatial D defined above. I.e.,

(6) $$\tilde{D} = 100 * .5 * \sum_j \left| \tilde{p}_{aj} - \tilde{p}_{bj} \right| ,$$

where $\tilde{p}_{ij} = \frac{s\_pop_{ij}}{\sum_j s\_pop_{ij}}$ for $i = a,b$ and j indicates the geographic unit. By calculating the spatial average of each population, weighting nearby neighborhoods or PUMAs more than distant ones, local

[1] In the next version of the paper, we will more formally review the literature on spatial measures of segregation. See, for instance, the papers by Waldorf (1993), Lee (2001), and Wong.

segregation matters less than segregation across larger distances in $\tilde{D}$, as the difference across contiguous tracts or PUMAs is blurred by the use of spatial weights. The advantage is that $\tilde{D}$ will be sensitive to broader patterns of segregation operating across regions as depicted in Maps 1-4.[2]

Migration Data and Population Redistribution

The migration data from the 2005 ACS can be represented as a matrix, M, where the rows represent the MPUMA of origin, and the columns represent the destination MPUMA. International migrants can be represented as a distinct row, but the absence of data for those who emigrated between 2004-5 means that the migration matrix cannot account for the outflow of individuals. Because there are 1,024 MPUMAs in the data, M represents a 1,025 by 1,024 matrix. If P_t represents the vector of population counts in each MPUMA (including the number of incoming migrants) at time t in the ACS data, then the population distribution can be projected forward as a stationary Markov process:

(7) $$P_{i,t+n} = P_{i,t}\left(M_i\right)^n,$$

where n is the number of years you wish to project forward and the subscript i indicates the population totals and migration matrix for group i.

In this paper, we will project the population distribution forward 20 years from 2005 to 2025 based on the inter-PUMA migration data in the 2005 ACS. It is important to note that the goal of this paper is not to actually calculate population projections by race and ethnicity, which would involve a number of other assumptions about future trends in fertility, mortality, and changes in migration rates, but to depict the trends in intergroup segregation implied by current migration patterns. As shown above in Table 1, state-level segregation between blacks, whites, and Hispanics has been remarkably

[2] Reardon and Matthews (2004) propose a spatial segregation measure using the entropy index that involves smoothing the population data. We will make use of this measure in the next version of this paper.

stable from 1980-2005. The question we pose in this paper is what the PUMA-level migration rates suggest about current trends in interregional segregation. The time frame is chosen to be comparable to the 1980-2005 data shown in Table 1, in order to indicate whether a decline in segregation due to differential migration is substantively meaningful. Nonetheless, the projected trends should be thought of as a derivative—i.e. a measure of current change—rather than a true population projection (much as, perhaps, the TFR is a measure of fertility at current rates for all age groups rather than a prediction of fertility for any single cohort).

Results

Interregional Migration Patterns

For purposes of historical comparison, Table 2 shows trends in $\tilde{D}$, D, and E at the state level from 1980-2005 using PUMS and ACS data. We also calculated these measures at the county-group (for 1980) and PUMA levels of geography, but the changing number of geographic units (PUMA definitions are not the same as counties, and changed from 1990 to 2000) raises questions of comparability. The key observations from Table 2 are that segregation of Hispanics to whites and blacks declined 5 points from 1980-2005, at the state level, while black-white segregation remained constant, but at a much lower level. Comparison of the results in Table 1 to Table 2 indicates that the greater level of geographic detail at the PUMA level picks up much of the black-white segregation that is not visible at the state level. The rise in the exposure of Hispanics to other groups, mirroring the increase in the Hispanic population as a whole, is clearly evident between 1980 and 2005.

Table 3 shows the race/ethnic composition of census regions in the 2005 ACS (see Appendix A for a list of states in Census regions). Although this is not a detailed measure of geography, clear regional differences exist among the percentage of the population by race and ethnicity. Table 4 shows the proportion of each region that changed residences between 2004-5, and Table 5 shows the number of cases for movers, by region and race. Overall, 15.9% of the population moved in the past year. This includes both local moves (i.e. within the same PUMA or state) as well as interstate moves.

There are 8 census regions, so an 8 x 8 matrix would depict migration flows for each race and ethnic group. Even with this level of geographic aggregation, however, presenting descriptive data on migration matrices is difficult because of the sheer amount of information that they contain. As an example of what the migration data looks like, Table 6 shows group differences in interregional migration from the Pacific region in 2004-5. Inspection of Table 6 raises some interesting questions. Given the prominence of recent Hispanic migration to the Southeast, Table 6 suggests that the percentage of individuals who left the Pacific region and moved to the South Atlantic region is the same for whites and Hispanics (16%), and much higher for blacks (29%). Hispanics are more likely than whites to move from the Pacific to the West South Central (which includes Texas).

Are the actual patterns of interregional migration different among whites, blacks, and Hispanics? Table 7 presents loglinear models of race/ethnic differences in migration patterns. Table 7 tests the loglinear model that includes all two-way interactions between origin, destination, and ethnicity,

(8) $\log m_{ijk} = \alpha + \alpha_i \times group_k + \alpha_j \times group_k + \alpha_{ij}$ for all i, j, and k.

versus the saturated model that includes the three-way interaction between origin, destination, and ethnicity ($\alpha_{ij} \times group_k$). In Equation 8, m_{ijk} is the number of individuals of group k migrating from i to j. After controlling for the number of individuals in each origin and destination location, the α_{ij} terms measure the relative size of the migration rate between any two geographic locations i and j.

Testing the fit of the model in Equation 8 versus the saturated model tests whether or not the migration matrix between origin i and destination j is the same for each ethnic group. It is useful to consider what this means in the context of white-Hispanic migration. The test of Equation 8 is not a test of whether the destinations of white and Hispanic migrants are the same, but whether pattern of movement is the same, i.e., the destinations conditional on the origins. Given the unequal regional distribution of whites and Hispanics, differences in migration destinations could be due to proximity to different regions rather than an inherent difference in the mobility pattern; if this was the case, we should not attribute segregation among migration destinations to migration itself, but to the preexisting spatial imbalance itself.

Model 1 of Table 7 tests the difference of migration rates among all groups simultaneously, and Models 2 and 3 test for Hispanic-white and black-white differences respectively. The results in Table 7 show that we can reject the hypothesis that the pattern of migration is the same among each of these three groups at the regional level. Given evidence of group differences in migration patterns at the regional level, it is likely that differences would be even larger at the State or PUMA level, given the higher level of residential segregation at more detailed levels of geography.[3]

Nonetheless, while Table 7 establishes the existence of race and ethnic differences in migration flows, it is unclear what impact this has on segregation levels. It is possible, for instance, that whites and Hispanics are moving to different areas, but that these areas simply reproduce the existing level of segregation. Alternatively, rapid desegregation would imply the movement of whites to Hispanic areas and vice versa, which would look like a group difference in migration patterns. In this sense, statistically significant differences in migration patterns would be good rather than bad for desegregation efforts. As a result, in order to see how differences in migration rates affect segregation we need to calculate segregation measures before and after the redistribution of the population due to internal migration.

As described above in the Methods section, we use the ACS migration data to project the population distribution into the future and calculate the resulting segregation measures. In doing so, we hold the current migration pattern constant. As discussed above, this would be a simplistic

[3] The next version of this paper will also formally test for differences of migration patterns at the state and PUMA level.

assumption if we really wanted to make future population projections. It does, however, allow us to observe the trends in segregation inherent in the current inter-PUMA migration flows.

We calculate segregation trends based on six different scenarios: three different migration matrices each under two migration possibilities. The first migration matrix ("actual" in Graphs 1-4) is the current migration probabilities for each race/ethnic group. Hence, in Equation 7 there are three different migration matrices, one for each group. Next, we wish to test the "spatial assimilation" hypothesis, which argues that immigrants assimilate geographically to the residential patterns of whites. The second migration matrix "US Born" is the migration matrix only for those respondents who were born in the U.S. The initial population, $P_{i,t}$ in Equation 7, still includes all respondents, foreign and native born, but now they migrate according to the pattern of native-born respondents. If the spatial assimilation hypothesis is true, then we would expect greater declines in geographic segregation between Hispanics and other groups using this mobility matrix than with the actual mobility matrix, which includes immigrants. Finally, the third matrix equalizes the migration rates for each group by taking the average probabilities of migrating from each area i to j, ignoring race and ethnicity. The degree to which inter-PUMA segregation is maintained by race and ethnic differences in migration patterns will be indicated by the difference between the results with the actual migration matrix and this matrix with equal probabilities of migration between i and j for each group.

Each of these different migration matrices was projected under two different immigration assumptions. First, we project the population distribution with no international immigration. In this case, changes in segregation are the product only of patterns of internal migration. Second, we hold both the level of immigration, and the geographic destination of immigrants constant as observed in the 2005 ACS data. Assumptions about immigration don't affect the levels of white-black segregation much, but it is useful to consider both of these scenarios because of the large level of Hispanic immigration and its potential effect on population distribution.[4] If the destination locations of Hispanic immigrants are generating segregation between Hispanics and other groups, then we would expect to see more rapid declines in segregation in projections based on internal migration with no immigration.

Graphs 1-4 show the results of projecting the population using the Markov chain projection assumption depicted in Equation 7. For each projection, we calculate the three measures of segregation discussed above: the aspatial and spatial indices of dissimilarity, D and $\tilde{D}$ and the exposure index, E. Given these three migration matrices and two immigration conditions, we project six different scenarios, one for each combination.

Hispanic-white segregation

Graph 1 shows the trends in Hispanic-white segregation (D and $\tilde{D}$) implied by current migration patterns. There are three surprising results depicted in this graph. First, given the actual pattern of internal migration, scenario 1 ("actual matrix, no immigration") shows very slow levels of decline in spatial and aspatial D over the next twenty years. This means that despite the large percentage increases in Hispanics in certain areas of the country such as the South since 1990, and the diffusion of Hispanic immigrants to many areas of the country with previously low levels of Hispanics, the overall pattern of unequal distribution between whites and Hispanics has not changed much—and the 2005 ACS migration data suggests that it is changing very slowly. Second, based on the results of the projection, we reject the "spatial assimilation" hypothesis, at least at the level of MPUMAs. Projecting the spatial distribution of the population twenty years into the future using only

[4] In calculating the number of immigrants, we take all respondents who reported that they were living in a foreign country a year ago. We then delete all respondents from this group who were born in the United States. As a result, we are ignoring the effect of returning citizens. This is reasonable given that we have no data on emigrants from the U.S.

the migration patterns of native-born respondents (Scenario 2) results in segregation levels that are no smaller than segregation levels in Scenario 1 (in fact, they are a little larger) suggesting that native born Hispanics are not "assimilating" towards the migration patterns or destinations of non-Hispanic whites any faster than foreign born Hispanics.

The third surprising result from Graph 1 is that immigration actually reduces the level of Hispanic-white segregation. This is evident for all three migration matrices and can be seen by comparing the upper row of trends, which has no immigration, with the lower row, which is the same matrix but incorporates the current level and destination probabilities as the 2005 ACS data. Because the index of dissimilarity is composition invariant it is not affected by an increase in the size of one of the populations, provided the geographic distribution of the population doesn't change. I.e., doubling the size of the white or Hispanic population in each MPUMA will not affect D. Hence, the decline in segregation between scenario 1 ("actual migration matrix, no immigration") and 4 ("actual migration matrix, with immigration") has to be due to the migration destinations of current immigrants. Below we discuss descriptive evidence on the mobility patterns of immigrants.

Finally, Scenarios 3 and 6 use the equalized migration matrices for whites and Hispanics. In both these scenarios, segregation declines substantially over a twenty year period. Compared to the results in Scenarios 1-4 this shows that the destination choices of white and Hispanic movers are not race/ethnic neutral and that the difference in migration patterns is the driving force behind the continued persistence of geographic segregation.

Black-white and black-Hispanic segregation

Graph 2 shows projected trends in black-white segregation based on current internal migration patterns. As expected, assumptions about immigration and nativity have little effect on changes in segregation. The key finding in Graph 2 is that MPUMA level segregation between whites and blacks is not declining.

Graph 3 shows trends in black-Hispanic segregation. Current migration patterns suggest a virtual stagnation in geographic segregation between blacks and Hispanics. This is surprising given the increase in Hispanics in the South, which is, as indicated in Maps 2 and 4, the area of greatest black geographic concentration.

Projected exposure levels

Graph 4 shows changes in exposure levels, E, based on 2005 migration patterns. The "exposure" of whites to Hispanics, i.e., the average % Hispanic in areas that whites live, will go up under all six scenarios. The assumptions about immigration have the biggest effect on exposure levels, which is not surprising given the results in Graph 1 and the fact that continuing existing immigration rates into the future will increase the overall size of the Hispanic population in the U.S. Hispanic-black exposure is higher than that of whites, but it declines based on current migration patterns in the absence of continued immigration flows.

Table 8 provides additional descriptive analyses of current migration patterns in order to explain the results in Graphs 1-4. Although the index of dissimilarity (D) has been criticized in the methodological literature on segregation (and in subsequent versions of this paper we will supplement it with alternative measures), it retains a degree of transparency that is useful for descriptive purposes. For example, if we are studying the segregation of group A from B, the movement of individuals between geographic units will decrease D only if individuals move from units with % A greater than average to units with % A less than average. As a result, we can collapse the origin and destination MPUMAs in our data into above- and below-average % minority groups, and see the number of cases that move from "above" to "below" and from "below" to "above" % minority MPUMAs in the 2005 ACS data.[5] (add discussion of Table 8).

[5] This holds only insofar as migration doesn't tip a geographic area above the line from an above- or below- % minority area. This is the justification for the projection approach we adopt above, which will calculate the longer term implications of simultaneous population movements of both groups.

Discussion and Conclusion

(coming soon…)

Appendix A

Definition of Census Regions

1. **Northeast Region**

- **New England Division**: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont
- **Middle Atlantic Division**: New Jersey, New York, Pennsylvania

2. **Midwest (formerly North Central) Region**

- **East North Central Division**: Illinois, Indiana, Michigan, Ohio, Wisconsin
- **West North Central Division**: Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota

3. **South Region**

- **South Atlantic Division**: Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia
- **East South Central Division**: Alabama, Kentucky, Mississippi, Tennessee
- **West South Central Division**: Arkansas, Louisiana, Oklahoma/Indian Territory, Texas

4. **West Region**

- **Mountain Division**: Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming
- **Pacific Division**: Alaska, California, Hawaii, Oregon, Washington

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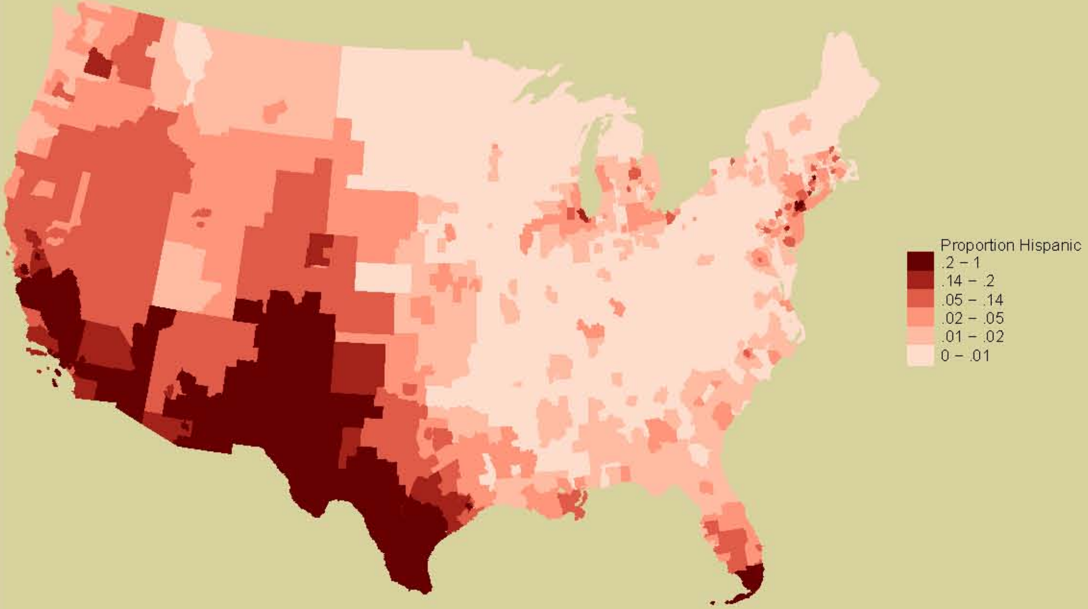
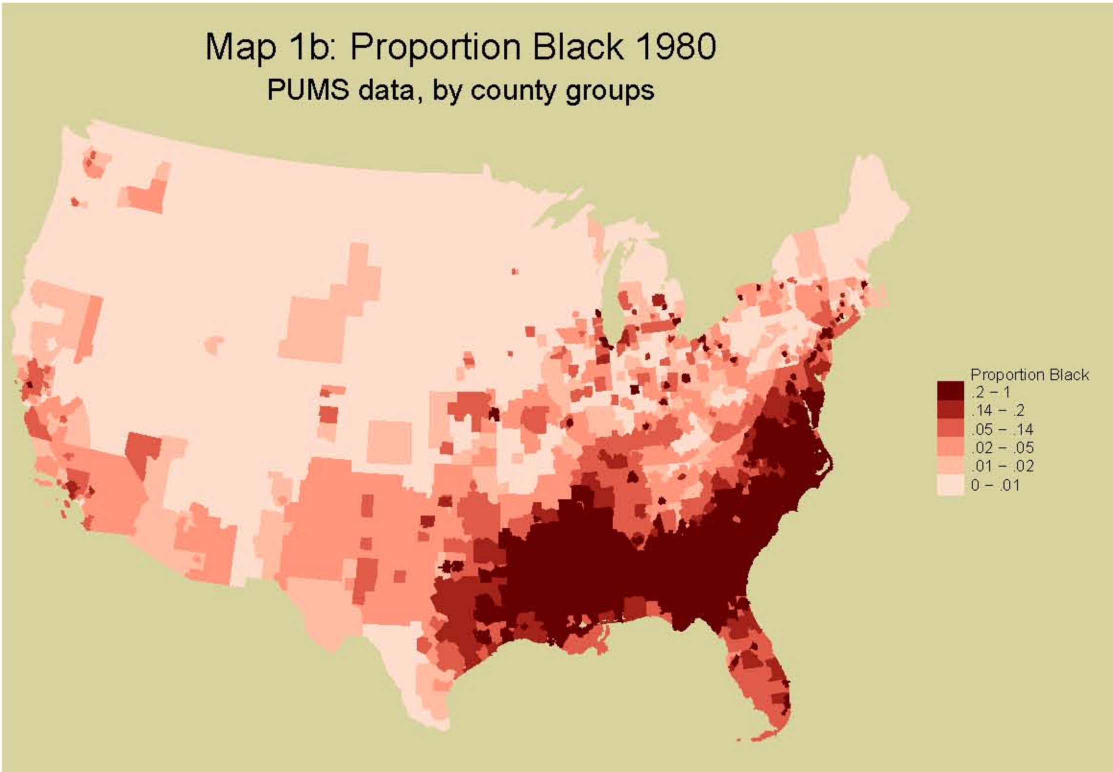
Map 1: Proportion Hispanic 1980

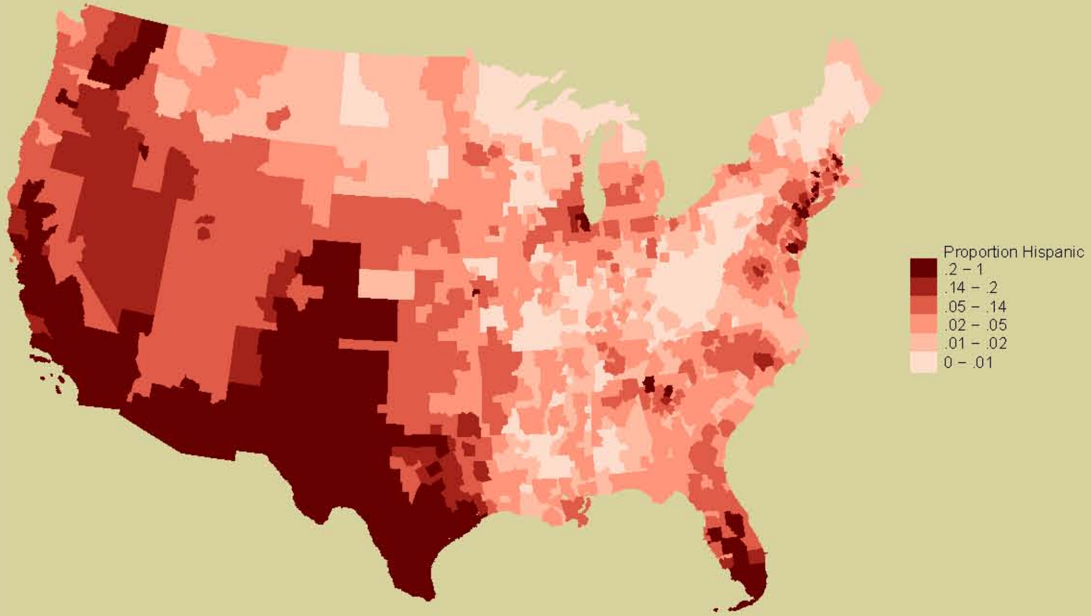
PUMS data, by county groups




Map 1b: Proportion Black 1980
PUMS data, by county groups
Proportion Black
.2 - 1
.14 - .2
.05 - .14
.02 - .05
.01 - .02
0 - .01

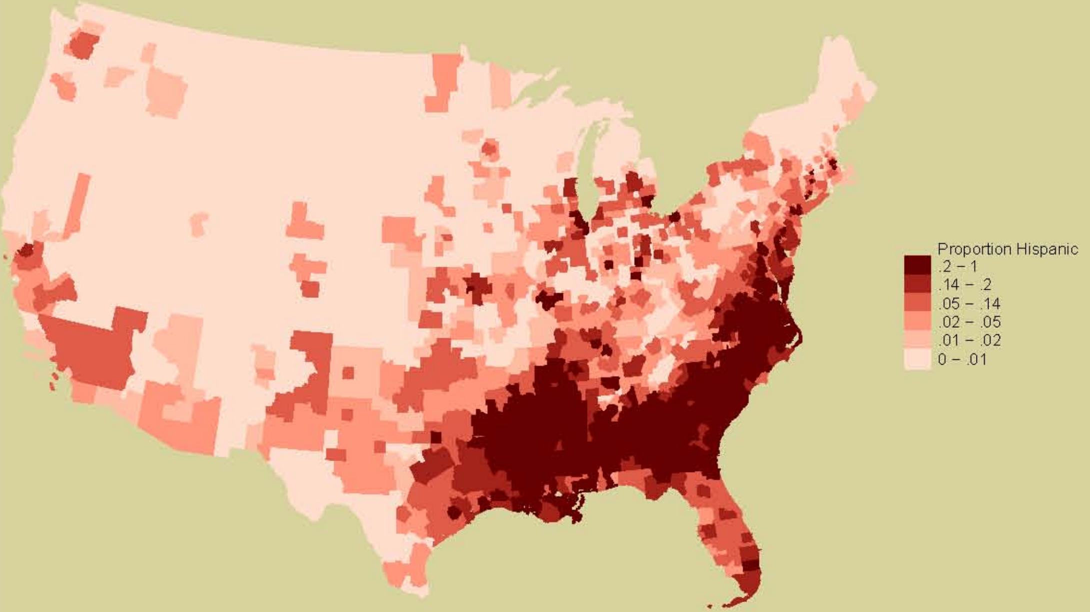
Map 2:Proportion Hispanic 2005

American Community Survey data



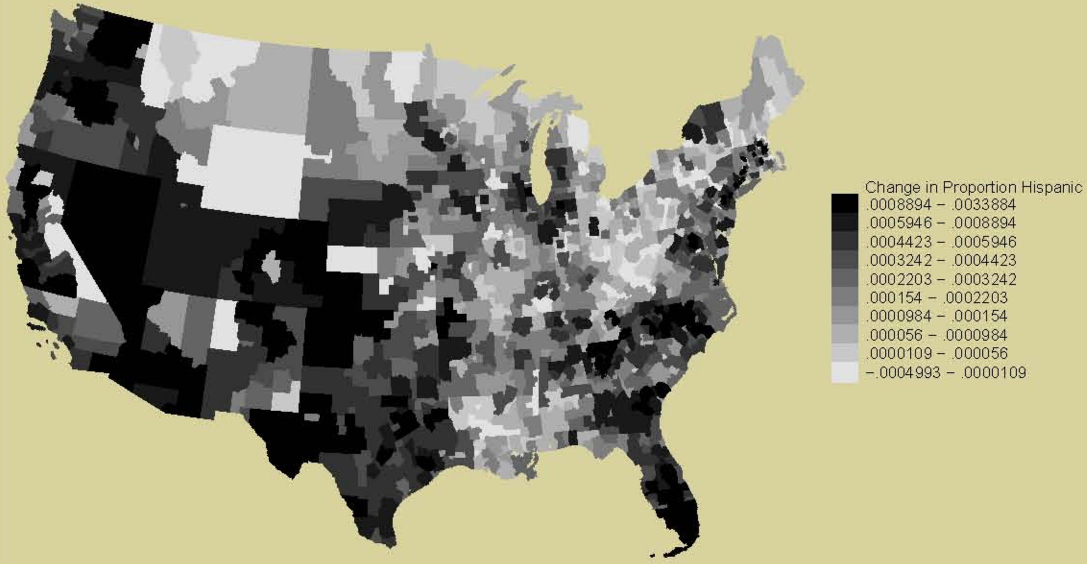
Map 2b:Proportion Black 2005

American Community Survey data



Map 3: Net Hispanic Migration 1995−2000

PUMS data



Map 4: Net White Migration 1995−2000

PUMS data

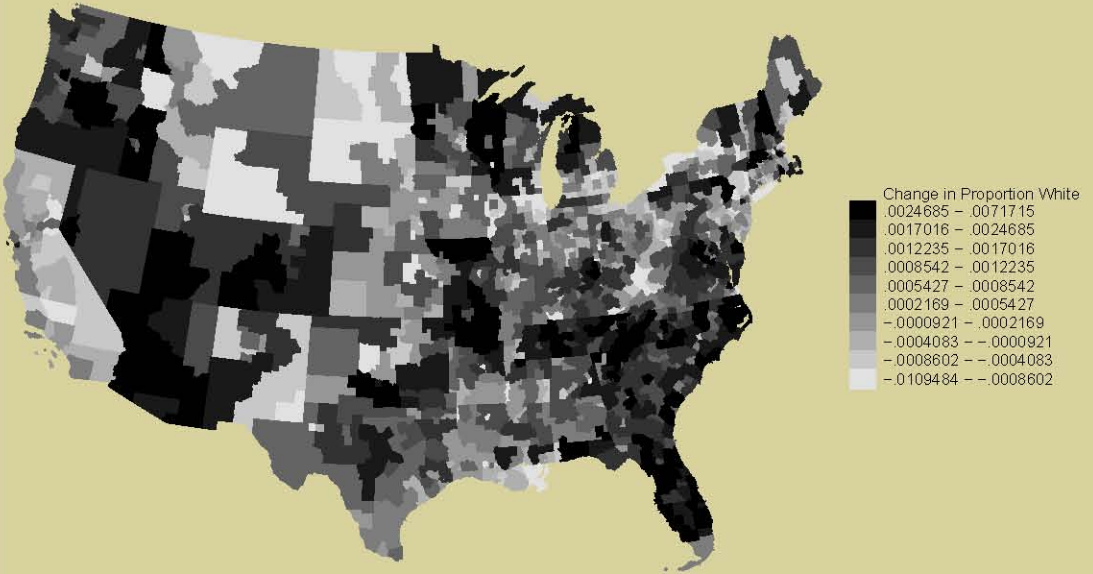


Table 1: Index of Dissimilarity by Geographic Detail, 2005 ACS

Dissimilarity	**PUMA**	**Migration PUMA**	**State**
Hispanic-White	**.581**	**.542**	**.443**
Black-White	**.576**	**.478**	**.276**
Hispanic-Black	**.627**	**.556**	**.475**
Number of geographic units	**2,071**	**1,024**	**51 (+DC)**

Table 2: Trends in State-Level Segregation 1980-2005

year	mean(sd_hw)	mean(d_hw)	mean(e_hw)
1980	0.1473	0.4963	0.0586
1990	0.1543	0.4978	0.0765
2000	0.1420	0.4559	0.1062
2005	0.1389	0.4432	0.1225

year	mean(sd_bw)	mean(d_bw)	mean(e_bw)
1980	0.0680	0.2780	0.1100
1990	0.0666	0.2718	0.1132
2000	0.0685	0.2750	0.1164
2005	0.0693	0.2761	0.1166

year	mean(sd_bh)	mean(d_bh)	mean(e_hb)
1980	0.1929	0.5199	0.0560
1990	0.2022	0.5177	0.0730
2000	0.1933	0.4841	0.1029
2005	0.1917	0.4759	0.1190

Key: sd_ is the spatial D, d_ is D, e_ is E. “bw” is black-white segregation, “bh” black-Hispanic segregation, and “hb” Hispanic-black segregation

Table 3: Race/Ethnic Composition of Census Regions, 2005 ACS

	Race/Ethnic %					
Region	White	Black	Hispanic	Other	Total	(N)
E N Cen	77.66	11.75	6.55	4.03	100	457,211
E S Cen	75.36	20.00	2.24	2.40	100	174,762
Mid Atl	67.98	12.67	12.33	7.03	100	386,821
Mtn	67.85	2.84	22.24	7.07	100	199,092
N Eng	82.18	5.15	7.39	5.28	100	137,840
Pacific	50.32	5.10	28.90	15.68	100	450,762
S Atl	64.26	21.00	10.25	4.49	100	550,791
W N Cen	85.54	5.81	4.21	4.43	100	197,446
W S Cen	55.41	13.71	25.51	5.36	100	323,655
Total	66.76	11.93	14.54	6.77	100	2,878,380

Table 4: Proportion Moving 2004-2005 by Race/Ethnicity and Region, 2005 ACS

Region	White	Black	Hispanic	Other	Total
E N Cen	0.131	0.203	0.196	0.202	0.147
E S Cen	0.150	0.197	0.265	0.208	0.163
Mid Atl	0.102	0.133	0.153	0.153	0.116
Mtn	0.191	0.276	0.225	0.212	0.202
N Eng	0.115	0.177	0.229	0.190	0.130
Pacific	0.162	0.186	0.172	0.169	0.167
S Atl	0.149	0.191	0.229	0.202	0.169
W N Cen	0.145	0.233	0.229	0.203	0.156
W S Cen	0.166	0.220	0.199	0.191	0.183
Total	0.143	0.191	0.194	0.182	0.159

Table 5: Number of Cases of Residential Mobility by Region 2004, ACS 2005

region_o	white	Black	Hispanic	Other	Total
E N Cen	41,068	6,110	3,555	2,613	53,346
E S Cen	16,238	4,358	700	688	21,984
Mid Atl	25,409	4,282	4,758	2,998	37,447
Mtn	21,121	883	6,103	2,167	30,274
N Eng	10,957	851	1,417	987	14,212
Pacific	33,917	3,113	16,006	9,392	62,428
S Atl	46,051	14,058	7,893	3,751	71,753
W N Cen	19,585	1,382	1,096	1,238	23,301
W S Cen	26,388	6,308	10,297	2,648	45,641
International	5,571	1,119	4,481	3,047	14,218
Total	246,305	42,464	56,306	29,529	374,604

Table 6: Race/Ethnic Differences in Migration for Interregional Migrants from the Pacific Region 2004-5

Destination Region	White	Black	Hispanic	Other	Total
E N Cen	9.42	8.46	7.12	13.27	9.27
E S Cen	4.6	4.97	1.97	3.75	4.02
Mid Atl	5.96	2.62	3.99	8.15	5.53
Mtn	39.51	27.13	43.68	32.98	38.72
N Eng	4.06	0.43	0.31	5.16	3.14
S Atl	16.03	29.26	16.37	18.67	17.39
W N Cen	6.71	7.1	4.9	4.64	6.18
W S Cen	13.73	20.02	21.65	13.38	15.75
Total	100	100	100	100	100

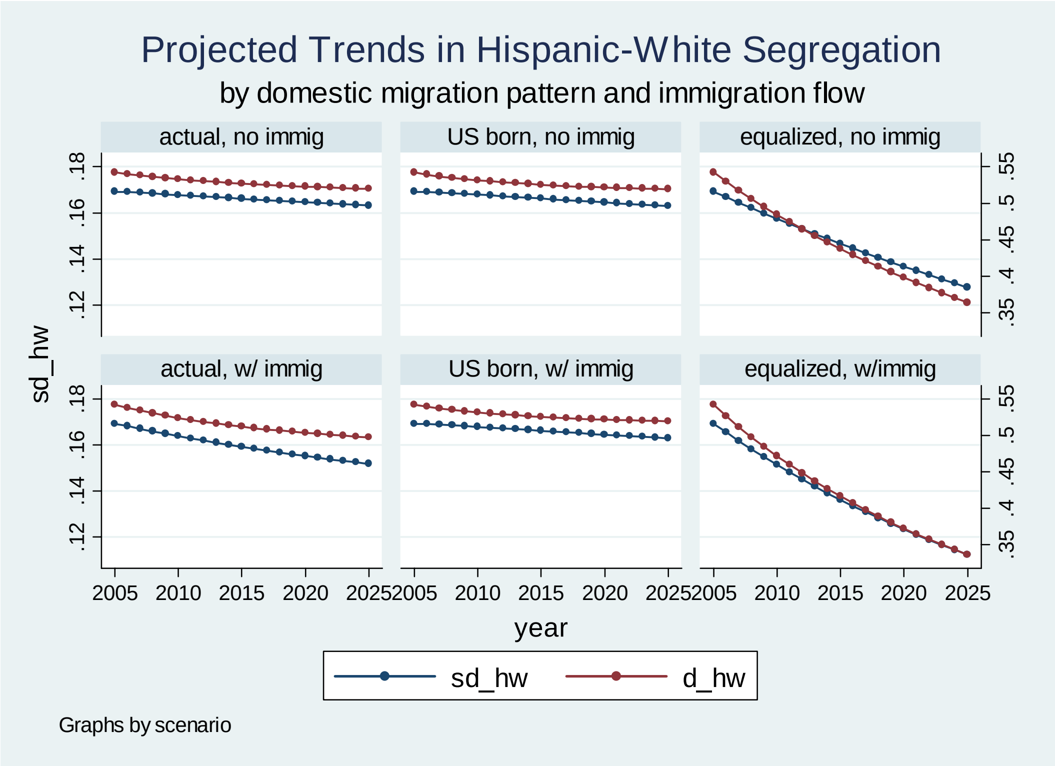
Table 7: Loglinear Models of Race/Ethnic Differences in Regional Migration Patterns

3-way interaction models of origin x destination x race/ethnicity, test of equal migration patterns

Model	Residual Degrees of Freedom	Chi-Squared Test vs Saturated Model	Prob>chi2	BIC
1. All	210	2136.54	0	903.992
2. Hispanic-White	69	934.16	0	577.0
3. Black-White	70	789.70	0	426.979

+ Table8

Graph 1:



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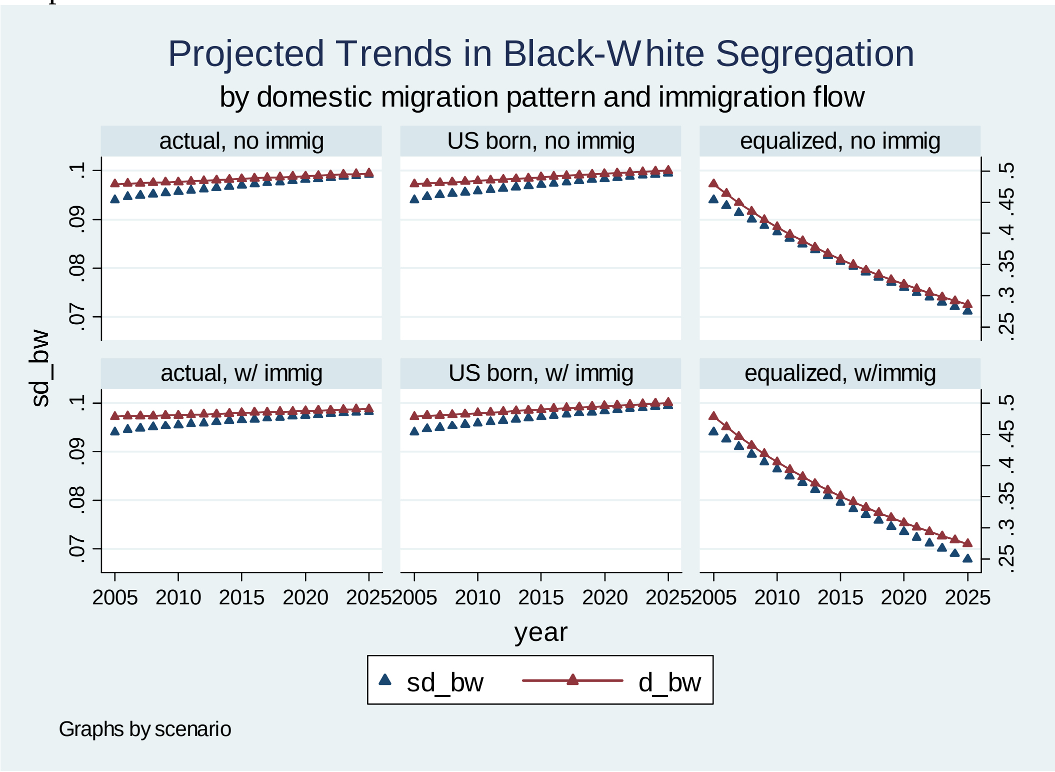

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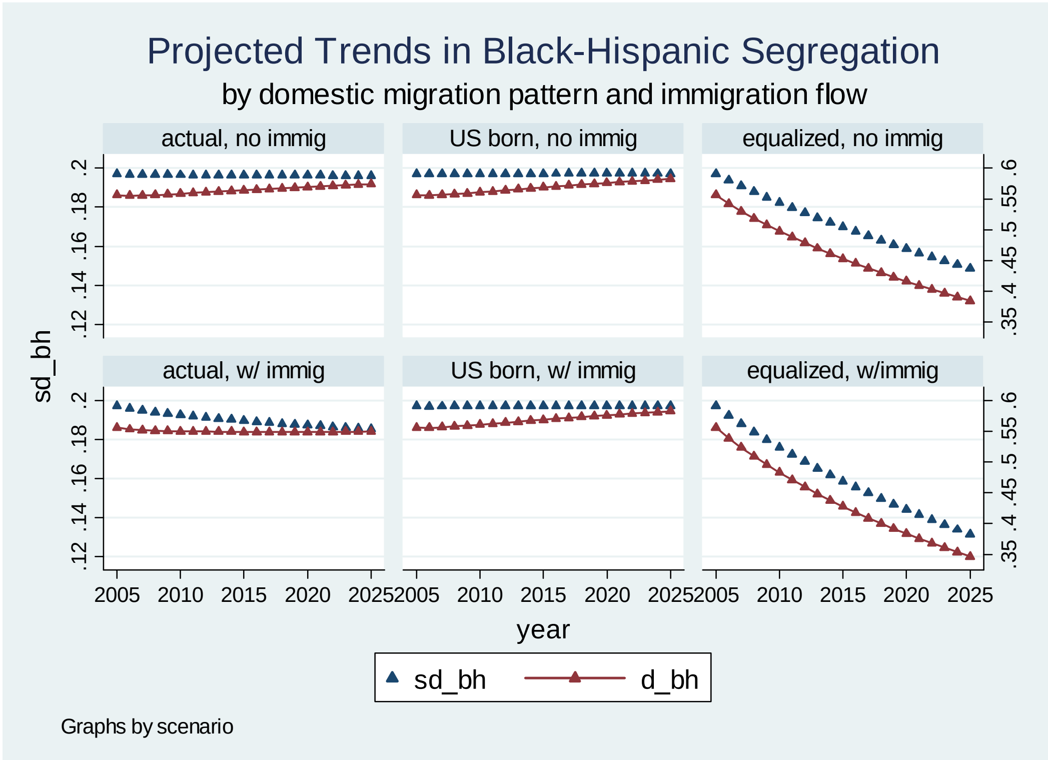
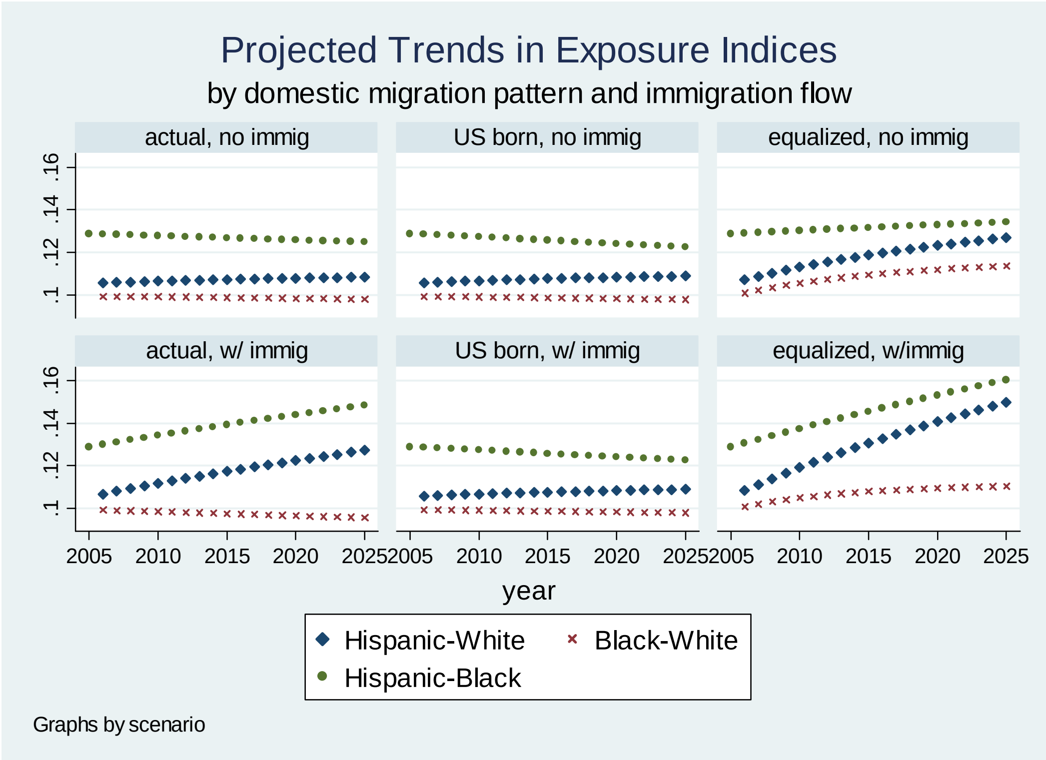


Graph 4



Projected Trends in Exposure Indices
by domestic migration pattern and immigration flow
actual, no immig
US born, no immig
equalized, no immig
actual, w/ immig
US born, w/ immig
equalized, w/immig
.1
.12
.14
.16
2005
2010
2015
2020
2025
year
Hispanic-White
Black-White
Hispanic-Black
Graphs by scenario