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Neighborhoods neighboring neighborhoods: adjacency, relative position and tract-  
level racial change in the U.S. 2000 to 2010

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**Abstract**

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Due to wide-ranging demographic shifts over the last forty years, the United States has experienced increasing ethnic and racial diversity at the national level. This diversity, however, has not been expressed evenly across metropolitan areas and their neighborhoods: certain places have remained racially homogeneous while others are now comprised of multiple groups. This paper explores the relationship between national level diversity and neighborhood level diversity by (1) describing general patterns in the geographic distribution of segregated and diverse neighborhoods observed in 2000 and (2) investigating how this distribution of neighborhoods moderated neighborhood change between 2000 and 2010. Census race and ethnicity counts are used to classify a database of Census tracts in metropolitan areas using a thirteen-part typology measuring diversity and most prevalent race or ethnicity. The geographic distribution of tracts within this typology is assessed using a measure of relative centrality and the classification of adjacent tracts. A multinomial logit model is used to estimate the relationship between different

neighborhood spatial contexts and neighborhood compositional change within the typology.

Findings demonstrate support for traditional theories of segregation, including spatial assimilation and place stratification, but with considerable complexity: less central tracts have become increasingly diverse but elements of White flight and neighborhood succession to suburbs remain.

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## 1. INTRODUCTION

“Waiting for 2042 is like waiting for Godot, alright? You’re wasting your time and you have nothing to wait for.” – Hari Kondabolu, *Waiting for 2042* (2014)

In the rhetoric on race and the demographic future of the United States, the year 2042 has become a key date. According to often cited U.S. Census Bureau projections, 2042 will likely be the year that Whites no longer constitute the racial majority (Bernstein and Edward, 2008). But as comedian Hari Kondabolu points out, fixation on 2042 is problematic. For one, it relies on a racial accounting that lumps all non-Whites together. Even if Whites are no longer the majority, they will remain the most numerous racial group well beyond 2042. More dubiously, the narrative around 2042 works under the assumption that racial categories are static, ignoring the contested and malleable definition of Whiteness throughout US history (Ellis 2001;Alba, 2016). When Kondabolu sharply quips that waiting for 2042 is a waste of time, he is both bringing the legacy of race and racism in the US to bear on the optimism surrounding demographic projections and highlighting that wide scale demographic transformations are already well underway.

One way to assess the impact of growing diversity in the United States is to evaluate how it is reflected at local scales. While the changing racial and ethnic composition of the US as a whole can be understood as a product of international migration and group-specific trends in aging and fertility, understanding patterns in neighborhood diversity requires a nuanced approach to the economic, social and cultural forces that interact to govern residential sorting at micro scales. Over the last 25 years there has been rigorous study of the relationship between metropolitan-level diversity and neighborhood racial residential segregation (Massey and

Denton, 1991; Iceland, 2004). Evidence suggests a complicated temporal and spatial dynamic: at the same time that neighborhood-level Black-White segregation peaked in the 1970s, international migration from Latin America and Asia began to rise, which generated growth in neighborhood-level diversity that has been highly uneven in terms of where it has occurred and how it has affected different racial groups (Massey and Denton, 1991; Farley and Frey, 1994; Iceland, 2004).

One clear result of the demographic changes over the last several decades has been an increase in the type of neighborhood racial and ethnic compositions and the rise of new patterns of neighborhood racial and ethnic change. With perfect diversity, where all groups are evenly represented in a neighborhood, still exceedingly rare and complete neighborhood succession and re-segregation no longer the expected outcome of all neighborhood change, researchers have looked beyond traditional measures of segregation towards new techniques for describing and classifying the wide range of neighborhoods observed at the turn of the 21<sup>st</sup> century (Logan and Zhang, 2010; Holloway et al. 2011; Clark et al, 2015). The purpose of this research is to extend the recent work on neighborhood classification by (1) describing the general geographic pattern of neighborhood racial compositions within metropolitan areas and (2) exploring the extent to which changes in neighborhood racial compositions between 2000 and 2010 are dependent on the geographic pattern of neighborhoods (i.e. their spatial relationships). By detailing how a given geographic distribution of neighborhood types observed at one point of time has a bearing on the distribution of neighborhood types observed at a later point in time, this research provides a method for understanding the ways in which national-scale demographic transformations are linked to local-scale neighborhood change and outlines a framework for discussing trajectories of neighborhood racial segregation in a period of growing racial and ethnic diversity nationally.

## 2. BACKGROUND

The primary driver of growing diversity in the United States has been international immigration (Grieco et al., 2012). Since the late 1960s immigration to the United States has steadily increased, to the point that just over one in eight US residents were foreign born in 2010 (Grieco et al., 2012). Unlike previous waves of immigration which drew almost entirely from Europe, the sources of “new immigration” are far more global, with the majority of recent immigrants hailing from origins in Latin America and Asia (Massey, 1995). As a result, most immigrants arriving to the United States since the 1960s have fallen outside of the historical Black-White racial paradigm that structured segregation in US cities for most of the twentieth century, thus giving rise to growing racial and ethnic diversity (Lee and Bean, 2004).

Though new immigration to the US is also largely an urban phenomenon, immigrant settlement is no longer as concentrated in traditional immigrant gateway cities like New York, Miami, San Francisco, and Los Angeles (Massey, 2008). New destinations such as Seattle and Atlanta have emerged, and internal migration trends of immigrants, particularly those from Latin America, have resulted in considerable growth of foreign born populations in small and medium sized metropolitan areas throughout much of the South and Midwest (Lichter and Johnson, 2006; Zúñiga and Hernandez-Leon, 2005).

The era in which new immigration to the US began was one of very high Black-White segregation in metropolitan areas. 1970 marked the end of the Second Great Migration of African Americans from the South to Northern cities which, through a regime of White suburbanization and institutional restrictions on the housing opportunities and residential mobility of African Americans throughout the mid-twentieth century, left African Americans

who migrated from the South highly isolated and concentrated in the urban centers of the North (Massey and Denton, 1993). In the late 1980s and early 1990s, scholars concerned with the causes and unjust consequences of Black-White segregation began investigating the impact of new Asian and Latino immigrants on this highly polarized landscape (Massey and Denton, 1987; Frey and Farley, 1993).

Evidence from the 1970s and 1980s suggested some attenuation of Black-White segregation. Metropolitan areas with multiethnic compositions were more likely to experience a decline in the level of Black segregation (Frey and Farley, 1996). The number of neighborhoods with multiple groups was also on the rise, signifying a deceleration of racially motivated neighborhood turnover and a possible shift in racial attitudes of Whites (Denton and Massey, 1991; Alba et al., 1995). Yet some of the same patterns persisted: Whites remained more likely to leave both neighborhoods with concentrations of non-White groups and those in close proximity to non-White majority neighborhoods, and many metropolitan areas with growing immigrant populations experienced increasing Latino and Asian segregation (Denton and Massey, 1991; Frey and Farley, 1996). The socio-economic impacts of declining segregation appeared to hinge on the kinds of diversity that developed. Black and Latino mixed neighborhoods in metropolitan New York, for example, had a similar socio-economic profile as all Black neighborhoods even as they effectively lowered the level of Black segregation (Alba et al., 1995).

As the level of diversity continued to grow in many metropolitan areas throughout the 1990s, the neighborhood segregation of Blacks and Whites in most metropolitan continued to fall whereas Latino and Asian segregation started to rise (Iceland, 2004). The extent to which the decline in Black segregation has been accompanied by socio-economic gains has spurred

considerable debate with some scholars declaring that 2000 marked the “end of the segregated century” (Vigdor and Glaeser, 2013). How one interprets the decline in Black segregation in large part depends on the theoretical model used to explain the persistence of segregation. While researchers generally agree that there is now a diversity of possible diversities throughout US metropolitan areas, the processes of neighborhood change are not well understood given the complexity in the kinds of neighborhoods that exist.

## 2.1 Understanding neighborhood change

Theories of ethnic and racial segregation and neighborhood change have roots in the ecological succession model of the Chicago school (Park, 1926). The rapid urbanization, high levels of immigration and massive residential churn of 1920s Chicago led Park to a model that combined upward social mobility of immigrants and outward mobility from inner city enclaves with displacement by new waves of immigration to the urban core. Under the succession model, as a new immigrant group settles in an area settled by older immigrant groups (or natives), the previously established group, motivated by a desire to maintain social distance from the new immigrant group will hand down their old neighborhood to newcomers and leave for a neighborhood more reflective of their status. If flows of the new immigrant group continue after the neighborhood has become predominantly comprised of the new group, the processes of chain migration will lead to spill-over and succession in nearby areas (Massey, 1985).

Though the ecological succession model of the Chicago School was primarily focused on the pressures caused by new immigrant settlement, scholars later expanded the model to explain racial dynamics and racial residential segregation. Writing during the peak of the Second Great Migration, suburbanization, and White flight, Duncan and Duncan (1957) theorized that

neighborhoods will change rapidly as a new group first “penetrates” or “invades” a previously established neighborhood and later “consolidates” or “piles up” within it. It is important to note that because racially diverse neighborhoods were highly uncommon for much of the 20<sup>th</sup> century, complete segregation for the Duncans was taken to be the equilibrium state.

There are two distinct spatial dynamics at play in any succession model: one in which the new group moves in and another in which the old group moves out. More current theorizations of segregation and neighborhood change can be differentiated by which of these two dynamics is the primary explanation for the levels of segregation that are observed. On one end of the spectrum, spatial assimilation theory suggests that systematic socio-economic differences between groups result in different levels of segregation (Logan and Alba, 1993; Iceland and Nelson, 2008). Groups with lower socio-economic status are less geographically mobile and remain in highly segregated contexts while groups with higher socio-economic status have more ability to move. On the opposite end of the spectrum is place stratification theory (Massey and Denton, 1993) which suggests that racial and ethnic segregation reinforce social stratification. Whites, the majority group, keep spatial distance from minority groups in order to maintain social distance. In this interpretation, the structural forces of racial prejudice maintain the higher status of Whites. In comparison to the spatial assimilation model that emphasizes the diffusion of upwardly mobile minority groups into affluent areas, the focus in place stratification theory is the out-migration of Whites from neighborhoods entered by non-White groups. It is well documented that Whites are more likely to exit neighborhoods with higher levels of minorities (Pais et al, 2009; Crowder, 2000), and research has consistently shown White avoidance of non-White space when making residential decisions.

Both the spatial assimilation and place stratification models are to some extent models of neighborhood change: in the former, diversity will register in affluent neighborhoods where upwardly socio-economically mobile minority groups have relocated, in the latter Whites will exit neighborhoods after minorities have entered in great enough numbers. Yet because these models focus on individual and household level residential mobility, they often treat the underlying geography of inequality and race as fixed. White neighborhoods, in particular, are taken as inherently desirable. With the growing complexity of neighborhoods and neighborhood transitions, this inflexibility is highly problematic (Wright et al, 2005) and hinders the ability of the spatial assimilation and place stratification models to explain emergent processes of neighborhood change like gentrification and the suburbanization of poverty (Howell and Timberlake, 2014). The process of White flight may still exist but it is not what it once was; the number of all White or nearly all White neighborhoods to which Whites can “flee” is steadily shrinking (Friedman, 2008), and the character of predominantly White neighborhoods has changed. Investigations into how individuals and households make decisions with respect to neighborhood choice and the extent to which these decisions are structurally constrained are illuminating and necessary, but they tell just one part of the story. By focusing on the dynamics of neighborhood change, this study will help develop a framework for understanding mobility decisions in a broader and increasingly diverse system of neighborhoods.

## 2.2 The spatial mechanisms of neighborhood change

In the literature on segregation, neighborhood change is often studied by proxy. Measurements of segregation typically occur at the population level and entail the quantification of some relative measure of dispersion between subpopulations across a set of areal subunits like census tracts. Holding the areal subunits fixed over time, any increase or decrease in population-level

segregation implies underlying change in the distribution of subpopulations. The canonical segregation indices measuring the five dimensions of evenness, exposure, centralization, concentration and clustering outlined by Massey and Denton (1988) all measure population-level segregation.

It is difficult, however, to characterize the nature of neighborhood change from a patterns in population-level segregation alone. Even in a simple two-group scenario, population-level segregation will be influenced by changes in neighborhood distribution of the first group or the second group or both. As the number of groups increases, the degrees of freedom can grow quite large, requiring a robust theoretical model for understanding the complex and intersecting process of race and class that govern patterns in sorting behavior of multiple groups at local scales. An alternative way to study the dynamics of neighborhood change is to disaggregate population-level segregation statistics to the neighborhood level. Once neighborhoods are classified based on their composition, the patterns neighborhood change can be observed and analyzed with a transition matrix (Massey and Denton, 1991). The empirical efficacy of the transition matrix approach rests on the construct validity of the classification scheme. In light of the growing complexity of neighborhoods, a number of different scholars have proposed neighborhood classification schemes that capture the important relative dimensions of local racial and ethnic diversity (Logan and Zhang, 2010; Holloway et al, 2011).

Population-level measures of segregation, like the Index of Dissimilarity and Isolation Index, have often been criticized for ignoring the underlying spatial relationships between areal subunits (Morrill, 1991; Wong, 1993), and transition matrices are also open to this critique. Simply disaggregating segregation trends to the neighborhood level transitions risks ignoring the multiscalar dynamics of segregation. Even if a transition matrix can tell us that fifty percent of

neighborhoods in category A transitioned to category B over a given period, we still know nothing about where these neighborhoods are with respect to each other and to other kinds of neighborhoods or where these neighborhoods are within the metropolitan area at large. To address issues of adjacency in population-level measures of segregation, Morrill (1991) and Wong (1993) have devised adjustments to popular segregation indices that more comprehensively reflect first-order spatial relationship between subunits. Within the neighborhood classification and neighborhood transition literature, Logan and Zhang (2010) following Massey and Denton (1991) have used adjacency dummies to measure the relative influence of nearby neighborhoods on neighborhood change, but this spatial approach remains largely unexplored.

Two models developed by Schelling (1969), the checker board model and the neighborhood tipping model, identify and expound upon two important spatial elements of neighborhood change: spatial proximity and tipping. Using an agent based model, the checkerboard model demonstrates that when agents (individuals) belonging to two racial groups are arranged in checkboard-like configuration, they will sort themselves into highly segregated blocks even if all agents have only moderate preferences for same group proximity. The neighborhood tipping model argues that succession of a neighborhood from one segregated state to another (e.g. all White to all Black) might mask the variation in individual same group preferences of the out group. As a members of a minority group enter a previously segregated neighborhood, the least tolerant members of the majority group will leave; however, if the homes of the departing majority group members are then occupied by more minority group members, then the least tolerant of the remaining majority group also leave. This process will accelerate until the neighborhood has moved or ‘tipped’ from one segregated equilibrium state to another.

The underlying spatial logic of the Schelling models can be expanded to encompass the spatial relationships between neighborhoods. As the findings from Logan and Zhang (2010) demonstrate, adjacent neighborhoods moderate the kinds of change a given neighborhood will experience. This conclusion fits within longstanding theories of segregation, spatial assimilation and place stratification, which while conceptualized at the individual level, attempt to reveal patterns in mobility across uneven socio-economic and racial space. However, the spatial diffusion and place stratification models imply slightly different spatial mechanisms. The spatial assimilation model predicts that centrally located concentrations of non-White groups will diffuse outward into more diverse, more affluent, suburbs or less centrally located neighborhoods (Massey, 1985). Therefore, we would expect (1) less central neighborhoods and areas in the suburbs to become more diverse and (2) White segregated neighborhoods adjacent to Asian, Latino and Black neighborhoods to become more diverse.

Recent work done on the White flight thesis, a crucial element of place stratification, demonstrates that recent growth in non-White populations in nearby areas often increases the likelihood of White out-migration from a neighborhood and exacerbates the positive effect of non-White populations within the neighborhood on White mobility (Crowder and South, 2008). Clearly, Whites react not just to what is happening in their immediate neighborhood but in nearby areas. In aggregate, their mobility will be reflected in different kinds of neighborhood change – predominantly White neighborhoods will become more diverse eventually becoming more segregated and racially homogeneous as Whites leave.

From the place stratification model, we expect the following set of spatial mechanisms: (1) White segregated neighborhoods will be more likely to transition to non-White when adjacent to Asian and Latino neighborhoods, but especially Black neighborhoods and (2)

diversity is most often located in places between macro-segregated areas. While neighborhoods do not turnover as rapidly as they once did, place stratification theory would suggest that the re-segregation of Whites into White neighborhoods remains a strong component of neighborhood change.

### 3. HYPOTHESES

From the spatial assimilation and place stratification models, we have developed six hypotheses that will be tested in the subsequent analyses of neighborhood change that occurred between 2000 and 2010. Each of the two models give way to different expectations with respect to how segregation and diversity are distributed across neighborhoods within metropolitan areas and how different spatial relationships are predictive of neighborhood racial change. Our first two hypotheses relate to location.

**1.a. Spatial assimilation (location):** *Diverse neighborhoods are located in less central locations.* The spatial assimilation model posits that segregation is the result of differences in socio-economic status by race and ethnicity. The lower socio-economic status of non-White groups reduces their access to desirable (i.e. White suburban) neighborhoods. Thus, the spatial assimilation model suggests that declines in metropolitan level segregation must be in part the result of growing diversity in desirable (i.e. White suburban) neighborhoods.

**1.b. Place stratification (location):** *Diverse neighborhoods exhibit less clustering than segregated neighborhoods.* In contrast to the spatial assimilation model, the place stratification model suggests that neighborhood-level racial and ethnic diversity is primarily a function of neighborhood change. Neighborhoods appear as diverse because

they are in transition from one racially homogeneous (i.e. segregated) state to another. As such, the spatial assimilation model suggests that diversity largely occurs in the neighborhoods between two areas of macro-level segregation (e.g. a transition zone between a cluster of homogeneous White neighborhoods and homogeneous Black neighborhoods) and thereby exhibit less clustering.

The spatial assimilation and place stratification models also give way to different expectations with respect to how the different distributions of neighborhoods by racial and ethnic composition are predictive of neighborhood change. The next two hypotheses relate to location and change among White neighborhoods.

**2.a. Spatial assimilation (location and White neighborhood change):** *White segregated neighborhoods adjacent to Asian, Latino and Black neighborhoods become more diverse as these populations diffuse out from centrally located neighborhoods of concentration.* This hypothesis builds off our argument above that the spatial assimilation model suggests diversity will be found in less central areas by proposing that White neighborhoods that are adjacent to non-White neighborhoods are more likely to increase in their level of diversity.

**2.b. Place stratification (location and White neighborhood change):** *White neighborhoods that are located in proximity to Asian and Latino neighborhoods, but especially Black neighborhoods are more likely to transition to non-White than White neighborhoods located near other White neighborhoods.* In a slight divergence from the spatial assimilation model, the place stratification model suggests that Whites will exit neighborhoods near non-White neighborhoods leading to neighborhood succession or turnover. The key difference between this hypothesis and the one stemming from the

spatial assimilation model has to do with the stability of diverse neighborhoods. Under the place stratification model, a White neighborhood that has become less White and is located near a non-White neighborhood is more likely to be abandoned by Whites than a White neighborhood that has become less White but is located near other White neighborhoods.

Though the trajectory of White neighborhoods are fundamentally tied to trajectories of non-White neighborhoods, we can expand the spatial assimilation and place stratification models to develop specific hypotheses about groups other than Whites.

**3.a. Spatial assimilation (location and Black neighborhood change):** *Black neighborhoods adjacent to Latino neighborhoods are more likely to become diverse than Black neighborhoods adjacent to Black neighborhoods.* The spatial assimilation model suggests that non-White groups tend to be segregated because they lack the economic ability to relocate to more desirable areas. To the extent that socio-economic status among the Black and Latino populations are similar, we would expect Black neighborhood diversity to grow in places near Latino neighborhoods.

**3.b. Place stratification (location and Latino neighborhood change):** *Latino neighborhoods when clustered together will decline in diversity.* The place stratification model suggests that population growth of a new group will eventually lead to succession. For this reason, we predict that the initial presence of Latinos in a cluster of neighborhoods will lead to consolidation and segregation of Latinos in those areas.

## 4. DATA

This study operationalizes "neighborhoods" as census tracts. Admittedly, census tracts are imperfect proxies for neighborhoods. They vary in shape, size and population, and their boundaries sometimes fail to correspond with meaningful social spatial differences, leading to internal heterogeneity and imprecise estimates of aggregate social characteristics. However, we contend that tracts are highly useful for measuring neighborhood change. Unlike a multi-scalar method that might use an ego center as its unit of analysis, tracts can be fixed with respect to time and easily conceptualized as discrete, bounded units through which groups of individuals move. This fixity also greatly simplifies the measurement of spatial effects; while the composition of a given tract and its neighboring tracts may change over time, a tract will always neighbor the same tracts. Moreover, the issues with meaningless borders and internal heterogeneity that can complicate the use of tracts in some cases are in fact features that we want to study. In large part, we are interested in assessing the extent to which the racial and ethnic heterogeneity of a tract and of its neighboring tracts are correlated with compositional change.

The primary dataset in our analysis consists of Census 1990, Census 2000, and Census 2010 race and ethnicity counts that have been harmonized to Census 2000 tract boundaries (Holloway et al., 2011). We apply three exclusions. First, we eliminate any tract that does not belong to one of the 276 county-defined Metropolitan Statistical Areas (MSAs) identified by the 1999 Office of Budget and Management (OMB) guidelines. Second, we drop any tract that was home to less than 50 people in 1990, 2000 or 2010. Finally, because we are interested in spatial mechanisms--the effect of adjacency in particular--we remove any tract that is not adjacent to at least one other non-water tract (e.g. islands). The last two criteria exclude only a very small number of tracts.

The 51,109 Census 2000 tracts that meet these three qualifications contained the vast majority of the United States population in 2000: 226.1 million people or roughly 80.3% of the total population that year. This percentage is considerably higher for the largest three non-White groups. Non-island tracts with greater than 50 people in MSAs were home to 86% of non-Latino Blacks, 94.1% of non-Latino Asians and 90.8% of Latinos in 2000. While the OMB has updated MSA definitions in subsequent years to account for growth of some metro areas, the proportion of the national population in the 1999 OMB-defined MSAs does not change considerably between 2000 and 2010.

#### 4.1 Measuring neighborhood change

The following analyses concern neighborhood racial change that occurred between 2000 and 2010. Though the dataset includes tract-level counts from 1990, we only use these to control for temporal lag in tract transitions (explained below). To standardize the race and ethnicity counts across the three censuses, we use six categories: White, Black, Native American, Asian, other and Latino. The Latino category includes all individuals who identified as Hispanic while the remaining five categories contain the residual. Because the 1990 Census did not provide respondents with the option to check multiple races, mixed race categories from the 2000 and 2010 Census have been collapsed into single-race groups according to the principle of largest non-White group (e.g. people who responded as being White-Black become Black, White-Asian become Asian Black-Asian become Black, Asian-Native American become Asian, and so on).

Even with just six distinct racial and ethnic groups, there are a multitude of possible neighborhood compositions that might be observed in a given year and even more ways in which compositions might change. To simplify the analysis, we make use of a thirteen category

typology developed by Holloway et al (2011) that isolates two distinct but interconnected dimensions of racial and ethnic composition: diversity and most prevalent group. The MixedMetro typology, as Holloway et al. call it, draws considerable analytical power from its conceptual clarity and portability to other scales of analysis. To apply the typology, areas are first designated as low-, moderate-, or high-diversity using a scaled entropy index on the six race and ethnicity categories. Low diversity areas are those for which the six group entropy index is less than 0.3707 and/or for which one group constitutes 80% or more of the area population. Moderate diversity areas are those for which the six group entropy lies between 0.3707 and 0.7414 and the largest group is at least 45% of the area population. High diversity areas are those for which the largest group is less than 45% of the population and the six group entropy is more than 0.7414. Once areas have been classified in terms of their diversity, low- or moderate-diversity areas are given a second designation based on the most prevalent group. This leads to thirteen categories: six low diversity (one for each racial and ethnic group), six moderate diversity (one for each racial and ethnic group) and one high diversity category. In general, low-diversity areas can be considered segregated and moderate diversity tracts less so. Importantly, the typology allows us to distinguish between low/moderately diverse neighborhoods that are still predominantly White, for example, from low/moderately diverse neighborhoods that are still predominantly Black.

We operationalize neighborhood racial and ethnic change as tract-level movement along the MixedMetro typology. With thirteen possible categories in 2000 and thirteen possible categories in 2010, there are 169 possible neighborhood transitions; however, the typology can be leveraged to isolate change along its two conceptual dimensions. To this end, the variable of interest will be a reduced set of categories, indicating one of three possible outcomes: (1) a tract

persists in the same MixedMetro category, (2) a tract retains its most prevalent racial group but changes in level of diversity (e.g. low to moderate, moderate to low) or (3) a tract changes in its most prevalent racial group, regardless of a change in diversity (e.g. White to Black, Black to Latino, Asian to White, etc). Due to the small number of tracts observed in certain categories in metropolitan areas over the period of analysis, we will focus on the outcomes of only six categories of tracts: low diversity White, Black and Latino dominant and moderate diversity White, Black and Latino dominant.

## 4.2 Centrality and adjacency

The primary goal of this analysis is to identify spatial mechanisms of neighborhood racial and ethnic change. We focus on two possible spatial mechanisms: centrality and adjacency. To assess the first hypothesis about spatial assimilation and diversity in less central areas, we create a measure of centrality that quantifies the relative position of each tract with respect to the distribution of all tracts by population density within its metropolitan area. Because large CMSAs often have more than one center, we first group tracts by primary MSAs (PMSAs) instead of MSAs or CMSAs (e.g. Dallas-Fort Worth CMSA consists of two PMSAs, Dallas and Fort Worth-Arlington, each with a different center). Within each PMSA we then calculate the distance of each tract to all other tracts and determine a PMSA center by identifying the tract for which the vector of distances to all other tracts is most negatively correlated with the vector of tract population densities. In general, the central tract identified by this method tends to be dense, but more importantly, it is surrounded by tracts of high density (relative to its PMSA) and is located far from tracts of low density on the urban fringe. Within each PMSA, we then determine the median-distance-to-center of all tracts and to account for the differences in land area between metropolitan areas, use the median-distance-to-center to calculate a PMSA-specific relative

centrality for each tract that is equivalent to its distance to the center tract divided by the median distance to the center tract. Finally, we normalized this measure relative distance by taking its log so that a negative value indicates that a tract is closer to the center than the median tract in its primary MSA and a positive value indicates the opposite (e.g. a tract with relative centrality of -0.693 is  $(e^{-0.693})$  0.5 or half the distance to the center relative to the median tract in its PMSA). We will test the first spatial assimilation hypothesis by determining whether more diverse tracts have less relative centrality than segregated tracts.

Our first and third place stratification hypothesis deal with the effect of same group proximity (clustering). Just as the Schelling (1969) model predicts that individuals living proximate to others of their same group will be less likely to move, we predict that neighborhoods proximate to neighborhoods of the same type will be less likely to change category. To measure the effect of same group proximity (clustering), we assign each tract the count of similar tracts that are adjacent using queen's adjacency. For example, one low diversity White tract might be adjacent to three low diversity White tracts while another low diversity White tract might be adjacent to zero such tracts. While the number of neighbors a tract has can vary, the mean is just above six (6.24), an average that is relatively consistent by MixedMetro category (low: 6.03 for low diversity Asian tracts; high: 6.34 for moderate diversity Latino tracts). We will test if less diverse tracts exhibit higher clustering by comparing the count of similar adjacent tracts by MixedMetro category. Later, we will estimate the effect of clustering on neighborhood change by modeling the relationship between the count of similar adjacent tracts and a variable indicating neighborhood change.

My remaining three hypothesis deal with the effect of particular types of tract categories on other categories. To measure these effects, we use queen's adjacency to create a set of

dummies measuring the presence of an adjacent tract for each of the six largest Mixed Metro categories plus the high diversity category. For example, the low diversity Latino adjacency dummy will take a value of one if a tract is adjacent to one or more low diversity Latino tracts. Using these dummies we will be able to test whether White tracts are more likely to change if they are adjacent to Black tracts relative to being adjacent to Latino tracts and whether Black tracts are more likely to become diverse when they are adjacent to Latino tracts.

### 4.3 Compositional controls

The primary dataset contains information on the 1990, 2000 and 2010 composition of each tract. Though the period of analysis is the decade between 2000 and 2010, we include a variable indicating whether the 1990 MixedMetro classification matches the 2000 MixedMetro classification. This variable will allow us to test for temporal lag in compositional change. Similarly, another measurable indicator of tract change is within tract (micro-scale) unevenness. To measure possible activity below the tract level, we applied the MixedMetro typology to the universe of Census 2000 block groups and generated a variable comprising the count of internal block groups that are classified differently from the parent tract. This variable will help control for inconsistencies in tract boundaries and allow us to test whether tracts that register as moderately diverse but have variable diversity and segregation across their block groups are more or less stable than moderately diverse tracts comprised of moderately diverse subunits.

### 4.4 Metropolitan- and tract-level socio-economic controls

To complement the compositional and geographic variables, the dataset is joined to a set of socio-economic control variables measured at either the tract or the MSA level. These covariates are taken from the 2000 Census Summary files made available by NHGIS (Minnesota

Population Center, 2011). The tract-level variables largely parallel those used in Logan and Zhang (2010) including median income, percent 65 or older, and percent female headed households by tract. We also added a measure of transience, calculated from Census data as the percentage of households that reported living at a different address five years prior to Census 2000 data collection. These variables are meant to control for obvious socio-economic correlates of mobility and neighborhood change such as age, income and family structure. How these variables might be associated with measure of neighborhood change may vary by group, but in general we would expect higher tract income to be associated with more neighborhood stability while older tract age, more female headed households and greater household hold transience to be associated with less stability.

In addition to tract-level characteristics, we wanted to control for obvious variations across metro area. To do so, we added a battery of socio-economic and demographic characteristics summarized at the MSA-level aggregated up from data by county within OMB-defined MSAs. These data include new housing units (built after 1990) expressed as a percentage of the total housing units in the metro area, log of the MSA population and MSA-level poverty measured as the percent of the metro population below poverty. Finally, we included a variable on MSA-level entropy so as to control for the metro-level racial composition. These variables are meant to control for metropolitan characteristics that might be associated with certain patterns of neighborhood change and neighborhood equilibrium. Obviously, we would expect more diverse metropolitan areas to have more diverse neighborhoods and metropolitan areas with more poverty to have more segregation. We expect larger metropolitan population size to be associated with higher rates of neighborhood change as higher absolute numbers of people would suggests higher absolute mobility (number of moves). Finally, we expect that metropolitan areas with

higher percentages of new housing would be more diverse as new opportunities for housing might potentially lead to greater outmigration from segregated areas.

## 5. Descriptive Results

### 5.1 Distribution of tract counts and tract population by category: 2000 to 2010

Of the 226.1 million people living in a metropolitan area in 2000, 55.4% lived in a census tract classified as low diversity while a corresponding 44.6% lived in a census tract classified as moderate or high diversity (Table 5.1). Holding tract boundaries constant but reclassifying tracts based on their new racial compositions, the percentage of the population in low-diversity tracts dropped to 42.9% by 2010, driven by a decline in the population living in low-diversity White and low-diversity Black tracts and a substantial increase in the population living in moderate-diversity White and moderate diversity Latino category tracts. Reflecting growth in Asian and Latino populations, both low-diversity Asian and low-diversity Latino tracts saw their share of the population rise on the decade; however, across the board the number of people living in higher diversity settings grew. The four largest moderate-diversity categories, White, Black, Asian and Latino, and the high-diversity category all experienced increases in their share of the population.

Table 5.1. Total MSA population by MixedMetro tract category (Census 2000 tract definitions)

<i>MM tract category</i>	<i>2000</i>		<i>2010</i>	
	<i>tot</i>	<i>pct</i>	<i>tot</i>	<i>pct</i>
Low-diversity White	108,068,060	47.80%	80,957,380	32.43%
Low-diversity Black	10,164,676	4.50%	8,873,953	3.55%
Low-diversity Asian	316,777	0.14%	397,889	0.16%
Low-diversity Latino	6,653,804	2.94%	9,062,458	3.63%
other Low-diversity	64,302	0.03%	60,801	0.02%
<i>Low-diversity sub-total</i>	<i>125,267,619</i>	<i>55.41%</i>	<i>107,145,884</i>	<i>42.91%</i>
Moderate-diversity White	64,579,586	28.56%	91,702,823	36.73%
Moderate-diversity Black	11,492,450	5.08%	14,134,111	5.66%
Moderate-diversity Asian	2,812,014	1.24%	4,499,766	1.80%
Moderate-diversity Latino	17,858,783	7.90%	26,763,037	10.72%
other Moderate-diversity	27,772	0.01%	27,112	0.01%
<i>Moderate-diversity sub-total</i>	<i>96,770,605</i>	<i>42.80%</i>	<i>137,126,849</i>	<i>54.92%</i>
High-diversity	4,044,917	1.79%	5,402,921	2.16%
<b><i>Total</i></b>	<b><i>226,083,141</i></b>	<b><i>100.00%</i></b>	<b><i>249,675,654</i></b>	<b><i>100.00%</i></b>

The population shares by MixedMetro category presented in Table 5.1 are just one way of considering tract-level segregation and tract-level change using the MixedMetro typology. It bears mentioning that the share of metro population in Black dominant tracts, for example, is not the same of the share of metro population that is Black (see Table 5.2). In fact, in 1999 OMB-defined MSAs only a small majority (53.4%) of Blacks lived in Black dominant tracts in 2000. In contrast, the vast majority of Whites (93.6%) lived in White dominant tracts. This pattern of White spatial concentration is in large part the outcome of Whites being the majority population; however, low percentages of Whites in moderate-diversity Black tracts compared to moderate diversity Latino is further evidence for the well-documented avoidance of Black neighborhoods by Whites (Logan and Zhang, 2010; Crowder and South, 2008). Asians are by far the least segregated minority group with a considerable majority (61.9%) in White-dominant tracts. Notably, very few (2.4%) Asians are in low-diversity Asian tracts while a significant share (10.4%) live in moderate-diversity Latino tracts. The population of Blacks and the population of Latinos in MSAs are relatively similar in size and have fairly similar population distribution across the MixedMetro categories by tract in 2000: 53.4% of Blacks live in Black dominant tracts compared to 50.8% of Latinos in Latino dominant tracts, while 36.4% of Blacks live in White dominant tracts compared to 39.0% of Latinos. Yet the segregation of the two groups differs considerably as 30.7% of Blacks live in low-diversity Black tracts in contrast to only 18.3% of Latinos in low diversity Latino tracts. To put it another way, two thirds of the 16 million Latinos living in predominantly Latino tracts live in moderate-diversity Latino tracts; for the 16 million Blacks living in predominantly Black tracts, only a third live in moderate-diversity Black tracts.

Table 5.2. Group population by MixedMetro tract category (Census 2000 tract definitions)

<i>MM tract category</i>	<i>White</i>		<i>Black</i>		<i>Asian</i>		<i>Latino</i>	
	<i>tot</i>	<i>pct</i>	<i>tot</i>	<i>pct</i>	<i>tot</i>	<i>pct</i>	<i>tot</i>	<i>pct</i>
Low-diversity White	98,061,509	65.61%	3,113,789	10.34%	2,402,824	21.55%	3,374,020	10.52%
Low-diversity Black	480,365	0.32%	9,253,287	30.73%	57,922	0.52%	292,083	0.91%
Low-diversity Asian	22,875	0.02%	3,478	0.01%	270,931	2.43%	15,574	0.05%
Low-diversity Latino	493,956	0.33%	155,880	0.52%	90,204	0.81%	5,872,231	18.31%
other Low-diversity	1,688	0.00%	111	0.00%	90	0.00%	3,318	0.01%
Moderate-diversity White	41,815,632	27.98%	7,831,911	26.01%	4,504,572	40.39%	9,148,077	28.52%
Moderate-diversity Black	2,719,707	1.82%	6,817,586	22.64%	318,125	2.85%	1,463,606	4.56%
Moderate-diversity Asian	633,197	0.42%	127,394	0.42%	1,551,051	13.91%	455,206	1.42%
Moderate-diversity Latino	4,017,047	2.69%	1,970,407	6.54%	1,157,519	10.38%	10,404,928	32.44%
other Moderate-diversity	7,008	0.00%	165	0.00%	144	0.00%	3,811	0.01%
High-diversity	1,215,420	0.81%	840,636	2.79%	798,522	7.16%	1,040,420	3.24%
<b>Total</b>	<b>149,468,404</b>	<b>100.00%</b>	<b>30,114,644</b>	<b>100.00%</b>	<b>11,151,904</b>	<b>100.00%</b>	<b>32,073,274</b>	<b>100.00%</b>

## 5.2 Socio-economic characteristics

There are prominent differences in the socio-economic characteristics of metro tracts by MixedMetro classification, as demonstrated in Table 5.3. Among low diversity categories, low-diversity White tracts have considerably higher prevalence of owner occupied homes and of individuals aged 25 or older with college educations. Low-diversity White tracts on average have the highest median household income (\$54,706). Low-diversity Latino tracts have the lowest mean rates of individuals aged 65 or older. Notably, all three low-diversity categories have comparable rates of transience measured as the share of households at a different address from five years prior (1995). In general, socio-economic statistics for moderate diversity tracts have similar distributions across the three groups and typically fall within the range of the corresponding statistics estimated for low diversity tracts. The levels of transience are all slightly higher for moderate-diversity categories compared to low-diversity categories while the percentages of 65 or older are all lower.

Table 5.3. Tract-level characteristics by 2000 MixedMetro category

MM tract category	total tracts	geographic characteristics			socio-economic characteristics				
		median relative tract centrality to metro pop centroid	mean pct of neighb tracts with same MM cat	mean pct of block grps with same MM cat	mean median income	mean pct 65 or older	mean pct in different house from '95	mean pct owner occupied household	mean pct female headed household
LD-White	24,195	1.28	81.4%	93.9%	\$54,706	13.7%	42.3%	76.0%	23.4%
LD-Black	3,206	0.50	67.4%	92.8%	\$26,698	11.4%	40.3%	46.7%	62.4%
LD-Latino	1,295	0.69	63.6%	89.3%	\$28,621	8.1%	45.0%	47.3%	33.9%
MD-White	14,199	0.95	56.4%	73.5%	\$46,421	10.5%	52.5%	57.3%	31.2%
MD-Black	3,041	0.67	35.4%	65.3%	\$31,937	9.4%	48.4%	47.1%	50.7%
MD-Latino	3,595	0.73	52.5%	73.9%	\$33,585	7.8%	50.7%	43.7%	37.7%

### 5.3 Geographical contexts – testing locational hypotheses

To test for our two locational hypotheses, we investigate the distribution of each of the six largest categories by relative centrality and clustering. The spatial assimilation model suggests that falling levels of metropolitan segregation will be manifested as increasing diversity in White suburban areas. To some extent this pattern is present in the data but only across Black dominated tracts: moderate diversity Black tracts tend to be less centrally located than low diversity Black tracts. For Latino dominated tracts there is virtually no difference between low- and moderate-diversity categories by relative centrality and for White tracts the pattern is reversed: moderate diversity tracts tend to be more centrally located than low diversity tracts. While diversity increases as one traverses out of the segregated urban core, it begins to fall as one approaches the predominantly White ex-urban periphery. The donut of diversity made up of inner-ring suburbs could be claimed as evidence for either the spatial assimilation model or the place stratification model. Non-Whites achieve higher levels of diversity as they relocate outside of the inner city; however, the process of their relocating in the suburbs entails a degree of further White flight into the periphery. The dynamics of centrality as they relate to patterns of neighborhood racial change will be further tested in the models discussed below.

The place stratification model suggests that neighborhood level diversity is inherently unstable as it is a reflection of neighborhood transition. As such we expect moderate diversity tracts to exhibit less clustering than low diversity tracts, and this is largely borne out by the data. Low-diversity White tracts exhibit higher levels of clustering than the other low-diversity categories as 81.4% of tracts neighboring low-diversity White tracts are also low-diversity White. The next highest level of concentration is observed among low-diversity Black tracts for which 67.4% of neighboring tracts are also low-diversity Black. Moderate-diversity tracts tend to

be in much more “mixed” settings with White and Latino moderate-diversity tracts all averaging a little over 50% of their neighboring tracts with the same category. Notably, moderate-diversity Black tracts have the lowest percentage of neighbors with the same category at 35.4%. As hypothesized (1.b.), segregated tracts are more clustered than diverse tracts.

#### 5.4 Tract transitions

The primary purpose of this analysis is to understand the geographical dimension of neighborhood change and what it can tell us about ongoing trends in segregation and diversification. The 2000 to 2010 transition matrix for the dataset of 51,109 MSA tracts along the MixedMetro typology can be seen in Table 5.4. The matrix is broken out into quadrants corresponding to low and moderate diversity categories. The diagonal of each quadrant is the persistence of the dominant group across the decade. For low-diversity categories, it is apparent that nearly all transitions that occurred were to their corresponding moderate-diversity categories (first quadrant diagonal), though not every low diversity category changed at the same rate. Low diversity Latino tracts were the most persistent with 92.2% remaining low-diversity Latino over the decade while on the other end, low diversity White tracts were the most likely to change as only 74.8% remained low diversity White.

The transition paths of moderate diversity tracts are more complicated. While their levels of persistence (fourth quadrant diagonal) are comparable to low diversity levels of persistence (second quadrant diagonal), moderate-diversity tracts that changed category did so in a heterogeneous way. First, a good number of moderate-diversity tracts became low-diversity tracts of the same type (third quadrant diagonal). A comparison of the diagonals of the first and third quadrants offers some heartening evidence for increasing diversity at local levels: with the

exception of the Latino categories, the shares of low-diversity tracts that transitioned to moderate diversity are greater than the shares of moderate diversity tracts that transitioned to low-diversity. Low-diversity White and low-diversity Black spaces declined on the decade. This pattern is particularly strong for White tracts; while 6,054 White dominated tracts went from low-diversity to moderate diversity a mere 190 went in the opposite direction. At the same time, a significant number of moderate-diversity tracts transitioned to a different moderate-diversity category (fourth quadrant off-diagonal). This trend was particularly strong for moderate-diversity White and moderate-diversity Black tract types.

Table 5.4. 2000 to 2010 tract transition matrix (all MSA tracts, Census 2000 boundaries)

		2010 MixedMetro Category											2000 totals	
		LD White	LD Black	LD Asian	LD Latino	LD other	MD White	MD Black	MD Asian	MD Latino	MD other	HD		
2000 MixedMetro Category	LD White	<b>18,102</b> 74.8%	<b>1</b> 0.0%				<b>6,054</b> 25.0%	<b>28</b> 0.1%		<b>8</b> 0.0%		<b>2</b> 0.0%	<b>24,195</b> 100.0%	
	LD Black	<b>1</b> 0.0%	<b>2,709</b> 84.5%		<b>1</b> 0.0%		<b>18</b> 0.6%	<b>474</b> 14.8%		<b>2</b> 0.1%		<b>1</b> 0.0%	<b>3,206</b> 100.0%	
	LD Asian			<b>64</b> 86.5%					<b>10</b> 13.5%				<b>74</b> 100.0%	
	LD Latino				<b>1,194</b> 92.2%		<b>4</b> 0.3%	<b>1</b> 0.1%		<b>96</b> 7.4%			<b>1,295</b> 100.0%	
	LD other					<b>22</b> 88.0%	<b>1</b> 4.0%			<b>2</b> 8.0%	<b>0</b> 0.0%		<b>25</b> 100.0%	
	MD White	<b>190</b> 1.3%	<b>7</b> 0.0%		<b>2</b> 0.0%	<b>1</b> 0.0%	<b>11,169</b> 78.7%	<b>762</b> 5.4%	<b>223</b> 1.6%	<b>1,431</b> 10.1%		<b>414</b> 2.9%	<b>14,199</b> 100.0%	
	MD Black	<b>3</b> 0.1%	<b>288</b> 9.5%		<b>1</b> 0.0%		<b>226</b> 7.4%	<b>2,217</b> 72.9%	<b>7</b> 0.2%	<b>248</b> 8.2%		<b>51</b> 1.7%	<b>3,041</b> 100.0%	
	MD Asian			<b>28</b> 4.7%			<b>6</b> 1.0%	<b>2</b> 0.3%	<b>541</b> 90.0%	<b>13</b> 2.2%		<b>11</b> 1.8%	<b>601</b> 100.0%	
	MD Latino	<b>2</b> 0.1%			<b>399</b> 11.1%		<b>130</b> 3.6%	<b>28</b> 0.8%	<b>29</b> 0.8%	<b>2,983</b> 83.0%	<b>1</b> 0.0%	<b>23</b> 0.6%	<b>3,595</b> 100.0%	
	MD other					<b>1</b> 10.0%					<b>9</b> 90.0%		<b>10</b> 100.0%	
	HD						<b>77</b> 8.9%	<b>36</b> 4.1%	<b>66</b> 7.6%	<b>218</b> 25.1%		<b>471</b> 54.3%	<b>868</b> 100.0%	
			<b>18,298</b>	<b>3,005</b>	<b>92</b>	<b>1,597</b>	<b>24</b>	<b>17,685</b>	<b>3,548</b>	<b>876</b>	<b>5,001</b>	<b>10</b>	<b>973</b>	<b>51,109</b>
			2010 totals											

## 6. Assessing spatial determinants of neighborhood change

### 6.1 Analytic approach

The next phase of the analysis analyzes the determinants of changes described in Table 5.4 in a multivariate framework. Rather than estimating a global model of transition for all tract types, we estimate separate models of transition for specific tract types. This approach allows us to explore differences between groups in terms of their relationships to key variables of interest and eases estimation and interpretation of the results. As in the descriptive centrality analysis, we restricted this phase of the analysis to the six largest categories for which we have enough transition observations – low diversity White, low-diversity Black, low-diversity Latino, moderate diversity White, moderate-diversity Black, moderate-diversity Latino – estimating separate models for each category. For each model, the dependent variable measures transition over the period 2000 to 2010 and takes a value representing one of three possible tract outcomes: (1) a tract persists in the same category, (2) a tract retains its most prevalent group but changes in level of diversity or (3) a tract changes in its most prevalent group, regardless of a change in diversity. For each category, we model tract  $i$ 's outcome in metro  $j$  using multinomial logit regression:

$$Outcome_{ij} \sim Multinomial(\boldsymbol{\pi}_{ij})$$

$$\boldsymbol{\pi}_{ij} \sim \text{logit}^{-1}(\mathbf{X}_{ij}\boldsymbol{\beta} + \mathbf{Y}_j\boldsymbol{\gamma})$$

where  $\boldsymbol{\pi}_{ij}$  is a vector estimated probabilities for each of the three outcomes,  $\mathbf{X}_{ij}$  is a vector of covariates including adjacency, centrality, continuity, internal consistency and socio-economic tract-level characteristics and  $\mathbf{Y}_j$  is a vector of metro-level socio-economic characteristics

corresponding to the metropolitan area to which the tract belongs. Because we have two different measures of adjacency, one being a count of adjacent tracts in the same category and the other being a set of seven dummy variables indicating adjacency to one or more tracts in the seven MixedMetro categories: low diversity White, Black, and Latino, moderate diversity White, Black and Latino and high diversity, we run two separate models to test the effect of these measures for each MixedMetro category. In total, we fit 12 models: one count model and one dummy model of low-diversity persistence for each of the three low diversity categories (6 total) and one count model and one dummy model of moderate-diversity persistence for each of three moderate diversity categories (6 total).

The models generate many coefficients and standard errors, and these are reported in Appendix A. For ease of interpretation, results from the models will be presented graphically using predicted probabilities generated through simulation based on sample draws from the multivariate normal distribution using the estimated coefficients and their estimated variance-covariance matrix. Depending on whether the model uses adjacency dummies or same category adjacency counts, we generate one of two graphics. First, for the dummy models, we create rope ladder plots showing the estimated change in predicted probabilities (with 95% confidence intervals) given a unit change in a covariate while holding all other covariates at a conceptually useful constant. These estimates require comparing the estimated probabilities from two hypothetical scenarios: a base scenario in which all the variables are set to particular constants and the alternative scenario in which one variable has changed. For each covariate simulation, the base model will be the following unless otherwise specified: dummy for same group adjacency set to one, all other adjacency dummies set to zero, and the remaining tract-level and metropolitan-level covariates set to their means. Thus, when we simulate the effect of adjacency

to moderate diversity Latino tracts on low diversity White tracts, for example, we are comparing two scenarios: one in which a low diversity White tract borders nothing but low diversity White tracts and another in which a low diversity White tract borders low diversity White tracts *and* at least one moderate diversity Latino tract. In both scenarios all other variables are held at their means. When estimating the predicted change in probability associated with a change in a tract level or metropolitan level variable, the adjacency dummies are all set to zero except for the dummy indicating adjacency to similar neighbor tracts.

For the six models estimating the effect of same category adjacency counts we generate a graph of the change in predicted probabilities of transitions with 95% confidence intervals as the same category adjacent tract count ranges from zero to six, holding all other variables in the model fixed at their means. Such a plot might demonstrate, for example, that for moderate diversity White tracts, a higher count of adjacent moderate diversity White tracts is associated with an increasing probability of transition to the low diversity White category and a decreasing probability of transition to a non-White category, while having no effect on the persistence in category.

## 6.2 Modeling White neighborhood change using adjacency dummies

Three of our hypotheses deal with the probability of neighborhood change given adjacency to different kinds of neighborhood types. From the spatial assimilation model, we expect White neighborhoods adjacent to non-White neighborhoods and Black neighborhoods adjacent to Latino neighborhoods to become more diverse. From the place stratification model, we expect White neighborhoods to turn over when adjacent to non-White neighborhoods.

Figures 6.1 through 6.6 show mixed support for these hypotheses. To understand the spatial mechanisms of neighborhood change among White neighborhoods, we look to Figure 6.1 and Figure 6.4 which show the multinomial logistic results for the low-diversity White and moderate diversity White models respectively. For low diversity White tracts (Figure 6.1), the three strongest predictors of transition to moderate diversity are higher metropolitan level entropy, internal block group inconsistency and adjacency to a moderate diversity White tract. The large estimated effect of higher metropolitan level entropy accounts for some variation in diversity across metropolitan areas. White tracts in more diverse metropolitan areas in 2000 were significantly more likely to transition to moderate diversity White than equivalent tracts in less diverse metropolitan areas. Though it seems obvious, there is no guarantee that aggregate diversity will be reflected in neighborhood level diversity, and the strong effect of this covariate suggests that places with higher initial aggregate diversity experienced rising neighborhood level diversity over the decade.

The other two prominent predictors of change among low diversity White tracts, internal block group inconsistency and adjacency to moderate diversity White tracts, demonstrate the strong spatiality of neighborhood change among White neighborhoods. When a low diversity White tract contains a block group that is not low diversity White (i.e. a block group that is moderate diversity White or some other non-White category), the predicted probability of transition to moderate diversity White goes up by nearly 0.3. This finding suggests that the transition from low diversity White to moderate diversity White between 2000 and 2010 was typically not the result of an even diffusion of non-Whites into White neighborhoods but was instead foreshadowed by uneven changes within the neighborhood that had already occurred by 2000. Adjacency to moderate diversity White tracts also has a strong effect on low diversity

White change. Notably, while adjacency to moderate diversity Black and moderate diversity Latino tracts also have a positive effect on low diversity White transition to moderate diversity, their effect is less pronounced than adjacency to moderate diversity White tracts.

A different side to White neighborhood change is presented in Figure 6.4 which shows modeling results for moderate diversity White neighborhoods. Due to their higher overall rates of change, moderate diversity White tracts appear to be more sensitive to the covariates in our models than low diversity White tracts. The predictors of transition to a non-White category with the greatest effect are adjacency to black and Latino moderate diversity tracts, and the strongest predictor of moderate diversity White tract persistence is adjacency to low diversity White tracts. This finding aligns with prior research on White flight and place stratification. Moderate diversity White tracts are more likely to turn over when they are adjacent to non-White neighborhoods and less likely to turn over when they are adjacent to low diversity White neighborhoods.

Other effects suggest that relative location and metropolitan context also condition White tract transitions. First, turnover of moderate diversity White tracts is negatively associated with centrality. In the years between 2000 and 2010, moderate diversity White tracts were more likely to transition to non-White categories if they were located further from the urban core. This is somewhat of an inversion of the traditional ecological succession model and likely reflects White gentrification in central areas and racial succession associated with the suburbanization of non-Whites. Notably, centrality has a much more limited effect on the transitions of low diversity White tracts. Low diversity White tracts are significantly more likely to transition to moderate diversity White when they are more central, but this effect is somewhat overshadowed by other spatial covariates related to adjacency and internal block group inconsistency. Second, unlike for

low diversity White tracts, the outcomes for moderate diversity White tracts do not appear to be affected by metropolitan level entropy. Higher metropolitan level entropy is predictive of increasing diversity in White neighborhoods but not necessarily of their succession.

Other control variables are largely similar in effects between the low diversity White model and moderate diversity White model and consistent with expectations. Higher median income is associated with persistence in both models as is higher percentages of residents 65 years old or older. In both models, the temporal lag variable has a significant negative effect on persistence. This is somewhat counter to expectation but is likely picking up on the slow pace of neighborhood change: neighborhoods that transitioned to low-diversity White between 1990 and 2000 are significantly less likely to transition out of this category between 2000 and 2010. The fact that moderate diversity White tracts exhibit the same pattern with respect to temporal lag suggest that there is some stability in moderate diversity White space. Higher rates of household turnover are negatively associated with low diversity White neighborhood persistence, yet somewhat perplexingly, are associated with moderate diversity White stability. Metropolitan areas with higher percentages of new housing also experience less stability in the White neighborhood categories. This might be due to increased housing opportunities resulting in greater residential churn.

To summarize, there is evidence that where low and moderate diversity White neighborhoods were located in relation to their primary MSA center and with respect to other kinds of neighborhoods in 2000 had a significant bearing on the kinds of change they experienced 2000 to 2010. While low diversity White neighborhoods were more likely to transition to moderate diversity White when adjacent to Black and Latino neighborhoods, adjacency to moderate White tracts and internal block group inconsistency had strong effects.

This somewhat unexpected finding can be interpreted as evidence for a spatially contiguous pattern by which non-White groups diffuse through White neighborhoods but also that Whites are sensitive to low percentages of non-Whites in proximate areas. For moderate diversity White neighborhoods, adjacency to low diversity White neighborhoods encouraged stability while adjacency to non-White neighborhoods encouraged change. More centrally located White neighborhoods were more stable while less central White neighborhoods were more likely to turnover to non-White groups.

### 6.3 Modeling Black and Latino neighborhood change using adjacency dummies

Though the spatial assimilation and place stratification models are primarily concerned with the diversity and neighborhood succession of White neighborhoods, valuable context is provided by the models predicting the trajectory of Black and Latino neighborhoods. From the spatial assimilation model, we hypothesized that the lower socio-economic status of Blacks and Latinos combined with the fast growth of the Latino population should result in Blacks and Latinos occupying similar neighborhoods in metropolitan areas where both groups live in considerable numbers. In particular, we predicted that low-diversity Black tracts adjacent Latino tracts would become moderate diversity Black tracts. As with the hypotheses pertaining to White neighborhoods, this dynamic is only partially borne out in the modeling results. Notably, as with low diversity White neighborhoods, the strongest predictors of low diversity Black neighborhood transition to moderate diversity Black are internal block group inconsistency and adjacency to moderate diversity (in this case) Black tracts. Once again as with low diversity White neighborhoods, these findings demonstrate the spatiality of change undergoing homogeneous Black space in metropolitan areas. Tract level change is often prefigured by uneven change happening below the tract level and predicted by the presence of moderately diverse Black

neighborhoods nearby. Adjacency to moderate diversity Latino and moderate diversity White tracts are associated with increased diversity in low diversity Black neighborhoods but the effects of these variables are less substantial than for adjacency to moderate diversity Black.

Results from the moderate diversity Black transition model are by far the most dynamic and complicated of any of the six adjacency count models. To start, not many covariates are predictive of moderate diversity Black persistence. In fact, only location in a small metropolitan area and high household turnover appear to be positively associated with moderate diversity Black tract persistence. Arguably, adjacency to moderate diversity White tracts has somewhat of a moderating effect on moderate diversity Black tract instability as it reduces the likelihood they transition to low diversity Black but does not significantly increase the likelihood they transition to a non-Black category, but this effect is small. By and large, most covariates are associated with a transition out of the moderate diversity Black category to either low diversity Black (higher metro-level poverty, higher tract median income, adjacency to low diversity Black tracts) or to a non-Black category (higher tract level household turnover, temporal lag, internal block group inconsistency, adjacency to moderate diversity Latino or high diversity tracts, increased centrality). While being proximate to Latino neighborhoods somewhat increases the likelihood of low diversity Black neighborhood transition to moderate diversity Black as we hypothesized, it greatly increases the likelihood of moderate diversity Black neighborhood transition to a non-Black (typically Latino) category. This finding is consistent with a neighborhood succession dynamic from Black to Latino neighborhoods. In terms of centrality, being more centrally located has a significant but small effect on low diversity Black transition to moderate diversity Black and a significant and fairly large effect on moderate diversity Black transition to a non-Black category. More centrally located low diversity Black tracts are more likely to transition to

moderate diversity Black while more centrally located moderate diversity Black tracts were more likely to transition to a non-Black category. This suggests somewhat of a shift in relative location of Black urban space away from the central areas towards inner ring suburbs as the relative stability of both kinds of Black tracts is lower in more central areas.

The models predicting change among low diversity and moderate diversity Latino tracts are presented in Figures 6.3 and 6.6 respectively. Overall, low diversity Latino tracts were the most persistent of any category of tract. Very few covariates in the model have a strong effect on low diversity Latino tract change. Low diversity Latino tracts in metropolitan areas with high poverty are even more likely to remain low diversity Latino than those in less impoverished metros while proximity to high diversity tracts appears to be the one large and statistically significant predictor of low diversity Latino neighborhood change. Meanwhile, the strongest predictors of moderate diversity Latino persistence are adjacency to high diversity tracts and higher rates of metropolitan level poverty. Surprisingly, adjacency to moderate diversity White tracts has a positive effect on both persistence and transition to a non-Latino category. The strongest predictor of moderate diversity Latino transition to low diversity Latino is adjacency to low diversity Latino, an indication of an expanding Latino enclave.

To summarize, findings from the models pertaining to the transitions of Black and Latino neighborhoods suggest that adjacency to Latino neighborhoods increases the likelihood of moderate diversity Black neighborhood transition to non-Black categories. While there has been an increase in the number of moderate diversity Black neighborhoods, these neighborhoods tend to be unstable overtime and either transition to low diversity Black or a non-Black category. Growth of the Latino population relative to the Black population has introduced a dynamic of neighborhood succession in some areas.

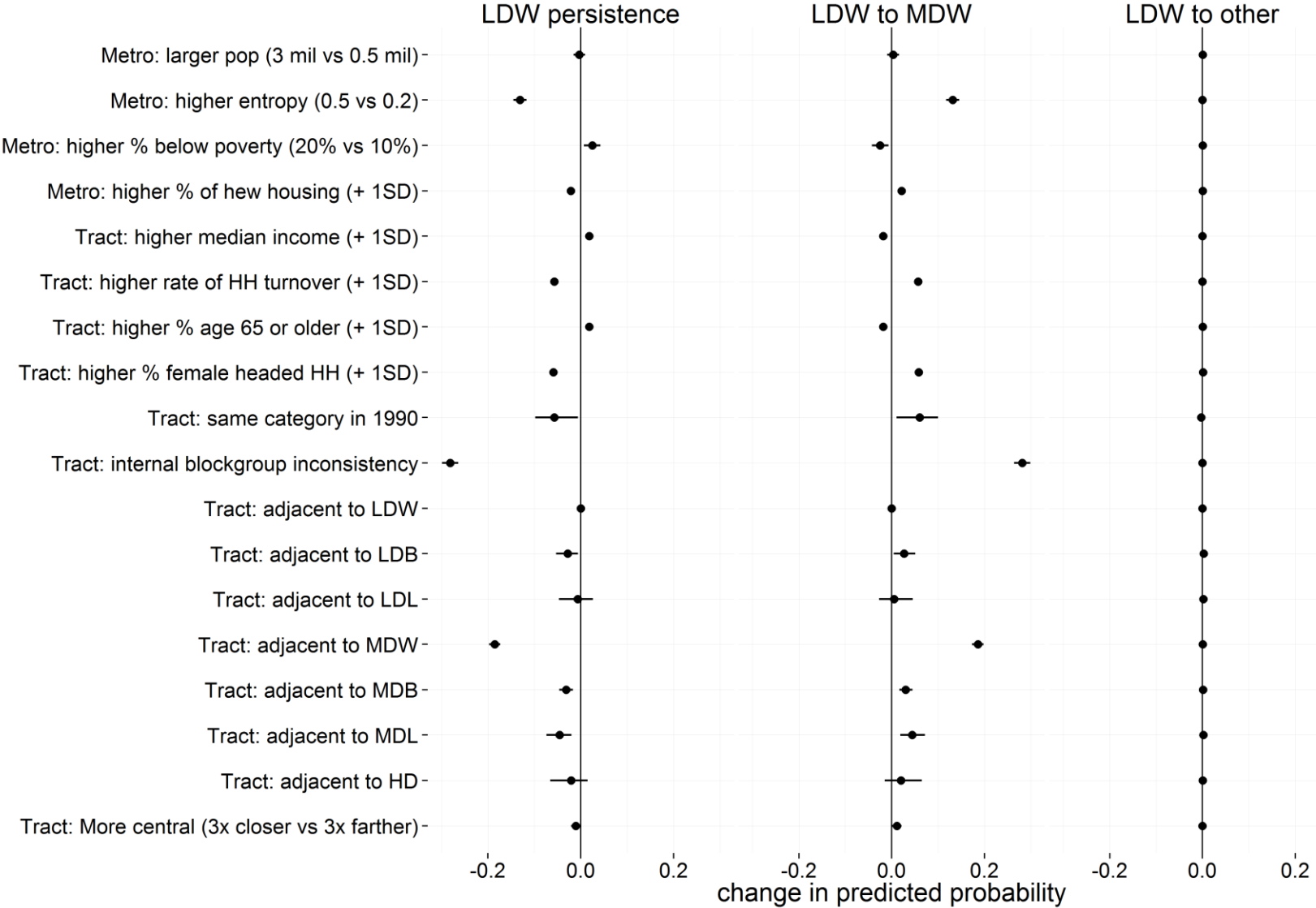


Figure 6.1. Low diversity White predicted effect (first difference) plots from multinomial logit model

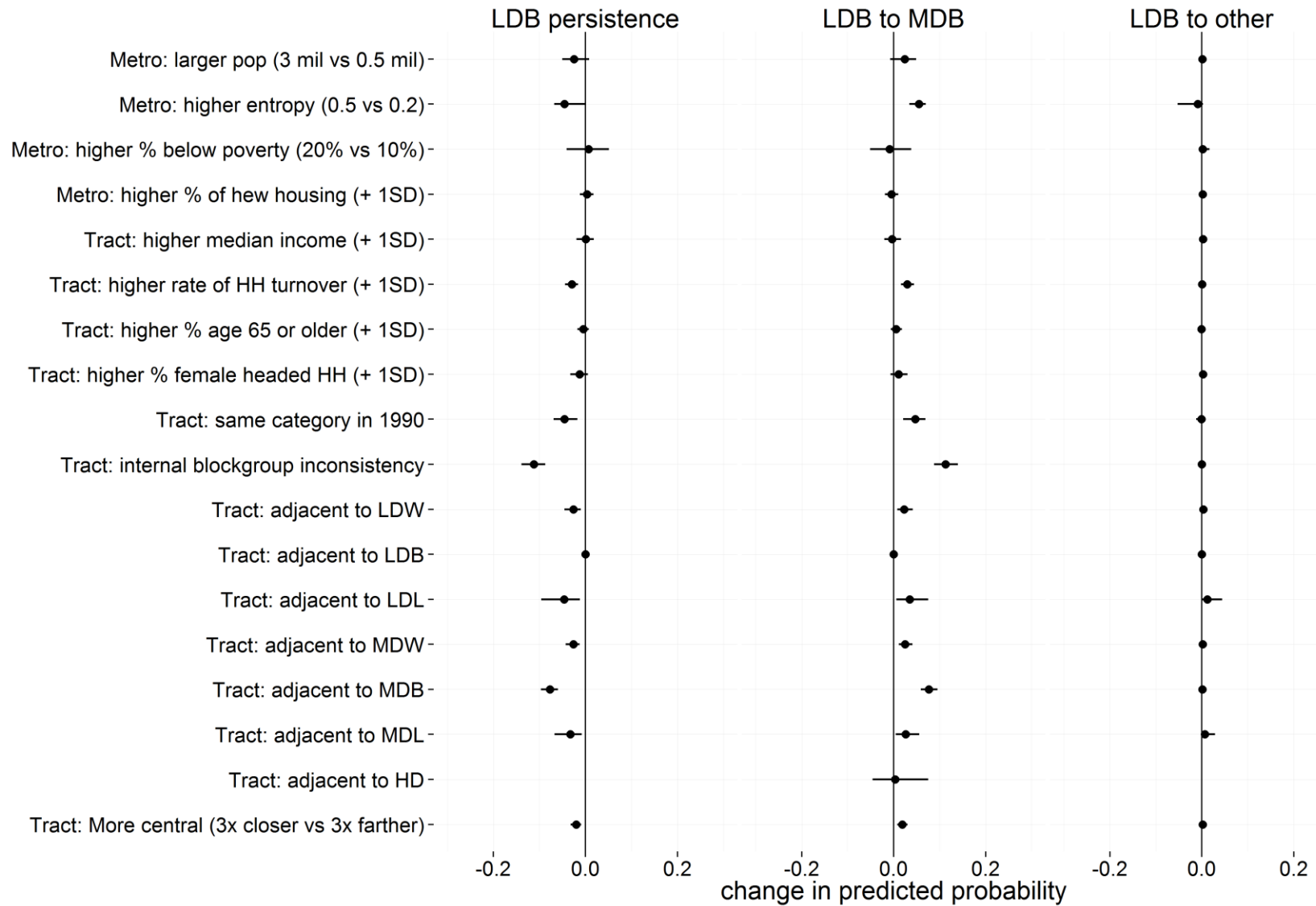


Figure 6.2. Low diversity Black predicted effect (first difference) plots from multinomial logit model

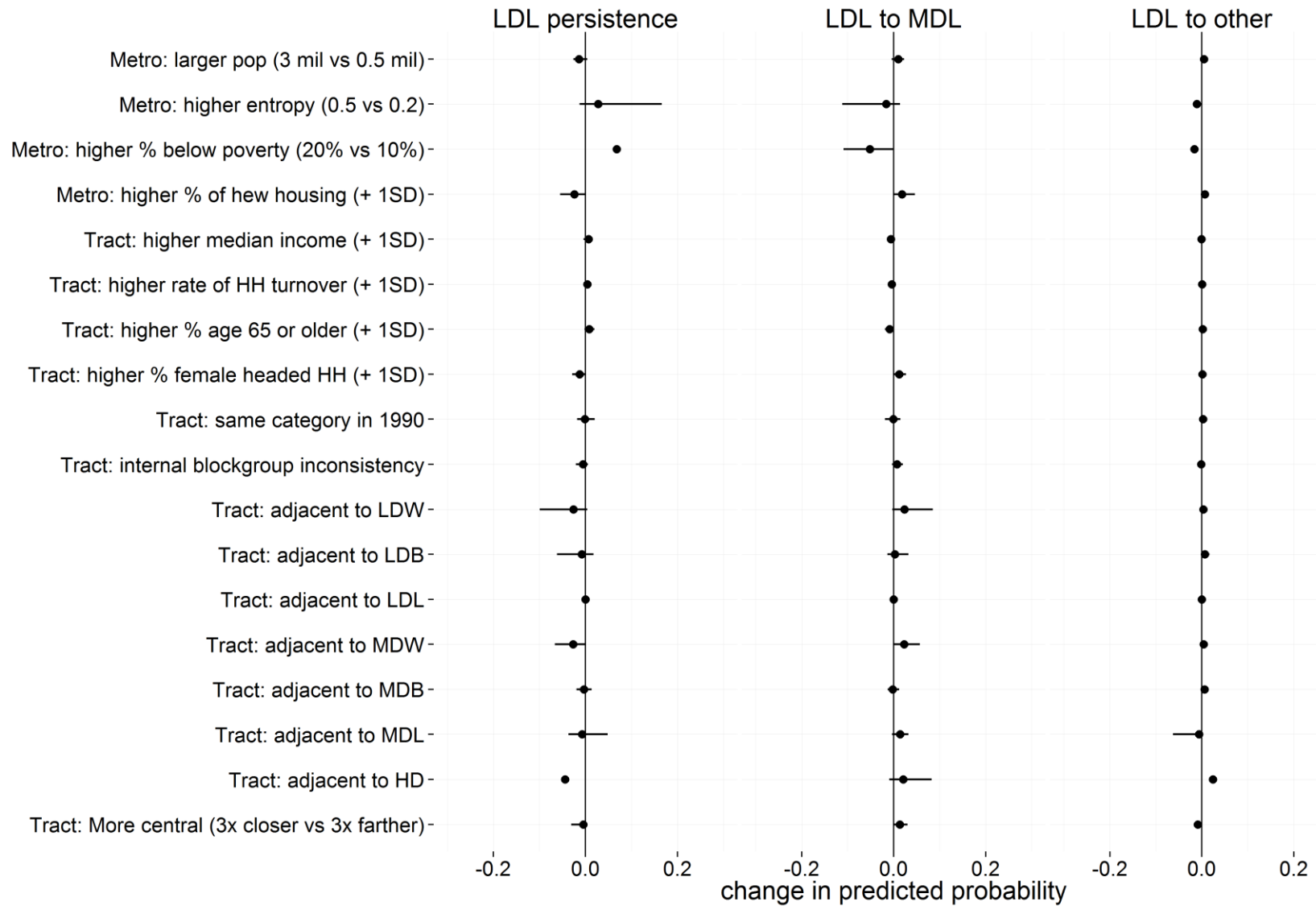


Figure 6.3. Low diversity Latino predicted effect (first difference) plots from multinomial logit model

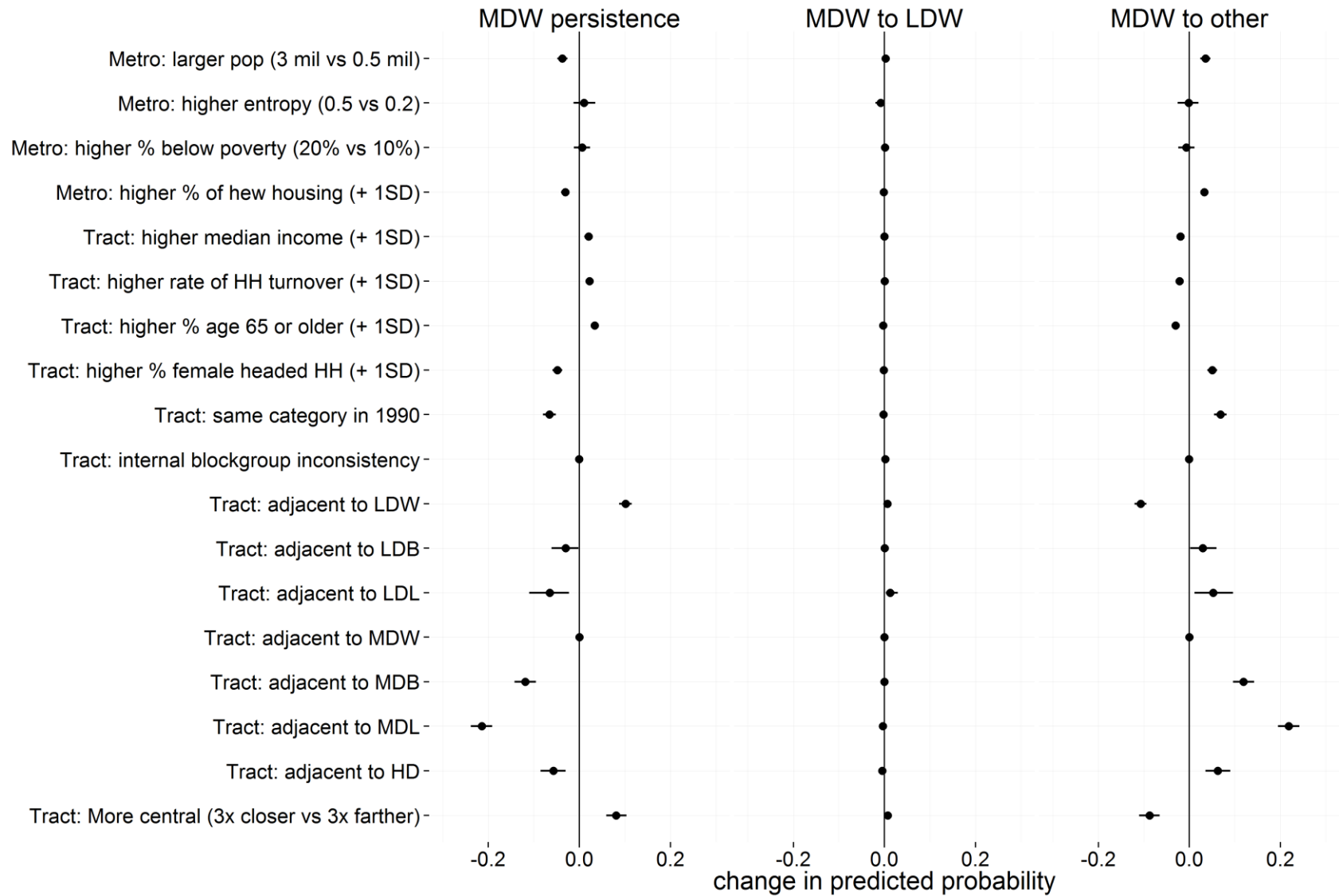


Figure 6.4. Moderate diversity White predicted effect (first difference) plots from multinomial logit model

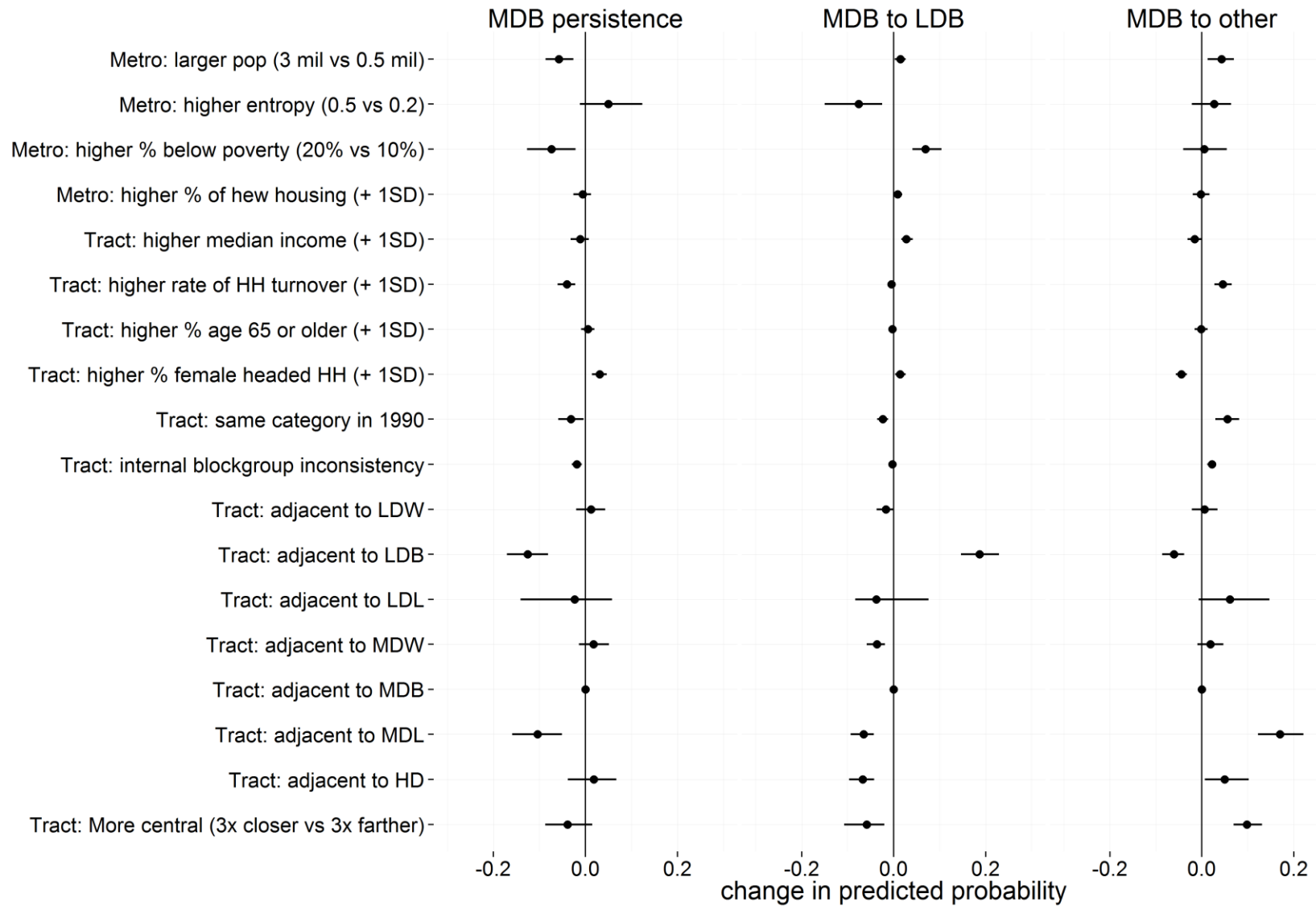


Figure 6.5. Moderate diversity Black predicted effect (first difference) plots from multinomial logit model

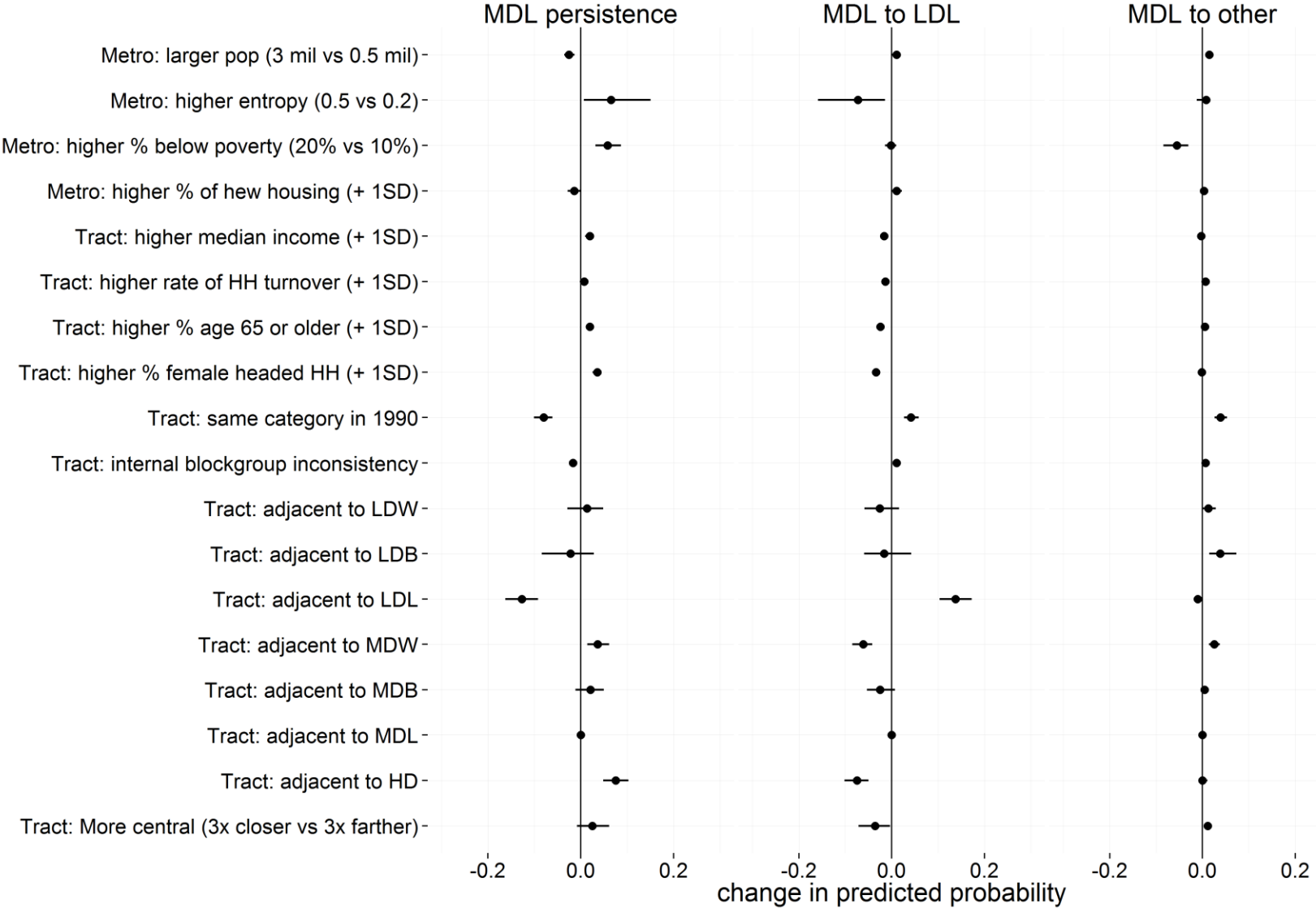


Figure 6.6. Moderate diversity Latino predicted effect (first difference) plots for multinomial logit model

#### 6.4 Testing the clustering hypothesis: modeling change using adjacency counts

A second set of multinomial logit models estimate the effect of clustering on tract change while controlling for tract centrality, temporal lag, internal consistency, and socio-economic characteristics observed at the tract and metropolitan level. The key covariate in these models is a count of the number of adjacent tracts that are of the same category. This covariate measures the degree to which the clustering of certain neighborhood contexts moderates their rates of change. The modeled effect of the adjacency count covariate in these six models is presented graphically in Figure 6.7 using simulated predicted probabilities and 95% confidence intervals.

Results from the multinomial logit models demonstrate considerable variation in the effect of clustering on different neighborhood types and their propensities of change. All three low diversity categories are most likely to transition to their corresponding moderate-diversity categories when they are adjacent to fewer like tracts, and the probability of transitioning to moderate diversity declines as the degree of clustering increase. For low-diversity Black tracts in particular, the greater the clustering the more likely they are to remain low-diversity Black. For low-diversity White tracts, the effect of clustering is less pronounced. This suggests that the processes governing the diversification of predominantly White neighborhoods is less affected by macro-level concentration of White space. When low diversity White tracts are adjacent to five or more low diversity White tracts there remains a non-trivial probability (~15%) that they will transition to moderate diversity White. For low-diversity Black tracts adjacent to five or more low diversity Black tracts, the probability of transition to moderate diversity approaches zero. The effect of clustering on low diversity Latino tracts is more difficult to model as so few of these tracts transition out of their 2000 category. That being said, the models indicate that the

low diversity Latino tracts that did transition to moderate diversity Latino or other categories had fewer low diversity Latino neighbors.

Together with the results from the low diversity adjacency count models, results from the moderate diversity adjacency count models depict a nuanced story with respect to neighborhood change and clustering. The most notable result from the moderate diversity models is that the effect of same category clustering is almost nonexistent for moderate diversity White tracts. Moderate diversity White neighborhoods remain moderate diversity White at a rate of just over 0.8 regardless of the number of other moderate diversity White tracts to which they are adjacent. Meanwhile the clustering of moderate diversity Black and moderate diversity Latino tracts appears to somewhat attenuate their transitions to other categories. Compared to moderate diversity White tracts, however, increased clustering of moderate diversity Black and moderate diversity Latino tracts also increases their rates of transition to their respective low diversity categories, suggesting a dynamic of succession. This finding supports our hypothesis that increased concentration of Latino neighborhoods leads to lower diversity in these areas. Notably, this pattern holds for Black neighborhoods as well.

An interesting story also emerges with respect to group change and clustering. Though some transitioned to their respective moderated diversity category, low diversity tracts -- White, Black or Latino -- were highly unlikely to change predominant group over the course of the decade. If a tract changed in its predominant racial or ethnic composition, it almost always started off as moderated diversity in 2000. While moderate diversity White tracts changed dominant group a high rate (~19%) regardless of the number of similar adjacent tracts, moderate diversity Black tracts adjacent to zero similar tracts changed dominant group at the highest rate

(~23%). This suggests that moderate diversity Black tracts are the least stable over time when not part of a larger moderate diversity same-race cluster.

To summarize, clustering appears to attenuate the probability of neighborhood change when the neighborhood is segregated. Tracts with predominantly Black compositions – low diversity and moderate diversity – are the most sensitive to the clustering effect. Specifically, low and moderate diversity Black tracts are the most likely to transition when they are adjacent to zero like tracts and more likely to either persist as low diversity or transition to low diversity as their macro-level concentration increases.

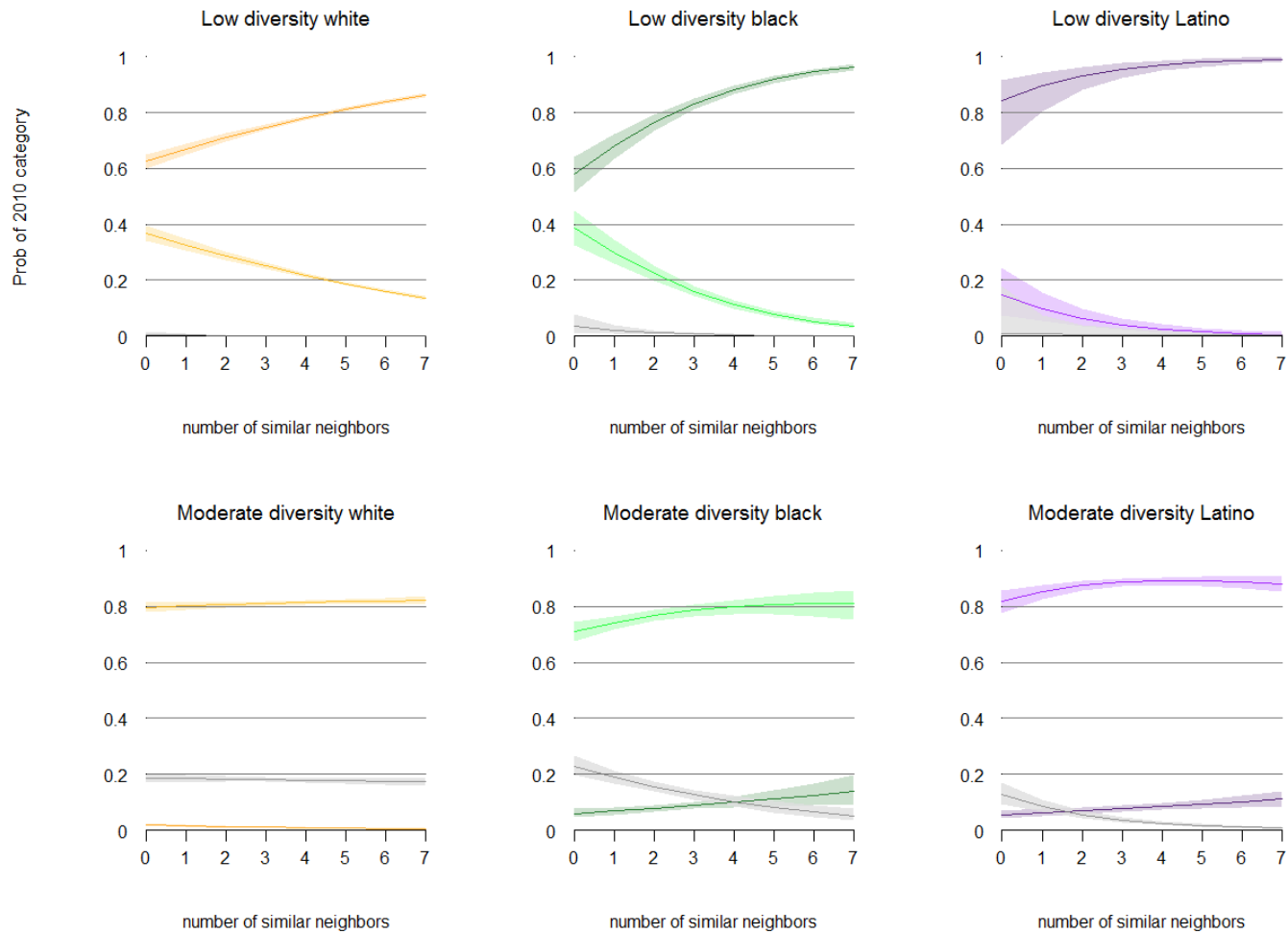


Figure 6.7. Predicted probability plot for six category transitions as a function of the count of similar adjacent tracts

## 7. Conclusion

Results from this analysis have demonstrated that there was a geographic pattern of segregated and diverse neighborhoods with respect to centrality and adjacency in 2000. Segregated neighborhoods of any category, White, Black, or Latino, tend to be adjacent similar neighborhoods (i.e. be located in large macro segregated areas), while diverse neighborhoods of any category tend to be adjacent to a greater variety of neighborhood types. This finding largely confirms our hypothesis that neighborhood level diversity is most often found in transition zones between macro segregated areas. In terms of centrality, the legacy of the Black inner city/White suburb is still present, but there is evidence that it is changing. In 2000, segregated Black neighborhoods were the most centrally located of any tract type while segregated White neighborhoods were the least centrally located. Diverse neighborhoods, be they White, Black or Latino dominated, all tended to be located between the two poles of White and Black segregated space. The general pattern appears to be, as one moves from the center to the edge, more segregation of non-White groups in central cities followed by more diverse but predominately non-White inner ring suburbs, followed by diverse White suburbs followed by segregated White places on the periphery. Notably, segregated Latino neighborhoods do not appear to differ much from more diverse Latino neighborhoods in terms of centrality.

This geography of neighborhood level segregation and diversity in 2000 was an expression of on-going processes that were then reflected in neighborhood change observed between 2000 and 2010. Findings from the multinomial logistic models demonstrate that the strong decline in the number of low diversity White neighborhoods and rise in the number of moderate diversity White neighborhoods was highly geographical. Low diversity White tracts adjacent to moderate diversity White tracts in 2000 were much more likely to transition to

moderate diversity White. In contrast, moderate diversity White neighborhoods adjacent to low diversity White neighborhoods were more stable. Adjacency to other moderate diversity White neighborhoods appeared to have little effect on moderate diversity White neighborhood stability. This represents somewhat of a Catch-22 for neighborhood-level diversity among White dominated tracts: adjacency to a low diversity White neighborhood will reduce the likelihood that a moderate diversity White neighborhood transitions to another racial category, but the effect of that same relationship on the low diversity White neighborhood is to increase the likelihood that it transitions to moderate diversity White. Because of these countervailing trends, the geography of moderate diversity White neighborhoods with respect to non-White neighborhoods becomes highly important for anticipating neighborhood succession.

Findings also indicate a change in the geography of Black dominated neighborhoods away from highly segregated neighborhoods in the central city to more diverse neighborhoods in the suburbs. That being said, adjacency to a segregated Black neighborhood or to a large number of other moderate diversity Black neighborhoods increases the likelihood that a moderate diversity Black neighborhood becomes less diverse. Here, again, we have a contradiction: the number of segregated Black neighborhoods has declined along with the concentration of the Black population in these kinds of neighborhoods, but there appear to be few processes encouraging the stability of moderate diversity black space. This suggests that while neighborhood level diversity is on the rise, the dynamics of neighborhood succession, in particular the avoidance of Black dominated neighborhoods by Whites, though weakened, is still present in the system.

When looking at the role specific kinds of adjacency play in neighborhood change, we hypothesized that low diversity and moderate diversity White tracts near non-White tracts would

be less stable. In a confirmation of the place stratification or White flight thesis, moderate diversity White tracts are less likely to transition to a non-White category when they are adjacent to low diversity White tracts; however, counter to the this thesis which predicts higher White sensitivity to Blacks, adjacency to Latino tracts has a larger positive effect on moderate diversity White tract transition to non-White than adjacency to Black tracts. This is perhaps due to strong Latino population growth over the decade. Meanwhile, there is evidence that centrality increases the stability of moderate diversity White tracts while diminishing the stability of moderate diversity Black and moderate diversity Latino tracts.

Going forward, there are a number of trends identified in this research that will have a bearing on the trajectory of further neighborhood change. For one, while there has been a strong increase in the number of moderate diversity White tracts, there is still evidence of White flight. Moderate diversity tracts do not become more likely to persist when they are adjacent to other moderate diversity White tracts; rather, they tend to be stabilized by proximity to low diversity White and destabilized by proximity to non-White tracts. In comparison to moderate diversity White tracts, moderate diversity Black and moderate diversity Latino tracts are much more likely to transition to low diversity same-race tract types, particularly when they are adjacent tracts in the corresponding low diversity category. Future research is needed to understand the precise mechanisms of neighborhood change, in particular, how different spatial patterns observed at the tract and block group level correspond to different types of flows of groups through space. Tying the spatial mechanisms analysis from this paper to an analysis of individual-level longitudinal data such as the Panel Study of Income Dynamics would be very enlightening in this regard.

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