Racial and Ethnic Disparities in the Residential Mobility Pathways of the Urban Poor: A Spatial and Network Approach

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Abstract

Studies that examine residential mobility across space tend to treat neighborhoods as independent units and ignore the strong socio-spatial and structural interdependencies between sending and receiving neighborhoods. This paper aims to contribute to the literature by examining these interdependencies and integrating two conceptual and methodological frameworks: spatial analysis and network analysis. Neighborhoods are conceptualized as vertices in a citywide network while the mobility patterns of families across space define inter-neighborhood ties. Results from analyses of residential history data between 1994 and 2002 of 959 low-income families who participated in the Moving to Opportunity (MTO) housing experiment in Boston show that neighborhood homophily characterizes respondents' patterns of mobility across space. Neighborhoods connected through moves by families in the control group are more similar in their high level of disadvantage than neighborhoods connected through complier moves, and the two patterns of inter-neighborhood exchanges tend to not overlap. While this indicates that ecological interdependencies may be overcome to an extent through interventions such as the MTO program, important racial/ethnic inequalities remain nonetheless. In contrast to white and Hispanic trajectories and despite the critical exogenous shock, Blacks' residential mobility shows little evidence of divergence from the structurally reinforcing spatial circuits of disadvantage and segregation.

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1. Introduction

Studies that address the question of residential mobility typically focus on the individual or the family as the key unit of analysis and model the likelihood of a residential transition into certain types of neighborhood or focus on the duration until a residential state changes. These approaches typically ignore the dyadic-dependence between the sending and receiving neighborhoods that shapes individuals spatial and social trajectories. By failing to examine the link between the sending and receiving contexts that individuals are exposed to in moving from a place to another over a lifetime we risk losing sight of key patterns that may affect individual level outcomes above and beyond individual characteristics.

An important aspect of observations in social science research, in addition to their individual characteristics, is their positioning *relative* to each other. This is particularly relevant for understanding highly dependent observations or areal units that are located closer to each other in space. The relative positioning of units in a geographic or abstract social space is a key factor in the spatial interaction between units, which can be reflected by measures of spatial or network autocorrelation[1]. In this paper, I argue that in examining patterns of residential mobility and segregation, moving the analytic lens from

[1] Models that estimate bivariate and multivariate patterns in dyadic data have been used in research on intergovernmental organizations (Beckfield 2008), research on boards of directors (Mizruchi 1990), corporate political behavior (Mizruchi and Marquis 2006), studies of cultural agreement and friendship ties (Krackhardt and Kilduff 1990), studies of international trade (Krempel and Plumper 2003), and in the analysis of network relations (e.g. Borgatti and Cross 2003; Gibbons and Olk 2003; Sorenson and Stewart 2001). Dekker, Krackhardt and Snijders (2007, p. 564) state that Krackhardt's multiple regression QAP approach has "an appeal of simplicity and accessibility" and Pattison (1988) praised it as "an exciting step forward in the analysis of network relations."

individual units to neighborhood relationships helps unveil the dynamic processes that make up the larger ecological structure of neighborhood stratification and inequality of place.

Analyses of flows between neighborhood dyads instead of the typical analyses of neighborhoods may reveal elements of urban stratification processes that are missed by analyses based on individual units. The added information may indicate that aspects of neighborhood connectivity other that socioeconomic characteristics may shape urban stratification processes in general and inter-neighborhood mobility in particular. Similarity in racial or ethnic composition for instance may prove to be more important than relative poverty levels in shaping connectivity between two neighborhoods. While mostly focused on individuals, Sampson and Sharkey (2008) have shown preliminary indications that individual mobility patterns, if aggregated into inter-neighborhood flows can look self-reinforcing. Yet very little work exists that examines the structural pattern of neighborhood interdependencies systematically. I address this gap here and examine neighborhood homophily based on pairwise similarity in socioeconomic characteristics (for a parallel approach in Chicago, see Sampson and Graif 2010).

A focus on inter-neighborhood residential mobility flows allows a direct and detailed examination of residential exchanges within the urban structural hierarchy of neighborhoods and reveals "where in the social structure opportunities for movement or barriers to movement are greater or less, and in so doing provide clues about stratification processes which are no less important, if different in kind, from those uncovered by multivariate causal models," as Hauser (1978, p. 921) states in reference to occupational mobility.

In these analyses, I examine racial and ethnic differences in pathways of spatial mobility as they unfold in Boston over time and investigate their role in reproducing inequality in neighborhood attainment. I analyze residential history data for participants in the Moving to Opportunity Experiment (MTO) between the baseline and the 2002 interim survey. More than a decade ago, the MTO program offered to poor families living in public assisted housing in very poor urban neighborhoods a chance to move to private housing and low-poverty neighborhoods. While many took up the offer, a few years later, many of these families moved again to neighborhoods that looked more like their neighborhoods of origin. Understanding the patterns driving the residential trajectories is critical for theory and policy.

Using the analytical framework and methodological toolkit developed for network analyses, I conceptualize individuals' residential mobility from a neighborhood to another as ties between the sender-receiver neighborhood dyads. Such dyadic analyses enable a better understanding of inter-neighborhood connections as formed and maintained by patterns of resident spatial exchanges. More specifically, they permit an understanding of potential patterns of neighborhood homophily (e.g. inter-neighborhood exchanges based on similarities in real estate values and housing attributes) and of processes underlying citywide patterns of inequality and residential segregation.

Through this conceptual framework, I build on Breiger's (1974) argument about the duality of individuals and groups, the idea of "migration chains" (Massey et al. 1990), and the body of work on homophily (McPherson et al. 2001). To the extent that neighborhoods constitute meaningful social circles, and the successive residence of individuals in different neighborhoods may be thought of as ties between the neighborhoods, the information about the residential location of families at different points in time may be used to construct the pattern of connectivity among nodes of the citywide network of neighborhoods. Individual connections that cut across the boundaries of neighborhoods are often thought to contribute to social capital (Coleman 1988). But if homophily dominates social relationships between neighborhoods, as the segregation literature implicitly suggests (Massey and Eggers 1990), then inter-neighborhood connections may reflect limited social capital. According to McPherson et al. (2001, p. 416) "Homophily is the principle that a contact between similar people occurs at a higher rate than among dissimilar people […] [It] implies that distance in terms of social characteristics translates into network distance, the number of relationships through which a piece of information must travel to connect two individuals. It also implies that any social entity that depends to a substantial degree on networks for its transmission will tend to be localized in social space and will obey certain fundamental dynamics as it interacts with other social entities in an ecology of social forms." If migration forms spatial ties in a citywide network of neighborhoods, processes of homophily may drive not just the social circles of individuals but inter-neighborhood ties as well. I thus expect that similarity in neighborhood characteristics will constrain inter-neighborhood mobility, a structural emphasis also consistent with Blau (1977).

A key part to understanding a neighborhood is examining its spatial and socio-structural positioning in the larger network in which it is embedded. Spatial proximity, together with similarity or dissimilarity in socioeconomic and ethnic compositions of neighborhood dyads may significantly predict inter-neighborhood connections based on the patterns of residential mobility. Overall, moving the analytic lens from a focus on individuals to a focus on neighborhood exchanges helps unveil the dynamics underlying the larger ecological structure of neighborhood stratification and inequality of place.

2. Residential Mobility and Spatial Attainment

Understanding neighborhood effects on individual and family outcomes cannot be complete without first understanding residential mobility. Tiebout hypothesizes (1956) that families make decisions about where to live after evaluating their needs relative to the taxes, resources and services in the areas of interest, school quality, crime rates, or environmental hazards (Wolpert 1966; Zelinsky 1971; Speare 1974; Schachter and Althaus 1982; Cullen and Levitt 1996; Dugan 1999; Sampson et al 1997; Hunter, White, Little, and Sutton 2003). Little is known however, about the impact of context when assessed longitudinally rather than cross-sectionally. Sharkey (2008) found considerable correlation between the contextual disadvantage of parents and that of their children suggesting long-term implications for growing up in the ghetto.

Ethnic and racial disparities in residential mobility and attainment constitute an important part of the debate. National level analyses show evidence of an enduring black-white gap in migration patterns from non-poor to poor neighborhoods. Analyzing national data on mobility patterns across time using the PSID, South et al (2005) find that despite the apparent convergence of blacks and whites in their mobility patterns from poor to non-poor neighborhoods and from non-poor to poor tracts, the improvements in the mobility of blacks are very small. "This fact alone casts doubt on the argument that progress toward racial equality in mobility processes has occurred through an erosion of discriminatory barriers to black residential mobility" (Crowder and South 2005: 1757). The black-white gap in mobility from non-poor to a poor neighborhood has also narrowed but mainly due to an increase in the probability of whites to move to such neighborhoods, most likely reflecting increasing trends in gentrification of the inner-city neighborhoods. Compared to whites, blacks remain considerably less likely to move from a poor to a non-poor neighborhood and substantially more likely to move from a non-poor into a poor neighborhood.

Although prominent theories (Massey et al 1994; Wilson 1987) speak to the issue of black and white selectivity gap out of poor neighborhoods, less understanding exists on puzzling high rates of blacks' movement from non-poor neighborhoods back into poor neighborhoods. Understanding the roles of discrimination or social networks in how individuals find out information on the housing markets in poor neighborhoods more easily than in non-poor neighborhoods is essential. Analyzing PSID data in combination with the Latino sample South et al (2005b) found that Hispanics are more likely than Anglos, but less likely than Blacks to move from low poverty into high poverty neighborhoods (but less likely than blacks and Anglos to escape high poverty neighborhoods). This finding supports models of ethnically differentiated residential attainment.

Two competing theories relevant for the residential mobility of minorities and immigrants have become prominent in the stratification and immigration literature. The spatial assimilation theory (Massey and Mullen 1984), building on the classical assimilation theory (Alba and Nee 1997; Gordon 1964) predicts that, as immigrants advance in generational and socio-economic status and assimilate into the mainstream institutions and labor market they tend to move to less disadvantaged and more racially integrated neighborhoods. South et al (2005a) find support for a classical assimilation theory, particularly in the case of Mexicans but less so in the case of Puerto Ricans. Mexicans moved to tracts with increasingly higher proportions of Anglos the higher their generational status, unlike Puerto Ricans whose generational status indicated higher chances to move to tracts of lower Anglo concentrations. The residential trajectories of Puerto Ricans indicated more support for a segmented assimilation theory (Portes and Zhou 1993). This second major theoretical perspective on assimilation processes predicts that along with upward assimilation likely for some groups, a separate, downward assimilation is more likely for population groups who live in neighborhoods dominated by an "underclass" culture. South et al.'s (2005a) results support this theory, particularly in the case of Puerto Ricans, and suggest that skin color may constitute a relevant dimension of inequality in residential stratification among Latinos. Also, compared to Mexicans, Puerto Ricans move significantly less, and Cubans more. The percentage of Latinos in their tract decreases the moving chances of all Latinos as a group as well as for each of the Latino subgroups.

2.1 Spatial and Structural Interdependencies

In a review of studies on the formation and maintenance of ties between individuals McPherson, Smith-Lovin and Cook (2001, p. 431) concluded that "geography is the physical substrate on which homophily is built." This claim goes against the grain of much common wisdom and scholarly work that claims, in contrast, "the death of distance" (Cairncross, 1997) and "placelessness" (Relph, 1976). While communication technologies have permitted the maintenance of relationships at longer distances, such relationships still require contact to be formed and maintained and, consequently, they continue to be shaped by geographic proximity (Verbrugge, 1983; Wellman, 1996; Zipf, 1949). What technology has done is to expand the circle within which friendships can be sustained, permitting them to cross boundaries into neighboring areas with greater ease. Such spatially conditioned contacts are likely to facilitate the transmission of information about safety and housing in the proximate area of one's neighborhood. It may also shape the perceived desirability of nearby neighborhoods inhabited by extended friendship or kinship circles. To the extent that families move, they then likely do so such that they can continue to tap into existing social networks and other resources left behind in their communities of origin or that may be stronger in nearby neighborhoods (Caplow and Forman, 1950; Hipp and Perrin, 2009). All these factors will converge in shaping spatially conditioned pathways of residential mobility, increasing the volume of residential exchange between nearby neighborhoods more than flows between spatially distant neighborhoods.

The tendency of people to associate with similar others based on characteristics such as race, income, and occupation has been well documented in studies of personal networks (Marsden, 1987) and in studies of social interactions within communities (Fischer, 1982; Hipp and Perrin, 2009). Moreover, Galaskiewicz and Shatin (1981) show that ties between neighborhood organizations and inter-organizational cooperation tend to be more likely if executives have similar educational and racial backgrounds. Homophily of interpersonal ties is also associated with homogeneity in the composition of a neighborhood based on race, ethnicity, religion, and family attributes (Lieberson, 1980).

To the extent that people actively seek socially similar relationships or are denied access to diverse relationships as they move to new places, pairwise similarity in the homogeneity of neighborhoods of origin and destination will be more likely. Studies of organizations as a unit offer lessons for neighborhood-level research—similar status, power, and other social attributes increase the diffusion of norms and information between organizational units (Burt, 1987; Galaskiewicz and Wasserman., 1989).

A major concept in the literature on urban sociology, social isolation combines features of spatial concentration with the level of social disadvantage (Wilson, 1987). Evidence suggests that powerful spatial segregation mechanisms tend to sort poor black families into highly disadvantaged and segregated black neighborhoods and high-income white families into more resource-advantaged white neighborhoods (Massey at al 1994). Even though segregation pressures will yield the strongest residential connections between neighborhoods with similar socioeconomic status, family poverty does not preclude residential mobility. For example, residential mobility is often associated with social mobility (Quillian, 1999; Sampson and Sharkey, 2008), including when African Americans move to neighborhoods with higher economic status and institutional resources, often outside of central city boundaries. However, I expect that the dominant pattern is social reproduction: neighborhoods with similar income levels and racial composition will be highly connected through residential flows.

2.2 Neighborhood Effects and the Inner-City Poor

Wilson's landmark work on the *Truly Disadvantaged* (1987) has incited passionate and fertile debates (e.g. Massey and Denton 1993) on the creation of highly disadvantaged urban neighborhoods, 'the ghetto.' Less disagreement exists, nevertheless, on the negative externalities of neighborhood concentrated disadvantage for a wide range of outcomes for individual residents, from health, education, and occupational attainment to criminal involvement (Small and Newman 2001; Sampson, Morenoff, and Gannon-Rowley 2002). Observational studies attempting to estimate such effects have not consistently delivered the evidence on neighborhood effects that theory predicts (Jencks and Mayer 1990). The inconsistent evidence so far has largely been blamed on a recurring problem in social science, the "selection bias". Emerging in scholarly exchanges again and again under slight variations, such as hidden bias, omitted variable bias, confounding, or unobserved heterogeneity, it refers to the likelihood that unobserved factors may affect both one's neighborhood of residence and individual outcomes, biasing the estimate of neighborhood effects on such outcomes.

Building on the promising findings of a famous 1976 federal court-ordered racial desegregation program in Chicago called the Gatreaux program, the US Department of Housing and Urban Development took up the challenge of neighborhood effects and selection bias in 1994 and initiated a new and much improved demonstration program, the Moving to Opportunity experiment, or MTO. Through its magnitude and unique sampling design, the MTO experiment constitutes a landmark in the study of neighborhood effects. It deals with selection bias by randomly assigning respondents to treatment or control conditions. Interim analyses of these respondents, about 4 to 7 years after the random assignment, have found that, as expected, moving to a low poverty neighborhood has brought significant gains in housing and neighborhood quality, and substantial benefits for the mental health of its low-income adults and female youth. It has also benefited female youth in a variety of other domains such as education, risky behavior, and physical health. Nevertheless, reducing neighborhood poverty has had no significant effects on adults' economic self-sufficiency and physical health. Most surprisingly, moving to low poverty neighborhoods seems to have resulted in significant adverse effects on the male youth concerning risky behavior and physical health.

2.3 Neighborhood Selection: Push and Pull Factors

Spatially bounded social networks and neighborhood closure (Coleman 1988) can work as important factors of integration or exclusion for families moving to a new neighborhood. Even as the MTO program pushes families into neighborhoods they would not have reached "naturally", the low-income neighborhoods of reception may be unwelcoming, prohibiting, and even hostile. Existing old social networks can play a role in families' choice of a neighborhood of residence and potentially explain why the poor may move back to a poor neighborhood even after they lived in a low poverty neighborhood (also Farley 1996). Some attention has been given to the impact of friends, relatives, and social groups in the long distance selection of the residential areas of mobile Blacks (Price-Spratlen 1998, 1999) but not much similar research exists on the more local inter-neighborhood migration. It is likely that social networks diffuse considerable informal information through their channels and that their tendency toward racial homophily is related to the tendency for blacks to continue to reside in tracts of concentrated poverty. Such networks may steer Blacks into poor neighborhoods because they know more about them and they are more likely to share them with relatives.

The percentage of blacks living in high poverty neighborhoods increased between 1970 and 1990, decreased considerably in the 1990s (Kingsley and Pettit 2003), was by

2000 ten times higher than the percentage of whites (Jargowsky 2003). Although there is an established trend of high status blacks moving out of low-income neighborhoods, which points to the possibility of decreasing discrimination, the same decreasing discrimination should protect this population against moving out of the non-poor neighborhoods. However, this does not seem to happen at the national level or in the MTO. Audit studies consistently unveil enduring racial and gender differences in discrimination (Darity and Mason 1998, Betrrand and Mullainathan 2004). In a nationally representative study of Latinos South et al (2005a) found that perceived discrimination marginally increases the likelihood of a Latino moving out of a neighborhood. These findings call for more research on moving patterns and on the factors that influence minorities' migration out of non-poor neighborhood into poor ones. More specifically researchers need to disentangle between responses to mobility restrictions, neighborhood preferences, or "voluntary vs. forced mobility" to be able to assess the relative impact of discrimination on such downward mobility.

Place stratification theory (Logan 1978; Logan and Molotch 1987) suggests that places can serve as status markers and shape individuals chances for social mobility. In doing so they create and reinforce place-based social hierarchies that impact differentials in political power, access to resources, school quality. Institutional resources, individual, and collective action are used to encourage or restrict in-migration. Key place gatekeepers, such as the real estate industry or mortgage lenders, contribute to a racially segmented housing market, and subsequent racially selective stratification of places that can lead into remarkable levels of neighborhood racial segregation (Massey and Denton 1993; Alba and Logan 1993; Lee et al. 2008; Matthews 2008). When geographically contiguous disadvantaged neighborhoods expand into large clusters they increase even more the social isolation of minority neighborhoods (Wilson 1987) widening the distance between low-income residents and employment opportunities, a social predicament called spatial mismatch (Kain 1968). Unlike spatial assimilation theory, which emphasizes assimilation differences based on social class inequalities and mobility, place stratification emphasizes spatial attainment processes based on racial prejudice and discrimination practices. Despite arguments for a closing gap between blacks and whites patterns of residential mobility, important evidence exists about discrimination against black home seekers (Yinger 1995) by real estate agents (Pearce 1979, Yinger 1995), local governments (Shlay and Rossi 1981) and mortgage lenders (Shlay 1988; Squires and Kim 1995). All factors converge in creating a racially segmented housing market that blocks the mobility of African Americans, despite aspirations of mobility by this population Crowder (2001).

Living in low poverty neighborhoods, among high SES peers and neighbors may lead to resentment among the poor, particularly the young. Resentment on the part of these disadvantaged youth may also owe to racial or ethnic or class based discrimination in such neighborhoods more than others (Wood 1989, Collins 1996). Attitudinal data shows some increases in whites' the tolerance for black neighbors (Schuman et al 1997). However, a persistent trend exists of whites resisting black neighbors (Emerson, Yancey, and Chai 2001). In low poverty neighborhoods, youth may be subjected to closer surveillance by police, neighbors, even storeowners. The "new kid on the block" may experience higher levels of unfair treatment, which may discourage his or her interaction with other youth or impede his or her assimilation of a new set of norms and values, and thus shaping their overall integration into the neighborhood (Hagan et al 1996). Mobile adolescents may be perceived as less able to counter personal attacks, which may increase their victimization in their new schools or neighborhoods (Miller 2001). Higher chances of victimization may in turn lead these adolescents to engage in violent behavior, either in retaliation, as prevention, or as a defense strategy (Lauritsen et al 1991).

Recent research indicates an increasing ability of African Americans to escape poor neighborhoods and to move to lower poverty areas (Crowder and South 2005). While the Black and white gap in residential mobility between poor and non-poor neighborhoods has received some attention, there is an important gap remaining that plagues our understanding of the patterns and determinants of residential mobility of Latinos between such neighborhoods. With few exceptions (e.g. Sampson and Sharkey 2008), the studies that address this issue are largely cross-sectional. Of the ones based on longitudinal data, most examine a very limited set of socioeconomic predictors.

A surprising finding in the MTO analyses so far is the impact of moving to a low-poverty neighborhood on increasing criminal involvement and behavioral problems by male youth. The discriminatory or status related factors that may push low-income families out of the low poverty neighborhoods may be similar to the ones that push male youth to get more involved in crime. The higher level of social cohesion and closure, characteristic of lower-poverty neighborhoods and working to the benefit of long-term residents, may in fact operate to the detriment of the welfare and human rights of low-income in-migrants. Unaccustomed to the “ecologically structured norms” (Sampson and Wilson 1995) of the new community, the incoming families may be treated as potential threat and pushed away.

On the other hand, spatial embeddedness of social support may deeply root the inner-city poor in the disadvantaged contexts of their neighborhoods of origin, holding them back even as they move away and perhaps deterring them to move too far. A parallel mechanism may also work to their disadvantage as they move to low-poverty areas. Building on the existing literature so far, I expect that as poor families move from a neighborhood to another, the receiving neighborhoods will likely resemble the sending neighborhoods more than not, rendering each new neighborhood of reception into yet another ring in the path-dependent chain of spatial deprivation. As importantly, I expect that such processes will be stratified racially and ethnically. To the extent that families of low socioeconomic status and racial or ethnic minority status tend to systematically live in and move to certain types of neighborhoods of residence rather than others for reasons related to choice or limited resources, similarity in the quality of the neighborhoods on their residential trajectory is not surprising. To the extent that these choices or resource constraints may be eliminated from the equation, will the subsequent residential trajectories be likely to converge across the different racial and socioeconomic groups?

3. Data and Measures

In the following, I address these questions by analyzing data from a housing intervention program, which randomly assigned a low-income families of different racial and ethnic groups (who applied to the program) to one of three conditions. In the treatment condition, families were given housing counseling and a voucher that they could use in neighborhoods with poverty rates below 10%. Since these are neighborhoods where low income families are less likely to move on their own, the program offers a unique opportunity to understand to what extent the residential trajectories of the families assigned to the full treatment condition take on a new route that is more similar across racial and ethnic groups than the trajectories of the families in the control group. Families assigned to the control group were given no voucher nor restricted about where to move but continued to receive project-based assistance. Families assigned to the third group, Section 8, received a housing voucher that they could use anywhere, without any geographic restriction. The Moving to Opportunity for Fair Housing Demonstration program was mandated by the U.S. Congress and carried out by the U.S. Department of Housing and Urban Development (HUD). In its first stage, it was carried out between 1994 and 1998 in five cities: Boston, Chicago, New York, Los Angeles, and Baltimore. To participate in this program, families volunteered. They were eligible to participate if they were: living in public housing or private assisted housing in inner city neighborhoods with more than 40% poverty rates; having very low incomes; and having children under 18 years old. About 4600 were considered eligible, of which 3169 were offered vouchers through the program, and 1676 families were able to successfully move using the program voucher. Only the Boston sample is included in the analyses here because it is the only site that includes more than a hundred white respondents in addition to Hispanics and blacks.

The study design has an important longitudinal dimension. In addition to the baseline survey, an interim evaluation survey was conducted in 2002. Administrative data was collected on the families' residential locations and the schools that children attended. The chain of all residential moves and the duration of stay at a particular address were recorded from both administrative sources of information and personal reports by respondents.

Nonexperimental studies of neighborhood effects cannot easily escape concerns about the selection bias. Selection bias exists when individuals sort themselves or are steered into certain neighborhoods rather than others in ways that may influence their later outcomes independent of neighborhood effects per se. Through its experimental design, the MTO study accounts for such selection processes and allows direct analyses of the presence, direction, and size of neighborhood effects on a variety of individual outcomes for poor families, adults, and children. Nevertheless, the MTO program was not particularly designed to test the social mechanisms underlying neighborhoods effects (or non-effects). Yet mechanisms shaping such effects may be critical in defining the intensity and even the direction of neighborhood effects for different population groups. To better understand the neighborhood and citywide contexts for individuals in this study, I limit the MTO analyses to families in Boston and add socio-demographic data on the city neighborhoods from several Census summary files and from the Geolytics' Neighborhood Change Data Base (NCDB) for the years 2000 and 1990-- normalized to 2000 tract boundaries.

Of all the families in the MTO program included in the 2002 interim evaluation, 959 families (22.58 %) are in Boston. Table 1 summarizes some of the main demographic characteristics of the MTO families in Boston by random assignment status. 326 families, or 34% of all families in the MTO program in Boston were assigned to the control group, 366 (38%) were assigned to the MTO experimental (or treatment) group. About 46% of those assigned to the treatment group actually complied with the program requirement to move to a low-poverty neighborhood. Across all randomization groups, more than 96% of the household heads in the program are female. Over 70% of the families have three members or more. 43% of the household heads in the control group are Hispanic, 35% are non-Hispanic Black, and about 10% are non-Hispanic white. About 47.5% of the household heads in the MTO treatment group are Hispanic, 32.5% are black (non-Hispanic) and 11% are white (non-Hispanic).

Table 2 describes the neighborhood environments of the MTO families assigned to the control and MTO treatment group[2]. Neighborhoods are represented by census tracts, as defined in 2000. The neighborhoods socio-demographic characteristics correspond to the residential location families' at the beginning of the study (baseline neighborhood) and at the time of the interim evaluation, in 2002 (current neighborhood).

The average poverty rate of the baseline neighborhoods is over 35% (as measured by the 2000 census) for all three main racial and ethnic groups, Hispanics, non- Hispanic blacks, and non-Hispanic whites[3]. By the time of the interim evaluation, the control and the MTO experimental families were located in neighborhoods of lower poverty rates, on average. The difference between the baseline and the current neighborhood poverty of families in the MTO experimental group is about 12% for blacks, 9% for Hispanics, and 29% for whites. Compared to the control group, the poverty level of the current neighborhoods of the MTO group is about 8 percentage points lower for blacks, 6.5 percentage points for Hispanics and about 16 percentage points for whites. These

[2] For now, I limit the analyses to the control and experimental groups.

[3] From here on, I will use the word "blacks" to refer to "non-Hispanic blacks" and "whites" to refer to "non-Hispanic whites"

differences between the control and the experimental groups are significant for all three racial/ethnic groups.

Similar patterns emerge when comparing the baseline neighborhoods and the current neighborhoods across treatment and racial/ethnic groups on a series of other indices of contextual disadvantage such as neighborhood unemployment rate, proportions of female-headed households, or of households with public assistance.

Table 1. Moving to Opportunity Families in Boston by Treatment Group Assignment, Complier Status, Racial and Ethnic status, Gender of the Household Head, and Househhold Size

			CONTROL	MTO	ALL FAMILIES
Complier Status					
	Complier	Count	0	168	297
		%	(.0)	(45.9)	(31.0)
Gender					
	Female	Count	313	358	935
		%	(96.0)	(97.8)	(97.5)
	Male	Count	13	8	24
		%	(4.0)	(2.2)	(2.5)
Household Size					
	2 members or less	Count	71	101	243
		%	(21.8)	(27.6)	(25.3)
	3 members	Count	122	116	330
		%	(37.4)	(31.7)	(34.4)
	4 members	Count	67	84	203
		%	(20.6)	(23.0)	(21.2)
	Total	Count	326	366	959
		%	(100.0)	(100.0)	(100.0)
Ethnicity/Race					
	Hispanic	Count	139	171	432
		%	(43.4)	(47.5)	(45.8)
	Black (non Hispanic)	Count	112	117	308
		%	(35.0)	(32.5)	(32.6)
	White (non Hispanic)	Count	31	41	102
		%	(9.7)	(11.4)	(10.8)
	Other (non Hispanic)	Count	38	31	102
		%	(11.9)	(8.6)	(10.8)
	Total	Count	320	360	944
		%	(100.0)	(100.0)	(100.0)

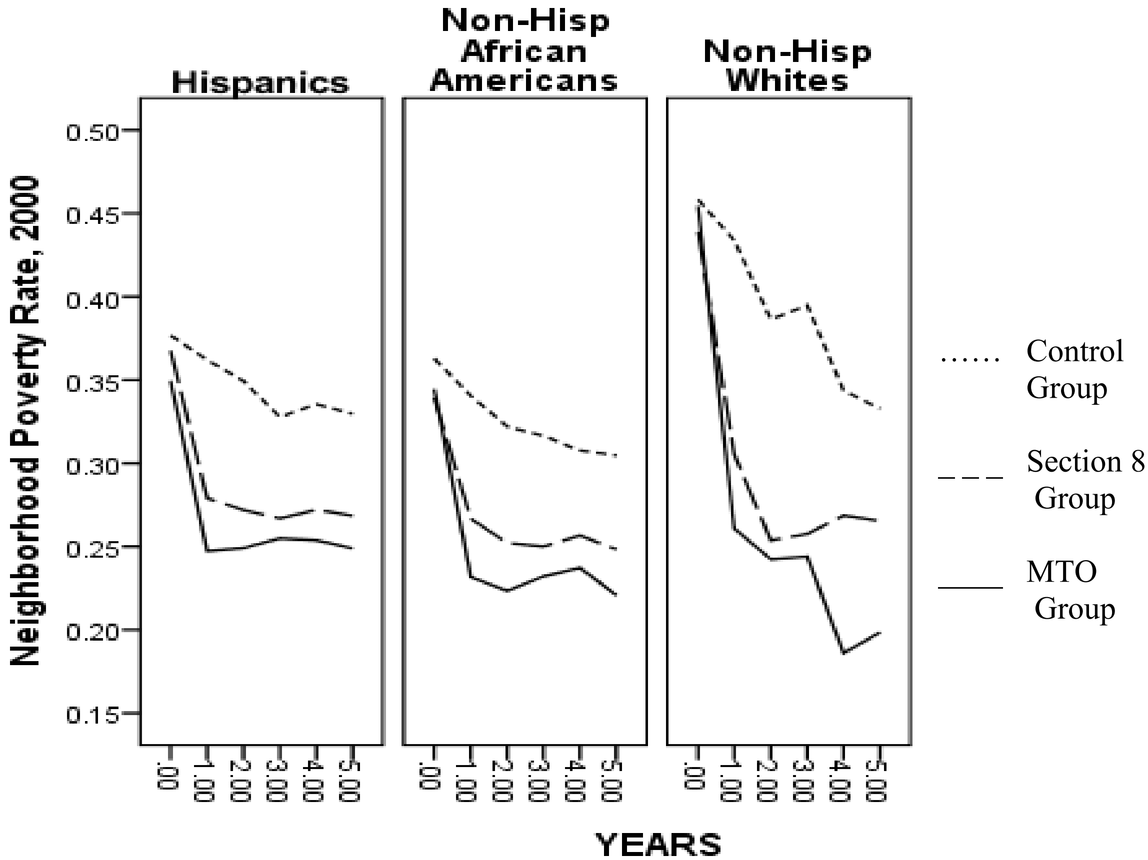

Figure 1. Exposure to neighborhood poverty rate across all neighborhoods of residence during the time of the study by 2002, for families in the MTO program in Boston by treatment assignment and by racial and ethnic group

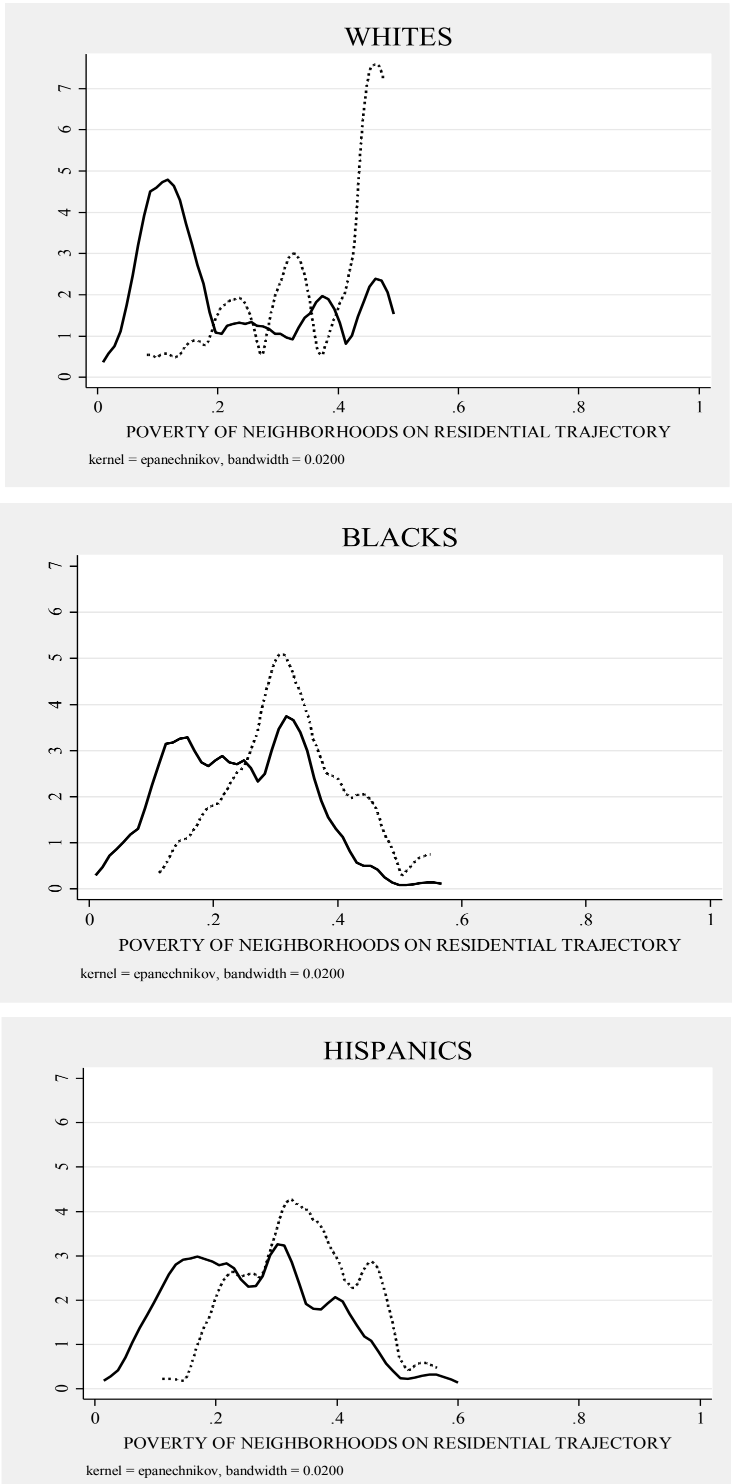

Figure 2. Inequality in exposure to neighborhood poverty (during the duration of the study) of MTO Boston families, by treatment group and by racial-ethnic group.

Figure 1. shows the average neighborhood poverty levels across Boston families in the MTO study in intervals of one year after random assignment (which may differ from a family to another), by that racial and ethnic group and by random assignment group. In contrast to simply comparing two snapshots of the neighborhoods of origin and of the current neighborhoods, respectively, this graphical depiction allows a better understanding of changes in neighborhood context due to residential mobility during the whole duration of the study. It indicates that for blacks and Hispanics in the MTO experimental group the biggest drop in neighborhood poverty occurred about one year after random assignment, after which they experience a sort of a plateau. In contrast, white families continue to drop in their level of neighborhood poverty long after their move with the program. Note that the level of poverty for all neighborhoods is indicated at their 2000 level to distinguish the poverty change for geographically mobile families from poverty change within a neighborhood over time for immobile families.

A more comprehensive way to understand exposure to structural disadvantage is to examine the level of neighborhood poverty that families are exposed to during their entire residential trajectory, not just at baseline or at their current neighborhood. A different poverty index is thus calculated as the average neighborhood poverty at each separate address where families lived during the duration of the study, weighted by the duration of their residence at that address. For each person-neighborhood, the poverty level is calculated using a simple linear interpolation based on the rate of change between 1990 and 2000 census years and the year of residence in that particular neighborhood. The bottom two rows of Table 2 indicate the average duration-weighted poverty (and a similarly calculated duration weighted unemployment rate) by racial/ethnic group and by random assignment group. The results indicate that, as a result of the intervention, all three racial/ ethnic groups experienced on average lower exposure to poverty during the entire period of the study.

In Figure 2, the dotted line indicates the kernel density distribution of duration-weighted neighborhood poverty for families in the control group, while the continuous line indicates the distribution for the MTO experimental group. Rather than simply showing averages of neighborhood poverty across groups, this figure permits a better understanding and visualization of the range of contextual experiences within and across groups. The contrast between the distribution of exposure to poverty between the control and the experimental group is highest for white families and less marked, but still significant, for Hispanics and blacks.

At both baseline and current addresses, the neighborhoods of white families in the study exhibit more than double the percentage of whites on average than the corresponding neighborhoods of black and Hispanic families (see Table 2). Moreover, Black and Hispanic experimental families start at baseline in neighborhoods with more than 40% blacks and do not change significantly on this index by the time they get to their current neighborhood. In contrast, white experimental families start in neighborhoods with 15% blacks on average and end up in neighborhoods at their current address that are on average 8% black. In sum, despite similar family characteristics and neighborhood poverty at baseline for families across all three racial/ethnic groups, these comparisons indicate important differences in the racial and ethnic make-up of the participants' neighborhoods at baseline, differences that are maintained over time, and changed little by an intervention that focused exclusively on the poverty contexts of its participants.

4. Methods

In the following analyses, I make use of mapping, spatial and GIS analysis, and network analysis tools. Mapping and GIS analyses are rapidly emerging as uniquely useful devices for exploration and analysis of geographic patterns across macro level units and for unveiling both global and local spatial associations. Below, I map the locations of individuals across neighborhoods and overlay color-coded information about neighborhood poverty rate in order to depict the trajectories of individuals and households in and out of citywide clusters of disadvantage. Neighborhood poverty and racial composition are classified based on ArcGIS's implementation of a Jencks optimization algorithm, which takes data distribution into account[4] using iterative sets of calculations to maximize the between-class variance and minimize the within class variance in feature values, setting the class boundaries at locations of lower frequencies between big jumps in data values (Slocum 1999).

To better understand the extent of spatial autocorrelation of neighborhood poverty rates or racial composition indices across the city, I calculate the Moran's I, a common measure of value association based on cross-products (Moran 1948, Cliff and Ord 1973), which uses a spatial weights matrix. I generate a spatial weight matrix (Anselin 2005) based on the Queen contiguity criterion using the polygon shape files with data on the geographic location and boundaries of all census tracts in Boston.

[4] In contrast, the classification based on quintiles flattens out the data distribution.

To examine the extent to which similarity or dissimilarity in socioeconomic and ethnic compositions of neighborhood dyads predict inter-neighborhood connections based on directed resident exchanges, I next make use of network analysis tools. I construct separate neighborhood-to-neighborhood matrices as a function of: a) direct and indirect resident exchanges; b) similarities in neighborhood socioeconomic characteristics; and c) circle distances between neighborhood pairs, based on the latitude and longitude coordinates (measured in degrees) of the census tract centroids, calculated first in ArcMap using Tiger files, imported then as attributes and transformed into distance matrices in network analyses[5]. I next map the inter-neighborhood networks as a function of geographic and social distance coordinates, respectively. I calculate the dissimilarity using the absolute value of the difference between a pair of neighborhoods' level of poverty etc.

The primary goal is to examine the relationship between the likelihood that two neighborhoods will share a tie (defined as a residential move between two neighborhoods by a family in the MTO study) and other dyad-level variables such as similarity in the level of poverty or racial composition)[6]. Autocorrelation and multiple regression analyses via quadratic assignment procedures (MRQAP) are based on square and symmetric neighborhood-by-neighborhood matrices of all city neighborhoods, where ties are defined based on receiving families in the study from shared third neighborhoods. In other words, ties indicate the extent to which two neighborhoods are spatially equivalent

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[5] In the mapping and analyses of the networks, I move back and forth between ArcGis and several software packages, like Pajek, Ucinet, and Netminer.

[6] Both the MRQAP and the ERGM methods of estimation are appropriate for this type of question. ERGM is another class of statistical approaches that permits analysis of dyadic associations while also allowing for tests of the influence of particular structural patterns. However, it only permits binary dependent variables.

in their patterns of receiving direct ties from the same other neighborhoods. This analytic framework switches the analysis from an individual unit (family or neighborhood) to a dyad. Using traditional OLS methods of analysis on dyadic observations is not appropriate because observations are not independent (Laumann and Pappi 1976). Instead, Krackhardt proposed a nonparametric approach to multiple regression (1987, 1988, 1993), which he called Multiple Regression Quadratic Assignment Procedure (Krackhardt 1992)—a multivariate extension of Hubert's (1987) bivariate permutation test[7]. In modeling associations between data with even moderately autocorrelated network structure using OLS, Krackhardt (1988) tests has yielded type I error rates over 50% of the time, in contrast to MRQAP's 5%.

In applying the MRQAP procedure to estimate multiple regression models, I leave the diagonals out of the calculations[8]. For each statistic, the significance tests are based on the reference distribution of that statistic generated from 2000 random permutations of the rows and columns of the dependent variable matrix. Dekker, Krackhardt, and Snijders' (2007) improvements in this procedure ensure conservative estimation of standard errors across less-than ideally structured data. I thus use the double semi-partialling Dekker permutation technique as implemented in UCINET 6 (Borgatti, Everett, and Freeman 2002)[9]. The permuted structure is isomorphic to the original,

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[7] The technique originates in a model proposed by Mantel (1967) in examining the geographic contagion of disease and was later extended by Hubert (1987) to correlations between any two square N x N networks.

[8] Krackhardt (1992 p.292) describes the QAP test as "a member of a family of conditional permutation tests. The QAP test was designed for cases where parametric assumptions about the data are unknown. […] no population is assumed; rather the data are assumed to comprise the population and hence no assumptions about sampling form a population are necessary."

[9] Also implemented in the "statnet" package in R by Handcock et al 2003

which, except for the order of the objects, permits the retention of all structural features of the original matrix.

5. Results and Discussion

5.1 The Spatial Context of Boston Neighborhoods

In the city of Boston, 50% of the neighborhoods have levels of poverty that are lower than 20%. 10% of the neighborhoods have poverty levels over 38%. Figure 3 presents the spatial distribution of 2000 poverty rates across all 157 Boston's census tracts. The thick line indicates the city boundary and the thinner grey lines indicate census tract boundaries (as of 2000). Both the tract boundaries and the citywide boundary are determined administratively and are, to an extent, artificial, although they tend to follow street lines and natural boundaries like lakes, ocean, or rivers. To understand the degree to which any clustering of poverty near the margins of the city continues or not beyond this administrative boundary, I also include in the map census tracts that are not in the city but are directly adjacent[10] to tracts on the city boundary.

I shade the neighborhood surfaces by their poverty level in 2000 classified in four categories in ARCGIS based on the Jencks algorithm, which identifies and follows "natural breaks" in the distribution of poverty levels across all neighborhoods (Slocum 1999). As the map indicates, the distribution of poverty across Boston's neighborhoods tends to be concentrated toward the center-west parts of the city, in the Fenway/Kenmore area, Allston/ Brighton area, South End, and the South of South Boston, where most of the neighborhoods are over 40% poor.

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[10] I do not include tracts that are fully separated by water from the tracts at the city boundary.

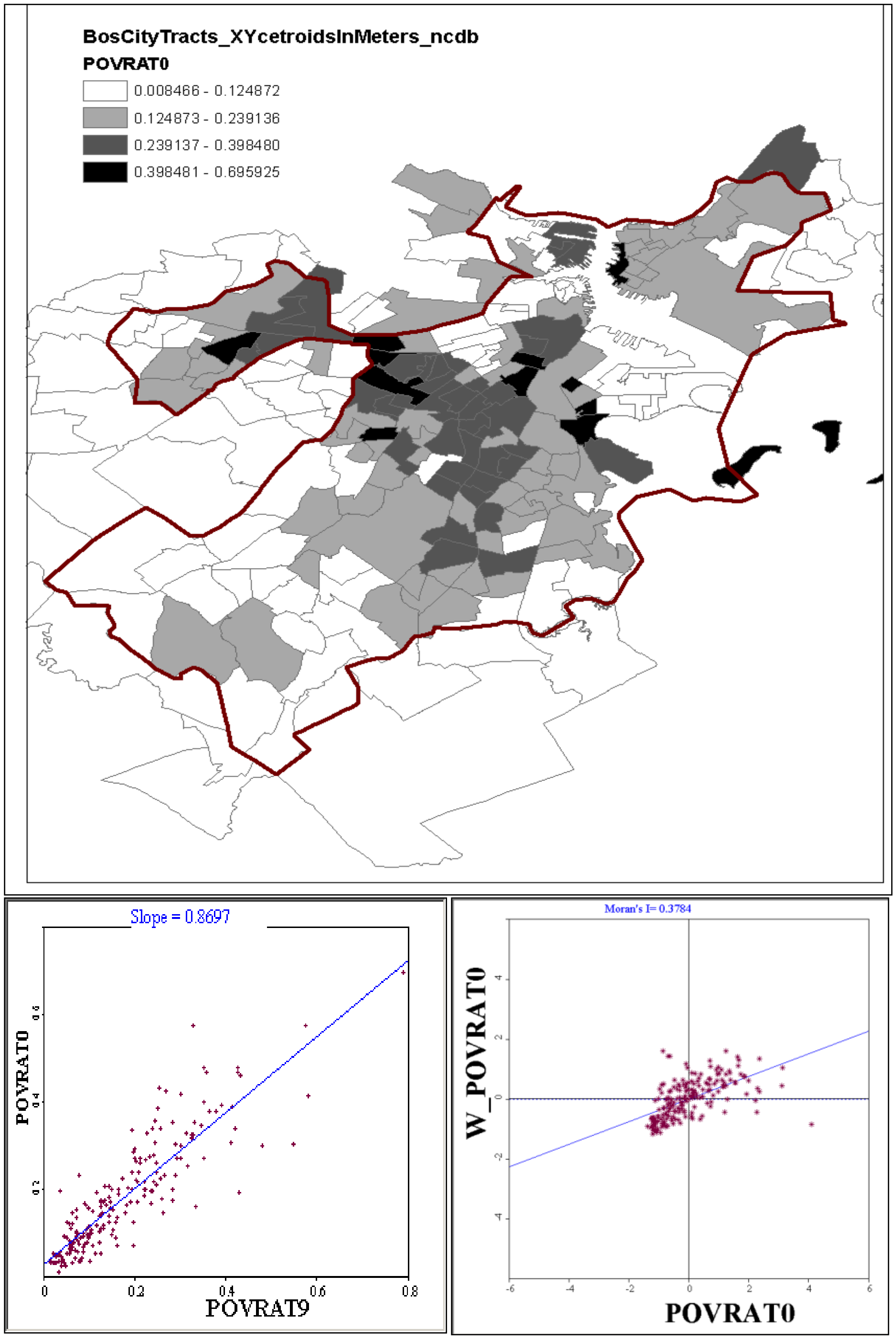

Figure 3. Spatial distribution of neighborhood poverty (Jencks algorithm)

The neighborhood poverty level in 2000 is highly correlated with poverty in 1990 (r =.85) suggesting strong temporal durability. Moreover, the Moran's I for the poverty rate is significant and moderately high (.3784) indicating that neighborhood poverty levels are significantly clustered in space. The spatial weight function that yields this value of Moran's I is based on the Queen contiguity criterion. Similar values are produced from other definitions of spatial proximity, such as the Rook contiguity criterion or the six nearest-neighbors.

Figure 4 shows the spatial distribution of racial and ethnic groups based on neighborhood concentration levels of non-Hispanic whites, non-Hispanic blacks, and Hispanics. The whites are concentrated more toward the outskirts of the city and towards the north-eastern areas, in Charlestown, South Boston area, Back Bay/Beacon Hill, and in the East Boston area. Blacks are highly concentrated at the core of the city (parts of Roxbury, and South Dorchester) and towards the South (in parts of Hyde Park). Hispanics also tend to reside in higher concentrations in the center of the city, in areas of Roxbury and Roslindale, overlapping with, or immediately neighboring the black neighborhoods, but also tend to spread toward north, in the East Boston area, where they share neighborhoods mostly with whites.

Significant Moran's I scores, of over .6 magnitude, indicate very high levels of spatial clustering by racial and ethnic groups across Boston neighborhoods[11]. These findings are important because they indicate that in order to understand the neighborhood context of any family in the city, one may need to take into account the larger structures within which a neighborhood is itself embedded. One can imagine how a disadvantaged neighborhood surrounded by other disadvantaged areas may perhaps constitute a heavier

[11] 999 iterations yielded p-values of .001 for each of the three indices of racial/ethnic composition.

burden for its residents' life than a disadvantaged neighborhood in another part of the city surrounded by non-disadvantaged areas (Sampson et al. 1999).

In light of these findings, I calculated a spatially weighted neighborhood poverty index that accounts for the poverty levels of the contiguous census tracts surrounding a focal neighborhood of residence at any point in time (see Table 2). While at the time of the random assignment, there is no significant difference between the control families and experimental families, at the time of the interim evaluation, 5 to 7 years after the intervention, significant differences emerge between the two groups in the level of poverty surrounding their neighborhoods of residence.

5.2 Neighborhood Dyads and Spatial Mobility Ties

Figure 5 represents moves between neighborhoods by families in the MTO study through a directed arc between a sending and a receiving neighborhood. Thicker lines indicate moves by more than one family. A family can generate more than one line if it moves more than once throughout the duration of the study between the baseline and the most current neighborhood of residence, by the time of the interim evaluation[12].

The map on the left represents inter-neighborhood mobility by families in the control group, while the map on the right represents mobility by the complier families in the experimental group. With some exceptions, compared to the complier group, the moves by the control group appear more local, concentrated within the center of the city, in the Roxbury, South Dorchester, and Mattapan areas, where poverty levels vary less. In

[12] The within-neighborhood mobility is considerable and important, but to limit the scope of this analysis, I focus here mainly on inter-neighborhood residential mobility. In addition, moves to neighborhoods outside the city, and from outside back in, are ignored in order to keep the analysis focused on the within city dynamics. In a different paper, I explore the residential mobility that connects the city to the suburbs and back.

contrast, the compliers in the MTO group move overall more toward outside the core of the city toward the less poor neighborhoods, in areas of Roslindale, Hyde Park, and even into South Boston. To get to these less poor neighborhoods, families travel a larger distance. This may have serious repercussions for the moving families by straining their access to locally embedded networks of social support. While a good part of their moves into less poor areas is by design, an immediate result of the program's requirement to do so, this map also indicates the extent to which, as they continue to move after the required year of residence in the low-poverty neighborhood of "treatment", they sometimes sort themselves into some of the same neighborhoods as the control group, such as the more poor areas of South Dorchester. In the following analyses, I examine the extent to which the overlap is significantly different from a random pattern.

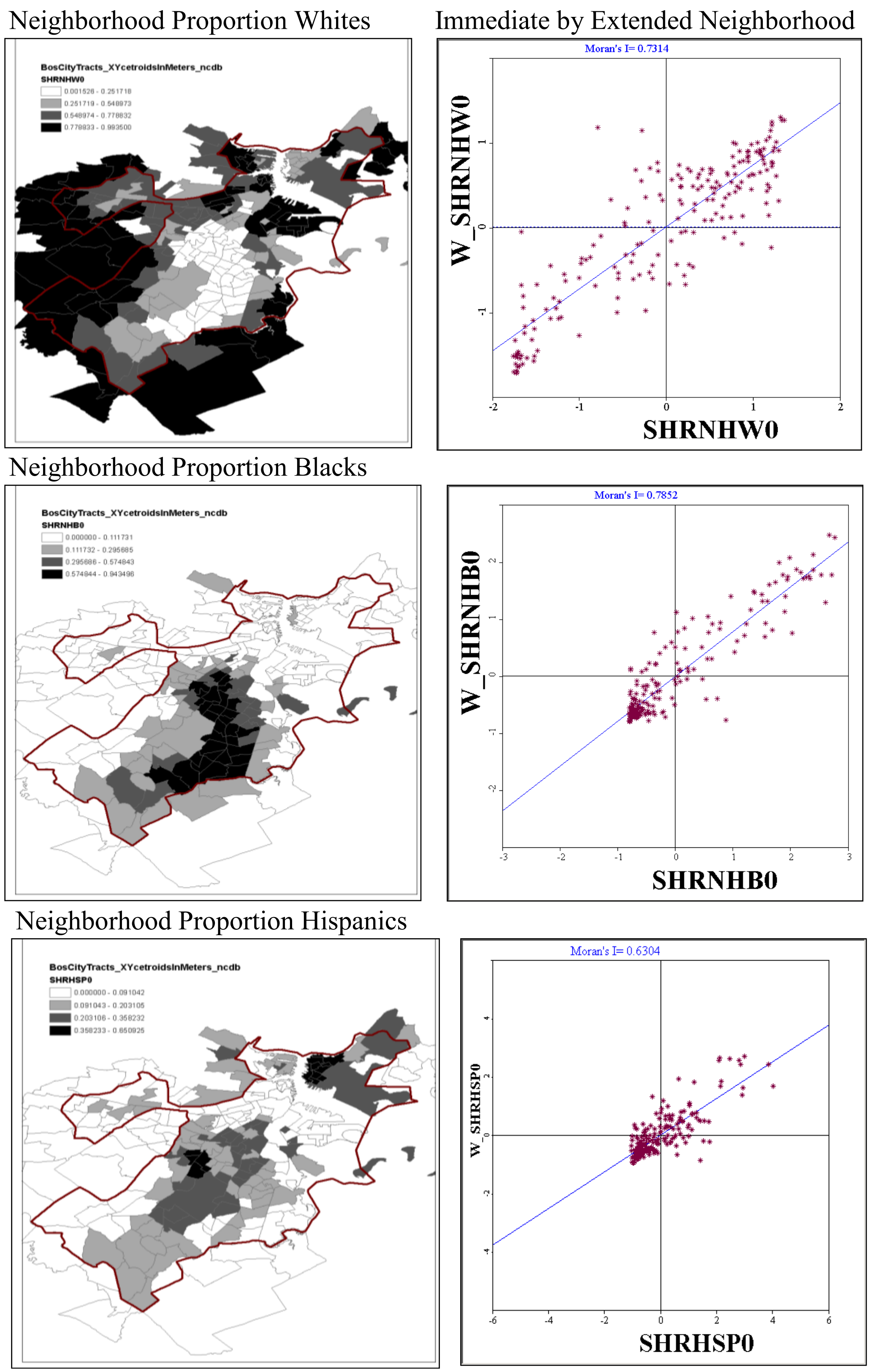

Figure 4. Spatial clustering of racial and ethnic groups across Boston neighborhoods and corresponding Moran's I scatterplots

Table 2. MTO Families in Boston: Sociodemographic characteristics of the baseline neighborhoods of residence, the most current neighborhoods of residence by 2002, and of the average neighborhoods of residence on families' residential trajectory between

	Blacks						Hispanics						Whites					
	Control		MTO		Δ		Control		MTO		Δ		Control		MTO		Δ	
	Mean	SD	Mean	SD	Mean	SE	Mean	SD	Mean	SD	Mean	SE	Mean	SD	Mean	SD	Mean	SE
Baseline Neighborhood																		
Poverty Rate	.363	(.107)	.345	(.086)	-.018	(.013)	.377	(.103)	.349	(.105)	-.027	(.012) *	.458	(.046)	.454	(.070)	-.004	(.014)
Unemployment Rate	.132	(.061)	.128	(.052)	-.004	(.007)	.128	(.054)	.127	(.059)	.000	(.006)	.113	(.017)	.116	(.030)	.004	(.006)
Prop. Males Unemployed	.536	(.086)	.521	(.096)	-.015	(.012)	.532	(.090)	.528	(.094)	-.004	(.011)	.540	(.060)	.546	(.077)	.006	(.017)
Prop. Female-Headed HH	.611	(.113)	.585	(.145)	-.027	(.017)	.562	(.137)	.572	(.134)	.010	(.015)	.591	(.074)	.574	(.117)	-.017	(.024)
Prop. Public Assistance HH	.267	(.058)	.263	(.055)	-.005	(.007)	.265	(.066)	.259	(.056)	-.006	(.007)	.292	(.042)	.294	(.059)	.002	(.012)
Prop. College Graduates or Higher	.152	(.095)	.174	(.126)	.022	(.015)	.182	(.129)	.167	(.117)	-.015	(.014)	.123	(.063)	.117	(.058)	-.006	(.014)
Prop. Owner Occupied HU	.135	(.107)	.128	(.090)	-.007	(.013)	.111	(.096)	.140	(.108)	.029	(.012) *	.135	(.059)	.141	(.113)	.006	(.022)
Prop. in Same House 5 yrs Earlier	.517	(.103)	.516	(.097)	-.001	(.013)	.487	(.108)	.514	(.100)	.027	(.012) *	.561	(.036)	.562	(.041)	.002	(.009)
Prop. Whites (non Hispanic)	.190	(.210)	.154	(.182)	-.036	(.026)	.244	(.203)	.186	(.200)	-.058	(.023) *	.432	(.163)	.436	(.149)	.004	(.037)
Prop. Blacks (non Hispanic)	.440	(.237)	.465	(.220)	.025	(.030)	.346	(.221)	.445	(.240)	.100	(.026) ***	.164	(.132)	.150	(.092)	-.014	(.026)
Prop. Hispanic	.306	(.103)	.314	(.088)	.008	(.013)	.319	(.108)	.296	(.100)	-.023	(.012)	.295	(.085)	.298	(.106)	.003	(.023)
Spatially Weighted Poverty Rate	.251	(.055)	.265	(.063)	.014	(.008)	.259	(.071)	.256	(.063)	-.003	(.008)	.210	(.035)	.201	(.038)	-.010	(.009)
Spatially Weighted Unemployment Rate	.103	(.027)	.104	(.022)	.002	(.003)	.093	(.022)	.098	(.021)	.005	(.002) *	.068	(.011)	.065	(.009)	-.003	(.002)
Current Neighborhood																		
Poverty Rate	.305	(.120)	.223	(.125)	-.082	(.016) ***	.324	(.117)	.258	(.131)	-.065	(.014) ***	.332	(.175)	.168	(.144)	-.164	(.038) ***
Unemployment Rate	.116	(.057)	.092	(.050)	-.024	(.007) ***	.112	(.041)	.106	(.065)	-.006	(.006)	.091	(.038)	.063	(.047)	-.028	(.010) **
Prop. Males Unemployed	.472	(.101)	.423	(.116)	-.049	(.014) ***	.489	(.113)	.454	(.125)	-.036	(.014) *	.464	(.124)	.371	(.119)	-.093	(.029) **
Prop. Female-Headed HH	.574	(.143)	.491	(.177)	-.083	(.021) ***	.546	(.144)	.505	(.172)	-.041	(.018) *	.475	(.174)	.323	(.179)	-.152	(.042) ***
Prop. Public Assistance HH	.216	(.078)	.172	(.094)	-.044	(.012) ***	.224	(.088)	.192	(.092)	-.032	(.010) **	.222	(.111)	.132	(.112)	-.090	(.027) ***
Prop. College Graduates or Higher	.163	(.112)	.194	(.131)	.031	(.016)	.190	(.145)	.181	(.119)	-.009	(.015)	.158	(.097)	.232	(.113)	.073	(.025) **
Prop. Owner Occupied HU	.232	(.152)	.342	(.213)	.111	(.025) ***	.189	(.160)	.294	(.204)	.105	(.021) ***	.261	(.210)	.415	(.239)	.153	(.054) **
Prop. in Same House 5 yrs Earlier	.528	(.103)	.548	(.092)	.019	(.013)	.508	(.107)	.534	(.097)	.025	(.012) *	.553	(.052)	.566	(.085)	.013	(.017)
Prop. Whites (non Hispanic)	.235	(.260)	.308	(.325)	.073	(.039)	.252	(.229)	.292	(.283)	.040	(.030)	.573	(.249)	.704	(.247)	.130	(.059) *
Prop. Blacks (non Hispanic)	.459	(.270)	.458	(.296)	-.001	(.038)	.387	(.256)	.406	(.273)	.019	(.030)	.113	(.105)	.080	(.131)	-.032	(.029)
Prop. Hispanic	.240	(.133)	.178	(.141)	-.061	(.018) ***	.282	(.145)	.236	(.140)	-.046	(.016) **	.220	(.150)	.117	(.143)	-.103	(.035) **
Spatially Weighted Poverty Rate	.233	(.067)	.184	(.089)	-.048	(.011) ***	.233	(.073)	.210	(.083)	-.023	(.009) *	.188	(.076)	.120	(.066)	-.068	(.017) ***
Spatially Weighted Unemployment Rate	.097	(.028)	.080	(.032)	-.017	(.004) ***	.088	(.026)	.089	(.037)	.001	(.004)	.067	(.025)	.051	(.020)	-.016	(.005) **
All Neighborhoods on Residential Pathway																		
Duration Weighted Poverty Rate	.238	(.055)	.191	(.078)	-.046	(.009) ***	.239	(.056)	.206	(.070)	-.033	(.007) ***	.190	(.056)	.139	(.064)	-.051	(.014) ***
Duration Weighted Unemployment Rate	.101	(.026)	.086	(.029)	-.015	(.004) ***	.092	(.021)	.089	(.030)	-.003	(.003)	.069	(.017)	.058	(.018)	-.010	(.004) *
N	111		117				138		169				31		40			

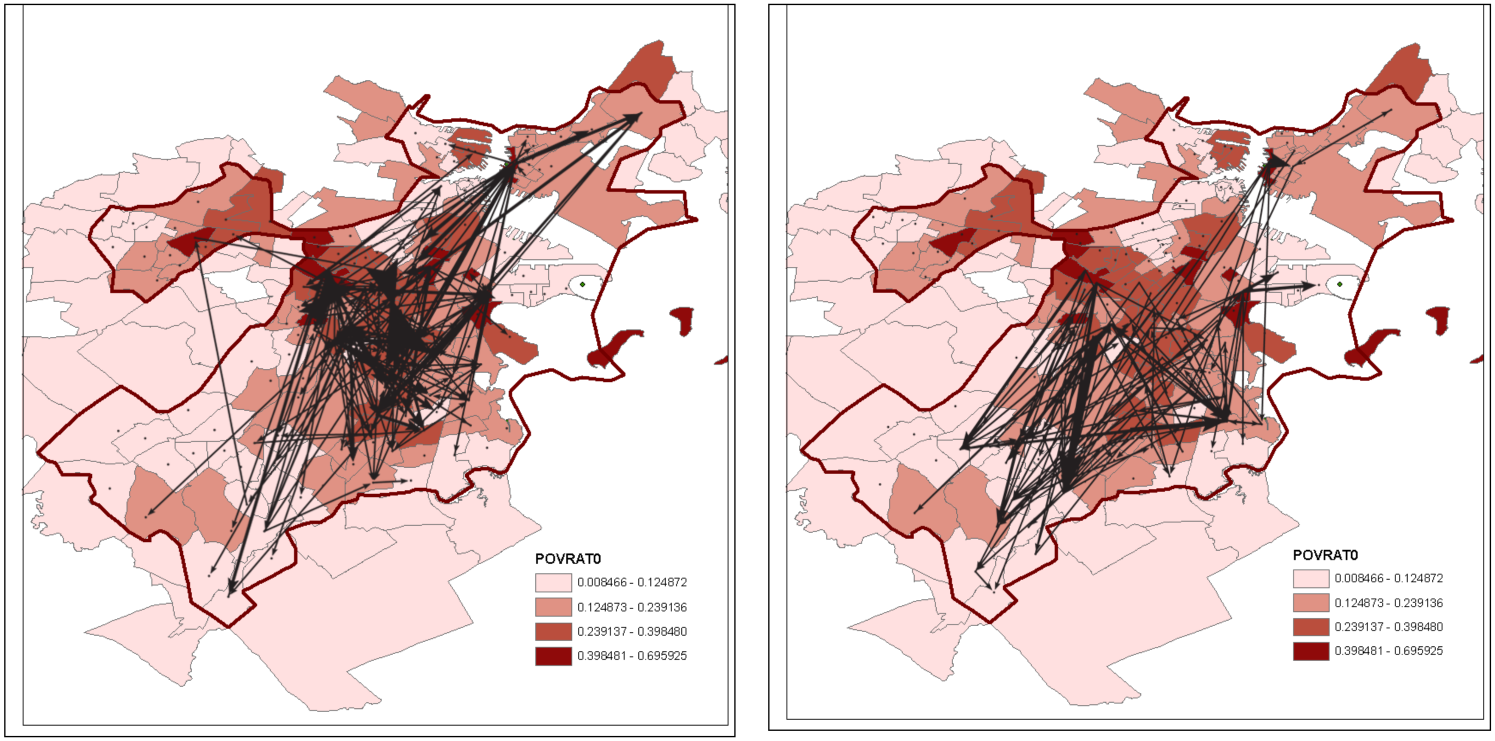

Figure 5. Inter-neighborhood connections based on residential mobility within Boston by MTO families in the control group and in the MTO experimental compliers group by 2002. Dots are neighborhood centroids; lines represent moves by families; arrows indicate the direction of the moves; neighborhood are color coded based on poverty rates.

Table 3. QAP Correlations. Ties between receiving neighborhood pairs are based on families moving in during the duration of the study by 2002 from a shared third neighborhood

	Inter-Neighborhood Mobility Networks (Receiver-by-Receiver)								
	Black Mover Ties			Hispanic Mover Ties			White Mover Ties		
	Control	Experimental Complier	Experimental All	Control	Experimental Complier	Experimental All	Control	Experimental Complier	Experimental All
Black Mover Ties									
Control	1.000								
	(.000)								
Experimental Complier	.019	1.000							
	(.126)	(.000)							
Experimental All	.066	.237	1.000						
	(.001)	(.000)	(.000)						
Hispanic Mover Ties									
Control	.095	.033	.119	1.000					
	(.000)	(.041)	(.000)	(.000)					
Experimental Complier	.014	.032	.019	.007	1.000				
	(.154)	(.056)	(.096)	(.284)	(.000)				
Experimental All	.076	.011	.048	.086	.498	1.000			
	(.001)	(.219)	(.010)	(.000)	(.000)	(.000)			
White Mover Ties									
Control	-.005	-.001	-.004	.007	-.003	-.007	1.000		
	(.785)	(.990)	(.814)	(.294)	(.890)	(.603)	(.000)		
Experimental Complier	-.003	-.001	-.003	-.004	-.002	-.004	-.001	1.000	
	(.896)	(.996)	(.919)	(.850)	(.953)	(.808)	(.989)	(.000)	
Experimental All	-.006	-.001	-.006	.002	-.004	-.009	.135	.483	1.000
	(.663)	(.984)	(.708)	(.439)	(.828)	(.468)	(.002)	(.000)	(.000)
Dissimilarity in Neigh. Prop. Black (non-Hispanic)	.007	-.001	.023	.000	-.018	-.017	-.030	-.016	-.038
	(.377)	(.489)	(.097)	(.481)	(.154)	(.225)	(.012)	(.122)	(.017)
Dissimilarity in Neigh. Prop. Hispanics	-.013	-.017	.015	-.002	-.012	-.012	.005	-.018	-.005
	(.296)	(.026)	(.239)	(.476)	(.295)	(.355)	(.350)	(.042)	(.436)
Dissimilarity in Neigh. Prop. White (non-Hispanic)	-.061	-.009	-.033	-.077	-.030	-.052	-.016	-.012	-.022
	(.001)	(.190)	(.014)	(.000)	(.014)	(.002)	(.083)	(.132)	(.049)
Dissimilarity in Neigh. Poverty Rate	-.022	-.012	-.028	-.018	-.046	-.019	.010	-.019	.020
	(.154)	(.122)	(.078)	(.222)	(.002)	(.243)	(.224)	(.033)	(.127)
Spatial Distance (caculated from X and Y coordinate i	-.068	-.015	-.067	-.088	-.034	-.068	-.011	-.018	-.046
	(.000)	(.071)	(.000)	(.000)	(.019)	(.003)	(.204)	(.059)	(.001)

Note: p- value in paranthesis. Results after 5000 permutations. N = 24492. Square matrices, valued edges, diagonals not counted.

Table 4. QAP multiple regressions. Ties between receiving neighborhood pairs are based on families moving in during the duration of the study by 2002 from a shared third neighborhood

	Inter-Neighborhood Mobility Networks (Receiver-by-Receiver)											
	All Mover Ties			Black Mover Ties			Hispanic Mover Ties			White Mover Ties		
	Control	Experimental Complier	Experimental All	Control	Experimental Complier	Experimental All	Control	Experimental Complier	Experimental All	Control	Experimental Complier	Experimental All
Intercept	.1890	.0570	.1890	.0388	.0020	.0253	.0562	.0200	.0709	.0027	.0025	.0070
Spatial Distance	-.0188	-.0033	-.0174	-.0040	-.0002	-.0033	-.0064	-.0013	-.0062	-.0003	-.0002	-.0012
	(.000)	(.016)	(.000)	(.001)	(.113)	(.000)	(.000)	(.042)	(.003)	(.127)	(.063)	(.000)
Dissimilarity in Neighb. Poverty	-.0003	-.1073	-.0700	.0059	-.0019	-.0088	.0204	-.0325	-.0010	.0030	-.0037	.0109
	(.529)	(.000)	(.258)	(.402)	(.259)	(.358)	(.263)	(.011)	(.504)	(.239)	(.067)	(.105)
Dissimilarity in Neighb. Prop. Blacks	.2101	-.0019	.1303	.0506	.0002	.0412	.0691	-.0029	.0224	-.0052	-.0024	-.0094
	(.001)	(.467)	(.012)	(.003)	(.440)	(.002)	(.000)	(.374)	(.214)	(.024)	(.056)	(.020)
Dissimilarity in Neighb. Prop. Hispanics	.0857	-.0295	.0433	.0158	-.0029	.0364	.0420	-.0026	.0071	.0007	-.0035	-.0032
	(.188)	(.193)	(.324)	(.260)	(.087)	(.048)	(.118)	(.444)	(.445)	(.399)	(.056)	(.383)
Dissimilarity in Neighb. Prop. Whites	-.2957	-.0127	-.1839	-.0697	-.0005	-.0458	-.1031	-.0060	-.0562	.0013	.0012	.0022
	(.000)	(.212)	(.001)	(.000)	(.336)	(.001)	(.000)	(.229)	(.013)	(.286)	(.200)	(.320)
R-square	.041	.009	.240	.012	.001	.010	.019	.004	.008	.001	.001	.004

Note: p- value in paranthesis. Results after 2000 permutations. N = 24492. Square matrices, valued edges, diagonals not counted.

5.3 From Space to Networks and Back

Table 3 presents bivariate patterns in the relational characteristics of dyads of neighborhoods defined to be tied to each other if they receive families from the MTO program moving in from the same third neighborhood. The coefficients indicate the extent to which a tie between two neighborhoods, based for instance on African American families moving in from the same third neighborhood, is associated with a tie based on moves by White families and Hispanic families from the same fourth and fifth neighborhood, respectively.

The last rows of the table indicate the extent to which neighborhood dyads indirectly connected through MTO families moving within Boston are more similar or dissimilar to each other in poverty, racial composition, or closer to each other in space. A negative coefficient indicates that similarity between two neighborhoods on a particular attribute predicts a tie between them. A positive coefficient indicates that dissimilarity in a particular attribute predicts a tie between two neighborhoods. A nonsignificant coefficient indicates that similarity or dissimilarity between two neighborhoods is non-significantly associated with neighborhood (indirect) connections based on moving patterns by families in the MTO program.

The results indicate that ties between two receiving neighborhoods based on mobility patterns within the city of Black families in the control group are not associated with ties based on moves by Black experimental compliers. This non-association between ties based on the control mobility and ties based on complier mobility is repeated for white families as well as for Hispanic families. This finding indicates that, across all racial and ethnic groups, the program has expanded compliers' residential pathways out of the structurally constrained residential pathways of the control group (and into new realms of resources and opportunity, as intended —but more on this below). Note, however, that the coefficient is not negative, which means that the patterns do not completely exclude each other, either.

When examining the patterns of connection within neighborhood dyads based on residential moves by all families in the experimental group (compliers or non-compliers), such ties are positively associated with ties based on moves by the control group. This finding is consistent across ties based on moves by each of the three racial and ethnic groups. It suggests that the moves by non-compliers are considerably pulling the experimental group back into residential pathways typical of the control group. While one would expect that non-compliers' moving patterns would resemble more the moving patterns of the control group, it is disconcerting that they supersede the advantage gained by the compliers to such a degree as to push the overall pattern back into its old tracks.

Inter-neighborhood ties based on receiving patterns from the same third neighborhood, defined from moves by control group families (of any racial/ethnic group) are not significantly related to inter-neighborhood similarity in poverty rates. In contrast to individual level analyses that indicate that even families in the control group over time lose significant levels of neighborhood poverty by moving to new neighborhoods, these results here indicate that the receiving neighborhoods dyads do not consistently exhibit the same levels of poverty. On the other hand, this also means that the receiving neighborhood pairs are not homogenously high-poverty or divergently low-high poverty, either. The pattern of association with poverty is not significantly different from a random pattern.

On the other hand, the receiving-neighborhood networks based on moves by compliers exhibits a significant association with similarity in poverty rates, particularly for White and Hispanics (but not for Blacks). This finding is robust to adding controls for racial composition and spatial proximity between neighborhoods, and indicates that the program works in shaping neighborhood trajectories of whites and Hispanics (but not of Blacks) in a way that keeps the receiving neighborhood contexts for these groups, even after subsequent moves, consistently low-poverty. Nevertheless, the advantage dilutes when looking at ties based on moves by the whole experimental group (rather than just the compliers). These patterns are consistent with the ones described above, and suggest that, overall, the neighborhood pathways of compliers and of the controls do not significantly overlap, yet, the pathways of the full experimental group tends to shift the residential patterns back into more similar tracks to those of the control families.

Similarity in neighborhood concentration of whites significantly predicts neighborhood similarity in receiving movers from the same third neighborhoods, particularly for Black and Hispanic movers in the control or experimental group, for whom the pattern is also robust to controls—see Table 4. For ties based on compliers in all three racial-ethnic groups however, the whites' concentration in a neighborhood matters non-significantly (as is apparent in the bivariate as well as in the multivariate models with added controls for poverty, racial composition, and spatial proximity).

Flows based on white movers in the control or experimental group are associated with similarity in neighborhood concentration of whites in the bivariate case but the pattern is not robust to controls for poverty, spatial distance and other races. Nevertheless, similarity in neighborhood concentration of blacks is significantly and positively associated with inter-neighborhood ties based on the pattern of moves by whites in any randomization group, a result that is robust to controls. This suggests that while similarity in the (high) concentration of whites is perhaps confounded with similarity in neighborhood affluence, similarity in the (low) levels of concentration of blacks is associated with the destination patterns for white movers independent of other relational characteristics of the receiving neighborhoods.

In contrast, inter-neighborhood receiver-to-receiver ties based on the pattern of moves by black families in the control and the experimental group (but not in the complier group) are negatively predicted by neighborhood dyadic similarity in the concentration of blacks, which indicates a significant heterogeneity in the black concentration of the destination neighborhoods for black families overall. The significant divergence in the destination pathways of black families in the control and experimental groups suggests that, while many of the families moving out of a black neighborhood cannot afford to/ or manage to enter neighborhoods of lower levels of black concentration, some are successful in escaping segregation even when unsuccessful in escaping from poverty.

Overall, neighborhood dyadic ties based on receiving patterns form the same third sending neighborhood, from all MTO families (all racial/ethnic groups together) in the complier group, are significantly predicted by similarity in (lower levels of) neighborhood poverty and non-significantly predicted by dyadic similarity in neighborhood racial/ethnic make-up. In contrast with the findings for the control groups, these results are consistent with the program's objective of lowering neighborhood poverty and with its implicit assumptions that the racial/ethnic make-up of the receiving neighborhoods would not interfere with this objective. Nevertheless, in looking closely at the neighborhood flows based on moves differentiated by race, it becomes apparent how the racial composition of the destination neighborhoods impact the moves by complying whites. However, when looking at the experimental group overall, the neighborhood dyadic connections follow a pattern of association that mirrors that of the control groups more than that of the compliers.

Spatial proximity of neighborhoods significantly and positively predicts inter-neighborhood ties based on moving patterns by families of any race/ethnicity, in any of the control, complier, or experimental group. The findings are robust to controls for dyadic similarity in poverty and racial composition and are repeated for each of the racial groups separately with two exceptions, black compliers and white controls, which exhibit an insignificant (but still negative) coefficient.

The results presented in Table 5 are similar to the ones in Table 4 except that the new models, examine direct rather than indirect ties. They also control for pairwise similarity in the racial and ethnic diversity levels of neighborhoods – a Herfindahl-based index of concentration and distribution of the major racial and ethnic groups in a neighborhood. The higher the score the more groups are present in a neighborhood and the less predominant is any one group in particular. In addition to estimating the role of pairwise dissimilarity in poverty (models i) in predicting an inter-neighborhood connection based on moves by families in the control group, the experimental group, or the experimental complier group, respectively, models (ii) estimate the role of pairwise dissimilarity in neighborhood socioeconomic disadvantage as measured as an average between the disadvantage level of a focal neighborhood and the corresponding level of its spatially contiguous neighboring neighborhoods. Models (iii) investigate in more detail the role of specific types of similarity in disadvantage in predicting inter-neighborhood flows.

In contrast to the non-significant results for indirect ties presented earlier, dissimilarity in neighborhood poverty has a significant role in predicting inter-neighborhood ties based on moves by families in the control and complier groups (but not those in the full experimental group). This result reflects the efforts of the control families to improve their environment and move to less poor neighborhoods. However, as column (ii) shows, their inter-neighborhood trajectories are significantly predicted by similarity in spatially weighted disadvantage suggesting that the control families are not able to escape inter-neighborhood dependencies of a more complex nature related to environmental deprivation that goes beyond poverty to also indicate higher unemployment rates, and higher proportions of families with public assistance, or of female-headed families with children. In contrast to the control group, the pairwise similarity loses significance in predicting the inter-neighborhood pathways based on moves by the experimental groups and the complier ties are predicted by dissimilarity in disadvantage, indicating the ability of the compliers to cut across disadvantage levels. Columns (iii) indicate that similarity in high levels of disadvantage are significantly more likely (than similarity in low levels of, or dissimilarity in disadvantage) to predict inter-neighborhood ties based on moves by families in the control group. In contrast, similarity in low levels of disadvantage is significantly more likely than similarity in high disadvantage levels to predict flows based on moves by families in the complier group. The role of similarity in disadvantage is not significant for moves by the full experimental group, which is an improvement compared to the control flows but a regression compared to the complier flows.

The model (iii) represented by the results in Table 5 is repeated in Table 6 separately for each of the three major ethnic and racial groups of MTO families. The first three columns indicate that the results for Hispanic flows follow the same pattern as the results for all families, mainly, similarity in low levels of disadvantage is significantly less likely than similarity in high levels of disadvantage to predict flows based on moves by Hispanic families in the control group but the parameters estimate loses significance and magnitude in predicting the inter-neighborhood trajectories of the Hispanics in the experimental group. For both Hispanics and white flows, similarity in low levels of disadvantage are more likely than similarity in high-level of disadvantage to predict flows based on moves by the complier groups. In predicting inter-neighborhood flows based on moves by Black families however, similarity in high levels of disadvantage remains significantly more likely than similarity in low levels of disadvantage -- indicating that the trajectories of Black experimental movers follow more closely the trajectories of the Black families in the control group.

Table 5: Estimating flows between neighborhoods based on moves of all racial and ethnic groups by random assignment status (binary ties)

	CONTROL MOVERS			EXPERIMENTAL MOVERS			COMPLIER MOVERS		
	(i)	(ii)	(iii)	(i)	(ii)	(iii)	(i)	(ii)	(iii)
Geographic Distance	-.073 *	-.067 *	-.025 *	-.074 *	-.072 *	-.056 *	-.042 *	-.041 *	-.049 *
	(.026)	(.022)	(.027)	(.027)	(.029)	(.022)	(.018)	(.019)	(.013)
Dismilarity in Population Density	-.022	-.023	-.014	-.031 *	-.031 *	-.031 *	-.021	-.021	-.029 *
	(.029)	(.024)	(.027)	(.030)	(.031)	(.023)	(.019)	(.019)	(.014)
Dismilarity in Residential Stability	-.058 *	-.052 *	-.037 *	-.055 *	-.051 *	-.044 *	-.041 *	-.037 *	-.037 *
	(.025)	(.022)	(.027)	(.026)	(.029)	(.022)	(.017)	(.018)	(.013)
Dissimilarity in Racial-Ethnic Diversity	-.058 *	-.042 *		-.056 *	-.058 *		-.047 *	-.056 *	
	(.021)	(.018)		(.017)	(.018)		(.010)	(.007)	
Low-Low Spatially Weighted Racial-Ethnic Diversity (a)			-.031			-.066 *			-.080 *
			(.028)			(.020)			(.009)
High-Low Spatially Weighted Racial-Ethnic Diversity (a)			-.037 *			-.061 *			-.074 *
			(.027)			(.020)			(.009)
Dissimilarity in Proportion Poverty	.041 *			.024			.032 *		
	(.024)			(.029)			(.016)		
Dissimilarity in Spatially Weighted Socioeconomic Disadvantage		-.031 *			.017			.049 *	
		(.025)			(.031)			(.017)	
Low-Low Spatially Weighted Socioecoonmic Disadvantage (b)			-.135 *			-.035			.050 *
			(.021)			(.024)			(.012)
High-Low Spatially Weighted Socioeconomic Disadvantage (b)			-.141 *			-.016			.087 *
			(.018)			(.023)			(.013)
Pseudo R-square	.014 *	.013 *	.026 *	.014 *	.014 *	.015 *	.007 *	.008 *	.012 *

NOTE.- Cell values represent standardized coefficients. Standard errors are in parantheses. N=24492. *p<.01. Values calculatde based on 200 iterations. (a) Reference is High-High Spatially Weighted Racial-Ethnic Diversity. (b) Reference is High-High Spatially Weighted Socioecoomic Disadvantage.

Table 6: Estimating flows between neighborhoods based on moves by racial and ethnic group by random assignment status (binary ties)

	HISPANIC MOVERS			BLACK MOVERS			WHITE MOVERS		
	CTRL	EXP	COMPL	CTRL	EXP	COMPL	CTRL	EXP	COMPL
Geographic Distance	-.012	-.039 *	-.031 *	-.017	-.027 *	-.022 *	-.012	-.029 *	-.031 *
	(.014)	(.012)	(.009)	(.012)	(.010)	(.003)	(.001)	(.001)	(.010)
Dismilarity in Population Density	-.012	-.032 *	-.026 *	-.017	-.021	-.023 *	-.017	.023 *	-.024 *
	(.014)	(.012)	(.009)	(.012)	(.010)	(.003)	(.001)	(.001)	(.010)
Dismilarity in Residential Stability	-.014	-.025	-.021 *	-.026 *	-.026 *	-.018	-.022 *	-.025 *	-.014
	(.014)	(.012)	(.009)	(.012)	(.010)	(.003)	(.001)	(.001)	(.010)
Low-Low Spatially Weighted Racial-Ethnic Diversity (a)	-.044 *	-.068 *	-.077 *	.022	-.018	-.022	.006	-.019	-.065 *
	(.014)	(.009)	(.005)	(.012)	(.010)	(.003)	(.001)	(.001)	(.006)
High-Low Spatially Weighted Racial-Ethnic Diversity (a)	-.053 *	-.060 *	-.071 *	.025 *	-.024	-.033 *	.010	-.009	-.056 *
	(.013)	(.009)	(.005)	(.040)	(.010)	(.002)	(.001)	(.001)	(.006)
Low-Low Spatially Weighted Socioecoonmic Disadvantage (b)	-.094 *	-.009	.049 *	-.107 *	-.055 *	.007	-.024	.005	.043 *
	(.012)	(.013)	(.008)	(.007)	(.009)	(.003)	(.001)	(.001)	(.009)
High-Low Spatially Weighted Socioeconomic Disadvantage (b)	-.099 *	.015	.085 *	-.114 *	-.058 *	.018	-.020	.008	.078 *
	(.011)	(.013)	(.008)	(.006)	(.008)	(.003)	(.001)	(.001)	(.009)
Pseudo R-square	.014 *	.009 *	.009 *	.013 *	.008 *	.002 *	.001 *	.002 *	.007 *

NOTE.- Cell values represent standardized coefficients. Standard errors are in parantheses. N=24492. *p<.01. Values calculatde based on 200 iterations. (a) Reference is High-High Spatially Weighted Racial-Ethnic Diversity. (b) Reference is High-High Spatially Weighted Socioecoomic Disadvantage.

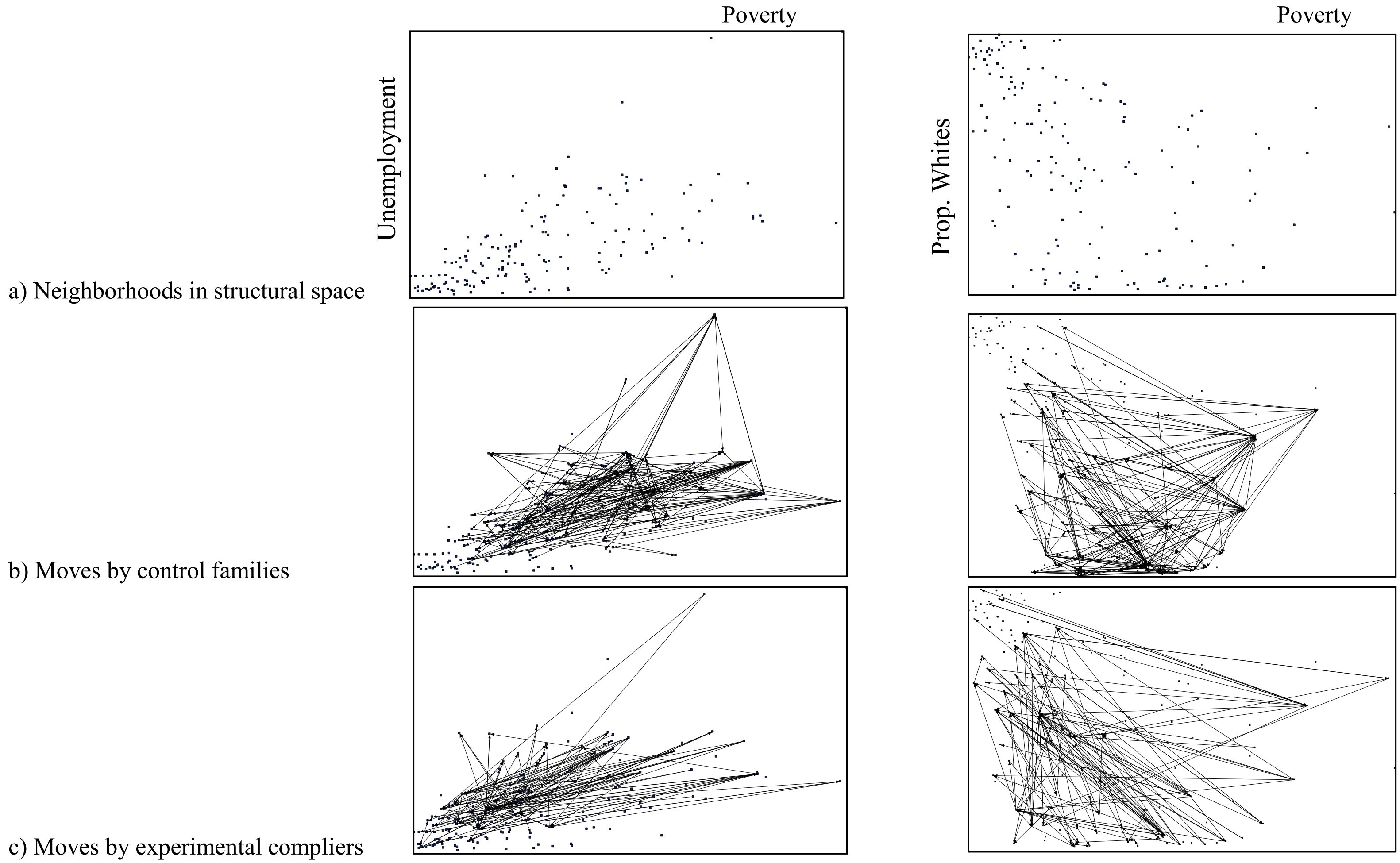

Figure 6. Inter-neighborhood connections based on residential mobility within Boston by MTO families in the control group and in the MTO experimental compliers group by 2002. Dots are neighborhoods; lines represent moves by families; arrows indicate the direction of the moves; neighborhood attributes substitute for spatial coordinates.

5.4 From Spatial Distance to Social Distance

For analyses depicted in Figure 6, I employ tools from social network analysis to illustrate the flexibility of the notion of space and shift the focus from geographic distance to that of social distance. Patterns in the inter-neighborhood direct ties based on residential mobility by the MTO families are overlaid on a social distance map of Boston neighborhoods, where the coordinates are represented not by measures of latitude and longitude but by their levels of poverty -- on the horizontal axis-- and their unemployment (the plots on the left) or concentration of white residents, respectively (the plots on the right) - on the vertical axis. The first row of plots shows the relative positioning of neighborhoods in an abstract space based on their levels of poverty and unemployment (first map) and on poverty and proportion of whites (the second map). The second row, adds to the layer above an additional layer that includes data on inter-neighborhood connections based on direct moves by control families from a sending to a receiving neighborhood. The third row is similar to the second row except that it is based on moves by the experimental complier families.[13]

In combination with analyses represented by models in Tables 3 to 6, these plots indicate the extent to which inter-neighborhood ties associate with patterns of similarity in neighborhood levels of poverty on the one hand, and unemployment, or proportion whites, on the other hand. They show that compared to the control group, the bulk of mobility flows based on complier moves tend to connect neighborhoods of slightly lower

[13] The appropriate groups to compare are the control and the full experimental group in order to eliminate concerns about potential differences between the compliers and non-compliers. I do so in the analyses. Visually, however, I compare the control group and experimental complier flows to illustrate that even when one maximizes the chances for contrast, the flows are not strikingly different.

unemployment and poverty, as well as toward neighborhoods with higher whites concentrations and lower poverty rates.

6. Conclusion

This paper aimed to contribute to the literature on racial and ethnic segregation and residential mobility of population by proposing an integration of the spatial analysis and network analysis frameworks. It shifted the focus of the analysis from the individual level to the neighborhood level and pushed it further from a focus on absolute attributes (of a person, family, or neighborhood) to relational attributes and inter-neighborhood connections. I argued that neighborhoods could be conceptualized as vertices in a citywide network of neighborhoods. Geographic proximity between two neighborhoods and similarity in socio-demographic characteristics shape inter-neighborhood connectivity based on residential mobility flows.

Results of spatial autocorrelation and multiple regression analyses show the role of inter-neighborhood dependencies in predicting the spatial and structural overlapping or divergence in the patterns of mobility of the MTO participants across Boston neighborhoods (overall and separated by groups based on race/ethnicity or randomization status). Neighborhoods connected through moves by the control group are more similar in their high level of disadvantage than neighborhoods connected through complier moves, and the two patterns of inter-neighborhood exchanges do not significantly overlap. This non-random separation in the patterns of flows indicate that the program has successfully expanded compliers' pathways out of the limited residential trajectories of the control group into neighborhoods of lower poverty levels for all three racial and ethnic groups. These new pathways translate into contextual gains for white and Hispanic compliers whose inter-neighborhood mobility pattern is consistently associated over time with low levels of poverty and disadvantage. However, the gains are less apparent for blacks.

The strong spatial autocorrelation scores for poverty and racial compositions found in Boston may in part reflect measurement error in the definition of neighborhood boundaries-- when administrative demarcation lines do not fully overlap with the actual or perceived boundaries of neighborhoods as places of social interaction -- an issue of shape as well as scale. Yet, evidence in other cities and at different scales of aggregation indicate that even when accounting for measurement error in boundary definitions, neighborhoods that are closer in space look more similar to each other than neighborhoods that are farther from each other in geographic space. A possible reason for this pattern is that residents in nearby neighborhoods have more opportunities to interact and associate with each other than residents of distant neighborhoods. The results of analyses presented above indicate that residential moves by the MTO participants – low-income families with children-- tend to occur within smaller, rather than larger, distances, perhaps reflecting their effort to maintain connectivity to old networks of social support.

Overall, the results suggest that poor white families in the MTO program in Boston were able to maintain over time their contextual advantage, Hispanic families when systematically helped were able to escape trajectories of disadvantage, while Blacks -- despite initial gains in neighborhood quality-- were not as successful in escaping the spatial and structural trajectories of disadvantage and segregation. Considering the nature and level of residential segregation that structures the U.S. urban landscape, results indicate that mobility regimes are considerably differentiated by racial and ethnic status. While similarity in high levels of neighborhood diversity shapes the inter-neighborhood mobility of Hispanic families in the control or experimental groups, the inter-neighborhood flows based on moves by Blacks or Whites are not associated considerably with differences in neighborhood diversity.

6.1 The Network Embeddedness of Segregated Neighborhoods

In an effort to move beyond spatial constraints to understanding the more general, structural constraints that influence the locational attainment of families, I examined the residential pathways of MTO families across space and time. Overlaying the dynamic map of residential mobility on the urban canvas to better understand the macrolevel inter-neighborhood dependencies that shape what on the surface may appear as voluntary flows, I show that MTO families of different racial and ethnic status move across space in starkly non-overlapping patterns. This analysis contributes to the literature by shifting the focus of analysis from individuals or neighborhoods to inter-neighborhood ties as formed by the geographic mobility of families across space. The findings contribute to the literature on racial and ethnic segregation by indicating that the mobility flows are considerably differentiated along racial and ethnic lines, a differentiation that remains little scathed by the exogenous shock of the intervention. These findings have key implications for public policy and for the literature on neighborhood effects and segregation by highlighting the need for further studies on the spatially embedded processes of integration and exclusion. Families participating in the Moving to Opportunity Experiment were not selected to be representative of all families, or of all low-income families in their respective cities, which limits the generalizability of the results. I expect however that the structural homophily found underlying neighborhood connectivity across space is a powerful force that governs the spatial mobility of other low income families, across cities, and perhaps of families of all levels of socioeconomic status. Preliminary analyses of residential mobility of Chicago residents based on the PHDCN data suggest that similar results may be expected in other contexts and for population groups of different socioeconomic status (Sampson and Graif 2010). Additional analyses based on representative populations in other cities would be valuable.

While the MTO results indicate that homophilic forces may be overcome to an extent, important racial/ethnic inequalities remain nonetheless. Moreover, the experimental design offers powerful leverage in understanding how an exogenous shock may bring new options for the urban poor by helping them break away from routine circuits of spatial deprivation and by rerouting them instead into new circuits of opportunity. These analyses constitute a valuable step further in understanding how neighborhood dyads shape the spatio-structural contexts of residential mobility while, at the same time, they, themselves are shaped by the larger spatial structures of the citywide neighborhood network in which they are embedded. Neighborhood interdependencies that transcend space are important to take into account when devising housing and mobility policies because of their inherent connection to segregation patterns in the city, (see also Clampet-Lundquist and Massey 2008; Sampson 2008), making up the durable and self-reinforcing structural forces that differentially limit opportunities and choice for different racial and ethnic groups.

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