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Determinants of Chicago Neighborhood Homicide Trajectories: 1965-1995

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ABSTRACT

The homicide rate in Chicago nearly tripled between 1965 and 1992, and subsequently declined by more than 50% through 2005. But is this trend representative of all areas in the city? Drawing on the social disorganization and concentrated disadvantage perspectives, this paper uses semi-parametric group-based trajectory modeling to examine homicide trajectories in Chicago neighborhoods from 1965-1995. Significant variability is found in homicide trajectories across neighborhoods. Multivariate results show that disadvantage increases the likelihood of having an increasing or persistently high homicide trajectory. Social disorganization and family disruption are also predictive of variation in homicide trajectories, but only in communities with already low levels of homicide. Other theoretically relevant predictors are evaluated, and suggestions for theoretical refinement and future research are discussed.

One of the most important social changes in the United States during the 1980s and 1990s was the dramatic increase and subsequent decrease in crime, and particularly violent crime, in large cities. Perhaps nowhere was this more controversial and publicized than New York City, but the changes in Chicago were similarly dramatic. Indeed, the homicide rate in Chicago nearly tripled between 1965 and 1992, after which it declined by more than 50% through 2005. This is a remarkable pattern of change, but is this trend representative of all areas in the city? If not, what other trends in homicide can be identified among Chicago neighborhoods, and what might explain the variation in trajectories across areas?

Much of the prior research on neighborhoods and crime has drawn on the social disorganization perspective which argues that neighborhoods characterized by high levels of poverty, residential turnover, and heterogeneity find it difficult to realize common values and solve collective problems, which may in turn lead to higher rates of crime (Shaw & McKay, 1942) . Others have expanded the perspective by specifying the intervening mechanisms through which structural characteristics of neighborhoods may influence crime rates, such as through social ties, mutual trust, or a shared willingness to engage in informal control (Bellair, 1997; Bursik, 1988; Sampson & Groves, 1989; Sampson, Raudenbush, & Earls, 1997). Though these theoretical approaches are firmly grounded in an ecological approach that emphasizes temporal concepts such as instability, population turnover, deterioration, and cyclical change, surprisingly few studies have employed longitudinal designs to explicitly capture such processes (Bursik, 1986; Fagan & Davies, 2004). This is likely due in part to data limitations, as it can be costly and time consuming to collect the necessary measures at multiple points in time. Moreover, at least in the early stages of the development of this perspective, statistical methods for effectively modeling change over time were not available. Thus, while a great deal of prior criminological research has examined variation across neighborhoods in levels of crime, much less work has been dedicated to describing crime trends within neighborhoods, and even less research has attempted to the identify characteristics associated with variation across neighborhoods in crime trajectories.

Another possible reason for the predominance of cross-sectional research in the study of communities and crime is the strong emphasis by Shaw & McKay (1942) on the stability of crime generating processes in neighborhoods (Bursik, 1984, 1986). That is, although rapid residential change was a large part of the social disorganization framework in the early Chicago School, there was an assumption that the processes that generated high crime in neighborhoods were, themselves, fairly stable over time. This led to their influential conclusion that neighborhood rates of juvenile delinquency remained relatively stable over time despite sometimes rapid changes in racial and ethnic composition within neighborhoods. However, a handful of studies in the 1980s and 1990s questioned this stability hypothesis, instead arguing that change in neighborhoods can occur through multiple processes, and even the same dynamic processes can lead to different outcomes across neighborhoods depending on their initial ecological characteristics and their current stage in the developmental process (Bursik & Grasmick, 1992; Schuerman & Kobrin, 1986; Taylor & Covington, 1988). This approach suggests that communities progress through developmental pathways that can yield variation across communities in not just crime rates at a single point in time, but also in their trajectories of crime over a span of time.

This notion of community careers in crime parallels the concept of 'criminal careers' from the individual-level developmental and life-course literature where researchers often attempt to identify classes of individual offenders, such as abstainers, adolescent-limited delinquents, and life-course persistent offenders (Laub & Sampson, 2003; Moffitt, 1993; Piquero, Farrington, & Blumstein, 2003). If we were to think of crime patterns in terms of a neighborhood 'life-course', what types of trajectories might be evident? Do neighborhoods essentially mirror the city-level crime trend, with differences only in scale, or does the pattern of change over time vary across neighborhoods? Recent macro-level research has begun to directly address these questions, with a general finding that neighborhoods do, indeed, seem to exhibit a variety of crime trajectories that are sometimes considerably different from the trend of the broader city (Chavez & Griffiths, 2009; Griffiths & Chavez, 2004; Weisburd, Bushway, Lum, & Yang, 2004).

The purpose of the current study is to extend this line of research, and to expand upon it in important ways. First, recent studies of neighborhood crime trajectories have examined relatively short periods of time, typically spanning around 15 years through the 1980s and 1990s. As noted earlier, this span of time was characterized by rapid changes in the crime rate, and certainly requires extensive analysis. However, the changes over this period are part of a broader trend that included a doubling of the national homicide rate from the mid 1960's to the late 1970's (Fox & Zawitz, 2007). Though the national homicide rate peaked in 1980 at a rate of 10.2 per 100,000, we had already reached a rate of 7.9 as early as 1970, and it continued to climb to a penultimate peak of 9.8 by 1974. A detailed and thorough analysis of each period of change is necessary, but the current paper takes a broader view by examining neighborhood homicide trajectories in Chicago over a span of more than 30 years.

A second way in which the current study builds upon prior research is by attempting to identify the characteristics of neighborhoods that are associated with particular homicide trajectories. Prior research has documented various crime trajectories across neighborhoods, but the next logical question is what gives rise to these various trajectories and, given similar levels of homicide at the beginning of the time period, what factors are associated with a neighborhood being categorized into one trajectory grouping over another? Drawing on the social disorganization and concentrated disadvantage literature, this study will assess the degree to which structural characteristics of neighborhoods influence homicide trajectories.

LITERATURE REVIEW

Social Disorganization and Between-Community Variation in Crime

Criminologists have long been interested in the extent to which crime and violence varies across neighborhoods. A large body of empirical research has identified substantial spatial variation in crime rates, and several major criminological theories have attempted to explain such between-unit differences. One of the earliest and most influential approaches to communities and crime in the United States was the analysis

of community areas in Chicago by Shaw & McKay (1942). They followed an ecological framework arguing that natural processes of growth, competition, and decay in the city create areas with consistently high levels of poverty, ethnic heterogeneity, and population turnover. It was argued that these factors tend to reduce levels of interpersonal interaction and value consensus among residents which impedes the community's ability to achieve common goals and control its residents. Using analytic methods that were sophisticated and ambitious for the time, Shaw & McKay were able to show that areas near the central business district of Chicago were consistently and considerably higher in rates of juvenile delinquency than neighborhoods further from the city core.

A large body of empirical work has since studied variation in crime across communities from the social disorganization perspective. Early studies found effects of socioeconomic characteristics, racial heterogeneity, home-ownership, and transiency on juvenile delinquency (Bordua, 1958; Chilton, 1964; Gordon, 1967; Lander, 1954). More recent research has expanded on Shaw & McKay's original framework by attempting to explicate the intervening mechanisms through which macro-social structural characteristics influence levels of informal social control and subsequently crime and delinquency (Sampson & Groves, 1989; Simcha-Fagan & Schwartz, 1986; Smith & Jarjoura, 1988; Patterson, 1991). For example, Sampson & Groves (1989) used data from the British Crime Survey to provide a more direct test of the social disorganization perspective by examining the mediating effects of local friendship networks, organizational participation, and the neighborhood capacity to supervise teens. They found that these indicators of social disorganization mediated much of the influence of neighborhood structural characteristics on crime and victimization. Likewise, Bellair (1997) found that getting together at least once a year with neighbors significantly reduced several forms of criminal victimization and mediated a large portion of the effects of ecological characteristics such as socioeconomic status and racial heterogeneity.

More recently, Sampson and colleagues have extended the social disorganization framework by emphasizing not just neighborhood ties, but also shared trust among neighborhood residents and a

willingness to actively engage in social control (Morenoff, Sampson, & Raudenbush, 2001; Sampson et al., 1997). Neighborhoods with high levels of collective efficacy are characterized by mutual trust and shared expectations with regard to informal control, and are better able to effectively mobilize to control criminal behavior among residents. Several empirical studies, mostly utilizing data from the Project on Human Development in Chicago Neighborhoods (PHDCN), have found supportive results for the notion of collective efficacy. For example, Sampson et al. (1997) found that commonly-used indicators of social disorganization – concentrated disadvantage, immigrant concentration, and residential instability – were inversely related to collective efficacy, and that the latter, in turn, was inversely associated with violent crime in Chicago neighborhoods. Other research has found that collective efficacy significantly reduced neighborhood levels of homicide and non-lethal violence among intimates (Browning, 2002), and that communities with lower levels of mutual trust and civic engagement tend to have higher levels of homicide (Rosenfeld, Messner, & Baumer 2001).

Social Disorganization and Within-Community Variation in Crime

The studies cited above have contributed a great deal to our knowledge and understanding of variation in community levels of crime, yet they all examine neighborhood crime cross-sectionally. This is despite the fact that Shaw & McKay themselves utilized several decades of data to draw their conclusions, and central to their argument was the notion that urban growth and change are the fundamental precursors to social disorganization and crime. Though one of Shaw & McKay's most influential findings was that neighborhood crime rates were actually quite stable over time regardless of the invasion and succession that was characteristic of Chicago neighborhoods in the early part of the twentieth century, others warned that city ecology can change over time (Chilton & Dussich, 1974; Rosen & Turner, 1967; Schuerman & Kobrin, 1986), and Bursik (1984) strongly states that "community processes related to delinquency can only be placed within larger urban dynamics and given a full meaning through longitudinal data" (p.395).

Starting in the 1980's, research on neighborhood crime began to directly examine the influence of neighborhood characteristics on change over time (Bursik 1984,1986; Heitgard & Bursik, 1987; Bursik & Webb, 1982; Taylor & Covington, 1988). Bursik & Webb (1982) re-analyzed Shaw & McKay's claim that the distribution of delinquency across Chicago neighborhoods was relatively stable over time. Examining data from 1940-1970, they generally confirmed the stability hypothesis for the earliest decade, but found that compositional changes in the subsequent decades were significantly related to changes in delinquency. Likewise, examining Baltimore neighborhoods from 1970-1980, Taylor & Covington (1988) found that increasing neighborhood instability was linked with increased levels of violence regardless of whether the neighborhood was undergoing decline or gentrification.

Subsequent research has expanded on these longitudinal approaches by simultaneously examining both within-neighborhood changes in crime and variation in crime trends across neighborhoods. In the first such study, Bursik & Grasmick (1992) found that neighborhoods characterized by increasing stability from 1930-1970 tended to experience significant declines in delinquency. They also showed that inferences about temporal processes gleaned from cross-sectional approaches could vary considerably from the conclusions drawn from research where time is directly incorporated. More recently, and using similar methods, Kubrin & Herting (2003) found significant variation in homicide trends across St. Louis neighborhoods from 1980-1994. They found that for some types of homicide, neighborhood disadvantage and instability helped explain both initial levels and changes over time.

Community Careers in Crime

An alternative approach to the study of neighborhood crime trends draws upon research in the developmental psychological literature that categorizes individuals into a discrete number of groups based on their pattern of delinquent, criminal, or deviant behavior over some period of time (Nagin, 2005; Nagin & Land, 1993). With regard to neighborhood crime, the objective is to identify a set of crime trajectories

that are representative of the patterns found in neighborhoods across the city. Regression analysis can then be applied to identify the characteristics associated with being categorized into a certain trajectory. Though the application of this approach to the macro-level analysis of crime is relatively new, this type of developmental perspective certainly follows the lead of urban ecology with its emphasis on the stages that communities pass through on their developmental trajectories.

Perhaps the first explicit application of the developmental perspective to the study of communities and crime was the study of crime trends in Los Angeles communities from 1950-1970 by Schuerman & Kobrin (1986). They introduced the notion of community careers in crime by categorizing neighborhood crime trends as either emerging, transitional, or enduring. They followed with an analysis of the determinants and consequences of each stage, finding that rising crime tended to be preceded by neighborhood deterioration characterized by factors such as increasing multiple-family dwellings and residential mobility.

More recently, several studies have utilized modern methods of trajectory analysis to analyze neighborhood crime trends. Using 14 years of crime data for Seattle street segments, Weisburd et al. (2004) were able to classify 30,000 micro-areas into 18 unique crime trajectories. They found that the city's overall crime trend was primarily determined by a small proportion of cases in the steeply declining trajectories. Griffiths & Chavez (2004) identified three unique homicide trajectories for Chicago neighborhoods from 1980-1995, and found a diffusion effect of gun-related violence from clusters of neighborhoods with persistently high homicide rates to areas where homicide was moderate and slowly increasing. In a subsequent study on Chicago neighborhoods over this same period, Chavez & Griffiths (2009) found that neighborhoods with a large presence of recent immigrants tended to fall in the persistently low homicide trajectory.

The application of a developmental perspective to the study of neighborhood crime has shown that crime trajectories do vary across neighborhoods. However, prior research has not yet examined a broad set

of theoretically relevant characteristics that may be associated with those varied trajectories. The purpose of this study is to expand on prior research by examining homicide rates in Chicago neighborhoods over a longer time period, 1965 to 1995, and to identify neighborhood characteristics that are associated with being in a particular homicide trajectory group.

RESEARCH DESIGN AND METHODS

Data Sources and Variables

The dependent variable in the multivariate analysis will be a categorical variable with values indicating assignment to one of a set of homicide rate trajectories estimated for census tracts in Chicago from 1965-1995. To generate the homicide rate (per 100,000), homicide counts were obtained from the Chicago Homicide Data Set available from the National Criminal Justice Archive at ICPSR (Block, Block, & ICJI, 1998). This data set provides detailed information for all homicides in Chicago from 1965-1995, and includes tract identifiers that allow for merging with other tract characteristics. The population sizes used in the denominator of the homicide rate were obtained from the decennial U.S. Census files for each decade from 1960-2000, using linear interpolation to generate intercensal estimates. Due to skewness of the homicide rate distribution, the natural log was used when estimating trajectories[1]. After excluding tracts with less than 100 persons in either 1965 or 1995, the sample size was 831 census tracts.

A number of compositional characteristics were also drawn from the Census files for 1960 and 2000, including median household income, the unemployment rate, the percentage who have graduated from high school and college, the divorce rate, the percentage of children living with a single parent, the percentage of people who lived in a different house 5 years prior, the home-ownership rate, population density, racial composition, immigrant composition, and the vacancy rate. In order to avoid the problems associated with high levels of multicollinearity among the regressors, several standardized mean indexes

1 A constant of 1 was added before logging in order to avoid undefined logged values.

were created to represent key concepts identified in previous empirical and theoretical work (Land, McCall, & Cohen, 1990). All predictors will be incorporated as both static levels at the beginning of the time period, and as measures of change over time (Kubrin & Herting, 2003; Rosenfeld, Fornango, & Rengifo, 2007). In order to generate change scores, values were first obtained for the decennial years and then linear interpolation was used to generate estimates for 1965 and 1995, which were then differenced.

The *concentrated disadvantage* index is comprised of median household income, the percentage of persons with a high school diploma, the percentage of persons with a bachelor's degree, percentage of persons who are African American, and the percentage of persons unemployed. This index captures levels of resource deprivation. The strong correlations between these component variables indicate that very high degrees of resource deprivation are differentially experienced by African Americans due to economic dislocation and high levels of racial residential segregation in Chicago (Land et al., 1990; Logan, Stults, & Farley, 2004; Massey & Denton, 1993; Morenoff et al., 2001; Wilson, 1987). It is expected that areas with high levels of disadvantage in 1965 will have trajectories with higher starting points, and that increases in concentrated disadvantage will predict increasing homicide trajectory. This index had a reliability score of 0.758 in 1965 and 0.889 in 1995.

Family disruption is measured using an index comprised of the percentage of persons divorced and the percentage of children not living with both parents. Some have argued that neighborhoods with high rates of family disruption have a diminished capacity for formal and informal social control which may lead to higher rates of homicide (Cohen & Felson, 1979; Sampson, 1986, 1987). As with concentrated disadvantage, high levels and increases in family disruption are expected to yield high and increasing trajectories of homicide. These variables were strongly correlated and the indexes had reliability scores of 0.779 in 1965 and 0.655 in 1995.

Social disorganization is measured with an index comprised of the percentage of persons who lived in a different house five years earlier, the percentage of homes that are renter-occupied, and population

density. High levels of population turnover and density are likely to inhibit the ability of residents to recognize each other and develop friendship networks (Kasarda & Janowitz, 1974; Kornhauser, 1978; Wirth, 1938), and residents in such areas may be less willing to exercise informal social control and guardianship behavior (Morenoff et al., 2001; Sampson et al, 1997). Thus, it is expected that areas with high levels of social disorganization in 1965 will have high starting points to their homicide trajectories, and that neighborhoods with increasing disorganization will be more likely to have increasing homicide trajectories. This index also exhibited a high level of reliability with alpha coefficients of 0.786 in 1965 and 0.685 in 1995.

Two other variables are included as separate items in the multivariate analysis. Though popular opinion among the American public is often that immigration and crime are strongly, positively related, much of the empirical research shows that immigrants are less likely to engage in crime than native-born Americans after controlling for other characteristics (Hagan & Palloni, 1999; Mears, 2010). Moreover, macro-level research typically finds either a null or negative relationship between immigrant concentration and crime rates (Chavez & Griffiths, 2009; Lee, Martinez, & Rosenfeld, 2001). Perhaps part of the reason for the presumed positive relationship between immigration and crime is the fact that immigrants are more likely to live in disadvantaged neighborhoods than their native-born counterparts (Alba, Logan, & Bellair, 1994; Alba, Logan, & Stults, 2000). Thus, the percentage of foreign-born persons is included in the multivariate analysis as a measure of *immigrant concentration* with the expectation that high initial levels will be associated with high homicide rates at the start of the time period, but controlling for levels of disorganization and disadvantage, areas with increasing concentrations of immigrants will be associated with a declining homicide trajectory.

Some researchers argue that signs of physical deterioration such as vacant buildings, trash-strewn lots, and graffiti, signal to potential offenders that an area is vulnerable to crime and that residents are too fearful to intervene when crime occurs (Skogan, 1992; Wilson & Kelling, 1982), though a direct empirical

linkage has been questioned (Markowitz, Bellair, Liska, & Liu, 2001; Sampson & Raudenbush, 1999). This is evaluated using the percentage of housing units that are vacant, with the expectation that higher levels and increases in housing vacancy will be associated with increasing homicide trajectories.

Analytic Method

The first stage of the analysis will be to determine whether change over time in neighborhood homicide rates essentially follow a single trend, with differences only in scale, or if there is significant variation in homicide trajectories across neighborhoods. This will be accomplished using semi-parametric group-based trajectory modeling via the SAS module PROC TRAJ (Jones, Nagin, & Roeder, 2001; Nagin, 2005; Nagin & Land, 1993). This approach uses mixture models to identify a finite set of trajectories within which each neighborhood can be categorized. The model parameters are free to vary across trajectories, thus allowing for a set of distinct trajectories that may follow either a linear, quadratic, or cubic functional form. The Bayesian Information Criterion (BIC) statistic is used to determine the optimal number of groups and the functional form that best fits the data. Once the trajectories have been identified, graphical displays are used to illustrate the trajectory that characterizes each group, and the proportion of neighborhoods falling within each trajectory.

The second stage of the analysis will examine whether neighborhoods in the different homicide trajectory groups also vary according to the neighborhood characteristics outlined above. This will entail a comparison of means across homicide trajectory groups in levels of the neighborhood characteristics in 1965 as well as their average change over time.

The final analytic stage will go beyond the descriptive and bivariate analysis by using binomial and multinomial logistic regression analysis to examine potential determinants of neighborhood homicide trajectories. This will make use of posterior probabilities of group assignment that are generated when the trajectory models are estimated. These probabilities are estimated for each neighborhood, and represent the

likelihood that the neighborhood belongs to a particular trajectory group (Nagin, 1999, 2005). Trajectory group assignments can then be used as the dependent variable in a logistic regression model. Thus, the neighborhood structural characteristics will be used as independent variables predicting membership in a given trajectory versus a chosen reference trajectory. This extends prior research by not only identifying a set of homicide trajectories that neighborhoods can be categorized into, but also assessing the extent to which other neighborhood characteristics are predictive or being in a given homicide trajectory group.

RESULTS

Chicago Neighborhood Homicide Trajectories, 1965-1995

The modeling of homicide trajectories followed a two-stage process (Nagin, 2005). The initial stage entails first estimating a one group model with a quadratic functional form, then a two group model, a three group model, and so on, until the inclusion of an additional group no longer improves model fit according to the BIC statistic. Though the maximum likelihood is always increased by adding additional groups, the BIC statistic includes a penalty for each additional parameter, thus rewarding parsimony. The BIC statistics presented in Table 1 show whether allowing for additional groups led to an increase in model fit, and the log Bayes factors presented in the last column provide a measure of the degree of evidence favoring each more complex model over the previous simpler model. These results show that each additional group provides an improvement to model fit up to a seven-group model, after which adding another group yields a decrease in the BIC statistic. This suggests that the improved fit provided by the additional parameters in the eight-group model is not enough to justify the reduction in parsimony. A log Bayes factor of greater than 10 is typically considered to be very strong evidence that a given model is favorable to the previous one (Jones et al., 2001). With a log Bayes factor of 366, the seven-group model emerges as the clear choice. Specifying alternative functional forms (e.g. linear or cubic) did not yield an improvement to model fit, so all trajectories were estimated as quadratic. The average posterior probability of group assignment for all tracts

was 0.935, further suggesting that the selected model fits the data well.

[Table 1 about here]

The predicted trajectories based on the seven-group quadratic model are illustrated in Figure 1[2]. Overall, we see that these seven trajectories are visibly distinct from one other and represent very different patterns of change in homicide. The first three trajectory groups start at low levels of homicide in 1965, but diverge in their trajectories from that point. Group 1, comprising about 12% of all census tracts, is characterized by persistently low levels of homicide throughout the entire time period. Groups 2 and 3 both increase from initially low levels, but Group 3 increases more rapidly to moderately high levels by the late 1980s, with a subsequent leveling off and slight decline into 1995. This pattern is mirrored by the Group 5 trajectory, but at higher levels throughout the time period. Groups 4 and 6 remain relatively constant until the mid-1970s and then begin to decline, but Group 6 starts at high levels and declines to a moderately low level, while Group 4 starts at a moderate level and declines to very low levels. Lastly, Group 7 starts at very high levels of homicide and remains high throughout the time period.

[Figure 1 about here]

Structural Characteristics of Homicide Trajectory Groups

It is clear from the trajectory analysis and the visual illustration in Figure 1 that these census tracts exhibit a variety of different trajectories of homicide over this time period. Census tracts within a particular group are similar in their homicide trajectory, but do they have other common characteristics, and might these be used to differentiate among the various groups in theoretically meaningful ways? Figures 2 and 3 present structural characteristics of the average tract in each trajectory grouping. Figure 2 provides mean values in 1965, the starting point of the series, while Figure 3 provides average levels of change between 1965 and 1995. The mean values underlying each figure are presented in tabular form in Appendices A and

[2] Because logged values are not intuitive, unlogged equivalents are included on the secondary (right-hand side) axis.

B. Because the three indexes are comprised of standardized values with a mean of zero and a standard deviation close to one, percent vacant and percent foreign-born have also been standardized for Figure 2 in order to clarify visual inspection and facilitate interpretation.

While evaluating the mean initial values shown in Figure 2, it is helpful to recognize that the trajectory groups are numbered according to their starting points for homicide in 1965, such that Group 1 has among the lowest homicide rates in 1965 and Group 7 has the highest 1965 homicide rate. Given this ordering, a clear pattern emerges from Figure 2; census tracts in trajectory groups with low homicide rates in 1965 also tend to have low levels of disadvantage, social disorganization, family disruption, and vacancy, while tracts with high starting points tend to have high values. Nearly all of these mean differences across groups are statistically significant (see Appendix A).

[Figure 2 about here]

The pattern for immigrant concentration is not as clear. Groups 1, 2, and 3 all start with very low values of homicide in 1965 and, as expected, tracts in these groups also tend to have above average levels of foreign born percentage. Also as expected, Groups 5, 6, and 7 had higher levels of homicide in 1965, and these groups have the lowest levels of foreign-born percentage. However, despite having among the highest immigrant concentrations, Group 4 also has a moderately high starting point to its homicide trajectory. In fact, the trajectories for Group 4 and Group 5 start at very similar levels, yet they have very different percentages of foreign-born population in 1965.

Figure 3 displays mean levels of change in each variable from 1965-1995 for each trajectory group. This provides an initial indication of whether census tracts in trajectory groups experiencing increases in homicide over the period also experienced increases in other theoretically relevant characteristics. Recall from Figure 1 that Groups 2, 3, and 5 all experienced overall increases in homicide, though from different starting points. Figure 3 shows that these three groups also experienced increases in many of the structural characteristics, though the only variable that increased for all three of these groups was disadvantage.

Family disruption also appears to have increased for all three groups, but the change for Group 2 was negligible. The results are more clear for Groups 4 and 6. Both of these groups experienced declines in homicide over the period, and it appears that they both also experienced sizable declines in every structural characteristic except social disorganization which only declined for Group 6. It should be noted, though, that the finding for the percentage foreign-born for these groups is contrary to expectations since declines in immigrant concentration were expected to be associated with increases in homicide.

Group 7 is also an unusual case in that it experienced relative stability in homicide rates over the period, yet levels of social disorganization declined dramatically during this time, and levels of percent vacant increased. The change in social disorganization appears to be driven by large decreases in residential mobility in these areas. Perhaps high levels of homicide led to the previous out-migration of those with enough resources to move, with few people willing to move in. This would result in a sort of residential stability, as well as stability in levels of concentrated disadvantage, but perhaps this is not the kind of stability that is expected promote the development of dense interpersonal ties, collective efficacy, and social control (Jankowski, 1991; Patillo, 1998). Once again, contrary to expectations, we see that the group with the highest persistent levels of homicide experienced increases in percentage foreign-born. These descriptive findings suggest that the factors associated with a high, persistent homicide trajectory may not be entirely congruent with contemporary theory.

Determinants of Trajectory Group Assignment

The final stage of analysis involves the use of logistic regression to identify characteristics of neighborhoods that are associated with being in a given trajectory grouping over others. One approach would be to include all seven trajectory groups in a single multinomial logistic regression. However, the number and diversity of comparisons that this would produce would yield a highly complex set of findings that would likely defy interpretation. Instead, the following analysis will be conducted on subsets of the full

set of trajectories, using sets of trajectory groups that provide particularly interesting and substantive comparisons.

The first homicide trajectory groups to be analyzed are Groups 1, 2, and 3, with results of the multinomial logistic regression reported in Table 2. Each of these trajectories start with very low levels of homicide in 1965, but change over time in different ways. Group 1, with persistently low levels of homicide, will serve as the reference group, in contrast to Group 2 which experienced moderate increases over this time period, and Group 3 which exhibits a more dramatic increase. Thus, the purpose of this model is to identify neighborhood characteristics that might be predictive of experiencing one of two different increasing homicide trajectories as opposed to a persistently low trajectory.

[Table 2 about here]

Based on the results in Table 2, we see that initial levels and change over the period in several of the variables are significantly associated with trajectory group assignment. Change over time in all three of the index variables increases the probability of being in one of the increasing homicide trajectories rather than the persistently low trajectory, and the effects appear particularly strong for Group 3 versus Group 1. For example, a one-unit increase in the disadvantage index makes a neighborhood 3.64 times as likely to fall into Group 2 as opposed to Group 1, and more than 18 times as likely to fall into the trajectory with the largest increase in homicide rates. Tracts with a larger concentration of immigrants are less likely to be in the rapidly increasing homicide trajectory group versus the low trajectory group, but not less likely to be in the group with a modestly increasing homicide rate. Changes in the vacancy rate are not significantly associated with trajectory group assignments, but tracts with a higher initial vacancy rate in 1965 appear to be more likely to fall into Group 2 versus Group 1.

Table 3 presents the results from two binomial logistic regression models. The first model examines homicide trajectory groups 4 and 5, with the former serving as the reference group. These two trajectories started at similar levels of homicide in 1965, but tracts in Group 4 experienced gradual declines in homicide

over this time period, while tracts in Group 5 experienced the most dramatic increases of all groups. Thus, the results of the first model in Table 3 identify characteristics that predict having a homicide trajectory that increases dramatically from moderate levels versus a trajectory that starts from a similar level but declines over time. Here we see, again, that an increase in disadvantage significantly increases the likelihood of being in the increasing trajectory group. Also as expected, we see that areas with an increasing percentage of immigrants are less likely to be in the increasing homicide trajectory group, and more likely to exhibit a declining trajectory. However, changes in social disorganization, family disruption, and vacancy are not predictive of following one trajectory over the other. The significant positive effects of initial levels of disadvantage and social disorganization are particularly interesting. Since these two trajectories start at similar levels, these effects are not simply capturing a cross-sectional effect of 1965 levels of disadvantage and social disorganization on 1965 homicide rates. Rather, these findings suggest that the initial level of these characteristics in 1965 are predictive of the manner in which homicide rates change over time. In fact, the initial level of disorganization is predictive of the trajectory of homicide for tracts in these groups, but change over time in social disorganization is not.

[Table 3 about here]

The final model in Table 3 provides the results from a binomial logistic regression model comparing Group 7 with Group 6. Both of these groups have homicide trajectories that start are high levels, but Group 7 remains persistently high, while Group 6 exhibits the most rapid decline of all the trajectories. Thus, the coefficients for this model indicate whether increases in these variables are associated with an increased likelihood of being in the persistently high trajectory as opposed to the high but declining trajectory. The results show that both the initial level of disadvantage in 1965, as well as change over time, are positively related to the likelihood of being in the persistently high trajectory. Social disorganization and immigrant concentration are not associated with membership in these trajectory groups, either in terms of initial levels or change over time, while higher initial levels of family disruption and vacant housing are both

associated with being in the persistently high trajectory. Thus, neighborhoods with lower initial levels of disadvantage, family disruption, and immigrant concentration, as well those that experienced declines over time in disadvantage, are more likely to be in the trajectory group characterized by initially high but rapidly declining rates of homicide.

DISCUSSION

The evidence presented in this paper indicates some support for expectations based on the social disorganization and concentrated disadvantage perspectives. One clear finding is that initial levels of neighborhood disadvantage, as well as changes over time, are significantly related to homicide trajectories. Regardless of whether a trajectory starts at low, moderate, or high levels of homicide, it appears that initially high levels of disadvantage, and increases over time, are predictive of having an increasing or persistently high trajectory of homicide. Several other findings were consistent with expectations, but only for trajectory groups at relatively low levels of homicide. For example, increasing levels of social disorganization and family disruption were associated with increasing homicide trajectories, and increases in immigrant concentration reduced the likelihood of being in the two most rapidly increasing trajectories. Support for expectations was also found in the descriptive analysis where it was shown that initial levels of disadvantage, disorganization, family disruption, and vacant housing were all related to the starting points of neighborhood homicide trajectories.

One conclusion that might be drawn from these findings is that traditional theoretical approaches to the study of neighborhood crime levels, which have typically been applied to the study of only between-unit or only within-unit variation in crime levels, can be similarly applied to the study of variability in homicide trajectories across neighborhoods. However, there are certain findings that at first glance appear to provide support for the disorganization and disadvantage literature, but upon closer inspection may pose challenges for these explanations. First, it is unclear why, in some cases, initial levels of the structural characteristics

were related to homicide trajectories, but change over time in those same characteristics was not. For example, higher percentages of vacant housing in 1965 were predictive of being in a low but increasing trajectory (Group 2) versus being in a persistently low trajectory (Group 1), yet change over time in vacancy rates was not significantly related. Likewise, initial high levels of social disorganization increased the likelihood of being in a dramatically increasing trajectory (Group 5) versus a decreasing one (Group 4), while change over time in social disorganization was unrelated.

When faced with similar findings, some have suggested the potential for a ceiling effect, such as when levels of crime are at the extremes such that changes in a predictor could no longer yield further increases or decreases in crime (Simons, Chao, Conger, Elder, 2001). This seems unlikely in the current case since these are trajectories that began at low or moderate levels, and either increased or decreased from those points. Thus, they did experience change in homicide. So, the question remains: why would initial levels of a predictor be associated with being in one trajectory over another while change over time is unrelated? In the case of the dramatically increasing trajectory (Group5) versus the declining trajectory (Group 4), group membership was significantly related to initial levels of social disorganization. Perhaps, as argued by the systemic model of social control, high levels of disorganization inhibit the ability of such neighborhoods to draw on resources from outside the neighborhood, such as effective policing, or money for infrastructure and services (Bursik & Grasmick, 1993). The absence of such resources at the beginning of the time period may have led to higher homicide rates, which in turn may have lead to further levels of disinvestment and continuing increases in homicide.

It is also unclear why we would expect certain neighborhood characteristics to be predictive of increasing trajectories at some levels of homicide, but not at others. For example, increases in family disruption and social disorganization were predictive of trajectory group membership in areas with low initial levels of homicide, but not for neighborhoods with moderate or high levels of homicide. Thus, these structural characteristics that have been identified by ecological theories of crime as important predictors of

neighborhood levels of crime do appear to be related to homicide trajectories, but not in the most violent neighborhoods.

The analysis presented in this paper expands on prior research in important ways, but several limitations and suggestions for future research should be discussed. First, the operationalization of key concepts was limited by the relatively small number of variables available in the 1960 census files. For example, the 1960 tract-level summary files to not include a poverty measure that is consistent with subsequent censuses, nor do they include a compatible measure of female-headed households. Moreover, relying solely on census data precludes the possibility of including any measures of attitudes, perceptions, or social processes. Measures of concepts such as social ties, social disorder, and collective efficacy are simply not available in census data for any decade. To the extent possible, future research should attempt to identify the intervening processes that mediate the effects of compositional and structural characteristics on neighborhood homicide trajectories.

Future research should also investigate alternative methods for evaluating change over time in the predictor variables. The trajectory analysis of homicide rates took advantage of a data source with more than 30 time points, but changes in the independent variables were measured simply as the change from 1965 to 1995. It is possible that this crude measure of change fails to capture additional temporal variability that occurred between those two time points. One possible approach is to use semi-parametric group-based modeling to identify trajectories in the predictor variables as well. These trajectories can then be cross-classified with the homicide trajectories, or a dual-trajectory analysis could be conducted (Nagin 2005). Though these models can be highly complex and often fail to converge, this and other strategies should be pursued to better understand how neighborhood dynamics influence homicide trajectories.

CONCLUSION

Despite the fact that the majority of research on communities and crime has been cross-sectional,

the theoretical and empirical literature clearly emphasizes the importance of change over time in neighborhood structure and social processes for understanding change over time in rates of crime. As researchers continue to gather longitudinal data at the neighborhood level, and as the statistical methods for analyzing change continue to advance, it is important to consider whether we must revise or reorient our theoretical approach to the study of variation in crime trends across local areas. A large body of empirical literature has developed regarding the predictors of homicide across communities, and that research has shown a large degree of consistency in the relevance of particular structural characteristics across different time periods, and across different levels of aggregation (Land, et al., 1990; McCall, Land, & Parker., this issue). Thus, the expectations are fairly clear regarding between-neighborhood variation in crime rates, and from these it is easy to extrapolate expectations about within-community change over time. The current analysis of between-neighborhood variability in within-unit trajectories may appear, at first glance, to be simply a combination of the traditional cross-sectional and longitudinal approaches seen in prior work. However, the preceding analysis and discussion suggests that current theoretical frameworks may not be sufficiently developed to offer clear expectations with regard to the between-unit variability in neighborhood trajectories of homicide.

This line of research could yield important policy recommendations. If we can consistently identify characteristics associated with certain crime trajectories, and assuming these characteristics are responsive to social policies and programs, policymakers could apply interventions that are specifically targeted at neighborhoods at a particular stage of development. For example, the finding that changes in social disorganization only influence homicide trajectories in areas where homicide levels are already low suggests that programs aimed at increasing neighborhood ties and collective efficacy might be effective in such places, but that these approaches may not be successful in areas where homicide is already high. Thus, continued research on the determinants of neighborhood crime trajectories may help in developing more refined, effective, custom-tailed strategies for reducing crime in neighborhoods.

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Figure 1. Predicted Values for Homicide Trajectory Groups, 1965-1995

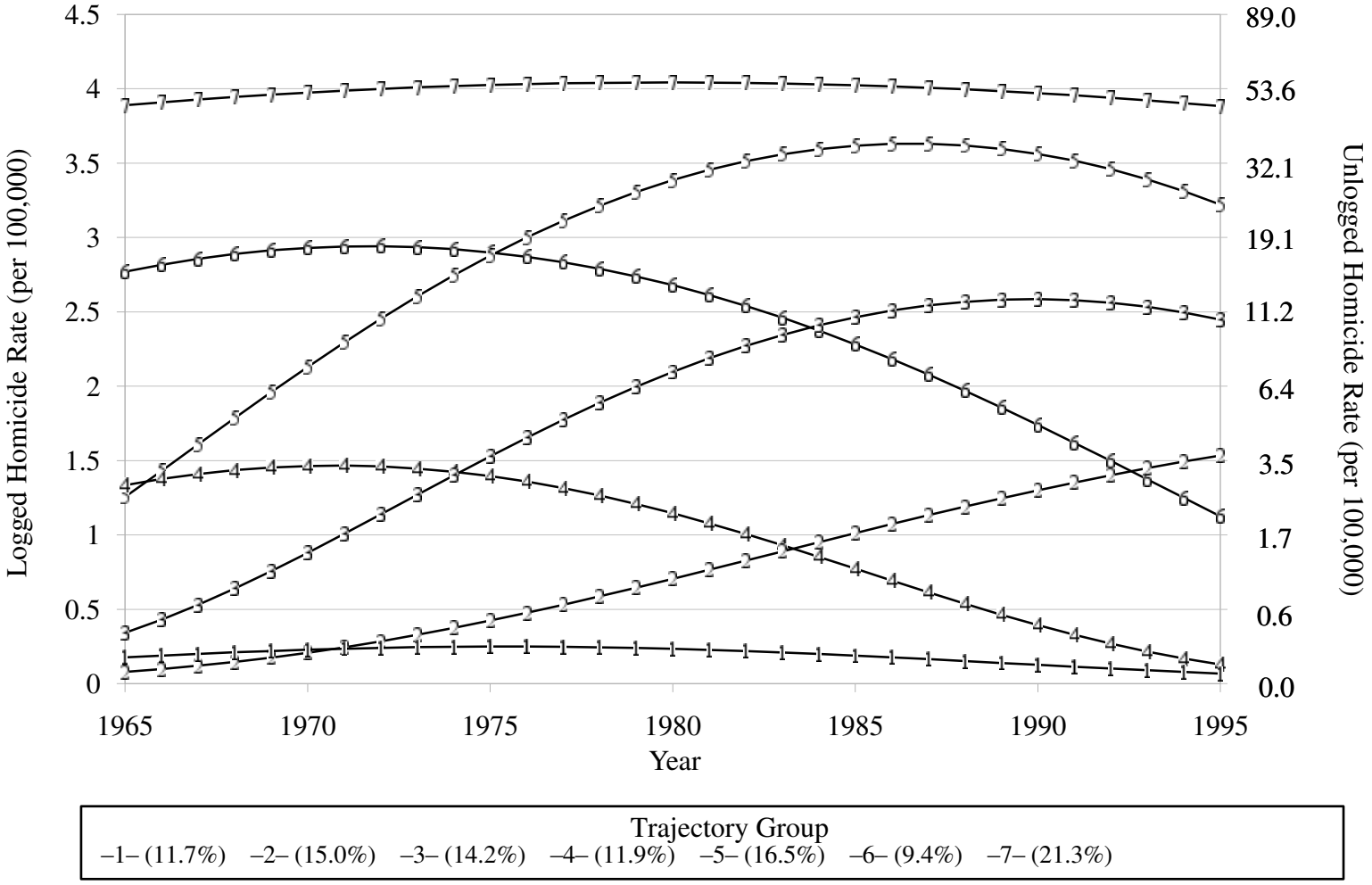

Figure 2. Mean Neighborhood Characteristics in 1965
by Homicide Trajectory Group

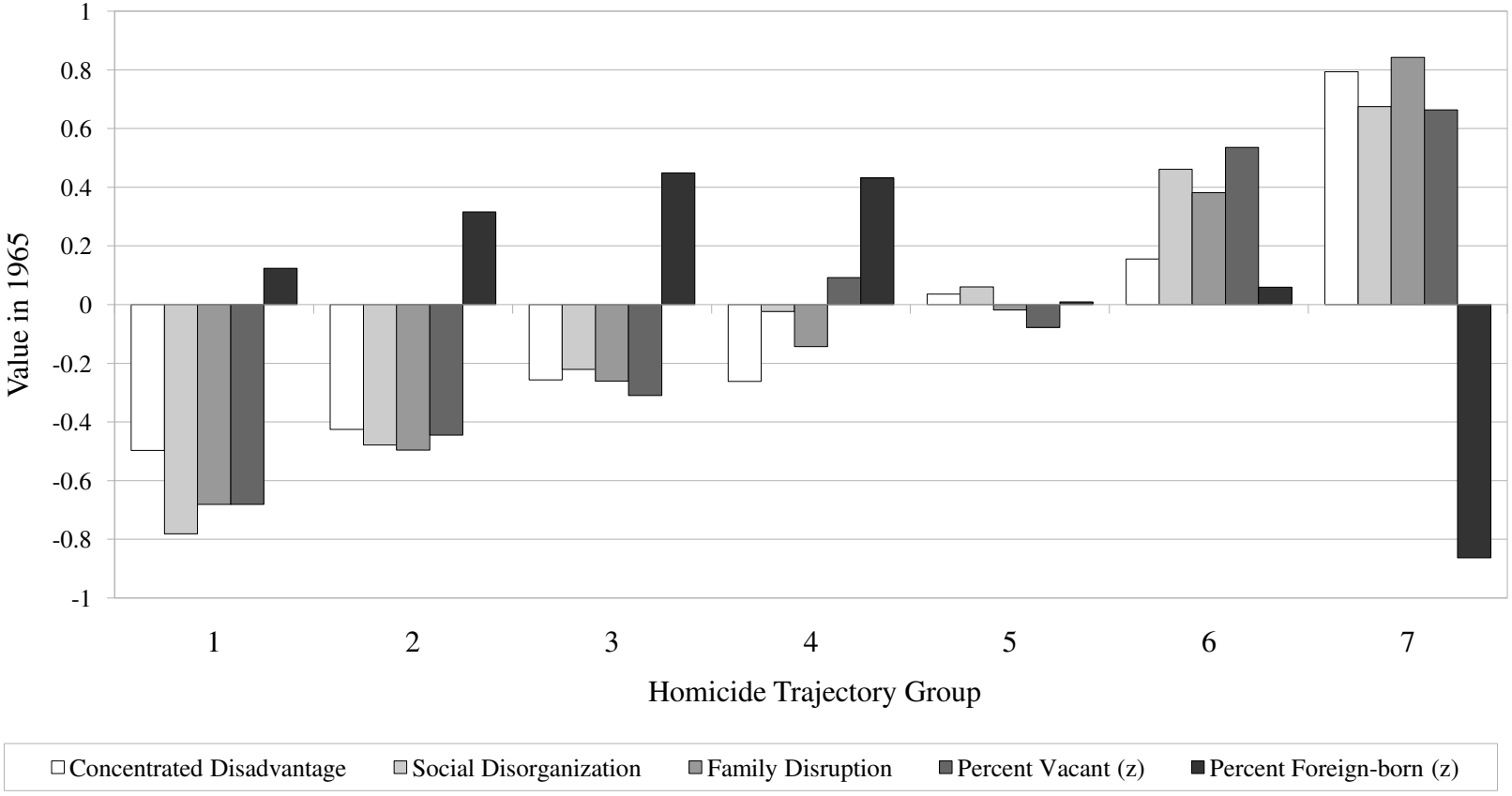

Figure 3. Mean Change in Neighborhood Characteristics from 1965 to 1995 by Homicide Trajectory Group

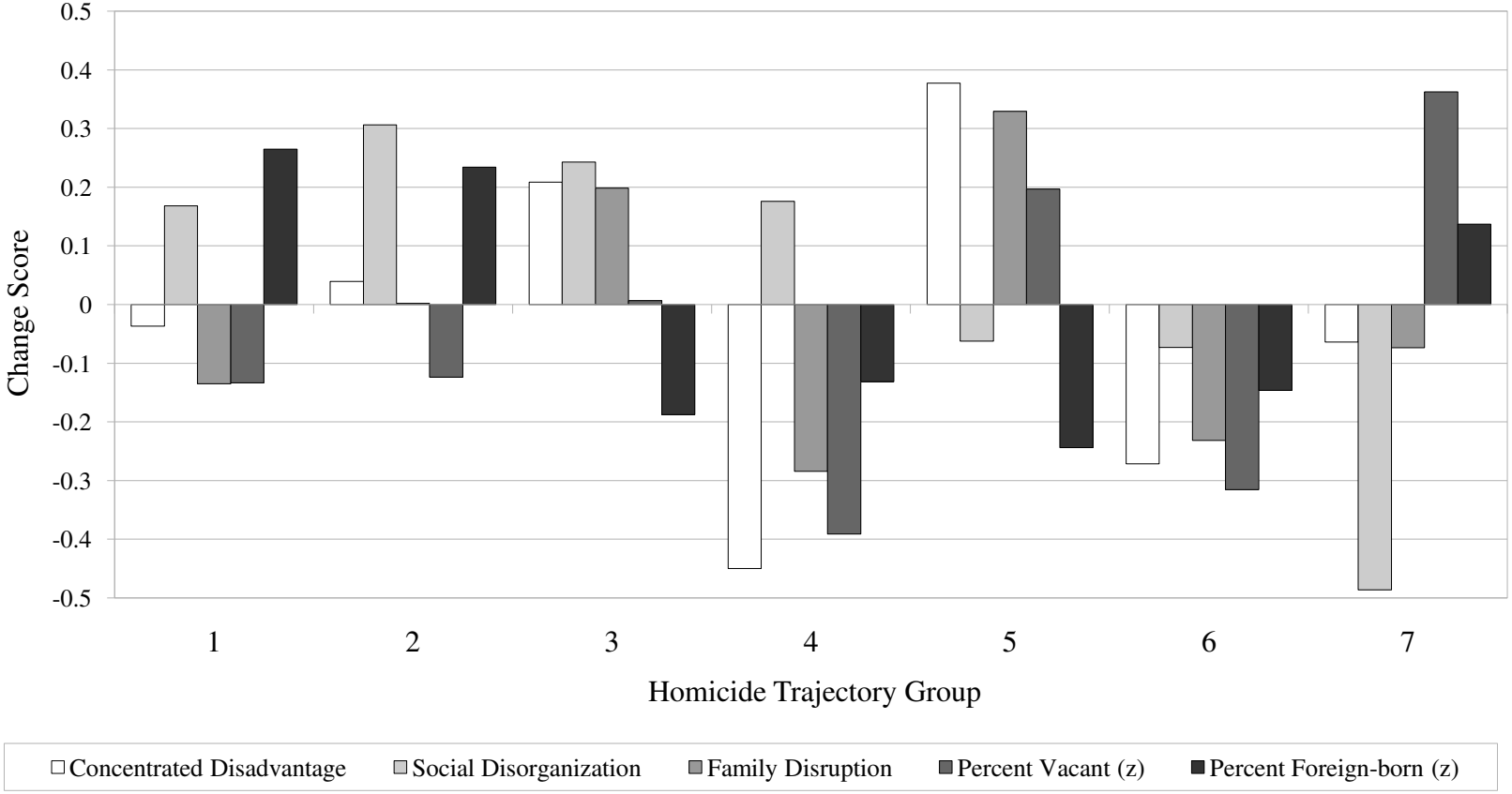

Table 1. Bayesian Information Criterion (BIC) and Log Bayes Factors [$2log_e(B_{10})$] for competing models

Number of groups	Null Model	BIC	$2log_e(B_{10})$
1		-48,006	
2	1	-43,020	9,973
3	2	-42,075	1,889
4	3	-41,505	1,141
5	4	-41,128	754
6	5	-40,897	462
7	6	-40,713	366
8	7	-40,919	-411

Table 2. Multinomial Logistic Regression of Homicide Trajectory Group Assignment Comparing Groups 2 and 3 vs. Group 1

	Group 2			Group 3		
	Logit	Standard Error	Odds Ratio	Logit	Standard Error	Odds Ratio
Disadvantage Index						
Change	1.290 *	(0.535)	3.64	2.950 **	(0.541)	18.40
Initial level	-0.210	(0.474)	0.81	1.577 **	(0.504)	3.92
Social Disorganization Index						
Change	2.100 **	(0.662)	8.19	1.000 *	(0.485)	5.81
Initial level	0.320	(0.452)	1.38	1.554 **	(0.524)	3.18
Family Disruption Index						
Change	0.820 *	(0.387)	2.26	1.193 **	(0.390)	2.91
Initial level	0.640	(0.543)	1.90	1.748 **	(0.641)	4.18
% Foreign-Born						
Change	-0.030	(0.022)	0.97	-0.047 *	(0.019)	0.93
Initial level	0.000	(0.040)	1.00	0.043	(0.038)	1.05
% Vacant						
Change	0.140	(0.076)	1.15	0.001	(0.058)	1.16
Initial level	0.340 **	(0.125)	1.41	-0.029	(0.102)	1.32
Constant	-0.640	(1.052)		1.926 *	(0.920)	
N of cases		125			118	
Likelihood Ratio			174.52			
Pseudo R^2			0.236			

* p < .05; ** p <= .01

Note: Reference category is Group 1 (n = 97)

Table 3. Logistic Regressions of Homicide Trajectory Group Assignment
Comparing Group 5 vs. Group 4 and Group 7 vs. Group 6

	Group 5 vs. Group 4[1]			**Group 7 vs. Group 6**[1]		
	Logit	Standard Error	Odds Ratio	Logit	Standard Error	Odds Ratio
Disadvantage Index						
Change	5.200 **	(0.799)	180.96	0.930 **	(0.352)	2.52
Initial level	3.910 **	(0.757)	50.01	1.260 **	(0.351)	3.54
Social Disorganization Index						
Change	-0.970	(0.781)	0.38	-0.710	(0.456)	0.49
Initial level	1.600 **	(0.528)	4.94	-0.170	(0.371)	0.84
Family Disruption Index						
Change	-0.700	(0.625)	0.50	0.470	(0.356)	1.59
Initial level	-0.190	(0.713)	0.83	0.890 *	(0.416)	2.44
% Foreign-Born						
Change	-0.090 **	(0.032)	0.91	-0.020	(0.024)	0.99
Initial level	0.020	(0.049)	1.02	0.020	(0.032)	1.02
% Vacant						
Change	-0.060	(0.077)	0.94	0.060	(0.031)	1.06
Initial level	0.060	(0.106)	1.06	0.160 **	(0.062)	1.18
Constant	1.110	(1.088)		-1.960 **	(0.687)	
N of cases	Group 4 = 99 Group 5 = 137			Group 6 = 78 Group 7 = 177		
Likelihood Ratio	185.41			91.71		
Pseudo R^2	0.578			0.292		

* p < .05; ** p <= .01

[1] reference group

Appendix A. Mean Differences in 1965 by Trajectory Group

Group	Group Mean	Significantly Different From
Black Disadvantage		
1	-0.497	3-7
2	-0.425	5-7
3	-0.257	5-7
4	-0.262	1, 5-7
5	0.036	1-4, 7
6	0.156	1-5, 7
7	0.793	1-6
Social Disorganization		
1	-0.781	1-7
2	-0.479	1, 4-7
3	-0.221	1, 5-7
4	-0.023	1, 2, 6, 7
5	0.060	1-3, 6, 7
6	0.461	1-5
7	0.675	1-5
Family Disruption		
1	-0.681	3-7
2	-0.496	4-7
3	-0.261	1, 6-7
4	-0.144	1, 2, 6, 7
5	-0.019	1, 2, 6, 7
6	0.382	1-5, 7
7	0.842	1-6

Group	Group Mean	Significantly Different From
% Foreign-born		
1	12.81	7
2	14.32	7
3	15.37	5-7
4	15.23	3, 5-7
5	11.90	3, 4, 7
6	12.30	3, 4, 7
7	5.04	1-6
% Vacant		
1	2.28	3-7
2	3.11	4-7
3	3.59	1, 4, 6, 7
4	5.00	1-3, 6, 7
5	4.40	1-3, 6, 7
6	6.57	1-5
7	7.02	1-5

Appendix B. Mean Differences in 1965-1995 Change Scores by Trajectory Group

Group	Group Mean	Significantly Different From
Black Disadvantage		
1	-0.037	3-5
2	0.039	4-6
3	0.209	1, 4, 6, 7
4	-0.450	1-3, 5, 7
5	0.378	1, 2, 4, 6, 7
6	-0.271	2, 3, 5
7	-0.064	3, 4, 5
Social Disorganization		
1	0.168	5-7
2	0.306	5-7
3	0.243	5-7
4	0.176	5-7
5	-0.062	1-4, 7
6	-0.073	1-4, 7
7	-0.486	1-6
Family Disruption		
1	-0.135	3, 5
2	0.002	5
3	0.198	1, 4, 6
4	-0.284	3, 5
5	0.329	1, 2, 4, 6, 7
6	-0.231	3, 5
7	-0.074	5

Group	Group Mean	Significantly Different From
% Foreign-born		
1	9.65	3, 5-7
2	10.68	1, 3-7
3	5.08	1, 2, 7
4	5.82	2, 5, 7
5	0.70	1, 2, 4
6	2.64	1, 2
7	-0.19	1-4
% Vacant		
1	1.871	5-7
2	2.780	5, 7
3	4.185	7
4	2.800	5, 7
5	6.360	1, 2, 4, 7
6	4.917	1, 7
7	10.175	1-6