Immigrant Concentration and Homicide Mortality: A Spatial and Temporal Analysis of the Effects of Ethnic Enclaves

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1. Introduction

Homicide was the eighth leading cause of death in Los Angeles County in 1997, but ranked second in the number of years of life lost (YLLs), due to the generally younger age profiles of homicide victims (Los Angeles County Department of Health Services 2000). Aggregate rankings of the impact of homicide on the county population also mask substantial variation in its effect on particular neighborhood areas. Among the eight geographic regions of Los Angeles County, the South region is disproportionately affected by YLLs from homicide mortality. The South region exhibits increases in disability adjusted life years, of which YLLs are an important component, due to violent acts at roughly twice the rate of any of the seven other county regions.

The existence of a link between residential location and homicide mortality risk is fairly well known, but the underlying processes which perpetuate that link are not completely understood. Variation in risk of homicide among individuals is attributable to a large extent to risk-seeking behaviors including prior criminal behavior (Wolfgang 1958; Lattimore, Linster & MacDonald 1997) and residential location in "safe" or "unsafe" communities (Sampson & Bean 2006). It has also been demonstrated, however, that the characteristics of the neighborhood itself produce effects that influence community safety independently of individual attributes of persons (Sampson, Morenoff & Gannon-Rowley 2002). While neighborhood effects on crime have been the subject of numerous studies in criminology (see e.g., Messner 1983; Land et al. 1990; Parker & McCall 1999; Sampson et al. 2002), less research has focused on the role of immigrant communities on neighborhood patterns of homicide. Maps 1 and 2 illustrate the distribution of the foreign born population and the number of homicide deaths, respectively, in Los Angeles

County. One striking feature of these two maps is the general discordance between those areas where immigrant concentration is highest and those areas where the greatest number of homicide deaths occur. Map 2 also clearly displays how homicide deaths tend to be clustered within a spatial area. This clustering effect is an important consideration, as it implies that the processes through which immigrant concentration might affect homicide rates should not be assumed to be independent between neighboring areas.

The aim of this paper is to analyze the impact of neighborhood immigrant concentration on the homicide rate within the community. By taking advantage of the detailed geographic information available in death registration data, and by incorporating measures which explicitly account for the spatial clustering of homicide events, this analysis will provide a rarely glimpsed view of local homicide mortality. The next section introduces theories which describe the anticipated effects of increasing immigrant flows, followed by a description of the data and the methods to be used in the analysis. Section 4 presents the results of the statistical models and section 5 discusses the interpretation of the analytical outcomes and the limitations of the study.

2. Theoretical Framework

There are notable theoretical reasons which suggest that larger proportions of immigrants in a community could affect the perpetration of homicide incidents. The foundational theory of social disorganization and the anticipated change in population age structure which accompanies immigration flows both imply a positive relationship between immigrant growth in neighborhoods and increased homicide. Theories of social capital and collective efficacy suggest that either a positive *or* a negative relationship might exist. The potential labor market consequences of immigration also imply an ambiguous association.

Why might immigrant concentration increase homicide rates?

Social disorganization theory, first proposed by Shaw and McKay (1942), suggests that a positive association exists between immigration and crime – including homicide. Social disorganization posits that the introduction of immigrants, who tend to be of lower economic status, into neighborhoods increases economic deprivation, lowers informal social controls as neighborhoods become more culturally heterogeneous, and results in the social dislocation of native residents (Sampson 1995). Large immigrant flows into a neighborhood may have adverse effects on the level of social capital (Putnam 2007) in a neighborhood, replacing existing native-born residents or diluting their numbers, thereby reducing the effectiveness of established social networks in deterring crimes of violence that result in homicides (Sampson, Raudenbush & Earls 1997). The reduction of informal social control, the byproduct of the dilution of group cohesiveness, increases the likelihood of conflict and violence (Bursik 1988). Greater levels of immigrant concentration may also interfere with the ability of residents to realize common goals because of ethnic and linguistic heterogeneity, which may hamper violence reduction initiatives (Sampson et al. 1997; Graif & Sampson 2009). Immigrants may also exhibit different normative attitudes regarding the legality of certain behaviors, including resolving disputes peacefully, which are inconsistent with those prevalent in the host country. These differences in norms may erode over time through acculturation and assimilation (Sellin 1938). To the extent that ethnic enclaves hinder the processes of acculturation and assimilation, neighborhood rates of homicide may be higher in enclaves.

Increased immigration might also be expected to contribute to intergroup tensions.

Conflict theory perspectives imply that diversity creates distrust between ethnic groups, due primarily to competition for resources, and promotes solidarity within each competing ethnic group; this may increase violence between groups and drive up the homicide rate (Blalock 1967). Putnam's (2007) constrict theory suggests that diversity may reduce both within-group solidarity and between-group solidarity, resulting in increased violence overall. If the level of immigration in a region is significant and results in the displacement of native workers in the labor market, there may also be some effect on intergroup tensions, as well as increased idleness, which may influence homicide rates (Shihadeh & Barranco 2010a,b).

Immigration also tends to change the age composition of a community, because immigrants are more likely to be young adults in search of work opportunities in the U.S. Neighborhoods with higher concentrations of immigrants are therefore more likely to have a higher proportion of young men, the age range at which criminal offending is most prevalent (Farrington 1986; Moehling & Piehl 2009). The concentration of immigrants in a neighborhood might be expected to be positively associated with an increase in homicide rates because a higher proportion of young men comprise the immigrant population share relative to the nonimmigrant population. Immigrants may thus be expected to experience greater risk of death by homicide. A higher risk of homicide death has been confirmed for new immigrants (less than 15 years) (Toussaint & Hummer 1999), young foreign-born residents of California (Sorenson & Shen 1999), foreign born White, Hispanic and Asian individuals (but not foreign born Blacks) (Sorenson & Shen 1996), and immigrant males over the age of 25 (Singh & Siahpush 2001).

Why might immigrant concentration decrease homicide rates?

As the proportion of a particular immigrant group in a neighborhood increases, social networks within this group may expand. This suggests that immigration may initially cause increased levels of homicide, but homicide rates may go down once the community reaches a certain concentration or saturation point of immigrants. Ethnic enclaves may generate positive effects on collective efficacy, if the enclave group exhibits high levels of informal social controls on its neighborhood residents. Additional benefits of segregation might be network formation and information sharing (Chiswick & Miller 2005), the improvement of social, cultural and economic institutions (Sampson 2008), or the preservation of traditional culture that is prone to avoiding violence as a means for dispute resolution (Escobar 1998). Halpern (1993) suggests a group density effect of immigrant concentrations for residents among members of the same ethnic group, based primarily on local, rather than national, experience. The local ethnic group effect may result from a reduction in exposure to prejudice and increased social support provided by the homogeneous local network. As a result, tensions and conflict may be less likely to occur, or, when they do occur, are less likely to escalate into violence which results in a homicide.

Labor market opportunities for immigrants may also be more plentiful in enclave areas because of the expanded social networks which they provide and because immigrant small-business owners or managers may prefer to employ workers of their own ethnic group. To the extent that employment opportunities are associated with reduced rates of homicide in neighborhoods, the access to job networks for immigrants living in enclave areas may reduce the overall propensity for violence in these areas.

Previous Research on the Relationship between Immigration, Crime, and Homicide

Earlier studies that have analyzed immigration and crime at the metropolitan area-level have shown little support for a positive or negative relationship between the two (Butcher &

Piehl 1998; Phillips 2002). However, in a more recent study analyzing 2000 census data for 150 metropolitan areas, the percentage foreign born is found to be negatively correlated with homicide rates (Reid, Weiss, Adelman & Jaret 2005). There was no observed relationship between the homicide rate and the percentage Latino foreign-born, percentage Asian foreign-born, or percentage foreign-born with limited English ability. Recent work by Stowell and colleagues (2009) indicates that those metropolitan areas experiencing increasing levels of immigration had significantly larger reductions in violent crime (robbery in particular) during the 1990s.

There is also inconsistent evidence regarding the relationship between immigration and crime in neighborhood level research. In models controlling for social composition, collective efficacy, and prior homicide rates, Sampson and colleagues (1997) observe no association between the immigrant concentration in Chicago neighborhoods, measured as an index comprised of the percentage foreign born and the percentage Latino, and the number of homicides. The immigration index was, however, positively correlated with reported violent victimization. Lee, Martinez, and Rosenfeld (2001) find that the percentage of the tract that is comprised of recent immigrants (less than 10 years in the U.S.) is negatively associated with Latino homicide counts in El Paso, but no association between the variables is found in Miami or San Diego. The proportion of the tract that is recent immigrant had no correlation with Black homicide counts in El Paso, a negative correlation with Black homicide counts in Miami, and a positive correlation with Black homicide counts in San Diego. Martinez, Stowell, and Cancino (2008) show that neighborhood homicide counts exhibit a negative association with the proportion of recent immigrants in San Diego, but no relationship between the two is observed in

San Antonio. These authors also demonstrate that there is no association between recent immigrants and the number of homicides in neighborhoods in which more than 40% of the population is Latino in *either* city. In research by Sampson, Morenoff and Raudenbush (2005), the percentage of the population in a Chicago neighborhood that was first-generation immigrant is negatively associated with self-reported violence in the community; however, this study does not include information on homicides. Using homicide data from the mid-1990's and census data from 1990, Velez (2009) shows that the percentage new immigrants in a census tract is negatively correlated with the homicide rate only in those neighborhoods in which concentrated disadvantage is high. Many studies define ethnic heterogeneity in terms of Black and White or other racial groups; few use immigrant versus non-immigrant designations, which may misrepresent the effect of immigrant enclaves on homicide rates. In a study in Israel, for example, ethnic heterogeneity was found to be insignificantly associated with the violent crime rate. After decomposing the ethnic heterogeneity index into the percentage immigrant and the percentage Arab, negative and positive associations, respectively, were found (Herzog 2009).

The results from prior research on the immigration-crime link leave important questions unanswered. Metropolitan area and city level studies have failed to establish a definitive association between an increased immigrant concentration and the homicide rate in the area, suggesting that any effect may differ across metropolitan areas. The analysis of large areas may also obscure patterns that become apparent when smaller geographic divisions are examined. Because immigrant residential patterns and homicides are both social phenomenon that are spatially concentrated, examining these two measures requires a lower level of aggregation than metropolitan areas or counties.

The processes through which immigrant communities exacerbate or mediate violence may vary between cities or by the ethnic composition of the particular immigrant community, clouding the results of previous neighborhood level studies. For example, immigrant neighborhoods in El Paso, which are largely Mexican-American, may not be expected to have the same underlying social structure as immigrant neighborhoods in Miami, which are largely Cuban-American. To the extent that a particular ethnic group fosters greater social capital or collective efficacy among its members, a larger protective effect from violent behavior might result. Local area studies which analyze neighborhoods solely within the central city and which exclude suburban communities may also misstate the effect of immigrant concentration if certain immigrants or groups are selecting into one neighborhood or the other. Neighborhood level studies which focus on census tracts within a single city may also have relatively small sample sizes, one consequence of which could be reduced statistical power and non-significant results.

Although it is the most populous county in the nation, with more than 9.5 million inhabitants, Los Angeles has not been the focal point of any study of the effect of immigration on homicide rates. This is an unfortunate oversight, since Los Angeles County is in many ways the ideal setting for such research. The county encompasses the entire cities of Los Angeles and Long Beach, as well as numerous smaller cities and rural areas, allowing for results that are not specific to a particular municipal definition. The Los Angeles area is a traditional gateway for immigrants, and is home to large foreign born populations from Mexico, Central and South America, and East and Southeast Asia. The residential patterns of the foreign born population in Los Angeles are varied, with immigrants settling in both urban and suburban neighborhoods throughout the county (see Logan, Zhang & Alba 2002, for a more detailed discussion of the settlement patterns of the foreign born population in Los Angeles). The proportion of the county that is foreign born is also increasing; more than 36% of individuals were foreign born in 2000, compared with 33% in 1990. The presence of this substantial, heterogeneous, and growing immigrant pool within a populous and residentially varied region is an asset to the current study.

This research is unique in its inclusion of measures of immigrant nativity, in addition to the total proportion foreign born that is common in previous studies, which highlight the effect of immigration on homicide mortality in specific immigrant communities. It relies on official cause-of-death data to observe homicide mortality, using this data in both an aggregated form, to smooth variation in homicide deaths in single years, as well as a time-series regression. This study also accounts for the areal clustering of homicides by explicitly incorporating a spatial autocorrelation term in the analyses.

3. Data and Methods

This analysis employs death registration data from the Los Angeles Office of Health Assessment and Epidemiology, the unit responsible for producing certificates for all deaths occurring within Los Angeles County. In addition to the precise date of death and the International Classification of Diseases (ICD) code for each death, the records also include the age, race, gender, and census tract of residence of the decedent. This study uses death registration data from the period 1996 to 2004, focusing on those deaths that were the result of intentional injury by homicide.[1] There were 9,935 homicide deaths in Los Angeles County in the nine year period under study. Of these 819 (8.2%) were missing geographic identifying information and were excluded from the analysis. These excluded cases were somewhat more likely than the full sample to be female and to be Caucasian or Asian, and were slightly older on average.[2] The sample of geographically identifiable deaths includes 9,116 deaths attributable to homicide.

One unique aspect of this study is the use of mortality data, rather than the FBI's Uniform Crime Reports or other statistics, to illustrate the incidence of violent crime in an area. The analysis of small areas requires these data, as Uniform Crime Reports are aggregated by city, county or metropolitan area and are not available for neighborhoods. It may, however, be instructive to compare the number of deaths reported as homicides on death certificates with the number of homicides reported in official crime statistics. In the period encompassing 2000 to

1 The deaths attributable to this cause were those classified to ICD9 codes E960-E969 and to ICD10 codes X85-Y09 and Y87.1. The data used in this study spans a period during which the categorization of causes of death switched from ICD9 codes (for deaths prior to year 2000) to ICD10 codes (for deaths occurring in year 2000 and beyond). While there was little change in the approach to classifying homicides between the two schemes, the ICD10 includes a grouping for homicides attributable to terrorist acts; however, no deaths during this period were assigned to this code.

2 The 891 deaths missing geographic info were 82.9% male and 17.1% female, 20.8% white, 38% Hispanic, 30.6% black, and 7.3% Asian, with an average age of 31.3. The 9116 deaths in the final sample are 86.2% male and 13.8% female, 11.7% white, 50.8% Hispanic, 33% black, and 4.3% Asian, with an average age of 29.3.

2004, 5,374 deaths were recorded by the Health Assessment Office as having an underlying cause of homicide, while 5,323 murders were reported by the California Attorney General's Office.[3] The small discrepancy between these two figures may reflect differences in reporting periods or legal technicalities in the definition of homicides. For example, official crime statistics may report the death as a homicide only after it has been determined by the county medical examiner to be a homicide. The lag between the actual death and the medical examiner's ruling may result in some under-counting of homicides in official crime statistics.

This study utilizes census tracts to define neighborhoods. The number of homicides over the nine year period was aggregated for each census tract to construct the dependent variable. Because census tract boundaries changed preceding the 2000 Census, all homicide deaths prior to this year were assigned to a 2000 census tract based on a tract-relationship file from the U.S. Census Bureau.[4] There were 2,054 census tracts in Los Angeles County in 2000. Those tracts with a population of less than 100 were removed from the analysis, as was any tract in which more than 25% of the population was group-quartered or institutionalized and the two tracts which constitute Santa Catalina Island. The final sample includes 2,006 census tracts, which

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3 CA Office of the Atty. General. Retrieved on 03/05/10 from http://stats.doj.ca.gov/cjsc_stats/prof08/19/1.htm.

4 The tract-relationship file designates the percentage of the total population in each 1990 tract that is encompassed by the corresponding 2000 tract and requires the assumption that homicide deaths were distributed evenly within the population of those tracts that were redrawn. In the sensitivity analysis done later only the homicide deaths from 2000 onward are used as the dependent variable, which, while covering a smaller period of time, makes the use of the tract-relationship file unnecessary. These result are shown to be similar.

encompass approximately 99.5% of the geographically identifiable homicide deaths. While a small number of homicides were thus excluded because they occurred in sparsely populated or otherwise unusual tracts, these deaths were included in the aggregation of homicides for the spatial term which is discussed later.

Previous research studying the effect of immigrant concentration on crime has operationalized immigrant concentration in a number of ways, including the percentage of a tract that is foreign born (Cagney, Browning & Wallace 2007; Nielsen & Martinez 2009), an index measure of the percentage of a tract that is foreign born and the percentage of the tract that is Hispanic (Sampson et al 1997; Stowell et al 2009), and the degree of linguistic isolation (Reid et al 2005). This study considers two separate measures of immigrant concentration: the proportion of the tract that is foreign-born and an "enclave intensity" quantity (*E*) defined as

$$E_i = (\text{\% of tract that is foreign born from country } i)^2 + (\text{\% of tract that is foreign born})^2.$$

The index value *E* measures the concentration of a particular ethnic group more precisely, and more accurately gauges whether a neighborhood may be defined as an enclave. The *E* value ranges from 0 (for a tract that contains no immigrants) to 2 (for a tract that is composed entirely of immigrants, all of whom are from the same country), and is calculated separately for each country of nativity. For this analysis, *E* is computed for Mexican, El Salvadoran, Filipino, Korean, and Chinese immigrants, five prominent groups which comprise 65% of the total immigrant population in Los Angeles County. All data measuring immigrant concentration was taken from the STF3 file of the 2000 U.S. Census. Maps 1 and 2 show the distribution of the foreign born population and the distribution of the count of homicide deaths in the County.

Data on neighborhood characteristics were obtained from the Urban Institute's

Neighborhood Change Database (Geolytics 2003), measured at the census tract level, and based on their value as of the 2000 Census. Characteristics were broadly organized into three groups based on the probable mechanism by which they might reduce or enhance homicide probability: (1) demographic composition, (2) poverty or concentrated disadvantage, and (3) residential stability. The number of possible measures is large and multicollinearity among these variables is likely to be problematic. Principal component analysis was used to address the potential multicollinearity and to reduce the total number of regressors in the estimation equations.

The change in demographic structure, measured as an index of the proportion of the population that is male between the ages of 18 to 34 and the proportion of the population that is below age 65, conveys the higher likelihood of homicide due to a greater density of frequent offenders.

Concentrated disadvantage or poverty, which is expected to have a positive effect on homicide mortality, includes an index of the proportion of the tract that is unemployed, the proportion that is below the poverty rate, the proportion that is receiving public assistance, the proportion of female headed households, and the proportion of the tract population that does not have a high school diploma. Median family income, which is correlated with the poverty index, was added as a separate variable, as it is expected to affect homicide mortality conversely. This variable is top-coded, although the number of tracts in which the median income exceeds the upper bound is small (n=10).

As noted above, increased residential stability is expected to contribute to a reduction in the level of crime, as longer term residents and homeowners have a greater stake in maintaining a safe neighborhood. Residential stability is evaluated as an index of the proportion of individuals who have been in their current home for more than five years, the proportion of housing units that are occupied, and the proportion of occupied housing units that are owner-occupied.

The number of murders within a neighborhood depends on the total number of potential homicide victims and the degree to which individuals come into contact with one another. The census tracts used in this study exhibit wide variation in areal size, ranging from .04 to 328 square miles, and population size, ranging from 171 to over 12,000 individuals. To account for this variation, the natural log of the total population and the natural log of the population density are included as controls.

Social capital and collective efficacy theories predict that the existing ethnic composition of a neighborhood affects the homicide rate within that area. If immigrants are selecting into a community based on the current prevalence of their ethnic group within that community, it is necessary to separate the immigrant effect from the ethnic group effect. While country-specific nativities are not available for the whole population at the census tract level, the proportion of the tract population that is Asian and the proportion of the tract population that is Hispanic are included as broad indicators of the potential effect of ethnic group composition.[5]

Neighborhood boundaries are arbitrary constructions and the processes through which

5 The ethnic group concentrations within a tract may be collinear with the proportion foreign born in the tract, as the former group includes those individuals who also comprise the latter. The correlation coefficients between the proportion of the tract that is Asian and the proportion foreign born and the proportion of the tract that is Hispanic and the proportion foreign born are .25 and .63, respectively. Collinearity between covariates should not bias the estimates of the regression model, but may result in excessively large standard errors.

immigrant concentration might be expected to affect homicide incidence are not spatially isolated within the borders of a particular census tract neighborhood. The spatial independence of neighborhoods, which is an implicit assumption in most studies of homicide, does not reflect the reality that neighborhoods are part of a larger social context and do not exist in isolation from nearby communities. The discretionary nature of neighborhood boundaries also means that the rate of homicide in an area may be influenced by retaliatory homicides that have occurred in proximal neighborhoods. Research is increasingly focusing on the spatial dynamics of neighborhood violence (Morenoff, Sampson & Raudenbush 2001; Graif & Sampson 2009). This analysis accounts for the spatial relationship between tract homicide rates using a spatial lag term comprised of the average homicide rate in adjacent neighborhood census tracts. This spatial analysis is carried out using GeoDa and ArcMap software.

As can be seen in Chart 1, the distribution of the number of homicide deaths per tract is noticeably skewed towards 0. This is also the mode of the distribution; more than an eighth of the tracts in the county had no homicide deaths during the study period. In addition, the number of homicide deaths, as a count variable, takes on discrete nonnegative values only and is left truncated at 0. Ordinary least squares regression is inappropriate when handling non-continuous, censored, or highly asymmetric data, as it may result in estimates that are biased, inconsistent or inefficient. While linear transformations might be used to remedy the problem of asymmetry, at least in part, the censoring and discreteness of count data requires maximum likelihood estimation procedures.[6] While the Poisson model is the most common method to estimate count data, the assumption of an equal mean and variance on which this model rests is violated in the data used here. The negative binomial regression model, which allows the variance to exceed the mean, provides a more suitable fit for this homicide death count data.[7]

Two separate models are estimated: a cross-sectional model with the dependent variable the sum of the homicide deaths for all nine years of data; and a pooled cross-sectional time-series model with the dependent variable the homicide deaths in each particular year. The cross-sectional model is described by the equation

$$\hat{Y} = \alpha + \beta X^{IMM} + \gamma \mathbf{X} + \rho + \varepsilon \qquad \textbf{(1)}$$

where $\hat{Y}$ is a vector composed of the aggregate number of homicide deaths in each tract, X^{IMM} is a vector of the immigrant concentration or enclave measure for each tract, $\mathbf{X}$ is a matrix consisting of other relevant tract characteristics, ρ is the spatial autocorrelation vector relating the

6 A Tobit model may also be used to estimate censored data. While the remainder of this paper relies on a negative binomial regression model, the analysis was also carried out using a Tobit estimation. The results from this model were similar in sign and significance to those achieved from the negative binomial model and are available upon request.

7 The *countfit* procedure in STATA was used to suggest the proper count model based on the given data. The procedure compares the Poisson, negative binomial, zero-inflated Poisson, and zero-inflated negative binomial regression models on a number of goodness-of-fit statistics. While the Poisson model is the most accurate in predicting the actual number of zero counts in the data, it is less successful in predicting the rest of the count outcomes. The negative binomial model is more effective at predicting count outcomes greater than zero, and is the preferred model based on nearly all criterion.

average homicide deaths in contiguous tracts, and α, β, and γ are parameters to be determined. This equation is evaluated using the various immigrant indicators discussed above, with the focus on the magnitude and significance of the β term. The pooled cross-sectional time-series model is described by the equation

$$\hat{Y}_t = \alpha + \beta X^{IMM} + \gamma \mathbf{X} + \rho + \lambda_t + \varepsilon \qquad \textbf{(2)}$$

where $\hat{Y}$ is a vector of the homicide deaths at year t in each tract, λ_t is a dummy variable indicating the year, and X^{IMM} and $\mathbf{X}$ are as above, considered time-invariant. This model is estimated using random-effects, which takes advantage of the repeated observations from a single tract over time, but which still allows for estimation of those coefficients on the covariates which, within a tract, do not change over time.

4. Analysis

Summary statistics of each of the variables under analysis are displayed in Table 1. The primary dependent variable, the homicide count from 1996-2004, ranges from zero to 40 with a mean of 4.5. Foreign born individuals comprise, on average, 36% of the population in the study tracts, with a low of 0% and a high of 79.1%. The *E* indices are very similar in mean, with the Mexican and Chinese variables exhibiting a slightly greater range of values.

The results from the regression of the aggregate homicide deaths on each neighborhood structural variable are shown in Table 2. Model *a* illustrates the association between the immigrant population, as measured by the percentage of the tract that is foreign born, and the homicide count. Without controls for neighborhood characteristics, these two variables exhibit a positive and significant relationship. As the proportion foreign born variable is bounded by zero and one, the estimated coefficient indicates that the expected number of homicide deaths in a tract that is entirely foreign born is 1.3 greater than the expected number in a tract that includes no foreign born. Models *b-h* illustrate the correlation between the dependent variable and each of the neighborhood structural characteristics and suggest the independent effect of each covariate on the number of homicide deaths. The use of principal components analysis to create indices of poverty, demographic structure, and residential instability, while effective in dealing with issues of collinearity, results in coefficient estimates that are mostly uninterpretable. In addition, because these models include no other control variables, the magnitude of the estimated parameters are of little consequence; the primary interest is in the directionality of the effect. The indices for demographic structure and poverty have positive signs, which is consistent with theoretical expectations. As the population becomes younger and more highly male or is subject to greater economic disadvantage the greater the predicted number of homicide events. Also consistent with theory are the negative correlations between the count of homicide deaths and the residential stability index and the median family income. The coefficient on the spatial autocorrelation term is positive and significant, indicating that a large number of homicides in adjacent tracts is associated with an increased homicide rate in the bounded tract. This confirms the importance of correcting for the spatial location of a tract in the succeeding models.

In Table 2.2, each neighborhood structural variable is added one at a time to a model which already includes the proportion of the tract that is foreign born. This table illustrates the impact that each neighborhood structural variable has on mitigating the effect of the foreign born variable on the aggregate homicide count. In models *d* and *f*, the addition of the poverty index and the median family income change the sign on the immigration variable from positive to negative, suggesting that the reason for the higher homicide incidence in largely immigrant neighborhoods is at least partially a consequence of economic disadvantage. In model *g*, the inclusion of the spatial autocorrelation term does not, in and of itself, explain the positive immigrant-homicide relationship observed in column *a* of Table 2.1.

Table 3 shows the results from the estimation of equation **(1)** above. Column *a* includes all of the explanatory variables apart from the spatial autocorrelation term, which is added in column *b*. The incorporation of the spatial term decreases the value of the foreign born coefficient by over 50%, evidence of the importance of accounting for spatial location in the analysis. In this spatially corrected model, the proportion foreign born coefficient is negative, suggesting that larger immigrant populations have a protective effect against homicide mortality. This effect is computationally small: An increase in the proportion foreign born in a tract of 10 points (from .20 to .30, for example) predicts a decrease in the aggregate number of homicide deaths in the tract in the nine-year period by .04, holding all else equal. The foreign born effect is further illustrated in Chart 2, which plots the predicted number of homicide deaths during the study period against varying levels of foreign born populations within the tract, holding all other variables at their mean values. Across the full range of tract immigrant compositions, the effect begins to look remarkable, with nearly one-half of a death less occurring in tracts with only immigrants relative to tracts with no immigrants. The coefficient on the spatial autocorrelation variable highlights the geographic variation in homicide events. It is also interesting to note that the sign on the residential stability variable has become positive, a point which is antithetical to theoretical expectations.

The results from Table 3 may also be considered in the form of incidence rate ratios. The incidence rate ratio, calculated by exponentiating the coefficient estimate on the proportion foreign born variable, describes the percentage change in the aggregate homicide count which corresponds to a unit change in the foreign born concentration. The incident rate ratio of .652 indicates that the shift of a tract from having no foreign born population to having a fully foreign born population is associated with an approximately 35% reduction in homicide deaths.

Equation **(1)** was also estimated using the *E* measures defined previously in place of the proportion foreign born variable; these results are displayed in Table 4. The *E* indices for the Mexican and Chinese nativities, which combine the proportion foreign born with the proportion of the population that is foreign born and from Mexico and China, respectively, are statistically significant at a 10% level. The *E* indices for all five of the tested nativities have the expected negative sign. It appears that in these models, some of the variation in homicide counts that was previously attributed to the immigration variable is now explained by the proportion of the tract that is Asian. The other variables shown little change from those presented in Table 3.

Table 5 shows the results from the cross-sectional time-series estimation of equation **(2)** above. The first column corresponds to the model which includes the proportion foreign born. The coefficient on the foreign born variable is negative and has nearly identical magnitude to that reported from the simple cross-sectional model, indicating again that immigrant concentration has a protective effect on homicide mortality. The coefficients on the yearly indicator variables illustrate a decreasing trend in the number of homicide events per year county-wide. Because this trend is controlled for in the model, the negative association implied by the coefficient on the foreign born variable is not driven by the temporal reduction in homicides.

The coefficient estimates for the *E* index for each of five large nativity groups are shown in columns *b* through *f* of Table 5. These measures of enclave concentration are highly correlated, which is not unexpected since the proportion foreign born is a component in the construction of each. It is not surprising, therefore, that the coefficient estimates vary little between each nativity group. While all of the parameter estimates exhibit a negative sign, corroborating the relationship found in column *a*, only the estimates for the foreign born populations from Mexico and China are statistically significant.

5. Discussion

The results presented above suggest that immigrant enclaves, when broadly defined, confer some type of protective effect against neighborhood homicide mortality. This is true even after controlling for neighborhood heterogeneity in demographic and ethnic composition and economic disadvantage, and adjusting for the spatial clustering of homicide deaths. The relationship between the concentration of foreign born individuals and the number of homicide events within a neighborhood does not appear to be an artifact of the general reduction in homicides which occurred in Los Angeles County during this period. While specific theories are not tested in this paper, it is important to consider how these results relate to the framework introduced earlier.

The negative relationship that is found between immigration and homicide refutes the base social disorganization theory, which implies that increased immigration should be manifest in a greater number of homicide deaths. While it is not possible to determine here the exact causal mechanism through which increasing neighborhood immigrant composition is affecting homicide activity, there is no evidence of a positive link between the two processes. The results here are consistent to some extent with theories of social capital and collective efficacy. The detrimental effects of these theories will likely be most salient when immigrants comprise only a small proportion of a community, or when immigration induces social isolation. Immigrant clustering in certain neighborhoods may be beneficial if, by providing a common cultural and linguistic background, it increases the predisposition of residents to intervene on behalf of one another. Cultural heterogeneity is likely to result in a greater level of informal social control, as ambiguity in social norms and accepted behaviors will be lessened. Linguistic heterogeneity, whether due to a greater propensity for particular groups to speak the language of the host county or due to the clustering of native language speaking immigrants, may produce enhanced levels of trust and social cohesion. There is little evidence in these models to either confirm or contradict labor market theories of the effects of immigration on homicide, nor is there reason to believe that significant labor market effects could even be found in neighborhood-level studies. Changes in the demographic structure of the population due to the age composition of immigrants certainly explains why a positive relationship between crime and immigration, without appropriate age-standardization, might be found. However, after controlling for variation in the age composition of different neighborhoods, this positive relationship is reversed, suggesting that demographic theories alone cannot describe the immigration-crime link.

The results from column *b* of Table 3, the final cross-sectional model, suggest the importance of incorporating measures of spatial autocorrelation into neighborhood effects analyses. The coefficient estimate on the spatial autocorrelation term, defined here as the average number of homicides in adjacent tracts, is positive and significant, implying that the social processes through which homicides occur do not respect the abstract boundaries of census tracts. Importantly, the inclusion of this spatial term reduces the effect of the immigrant concentration variable by more than one half, in addition to moderating the response to nearly every other explanatory variable.

Robustness Tests and Limitations of this Analysis

The homicide death data used in this analysis span a period during which census tract boundaries changed, making it necessary to ascribe 1990 tract-defined deaths to a 2000 census tract based on a tract-relationship file. This imputation implicitly assumes that these deaths were distributed evenly within the population of the tract, an assumption which may not be warranted and which may be problematic in tracts which underwent significant transformation. Because deaths which occurred between 2000 and 2004 were not subject to this complication, the cross-sectional model in equation **(1)** was rerun using the total homicide deaths in this five year period as the dependent variable. The results from this analysis are shown in Table 6. The proportion foreign born variable shows a somewhat stronger effect under this specification and the coefficients on the *E* indices become significant for four of the five ethnic groups considered. In general, the outcomes from this analysis do not discredit the conclusion of a negative relationship between immigrant concentration and homicide deaths.

Although neighborhood ethnic composition is included as a potential confounding variable in these models, racial composition is not. Relative to many cities in the eastern and southern United States, Los Angeles does not have a sizable African American population; less than 10% of the county population is non-Hispanic black. In only 11% of the tracts used in this study does the non-Hispanic black population comprise more than a quarter of the tract population. To test the assumption that the proportion non-Hispanic black is not a necessary component in the model, post-analysis estimations of homicide deaths were calculated from the results of equation **(1)**. Deaths were predicted using the values of each explanatory variable at four different levels of non-Hispanic black population concentration, corresponding to the quartile cutoffs. No significant difference was observed between these predicted values implying that this racial composition variable was trivial to the analysis.[8]

This analysis is limited by the dearth of available data at the neighborhood level. The lack of annual population estimates at the census tract level necessitates the use of decennial demographic information as control variables. While this has no implications for the cross-sectional analysis, the explanatory power of the random-effects model is significantly reduced with the use of time-invariant variables. The incorporation of annual neighborhood characteristics would allow for a much stronger causal model.

6. Conclusion

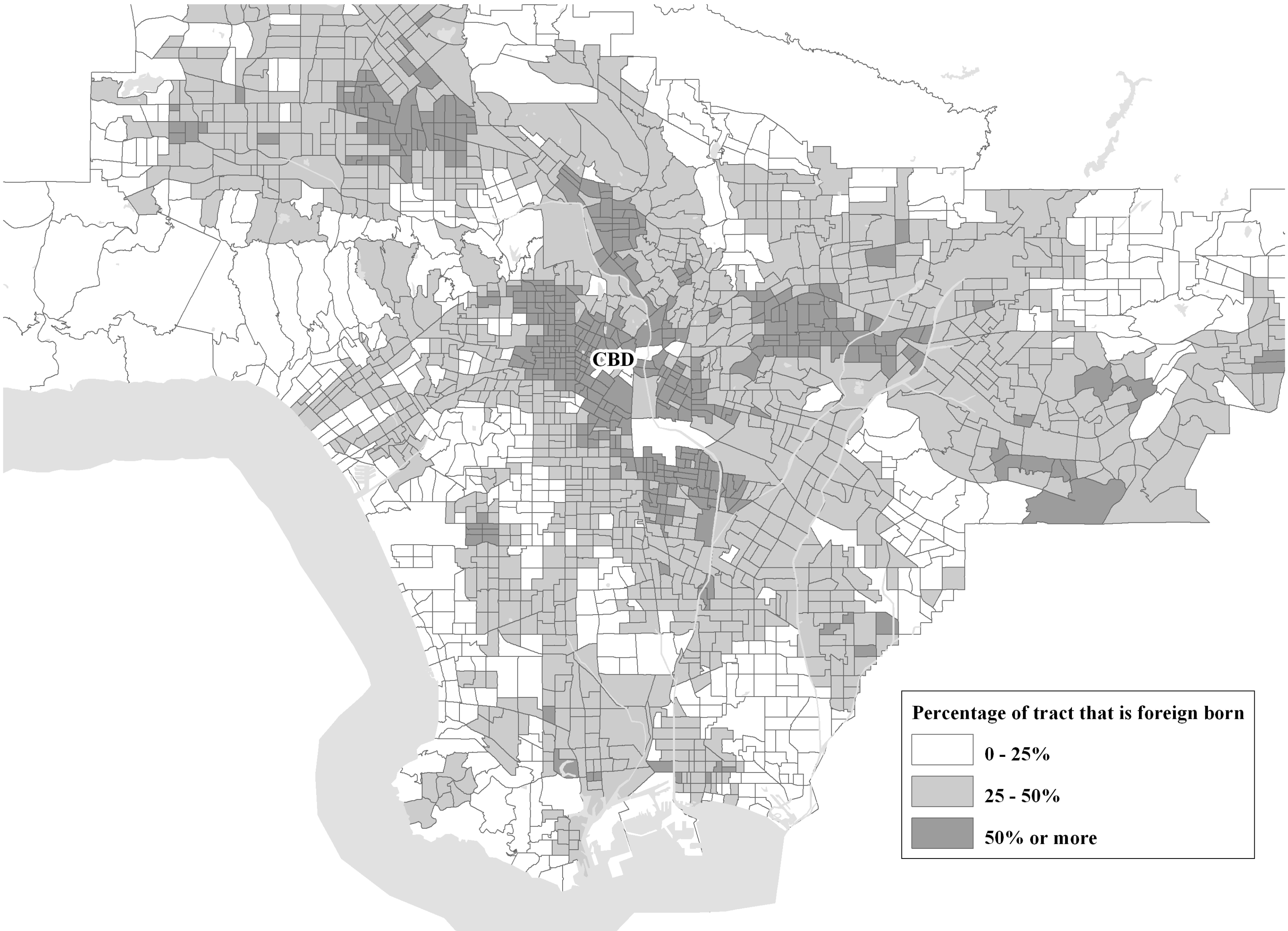
Immigration is the largest component of population growth in the United States today and immigrant concentration will continue to grow in the foreseeable future. Ethnic enclaves will continue to expand if the historical precedent of immigrant residential clustering upholds. The potential effects that neighborhood clustering of immigrants has to either provide protection from, or contribute to, homicide mortality, has important policy implications. These may include the efficient allocation of police or other public safety resources or the placement of public health facilities or outreach programs. The determination of the processes through which any positive

8 In those tracts with the lowest prevalence of blacks (less than 1.31%) the predicted number of homicide deaths was 3.5 (SD=2.4); in tracts with a black percentage between 1.31% and 3.65%, 2.7 (SD=2.0); in tracts with a black percentage between 3.65% and 9.04%, 3.2 (SD=2.1); in tracts with a black percentage greater than 9.04%, 8.9 (SD=7.9).

consequences of immigrant clustering occur might suggest policies or treatments that could be enacted in non-immigrant neighborhoods. Subsequent research which questions the role of neighborhoods on individual health may wish to incorporate some measure of immigrant concentration as an explanatory variable.

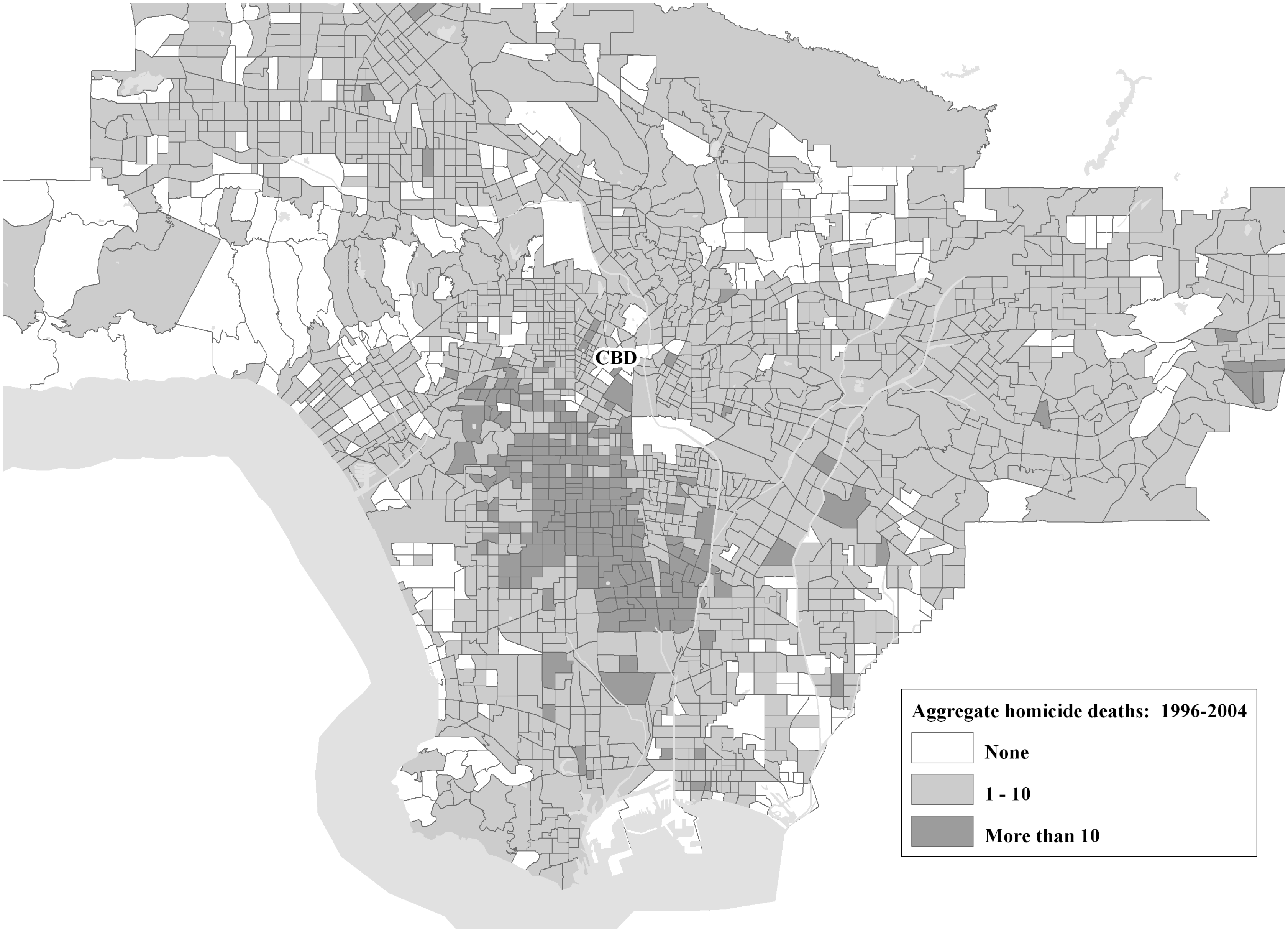
One of the primary purposes of this paper is to examine the link between immigrant enclaves and neighborhood homicides rates in a previously unstudied area, Los Angeles County. This research adds to the existing literature by highlighting the importance of properly accounting for spatial autocorrelation in neighborhood-level studies. It also showcases the use of death registration data in homicide research, providing an effective way to study homicide mortality at the local level.

Map 1: Distribution of the Foreign Born Population



*** The value of the Moran's I term, which measures spatial clustering, is .39. This is significant at the 1% level and indicates that the foreign born population is highly clustered.**

Map 2: Distribution of Homicide Deaths



*** The value of the Moran's I term, which measures spatial clustering, is .40. This is significant at the 1% level and indicates that homicide deaths are highly clustered.**

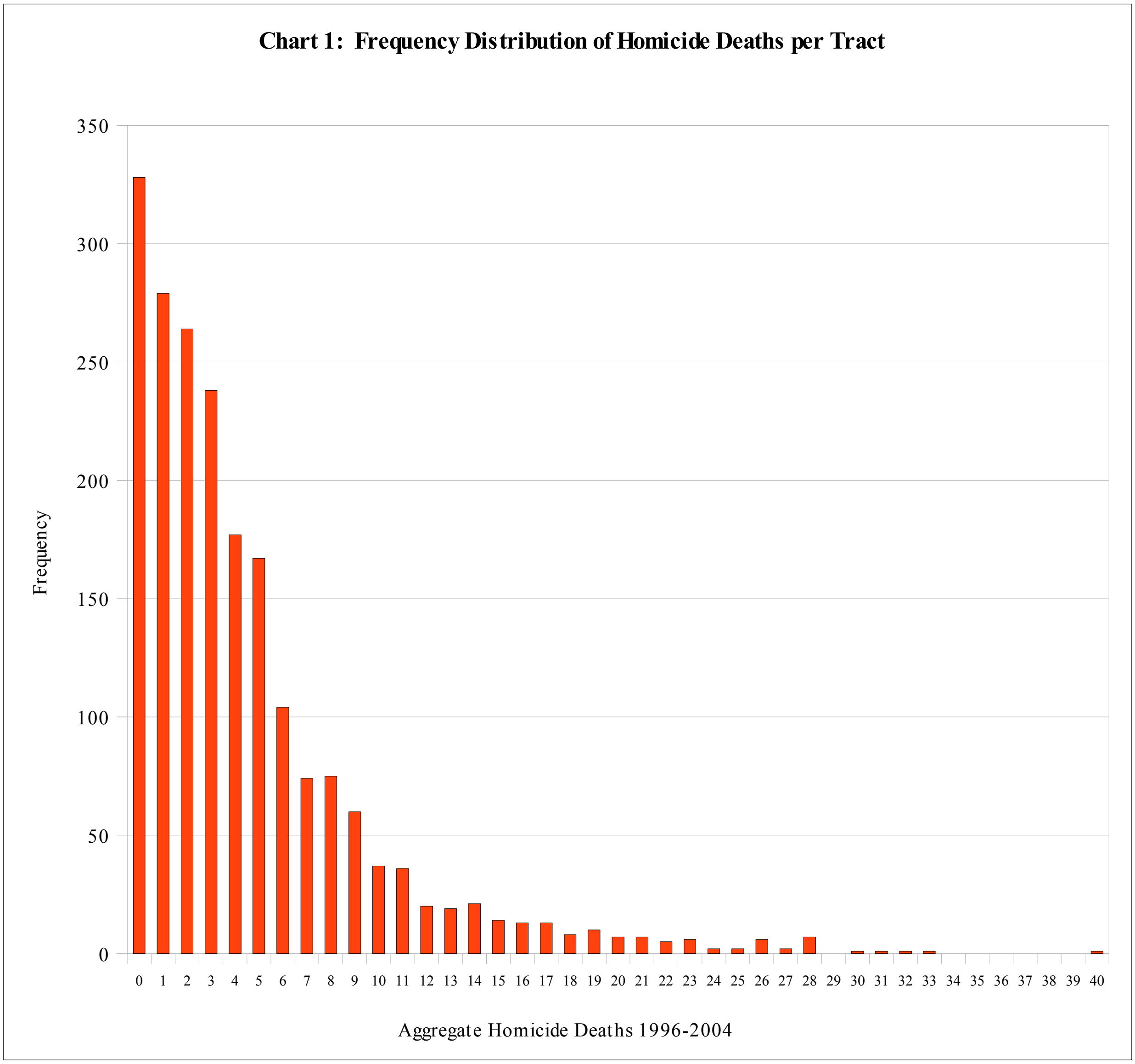


Chart 1: Frequency Distribution of Homicide Deaths per Tract
Frequency
350
300
250
200
150
100
50
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Aggregate Homicide Deaths 1996-2004

Table 1: Summary statistics of neighborhood structural variables				
	Mean	**Standard Deviation**	**Minimum**	**Maximum**
Dependent Variables				
Homicide Count (1996-2004)	4.5	5.1	0	40
Homicide Count (2000-2004)	2.5	3.2	0	25
Independent Variables				
% Foreign Born	35.9	16.1	0	79.1
E Index – Mexican	0.20	0.17	0	0.86
E Index – Chinese	0.16	0.12	0	0.93
E Index – Filipino	0.16	0.12	0	0.63
E Index – Salvadoran	0.16	0.12	0	0.64
E Index – Korean	0.16	0.12	0	0.71
Total Population	4687	1700	171	12399
% Total Population Asian	13.4	14.9	0	88.8
% Total Population Hispanic	44	29.5	2.3	100
Population Density (Person/Square Mile)	12680	10780	2	99080
Median Family Income	52160	29345	11144	200000
Demographic Composition Index Components				
% Male Age 15 to 34	15.3	4.3	4.5	45.7
% Age 64 and Younger	89.9	5.3	57.4	100
Concentrated Disadvantage Index Components				
Unemployment Rate	8.6	4.7	0	44.2
Poverty Rate	17.7	12.4	0	70.0
% Families Receiving Public Assistance	13.0	8.8	0	72.1
% Female-Headed Households	24.2	10.4	0	76.3
% No High School Diploma	11.1	11.2	0	100
Residential Stability Index Components				
Occupancy Rate	95.8	3.2	57.0	100
% Housing Owner-Occupied	49.8	26.6	0	100
% Residents in Same House 5 Years Earlier	52.7	10.8	2.2	81.4
Spatial Variables				
Neighbor Homicide Count (1996-2004)	4.5	4.3	0	27.5
Neighbor Homicide Count (2000-2004)	2.5	2.6	0	17.2

Table 2.1: Coefficients from the regression of the number of homicide deaths on neighborhood structural variables								
Homicide Deaths 1996-2004	**Model**							
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**
Proportion Foreign Born	1.305** (7.38)							
Proportion Total Population Asian		-2.491** (-14.62)						
Proportion Total Population Hispanic			1.741** (19.25)					
Demographic Structure Index				0.367** (14.06)				
Poverty Index					0.397** (34.53)			
Residential Stability Index						-0.214** (-10.99)		
Median Family Income							-0.000031** (-23.70)	
Spatial Autocorrelation								0.148** (32.91)
Number of observations	2006	2006	2006	2006	2006	2006	2006	2006

Negative binomial regression models. Dependent variable is the total number of homicide deaths from 1996 to 2004. Spatial autocorrelation term is average number of homicides in adjacent census tracts. Robust standard errors. Z-scores in parentheses. **=significant at 1%.

Table 2.2: Coefficients from the regression of the number of homicide deaths on neighborhood structural variables							
Homicide Deaths 1996-2004	**Model**						
	a	**b**	**c**	**d**	**e**	**f**	**g**
Proportion Foreign Born	2.094** (12.65)	-1.156** (-5.87)	-0.384† (-1.88)	-0.514** (-3.63)	0.711** (3.72)	-1.702** (-10.02)	1.447** (13.07)
Proportion Total Population Asian	-3.156** (-18.76)						
Proportion Total Population Hispanic		2.157** (22.85)					
Demographic Structure Index			0.397** (13.76)				
Poverty Index				0.415** (31.83)			
Residential Stability Index					-0.179** (-8.66)		
Median Family Income						-0.000038** (-22.17)	
Spatial Autocorrelation							.145** (35.38)
Number of observations	2006	2006	2006	2006	2006	2006	2006

Negative binomial regression models. Dependent variable is the total number of homicide deaths from 1996 to 2004. Spatial autocorrelation term is average number of homicides in adjacent census tracts. Robust standard errors. Z-scores in parentheses. **=significant at 1%. *=significant at 5%. †=significant at 10%.

Table 3: Coefficients from the regression of the number of homicide deaths on neighborhood structural variables		
Homicide Deaths 1996-2004	**Model**	
	a	**b**
Proportion Foreign Born	-0.888** (-4.72)	-0.427* (-2.53)
Proportion Total Population Asian	-0.741** (-4.22)	-0.283† (-1.84)
Proportion Total Population Hispanic	-0.088 (-0.77)	0.230* (2.12)
Demographic Structure Index	0.065** (2.67)	0.029 (1.25)
Poverty Index	0.293** (14.59)	0.117** (6.32)
Residential Stability Index	0.230** (10.96)	0.094** (4.55)
Median Family Income	-0.000018** (-7.84)	-0.000015** (-7.66)
Log Population	0.864** (19.66)	0.858** (21.51)
Log Population Density	0.025 (1.10)	-0.019 (-0.86)
Spatial Autocorrelation		0.075** (18.25)
Constant	-4.968** (-11.59)	-5.368** (-14.06)
Number of observations	2006	2006

Negative binomial regression models. Dependent variable is the total number of homicide deaths from 1996 to 2004. Spatial autocorrelation term is average number of homicides in adjacent census tracts. Robust standard errors. Z-scores in parentheses. **=significant at 1%. *=significant at 5%. †=significant at 10%.

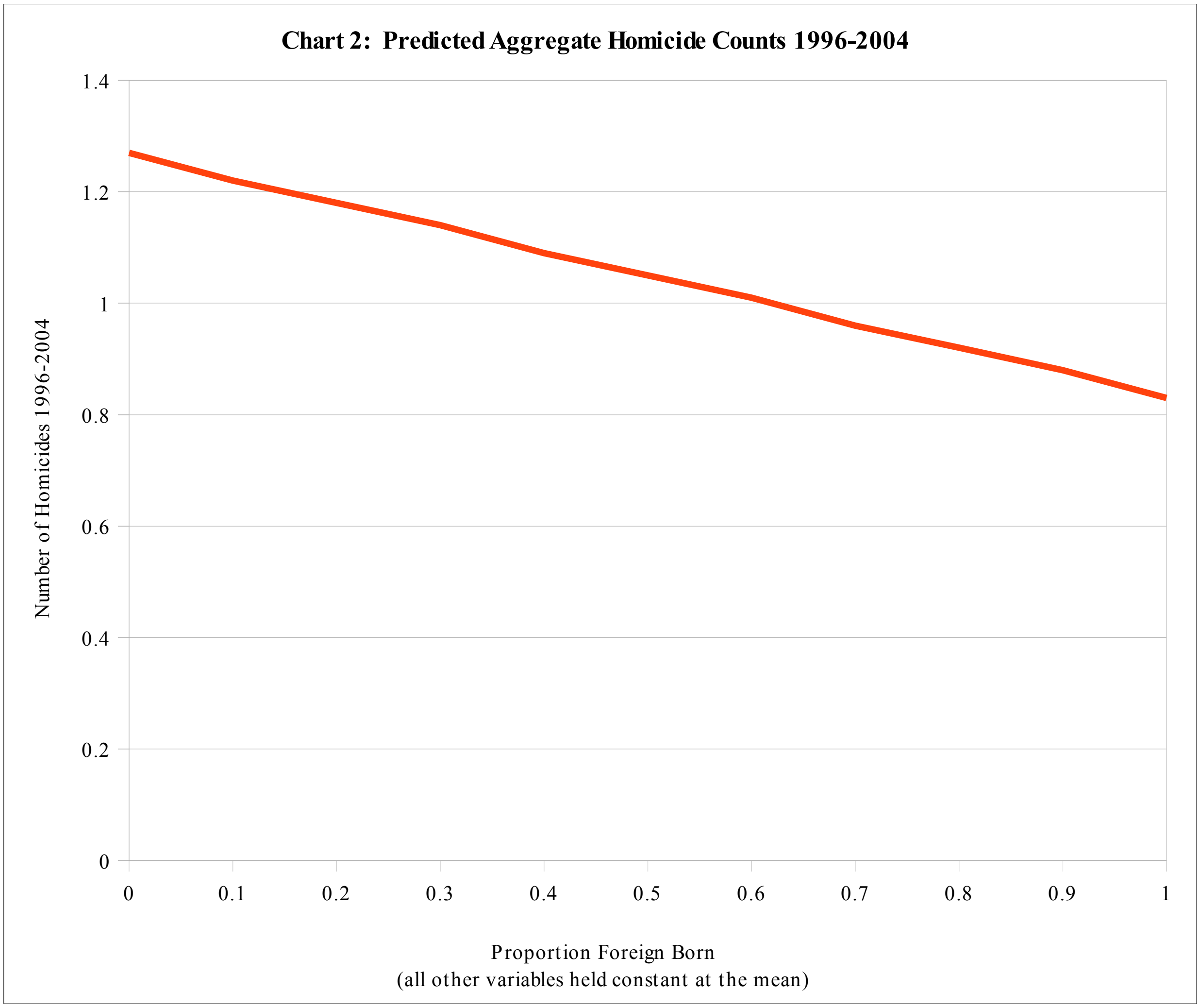


Chart 2: Predicted Aggregate Homicide Counts 1996-2004
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Number of Homicides 1996-2004
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Proportion Foreign Born
(all other variables held constant at the mean)

Table 4: Coefficients from the regression of the number of homicide deaths on neighborhood structural variables and enclave indices					
Homicide Deaths 1996-2004	**Model**				
	a	**b**	**c**	**d**	**e**
E-Index Mexican	-0.272† (-1.79)				
E-Index Chinese		-0.333† (-1.77)			
E-Index Filipino			-0.284 (-1.48)		
E-Index Salvadoran				-0.298 (-1.60)	
E-Index Korean					-0.265 (-1.42)
Proportion Total Population Asian	-0.413** (-2.90)	-0.373* (-2.44)	-0.397** (-2.63)	-0.395** (-2.65)	-0.403** (-2.65)
Proportion Total Population Hispanic	0.200† (1.67)	-0.158 (1.49)	0.146 (1.37)	0.150 (1.42)	0.141 (1.34)
Demographic Structure Index	0.029 (1.23)	0.027 (1.16)	0.027 (1.17)	0.027 (1.17)	0.027 (1.17)
Poverty Index	0.120** (6.49)	0.119** (6.42)	0.119** (6.44)	0.119** (6.43)	0.119** (6.43)
Residential Stability Index	0.098** (4.69)	0.098** (4.66)	0.099** (4.72)	0.098** (4.69)	0.099** (4.72)
Median Family Income	-0.000015** (-7.64)	-0.000015** (-7.67)	-0.000015** (-7.68)	-0.000015** (-7.67)	-0.000015** (-7.67)
Log Population	0.856** (21.12)	0.857** (21.23)	0.859** (21.26)	0.858** (21.18)	0.859** (21.24)
Log Population Density	-0.026 (-1.18)	-0.024 (-1.09)	-0.026 (-1.15)	-0.025 (-1.11)	-0.026 (-1.17)
Spatial Autocorrelation	0.076** (18.25)	0.075** (18.10)	0.075** (18.12)	0.075** (18.10)	0.076** (18.21)
Constant	-5.386** (-14.13)	-5.384** (-14.10)	-5.388** (-14.13)	-5.384** (-14.11)	-5.388** (-14.13)
Number of observations	2006	2006	2006	2006	2006

Negative binomial regression models. Dependent variable is the total number of homicide deaths from 1996 to 2004. Spatial autocorrelation term is average number of homicides in adjacent census tracts. Robust standard errors. Z-scores in parentheses. **=significant at 1%. *=significant at 5%. †=significant at 10%.

Table 5: Coefficients from the random-effects regression of the number of homicide deaths on neighborhood structural variables						
Homicide Deaths Per Year	**Model**					
	a	**b**	**c**	**d**	**e**	**f**
Proportion Foreign Born	-0.426* (-2.40)					
E-Index Mexican		-0.272[†] (-1.72)				
E-Index Chinese			-0.331[†] (-1.71)			
E-Index Filipino				-0.282 (-1.46)		
E-Index Salvadoran					-0.297 (-1.56)	
E-Index Korean						-0.263 (-1.38)
Proportion Total Population Asian	-0.284[†] (-1.81)	-0.414** (-3.01)	-0.375* (-2.52)	-0.398** (-2.69)	-0.396** (-2.72)	-0.404** (-2.73)
Proportion Total Population Hispanic	0.231* (2.17)	0.202[†] (1.82)	0.160 (1.63)	0.147 (1.51)	0.151 (1.55)	0.143 (1.47)
Demographic Structure Index	0.029 (1.42)	0.029 (1.42)	0.027 (1.33)	0.027 (1.34)	0.027 (1.34)	0.027 (1.34)
Poverty Index	0.117** (7.47)	0.120** (7.65)	0.118** (7.56)	0.118** (7.56)	0.118** (7.56)	0.118** (7.55)
Residential Stability Index	0.094** (5.09)	0.098** (5.37)	0.097** (5.32)	0.098** (5.39)	0.098** (5.35)	0.098** (5.38)
Median Family Income	-0.000015** (-9.65)	-0.000015** (-9.49)	-0.000015** (-9.61)	-0.000015** (-9.60)	-0.000015** (-9.60)	-0.000015** (-9.59)
Log Population	0.856** (21.38)	0.855** (21.08)	0.856** (21.18)	0.858** (21.22)	0.856** (21.16)	0.858** (21.21)
Log Population Density	-0.020 (-0.93)	-0.026 (-1.25)	-0.025 (-1.16)	-0.026 (-1.23)	-0.025 (-1.18)	-0.026 (-1.24)
Spatial Autocorrelation	0.075** (20.24)	0.075** (20.24)	0.075** (20.14)	0.075** (20.16)	0.075** (20.14)	0.076** (20.22)
1997	-0.170** (-4.05)	-0.170** (-4.05)	-0.170** (-4.05)	-0.170** (-4.05)	-0.170** (-4.05)	-0.170** (-4.05)
1998	-0.364** (-8.23)	-0.364** (-8.23)	-0.364** (-8.23)	-0.364** (-8.23)	-0.364** (-8.23)	-0.364** (-8.23)
1999	-0.417** (-9.28)	-0.417** (-9.28)	-0.417** (-9.28)	-0.417** (-9.28)	-0.417** (-9.28)	-0.417** (-9.28)
2000	-0.292** (-6.74)	-0.292** (-6.74)	-0.292** (-6.74)	-0.292** (-6.74)	-0.292** (-6.74)	-0.292** (-6.74)
2001	-0.206** (-4.87)	-0.206** (-4.87)	-0.206** (-4.87)	-0.206** (-4.87)	-0.206** (-4.87)	-0.206** (-4.87)
2002	-0.139** (-3.35)	-0.139** (-3.35)	-0.139** (-3.35)	-0.139** (-3.35)	-0.139** (-3.35)	-0.139** (-3.35)
2003	-0.222** (-5.22)	-0.222** (-5.22)	-0.222** (-5.22)	-0.222** (-5.22)	-0.222** (-5.22)	-0.222** (-5.22)
2004	-0.226** (-5.31)	-0.226** (-5.31)	-0.226** (-5.31)	-0.226** (-5.31)	-0.226** (-5.31)	-0.226** (-5.31)
Constant	-2.266 (-1.55)	-2.317 (-1.63)	-2.288 (-1.57)	-2.304 (-1.60)	-2.293 (-1.58)	-2.307 (-1.61)
Number of observations	18054	18054	18054	18054	18054	18054

Random effect negative binomial regression models. Dependent variable is the number of homicide deaths per tract per year. Spatial autocorrelation term is average number of homicides in adjacent census tracts. Reference year for temporal variables is 1996. Robust standard errors. Z-scores in parentheses. **=significant at 1%. *=significant at 5%. [†]=significant at 10%.

Table 6: Coefficients from the regression of the number of homicide deaths on neighborhood structural variables: Sensitivity analysis using homicide deaths from 2000 to 2004						
Homicide Deaths 2000-2004	**Model**					
	a	**b**	**c**	**d**	**e**	**f**
Proportion Foreign Born	-0.586** (-2.63)					
E-Index Mexican		-0.421* (-2.11)				
E-Index Chinese			-0.525* (-2.18)			
E-Index Filipino				-0.496* (-2.05)		
E-Index Salvadoran					-0.482* (-2.04)	
E-Index Korean						-0.428† (-1.79)
Number of observations	2006	2006	2006	2006	2006	2006

Negative binomial regression models. Dependent variable is the total number of homicide deaths from 2000 to 2004. All models also control for tract population and density, demographic and ethnic composition, poverty, residential stability, median family income, and spatial autocorrelation. Robust standard errors. Z-scores in parentheses. **=significant at 1%. *=significant at 5%. †=significant at 10%.

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