J Quant Criminol (2013) 29:191–215
DOI 10.1007/s10940-012-9176-8

ORIGINAL PAPER

The Effects of Immigrant Concentration on Changes in Neighborhood Crime Rates

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Published online: 2 June 2012

Abstract
Objectives This study investigated the extent to which immigrant concentration is associated with reductions in neighborhood crime rates in the City of Los Angeles.
Methods A potential outcomes model using two-stage least squares regression was estimated, where immigrant concentration levels in 1990 were used as an instrumental variable to predict immigrant concentration levels in 2000. The instrumental variables design was used to reduce selection bias in estimating the effect of immigrant concentration on changes in official crime rates between 2000 and 2005 for census tracts in the City of Los Angeles, holding constant other demographic variables and area-level fixed effects. Non-parametric smoothers were also employed in a two-stage least squares regression model to control for the potential influence of heterogeneity in immigrant concentration on changes in crime rates.
Results The results indicate that greater predicted concentrations of immigrants in neighborhoods are linked to significant reductions in crime. The results are robust to a number of different model specifications.
Conclusions The findings challenge traditional ecological perspectives that link immigrant settlement to higher rates of crime. Immigration settlement patterns appear to be associated with reducing the social burden of crime. Study conclusions are limited by the potential for omitted variables that may bias the observed relationship between immigrant concentration and neighborhood crime rates, and the use of only official crime data which may under report crimes committed against immigrants. Understanding whether immigrant

Earlier drafts of this paper were presented at the 2008 Annual Workshop on Crime and Population Dynamics, MD and the 2008 American Society of Criminology meetings, St. Louis, MO.

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concentration is an important dynamic of changing neighborhood patterns of crime outside Los Angeles will require replication with data from other U.S. cities.

Keywords Immigration · Neighborhood effects · Counterfactual · Selection bias

Introduction

Social scientists dating back to the nineteenth century have noted that the levels of crime within cities varied with the concentration of immigrants (see Vold and Bernard 1986 for a summary). In the national policy context, the National Committee on Law Observation and Enforcement (popularly called the Wickersham Commission) observed as early as 1931 that there was no evidence connecting immigration to increased crime patterns (Tonry 1997; Moehling and Piehl 2009). However, decades of social science research beginning in the Chicago School tradition (e.g., Reckless and Smith 1932; Sutherland 1934; Sellin 1938; Shaw and McKay 1942) have sought to identify and explain the link between the spatial concentration of crime and immigrant settlement patterns.

Most sociological explanations of immigration and crime suggested that immigrants themselves had relatively low rates of criminal offending, but their tendency to settle into disadvantaged areas exposed their children to economic disadvantage, a culture of conflict between new arrivals and native residents, breakdowns in formal and informal social controls, and underclass norms favorable to violations of the law (e.g. Thrasher 1927; Merton 1938; Sellin 1938). Population turnover, as older groups of immigrants assimilated and moved on, resulted in social disorganization in the transitional neighborhoods (Shaw and McKay 1942). Natural settlement and assimilation patterns, not immigration itself, drove the neighborhood dynamics of crime.

However, more recent lines of empirical research on the immigration-crime nexus suggest that we may need to reconsider the sociological processes that link immigrant settlements to neighborhood crime rates (cf. Morenoff and Astor 2006; Martinez et al. 2010). During the 1990s a number of U.S. cities experienced a dynamic growth of immigrant settlement into inner-city poverty-stricken areas (Malone et al. 2003; Passel and Suro 2005). Neighborhood patterns of poverty and residential segregation in many U.S. cities are now correlated with a greater stock of immigrants, fundamentally changing the long-standing racial or ethnic disparities in income and housing segregation (Cutler et al. 2008). Given that population composition has appreciable effects on the variation in crime rates at different spatial units (Land et al. 1990), it is reasonable to expect these immigration settlement patterns could also be fundamentally important for understanding the neighborhood dynamics of crime, rather than just a spurious relationship engendered by natural settlement and assimilation patterns. The self-selection of labor migrants into the U.S. in search of work and economic advancement suggests that they may have greater incentives to remain law abiding and avoid interactions with the criminal justice system than similarly situated native residents living in neighborhoods of concentrated poverty that are part of a stable underclass (Wilson 1987; Massey and Denton 1993; Sampson and Wilson 1995). Additionally, settlement patterns themselves may produce meaningful changes in neighborhood dynamics by affecting social networks, cultural norms, and informal social control mechanisms. In many ways the dynamics of immigration settlement and crime reflect issues of spatial (Massey 1985) and segmented assimilation (Portes and Zhou 1993) that contrast with the experience of America's underclass (cf. Wilson 1987). Many immigrants are moving into U.S. cities from countries of origin with intense levels of concentrated poverty and unemployment.

Destination cities and neighborhoods are often seen as temporary transition points, and immigrants are more likely to settle into areas with co-ethnics that provide various forms of social support (cf. Portes and Zhou 1993; Lichter et al. 2010).

Despite the wealth of studies examining the dynamics of crime rates across neighborhoods, there has been minimal empirical research on the effect of immigrants on changes in neighborhood crime rates (see Sampson et al. 2005; Morenoff and Astor 2006; Desmond and Kubrin 2009; Martinez et al. 2010). In part, this state of affairs is due to the methodological challenge involved in addressing this question. To the extent that immigrants relocate to neighborhoods with low levels of economic resources and the social processes that foster crime, immigrants will be disproportionately located in neighborhoods with higher rates of crime simply due to these residential mobility decisions (Vang 2012). On the other hand, if immigrants are attracted to live in areas with other co-ethnics that are recent arrivals to the U.S. and share similar incentives to avoid law violating behaviors, such a process would bias findings toward lower crime rates that are simply an artifact of segmented assimilation (Wilson and Portes 1980). Thus, it is important for multiple reasons to account for the selection process of neighborhood locations for immigrants in order to control for the simultaneity that will likely bias estimates of the association of immigrant concentrations and neighborhood crime rates.

In the present study, we examine the effect of immigrant concentration on recent changes in neighborhood crime rates in the city of Los Angeles (LA), using a potential outcomes framework to minimize the simultaneity between immigrant settlement patterns and crime and assess the effect of immigrant concentration on changes in neighborhood crime rates.[1] We hypothesize that the incentives for economic advancement that often draw immigrants to the U.S., and the transitional nature of arrival and assimilation into ethnic enclaves, could be expected to produce net reductions in neighborhood crime rates, holding other relevant neighborhood attributes constant. We use historical immigration patterns, estimated from 1990 census data, as an instrumental variable for immigrant settlement patterns observed in the 2000 census to adjust for the selection of immigrants into LA neighborhoods,[2] and examine changes in total crime and violent crime rates in neighborhoods for the period 2000–2005. We find that a higher concentration of immigrants is linked to greater than expected reductions in total reported index crimes and violent crimes. The results are robust to a variety of specifications, including tests for heterogeneity in immigrant treatment take-up or the propensity for neighborhoods to become immigrant enclaves. Our findings suggest that new immigrant replacement populations lead to greater reductions in crime rates over time, even after taking into account the propensity of immigrants to locate into neighborhoods with co-ethnics.

Neighborhood Composition, Immigration, and Crime

Prominent perspectives of neighborhood dynamics of crime have suggested that immigration is either spuriously related to crime, or increases crime through the process of

[1] More recent work from the Moving to Opportunity (MTO) experiments suggests that the long term effects of neighborhood characteristics on criminal propensity are modest, and appear to occur only for black females (see Kling et al. 2005). However, Clampet-Lundquist and Massey (2008) argue that the MTO study failed to deliver enough of a dosage in race-class differences in neighborhoods to adequately assess neighborhood effects. Ludwig et al. (2008) in the same issue provide a rebuttal.

[2] The use of historical immigration patterns as an instrument for current patterns has been done in economics to remove selection bias in estimating the effect of immigration on labor market outcomes for different skill groups (Altonji and Card 1991; Card 2001).

population turnover. The structural perspective for explaining the neighborhood dynamics of crime, which is rooted in the early ecological theories in the Chicago School tradition (Park and Burgess 1924; Thrasher 1927; Shaw and McKay 1942), points to the stability of crime over time in some neighborhoods as evidence that the natural and social environment of the place, not the changing ethnic composition of its residents, explains crime rates. This perspective remains central to ecological explanations of crime (Bursik and Webb 1982; Bursik and Grasmick 1993; Sampson et al. 1997; Glaeser and Sacerdote 1999; Morenoff et al. 2001; Sampson et al. 2002). There is a theoretical basis for suggesting that population change and turnover in neighborhoods can increase crime by breaking down social networks and informal social controls and introducing competing normative cultures (Wirth 1938; Sellin 1938; Bursik and Grasmick 1993, Bursik 2006), or creating differential social organization by displacing non-immigrants from work (Sutherland 1934). Conversely, increasing crime in neighborhoods causes some share of residents with economic means to move, thus increasing patterns of residential segregation (Schuerman and Kobrin 1986; Taylor 1995; Morenoff and Sampson 1997; Cullen and Levitt 1999; Hipp 2010).

Whether the effects of structural and dynamic aspects of neighborhood environments are truly exogenous to residential location decisions and individual attributes, however, remains a matter of some scholarly debate (Mayer and Jencks 1989; Ludwig et al. 2008). Furthermore, during the 1990s a number of large U.S. cities experienced substantial changes in the residential composition of poor inner-city neighborhoods as a result of the mass immigration of Latin Americans. At the same time, a number of U.S. cities also experienced large reductions in crime, a trend that has continued in many cities into recent years (Blumstein and Wallman 2001; Sampson 2008).

It is reasonable to expect that many immigrants residing in the U.S. have greater incentives to avoid criminal behavior and interactions with the criminal justice system than similarly-situated native residents, given the distressed environments they are escaping and the desire to remain in the U.S. A criminal conviction can result in deportation for both documented and undocumented immigrants, including lawful permanent residents, suggesting that those who wish to stay in the country have a greater stake in conformity. Also, neighborhoods initially selected by immigrants are not typically viewed as permanent destinations, but as temporary places to live while one attempts to attain better economic means for oneself or one's family. This point is particularly pertinent to the population composition of neighborhoods in immigrant gateway cities like Los Angeles. Charles (2006), for example, notes that immigrants in Los Angeles predominately arriving from Latin American countries come with a belief in the U.S. as the "land of opportunity" and a long-term plan for becoming successful. Immigrants initially settle into neighborhoods already populated with their fellow co-ethnics, seeking financial and social support networks to assist in the process of acculturating into life in the U.S. However, their longer-term plans involve moving out of these transitional neighborhoods (cf. Portes and Zhou 1993). For immigrants, the classical assimilation model appears operable, in which the ability to move into any neighborhood in the future can occur through improvement in work earnings. This contrasts with the experiences of African Americans and native Latino residents who have experienced the limited mobility options described by the place stratification model (Alba and Nee 2003). The immigrant situation therefore differs from that of African-American and native Latino residents who have lived in areas of entrenched poverty for decades. For these groups, segregation and lack of opportunity is a feature of normal life, as it has been for generations, and there is no reason for them to move on.

Sampson (2008:30) argues that "[c]ities of concentrated immigration are some of the safest places around," adding that "[i]t has been widely hypothesized that immigrants, and

Mexicans in particular, selectively migrate to the United States on characteristics that predispose them to low crime, such as motivation to work, ambition, and a desire not to be deported." Studies do find that immigrants offend at lower rates than similarly situated non-immigrants (see Hagan and Palloni 1998), and that cities with higher concentrations of immigrants do not appear to be associated with higher than expected levels of crime. Martinez and Lee (2000:68) note in their review:

> Local context is a central influence shaping the criminal involvement of both immigrants and natives, but in many cases, compared with native groups, immigrants seem better able to withstand crime-facilitating conditions than native groups.

An emerging body of research supports the contention that immigrant settlement patterns either reduce or do not affect crime rates at the city level. Butcher and Piehl (1998) find evidence that the flow of immigrants is positively correlated with city differences in crime, but that there is no effect of immigration flow on metropolitan area crime rates once one takes into account between-city differences and overall time trends. Their analysis also suggests that demographic shifts explain very little within-metropolitan area variation in crime rates. As they state, "Because little of the variation in changes in city crime rates can be explained by demographics, it seems unlikely that changing the composition of immigrants will make an appreciable impact on crime" (p. 460). However, Butcher and Piehl's (1998) analysis is based on changes in crime during the decade of the 1980s, which preceded the substantially larger migrations of Latin Americans into major U.S. cities in the 1990s. More recent work by Stowell et al. (2009) examining within-metropolitan area changes in violent crime between 1994 and 2004, during the period of large migrations of Latin Americans into U.S. cities, find areas with greater increases in their concentration of immigrants experienced significantly larger declines in crime. Ousey and Kubrin (2009) also investigated the longitudinal relationship between changes in immigrant concentration in cities and changes in violent crime between 1980 and 2000. Their results suggest that increasing immigrant populations are associated with greater within-city reductions in violent crime, and that half of the marginal reduction is accounted for by an increase in two-parent family structures associated with cities that have rising immigration populations.

These previous studies focused on the marginal effect that the flow of immigrants has on crime rates in metropolitan areas or cities, not the effect that the concentration of immigrants has on crime within city neighborhoods. Given that the majority of crime in cities occurs within a small fraction of neighborhoods, neighborhoods are a more useful unit of analysis for assessing the effects of immigrants on crime. Several studies by Martinez et al. have investigated the cross sectional association between immigrant concentrations and neighborhood homicide rates, generally finding that Latino immigrants experience the same or lower victimization rates than one would expect given comparable levels of structural disadvantage among non-Latinos in studies of Miami, San Diego, and El Paso (see e.g., Lee et al. 2001; Lee and Martinez 2006; Stowell and Martinez 2007; Martinez et al. 2008). Graif and Sampson (2009) also find that neighborhood characteristics in Chicago vary significantly in predicting homicide, but that immigrant concentration is either unrelated or inversely related to homicide and that language diversity is consistently linked to lower homicide rates. Martinez et al. (2010) find that increases in the percentage of foreign-born residents in San Diego between 1980 and 2000 were associated with significant within-neighborhood reductions in homicide rates. Sampson et al.'s (2005) study of Chicago neighborhoods finds that immigrant concentration is negatively correlated with self-reported youth violence, after controlling for individual-level characteristics. Desmond and Kubrin (2009) show using Add Health and census tract data that youth

residing in neighborhoods with greater immigrant concentration generally have lower average levels of violence, and that these effects are stronger for Hispanics, Asians, and adolescents born outside the U.S.

However, the focus of this work on neighborhood effects of immigration on crime has been largely cross sectional and not addressed the process of residential location decisions that Shaw and McKay's (1942) work suggested could produce selection bias in estimating the link between immigrant residential concentrations and crime (see Martinez et al. 2010 for an exception). Residential stability may be important for establishing informal social controls and reducing the propensity for crime in neighborhoods (Donnelly and Majka 1998). But, it is also likely that residents living in areas with long-standing high crime rates lose incentives for pro-social behaviors as crime becomes part of standard social norms (Anderson 1998; Venkatesh 2000).

Place stratification models have noted that crime production is one of the many negative effects on local environments that results from eroding employment and housing segregation (Logan 1978; Wilson 1987; Massey and Denton 1992). Segmented assimilation theory (Wilson and Portes 1980) by contrast suggests that an increasing encampment of new immigrants into areas of distressed poverty may produce net reductions in neighborhood crime rates by providing a larger set of the residential population with new orientations and incentives to avoid criminal behavior. Morenoff and Astor (2006), for example, note that first generation immigrant youth are at reduced risk of criminal behavior compared to second and third generation youth living in neighborhoods of comparable disadvantage. The process of segmented assimilation would lead one to infer that immigration causes lower neighborhood crime rates because of only residential location decisions made by new immigrants.

It is also important to emphasize that many neighborhoods in large U.S. cities have transitioned into immigrant enclaves, which may contain all the advantages described at length in the ethnic enclave literature (e.g., Wilson and Portes 1980; Wilson and Martin 1982; Logan et al. 2002). For example, as the neighborhood transitions to majority immigrant, institutional completeness becomes more possible as restaurants, grocery stores, banks, and other businesses transition to serving this new clientele (Breton 1964). This institutional completeness is likely also accompanied by social cohesion (Portes and Rumbaut 1990) and the greater potential for improved socioeconomic outcomes (Zhou 1992; Edin et al. 2003). In such an environment, social norms can be enforced without the culture of conflict proposed in the early sociological literature (Sutherland 1934; Sellin 1938). To the extent that these immigrants are more inclined towards pro-social norms consonant with mainstream society, this can bring about the informal social control that theorists posit will reduce the amount of crime in such neighborhoods (Sampson 1995). The pattern of immigrants moving into existing ethnic enclaves is particularly the case for the dominant group of labor immigrants of Central American origin residing in LA County (Logan et al. 2002). If immigrants are simply less criminally involved than non-immigrants this would lead to reductions in crime simply by the movement patterns of recent migrants. Under this scenario there would be no "true" neighborhood effect of immigrants on crime rates. Rather, crime rates would drop simply because less criminally involved immigrants are settling into areas with existing co-ethnics.

Hypotheses

The structural differences in areas in which immigrants settle are theoretically important for examining cross sectional differences in neighborhood patterns of crime or population

turnover and crime patterns over time (Heitgerd and Bursik 1987; Bursik 1986; Schuerman and Kobrin 1986). However, settlement patterns have not been systematically modeled as a selection process as part of the explanation for the dynamics of changing neighborhood crime rates. To address these problems, we construct a selection model based on a spatial segregation perspective (Massey 1985) of the settlement patterns of immigrants in Los Angeles neighborhoods. We posit that immigrants are more likely to settle into areas with other immigrants, which Logan et al. (2002) demonstrate is true for Los Angeles. We then estimate the effect of immigrant concentrations on changes in neighborhood crime rates after adjusting for the spatial segregation of immigrant residents and other control variables.

The key contribution of our work is that our analysis accounts for both the dynamic nature of neighborhood settlement and the changing patterns of crime. We hypothesize that even after taking into account immigrant settlement patterns that immigrants will lead to greater reductions in neighborhood crime rates. Our hypothesis is derived from the immigrant assimilation literature (Morenoff and Astor 2006), which would predict that immigrants will lead to reductions in neighborhood crime net the effects of structural deficits in poverty concentration, mobility, and age structure. To the extent to which immigrant settlement decisions are based on where existing co-ethnics live, this will provide additional evidence that immigration is directly linked to changes in neighborhood crime rates and not spuriously related through the natural processes of settlement, assimilation and residential mobility.

Methods

Data

To examine the relationship between immigrant concentrations and crime, we use official crime statistics and demographic data for census tracts (n = 835) located in the City of Los Angeles for years 2000–2005. The sources for these data include yearly counts of all index offenses[3] reported to the Los Angeles Police Department (LAPD) and aggregated to reporting districts (RD), the smallest reliable geographic unit reported by the police consistently over time, and geo-coded to its corresponding census tract. Census tract-level data for demographic and household characteristics were abstracted from the U.S. Bureau of Census for the decennial census summary files (SF 1 and SF 3) 2000.[4] Data were spatially integrated with ArcMap, a geographic information system program.[5] Census tracts were chosen as the target geographic zone and RDs were interpolated into tract areas using a spatial weight—the proportion of spatial overlap between the source and target zones.[6]

[3] FBI Uniform Crime Index offenses reflect the following criminal offenses: homicide, rape, robbery, aggravated assault, burglary, larceny/theft, and motor vehicle theft.

[4] http://factfinder.census.gov/.

[5] There are on average about 1.2 RDs per census tract. Because census tracts and RDs have different geographic shapes, spatial interpolation is necessary to re-configure all data sources into the same unit of analysis. The overall degree of overlap was approximately 85–90 % between RDs and census tracts. Location data (X–Y coordinates) for all index offenses were not routinely collected by the LAPD until 2006. The RD is the lowest level of reliable geography for LA.

[6] This method assumes that the source data or analysis units are uniformly distributed over the source zones. Since there is no clear process to inform how the crime units are spatially distributed, the areal weighting method is an acceptable approach (Goodchild and Lam 1980).

We examine the 6-year change in the total crimes and the subset violent crimes separately, because violent crimes are less susceptible to under-reporting to the police by all ethnic groups (Hindelang 1981). Violent crimes include only reported homicide, robbery, aggravated assault, and rape. The modal number of reported rapes in each year was zero, and more than half of the census tracts reported less than 1 rape a year. Excluding rape from the analysis does not materially affect the results. We focus on crime data for years 2000–2005 to insure that outcome variables occur temporally after the 2000 census measures from which we construct our primary measure of immigrant concentration.

To measure immigrant concentration we rely on census estimates of the proportion of residents in each census tract that are of Hispanic/Latino (proportion Latino) ethnicity and the proportion of residents born outside the United States (proportion foreign born) in 1990 and 2000. The bulk of immigrants in Los Angeles are of Latin American (primarily Mexican) origin and the two measures are highly correlated ($r = 0.65$ for 1990; $r = 0.71$ for 2000). The high correspondence between proportion of residents of Latino ethnicity and foreign-born population makes sense since given that 65.9 % of immigrants residing in LA in 2000 were born in Latin America.[7] There is also a high degree of correlation ($r = 0.77$) between 1990 and 2000 neighborhood measures of immigrant concentration, consistent with our spatial segregation and assimilation assumption.

We also include several measures of population characteristics from the 2000 census as control variables to improve precision in our estimates of immigrant concentration, because previous research has found these measures are correlated with crime at the neighborhood level (Sampson et al. 2002). However, our focus is on the theoretical effect of immigrant concentration rather than these control variables. We measure the concentration of poverty in each neighborhood according to the proportion of household families receiving governmental assistance (welfare), the proportion of persons living below the poverty line, the proportion of the population currently unemployed, and the proportion of family households with female heads. We also measure the proportion of males under age 25 in the neighborhood population, the proportion of the residents that are black, the residential stability (measured by the proportion of home owners and residents living in the neighborhood for 5 years or more), and the population density (population per square mile; Land et al. 1990; Levitt 2004).

To reduce regressor space and avoid problems associated with multicollinearity among our independent variables, we created indices from a principal components analysis (PCA) of these measures, calculated as the sum of the variables weighted by the first principal component (Land et al. 1990; Jolliffe 2002). The proportion of residents born outside the U.S. and the proportion of residents of Hispanic ethnicity were combined into a single PCA index measuring *immigrant concentration*. It is important to emphasize that multicollinear relationships emerge if we estimate the effects of the proportion foreign born and Hispanic/Latino separately on changes in crime. This is evident from the fact the foreign born coefficient's effect on changes in crime rates exceeds the unconditional observed drop in crime in LA neighborhoods by a factor of six. The four measures of neighborhood poverty are combined into a single PCA *poverty index*. The proportion of residents living in the

[7] When we calculate the predicted change in the percentage of residents that are of Hispanic/Latino ethnicity between 1990 and 2000 and the predicted change in the percentage of residents that are foreign born—the two are so highly correlated ($r = 0.75$) that they are statistically indistinguishable from each other.

current residence for five or more years and the proportion of homes that are owner-occupied were combined into a single PCA *residential stability index*.[8]

Counterfactual Model

The units of analysis in this study are neighborhoods, measured as tracts (denoted as i), in the city of Los Angeles (LA) over a 6-year period (2000–2005). To assess within-neighborhood changes in crime we compute the 6-year changes in crime outcomes in each neighborhood. Our conceptual approach explicitly estimates the selection of immigrants into neighborhoods with pre-existing immigrant populations—the normative pattern of settlement for all immigrants in LA County (especially the dominant group of immigrants of Latin American origin; Logan et al. 2002). We estimate the "effect" of immigrant concentration on the observed yearly (x) change in neighborhood crime rates (y) $\left(\Delta Y_i = \sum (x_i - \bar{x}_i)(y_i - \bar{y}_i) \Big/ \sum (x_i - \bar{x}_i)^2\right)$. We apply a potential outcomes causal model (see Rubin 1974; Angrist and Krueger 2001; Angrist et al. 1996) as our method for identifying the immigrant concentration effect, or the difference between the expected changes in crime (denoted by ΔY_i) observed among neighborhoods with a significant concentration of immigrants (denoted by $T_i > 0$) and the outcomes that would have been observed had those same neighborhoods not had a concentration of immigrants (denoted by $T_i = 0$); formally:

$$E[\Delta Y_i | T_i > 0] - E[\Delta Y_i | T_i = 0] \tag{1}$$

We cannot observe this potential outcome, but we can estimate it by comparing differences in the average change in crime between neighborhoods with high concentrations of immigrants (denoted by ΔYI_i) to neighborhoods with similar expected probabilities of immigrant concentration that do not actually have high concentrations of immigrants (denoted by $\Delta Y0_i$); formally:

$$E[\Delta Y1_i | T_i > 0] - E[\Delta Y0_i | T_i > 0] = E[\Delta Y1_i - \Delta Y0_i] \tag{2}$$

The potential outcomes model for the effect of immigrant concentration on changes in crime can also be expressed by the reduced form structural Eq. (3).

$$\Delta \hat{Y} i = \mu + \theta T_i + X_i' \beta + \delta_{d(i)} + \eta i \tag{3}$$

The change in crime rates for neighborhood (i), ΔY_i, is a function of the propensity to "take-up the treatment" ($T_i* > 0$) of immigrant concentration (Heckman and Vytlacil 1999; Moffitt 1999), controlling for a vector other neighborhood characteristics (X), with a vector of fixed effects parameters (δ) for different geographic regions (denoted as d) of the city, and other unmeasured variables specific to the neighborhood (η). Identifying the parameter for immigrant concentration (θ) is complicated by the fact that immigrants are more likely to select into neighborhoods with higher rates of poverty and crime, a point noted in the Chicago School ecological explanation of crime (cf. Shaw and McKay 1942), suggesting that the concentration of immigrants in neighborhoods is endogenous to crime.

[8] Approximately 85 % of the joint variance in foreign born and Latino is accounted for by the first principal component; 72 % of the variance in four measures of poverty is accounted for by the first principal component; 91 % of the joint variance in percentage owner occupied and units 5 years or more is accounted for by the first principal component.

Angrist et al. (1996) have shown that estimating such a treatment effect with an instrumental variable (denoted as Z) and two-stage least squares (2SLS) can be embedded in a potential outcomes model. Therefore, to identify the effect of immigrant concentration in 2000 (θ) on estimated changes in crime ($\Delta\hat{Y}_i$) between 2000 and 2005 we rely on 2SLS estimations with an instrumental variable. We use the level of immigrant concentrations recorded for neighborhood census tracts in 1990 as an instrumental variable (Z) to predict immigrant concentrations in 2000 (T). We chose this instrument because it is well documented that immigrants are more likely to select into areas with other immigrants (Alba and Nee 2003; Logan et al. 2002; Card 2001; Cutler et al. 1999, 2008), and this selection should in principle be strongly related to the concentration of immigrants in the 2000 census period we examine, but theoretically independent of the change in crime rates during this time. Thus, controlling for the selection of immigrant settlements should provide us with an exogenous test of the average effect of immigrant concentration in 2000 on changes in crime during the 2000–2005 time period.[9] We are unable to estimate a panel model of yearly effects of immigrant change on crime rates given that we do not have repeat measurements of immigrant concentration by year (see Hipp et al. 2009 for an example of such an approach). Nonetheless, our strategy has the desirable feature of setting up a clear counterfactual to address selection bias *rather* than assuming a uniform city-wide immigrant concentration effect.

Equation (4) models the key endogenous explanatory variable of immigrant concentration (T_i) in 2000 as a function of immigrant concentrations that existed in 1990 (Z) and a vector of control variables measured in 2000 (X) (poverty index, residential stability index, population density, percentage of males under 25) used to minimize the difference between neighborhoods (i) that have high concentrations of immigrants and those that do not. The vector of control variables is intended to minimize differences in the selection model.[10] We also include a vector of fixed effect terms (δ) for geographic regions (d) of the city[11] for each neighborhood (i) to control for the fact that immigration patterns are spatially concentrated. These fixed effect parameters remove these average spatial differences in immigrant concentration from our selection estimates.[12]

[9] We are interested in neighborhoods with similar expected probabilities of receiving immigrant settlement, and comparing the difference in crime changes between those that actually receive this treatment versus those that don't. We explicitly do not examine changes in neighborhood immigrant concentration between 1990 and 2000 as predictors of changes in crime from 2000 to 2005 because this assumes a uniform effect of across neighborhoods. The relative change in levels of immigrant concentration is biased toward neighborhoods with low immigrant populations in 1990. Neighborhoods with relatively high concentrations of immigrants in 1990 will have little change over time, as we note in our selection model.

[10] The vector of parameters from these variables should not be interpreted as causal estimates since they have not been identified in our selection model (Angrist and Krueger 2001).

[11] For geographic areas we rely on LAPD Divisions: 19 unique geographic boundaries that represent semi-autonomous areas for which police allocation and planning decisions are made.

[12] An alternative specification to control for larger spatial effects is to include a spatial lag to account for the fact that crime in neighboring areas may be correlated with changes in each neighborhood (i). A spatial lag comes from a spatial weight matrix that would typically be constructed by a weighted average of crime rates for each neighborhood (i) as a function of all other neighborhoods of LA either bordering each other or at different distances (j), with weights equal to the inverse of the distance (1/distance) i to j. This approach was developed for handling the problem of spatial autocorrelation in cross sectional data. There are, however, well known shortcomings to the spatial econometric approach as it applies to longitudinal data. If we included a spatial lag parameter in our model we would have to assume that the spatial elements are exogenous to the model and not correlated with the residuals. Instead, we control for spatial dependence by including police division parameters, which adjusts for the average level of crime in different geographic

$$T_i = \mu + \pi_i Z + X_i'\beta + \delta_{d(i)} + e_i \quad (4)$$

Eq. (5) models the second stage process and the dependent variable of average change in crime for each neighborhood (i) as a function of the predicted immigrant concentration ($\hat{T}$) from Eq. (4) and a vector of control variables (X) with a vector of fixed-effects (Ψ) for geographic regions (d) of the city to control for the spatial concentration (autocorrelation) of crime. Thus, this two-stage structural equation model estimates the effect of immigrant concentration on changes in neighborhood crime.

$$\Delta\hat{Y}_i = \mu + \theta_i\hat{T} + X_i'\Gamma + \Psi_{d(i)} + s_i \quad (5)$$

The key parameter of interest is the estimated relationship between immigrant concentration (θ) and changes in neighborhood crime (ΔY). By measuring the within-neighborhood change in crime we remove the heterogeneity between neighborhoods in the average amount of crime and secular trends in changing crime for LA as a whole. For our structural Eq. (5) to be truly identified we have to assume that covariance between the first stage (Eq. 4) and second stage (Eq. 5) equations [Cov(ΔY, Z)/Cov(T, Z)] are consistent and free of bias from omitted variables, due to the fact that immigrant concentrations in 1990 (Z) is correlated with changes in neighborhood (i) crime rates only through its effect on future immigrant concentrations in 2000 (T). Since immigrants typically make housing decisions based on costs and connections to labor markets and services established by previous co-ethnic arrivals, this assumption seems plausible. Thus, our choice of instrument is driven by theory and not the standard type of lagged variable in time series panel data that Angrist and Krueger (2001) criticize for being "atheoretical" and presenting "hard-to-assess assumptions about dynamic relationships" (p. 76).

The structural equation model (5) assumes that the estimated effect of the concentration of immigrants in neighborhoods (θ) on changes in crime (ΔY) is monotonic (increasing or decreasing). Recognizing the potential problem with this monotonic assumption, we also adjust estimations for variations in the estimated probability of immigrant concentration ($\hat{T}$). Neighborhoods are classified into four strata, based on the 25th, 50th, and 75th quartiles, for their predicted value of immigrant concentration. The expected change in total and violent crime outcomes is then re-estimated, adjusting the standard errors according to stratum.

Up until this point we have only considered a model for the homogeneous treatment effect of immigrant concentration on changes in crime. Recognizing that not all neighborhoods are potential receivers of immigrants raises the question of whether the potential marginal effect is truly homogeneous, or driven by a non-linear relationship associated with subpopulations of the estimated probability density of immigrant concentration ($\hat{T}$). To model the potential heterogeneity in the treatment take-up of immigrant concentration, or the propensity for neighborhoods to become immigrant enclaves, we follow Moffitt's

Footnote 12 continued
regions and controls for this form of spatial dependence non-parametrically. We did estimate a separate spatial errors model according to the following form:

$$\Delta\hat{Y}_i = \mu + \theta i\,\hat{T} + X_i'\beta + e_{d(i)}$$

where $e_{d(i)}$ represents a weight matrix of the residuals clustered within the 19 police divisions. The results from this spatial errors specification are substantively the same and presented in "Appendix 1".

(1999, 2008) suggested approach and re-estimate our selection and outcome equations using non-parametric smoothers[13] according to the following form (6–7):

$$T_i = \pi_0 + \pi_i \sum_{k=1}^{3} NS_k(Z) + X_i'\beta + \delta_{d(i)} + e_i \tag{6}$$

$$\hat{Y}_i = \beta_0 + \theta_i \hat{T} + X_i'\Gamma + \Psi_{d(i)} + s_i \tag{7}$$

Including prior immigrant concentration from 1990 as our instrumental variable (Z) and fixed-effect terms for different regions of the city should provide unbiased estimates of the heterogeneity in treatment effect of immigration on changes in crime, assuming that Z meets necessary assumptions for identification.

It is worth noting that the 2SLS estimates provide only a test of the local average treatment effect (LATE), or the effect of immigrant concentration on changes in crime for those neighborhoods most likely to receive immigrant residents. The estimates of immigrant effects on changes in neighborhood crime rates do not tell one what would happen to crime rates in neighborhoods that are never likely to receive immigrant residents (see Kirk 2009 for another example of LATE). This is not a serious limitation since spatial segregation and segmented assimilation theories would not expect immigrants to settle in areas that they are prevented from living for social, economic, or political reasons.

Descriptive Statistics and Trends

Table 1 describes the average characteristics for the Los Angeles neighborhood census tracts and their change in crime over the 6-year period of observation. Residents of Hispanic/Latino ethnicity comprised approximately 39 % of the population in Los Angeles 1990, and 46 % in 2000. Los Angeles also experienced a growth in the percentages of foreign-born residents between decennial census periods from 38 % to roughly 41 %. Table 1 also shows that average neighborhood total crime and violent crime rates declined by 9.5 and 4.9 reported offenses per year respectively, for a 6-year (2000–2005) cumulative reduction of 27 % for total crimes and 53 % for violent crimes.

The geographic dispersion of immigrant concentrations in Los Angeles neighborhoods between 1990 and 2000 is displayed in Fig. 1, indicating that the growth in Hispanic/Latino residents and immigrants was not uniform across Los Angeles. We leverage this non-uniformity in immigrant settlement to remove the simultaneity in our estimates of the link between immigrant concentrations in 2000 and changes in neighborhood crime rates.

While there was considerable average reduction in the amount of reported crime across neighborhoods in LA during a period of increasing immigrant settlement patterns, we theorize that it is important to investigate the heterogeneity in the places that immigrants settle to assess the effect of immigrant concentration on changes in neighborhood crime rates.[14]

[13] We use natural cubic spline parameters with 3 knots computed from a B-spline basis.

[14] We do not calculate crimes per population for each census tract because the census tract population does not present a stable denominator of the population at risk. A number of high frequency census tracts are located in central-city business districts and industrial areas with relatively low populations. Therefore, calculating the crime rate per census tract population could lead to distorted estimates. Since our focus is on within-neighborhood change in crime, the lack of a specific denominator for population at risk does not present a problem. In fact all areas of LA were increasing in population suggesting that our use of the change in crime counts is a conservative estimate of the change in crime rates.

Table 1 Summary statistics for Los Angeles neighborhoods

Variable	
	Mean (within-SD)
Total crime change (2000–2005)	−9.457 (13.59)
Violent crime change (2000–2005)	−4.88 (2.93)
	Mean (SD)
Immigrant concentration 2000	
Hispanic/Latin American (proportion)	0.464 (0.293)
Foreign born (proportion)	0.407 (0.158)
Poverty index	
Families on gov. assistance (proportion)	0.113 (0.082)
Persons in poverty (proportion)	0.224 (0.144)
Unemployed (proportion)	0.098 (0.057)
Female head of household (proportion)	0.129 (0.074)
Age structure and race	
Males < 25 years old (proportion)*	0.191 (0.062)
Black residents (proportion)	0.108 (0.167)
Stability index	
Residence 5 + years (proportion)	0.449 (0.136)
Homes owner occupied (proportion)	0.40 (0.266)
Population density	
Persons per square mile*	16,027.54 (13,609.58)
Population (per tract)	4,417.37 (1,388.25)

Proportion of males under 25 is converted into standard deviation units in the subsequent regression estimates to reduce the influence of outliers. Persons per square mile measure is converted into its natural logarithm to linearize the measures and remove the extreme right hand skew. The full sample represents observations of 835 neighborhood census tracts with complete data on all covariates and 6 years (2000–2005) of crime data

Results

Table 2 presents results from the first-stage regressions estimating the level of immigrant concentration in 2000 and reduced form estimates of changes in crime.[15] Consistent with our predictions, we find a strong relationship between neighborhood concentrations of immigrants in 1990 and 2000 ($F = 161.7$; $p < 0.001$), suggesting that prior levels of immigration may provide a suitable instrumental variable (Z) to address the problems of endogeneity (selection). Specifically, concentrations of immigrants (Hispanics/Latinos and foreign-born) in neighborhoods in LA during 2000 were at least partially a function of pre-existing patterns of settlement measured in 1990. However, as we noted in the maps displayed in Fig. 1, there remains a substantial dispersion of immigrant settlements in LA neighborhoods by 2000 not accounted for by 1990 levels. We leverage this dispersion in our estimates of the treatment effect of immigrant concentration on changes in crime rates.

The last two columns of Table 2 (models 3 and 4) show our reduced-form estimates of the relationship between pre-existing levels of immigrant concentration and changes in total crime and violent crime. The level of immigrant concentration in 1990 is negatively related to changes in neighborhood crime rates. Under the assumption that the exclusion of pre-existing levels of immigrants from the changes in crime Eq. (5) is a valid instrument (Z_i), the positive estimate in the first stage selection model of immigrant concentration in 2000 and a negative estimate in the reduced form model of changes in crime for years

[15] The reduced form estimates are obtained by substituting Eq. 4 into Eq. 5.

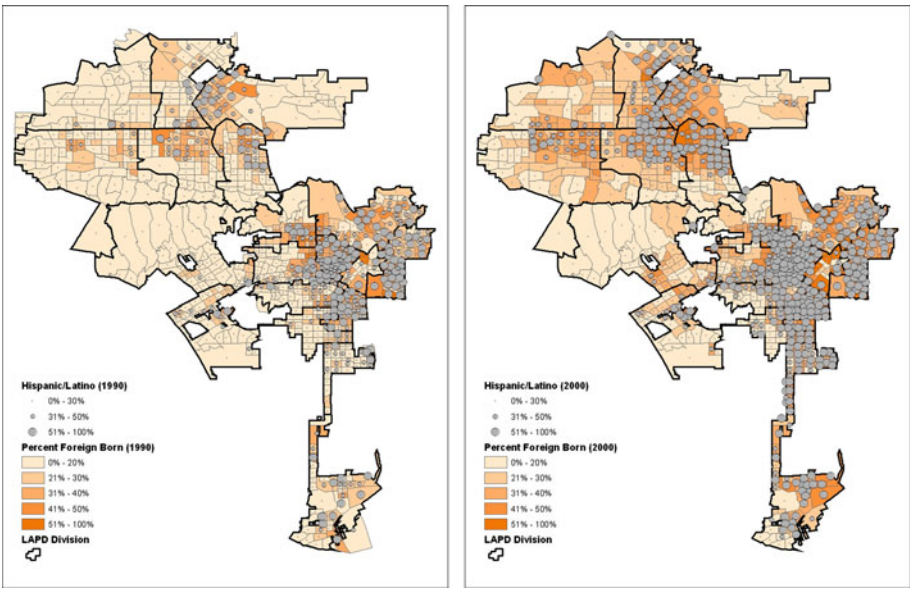

Fig. 1 Immigrants and Latinos in Los Angeles neighborhoods

Table 2 The relationship between pre-existing levels of immigrant concentration, current levels, and changes in crime (2000–2005)

	First stage		Reduced form	
	Immigrant concentration		Violent crime	Total crime
	(1) Coefficient	(2) Coefficient	(3) Coefficient	(4) Coefficient
Immigrant concentration 1990	0.42 (0.02)*	0.34 (0.02)*	−1.39 (0.12)*	−2.35 (0.47)*
Poverty index	0.14 (0.02)*	0.09 (0.02)*	−0.37 (0.14)*	−0.14 (0.52)
Residential stability index	0.02 (0.02)	0.01 (0.02)	0.77 (0.13)*	4.58 (0.50)*
Ln (persons per square mile)	0.34 (0.03)*	0.32 (0.03)*	0.04 (0.19)	4.88 (0.72)*
Males under age 25[a]	0.39 (0.02)*	0.39 (0.03)*	0.84 (0.18)*	0.82 (0.67)
Black residents (proportion)	−2.20 (0.16)*	−2.10 (0.21)*	−8.81 (1.22)*	−11.67 (4.56)*
Area-fixed effects	No	Yes	Yes	Yes
F test	535.96*	161.70*	26.43*	12.19*
R^2	0.79	0.82	0.44	0.27

The dependent variables in models (1) and (2) show the concentration of immigrants in 2000. The dependent variables in models (3)–(4) show the changes in violent crime and total crime rates. Standard errors are reported in parentheses. Results from these models are substantively the same if weighted by census tract population with robust standard errors estimated. The number of observations is based on 835 neighborhood census tracts

* $p < 0.01$

[a] Converted into standard deviation units

Table 3 Immigrant concentration on changes in neighborhood crime

	Violent crime (1) Coefficient	Violent crime (2) Coefficient	Total crime (3) Coefficient	Total crime (4) Coefficient
Predicted immigrant concentration	−2.73 (0.32)*	−4.01 (0.45)*	−3.86 (1.06)*	−6.76 (1.42)*
Poverty index	−0.02 (0.16)	0.01 (0.18)	−0.15 (0.54)	0.51 (0.58)
Residential stability index	0.74 (0.14)*	0.82 (0.16)*	4.91 (0.49)*	4.67 (0.52)*
Ln (persons per square mile)	1.10 (0.26)*	1.35 (0.29)*	6.98 (0.86)*	7.09 (0.90)*
Males under age 25[a]	1.63 (0.23)*	2.40 (0.31)*	2.56 (0.79)*	3.46 (0.97)*
Black residents (proportion)	−13.63 (1.45)*	−17.24 (1.96)*	−17.45 (4.83)*	−25.89(6.12)*
Area-fixed effects	No	Yes	No	Yes
Wald-Test	347.30*	412.02*	165.58*	270.68*
R^2	0.17	0.11	0.14	0.18

2SLS—two stage least squares regression. The dependent variables models (1)–(4) show the changes in total crimes and violent crimes per census tract between years 2000–2005 instrumented on the estimated level of immigrant concentration. Standard errors are reported in parentheses. Results from these models are substantively the same if weighted by census tract population with robust standard errors estimated. The number of observations is based on 835 neighborhood census tracts

* $p < 0.01$

[a] Converted into standard deviation units

2000–2005 suggests that the instrumental variables models will be negative.[16] Tests for exogenous variation in our instrument of immigrant concentration are corroborated by the fact that the predicted concentration of immigrants is uncorrelated with the residuals in the reduced form models estimates.[17]

Table 3 presents the second-stage estimates from the 2SLS regression models. Consistent with our hypothesis, higher predicted concentrations of immigrants are associated with greater than expected reductions in total reported criminal offenses and violent crimes. The effects of current levels of immigrants on changes in crime in the 2SLS estimates is also about two times as strong as the reduced form equations estimate, suggesting a strong selection effect. These findings suggest that the predicted concentration of immigrants is strongly associated with neighborhood decreases in crime, net the effects of poverty indicators, residential stability, population density, age structure, and regions of the city. Interpreting the estimates at the sample means for total and violent crimes suggests that a 19.1 % increase (half a standard deviation) in the concentration of immigrants in Los Angeles neighborhoods reduces the average amount of total crime in a neighborhood by 35.7 % and violent crime by 40.9 %.

The inclusion of instrumental variables estimates, fixed-effects for geographic regions of Los Angeles, and controls for neighborhood differences in poverty, residential stability, age structure, percent black residents, and population density was intended to isolate the

[16] The Wu-Hausman test of the null hypothesis of endogeneity between immigrant concentration in 2000 and change in violent crime ($F = 112.83$) and total crime ($F = 21.65$) was rejected at the $p < 0.001$ level, suggesting that levels of immigration were endogenous to changes in crime and that OLS estimates would be inconsistent. The OLS estimates of including percent immigrants in 2000 as a covariate without taken into account selection find a small effect on violent crime ($b = -0.608$; $t = -3.22$; $p = 0.001$) and a non-significant effect for total crime ($b = -1.20$; $t = -1.80$; $p = 0.072$).

[17] The Pearson correlation between predicted immigrant concentration and residuals was 0.034 ($p = 0.324$) for violent crime and 0.017 ($p = 0.621$) for total crime.

Table 4 Sensitivity analysis of the monotonic impact of immigrant concentration on changes in neighborhood crime

	Violent Crime (1) Coefficient	Total Crime (2) Coefficient
Predicted immigrant concentration	−4.01 (0.550)*	−6.76(1.42)*
Poverty index	0.018 (0.269)	0.516 (0.532)
Residential stability index	0.828 (0.181)*	4.67 (0.839)*
Ln(persons per square mile)	1.35 (0.339)*	7.09 (2.62)*
Males under 25[a]	2.40 (0.438)*	3.46 (2.39)**
Black residents (proportion)	−17.24 (2.44)*	−25.89 (6.44)*
Area-fixed effects	Yes	Yes
F test	16.54*	11.74*
R^2	0.11	0.18

2SLS—two stage least squares regression. The dependent variables in models (1)–(2) are the changes in total crimes and violent crimes per census tracts between years 2000–2005 instrumented on the estimated level of immigrant concentration. Standard errors are reported in parentheses and adjust for clustering within strata. The number of observations in columns 1–2 is 831 (4 strata adjustment removed by design from estimation)

* $p < 0.01$; ** $p < 0.05$

[a] Converted into standard deviation units

effects of immigrant concentration on neighborhood crime rate changes. If our instrumental variable is valid then our control variables for neighborhood attributes and geographic regions of LA provide a more refined and unbiased estimate of the treatment effect of immigrant concentration on changes in crime (Angrist and Pischke 2009).

Table 4 reports the results from further specifications of the immigration effect on neighborhood crime that adjust standard errors for observations being clustered within stratum. The standard errors only change marginally and the substantive significance is the same, suggesting that the parameter for the effect of immigrant concentration on changes in neighborhood crime rates is not driven by heteroscedasticity in the upper or lower limit of the expected probability distribution of predicted immigrant concentrations.

The role of immigrant concentration on reductions in neighborhood crime rates is further explored in Fig. 2, which graphs the actual mean changes in total and violent crimes for the four strata based on the 25th, 50th, and 75th quartiles of the predicted value of immigrant concentration. Figure 2 reveals that when immigrant concentration for neighborhoods in 2000 is predicted based on the previous 1990 decennial census there is a clear crime reduction effect of having a higher concentration of immigrants in a neighborhood.

The results from estimating the potential heterogeneity in the treatment effects of immigrant concentration on changes in crime are reported in Table 5. While the overall fit of predicting immigrant concentration is marginally improved by including nonparametric smoothers, and the predictions of treatment take-up are marginally bigger at higher order thresholds, the point estimates between two out of the three spline terms cannot be distinguished from zero ($p > 0.05$) according to Wald-test comparisons. The results in columns 2 and 3 indicate the overall effect of immigrant concentration on changes in crime remains materially the same, suggesting that this effect is not a non-linear effect driven by specific parts (e.g., the upper tail) of the probability density function of immigrant

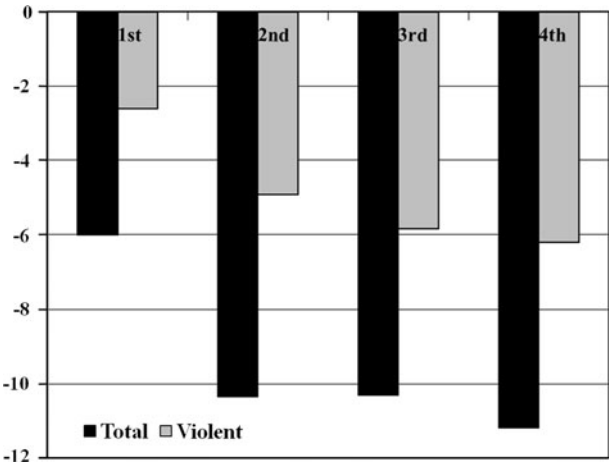

Fig. 2 Average change in crime by quartiles of predicted immigrant concentration

Table 5 Heterogeneity in treatment impact of immigrant concentration on changes in neighborhood crime rates

Variable	First stage (1) Coefficient	Violent crime (2) Coefficient	Total crime (3) Coefficient
Prior immigrant NS2	11.81 (2.88)*	–	–
Prior immigrant NS3	12.25 (1.68)*	–	–
Prior immigrant NS4	9.35 (5.14)*	–	–
Predicted immigrant concentration	–	−3.14 (0.36)*	−5.16 (1.20)*
Poverty index	0.096 (0.02)*	−0.124 (0.17)	0.252 (0.56)
Residential stability index	0.023 (0.02)	0.819 (0.15)*	4.65 (0.51)*
Ln(persons square mile)	0.278 (0.03)*	1.04 (0.26)*	6.50 (0.85)*
Males under 25[a]	0.367 (0.02)*	1.98 (0.27)*	2.67 (0.89)*
Black residents (proportion)	−1.95 (0.20)*	−14.80 (1.73)*	−21.36 (5.67)*
Area-fixed effects	Yes	Yes	Yes
F test/Wald-test	169.77*	456.31*	276.40*
R^2	0.84	0.22	0.21

2SLS—two stage least squares regression. The dependent variables column (1) is the estimated level of immigrant concentration. The dependent variables in columns (2)–(3) are the changes in violent crimes and total crimes per census tracts between years 2000–2005 instrumented on the estimate level of immigrant concentration. The number of observations is 835 neighborhoods. NS denotes natural cubic spline terms for predicted level of immigrant concentration

[a] Converted into standard deviation units

concentration in 1990. Higher values of immigrant concentration are linked to greater than expected reductions in violent crime and total crime.

Taken together, the results from the various regression estimates suggest a considerable marginal net reduction in neighborhood crime rates was associated with higher concentrations of immigrants to Los Angeles neighborhoods during this observation period.

Additional Tests

Racial disparities in the propensity for crime and violence (Cook and Laub 1998) might lead some to speculate that immigrants are simply replacing African American populations in economically distressed LA neighborhoods. We estimated additional models that included the change in the percentage of black residents between 1990 and 2000 in each neighborhood. Including this additional parameter produced no substantial change to the immigrant concentration results presented. We also estimated 2-stage least squares models of the proportion of Black or White residents in 2000 as separate outcomes through the same structural equation we used to estimate crime changes ($\text{Prop}\,(\text{Black, White})_i = \mu + \theta_i \hat{T} + X_i'\Gamma + \Psi_{d(i)} + e_i$). We find nearly identical effects of the predicted levels of immigrant concentration on the expected proportion of White (b = −0.065 SE = 0.010; $p < 0.001$) and Black (b = −0.056 SE = 0.008; $p < 0.001$) populations. These findings suggest that our estimates of immigrant concentration in 2000 on changes in crime rates are not simply an artifact of the displacement of Black or White residents. It is also worth noting that African Americans are not a majority population in any of the top 20 areas with the highest predicted levels of immigrant concentration.

Regression diagnostics were also conducted on all specifications for multicollinearity and influential observations. No variance inflation factor values (VIF) exceeded 4.0, suggesting that multicollinearity is not a concern with the specified models. To examine the potential impact of influential observations on parameter estimates, standardized residual plots were examined. An observation would be influential if removing it from the model resulted in a substantive change in the parameter estimates. Less than 2 % of cases had standardized residuals greater than the absolute value of 3.0 in both the violent crime and total crime equations. Removing observations whose residual values were more than plus or minus 3.0 standard deviations did not change the substantive interpretation of a significant association between increasing immigrant concentration and declining crime. To assess the functional form of the model we also examine the distribution of fitted values from the selection of immigrants (Eq. 4) and the change in total and violent crime outcomes (Eq. 5), as well as the relationship between the predicted and actual values of changes in crime. The plots suggest that the errors are normally distributed around the expected mean and that there is a clear linear relationship between the predicted and actual values of changes in the crime rates.

Weights were also applied to these 2SLS estimations, with weights determined by census tract populations and robust standard errors obtained to account for heteroscedasticity. The results with and without weighting by census tract populations are substantively the same. The parameters are also unaffected by robust standard errors corrections. We present the un-weighted estimates since it is unclear whether residential populations provide an appropriate denominator (or population at risk) for crime counts and because the parameters remain unaffected by standard errors corrections.[18]

We also recognize that the PCA measure of immigrant concentration that combines the proportion of Latino with proportion foreign-born in each census tract could potentially confound first and second generation immigrants. While this is a possibility, the level of correlation between these two measures is so high that estimating them simultaneously

[18] Freedman (2006) notes that the use of robust standard errors corrections on observational data requires the analyst to make the assumption that the model is correct, but that the standard errors estimated are wrong. If such is true then it might be useful to get the correct variance, but if interest is in interpreting the parameters then correcting the variance is not useful.

results in problems of multicollinearity. As we previously noted, when these two measures are entered into the regressions simultaneously we get a coefficient estimate of average reduction in crime from the proportion foreign born that exceeds any observed neighborhood crime reduction—indicating a biased parameter. Similarly, leaving either proportion Latino or proportion foreign born out of the estimations may lead to omitted variable bias. Recognizing this limitation, we did re-estimate the models combining the proportion of foreign-born Latinos and proportion foreign-born into a single PCA index of *Latino immigrant concentration*.[19] This PCA index, therefore, captures the concentration of foreign-born Latinos as a share of the total foreign born population of each neighborhood census tract. We then re-estimated both our selection (Eq. 4) and outcome models (Eq. 5). The results from these regressions are reported in "Appendix 2" and indicate nearly identical parameter estimates. A greater predicted Latino immigrant concentration in a census tract is associated with significant reductions in the total crime ($b = -6.24$; $p < 0.001$) and violent crime ($b = -3.70$; $p < 0.001$) rates. The results clearly indicate that the previous specifications are not the result of confounding the effects of 1st and 2nd generation immigrants of Hispanic/Latino ethnicity. We also conducted the same set of tests of monotonic trends and heterogeneity estimated in Eqs. (5) and (7) for this composite measure of Latino immigrant concentration and the results are substantively the same. The main driving force of the immigrant concentration effect on crime observed in LA appears to be first generation immigrants, primarily of Latin American origin.

Finally, to address the potential effect that the under-reporting of crime by immigrants may have on changes in neighborhood crime rates we obtained separate estimates for between-neighborhood differences in homicide rates only. These separate estimations also indicated that the average change in total reported homicide ($b = -0.061$ SE $= 0.018$; $p < 0.01$) was significantly reduced for areas with higher predicted concentrations of immigrants. Given that homicides are rare events that occur on average less than 1 time a year (0.69) in a census tract neighborhood, there is quite a bit of uncertainty around the point estimate (95 % confidence interval -0.10 to -0.021). The findings from our homicide estimates suggest that the observed immigrant effects on crime are not likely a result of systematic under-reporting of crime to the police.

Discussion and Conclusion

In this paper we present evidence suggesting that a greater concentration of immigrants in neighborhoods is associated with significant reductions in serious crimes. An increase in the concentration of immigrants in neighborhoods reduces the average amount of total and violent crime by substantial magnitudes, even after taking into account that immigrants are likely to select into neighborhoods with their existing co-ethnics. Although Sampson (2008) suggests that there is a link between rising immigration patterns in cities and the declines in crime rates that occurred during the 1990s, until recently immigration (Stowell et al. 2009; Martinez et al. 2010) has not played a central role in explanations of neighborhood patterns of crime or, more generally, the overall crime drop in the United States (Levitt 2004). This study modeled the link between within-neighborhood changes in crime and predicted immigrant settlement patterns in LA, net the effects of population and housing characteristics traditionally correlated with crime. The results suggest that immigrant settlement patterns are associated with appreciable reductions in the crime in

[19] Eighty-three percent of the covariance between these two variables was explained by the first component.

neighborhoods, once we control for the selection of immigrants into particular areas. The association between greater concentrations of foreign born of primarily Latin American origin and declining crime rates appears to be robust to a variety of model specifications.

Past research has noted the negative effect that crime has on city economies, causing urban flight and population decline for entire cities or in specific neighborhoods (see e.g., Cullen and Levitt 1999; Morenoff and Sampson 1997). For the immigrant "gateway" LA, subsequent to the rising crime rates of the late 1980s and early 1990s was a period of increasing migration of predominately Latin American immigrants to neighborhoods of concentrated poverty that produced net reductions in serious crimes reported to the police. The "replacement population" of immigrants appears to have been good for the social burden of crime in LA. The biggest predicted reductions in crime occurred in areas of concentrated poverty located in the Southeast and Central sections of Los Angeles, areas that have been historically linked to crime and gang violence among native Latino populations.

There are limitations to the findings presented from our model. The observational data we analyzed are limited to official crimes reported to the police. If immigrants are systematically less likely than other groups to report crimes to the police, then the patterns observed may represent the underreporting crimes to the police by these groups. We attempted to reduce the influence of underreporting of crimes with the associated patterns observed by focusing our analysis on only serious criminal offenses and a subset of violent crimes most likely to come to the attention of the police, including a separate analysis of homicide rates. Underreporting of crime among immigrants may be less of a concern in LA given that the LAPD have been mandated by policy since 1979 to not initiate "police action with the objective of discovering the alien status of a person," and to not arrest or book a person for "illegal entry" into the United States (Rampart Independent Review Panel 2001). The LAPD have been vigilant about not enforcing federal immigration laws so that they can encourage immigrants to actively report crimes. Future efforts should, however, assess how sensitive immigrant effects are to the potential underreporting of specific crime types among different immigrant groups.

Other unknown forms of omitted variable bias may also explain the observed link between immigrant concentration and neighborhood crime patterns. It is possible that there are unobserved mechanisms outside of pre-existing levels of immigrants that explain why some neighborhoods attract immigrants, and that this attraction precedes downturns in crime. Immigrant attractor neighborhoods, for example, may be areas that are on the tipping point of long-term reductions in neighborhood crime patterns. However, since we reduced neighborhoods to their actual change in crime over the period of observation, such potential regression to the mean effect is a less powerful explanation. Since pre-existing levels of immigrant concentration are strong predictors of our observed levels of immigrant concentration, this appears to represent a strong assignment mechanism that takes into account selection bias, and we can say with fair confidence that we have identified an exogenous link between immigration and changes in crime rates. However, we recognize that our instrumental variables estimations require some faith in the assignment or selection mechanism specified. Future research could consider other approaches, such as natural experiments, that more clearly mimic randomization of changes in immigrant settlement patterns and are truly independent of changes in crime.

Having established a link between increasing immigrant settlement and declining crime in neighborhoods, the next step is to understand more clearly the actual sociological mechanisms whereby immigrant enclaves cause crime rates to lower in neighborhoods. Whether immigrant concentration is an important dynamic of changing neighborhood

patterns of crime more generally will require replication with data from other U.S. cities and ethnographic approaches to studying specific neighborhoods. These findings do call into question traditional ecological explanations that suggested immigrant settlement and crime were spuriously related through the natural process of settlement and assimilation. Our study suggests that immigrants settling into areas of concentrated poverty in LA reduce the crime rate, and that immigrants are not merely a replacement population as part of a natural ecological process. On the other hand, parts of LA with entrenched poverty and native residents have not seen the same reductions in crime over the period of observation. Our findings suggest that the initial assimilation of immigrants into neighborhoods may produce reductions in crime, but that the crime reduction benefits will be undermined if residential stratification leads subsequent generations to live in sustained periods of underclass poverty.

Acknowledgments Aaron Kofner at RAND provided GIS and other programming assistance. The authors thank Phil Cook, Jeffrey Morenoff, Jeffrey Fagan, and Anne Morrison Piehl for their helpful suggestions on an earlier draft of the manuscript. All errors and omissions are those of the authors. Support for this project was made possible in part by funding from Centers for Disease Control and Prevention: 1U49CE000773 to the RAND Corporation. The points of view are those of the authors only.

Appendix 1

See Table 6.

Table 6 Spatial error estimation of immigrant concentration on changes in neighborhood crime rates

Variable	First stage (1) Coefficient	Violent crime (2) Coefficient	Total crime (3) Coefficient
Prior immigrant 1990	0.42 (0.076)*	–	–
Immigrant concentration	–	−2.73 (0.554)*	−3.86 (0.135)*
Poverty index	0.14 (0.050)*	−0.027 (0.201)	−0.157 (0.938)
Residential stability index	0.02 (0.059)	0.742 (0.163)*	4.91 (0.943)*
Ln (persons per square mile)	0.34 (0.075)*	1.10 (0.217)*	6.98 (2.54)*
Percent male under 25[a]	0.39 (0.104)*	1.63 (0.449)*	2.56 (1.90)*
Percent black	−2.20 (0.28)*	−13.63 (3.11)*	−17.45 (5.80)*
F test	384.65*		
Wald-test		212.76*	137.39*

2SLS—two stage least squares regression with weighted standard errors for 19 police divisions. The dependent variables column (1) is the estimated level of 2000 immigrant concentration from 1990 levels. The dependent variables in columns (2)–(3) are the changes in violent crimes and total crimes per census tracts between years 2000–2005 instrumented on the estimate level of immigrant concentration from first stage column (1). The number of observations is 835 neighborhoods

[a] Converted into standard deviation units

Appendix 2

See Table 7.

Table 7 Effect of foreign born latino concentration on changes in neighborhood crime rates

Variable	First stage (1) Coefficient	Violent crime (2) Coefficient	Total crime (3) Coefficient
Prior immigrant 1990	0.37 (0.031)*	–	–
Latino immigrant concentration	–	−3.70 (0.468)*	−6.24 (0.135)*
Poverty index	0.06 (0.03)**	−0.133 (0.201)	0.26 (0.584)*
Residential stability index	−0.07 (0.033)*	0.497 (0.192)*	4.11 (0.557)**
Ln(persons per square mile)	0.32 (0.047)*	1.24 (0.316)*	6.90 (0.920)*
Percent male under 25	0.11 (0.044)*	1.27 (0.266)*	1.55 (0.775)*
Percent black	−0.82 (0.300)*	−11.86 (1.81)*	−16.82 (5.28)*
Area-fixed effects	Yes	Yes	Yes
F test	59.38*		
Wald-test		332.14*	251.57*

2SLS—two stage least squares regression. The dependent variables column (1) is the estimated level of Latino foreign born as share of immigrant population. The dependent variables in columns (2)–(3) are the changes in violent crimes and total crimes per census tracts between years 2000–2005 instrumented on the estimate level of immigrant concentration from first stage column (1). The number of observations is 835 neighborhoods

[a] Converted into standard deviation units

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