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Abstract

Objectives: Longitudinal studies of the relationship between neighborhood change and changes in crime typically focus exclusively on the *net* level of change in key socio-demographic characteristics.

Methods: We instead propose a demographic accounting strategy that captures the *composition* of neighborhood change: our measures capture which types of people are more likely to leave, stay, or enter the neighborhood. We use data for 3,325 tracts in the Southern California region over nearly two decades of 2000-2010 and 2010-2017 and construct flow measures based on race/ethnicity; the length of residence of owners and renters; the age structure.

Results: These flow measures improve the predictive power of the models—implying important theoretical insights. Neighborhoods with higher percentages of middle-aged residents who recently entered the neighborhood exhibit larger increases in violent and property crime. The relative stability of those in the highest crime-prone ages (aged 15-29) is associated with the largest increases in violent and property crime. The loss of Black and Asian residents decreased crime while moderate outflows of Latinos increased crime. The mobility of long- and short-term renters was related to crime changes.

Conclusions: This new technique will likely encourage further theoretical innovation for the neighborhoods and crime literature.

Keywords: neighborhood change; crime; demographic change

Bio

John R. Hipp is a Professor in the Departments of Criminology, Law and Society, and Sociology, at the University of California Irvine. His research interests focus on how neighborhoods change over time, how that change both affects and is affected by neighborhood crime, and the role networks and institutions play in that change. He approaches these questions using quantitative methods as well as social network analysis. He has published substantive work in such journals as *American Sociological Review, Criminology, Journal of Quantitative Criminology, Social Forces, Social Problems, City & Community, and Urban Studies*. He has published methodological work in such journals as *Sociological Methodology*, *Psychological Methods*, and *Structural Equation Modeling*.

Alyssa W. Chamberlain is an Associate Professor in the School of Criminology and Criminal Justice at Arizona State University. Her research interests focus on the nexus between neighborhood dynamics and crime, more specifically, the spatial and temporal relationship between neighborhood structural characteristics, social inequality and crime and how those factors shape neighborhood change over time. She also examines issues related to prisoner reentry and corrections.

Who Leaves and Who Enters? Flow Measures of Neighborhood Change and Consequences for Neighborhood Crime

A large body of evidence demonstrates that neighborhoods with characteristics such as concentrated disadvantage, residential instability, or racial/ethnic heterogeneity tend to have higher levels of crime (Krivo and Peterson 1996; Land, McCall, and Cohen 1990; Morenoff, Sampson, and Raudenbush 2001; Rountree, Land, and Miethe 1994). This has generated interest in exploring how neighborhood change based on various socio-demographic characteristics impacts the change in crime levels (Kirk and Laub 2010; Kubrin and Weitzer 2003; Taub, Taylor, and Dunham 1984). Although this literature focusing on neighborhood change is more limited, much of it builds on social disorganization theory and posits that the *net* level of change in these socio-demographic characteristics will result in higher levels of crime. While such studies are useful for understanding the longitudinal dynamics between neighborhood change and crime, the nearly exclusive focus on net change fails to account for the *composition* of neighborhood change. As a consequence, specific demographic processes and their implications for neighborhood outcomes regarding neighborhood change are relatively unexplored for criminological theory.

While the net change in the composition of a neighborhood captures the difference in overall out-migration versus overall in-migration, more granular information on which types of people are more likely to leave, stay, and enter the neighborhood can more clearly elucidate the sociodemographic drivers of crime. By capturing the *flow* of residents based on various characteristics into and out of neighborhoods, a richer understanding can be obtained of how neighborhoods change, and the subsequent consequences of this for changes in neighborhood crime. In short, we argue that it is important to know which residents are more or less likely to

leave a neighborhood, as well as which residents are more or less likely to enter a neighborhood, rather than simply measuring the net change in the neighborhood composition. We conjecture that these flows can help in understanding how rates of crime change over the period of a decade.

Although there are various possible characteristics we could study regarding who leaves or enters a neighborhood, we focus on three characteristics of households that generally follow from social disorganization theory. First, the racial/ethnic composition of a neighborhood is an important factor in existing ecological studies of crime—whether it is because such neighborhoods are perceived as being more disadvantaged as articulated by the racial proxy hypothesis (Harris 2001) or because of the limited resources such neighborhoods receive as noted by the racial disparities literature (Krivo and Peterson 1996)—therefore we focus on the race/ethnicity of households who are more likely to leave a neighborhood, or enter a neighborhood. Second, given that homeownership and length of residence are important components of residential stability, we study whether there are differences in mobility patterns for short-term vs. long-term renters and owners, and the consequences for changes in crime. Third, we study the age composition of residents in the neighborhood. Although ecological studies of crime have typically only focused on the presence of adolescents and younger adults—under the hypothesis that they tend to be in the more active time period of the age/crime curve—the presence of middle-aged adults may be important for their ability to provide informal social control in the community (Anderson 1999; Hurd, Zimmerman, and Reischl 2011) compared to retirees who have less physical ability to do so and may also be more attractive targets (Akers et al. 1987).

We explore these questions using neighborhood data for 3,325 tracts in the Southern California region over two decades of 2000 to 2010 and 2010 to 2017 (the most recent year for

which we have data). We introduce a demographic accounting technique to capture the flows of different types of persons who either disproportionately leave or enter a neighborhood, and the consequences of this for changes in crime. In so doing, we provide a more comprehensive understanding regarding how and why neighborhoods change, and assess how different forms of neighborhood change might differentially affect changes in neighborhood crime over a decade.

Residential mobility and neighborhood change

Neighborhood change is dynamic and largely tied to resident characteristics. There are a number of ways by which net changes in the sociodemographic characteristics of neighborhoods may occur. These changes largely occur as a result of changes in the composition of residents due to residential mobility *or* due to the natural demographic changes of residents that occur due to non-mobility change. We describe each of these types of change next.

The socio-demographic characteristics of a neighborhood can change due to residential mobility. One mechanism by which this may occur is when a housing unit turns over. Importantly, a housing transition need not necessarily result in neighborhood change along a particular social dimension. For example, such a transition will not result in neighborhood change if the new residents are the same as the previous residents on such characteristics as race/ethnicity, household type, presence of children, or level of income. What is required to bring about change in neighborhood demographic characteristics is that not only is there a change in residents in the unit, but that the new residents *differ* from the prior ones based on certain characteristics (Hipp 2019). For example, residential turnover can result in racial/ethnic change in a neighborhood, which is posited to impact crime either by changing the number of racial minorities, or because it increases the racial/ethnic heterogeneity in a neighborhood, both of which are posited to impact crime rates (Pratt and Cullen 2005). To the extent that residential

turnover changes the level of socioeconomic resources of residents in a neighborhood, this is also posited to impact crime rates (Hipp, Tita, and Greenbaum 2009; Sampson, Raudenbush, and Earls 1997). However, these perspectives typically focus on the composition of residents in a neighborhood, and how the *net* change in this composition will impact crime rates. This may be an overly narrow assessment of how these processes unfold over time and their relative impact on crime, as focusing on the net change ignores the underlying factors contributing to such change.

Alternatively, the characteristics of a neighborhood may change due to a *lack* of residential mobility. Although residential stability is generally viewed as a positive characteristic for a neighborhood, this does not mean that these neighborhoods do not experience demographic change. For instance, there are a number of natural demographic processes that occur over time that will result in a change despite a stable neighborhood population. One such process is aging, as all household members age (Cagney 2006). An aging household has implications for the larger structure of the household, as couples can marry, divorce, or have children. Conversely, children may mature into adults and their exit can consequently change household structure, or household members may die. These demographic processes can change the composition of the neighborhood (Myers 1999). Thus, neighborhood change is inevitable, regardless of the level of stability in a neighborhood.

Despite this potential for change, it is worth noting that the neighborhood change literature often finds that change occurs quite slowly. For example, Sampson (2012) pointed out that neighborhoods can exhibit considerable stability in levels of disadvantage over long periods of time and over multiple decades. This suggests that while neighborhoods can experience internal change, the distribution of poverty between neighborhoods remains relatively stable

(Sampson 2009; Sampson and Morenoff 2006). Nonetheless, despite this general pattern of limited change, some neighborhoods can indeed undergo change, and sometimes quite dramatic change—although over shorter periods of time (such as racial transition, or gentrification) (Covington and Taylor 1989; Taylor and Covington 1988). For instance, Schuerman and Kobrin (1986) assert that the *velocity* of neighborhood structural change exceeds changes in crime early in the transition process, whereas the speed of change in crime accelerates later in the process. It is these changes that are of interest to scholars focusing on changing levels of crime in neighborhoods, and our focus here as well.

Who moves out, and who moves in?

The mobility decision by households is based on many push and pull factors, including the degree to which the housing unit fits the needs of the household and satisfaction with various features of the neighborhood (Bolan 1997; Clark and Ledwith 2006; Clark 2005). A body of mobility studies has shown that which households are more likely to move is not random, but rather varies systematically based on certain key features. One important dimension is the household's relative satisfaction with the unit and the neighborhood (Speare 1974). Studies have found that residents who are less satisfied with the neighborhood are more likely to intend to move (Landale and Guest 1985; Lu 1998; McHugh, Gober, and Reid 1990) and more likely to actually move (Clark and Ledwith 2006; Deane 1990; Lu 1999). As another example, homeowners have a greater economic investment in their unit, as well as the neighborhood to the extent that it impacts their home value over time, and therefore are much less likely to move compared to renters (Galster 1987; Rohe, McCarthy, and Zandt 2013; Saunders 2020). This is also the case because there are greater social and economic costs to moving away from an owned unit and needing to sell it, compared to leaving a unit that one rents. As another example,

households with school-aged children are typically much less likely to move compared to young residents, or retirees, given the social costs to uprooting school-aged children when moving to a new location (Dawkins 2006).

Although residents may wish to move, they are sometimes constrained in their ability to move. One constraint is economic resources, as housing costs in some neighborhoods can simply be out of economic reach for certain households (Gramlich, Laren, and Sealand 1992; South, Crowder, and Chavez 2005; South and Deane 1993). This may be particularly relevant for Black residents, who are more likely to remain in housing or neighborhood conditions deemed unsatisfactory (Quillian 2003; South and Deane 1993). There is also evidence that certain racial/ethnic groups can be steered away from some neighborhoods and into others (Christensen and Timmins 2018; Massey 2005; South and Crowder 1998). The implication is that racial minorities—particularly Black residents—may have limited options in where they can move and therefore would be more likely to move into more disadvantaged neighborhoods (Ellen 2000; Hipp 2012; Ioannides and Zabel 2008). This has led to considerable segregation by race across the neighborhoods of contemporary U.S. society (Farley 2008; Wright et al. 2014).

Alternatively, residents may be pushed out of neighborhoods and forced to relocate to other, possibly less desirable neighborhoods. For example, gentrification initiates residential transition, where higher income residents displace lower income residents, many of whom are disproportionately ethnic-minorities (Freeman 2005; Glass 1964). As housing prices rise, long-term residents may be priced out of a neighborhood undergoing urban transformation, and this often results in Black-to-White racial change (Lee, Spain, and Umberson 1985). In the Southern California region, a significant number of Black neighborhoods have transitioned into predominantly Latino neighborhoods, resulting in Black residents being squeezed out of decent,

low-income neighborhoods (Mare and Bruch 2003). Often times, residents are forced into neighborhoods with more affordable housing but lower desirability, with some research finding residents are often driven into overcrowded apartments, shelters, or even become homeless (Desmond and Shollenberger 2015; Newman and Wyly 2006). Renters in these neighborhoods might be subject to eviction (Chum 2015; Desmond and Shollenberger 2015), a form of forced mobility which may trigger a number of changes to a neighborhood, including the conversion of rental units to owner-occupied units, racial/ethnic transition, and the disproportionate displacement of minority women (Desmond 2012). Additionally, homeowners might face foreclosure, a phenomenon that became particularly commonplace during the housing crisis in the late 2000s. Foreclosures create instability among homeowners, which may be particularly corrosive for social ties and informal social control (Hipp and Chamberlain 2015), and can therefore stimulate racial/ethnic change (Hall, Crowder, and Spring 2015; Lauria and Baxter 1999).

Implications of demographic change for neighborhood crime

The social disorganization perspective posits that neighborhoods characterized by high levels of poverty, residential instability, and racial/ethnic heterogeneity will have fewer interactions among residents, weakening informal social control and reducing the ability of communities to collectively address problems such as crime (Sampson and Groves 1989; Shaw and McKay 1942). Further, neighborhoods with a greater presence of single parent households have fewer guardians in a neighborhood, which can further undermine informal social control, especially among youth—and limit the regulatory power among residents to prevent crime (Sampson and Groves 1989). The presence of older adults in a neighborhood may offset the negative effects of these factors, as older male role models may be important for the pro-

socialization of youth and a decrease in crime (Anderson 1999; Hurd, Zimmerman, and Reischl 2011).

Whereas social disorganization theory posits that residential instability as well as net changes in the demographic composition of the neighborhood based on SES and race/ethnicity will impact changes in crime rates (Shaw and McKay 1942), we propose here that a more nuanced view of demographic transition will reveal more explicitly how these processes of change might catalyze crime. Of particular importance in our approach is focusing not just on the net change in the composition of a neighborhood—as is the standard approach—but rather looking closely at *what types of people are remaining in a neighborhood*, *what types are leaving*, and *what types of people are entering a neighborhood*.

The question then is, for a particular group of residents (e.g., a racial group, homeowners, age group), what percentage of residents remained in the neighborhood rather than leaving? Given that there is typically a baseline level of residential mobility that occurs for all residents, we might consider that mobility rates of stayers indicate one of four situations: 1) a mobility rate higher than average would indicate that residents are relatively dissatisfied (although it could also indicate higher turnover due to gentrification); 2) a mobility rate at the average would indicate that residents are neither satisfied nor dissatisfied; 3) a mobility rate somewhat below the average would indicate that residents are relatively satisfied; 4) a mobility rate near zero might indicate residents are very satisfied, but also might indicate that they are "trapped". In this latter case, residents would presumably be dissatisfied and wishing to leave, but unable to do so, perhaps for economic reasons or because the neighborhood is undesirable to potential in-movers (Gramlich, Laren, and Sealand 1992; Skogan 1990; South, Crowder, and Chavez 2005; South and Deane 1993). Note that this is a crude proxy for neighborhood satisfaction, but nonetheless

ties in with the residential mobility literature demonstrating the relationship between neighborhood satisfaction and mobility, even when controlling for the many other determinants of household mobility (Clark and Ledwith 2006; Deane 1990; Lu 1999) The implication is that these long-term residents may be important for enhancing informal social control capability in the neighborhood if they are satisfied with the neighborhood. These mechanisms are particularly important when considering the demographic processes examined here: homeownership, age, and race/ethnicity.

First, homeowners typically remain in a neighborhood for a longer period of time (Dietz and Haurin 2003; Rohe and Stegman 1994), and are also more committed to the neighborhood in ways that promote informal social control through greater social and political engagement (McCabe 2013; Rohe and Stegman 1994). However, if owners are more likely to exit a neighborhood, this may reduce cohesion in a neighborhood. Renters may also play an important role. If more renters as opposed to home owners move into the neighborhood this might impact the degree to which informal social control can be established, particularly in disadvantaged neighborhoods (Warner 2014). Renters are more transitory and often of lower socioeconomic status than owner-occupiers, which increases neighborhood turnover, heterogeneity, and social distance (Hipp 2010), all of which have implications for neighborhood crime (Jr, Goldstein, and Frey 1975; Rohe, Zandt, and McCarthy 2002). However, renters can also exhibit stability (McHugh, Gober, and Reid 1990), and this may be beneficial to neighborhood processes of social control, particularly in neighborhoods where a significant portion of the housing stock is renter-occupied. That is, renters tend to uniformly exhibit more mobility, so the gain in stability in a neighborhood from renters who do not leave may be particularly important, especially from long-term renters.

Second, even neighborhoods that exhibit high levels of stability can experience change, and this is especially relevant when considering age. Residents who do not move will nonetheless shift age bins: those in the 20-30 year old bin at the beginning of the decade will be in the 30-40 year old bin at the end of the decade.[1] A shift in the age pyramid of a neighborhood is also likely consequential for neighborhood crime (Laub and Sampson 1993). For example, middle aged households are the least likely to move (La Gory and Pipkin 1981; Richards, White, and Tsui 1987), and this may be an important group given that middle aged residents with families arguably have the ability to be the most engaged in the neighborhood, and therefore provide the most informal social control. In contrast, neighborhoods in which this group is more mobile may have less cohesion and thus higher levels of crime.

Another potentially important age group is adolescents and young adults, as evidence from the age/crime curve shows that they are the most crime-prone (Laub and Sampson 1993). A neighborhood with an increasing youthful population may experience increasing rates of crime, since young males are more likely to engage in crime and be victims of crime (Sampson and Groves 1989; Sampson and Raudenbush 1999). However, this crime involvement tendency may differ depending on how engaged members of this age group are with mainstream institutions (McCall et al. 2013). Most individuals between the ages of 18 to 25 transition out of a neighborhood due to college enrollment, and/or enter the labor force; neighborhoods in which this group is particularly *mobile* may therefore have lower levels of crime. In contrast, neighborhoods in which members of this age group do not make this transition are more likely to remain in the neighborhood but lack institutional engagement. The lack of prosocial bonds may translate to deleterious outcomes for a neighborhood, including crime (McCall et al. 2013).

[1] We will discuss this issue in more depth in the methods section when we describe how we construct our flow measures.

The third sociodemographic characteristic we focus on is the race/ethnicity of residents who are disproportionately likely to exit or enter a neighborhood. This builds on the racial segregation and gentrification literatures. First, most urban areas are residentially segregated along racial-ethnic lines, thus creating distinct spaces within a city that are designated as "White" or "Black" areas (Krivo, Peterson, and Kuhl 2009; Ousey and Lee 2008). The spatial concentration of race limits the mobility patterns of individuals, since individuals tend to select into neighborhoods that are reflective of their own race (Sampson and Sharkey 2008). Further, minorities are more likely to experience racial discrimination in housing access, and may be steered away from units located in areas that are distinctly White (Fischer and Massey 2004; Turner and Mikelsons 1992). Relatedly, the mobility literature has found that racial minorities are often less likely to exit neighborhoods, which may be evidence of these constrained options. Since minority neighborhoods typically have fewer resources, higher levels of disadvantage, and residential turnover, they are also more vulnerable to crime (Peterson and Krivo 2009). Thus, mobility options for minorities are more restricted, and those that are available may be more proximate to crime prone areas. This suggests that racial stability likely perpetuates neighborhood crime trends.

Furthermore, when racial ethnic transition occurs, this may be due to the processes of gentrification. If gentrification initiates racial transition, this might trigger other social consequences, such as higher crime due to increases in social distance, relative deprivation, and decreases in informal social control (Blau and Blau 1982; Boggess and Hipp 2016; Chamberlain and Hipp 2015). Additionally, displaced residents must relocate, and minority residents are often pushed into less desirable neighborhoods. This suggests that neighborhoods that are the

recipients of displaced residents also experience instability and may experience increases in crime, at least in the short term.

Who moves, who stays? Introducing a demographic accounting framework

To understand how our demographic accounting approach provides unique information not captured in traditional net change measures, Table 1 shows the counts and constructed measures for five hypothetical neighborhoods of 100 persons each based on the technique we will use in this study. For simplicity, we assume that there are equal numbers of group A and group B members in the population in the entire region in this example. In this table, row 1 contains the number of persons in the neighborhood at time 1 who were not there at time 2, row 2 contains the number of persons in the neighborhood at both time points, and row 3 contains the number of persons in the neighborhood at time 2 who were not present at time 1. Each of these hypothetical neighborhoods were composed of 40 members of group A and 60 members of group B at time 1, and then 30 members of group A and 70 members of group B at time 2. Thus, a standard approach would conclude that there was a 10-percentage point increase in the composition of group B in the neighborhood over this period. However, this masks different types of change.

<<<Table 1 about here>>>

In this table, there are five forms of neighborhood change for these five hypothetical neighborhoods: 1) only households of group A exit, and only households of group B enter; 2) only households of group A exit, but households of group A and group B enter in equal numbers; 3) households of group A and group B exit in equal numbers, but only households of group B enter; 4) households of group A and group B are equally likely to exit (exit in proportion to their numbers at time one), but households of group B are disproportionately likely to enter; 5)

households of group A and group B are equally likely to enter (enter in proportion to their numbers at time one), but households of group B are disproportionately likely to exit. Note that in this table, rows 1 and 2 always sum to 40 for group A and to 60 for group B to capture the number of residents at time 1 for each of these groups. Likewise, rows 2 and 3 always sum to 30 for group A and 70 for group B to capture the number of residents at time 2 for each of these groups. We can then compute various measures of interest based on this demographic accounting framework: in row 4 we compute the percent of persons at time 1 who were still present at time 2, and in row 5 we compute the percent of persons at time 2 who had moved in since time 1.

For the measure of the percentage of residents for a particular group that stayed in the neighborhood (row 4), the largest gaps between groups A and B occur in neighborhood 2 (100% versus 50% for groups A and B) and neighborhood 5 (67% and 25% for groups A and B). The narrowest gap is neighborhood 4, where the values are 50% for each group (as this neighborhood assumed equal probability of leaving). In neighborhood 5, group A appears very dissatisfied and group B appears somewhat dissatisfied, which implies negative consequences for the cohesion of the neighborhood, and may result in more crime at subsequent time points. Likewise, in neighborhood 4 both groups A and B appear dissatisfied. In contrast, in neighborhood 3 both groups A and B appear relatively satisfied, implying that this neighborhood would have more cohesion and less crime in the future. In neighborhood 2, group A appears dissatisfied whereas group B appears trapped (and therefore likely dissatisfied); this implies low cohesion and hence more crime in the future. In neighborhood 1, group A appears satisfied whereas group B is either satisfied or, more likely, trapped. The predictions for this neighborhood are least clear: if indeed group B is trapped and therefore dissatisfied, this could imply a large split in the neighborhood

social network based on group membership (Hipp 2010). This suggests more cohesion within group A, but less cohesion overall (especially across groups) and therefore more crime.

If we hypothesize that the composition of those entering a neighborhood is important, we can compute the percentage of group members who entered the neighborhood in this period. There are considerable differences across these neighborhoods (row 5): whereas the percentage of newcomers by group is higher for group B in neighborhoods 2 and 5 (33% versus 14%, and 67% versus 43%), it is lower for group B in neighborhoods 1, 3, and 4 (0% versus 14%, 0% versus 29%, and 33% versus 57%). In neighborhoods 1 and 3, it appears that group A very much finds this neighborhood undesirable (as none are moving in). In this situation, stayers appear satisfied but outsiders of group A are not interested in the neighborhood. In neighborhoods 4 and 5, both groups are moving in, even though both groups have dissatisfied members among the stayers. This suggests an undesirable neighborhood to these newcomers, and implies negative consequences for neighborhood cohesion. Finally, in neighborhood 2 group A members are particularly likely to be moving in, but the group A members who are stayers in the neighborhood are dissatisfied. This suggests that there will be dissatisfaction among group A members in general, and likely will cause a schism in the neighborhood network structure, which would likely reduce cohesion.

Taking the insights from the demographic accounting approach outlined above, we will construct flow measures over a decade for three neighborhood sociodemographic processes: age, race/ethnicity, and owner/renter status. This will enable an assessment of how the movements of different groups in and out of neighborhoods, as well as the dynamics of groups remaining in a neighborhood, might have differential effects on changes in crime. In doing so, we highlight the

importance of capturing the nuance behind neighborhood change that has been previously concealed by examining change in the aggregate.

Data and Methods

Setting

Our study site and time period is the southern California region in the first two decades of the 21st century. Southern California is notable in that it is an economically vibrant region that has exhibited growing population over this time period, in contrast to more stagnant regions. Furthermore, it is a region with considerable racial/ethnic heterogeneity across the region, along with notable levels of segregation. An important consideration for the time period under study is that it includes the housing crash of the late 2000s, and therefore we also include the decade of the 2010s to avoid focusing on this one possibly anomalous decade. The region has also experienced considerable gentrification in the areas near downtown Los Angeles. All of these patterns make this an interesting area for studying neighborhood change, and the potential consequences for changing crime levels. We next turn to a description of our data.

Data

The present study utilizes crime data for 3,325 census tracts in the Southern California region in the years 2000, 2010, and 2017. An advantage of using census tracts is that past studies have frequently used them to proxy for neighborhoods, they contain a mean of about 4,300 residents in 2000 (with 95% of the tracts containing between about 1,400 and 8,000 persons), and they were initially constructed by the Census Bureau to be relatively homogeneous neighborhoods (Green and Truesdell 1937; Lander 1954). We need to use this geographic unit given that the aggregated Census data we use for our demographic accounting strategy is not

available at smaller units (such as block groups). We used U.S. Census data from 2000, and American Community Survey (ACS) 5-year estimates for 2008-12 and 2015-19. To be in the sample, a tract needed to have crime data either in 2000 and 2010, or 2010 and 2017. The sample size is 3,325 tracts based on 2000 boundaries, with 4,564 total observations for tracts that had crime data at two consecutive time points. By using such a large sample size, we minimize the possibility of obtaining idiosyncratic findings due to the peculiarities of a single city. By using data over two decades, we also hope to smooth out idiosyncratic effects that might be detected when looking at change within a single decade. We will return to this general issue in the Discussion section.

Dependent Variables

The dependent variables in the analyses are the changes in crime rates based on official crime incidents as reported to and coded by the police agencies in the region, aggregated to census tracts. The data are computed as three-year averages at each time point to smooth random fluctuations over years: 2000-2002 for the first time point, 2009-11 for the second time point, and 2015-17 for the last time point (since this was the last year we had crime data for many of the tracts). We estimated models using crime incidents aggregated to violent crime (aggravated assault, homicide, and robbery) and property crime (burglary, motor vehicle theft, and larceny). We created crime rates per 10,000 population at each time point, log transformed these measures, and then computed the difference between the two adjacent time points. By taking the difference in two logged measures, we are effectively capturing the percentage change in crime as the outcome variable.

Independent demographic flow variables

We constructed variables capturing who is moving in, who is staying, and who is moving out based on our approach to computing demographic flow variables for each of our three groups: race structure, owner/renter structure, and age structure. This strategy provides us estimates of the composition of households who stayed in the neighborhood over the 10-year period, those who left the neighborhood, and those who entered the neighborhood.

To measure *racial/ethnic group* change, we computed the proportion of each racial/ethnic group who left the tract over the previous ten years. Summing the cells for rows 1 and 2 in Table 1 yield the number of persons living in the tract at the first time point. For neighborhood 1, the sum of cells 1a and 2a (10+30) yields the number of group A residents at the first time point. Similarly, summing the cells for rows 2 and 3 yields the number of persons living in the tract at the second time point, and therefore the sum of cells 2a and 3a (30+0) is the number of group A residents at time two. We can construct the values in Table 1 based on Census variables with the length of residence in each neighborhood by racial/ethnic group at the second time point (which gives us the values for cells 2a, 2b, 3a, and 3b for neighborhood 1). The racial/ethnic composition of the tract at the first time point allows us to compute the values of cells 1a and 1b given that we know the values of cells 2a and 2b, and we know that, for instance, cells 1a and 2a must sum to the number of White persons in the neighborhood at the first time point. For example, if we know at time 2 that there are 30 group A residents in neighborhood 1, and they all entered the neighborhood in the last 10 years, then we enter values of 30 and 0 in cells 3a and 2a, respectively; and if there were 40 group A residents in the neighborhood at time 1, then since 30 of these are in cell 2A, we know that 10 must be in cell 1A.

Note the information that this table provides for us. Row 3 is of particular interest, as it allows us to compute the proportion of in-movers from this racial/ethnic group (based on rows 2

and 3). Row 1 allows us to compute the proportion of those moving out who are from this group. We combine the information from rows 1 and 2 to compute the proportion moving out by group. We also constructed measures that capture the percent of residents who left the neighborhood who were part of each racial/ethnic group.

Additionally, to capture the *owner/renter structure*, we created a measure of residential stability based on the tenure and length of residence of residents. For homeowners, we computed the proportion of residents who left the neighborhood during the decade who have lived: 1) 0 to 10 years in the neighborhood; 2) 10 to 20 years in the neighborhood; and 3) 20 or more years in the neighborhood. We created similar measures for renters.

Using mobility model parameter estimates

To estimate the change in *age characteristics* of residents in the neighborhood required getting an estimate of mobility since we cannot compute them using the accounting framework just described. In this case, we have information from the Census that gives totals at time one (rows 1 and 2 of Table 1) and time two (rows 2 and 3 of Table 1). We use our mobility model information to create an estimate of mobility at time one, which allows us to disaggregate persons at time one into rows 1 and 2. These values in row 2 then allow us to disaggregate the number of residents at time two into rows 2 and 3. Prior research consistently shows that certain types of households are less likely to leave a neighborhood, such as owners, older residents, those with longer residence, and those with children aged 6-18 (Boehm, Herzog, and Schlottmann 1991; Crowder 2001; Deane 1990; Hipp 2019; Landale and Guest 1985; Lee, Oropesa, and Kanan 1994; Richmond 2003; South and Crowder 1998). To obtain estimates of mobility for different demographic characteristics, we used the American Housing Survey (AHS) for the years 1984-2009. We computed the percent moving within 8 years (the AHS is typically

conducted every 4 years) to approximate the 10-year period of the Census based on the age of household head categorized into the bins that match the Census. For those we estimate to not leave, we add ten years to their previous age to obtain their current age. This gives us an estimate of the current age structure, and we subtract these values from the time 2 age structure values to get an estimate of the age structure of those moving into the neighborhood.[2]

Control variables

To minimize the possibility of spurious results, we included several other potentially important covariates. We construct difference variables of the standard measures used in ecological studies of crime by subtracting the measure at time 1 from time 2, and at time 2 from time 3. Thus, we create a measure of the *change in the average income of households* in the tract. We measure *residential instability* based on the change in the average length of residence. To capture criminal opportunities, we compute the *change in population density* and the *change in proportion vacant units*. Given that neighborhoods with higher populations of young adults experience higher rates of crime (Sampson and Groves 1989), we compute the *change in the proportion aged 16 to 29* to capture potential offenders, which allows us to control for this effect when viewing our demographic flow measures of disproportionate likelihood of this age group either entering or leaving the neighborhood. To capture the possible effect of *inequality* on crime rates, we computed the change in the Gini coefficient for household income in the tract. We create measures of the *change in the percentage Blacks* and *percentage Latinos*. To account for the effect of racial/ethnic mixing on crime, we constructed a measure of change in the

[2] Note that a limitation of our approach is that we only have *estimates* of the number of movers: in instances in which there are many members of a group at time 2 our approach will assume there is disproportionate high in-movement of this group; an alternative possibility that we cannot rule out is that there is disproportionate low out-movement of this group. In either instance, our technique will yield information on groups that are disproportionately present in the neighborhood. Note also that whereas we can measure the percent aged 5 to 14 who entered, we cannot assess who entered the neighborhood in the last 10 years who are less than 10 years of age. Therefore the minimum age category of those entering is 10 to 14.

racial/ethnic heterogeneity in the tract by using a Herfindahl index (Gibbs and Martin 1962: 670) of five racial/ethnic groupings (White, Black, Latino, Asian, and other races) that is a sum of squares of group proportions at each time point and computed the difference. We computed the *change in percentage immigrants*.

Spatial effects

Given that these data come from tracts located in physical space, we accounted for the possibility that the structural characteristics of one neighborhood may affect nearby neighborhoods. We follow the suggestion of Elffers (2003) and Anselin (2003: 161), among others, in specifying a model testing whether spatially-lagged versions of our structural measures impact neighborhood crime (Elffers 2003; Krivo, Peterson, and Kuhl 2009; Morenoff 2003). We used an inverse distance decay function with a cutoff at five miles (beyond which the neighborhoods have a value of zero in the W matrix) in measuring the distance of surrounding neighborhoods from the focal neighborhood. This weight matrix (W) was then row-standardized and multiplied by the exogenous control variables to create spatially lagged versions of them.[3]

Methods

The models examine the change in crime during two time periods: 2000-2010 and 2010-17. We estimate random effects models that include our demographic flow variables, which can be represented as:

$$(1) \qquad \Delta y_{ijt} = \Gamma_1 \Delta X_{ij} + \Omega W \Delta X_{ij} + \Gamma_2 Z_{ij} + e_{ij}$$

where Δy_{ijt} is the change in the crime rate between the two time points, ΔX_{ij} includes the typical demographic change variables, $W\Delta X_{ij}$ contains the spatial lag versions of these demographic change variables, Z_{ij} includes our demographic flow variables, and e_{ij} is a random error term with

[3] We do not include a spatially lagged inequality measure since it has less conceptual relevance compared to the neighborhood measure.

an assumed normal distribution, and a mean of zero. These models account for the nesting of the data across the two time periods.

We first estimate models for violent and property crime that include just the control variables and the spatial lags, as a baseline against which to compare our demographic flow measures. We then estimate models that include our demographic flow measures based on these three different categories. Finally, we test for nonlinear effects of our demographic flow variables by constructing and including quadratic versions of the variables. The final model results provide the best model fit, and since the findings in the first two models are relatively consistent with those in the final model, we present *only* the results of the final models. For parsimony, we include only statistically significant quadratic parameters.

Results

We begin with the summary statistics for the variables used in the analyses, presented in Table 2. First, looking at the age-structure variables, younger residents were more likely to both enter and leave a neighborhood relative to older residents. Residents between 10 and 14 were most likely to enter a neighborhood during the decade, whereas older residents 60 and up were the least likely to enter. The age structure among residents leaving a neighborhood was relatively similar on average, though residents between 15 and 29 were the most likely to leave, and those between 30 and 59 were the least likely to leave. Second, mobility distinctions across race were modest. Whites were less likely to enter a neighborhood compared to non-Whites. In contrast, Latinos were most likely to leave a neighborhood relative to other racial groups. This may reflect the churning of immigrants in ethnic enclaves (Boggess and Hipp 2010; Shihadeh and Barranco 2010). Third, there are important differences in mobility between long- and short-term owners and renters. Whereas short-term renters (0-10 years) are the most likely to leave a neighborhood,

the most mobile group among owners was short-term residents—those who had lived in the neighborhood less than 10 years.

<<<Table 2 about here>>>

We next describe how our demographic flow measures greatly improve the model fit of our two models for violent and property crime. We first tested a baseline model including only the controls and the spatial lags (results not shown). The R-squares for the baseline models are 0.057 and 0.051 respectively for violent and property crime. Next, we added to the baseline model the linear versions of our demographic flow measures (results not shown), and the overall explanatory power of our model improved, with R-squares of 0.093 and 0.095 for violent and property crime, respectively. Finally, we estimate a third model, including the baseline, demographic flow measures, and quadratic versions of the flow measures, when significant (Table 3). In this model, the variance explained doubles for violent crime (0.112), and increases 140% for property crime (0.122) compared to the baseline model. Thus, our demographic flow measures are clearly capturing important information for understanding how crime changes in neighborhoods over the decade. We next describe which of the demographic flow measures are particularly important for explaining changes in crime.

<<<Table 3 about here>>>

Changing age-structure and crime

The measures capturing the age composition of who enters or leaves the neighborhood demonstrate that the age group of those 15 to 29 impacts crime levels. Although studies often include this measure—either in static form in cross-sectional models, or as a net change measure in longitudinal models (and indeed we control for this net change measure here)—we see that these flow measures are important for explaining changes in crime. In fact, it appears that it is

stability in this age group that results in increasing crime levels: for the proportion of aged 15 to 29 who left the neighborhood, the positive main effect along with the negative quadratic effect implies an accelerating negative relationship with violent and property crime when we plotted it (not shown). Furthermore, when accounting for our demographic flow measures, the measure capturing the net change in percent aged 16 to 29 does not have a significant effect in the models.

Consistent with our earlier discussion, it appears that the largest increases in violent and property crime occur in neighborhoods in which middle-aged residents (aged 30 to 59) are either stuck or fleeing. The nonlinear pattern results in a U-shaped relationship between entering middle aged residents and crime. This pattern is plotted in Figure 1a, and shows that the largest increases in violent crime occur in neighborhoods in which either a very small or a very large proportion of middle-aged residents are new (the left and right sides of this graph), but especially when many are new. Instead, the smallest increases in crime occur in neighborhoods in which a moderate proportion of middle-aged residents are new to the neighborhood. This finding is consistent with our earlier discussion that a moderate amount of residential mobility may indicate a well-functioning neighborhood. In contrast, if there is very little or very high mobility—particularly for this age group—that may be indicative of a neighborhood in which residents are not satisfied with the neighborhood, and therefore have less cohesion and informal social control. We also see that a greater percentage of these middle-aged residents leaving a neighborhood is associated with falling property crime ($\beta = -.607$). Finally, a greater proportion of older residents (60 and over) who have entered the neighborhood are associated with increasing violent and property crime.

<<<Figure 1 about here>>>

Changing race structure and crime

Turning to the racial/ethnic flow measures, we detect interesting differences in how movement patterns impact crime, with important distinctions across race/ethnicity. Among those entering a neighborhood, Latinos and Whites are distinct from the other groups. There is a slowing positive relationship between the proportion Latino who are new and changes in violent crime (not shown). This may indicate that this group is more likely to be pushed into undesirable neighborhoods. Similarly, a neighborhood in which a low proportion of White residents are new will have larger crime increases. As the proportion Whites who enter increases, crime rates fall (particularly violent crime, (β = -.705)). This may capture a gentrification effect.

As we mentioned in the Data section, there are at least two different ways to construct flow measures for who is more likely to leave the neighborhood. First, similar to the measures for flows in age composition, we constructed measures of the proportion of each racial/ethnic group that left during the decade. Second, we constructed measures of the proportion of all residents who leave the neighborhood who are members of different racial/ethnic groups. For these measures, the denominator is the total number of residents who left, and the numerator is the number of residents who left for each of the racial/ethnic groups. Given that which groups are leaving a neighborhood is important for capturing racial/ethnic change in a neighborhood, we preferred using these particular measures. Indeed, this second set of measures exhibited more robust effects, so we display these measures here (we excluded the proportion of those who left who are White, as this would be perfectly collinear with the other three measures).

We find nonlinear effects for the proportion of residents who left by racial/ethnic group. There is a slowing negative relationship between the percentage of Asians leaving a neighborhood and both violent and property crime, as shown in Figure 1b. There is a similar

pattern for Black leavers (not shown). Similar to the result for crime falling when more Whites enter neighborhoods, this may capture gentrification. Even more striking is the strong nonlinear relationship between Latinos leaving a neighborhood and changes in violent and property crime. As shown in Figure 1c, there is little evidence of increasing crime for neighborhoods in which Latinos are either a very low or very high percentage of residents leaving the neighborhood (the left and right sides of this graph). Instead, violent and property crime increase the most in neighborhoods in which Latinos are a moderate proportion of the residents who are leaving. We did not anticipate this finding, but one possibility is that a neighborhood with very few Latinos leaving is an ethnic enclave, and therefore the level of cohesion in such neighborhoods results in lower crime, whereas a neighborhood in which many Latinos are leaving is undergoing gentrification, which may result in short-term decreases in crime. Note that the effects of the *net* change in percent Black are non-significant.

Changing owner/renter structure and crime

Finally, we assess the impact of changes in homeownership and length of residence in a neighborhood on crime. We find that the exiting of short-term owners appears important for changes in crime. There is an inverted-U relationship for neighborhoods in which a higher proportion of short-term owners (less than 10 years) left the neighborhood, as property crime increased the most when a moderate proportion of these short-term owners exited (not shown). Instead, the largest property crime decreases occurred when either very few, or very many, of these short-term owners exit the neighborhood. In contrast, there is some evidence that a greater proportion of short-term and long-term renters who leave is associated with changing crime rates, but in very different ways. On the one hand, there is an accelerating negative relationship between the proportion of short-term (less than 10 years) renters who leave and changes in

crime, especially violent crime (not shown). There is also a linear negative relationship between a greater proportion of mid-term renters leaving (10-20 years) and violent crime ($\beta = -.306$). In these cases, low mobility by short-term renters may be evidence of "trapped" households, and explain the larger crime increases. On the other hand, there is an accelerating *positive* relationship between the proportion of long-term (20 or more years) renters who leave and changes in violent crime. Given that renters tend to be more mobile in general, the rarity of these long-term renters may indicate that their leaving a neighborhood is a particularly bad sign for collective efficacy, and therefore results in these increasing violent crime rates.

We note that these effects we observe are in addition to the control variables in the models. There were generally weaker effects for the control variables. We find that increasing percent Latino and racial/ethnic heterogeneity is associated with falling crime levels. And whereas increasing household income and residential stability are associated with falling property crime levels, increasing inequality is associated with falling violent crime rates. Several of the spatial lag variables show significant effects, also highlighting that our results are detected even when accounting for these spatial effects. For example, increasing household income, percent immigrants, residential stability, racial/ethnic heterogeneity, and population density in nearby areas are associated with falling crime levels.

Ancillary analyses

Given that our models pooled two decades of data (2000-10 and 2010-17), a question is whether the results are robust over these two time periods. To assess this, we estimated ancillary models that created an indicator variable for the second decade and included interactions between this measure and all variables in the models. In general, the results were robust over the two decades, although there was some evidence of differences among both our flow and control

variables. Among our flow measures, the only difference among the age structure measures was that the effect of the variable capturing the proportion aged 30-59 who entered the neighborhood is even stronger in the second decade for the property crime models (there were no differences in the violent crime models). Among the measures capturing the flows of owners and renters, there were only differences in the violent crime models. These differences involved the effects for short-term, mid-term, and long-term renters who left and are only present in the first decade. The most notable differences are for the flow measures capturing the race of residents who enter or leave, as nearly all of these measures exhibited stronger relationships in the first decade.

It is worth highlighting that there were a number of differences over the two decades for the control variables: 3 of the 10 tract-level control variables were different across the two decades in the violent crime models, and 2 of the 10 for the property crime models.[4] Among the spatial lag measures, 7 of the 9 were different across the two decades for the violent crime model, and 5 of the 9 were different for the property crime model.[5] Thus, there is less consistency across the two decades for these common criminological measures than one might otherwise presume. Across these two specific decades, the housing crisis at the end of the 2000s may well have impacted the mobility patterns of different groups, which may have implications for which differences were observed. More generally, these results highlight the need for future longitudinal research to account for the context of the specific decade in which such change occurs, and the need for accompanying theoretical development potentially explaining such differences. This is an interesting question, but outside the scope of the current study.

[4] These were racial/ethnic heterogeneity, inequality, and residential stability in the violent crime model, and percent Latino and racial/ethnic heterogeneity in the property crime model.
[5] These were all but average income and residential stability in the violent crime model, and all but percent Latino, percent aged 16-29, population density, and residential stability in the property crime model.

Discussion and Conclusion

This study has introduced a new technique for assessing neighborhood change: demographic flow measures. These measures decompose the typical measures of net change that are used in longitudinal criminological research, and instead assess which types of residents are likely to leave the neighborhood or stay, and which types of residents are likely to enter the neighborhood. Our results demonstrated that these flow measures are empirically justified, as they provided dramatic improvements in model fit compared to a model with standard net change measures. These demographic flow measures provide a conceptually distinct way to think about neighborhood change, and therefore should spark further theoretical innovation. Importantly, our flow measures provided more definitive explanations regarding the change in crime when compared to the net changes in sociodemographic characteristics. Clearly, capturing the demographic flows of specific groups in and out of neighborhoods is important, and unmasks notable differences for crime that are typically hidden when these measures are examined as net change. We next highlight the key findings from our results.

First, whereas existing research has explored whether the presence of those in the highest crime risk ages (15 to 29) impact the amount of crime in neighborhoods—with generally mixed results (McCall et al. 2013)—we found that an important previously unexplored feature is whether these persons are entering or leaving the neighborhood. In neighborhoods in which this age group exhibits relatively high mobility out of the neighborhood, crime rates tend to fall much more. The implication is that neighborhoods in which those in this age group are not very mobile experience much higher increases in both violent and property crime. One possibility is that this is capturing what McCall and colleagues (McCall et al. 2013) referred to as differential

institutional involvement. Disengaged youth are more vulnerable to engaging in crime, in part, due to the inability of the community to effectively direct them into normative adult lifestyles.

A second important finding was the nonlinear relationship between the middle-aged group (aged 30 to 64) entering a neighborhood and changes in crime, which appears to be most likely linked to informal social control capability in these neighborhoods. Higher levels of mobility will have negative consequences for crime in neighborhoods vis-à-vis the informal social control capability posited by systemic theory (Bursik and Grasmick 1993). Our results showed that this age group is particularly important, as it presumably captures residents who are best able to provide such informal social control. When a higher proportion of middle-aged residents enter a neighborhood, cohesion and informal social control are less well developed, resulting in larger increases in crime. Furthermore, the idea that very low levels of mobility may have negative consequences has only occasionally been suggested: the ideas of being trapped in a neighborhood has been posited by various scholars (Gramlich, Laren, and Sealand 1992; South, Crowder, and Chavez 2005; South and Deane 1993). Our evidence here suggests that when these middle-aged residents are particularly unlikely to enter a neighborhood there are negative consequences for crime in those neighborhoods. This lack of mobility does not appear to be an indicator of greater cohesion, but rather a "trapped" phenomenon.

A third key pattern was the findings for our flow measures capturing residents based on racial/ethnic groups. Neighborhoods in which a *smaller* proportion of Latinos and *larger* proportion of Whites enter experienced larger crime drops. Note that this is not just saying that neighborhoods that Whites enter experience falling crime, as the comparison is to neighborhoods where Whites were present before the decade. Instead, it is something about neighborhoods in which Whites are entering, as opposed to neighborhoods where Whites are remaining present,

that results in crime drops. When Whites relocate to a new neighborhood, they typically move to communities with a higher socioeconomic status (South and Crowder 1998); residents in these neighborhoods have greater economic, social, and political resources to reduce the overall vulnerability of the neighborhood (Logan and Molotch 1987). The addition of more White residents in these neighborhoods appears to contribute to continued declines in violent and property crime, although the additive benefit for property crime tapers off once the percentage Whites entering approaches 60 percent.

When focusing on which racial groups are leaving a neighborhood, there were notable differences. As the proportion leaving who are Black or Asian (instead of White) increases, crime rates fall during the decade. This may reflect neighborhood gentrification, where minority groups are being pushed out of neighborhoods (Freeman 2005; Glass 1964); improving housing conditions attract more affluent buyers who may be more invested in the neighborhood and more willing to develop social ties with other residents (McCabe 2013; Rohe and Stegman 1994). Alternatively, this indicates that as the percentage White leaves a neighborhood, crime rates increase. Particularly notable was the pattern for Latinos, in which it appears that the best scenario for a neighborhood is when either nearly none of the residents exiting are Latino, or when nearly all of the exiting residents are Latino, as these neighborhoods experienced the largest drops in crime. Neighborhood enclaves of predominantly Latinos and foreign-born residents have a distinct culture and are characterized by strong family and social bonds that serve as protective factors for neighborhoods (Feldmeyer 2009; Shihadeh and Barranco 2010). These benefits may be maximized in neighborhoods that have only moderate out-migration among Latinos. But, when these neighborhoods begin to lose Latino population, they may be unable to fully reap the benefits of a close-knit culture, resulting in an increase in crime.

We found evidence that the mobility of owners or renters from the neighborhood impacted crime. Although mobility and owner-renter status are often combined into a measure of residential instability (Boggess and Hipp 2010; Sampson and Groves 1989), our results indicated that the likelihood of residential mobility by owners or renters based on length of residence had important consequences. Among homeowners, it appeared that greater mobility by those who have not lived long in the neighborhood had particularly negative consequences. This could be evidence that these new homeowners detect problems in the neighborhood that reduce their willingness to stay. Given that owners typically exhibit relatively low mobility, exits by this group may be a particularly problematic sign. Likewise, renters tend to be much more mobile, so it may be that long-term renters choosing to leave the neighborhood is particularly problematic. Indeed, this is what we found. Long-term residency, regardless of its form (renter or owner), enhances the informal social control capability of a neighborhood, so the exit of long-term renters would have a particularly strong negative impact on cohesion. Conversely, low mobility by short-term renters may be evidence of "trapped" households, and explain why we observed greater crime increases in these neighborhoods. These considerations are clearly speculative, but highlight that our approach using flow measures has the potential to provide new insights to criminologists regarding neighborhood change patterns.

We acknowledge some limitations to this study. First, although we utilized longitudinal models, we do not make causal claims about our analyses. The fact that these flow measures are capturing neighborhood changes over the same time period as the changes in crime highlights that we cannot be certain of the causal direction for the effects. A challenge is that these flow measures are too new, and the mechanisms too uncertain, to identify plausible instruments to tease apart the causal direction. Our goal here was simply to illustrate the key insights that can

be obtained from this technique, and future research will need to address this potential endogeneity in an effort to make causal claims. Relatedly, we did not measure the mechanisms, so we cannot be sure *why* a disproportionate influx of a group, or exit, impacts crime levels. Likewise, we do not know for certain whether higher levels of mobility represent dissatisfaction with the neighborhood. We hypothesized that this is due to informal social control capability, but future work would need to explicitly test this. Second, we limited our analysis to these three socio-demographic dimensions as a scope condition, but future research will want to consider other possible socio-demographic dimensions for constructing flow measures that may be theoretically important for explaining changes in crime. As a related point, measuring some other sociodemographic dimensions may be challenging given that what is needed are 2x2 tables of demographic measures for the demographic accounting approach, but the Census often only provides the column or row margins.[6] In these cases, researchers would need to rely on the results of a mobility model for creating estimates of what percent of people left the neighborhood. Although access to a Census Data Center would provide more specific information about new households, the lack of longitudinal Census data indicates our demographic flow strategy would still be needed. As a consequence, future efforts to improve the mobility model, and in particular by combining such model improvements with bivariate (or trivariate) Census data tables will be needed. We leave these challenges to future work. We also note that, just as in nearly all other ecology of crime studies, we only have measures of *reported* crime and not measures of *actual* crime in these neighborhoods. However, we emphasize that Baumer (2002) showed that there is little evidence of systematic bias across neighborhoods in

[6] For example, the Census provides racial groups by length of residence as a cross-tabulation. However, if they only provided the marginal totals of racial groups—and not broken out by length of residence—this would inhibit our ability to use our demographic accounting technique. The same issue arises for any other measures that the Census does not break out into cross-tabulations by length of residence.

the reporting of the types of Part 1 crimes that we focus on here. Nonetheless, this potential limitation should be kept in mind.

Despite these limitations, we believe this study has demonstrated a new way for criminologists to think about neighborhood change. Moving beyond measures of net change, we have described a demographic accounting technique that allows creating measures of flows of residents, and demonstrated the technique based on flows of three different dimensions: age, race/ethnicity, and owner/renter status. Our results illustrated that this approach provides considerable insight in understanding how neighborhood demographic change is related to changes in violent or property crime over a decade. Additionally, this approach demonstrates the importance of capturing specific population flows and their effects on crime, rather than just net change, which may be misleading. By decomposing measures of the net change into more fine-grained measures capturing different types of change, we can better understand how these processes of neighborhood change impact trajectories of crime. Although we have proposed some theoretical reasoning for our measures that showed strong relationships with changes in crime based on social disorganization theory, we believe that this technique opens an exciting new direction for researchers not only empirically but also for theoretical innovation. Our hope is that new theoretical directions can come from this new way of thinking about the flows of residents into and out of neighborhoods.

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Tables and Figures

Table 1. Five hypothetical neighborhoods undergoing change for two sub-groups (A and B)

		Neigh 1		Neigh 2		Neigh 3		Neigh 4		Neigh 5	
		A	B	A	B	A	B	A	B	A	B
1)	Move out	10	0	20	0	10	10	20	30	30	20
2)	Stay	30	60	20	60	30	50	20	30	10	40
3)	Move in	0	10	10	10	0	20	10	40	20	30
	Constructed measures										
4)	Percent stayers by group	75	100	50	100	75	83	50	50	25	67
5)	Percent newcomers by group	0	14	33	14	0	29	33	57	67	43

Table 2. Summary statistics of variables used in analyses

	Mean	S.D.
Dependent variables		
Change in violent crime rate	-0.39	0.87
Change in property crime rate	-0.10	0.76
Age structure		
Proportion aged 10 to 14 who entered	0.53	0.23
Proportion aged 15 to 29 who entered	0.43	0.22
Proportion aged 30 to 59 who entered	0.45	0.11
Proportion aged 60 and up who entered	0.20	0.12
Proportion aged 5 to 14 who left	0.51	0.12
Proportion aged 15 to 29 who left	0.55	0.05
Proportion aged 30 to 59 who left	0.41	0.05
Proportion aged 60 and up who left	0.51	0.10
Race structure		
Proportion Black who entered	0.59	0.23
Proportion Latino who entered	0.45	0.13
Proportion Asian who entered	0.56	0.19
Proportion White who entered	0.40	0.17
Proportion who left who are Black	0.08	0.12
Proportion who left who are Latino	0.43	0.27
Proportion who left who are Asian	0.12	0.13
Proportion who left who are White	0.37	
Owner/renter structure		
Proportion 0-10 year owners who left	0.33	0.20
Proportion 10-20 year owners who left	0.19	0.18
Proportion 20 or more year owners who left	0.19	0.18
Proportion 0-10 year renters who left	0.43	0.11
Proportion 10-20 year renters who left	0.22	0.21
Proportion 20 or more year renters who left	0.24	0.28
Tract change measures		
Percent Black	-0.26	3.70
Percent Latino	1.25	6.80
Racial/ethnic heterogeneity	1.20	6.75
Percent immigrants	-0.52	5.67
Average household income	12	17
Percent occupied units	0.13	4.84
Average length of residence	5.74	4.91
Population density	0.2	1.9
Income inequality	-24.66	18.05
Percent aged 16 to 29	-0.66	4.57

Spatial lag measures		
Percent Black	-0.24	1.00
Percent Latino	1.02	2.64
Racial/ethnic heterogeneity	1.19	2.41
Percent immigrants	-0.62	1.78
Average household income	10	14
Percent occupied units	0.04	1.78
Average length of residence	8.62	1.05
Population density	0.3	0.6
Percent aged 16 to 29	-0.71	1.29
Note: N = 4,564 tract/years		

Table 3. Predicting change in logged crime rates in tracts from 2000-2010 and 2010-2017

	Violent crime			Property crime	
Demographic change measures					
Age structure					
Proportion aged 10 to 14 who entered	-0.014			0.015	
	-(0.20)			(0.26)	
Proportion aged 15 to 29 who entered	0.069			-0.100	
	(0.93)			-(1.55)	
Proportion aged 30 to 59 who entered	-2.240	**		-2.880	**
	-(3.67)			-(5.60)	
Proportion aged 30 to 59 who entered squared	3.277	**		4.047	**
	(5.09)			(7.45)	
Proportion aged 60 and up who entered	0.535	**		0.272	**
	(4.42)			(2.58)	
Proportion aged 5 to 14 who left	0.066			-0.104	
	(0.57)			-(1.04)	
Proportion aged 15 to 29 who left	2.464	†		1.843	
	(1.82)			(1.58)	
Proportion aged 15 to 29 who left squared	-2.540	*		-2.365	*
	-(2.22)			-(2.40)	
Proportion aged 30 to 59 who left	0.219			-0.607	*
	(0.72)			-(2.28)	
Proportion aged 60 and up who left	-0.173			-0.053	
	-(1.35)			-(0.48)	
Race structure					
Proportion Black who entered	0.063			0.098	
	(0.92)			(1.64)	
Proportion Latino who entered	1.768	**		0.186	
	(3.01)			(1.29)	
Proportion Latino who entered squared	-1.500	**			
	-(2.62)				
Proportion Asian who entered	0.079			0.028	
	(0.93)			(0.38)	
Proportion White who entered	-0.210	*		-0.705	*
	-(2.09)			-(2.56)	
Proportion White who entered squared				0.584	*
				(2.22)	
Percent who left who are black	-1.429	**		-1.617	**
	-(4.34)			-(5.61)	
Percent who left who are black squared	1.488	**		1.849	**
	(3.27)			(4.58)	

Percent who left who are Latino	1.011	**		1.166	**
	(3.96)			(5.27)	
Percent who left who are Latino squared	-1.125	**		-1.278	**
	-(4.47)			-(5.85)	
Percent who left who are Asian	-1.090	**		-1.424	**
	-(3.38)			-(5.06)	
Percent who left who are Asian squared	1.349	**		2.458	**
	(2.59)			(5.41)	
Owner/renter structure					
Proportion 0-10 year owners who left	-0.054			0.404	**
	-(0.80)			(2.66)	
Proportion 0-10 year owners who left squared				-0.498	*
				-(2.49)	
Proportion 10-20 year owners who left	-0.098			0.027	
	-(1.40)			(0.45)	
Proportion 20 or more year owners who left	0.052			-0.032	
	(0.67)			-(0.49)	
Proportion 0-10 year renters who left	1.967	**		0.609	†
	(4.94)			(1.77)	
Proportion 0-10 year renters who left squared	-2.845	**		-0.919	*
	-(5.66)			-(2.13)	
Proportion 10-20 year renters who left	-0.306	*		0.063	
	-(2.13)			(1.21)	
Proportion 20 or more year renters who left	-0.103	*		-0.006	
	-(2.31)			-(0.15)	
Proportion 20 or more year renters who left squared	0.569	**			
	(3.03)				
Tract measures					
Percent black	-0.004			-0.002	
	-(1.02)			-(0.51)	
Percent Latino	-0.006	**		-0.005	**
	-(2.68)			-(2.79)	
Racial/ethnic heterogeneity	-0.006	**		-0.004	*
	-(2.80)			-(2.40)	
Percent immigrants	-0.002			-0.002	
	-(0.81)			-(0.90)	
Average household income	0.001			-0.002	*
	(1.63)			-(2.21)	
Percent occupied units	0.003			0.002	
	(1.21)			(0.95)	
Average length of residence	0.007			-0.011	*
	(1.34)			-(2.40)	
Population density	-0.003			-0.006	
	-(0.41)			-(0.92)	

Income inequality	-0.003	*		-0.001	
	-(2.35)			-(1.02)	
Percent aged 16 to 29	0.003			0.002	
	(1.06)			(0.81)	
Spatial lag measures					
Percent black	-0.025			0.045	**
	-(1.60)			(3.33)	
Percent Latino	0.024	**		0.021	**
	(3.80)			(3.86)	
Racial/ethnic heterogeneity	-0.017	**		-0.028	**
	-(2.76)			-(5.29)	
Percent immigrants	-0.058	**		-0.022	**
	-(6.27)			-(2.69)	
Average household income	-0.002	†		-0.002	*
	-(1.84)			-(2.41)	
Percent occupied units	0.036	**		0.014	†
	(4.11)			(1.92)	
Average length of residence	-0.096	**		-0.028	*
	-(5.89)			-(1.99)	
Population density	-0.121	**		-0.071	**
	-(4.94)			-(3.32)	
Percent aged 16 to 29	-0.017			0.006	
	-(1.36)			(0.51)	
Intercept	-0.788	†		0.594	
	-(1.68)			(1.46)	
R-square	0.112			0.122	
Percent change from baseline model	96.5%			139.2%	
Baseline model r-square	0.057			0.051	

*** p < .01(two-tail test), * p < .05 (two-tail test), † p < .10 (two-tail test). T-values in parentheses. N=4,564 tract/years*

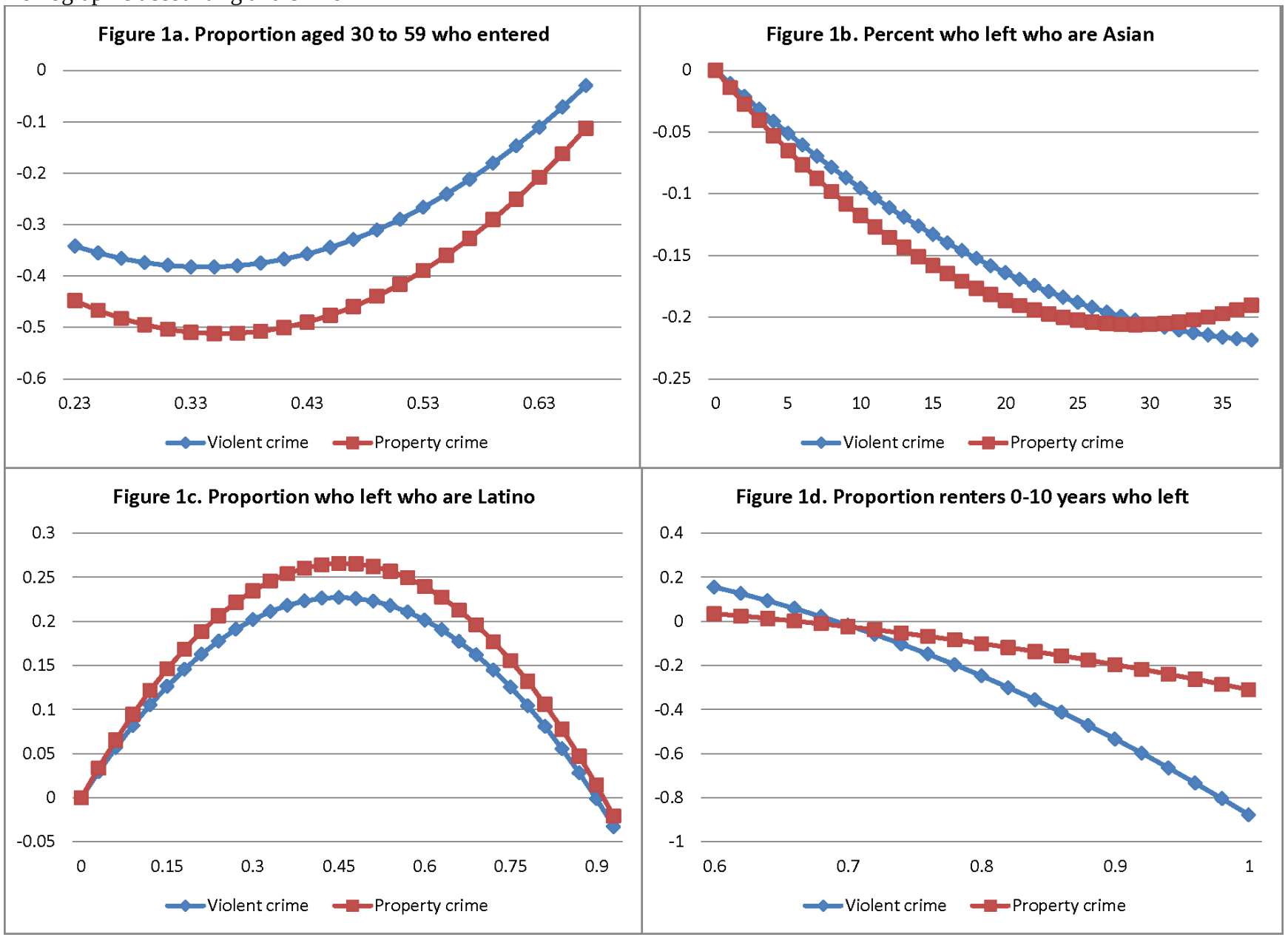
Figure 1a. Proportion aged 30 to 59 who entered
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
0.23
0.33
0.43
0.53
0.63
Violent crime
Property crime
Figure 1b. Percent who left who are Asian
0
-0.05
-0.1
-0.15
-0.2
-0.25
0
5
10
15
20
25
30
35
Violent crime
Property crime
Figure 1c. Proportion who left who are Latino
0.3
0.25
0.2
0.15
0.1
0.05
0
-0.05
0
0.15
0.3
0.45
0.6
0.75
0.9
Violent crime
Property crime
Figure 1d. Proportion renters 0-10 years who left
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
0.6
0.7
0.8
0.9
1
Violent crime
Property crime