Residential rentals and neighborhood crime

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Abstract

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Single-family homeowners have long fought the entry of residential rentals into their neighborhoods. One of their concerns is that rentals may raise the level of neighborhood crime. Evidence on whether rentals actually increase neighborhood crime is absent from the literature. In this paper we provide the first-ever evidence on the effects that different types of rentals have on neighborhood crime and on crime occurring on single-family owner-occupied properties. Our results are based on the estimation of Poisson control function models and the use of a 13-year panel of suburban neighborhoods from Miami-Dade County, Florida. Causality over correlation is buttressed by our inclusion of year and neighborhood fixed effects and controls for the possible endogeneity of the rental units. We find that while all types of rentals impact crime, single-family rentals located outside of the immediate neighborhood have comparatively large positive effects on neighborhood crime and on crime occurring on single-family properties.

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## 1. Introduction

Single-family (SF) homeowners have fought the entry of residential rental properties into their neighborhoods, primarily based on fears that rental units will lower property values. Extant evidence, while thin, suggests that these fears may be grounded in reality. Some studies have shown that having more SF owners and fewer SF renters within the neighborhood increases property values (Wang et al., 1991; Coulson et al.; 2002; Coulson and Li, 2013) while others have shown that values are higher in neighborhoods containing fewer multifamily properties (Moody and Nelson, 2007; Ihlanfeldt, 2019). However, the sources underlying these effects remain unknown. Some possibilities include negative sight externalities emitted by rentals due to their relative lack of maintenance compared to owner-occupied SF housing, concerns that rental buildings may have physical structures out of character with the rest of the neighborhood, and the possibility that rentals raise the level of neighborhood crime.[1] The purpose of this paper is to provide the first-ever evidence on the impacts that rentals have on neighborhood crime and on crime that occurs on owner-occupied SF properties within neighborhoods. The growth in rental units within America's urban neighborhoods, especially among SF rentals, adds to the salience of our research question.[2]

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[1] Buttressing maintenance and crime as possible pathways linking rentals to home values is evidence showing that rentals are under maintained (Galster, 1983; Shilling et al., 1991; Harding et al., 2000) and that home buyers value neighborhood safety and security in their willingness to pay for housing (Ihlanfeldt and Mayock, 2010).

[2] Based upon property tax records from Florida, Ihlanfeldt et al. (2018) show that on average across Florida's urban counties the share of housing units represented by rentals increased six percentage points from 42 percent in 2000

Using a unique 13-year panel of neighborhoods from Miami-Dade County, Florida, we estimate Poisson control function (PCF) crime count models which relate various types of crimes (property and violent, also broken down into their constituent subcategories) to counts of the different types of housing units found within the neighborhood and the numbers of commercial and industrial properties. Our housing typology consists of SF homes, condominiums (condos), apartments, and REOs, where the SF and condo properties are broken down by housing tenure.[3] For our purposes, we define the "immediate neighborhood" as the census block group (BG) and the "broader neighborhood" as the census tract (CT) of which the BG is a part. Our crime counts are for the immediate neighborhood. The number of each of the types of housing units located within the BG and outside of the BG but within the CT serve as our explanatory variables. To establish a causal interpretation of our results, we include neighborhood and yearly fixed effects and devise an instrumental variable to address the possible endogeneity of our housing variables.

Our results suggest that all three types of rentals impact BG crime but their effects vary between their location within and outside of the BG. The largest positive effects are registered for SF rentals located outside of the BG, but within the CT. Among the other property types, REOs and owner-occupied condos also seem to produce crime effects, but the spatial pattern of the effects suggests that they relocate crime from one area to another, rather than producing new opportunities for crime.

In the next two sections, we describe various pathways whereby rentals may affect the amount of neighborhood crime. Section 4 describes our panel data for suburban neighborhoods within Miami-

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to 48 percent in 2014, while the growth in the SF rental share increased seven percentage points from 15 to 22 percent. Based on their own calculations using data from the American Community Survey (ACS), the rentals share at the national level measured over a shorter period (2005–2014) grew from 33.1 to 36.9 percent, while the share of SF rentals grew from 10.2 to 12.9 percent. They note that the ACS does not report the rental shares broken down by urban versus rural, but based on their findings from Florida the increase in the shares of rentals for urban areas nationally is expected to be much greater than for urban and rural areas combined.

[3] REO is the acronym for Real Estate Owned properties, which are homes that are owned by financial institutions as a result of foreclosure proceedings.

Dade County. Our PCF models are laid out in Section 5. Descriptive statistics are given for crimes and the property types in Section 6. In Sections 7.A and 7.B, we report our results from regressions that explore the effects of the property types on the total count of crimes in a BG and on crimes occurring on SF owner-occupied properties, respectively. In Section 8, we show the results from simulations revealing how crime may have changed within the average neighborhood as the result of changes in the numbers of the various property types over the panel. We conclude in Section 9 with suggestions for future research.

## 2. Rentals and crime: possible linkages

To motivate our analysis, we outline a number of possible pathways whereby rentals may have an impact on neighborhood crime. Establishing the relative importance of these pathways empirically may be a daunting task, but the logically first step is to determine whether neighborhood crime and rentals are causally related. We draw upon the standard economic model of the rational criminal to analyze possible effects of rental units on neighborhood crime (Becker, 1968). According to this model, the equilibrium quantity of crime within a neighborhood occurs where an upward-sloping marginal cost (supply) curve of crime intersects a downward-sloping marginal benefit (demand) curve of crime (see point number 1 on Figure 1).[4] Marginal costs (MC) and marginal benefits (MB) are perceived from the perspective of a potential criminal. Because we break our crime counts into categories, and because the MC and MB curves are expected to vary for different types of crime, the x-axis is not the total number of crimes, but rather the number of a particular crime type. Because neighborhood residents are most

[4] O'Sullivan (2009) presents a simple supply and demand model based on the rational criminal that explains the equilibrium quantity of crime within a city. We draw upon his model in developing an equally simple model to explain the equilibrium quantity of crime within a neighborhood and how this equilibrium may be affected by a change in the number of different types of housing units within the neighborhood. The supply curve has a positive slope because as the price of the expected payoff (loot) of crime rises more potential criminals with higher opportunity and anguish costs are drawn into the criminal market. The marginal benefit curve has a negative slope because the most lucrative and easy targets are hit first, with subsequent targets being less attractive.

concerned about burglaries, we define the count of burglaries as our dependent variable for illustrative purposes, but later consider how the analysis may differ for other types of crimes.

Factors causing shifts in the MC and MB curves alter the equilibrium quantity of crime within the neighborhood. Shifts in the MC curve can come from changes in the criminal's subjective assessment of apprehension and from changes in the direct and opportunity costs of committing a crime. Changes in the expected booty (loot) from a crime shift the MB curve. Also shifting the MB curve is a change within the neighborhood in the level of "anguish" cost associated with committing a crime. The expected utility from committing a crime is the utility provided by the loot plus the disutility from the risk of penalties, both legal and psychological.

One pathway linking rental units to crime is the perceived probability of apprehension within the neighborhood, which may decline if rental housing lowers the general physical appearance of the neighborhood. Because rental housing is often less well-maintained than owner-occupied housing, an increase in the number of rentals may create negative sight externalities. According to "broken windows" theory (Kelling and Wilson, 1982), this decline in the appearance of the neighborhood may signal to criminals a lack of concern for the neighborhood on the part of its residents or an area that is not well-policed, resulting in a lower perceived risk of getting caught and a downward shift in the MC curve and a higher equilibrium quantity of crimes.

An increase in rentals may also lower the MC curve by changing the socioeconomic composition of neighborhood residents. Since renters have, on average, lower incomes than homeowners, they face lower opportunity costs when deciding whether to participate in criminal activities.[5] Thus, we should expect an increase in rentals to increase the number of crimes, since criminals tend to commit their

[5] According to the 2010 Census, within Miami-Dade County there is a marked difference in the incomes of homeowners and renters. The median incomes of the two groups are $58,995 and $28,428, respectively.

crimes within their own or nearby neighborhoods (Reppetto, 1974; Pope, 1980; Bernasco and Block, 2011).

Thus far, the downward shifts in the MC curve caused by an increase in rental housing suggest that the equilibrium amount of burglary crime will rise in the neighborhood (see point number 2 on Figure 1). Turning to shifts in the MB curve, there are two factors from an increase in rentals that may raise this curve and reinforce the downward shift in the MC curve, resulting in a higher equilibrium quantity of burglaries. According to social disorganization theory, the behavior of a neighborhood's residents is affected by the social norms of the neighborhood, which are enforced by existing residents. These norms include an avoidance of crimes against one's own neighbors. Accepting these norms would presumably increase the anguish cost of residents committing crimes within their own neighborhood. Because renters may have less social interaction with homeowners than other homeowners, they may be under less pressure to accept the neighborhood's social norms. Hence, an increase in rentals would lower anguish cost within the neighborhood, shift the MB upward, and raise the equilibrium amount of crime. Finally, the MB curve may also shift upward because, regardless of the type of housing unit added to the neighborhood, more units mean there are more targets of opportunity, resulting in a larger potential booty (see point number 3 on Figure 1).

Because we include non-rental housing types (specifically, the number of owner-occupied SF units, owner-occupied condos, and REOs) as explanatory variables in our estimated crime models, it is instructive to also consider possible pathways whereby these different units may affect the equilibrium amount of neighborhood crime. With respect to SF homeowners, increasing their number may raise the level of "passive policing" within the neighborhood. As coined by Goodstein and Lee (2010), passive policing refers to the efforts that neighborhood residents make to control crime within their own neighborhood. Having no claim to ownership, renters are less invested in the neighborhood than homeowners, who have strong financial incentives to maintain neighborhood quality. Homeowners are

more likely to engage in passive policing, whether it takes the form of something informal, like providing more "eyes on the street," or something more formal, such as participating in neighborhood watch programs. A higher probability of apprehension from more passive policing shifts the MC upward, resulting in a lower level of neighborhood crime. Possibly counteracting this change, the MB curve may shift upward because, again, more units of any type increase the total booty available within the neighborhood. This would be especially true for owner-occupied units, compared to rental units, because homeowners are typically wealthier and own more expensive household possessions that are attractive to burglars. Hence, in contrast to rental housing, where there is a clear expectation of a positive impact on crime, because of countervailing effects, it is unclear whether more owner-occupied homes will raise or lower the equilibrium amount of neighborhood crime.

One factor which may be relevant to condo properties, regardless of tenure, is that within Miami-Dade County, they are characterized by high levels of security. Since these properties are typically well-lit and employ dedicated security guards, they may produce positive spillover benefits to nearby properties by raising criminals' expectation of apprehension.[6] A shift upward in the MC curve lowers the amount of neighborhood crime.

By lowering the probability of apprehension and moving the MC downward, REOs may raise the equilibrium amount of neighborhood crime by providing an unguarded target and a safe haven to which criminals may escape after committing their crimes. Because these properties are often not very well-maintained, they may also detract from the appearance of the neighborhood, causing more crime, assuming the validity of broken windows theory. Prior research has shown that there exists a

[6] Some support for the security spillover hypothesis comes from our regression of the number of jobs in protective services on the number of condos and the number of apartments. Census tract level data on jobs come from the Census Transportation Planning Package and the condo and apartment counts from the FDOR tax rolls. The regression was run for all tracts within Miami-Dade County. The estimated effects of condos and apartments are positive and statistically significant at the five percent level.

correlation between REOs and neighborhood crime (Ellen and Lacoe, 2015), but whether REOs cause crime has been open to dispute (Jones and Pridemore, 2012; Kirk and Hyra, 2012; Wolff et al., 2014).

Analyzing larcenies, robberies, auto thefts and vandalism, rather than burglaries, makes little difference for this analysis. As is true for burglaries, larger neighborhood numbers of rentals increase the equilibrium number of each of these crimes by shifting the MC curve downward (by decreasing the appearance of the neighborhood and lowering the average opportunity cost of crime of within the neighborhood) and by shifting the MB curve upward (by reducing anguish cost within the neighborhood and increasing the number of possible targets). Hence, as for burglaries, a priori, the expectation is that more rentals will raise the equilibrium amounts of these crimes in the neighborhood.

For the crimes of murder and assault, the available loot is expected to have little, if any, effect on their MB curves. However, more rentals translate into more potential victims of these crimes; hence, we might expect a greater number of violent crimes. The lower anguish and opportunity costs of the residents of rentals and possible broken windows effects may also raise the number of these crimes. However, because these crimes are frequently crimes of rage or of passion, the economic model of crime may be less applicable in these cases. For this reason, we expect that rentals (and the other housing types) will have less effect on violent crimes than on property crimes.

## 3. The crime effects of the housing types within and outside the immediate neighborhood

A unique characteristic of our empirical methodology is that we account for the number of each of the different types of housing units, both within the BG (the immediate neighborhood), as well as outside the BG but within the CT (the broader neighborhood).[7] How might a parcel located within the

[7] In lieu of measuring rentals within the BG and outside of the BG but within the CT, a popular approach made possible by GIS is to construct distance rings around the BG and count the number of each type of housing unit within each ring. We chose not to follow this approach for a number of reasons. First, the distances of the rings and their diameters are generally arbitrary. On the other hand, BGs are part of census tracts, which "are designed to be relatively homogenous with respect to population characteristics, economic status, and living conditions" (U.S. Census Bureau definition). The idea of an immediate and broader neighborhood are more natural geographies. Second, the rings approach does not easily lend itself to treating the housing units as endogenous.

BG affect crime patterns within the immediate neighborhood differently from its location outside the BG? A housing unit's effect on the immediate neighborhood may be greater if located within the BG. The proximity from being within the BG suggests it may have a stronger broken windows effect. Also, potential criminals living in the unit would presumably have greater knowledge of potential targets and escape routes in their immediate neighborhood, compared to their knowledge of areas farther afield. On the other hand, criminals may be less likely to target their immediate neighborhood, since they presumably face a higher probability of recognition and, therefore, apprehension. Potential criminals may also feel more anguish from committing a crime within their own neighborhood in comparison to someone living outside the neighborhood. Because of these countervailing influences, it is unclear whether rentals within or outside the BG will yield a stronger impact on BG crime.

Another factor affecting the relative crime effects of rentals inside and outside the immediate neighborhood is the possibility of crime diversion. Criminals who target a particular CT weigh the perceived costs and benefits associated with alternative targets. Hence, attractive rental targets in the broader neighborhood may reduce crime within the immediate neighborhood. On the other hand, if the outside targets are less attractive, possibly because of a higher expectation of apprehension, then crime may rise within the BG.

REOs within the BG and outside the BG may also have different effects on BG crime. REOs within the BG would produce the stronger broken windows effect and provide the safer haven for criminals in the BG. On the other hand, REOs outside the BG may divert criminal activity away from the BG, resulting in a sign reversal between the two effects.

The possible spillover effects from condo security could also result in this type of housing unit having a negative effect on crime if located within the BG, but a positive effect if located just outside the

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Essentially, separate instruments would be needed for the housing units within each ring. The well-known drawback associated with relying upon census geography is that there could be effects from outside the borders of the census tracts that are being ignored.

neighborhood. Criminals may be diverted away from the BG by high-security condos within the BG but toward the BG from high-security condos outside the BG.

## 4. Data

The dependent variables of our estimated crime models are the annual number of each type of crime reported in the BG.[8] To obtain our crime counts, we assigned crimes contained in the incident reports provided by the Miami-Dade County Police Department to neighborhoods for the years 2002–2014.[9] Our crime typology consists of property crimes (burglaries, larcenies, and motor vehicle thefts) violent crimes (robberies, assaults, and murders) and acts of vandalism.

The primary source for our housing data is a collection of tax assessment records from the Florida Department of Revenue (FDOR). These records cover the years 1998–2014. While our crimes only cover the years 2002–2014, we employ the 1998 FDOR records to define the base year used in constructing our instrumental variables (as described in detail below). What is most important for our study is a field within the tax rolls which indicates whether or not a property was granted a property tax homestead exemption. According to Florida Statute 196.031, this exemption is available to "[a] person who, on January 1st, has the legal title or beneficial title to real property in [Florida] and who in good faith makes the property his or her permanent residence or the permanent residence of another or others legally or naturally dependent upon him or her." We use the presence of a homestead exemption to classify a property as owner-occupied, and housing units without a homestead exemption are classified as renter-occupied. Because the exemption provides significant tax savings, owner-occupants

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[8] Our choice of the census BG rather than the census tract as the unit of observation is partly based on Wilson (2015). He experiments with both BGs and tracts as the unit of observation in estimating the crime impacts of foreclosures. He finds that moving from BGs to tracts is indicative of Simpson's Paradox. Simpson's Paradox occurs when a switch to a larger geographical unit alters fundamental relationships between the dependent and independent variables.

[9] Our crime data are composed of more than one million criminal incident reports from unincorporated Miami-Dade County and a collection of suburban jurisdictions which contract with the county for the provision of police services, an area containing just over 40 percent of the county's population and over 50 percent of its suburban population. The jurisdictions are Miami Gardens, Miami Lakes, Doral, Palmetto Bay and Cutler Bay. See map in appendix, Miami-Dade County: Crime Coverage Area.

have strong financial incentives to file for the exemption, and we are therefore confident that homestead status reliably identifies owner-occupants.[10] Properties not covered by a homestead exemption are primarily rental units, vacant or second homes. The fraction of SF homes that are second homes is expected to be small because in Florida most vacation homes are condominiums. For condominiums we cannot rule out the possibility that some fraction of the properties labeled as rentals may in fact be second homes not available for rent.

For each BG/year observation we obtained from the FDOR records the number of each of the following housing units located within the BG and outside the BG within the CT: SF owner-occupied and rental homes, owner-occupied and rental condos, apartments, and REOs.[11] We also used the FDOR data to count the total number of commercial and industrial properties located within and outside the BG.[12] Finally, we linked the FDOR data to property records from DataQuick that can be used to identify foreclosure completions (i.e., Real Estate Owned properties, or REOs).[13] Our crime coverage area is the unincorporated area of the county plus a number of incorporated areas for which the Sheriff's Office provides law enforcement. If a BG lies totally within our coverage area, we include it as one of our observation units. At the beginning of our panel in 2002 a number of the BGs were located in CTs that contained no or very small amounts of owner-occupied SF housing units. After dropping these BGs, our panel included 550 BGs (immediate neighborhoods) located in 189 CTs (broader neighborhoods). The panel we constructed satisfied our aim to identify suburban neighborhoods where the increase in the number of rentals poses the greatest crime threat to incumbent homeowners.

## 5. Empirical methodology

[10] A homestead exemption decreases a property's taxable value by as much as $50,000.
[11] The condo and apartment counts are for the individual homes and not the entire building.
[12] Within the suburban area represented by the BGs in our panel, the vast majority of commercial properties are stores and offices, while the industrial properties are mostly light manufacturing, such as small machine shops and printing plants, and warehouses.
[13] The algorithm we used to identify REOs with these data is described in detail in our earlier work (Ihlanfeldt and Mayock, 2016).

We estimate Poisson models to address the discrete nature of our crime data following the guidance of Wooldridge (2010). Because the distribution of crime counts is skewed towards zero, a typical linear regression of crime counts on our explanatory variables will be inefficient. Our benchmark model is shown below, in equation (1):

$$C_{it} = \exp(H_{it}\beta + \tau_t + a_i + \varepsilon_{it}), \tag{1}$$

where $C_{it}$ is a count of crimes occurring in BG *i* during year *t*, $H_{it}$ is a vector of housing variables (which we treat as potentially endogenous), including owner-occupied SFs, rental SFs, owner-occupied condos, rental condos, apartments, and REOs located inside and outside of the BG, and $\tau_t$ and $\delta_i$ are yearly and neighborhood fixed effects, respectively.

We estimate (1) using the PCF approach. This approach is an alternative estimation strategy to typical instrumental variables approaches, such as two-stage least squares (2SLS) and generalized method of moments, which are usually used to address concerns of endogeneity. In contrast to the 2SLS approach, which substitutes first-stage predictions of endogenous variables into the estimating equation, the PCF approach uses first-stage residuals to estimate the equation of interest. In linear models, this approach provides identical point estimates to 2SLS models. However, the PCF approach offers at least two compelling advantages for our application. First, PCF flexibility allows for the nonlinear relationship among explanatory variables in a Poisson model, unlike 2SLS, which requires linearity in specification. Second, by including the first-stage residuals as regressors, the PCF approach provides a straightforward test for the endogeneity of each of our housing counts and controls for its possible endogeneity.

To illustrate our method, consider the following procedure for estimating equation (1). First, assume the housing counts, $H_{it}$, can be represented as a linear function of the instruments, which we denote as the vector $Z_{it}$, along with yearly and neighborhood fixed effects. That is,

$$H_{it} = Z_{it}\Pi + \theta_t + b_i + e_{it}, \tag{2}$$

where $\theta_t$ and $b_i$ are yearly and neighborhood fixed effects, respectively. We can decompose the neighborhood fixed effects, $a_i$ and $b_i$ from equations (1) and (2), using the Chamberlain-Mundlak device as follows:

$$a_i = \psi + \bar{Z}_i\xi + r_i \tag{3}$$

$$b_i = \phi + \bar{Z}_i\Xi + s_i, \tag{4}$$

where $\bar{Z}_i$ is the mean of $Z_{it}$ averaged across all $t = 1, 2, \ldots, T$ for each unit $i$. Substituting (3) into (1) and (4) into (2), we get:

$$C_{it} = \exp(\psi + H_{it}\beta + \bar{Z}_i\xi + \tau_t + u_{it}) \tag{5}$$

$$H_{it} = \phi + Z_{it}\Pi + \bar{Z}_i\Xi + \theta_t + v_{it}, \tag{6}$$

where $u_{it} = \varepsilon_{it} + r_i$ and $v_{it} = e_{it} + s_i$. Given joint normality of $(u_{it}, v'_{it})$, we can assume that $E[\exp(u_{it})\,|v_{it}] = \exp(\eta + v_{it}\rho)$, and thus, we obtain the following estimating equation:

$$Y_{it} = \exp(\mu + H'_{it}\beta + \bar{Z}'_i\xi + \tau_t + v'_{it}\rho), \tag{7}$$

where $\mu = \psi + \eta$.

Since we cannot directly observe $v_{it}$, we first estimate equation (6) using pooled OLS to obtain the residuals $\hat{v}_{it}$. Then, in the second stage, we apply a quasi-maximum likelihood estimation technique, where the unobserved $v_{it}$ is substituted for the observed first-stage residual, $\hat{v}_{it}$. Like the inclusion of the predicted endogenous variable from the first stage in 2SLS estimation, the inclusion of these residuals in the PCF method addresses the problem of endogeneity, assuming the validity of our instruments. Furthermore, we can apply the usual inferential techniques to test the null hypothesis, $\rho_j = 0$, where $\rho_j$ is the coefficient for the $j$th housing type. In this case, if the null hypothesis is rejected, we can conclude that housing type $j$ is endogenous and we obtain standard errors through 1,000 iterations of bootstrapping.

While the Chamberlain-Mundlak device can control for time-invariant heterogeneity affecting crime within neighborhoods, we begin with the assumption that there are time-varying unobservables

correlated with our housing variables, which have their own impact on neighborhood crime. In fact, it may be these other factors which affect neighborhood crime that account for both the increase in rentals and REOs, along with observed changes in crime patterns. Hence, we must devise instrumental variables for the housing types which satisfy strict exogeneity (i.e., variables that would be correlated with the housing counts but would not have their own influence on the amount of crime). Conceptually, it is reasonable to argue that a change in one of the housing types, say SF rentals, is driven by factors both within the neighborhood and countywide. While these neighborhood factors may be endogenous to crime, countywide trends should not be affected by conditions within the home BG, especially if the countywide trend is defined over the portion of the county which excludes the home BG.

Based on this logic, the following instrumental variable is suggested: first, define a base year preceding the beginning of the panel. Using the entire county, then calculate the percentage change in the housing type ($H_j$) at the county level between the base and current years, excluding the home BG value.[14] These percentage changes are then multiplied by the base year value of the housing type to obtain a prediction of the current year value ($\widehat{H}_j$), assuming the growth in the housing type followed the change that occurred at the county level. Formally,

$$\widehat{H}_{jit} = H_{jib} \times \left(1 + \frac{x-y}{y}\right), \tag{8}$$

where $x = H_{jct} - H_{jit}$ , $y = H_{jcb} - H_{jib}$, $j$ indexes the housing type, $i$ indexes the BG, $t$ indexes the current year, $b$ is the base year, and $c$ represents the county.

where $x = H_{jct} - H_{jit}$, $y = H_{jcb} - H_{jib}$, $j$ indexes the housing type, $i$ indexes the BG, $t$ indexes the current year, $b$ is the base year, and $c$ represents the county.

While contemporaneous changes in crime could plausibly affect the amount of a given type of housing in a BG ($H_{jit}$), they should not affect the composition of housing several years before the start of our

[14] Note that we are using the entire county (not just the suburban portion of the county which constitutes our crime coverage area) in constructing our instruments. This further ensures their exogeneity.

panel during the base year either at the neighborhood level ($H_{jib}$) or at the county level ($H_{jcb}$). Moreover, by excluding the home BG from the countywide calculation ($H_{jct} - H_{jit}$), we mitigate any indirect channels through which neighborhood crime might impact countywide trends. Therefore, while changes in crime in year $t$ may affect $H_{jit}$, they should not have an effect on $\widehat{H}_{jit}$.

Ultimately, however, the validity of $\widehat{H}_{jit}$ as an instrumental variable depends on whether the neighborhood base year housing count can be treated as exogenous to contemporaneous changes in crime. That is, there may be omitted variables correlated with the base year value which have a delayed impact on the amount of neighborhood crime. In that case, the instrument would not be orthogonal to the error term of our estimating equation. To help rule out that possibility, we experimented with using a number of different base years to define our instrument. Our results are robust to using base years that were 2 (2000), 3 (1999) and 4 (1998) years prior to the beginning of the panel and we report results in our tables obtained with 1998 as the base year. While it is still possible that events 4 years prior to the beginning of the panel could affect the current level of crime, this seems unlikely.

To instrument the housing types outside the BG but within the CT we followed a similar strategy:

$$\widehat{H}_{jkt} = H_{jkb} \times \left(1 + \frac{z-w}{w}\right), \tag{9}$$

where $z = H_{jct} - H_{jkt}$, $w = H_{jcb} - H_{jkb}$, $k$ indexes the area outside the BG but within the CT, $c$, $j$, and $t$ are the same as above, and the base year, $b$, is 1998. The number of commercial and industrial properties within the BG and outside the BG are instrumented in exactly the same way as described by equations 8 and 9, respectively.

One final concern is the possibility that our instruments are "weak." While first-stage diagnostics are not provided using the PCF approach, they can be obtained from 2SLS. The statistic commonly used to detect weak instruments is the *F*-test of the joint significance of the instruments in the first-stage reduced form regression. As Appendix Table A.1 shows, for all of our explanatory variables, the *F*-

statistic is highly statistically significant. However, Baum et al. (2003) have shown that for models with multiple endogenous variables the *F*-statistic may not be sufficiently informative. More informative tests are the Sanderson-Windmeijer (2016) first-stage chi-squared and *F* statistics that test the under-identification and weak identification, respectively, of individual endogenous regressors. These statistics are constructed by "partialling-out" linear projections of the remaining endogenous regressors. These statistics are also reported in Appendix Table A.1 and show that for all variables the null hypothesis that the variable is under-identified or weakly identified is strongly rejected.

6. Descriptive statistics

Appendix Tables A.2 and A.3 report the means and standard deviations of our dependent variables (crimes) and our explanatory variables (properties), respectively. For the latter variables, we report the within standard deviations. With panel data, a standard deviation (SD) change can be measured as either “between” or “within” the observational units. The between SD comparison can be thought of as selecting two neighborhoods from the same year, with one experiencing and the other not experiencing a standard deviation increase in one of the properties. The within SD compares two years for the same neighborhood, where in one of the years but not the other there is a standard deviation increase in the property. Because the within SD is a better gauge of the economic significance of the rental effects on neighborhood crime, we make use of this change in presenting our results and report it in Table A.3.

Crime means (and SDs) are reported for the BG and for crimes that occur on SF owner-occupied homes located within the BG. As expected, property crimes are far more numerous than violent crimes. Also not surprising is that larceny and assault are the most frequently reported property and violent crimes, respectively. Murders have a nonzero mean at the neighborhood level, but there were no murders reported on owner-occupied SF properties over the course of our panel.

The means of the explanatory variables are reported for the values inside the BG and outside of the BG but within the CT. For both areas, SF owner-occupied properties far outnumber any of the other types of properties, largely reflecting our choice of using a suburban sample. However, nontrivial amounts of all of the other property types can be found in our panel and all show movements over time within the BGs, as revealed by the within SDs.

## 7. Results

The results obtained from estimating our two sets of models are reported in Table 1 (BG crimes) and Table 2 (crimes on owner-occupied SF properties). For each explanatory variable, four numbers are reported: the estimated Poisson coefficient, the estimated standard error clustered at the BG level based on 1,000 bootstrap replications (in parentheses), the average marginal effect (in square brackets), and an estimate of the probability of a housing unit in the median BG experiencing the crime from a within standard deviation increase in the variable (in curly braces). Without exception, the statistical significance of the residuals entering our PCF models, both individually and jointly, indicate that the property types should be treated as endogenous variables. Hence, the residuals are retained in all of our estimated models as explanatory variables in order to ensure consistent estimates.[15]

### 7.A Neighborhood crime results

Our discussion of the results can be organized by type of crime or by type of property. We begin with the latter approach, given our interest in the effects that rentals have on neighborhood crime. Beginning with SF rental properties, the results sharply contrast for properties within and outside the BG. Within the BG, these rentals have no statistically significant effect on either the overall level of property or violent crime; however, if located outside the BG but within the CT, they cause a statistically significant (5% level) increase in both types of crime. The breakdown of the crimes into their

[15] Like the time means, the estimated coefficients on the residuals have no useful interpretation; hence, these variables are excluded from our tables.

subcategories shows that the increase in property crime comes from burglaries and motor vehicle thefts, while the increase in violent crime is due to assaults and robberies. Possible explanations for these results are that homeowners within the BG may have greater moral authority over renters living close by or potential criminals may choose not to victimize their closest neighbors. These explanations may also apply to SF rentals, reducing vandalism within the BG but increasing vandalism if located outside the BG. One pathway suggested by these results is that without possible offsets within the BG, the lower average income of the occupants of SF rentals located outside of the BG lowers the average opportunity cost of crime within the CT and thereby raises the level of BG crime.

In contrast to the effects found for SF rentals, apartments, regardless of their location, have no significant effect on either property or violent crime. Based on the pathways we identified in Section 2, this insignificance is an unexpected result; however, as discussed below, apartments within the BG do increase the number of larcenies that occur on SF owner-occupied properties. Also, the regression results reported in footnote 6 suggest that apartments may lower crime in their immediate vicinity as the result of bringing more security guards into the BG. This effect may serve to counteract to some degree an increase in crime from apartment residents having lower incomes and therefore a lower opportunity cost of engaging in crime. Differing from the effects produced by both of the other two types of rentals, condo rentals only have effects if located within the BG. Positive and significant effects are found for burglaries, motor vehicle thefts, and vandalism. While these results may simply reflect an increase in the number of possible targets within the BG, this conclusion is belied by the negative effects that owner-occupied condos have within the BG. We will return to these effects below.

Turning to the other property types (i.e., the non-rentals), the effects of REOs on BG crime come largely from their location outside the BG. More REOs outside the BG but within the CT are found to reduce overall violent crime, motor vehicle theft, vandalism, and robbery. As suggested above, these

effects may be driven by diversion, with criminals that otherwise would have targeted the BG choosing instead these REOs as easy targets and safe havens.

Diversion may also explain the effects of SF owner-occupied properties, which have no effects if located within the BG, but have negative and significant effects if located outside the BG on violent crime, burglary, vandalism, assault, and robbery.

Among the most interesting crime impacts from the non-rental properties are those produced by owner-occupied condos. For many of the crime categories, these properties have negative effects if located within the BG but positive effects outside the BG. These results are consistent with the idea that condos generate nearby crime prevention from security spillover effects (we again note the results reported in footnote 6 showing a positive correlation between the number of condos and the number of protective security workers). They deter crime if located within the BG, but divert crime to the BG if located outside the BG.

So far, we have focused on the statistical significance of the property types. To study the relative magnitudes of their effects, we report in Table 1 average partial effects (APE) and the probability of a housing unit in the median BG experiencing the crime from a within SD increase in the property number, which we refer to as the probability of victimization (VP). It is useful to organize the discussion by type of crime and to focus on the components of property and violent crime, rather than these aggregates. We also limit our discussion to only those effects which are statistically significant. Because none of the property types have significant effects on larcenies and murders, these crimes are excluded.

7.A.i Burglaries

By a wide margin, the property type having the strongest positive effect on burglary crime is SF rentals outside the BG. Three additional units roughly result in one additional burglary per year (APE = .367), with a VP = .059. The other positive effects come from condo rentals within the BG (APE = .102,

VP = .011) and condo owner-occupied units outside the BG (APE = .048, VP = .013). These are comparatively small effects that are only one-fifth as large as the VP from SF rentals outside the BG.

The largest negative effects on burglary crime come from SF rentals within the BG (APE = −.358, VP = −.027). The other negative effects are much smaller: condo owner-occupied units within the BG (APE = −.098, VP = −.012) and SF owner-occupied units outside the BG (APE = −.025, VP = −.008).

7.A.ii Motor vehicle theft

As for burglary crime, the property type having the largest positive effect on motor vehicle crime is SF rentals outside the BG (APE = .137, VP = .022). The other positive effect, which is notably smaller, comes from condo rentals inside the BG (APE = .058, VP = .006). The only negative effect, which is comparatively large on a per-unit basis, is produced by REOs outside the BG (APE = −1.640, VP = −.013). An additional unit raises the number of motor vehicle thefts by more than one a year, but the small inter-temporal growth in REOs causes only a modest increase in the VP.

7.A.iii Vandalism

Once again, SF rentals outside the BG have a comparatively large effect on vandalism crime (APE = .414, VP = .066). The other positive effect, which is probably of no consequence, comes from condo rentals inside the BG (APE = .091, VP = .009). Negative effects come from many of the property types, but by a large margin the dominant effect is produced by REOs outside the BG (APE = −4.020, VP = −.032).

7.A.iv Assaults

SF rentals outside the BG continue their comparative importance, with their effects on assaults equaling APE = .357 and VP = .057. Condo owner-occupied properties outside the BG also produce a positive, albeit much smaller effect (APE = .043, VP = .012). Negative effects are caused by owner-occupied condos within the BG (APE = −.087, VP = −.010) and SF owner-occupied properties outside the BG (APE = −.022, VP = −.007).

7.A.v Robberies

To complete their relative strong positive effects across all crimes, SF rentals outside the BG have the largest effect on robberies (APE = .136, VP = .022). The other positive effect—from condo owner-occupied units—is inconsequential (APE = .017, VP = .005). Negative effects are registered for many of the property types, but all are small in magnitude, except REOs outside the BG have a large per-unit effect (APE = −1.351).

To summarize the effects of the types of rentals on BG crime, the most noteworthy effects are produced by SF rentals outside the BG. SF rentals outside of the BG but within the CT have statistically significant, positive effects across all crimes where the property types matter, and these properties have comparatively the largest absolute value effects on BG crime, as measured jointly by the APE and VP. Condo rentals also increase BG crime, but only if located within the BG and their effects are notably smaller than those produced by SF rentals outside the BG. The only effect found for apartments is that if they are located outside the BG they reduce vandalism within the BG, suggesting that these properties may divert crime away for the BG.

Regarding the non-rental property types, REOs outside the BG have the largest negative per-unit effects as measured by the APE. Additionally, we find no evidence that apartments, commercial properties, or industrial properties affect any of the types of crime. While the unimportance of the nonresidential properties is somewhat surprising, this may reflect the fact that our neighborhoods are largely SF home neighborhoods, where these properties are mostly stores and shops. Finally, the results are consistent with the hypothesis that owner-occupied condos divert crime if located within the BG, but attract crime if located outside the BG.

7.B Crimes occurring on single-family owner-occupied properties

The results from estimating our PCF models explaining crimes occurring on SF owner-occupied properties within BGs are reported in Table 2. Following Section 7.A, we first report property type

effects that are statistically significant and then compare their APE and VP relative magnitudes. We again organize our discussion first by property type and then by type of crime.

SF rentals within the BG have statistically significant effects on property crimes and violent crimes, as well as on all subcategories of the crimes of these aggregates. In all cases the effects are negative. One explanation for these results is that regardless of tenure, the occupants of SF homes may provide increased surveillance of the neighborhood. Alternatively, these rentals may divert the attention of criminals away from SF owner-occupied homes, which may be more difficult targets, having greater home security. In contrast, SF rentals outside the neighborhood have significant positive effects in all cases, suggesting that the inhabitants of these units who are criminally inclined target SF homes outside their immediate area, possibly because there is less risk of identification and therefore of apprehension. Note that these effects from SF rentals on crimes occurring on SF owner-occupied properties are consistent with our findings for BG crime. So, many of the crimes within the BG that are generated by SF rentals outside the BG are being reported by SF homeowners.

In contrast to the largely null effects that apartments are found to have on BG crime, more apartments have statistically significant effects on the number of crimes occurring on SF owner-occupied properties. Larcenies are greater if the apartments are within the BG, burglaries are less if the apartments are outside the BG, and there are also fewer robberies if the apartments are within the BG.[16] This mixture of effects suggests various pathways, as outlined above, are active depending on the type of crime and the location of the apartments, though we can say unfortunately little about the relative magnitudes of these pathways.

[16] The larcenies that occur on SF owner-occupied properties from apartments begs the question of what these thefts might represent. Larcenies in our crime data are further broken down into thefts from buildings, coin machines, motor vehicles, and other. We estimated separate models for each of these types of crimes. Unsurprisingly, apartments only are statistically significant in affecting thefts from motor vehicles on SF owner-occupied properties.

If located within the BG, condo rentals have positive and significant effects on all types of property crime and on vandalism crimes. Outside the BG condo rentals reduce the number of burglaries. These results suggest that the inhabitants of rented condos who engage in crime may target nearby SF owner-occupied homes.

Paralleling the results obtained for BG crime, REOs and SF owner-occupied homes outside the BG seem to divert criminals' attention away from SF owner-occupied properties, with significant, negative effects found for property, violent, and vandalism crimes. The breakdown of property and violent crimes into their components show that most all are similarly affected.

Also consistent with the BG crime results are the negative effects that condo owner-occupied units have on property, violent, and vandalism crimes within the BG, but positive effects outside the BG. All of the components of property and violent crime (except for robberies if located outside the BG) are also similarly affected.

While commercial properties, regardless of their location, have no significant effects on crimes committed on SF owner-occupied properties (as is also true for BG crime), industrial properties are sometimes found to be significant (which contrasts to the null effects found for BG crime). These effects show up most consistently for industrial properties outside the BG, having positive effects on property crime, larceny, and motor vehicle thefts and a negative effect on robberies.

To compare the relative magnitudes of the impacts that the various property types have on crimes committed on SF owner-occupied properties we next consider the APE and VP estimates by type of crime. We again only consider those effects that are statistically significant.

7.B.i Burglaries

SF rentals within and outside the BG have the largest absolute value impacts of all property types on burglaries of SF owner-occupied properties (APE = −.344, VP = −.052 and APE = .311, VP = .102, respectively). REOs outside of the BG are next in magnitude, with an especially large APE (−2.738) and

the second largest VP (−.044). The magnitude of impact is similar for condo rentals (APE = .116, VP = .024) and condo owner-occupied units (APE = −.108, VP = −.026) within the BG. Other statistically significant effects are all small by comparison.

7.B.ii Larcenies

SF rentals again have the dominant impacts on larcenies committed against SF owner-occupied properties, both within the BG (APE = −.325, VP = −.049) and outside the BG (APE = .267, VP = .086). Also, once again condo rentals (APE = .187, VP = .040) and owner-occupied units (APE = −.135, VP = −.034) within the BG have similar but reverse impacts. Other statistically significant effects are all small by comparison.

7.B.iii Motor vehicle theft

SF rentals outside the BG have the largest absolute value effect on motor vehicle thefts occurring on SF owner–occupied properties (APE = .077, VP = .021). The other significant effects are small in comparison, yielding small APEs and VPs less than .010, except for REOs outside the BG (APE = −.736, VP = −.012).

7.B.iv Vandalism

SF rentals outside the BG have an especially large comparative effect on vandalism directed against SF owner-occupied properties (APE = .186, VP = .060). The effect of REOs outside the BG is also relatively large in absolute value (APE = −1.668. VP = −.027). Other statistically significant effects are all small by comparison.

7.B.v Assaults and robberies

As expected, all of the statistically significant effects of the property types on assaults and robberies occurring on SF owner-occupied properties are small in magnitude. Comparatively, SF rentals outside the BG are dominant for assaults (APE = .090, VP = .029) and SF rentals within the BG matter most to robberies (APE = −.030, VP = −.004).

Many of the conclusions we reached regarding BG crime overall extend to crimes specifically committed on SF owner-occupied properties. Given our focus on rental properties, the most noteworthy effects for both BG crimes and crimes on SF owner-occupied properties are those produced by SF rentals outside the BG. SF rentals outside of the BG but within the CT have statistically significant, comparatively large positive effects on crimes both within the BG and on SF owner-occupied homes. For both areas, condo rentals within the BG are also a source of crime, but their effects are comparatively smaller. Apartments differ from the other two types of rentals in that they are found to have important effects only on the number of crimes experienced on SF owner-occupied properties and not BG crime, but their effects are the smallest in magnitude of the three types of rentals.

Regarding the non-rental property types, REOs outside the BG are found to reduce crimes both within the BG and on SF owner-occupied properties within the BG. The per-unit REO effects are the largest of all of the property types, suggesting that REOs play an important role in crime diversion. Owner-occupied condos are another apparent source of crime diversion. They divert crime away from the BG and SF owner-occupied properties if they are located within the BG, but divert crime in the reverse direction if located outside the BG.

## 8. Simulations

To further investigate the comparative effects of the property types on BG crime and crimes occurring on SF owner-occupied properties, we used our PCF results to predict how the number of property crimes changed over the course of our panel (2002–2014) assuming a BG possessed the mean values of the property types. Not only does this allow a comparison of the crime impacts of the individual housing types, but it also permits us to assess how crime may have changed over time within suburban Miami-Dade County as the result of actual changes in the numbers of the property types. To illustrate, at the 2002 and 2014 mean values of the property types our estimates predict that in 2002 and 2014 a BG would have 67.9 and 79.7 property crimes, respectively—indicating that over the course

of our panel crime increased by 17.3 percent as the result of changes in land use. The implication is that, on net, the changes in neighborhood composition caused property crime to increase (a countervailing tendency to the observed decline in crimes over this period, as reported below). To determine the importance of an individual property type, we predicted what the 2014 crime count would be if the BG had the 2014 mean value of the type, holding the numbers of all of the other property types constant at their 2002 mean values. For example, assuming the only change is in the mean value of SF rentals outside the BG, there would be 18 additional property crimes within the BG, a 27.0 percent increase. Table 3 shows the absolute and percentage changes in property crime from these simulations for BG crimes and crimes on SF owner-occupied properties.

By a wide margin, the change in the mean value of SF rentals outside the BG produces the largest percentage increases in BG crime and crime occurring on SF owner-occupied properties. As noted, BG crime increases by 27.0 percent, while the percentage increase on SF properties is a remarkable 470 percent. The latter change reflects both the strong impact that these SF rentals have on crime and the substantial growth that has occurred in these properties over the years of our panel. Other properties that register important, albeit considerably smaller increases in crime are condo rentals and condo owner-occupied units within the BG. Interestingly, the latter increase is from the number of mean units declining over the panel, given that these units have a negative effect on crime. The largest declines in crime come from REOs located outside the BG (8 and 45 percent for BG crime and on crime on SF properties, respectively). Mean values of REOs grew from 2.82 to 4.82, and our PCF point estimates suggested that these properties divert the attention of criminals away from the BG.

The number of crimes within our coverage area fell over the course of our panel, paralleling downward trends at the national level. The percentage declines are 41 and 45 percent for property and violent crimes, respectively. The corresponding percentage reductions in crime on SF owner-occupied properties are 26 and 27 percent. How do these trends mesh with our findings that changes in the

property types tended to raise neighborhood crime? Because our results are at the BG level, they reflect how the numbers of crimes in the aggregate are allocated across BGs based on the property types found within the BG and outside the BG but within the CT. Hence, there is no inconsistency between our findings and the aggregate trends. Depending on their specific changes in the numbers of the various property types, some neighborhoods witnessed relative declines in their crime, while others experienced a relative worsening of their crime. Especially at risk were those immediate neighborhoods having SF rentals nearby in other immediate neighborhoods.

## 9. Conclusions

Although rentals are frequently mentioned as a source of neighborhood crime, to our knowledge, there has been no prior evidence on this issue. Based on PCF models that address simultaneity and unobservable heterogeneity across neighborhoods and over time within neighborhoods, we have provided a comprehensive investigation of the effects that different types of rentals (and other types of properties) have on both property and violent crimes occurring within BGs and on SF owner-occupied properties within BGs. Rentals are found to have important effects, but these effects vary by type of rental and the proximity of the rentals. Most importantly, among all of the property types we considered, SF rentals outside of the BG but within the CT have the largest positive impacts on both BG crime and crime on SF owner-occupied homes. Since the Great Recession there has been unprecedented growth in these rentals and this growth is expected to continue.[17] Hence, our results point to a need for policymakers to address SF rentals as a source of neighborhood crime. Appropriate strategies, however, should be based on the pathway(s) that link these rentals with more crimes. Hence, we encourage future research on not only these pathways, but the pathways generally accounting for the various neighborhood crime effects by property type observed from estimating our

[17] The lion's share of the investment in SF rentals has originated from institutional investors (Smith and Liu, 2017; Mills et al., 2019). Mills et al. (2016) conclude that these investors are in for the long haul and do not intend to liquidate their rental holdings anytime soon. This suggests that SF rentals in neighborhoods are here to stay.

models. Because of the pioneering nature of our investigation, we also recognize the need for future studies to confirm our basic conclusions. While we believe the suburban neighborhoods of Miami-Dade County are representative of many neighborhoods throughout the nation that have experienced growth in SF rentals and that our results have applicability elsewhere, additional research based on data from other urban areas would be valuable. We hope that the PCF methodology we have developed to study neighborhood crime and its relationship to rental properties is beneficial in these endeavors.

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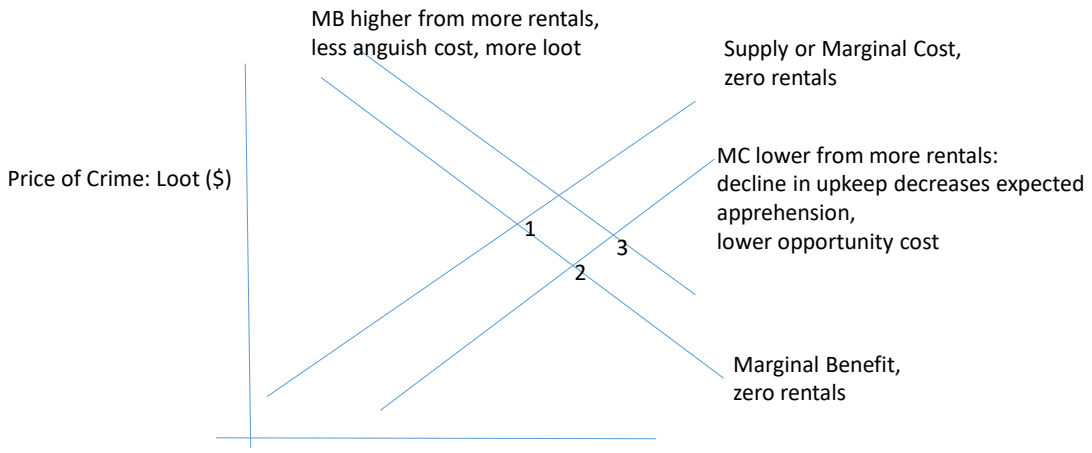
Figure One: Rentals and Neighborhood Burglary Crimes




1=equilibrium number of crimes, no renters; 2=equilibrium number of crimes, with renters, less anguish, more loot; 3=equilibrium number of crimes, with renters, less anguish, more loot, lower likelihood of apprehension, lower opportunity cost

Table 1
Neighborhood crime: Poisson control function estimates.

| | Property Crime | Violent Crime | Burglary | Larceny | Vehicle Theft | Vandalism | Assault | Robbery | Murder |
|---|---|---|---|---|---|---|---|---|---|
| Within Block Group | | | | | | | | | |
| Single-family rental | −.00087 | −.02209 | −.02543* | .00488 | −.00875 | −.02612** | −.01979 | −.03664* | −.07746 |
| | (.00988) | (.01380) | (.01429) | (.01080) | (.01270) | (.01061) | (.01439) | (.02041) | (.06492) |
| | [−.05713] | [−.40628] | [−.35765] | [.21410] | [−.00509] | [−.25362] | [−.30053] | [−.11282] | [−.00962] |
| | {−.004} | {−.030} | {−.027} | {.016} | {−.005} | {−.019} | {−.022} | {−.009} | {−.001} |
| Apartment | .00103 | .00094 | .00077 | .00093 | .00114 | .00006 | −.00003 | .00038 | .00108 |
| | (.00065) | (.00079) | (.00081) | (.00073) | (.00084) | (.00068) | (.00077) | (.00146) | (.00525) |
| | [.06799] | [.00174] | [.01122] | [.04075] | [.00848] | [.00055] | [−.00051] | [.00116] | [.00013] |
| | {.007} | {.000} | {.001} | {.004} | {.001} | {.000} | {−.000} | {.000} | {.000} |
| Condominium rental | .00397 | .00546 | .00701* | .00213 | .00777* | .00938** | .00456 | .00802 | .01025 |
| | (.00346) | (.00418) | (.00424) | (.00395) | (.00452) | (.00368) | (.00422) | (.00747) | (.02618) |
| | [.26152] | [.10038] | [.10214] | [.09329] | [.05781] | [.09112] | [.06926] | [.02471] | [.00127] |
| | {.027} | {.010} | {.011} | {.010} | {.006} | {.009} | {.007} | {.002} | {.000} |
| REO | .03584 | −.11803 | .06514 | .01615 | .02731 | −.22536*** | −.10948 | −.20905* | −.34769 |
| | (.05049) | (.07715) | (.08259) | (.05580) | (.07118) | (.06172) | (.07869) | (.12162) | (.40444) |
| | [2.36089] | [−2.17090] | [.94967] | [.70816] | [.20312] | [−2.18791] | [−1.66291] | [−.64373] | [−.04318] |
| | {.005} | {−.005} | {.002} | {.002} | {.000} | {−.005} | {−.004} | {−.001} | {−.000} |
| Single-family owner | −.00092 | .00017 | .00047 | −.00099 | −.00075 | −.00078 | .00030 | −.00014 | .00249 |
| | (.00097) | (.00104) | (.00123) | (.00098) | (.00102) | (.00101) | (.00106) | (.00156) | (.00506) |
| | [−.06085] | [.00306] | [.00692] | [−.04358] | [−.00557] | [−.00754] | [.00460] | [−.00044] | [.00031] |
| | {−.010} | {.000} | {.001} | {−.007} | {−.000} | {−.001} | {.001} | {−.000} | {.000} |
| Condominium owner | −.00199 | −.00679** | −.00672** | −.00035 | −.00453 | −.01042*** | −.00571* | −.01235** | −.02131 |
| | (.00228) | (.00318) | (.00321) | (.00259) | (.00309) | (.00257) | (.00332) | (.00485) | (.01566) |
| | [−.13084] | [−.12494] | [−.09794] | [−.01554] | [−.03368] | [−.10116] | [−.08670] | [−.03803] | [−.00265] |
| | {−.016} | {−.016} | {−.012} | {−.002} | {−.004} | {−.013} | {−.010} | {−.005} | {−.000} |
| Commercial | .00001 | −.00015 | −.00026 | .00007 | −.00006 | −.00031 | −.00015 | −.00014 | −.00058 |
| | (.00254) | (.00173) | (.00074) | (.00317) | (.01310) | (.00149) | (.00151) | (.00307) | (.00187) |
| | [.00009] | [−.00273] | [−.00383] | [.00290] | [−.00048] | [−.00300] | [−.00222] | [−.00044] | [−.00007] |
| | {.000} | {−.101} | {−.002} | {.001} | {−.000} | {−.001} | {−.001} | {−.000} | {−.000} |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Industrial | .00009 | −.00212 | −.00143 | .00054 | −.00014 | −.00387 | −.00170 | −.00429 | −.01024 |
| | (.00259) | (.00265) | (.00274) | (.00294) | (.00278) | (.00248) | (.00267) | (.00554) | (.01179) |
| | [.00615] | [−.03905] | [−.02089] | [.02381] | [−.00105] | [−.03758] | [−.02580] | [−.01323] | [−.00127] |
| | {.000} | {−.001} | {−.001} | {.001} | {−.000} | {−.001} | {−.001} | {−.000} | {−.000} |
| Outside Block Group | | | | | | | | | |
| Single-family rental | .00488 | .02694** | .02519** | −.00158 | .01845* | .04268*** | .02348** | .04405*** | .05519 |
| | (.00813) | (.01120) | (.01107) | (.00924) | (.01055) | (.00860) | (.01156) | (.01672) | (.05163) |
| | [.32149] | [.49549] | [.36725] | [−.06935] | [.13723] | [.41433] | [.35671] | [.13566] | [.00685] |
| | {.052} | {.080} | {.059} | {−.011} | {.022} | {.066} | {.057} | {.022} | {.001} |
| Apartment | .00001 | −.00098 | −.00019 | .00003 | .00039 | −.00179** | −.00083 | −.00201 | −.00408 |
| | (.00063) | (.00083) | (.00088) | (.00071) | (.00089) | (.00072) | (.00090) | (.00146) | (.00477) |
| | [.00059] | [−.01809] | [−.00278] | [.00125] | [.00288] | [−.01738] | [−.01256] | [−.00620] | [−.00051] |
| | {.000} | {−.003} | {−.001} | {.000} | {.001} | {−.003} | {−.002} | {−.001} | {−.000} |
| Condominium rental | .00020 | −.00182 | .00060 | −.00007 | .00173 | −.00196 | −.00143 | −.00476 | −.01396 |
| | (.00176) | (.00225) | (.00231) | (.00194) | (.00242) | (.00193) | (.00243) | (.00399) | (.01356) |
| | [.01308] | [−.03352] | [.00869] | [−.00320] | [.01284] | [−.01908] | [−.02171] | [−.01466] | [−.00173] |
| | {.003} | {−.000} | {.002} | {−.001} | {.003} | {−.004} | {−.005} | {−.003} | {−.000} |
| REO | −.04172 | −.25304** | −.16568 | .01298 | −.22044* | −.41408*** | −.21486 | −.43884** | −.48894 |
| | (.08554) | (.11592) | (.11737) | (.09841) | (.11569) | (.09455) | (.12020) | (.18009) | (.55170) |
| | [−2.74724] | [−4.65390] | [−2.41523] | [.56912] | [−1.63968] | [−4.02000] | [−3.26234] | [−1.35136] | [−.06072] |
| | {−.022} | {−.038} | {−.019} | {.005} | {−.013} | {−.032} | {−.026} | {−.011} | {−.000} |
| Single-family owner | −.00017 | −.00162*** | −.00169*** | .00017 | −.00073 | −.00255*** | −.00144** | −.00260*** | −.00391 |
| | (.00046) | (.00063) | (.00060) | (.00049) | (.00056) | (.00047) | (.00663) | (.00094) | (.00296) |
| | [−.01148] | [−.02985] | [−.02460] | [.00758] | [−.00541] | [−.02481] | [−.02191] | [−.00799] | [−.00048] |
| | {−.004} | {−.010} | {−.008} | {.002} | {−.002} | {−.008} | {−.007} | {−.003} | {−.000} |
| Condominium owner | .00069 | .00331** | .00328** | −.00001 | .00259 | .00558*** | .00288* | .00544** | .00750 |
| | (.00122) | (.00163) | (.00166) | (.00140) | (.00160) | (.00130) | (.00170) | (.00247) | (.00781) |
| | [.04519] | [.06091] | [.04786] | [−.00856] | [−.01926] | [.05418] | [.04373] | [.01675] | [.00093] |
| | {.012} | {.016} | {.013} | {−.002} | {.005} | {.014} | {.012} | {.005} | {.000} |
| Commercial | .00001 | .00002 | .00006 | −.00001 | .00001 | .00003 | .00002 | .00005 | .00005 |
| | (.00013) | (.00023) | (.00016) | (.00016) | (.00020) | (.00012) | (.00022) | (.00029) | (.00037) |
| | [.00073] | [.00039] | (.00085] | [−.00009] | [.00009] | [.00031] | [.00026] | [.00015] | [.00001] |
| | {.001} | {.000} | {.001} | {−.000} | {.000} | {.000} | {.000} | {.000} | {.000} |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Industrial | −.00010 | .00009 | .00040 | −.00028 | .00049 | .00044 | .00016 | −.00084 | .00194 |
| | (.00092) | (.00111) | (.00094) | (.00101) | (.00111) | (.00086) | (.00107) | (.00192) | (.00523) |
| | [−.00671] | [.00171] | [.00583] | [−.01249] | [.00362] | [.00426] | [.00239] | [−.00259] | [.00024] |
| | {−.000} | {.000} | {.000} | {−.001} | {.000} | {.000} | {.000} | {−.000} | [.004} |

Notes:

(i) Each equation also contains year dummies, time means of explanatory variables at the block group level, and control variables for endogeneity.

(ii) The numbers in parentheses are standard errors clustered at the block group level based on 1,000 bootstrap replications. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

(iii) Average marginal effects are in square brackets.

(iv) The number in curly braces is the probability of a housing unit in the median block group experiencing the crime from a within standard deviation increase in the explanatory variable.

Table 2
Crime on owner-occupied single-family properties within neighborhood: Poisson control function estimates.

| | Property Crime | Violent Crime | Burglary | Larceny | Vehicle Theft | Vandalism | Assault | Robbery |
|---|---|---|---|---|---|---|---|---|
| Within Block Group | | | | | | | | |
| Single-family rental | −.04059*** | −.04254*** | −.06747*** | −.02947** | −.02830* | −.03860** | −.03842** | −.09137** |
| | (.01378) | (.01706) | (.01913) | (.01462) | (.01665) | (.01685) | (.01788) | (.03745) |
| | [−.74114] | [−.13511] | [−.34436] | [−.32487] | [−.06030] | [−.11317] | [−.10955] | [−.02967] |
| | {−.112} | {−.020} | {−.052} | {−.049} | {−.009} | {−.017} | {−.016} | {−.004} |
| Apartment | .00308* | .00049 | .00268 | .00342* | .00261 | .00264 | .00137 | −.01261** |
| | (.00169) | (.00164) | (.00213) | (.00193) | (.00181) | (.00182) | (.00168) | (.00523) |
| | [.05616] | [.00016] | [.01368] | [.03776] | [.00557] | [.00773] | [.00390] | [−.00410] |
| | {.012} | {.000} | {.003} | {.008} | {.001} | {.002} | {.001} | {−.001} |
| Condominium rental | .01853** | .01051 | .02278** | .01698** | .01755** | .02477*** | .01392* | −.04390* |
| | (.00749) | (.00792) | (.00978) | (.00865) | (.00846) | (.00843) | (.00812) | (.02438) |
| | [.33842] | [.03239] | [.11627] | [.18722] | [.03738] | [.07262] | [.03970] | [−.01426] |
| | {.071} | {.007} | {.024} | {.040} | {.008} | {.015} | {.008} | {−.003} |
| REO | −.11552 | −.29436** | −.19124 | −.08023 | −.06428 | −.17672 | −.23922* | −1.12923*** |
| | (.11472) | (.11815) | (.14876) | (.12994) | (.12056) | (.12348) | (.12231) | (.33869) |
| | [−2.10916] | [−.93484] | [−.97603] | [−.88450] | [−.13698] | [−.51809] | [−.68201] | [−.36682] |
| | {−.009} | {−.004} | {−.004} | {−.004} | {−.001} | {−.002} | {−.003] | {−.002} |
| Single-family owner | .00168 | .00209 | .00304 | .00111 | .00028 | −.00160 | .00178 | .00713** |
| | (.00215) | (.00155) | (.00234) | (.00232) | (.00193) | (.00233) | (.00155) | (.00349) |
| | [.03075] | [.00664] | [.01552] | [.01228] | [.00061] | [−.00468] | [.00508] | [.00231] |
| | {.011} | {.002} | {.005} | {.004} | {.000} | {−.002} | {.002} | {.001} |
| Condominium owner | −.01499*** | −.01604*** | −.02133*** | −.01222*** | −.01434*** | −.02037*** | −.01586*** | −.01575* |
| | (.00408) | (.00483) | (.00500) | (.00430) | (.00460) | (.00488) | (.00504) | (.00940) |
| | [−.27377] | [−.05095] | [−.10884] | [−.13468] | [−.03055] | [−.05971] | [−.04523] | [−.00512] |
| | {−.069} | {−.013} | {−.026} | {−.034} | {−.008} | {−.015} | {−.011} | {−.001} |
| Commercial | −.00032 | −.00026 | −.00059 | −.00022 | −.00009 | −.00038 | −.00019 | −.00116 |
| | (.00123) | (.00147) | (.00149) | (.00113) | (.00164) | (.00131) | (.00150) | (.00167) |
| | [−.00583] | [−.00083] | [−.00304] | [−.00244] | [−.00020] | [−.01122] | [−.00055] | [−.00038] |
| | {−.006} | {−.001} | {−.003} | {−.002} | {−.000} | {−.001} | {−.000} | {−.000} |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Industrial | −.00464 | −.00387 | −.00788* | −.00344 | −.00160 | −.00666 | −.00399 | .00055 |
| | (.00355) | (.00545) | (.00453) | (.00389) | (.00385) | (.00486) | (.00591) | (.01013) |
| | [−.08479] | [−.01229] | [−.04022] | [−.03794] | [−.00342] | [−.01954] | [−.01139] | [.00018] |
| | {−.006} | {−.001} | {−.002} | {−.003} | {−.000} | {−.001} | {−.001} | {.000} |
| Outside Block Group | | | | | | | | |
| Single-family rental | .03553*** | .03386** | .06086*** | .02422** | .03636*** | .06339*** | .03163** | .04266 |
| | (.01144) | (.01501) | (.01560) | (.01214) | (.01375) | (.01421) | (.01568) | (.03175) |
| | [.64872] | [.10754] | [.31061] | [.26705] | [.07748] | [.18584] | [.09018] | [.01386] |
| | {.211} | {.034} | {.102} | {.086} | {.021} | {.060} | {.029} | {.005} |
| Apartment | −.00150 | −.00119 | −.00283** | −.00114 | .00032 | −.00154 | −.00107 | −.00245 |
| | (.00093) | (.00123) | (.00127) | (.00102) | (.00120) | (.00124) | (.00129) | (.00297) |
| | [−.02747] | [−.00378] | [−.01445] | [−.01258] | [.00068] | [−.00452] | [−.00306] | [−.00079] |
| | {−.010} | {−.001} | {−.005} | {−.004} | {.000} | {−.001} | {−.001} | {−.000} |
| Condominium rental | −.00398* | −.00385 | −.00653** | −.00381 | .00315 | −.00137 | −.00388 | −.00450 |
| | (.00235) | (.00334) | (.00327) | (.00269) | (.00329) | (.00338) | (.00348) | (.00841) |
| | [−.07247] | [−.01223] | [−.03333] | [−.04199] | [.00672] | [−.00401] | [−.01108] | [−.00146] |
| | {−.002} | {−.005} | {−.015} | {−.018} | {.003} | {−.002} | {−.005} | {−.001} |
| REO | −.30338** | −.27782* | −.53645*** | −.19000 | −.34543** | −.56908*** | .27501 | −.10025 |
| | (.12552) | (.16761) | (.17464) | (.13573) | (.15398) | (.15607) | (.17401) | (.37318) |
| | [−5.53916] | [−.88233] | [−2.73783] | [−2.09456) | [−.73604] | [−1.66837] | [−.78406] | [−.03257] |
| | {−.091} | {−.014} | {−.044} | {−.034} | {−.012} | {−.027} | {.013} | {−.001} |
| Single-family owner | −.00128** | −.00200*** | −.00277*** | −.00070 | −.00098 | −.00346*** | −.00161** | −.00606*** |
| | (.00058) | (.0069) | (.00080) | (.00063) | (.00074) | (.00073) | (.00072) | (.00178) |
| | [−.02345] | [−.00635] | [−.01415] | [−.00771] | [−.00210] | [−.01013] | [−.00459] | [−.00197] |
| | {−.016} | {−.004} | {−.010} | {−.006} | {−.001} | {−.007} | {−.003} | {−.001} |
| Condominium owner | .00554*** | .00456** | .00926*** | .00386 | .00585*** | .00852*** | .00464** | .00114 |
| | (.00194) | (.002439) | (.00257) | (.00206) | (.00228) | (.00228) | (.00254) | (.00502) |
| | [.10121] | [.01445] | [.04725] | [.04256] | [.01245] | [.02498] | [.01323] | [.00037] |
| | {.054} | {.007} | {.025} | {.022} | {.006} | {.013} | {.007} | {.000} |
| Commercial | .00005 | .00002 | .00008 | .00003 | .00010 | .00005 | .00003 | −.00002 |
| | (.00032) | (.00293) | (.00047) | (.00027) | (.00024) | (.00036) | (.00311) | (.00030) |
| | [.00087] | [.00009] | [.00044] | [.00034] | [.00021] | [.00015] | [.00009] | [−.00001] |
| | {.002} | {.000} | {.008} | {.001} | {.000} | {.000} | {.000} | {−.000} |
| Industrial | .00296* | .00174 | .00182 | .00351* | .00319* | .00388 | .00229 | −.00946* |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | (.00164) | (.00171) | (.00201) | (.00188) | (.00192) | (.00211) | (.00180) | (.00489) |
| | [.05399] | [.00553] | [.00930] | [.03867] | [.00680] | [.01137] | [.00653] | [−.00307] |
| | {.004} | {.000} | {.004} | {.003} | {.000} | {.001} | {.000} | {−.000} |

Notes:

(i) Each equation also contains year dummies, time means of explanatory variables at the block group level, and control variables for endogeneity.

(ii) The numbers in parentheses are standard errors clustered at the block group level based on 1,000 bootstrap replications. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

(iii) Average marginal effects are in square brackets.

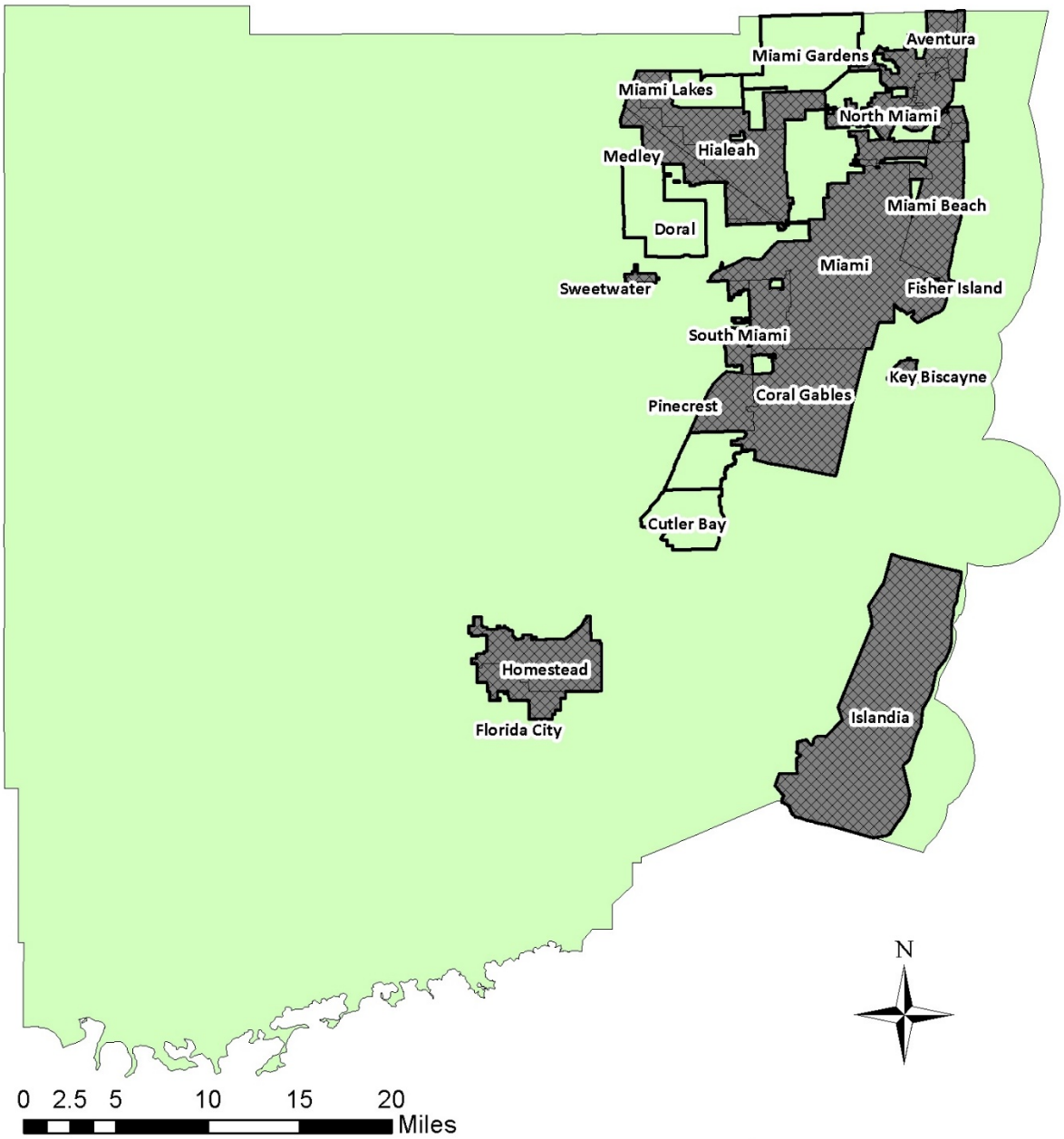
(iv) The number in curly braces is the probability of a housing unit in the median block group experiencing the crime from a within standard deviation increase in the explanatory variable.

Table 3
Predicted changes in property crimes from changes in mean values: 2002–2014.

| | Block Group | | Single-Family Owner-Occupied | |
|---|---|---|---|---|
| | Absolute Change | Percentage Change | Absolute Change | Percentage Change |
| Changes in | | | | |
| All variables | 11.725 | 17.261 | 8.635 | 58.447 |
| Within Block Group | | | | |
| Single-family rental | −1.006 | −1.481 | −7.424 | −50.250 |
| Apartment | −.452 | −.665 | −.311 | −2.105 |
| Condominium rental | 2.864 | 4.216 | 3.141 | 21.260 |
| REO | 1.403 | 2.065 | −.951 | −6.437 |
| Single-family owner | −2.525 | −3.717 | 1.056 | 7.158 |
| Condominium owner | 4.258 | 6.268 | 8.602 | 58.224 |
| Commercial | −.001 | −.001 | .093 | .629 |
| Industrial | .022 | .032 | −.233 | −1.577 |
| Outside Block Group | | | | |
| Single-family rental | 18.357 | 27.024 | 69.484 | 470.313 |
| Apartment | −.012 | −.018 | .465 | 3.147 |
| Condominium rental | .480 | .265 | −1.940 | −13.131 |
| REO | −5.437 | −8.004 | −6.720 | −45.485 |
| Single-family owner | −1.225 | −1.803 | −1.854 | −12.549 |
| Condominium owner | −3.079 | −4.533 | −4.617 | −31.251 |
| Commercial | −.059 | −.087 | −.056 | −.379 |
| Industrial | −.054 | −.079 | .345 | 2.355 |

Note: The estimate for the individual property type is the change in property crime (2002 to 2014) from changing the number of the property from its mean value in 2002 to its mean value in 2014, holding the numbers of all other properties at their 2002 mean values.

# Miami-Dade County: Crime Coverage Area




Our crime data includes the entire unincorporated portion of Miami-Dade County, as well as the following jurisdictions: Miami Gardens, Miami Lakes, Doral, Palmetto Bay and Cutler Bay. Jurisdictions excluded from our sample are marked with a crosshatch.

Excluded Areas
Census Places
Crime Coverage Area

Appendix Table A.1
Summary results for first-stage regressions.

| Variable | *F*-statistic | Under-Identification Chi-Square | Weak Identification *F* |
|---|---|---|---|
| Within Block Group | | | |
| Single-family rental | 11.92 | 10.62 | 10.56 |
| | (.000) | (.001) | (.001) |
| Apartment | 18.41 | 10.75 | 10.69 |
| | (.000) | (.001) | (.001) |
| Condominium rental | 3.96 | 10.67 | 10.61 |
| | (.000) | (.001) | (.001) |
| REO | 8.31 | 8.77 | 8.72 |
| | (.000) | (0.003) | (.003) |
| Single-family owner | 10.12 | 11.21 | 11.15 |
| | (.000) | (.001) | (.001) |
| Condominium owner | 10.07 | 27.77 | 27.62 |
| | (.000) | (.000) | (.000) |
| Commercial | 79.25 | 41.68 | 41.45 |
| | (.000) | (.000) | (.000) |
| Industrial | 8.98 | 15.46 | 15.37 |
| | (.000) | (.000) | (.000) |
| Outside Block Group | | | |
| Single-family rental | 18.85 | 17.77 | 17.67 |
| | (.000) | (.000) | (.000) |
| Apartment | 20.29 | 12.82 | 12.75 |
| | (.000) | (.000) | (.000) |
| Condominium rental | 7.78 | 11.03 | 10.97 |
| | (.000) | (.001) | (.001) |
| REO | 15.55 | 15.44 | 15.36 |
| | (.000) | (.000) | (.000) |
| Single-family owner | 18.12 | 15.29 | 15.20 |
| | (.000) | (.000) | (.000) |
| Condominium owner | 15.36 | 27.38 | 27.23 |
| | (.000) | (.000) | (.000) |
| Commercial | 3650 | 1057 | 1051 |
| | (.000) | (.000) | (.000) |
| Industrial | 26.02 | 16.47 | 16.38 |
| | (.000) | (.000) | (.000) |

Notes: *p*-value is in parentheses. The last two columns are first-stage chi-squared and *F* statistics that test the under-identification and weak identification of individual regressors.

Appendix Table A.2
Means and standard deviations of crimes.

| | Neighborhood (Block Group) | | On Single-Family Owned Properties | |
|---|---|---|---|---|
| | Mean | Standard Deviation | Mean | Standard Deviation |
| Property Crime | 65.857 | 56.668 | 18.258 | 15.785 |
| Violent Crime | 18.393 | 23.000 | 3.176 | 4.045 |
| Burglary | 14.577 | 13.201 | 5.104 | 5.592 |
| Larceny | 43.841 | 45.113 | 11.024 | 9.811 |
| Motor Vehicle Theft | 7.438 | 7.567 | 2.131 | 2.701 |
| Vandalism | 9.708 | 7.506 | 2.932 | 3.199 |
| Assault | 15.189 | 18.468 | 2.851 | 3.666 |
| Robbery | 3.079 | 5.160 | .324 | .734 |
| Murder | .124 | .411 | | |

Appendix Table A.3
Means and within standard deviations of explanatory variables.

| | Mean | Within Standard Deviation |
|---|---|---|
| Within Block Group | | |
| Single-family rental | 59.547 | 35.290 |
| Apartment | 67.512 | 49.725 |
| Condominium rental | 58.539 | 48.764 |
| REO | 1.481 | 1.055 |
| Single-family owner | 245.398 | 80.289 |
| Condominium owner | 85.167 | 59.575 |
| Commercial | 26.063 | 222.078 |
| Industrial | 74.231 | 15.126 |
| Outside Block Group | | |
| Single-family rental | 160.409 | 75.687 |
| Apartment | 180.773 | 83.657 |
| Condominium rental | 148.223 | 101.879 |
| REO | 4.155 | 3.832 |
| Single-family owner | 637.365 | 161.016 |
| Condominium owner | 203.221 | 124.189 |
| Commercial | 88.458 | 446.152 |
| Industrial | 19.845 | 19.426 |