

# The Impact of Single-family Mortgage Foreclosures on Neighborhood Crime

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**ABSTRACT** *Foreclosures of single-family mortgages have increased dramatically in many parts of the US in recent years. Much of this has been tied to the rise of higher-risk subprime mortgage lending. Debates concerning mortgage regulation, as well as around other residential finance policies and practices, hinge critically on the social as well as personal costs of loan default and foreclosure. This paper examines the impact of foreclosures of single-family mortgages on levels of violent and property crime at the neighborhood level. Using data on foreclosures, neighborhood characteristics, and crime, the study found that higher foreclosure levels do contribute to higher levels of violent crime. The results for property crime are not statistically significant. A standard deviation increase in the foreclosure rate (about 2.8 foreclosures for every 100 owner-occupied properties in one year) corresponds to an increase in neighborhood violent crime of approximately 6.7 per cent. The policy implications of these findings are discussed.*

**KEY WORDS:** Foreclosures, subprime loans, mortgages, crime

## Introduction

In March of 2000, Mayor Richard M. Daley of Chicago held a press conference in front of a boarded-up brick bungalow on Chicago's Southwest Side to announce a proposed ordinance aimed at reducing mortgage foreclosures in city neighborhoods (Washburn, 2000). The mayor compared the 'menace' of abusive mortgage lending and resulting foreclosures to the problem of criminal street gangs. He went on to say that "vacant buildings are ugly. They attract gangs ... They are the most frequent problems encountered by the (community policing program) and by block clubs and community organizations" (Spielman, 2000, p.24). In the next few months, a high-profile series of six murders in abandoned buildings in one South Side neighborhood brought increased attention to the problem of abandoned properties. By September, the City had passed the first municipal ordinance in the country aimed at reducing predatory lending. Supporters

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of the law continually referred to the scourge of abandoned buildings stemming from high-risk home loans as a principal reason for passing the law.

Community concern over the problem of boarded-up and abandoned buildings, many of which stemmed from increased mortgage foreclosures, provided important political support for passage of the City's hotly contested predatory lending ordinance. Certainly concern for the more direct victims of predatory mortgages and the other effects that blighted buildings may have on a community played a role as well, but the notion that such buildings lead to increased crime was a critical factor. Yet despite the clear convictions of the Mayor and many other policy makers and community groups around the country that vacant and abandoned homes can lead to crime, the systematic research in this area is quite scarce. In fact, the authors are aware of only one study that systematically links abandoned buildings to crime and none that measure the effect of foreclosures on crime. Spencer (1993) found that crime rates on blocks with open abandoned buildings were twice as high as rates on similar blocks without open buildings.

This paper seeks to measure the effect of foreclosures of single-family homes on levels of violent and property crime at the neighborhood level. It is not suggested that any effect of foreclosures on crime is more important than other harms that foreclosures might cause. Effects on the directly affected households as well as other neighborhood impacts (e.g. aesthetics, stability or property value) may be as or more important than any effects on crime. However, effects on crime are clearly of concern, especially in many of the neighborhoods that have been hit hard by the growing levels of foreclosures in cities across the US.

### **The Foreclosure Problem**

Nationally, foreclosure levels in the US have generally risen significantly since the 1970s. During the 1980s, foreclosure rates on conventional loans rose significantly from about 0.3 to 0.4 per cent up to levels of around 0.8 per cent by the end of the decade (Elmer & Seelig, 1998). This may have been expected to some degree due to the strong economic restructuring during the 1980s. However, even as the economy improved in the latter part of the decade foreclosure rates increased. In the 1990s, despite a strong economy during most of the decade, foreclosures continued a generally upward trend reaching 1.04 per cent by 1997. In the late 1990s and early 2000s, the pattern remained one of historically high foreclosure levels, peaking at 1.3 per cent in late 2003 before declining a small amount in 2004 (Federal Deposit Insurance Corporation, 2004).

States such as Indiana, Ohio, Kentucky, South Carolina, Pennsylvania and Mississippi all had foreclosure rates above 2 per cent in late 2003 (Federal Deposit Insurance Corporation, 2004). Twenty-three states saw increases in foreclosures of more than 24 per cent from the end of 2001 to the end of 2003, with eight of these seeing increases of more than 50 per cent over the period. While the weak economy certainly contributed to this problem, the magnitude of these increases was particularly large and is certainly related to the underlying vulnerability of the mortgages to economic downturns.

Immergluck & Smith (2005) show that, in the Chicago area, foreclosure starts rose 238 per cent from 1995 to 2002. Although foreclosures of government-guaranteed mortgages rose by 105 per cent, conventional foreclosures increased at a much faster pace of 350 per cent. As a result, while conventional loans accounted for only slightly more than half of

foreclosures in 1995, they accounted for almost three out of four just seven years later. Much of the increased foreclosure activity in the Chicago area was concentrated in lower-income and minority communities. Neighborhoods with minority populations of less than 10 per cent in 2000 saw an increase in foreclosures of 215 per cent, while neighborhoods with 90 per cent or greater minority populations experienced an increase of 544 per cent. Neighborhoods with 90 per cent or more minority residents in 2000 accounted for 40 per cent of the 1995–2002 increase in conventional foreclosures. These same tracts represent only 9.2 per cent of the owner-occupied housing units in the region. Tracts with 50 per cent or greater minority populations accounted for more than 61 per cent of the increase in conventional foreclosures.

Foreclosures can entail significant costs and hardships for the families affected. McCarthy *et al.* (2000) describe how foreclosures can involve losing not only accumulated home equity and the costs associated with acquiring the home, but also access to stable, decent housing. Moreover, foreclosures can damage credit ratings, hurting the owners' prospects not only in credit markets but also in labor and insurance markets and in the market for rental housing. Moreno (1995) estimated average losses to a foreclosed family of \$7200.

But the economic and social costs of foreclosures may affect more than the families most directly involved. Foreclosures can have implications for surrounding neighborhoods and even for their larger communities. Cities, counties and school districts may lose tax revenue from abandoned homes. In examining FHA foreclosures, for example, Moreno (1995) estimated average city costs of \$27 000 and neighborhood costs of \$10 000. Moreover, these figures do not account for all of the social and psychic costs of foreclosures, either to the family or the community. One of the possible social costs is increased crime.

### **Subprime Lending and Increasing Foreclosures in Urban Areas**

The problem of high foreclosure levels in recent years has been linked to the increasing activity of subprime mortgage lenders that specialize in lending to borrowers with imperfect credit. A number of studies have identified some relationship between subprime lending and foreclosures at the neighborhood level (Burnett *et al.*, 2002; Collins, 2003; Gruenstein & Herbert, 2000; Newman & Wyly, 2004). In Atlanta, Abt & Associates found that foreclosures attributed to subprime lenders accounted for 36 per cent of all foreclosures in predominantly minority neighborhoods in 1999, while their share of loan originations was between 26 and 31 per cent in the preceding three years (Gruenstein & Herbert, 2000). In Essex County, New Jersey, researchers found that the percentage of foreclosures attributed to subprime lenders increased from 19 per cent in 1995 to 30 per cent in 2000, although they also admitted that these figures substantially underestimated the subprime share of foreclosures (Newman & Wyly, 2004).

In general, these studies tend to underestimate the proportion of foreclosures due to subprime originators because many subprime loans are sold to financial institutions identified by the US Department of Housing and Urban Development as 'prime' lenders or are held in trusts at prime lending institutions (usually banks). Thus, foreclosures of subprime loans sold to prime lenders or trusts would list only the prime lender who currently holds the loan, not the originating subprime lender. The reverse generally does not occur. That is, subprime lenders do not tend to buy loans from prime lenders and generally do not have trust capacity.

Immergluck & Smith (2005) found that subprime lending has a very substantial effect on foreclosures. In the case of refinance lending, for example, a tract with 100 more subprime loans over a five-year period (compared to a standard deviation of 73 loans), other things equal, corresponds to almost eight foreclosures in the year following this period. The effect of subprime lending on foreclosures is generally on the order of 20 to 30 times the effect of prime lending, after controlling for neighborhood economic and demographic conditions.

Quercia *et al.* (2005) found that 20.7 per cent of all first-lien subprime refinance loans originated in 1999 had entered foreclosure by December 2003 and that the rate at which subprime loans entered foreclosure in late 2003 was more than ten times the rate for prime loans.

### **From Foreclosure to Vacancy and Abandonment**

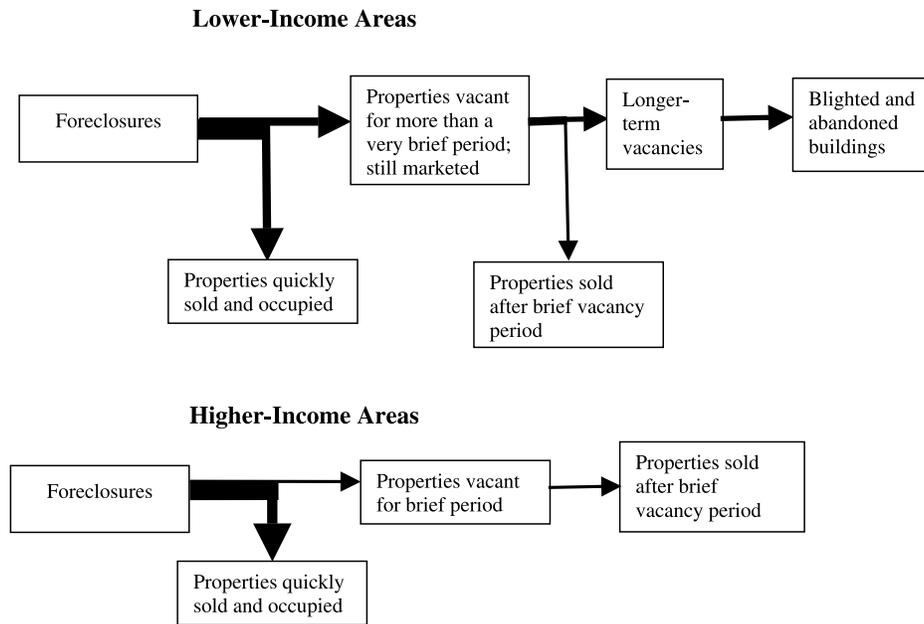
In most middle- and upper-income neighborhoods where demand for residential property is strong, where foreclosures are not very densely concentrated, and where homebuyers and lenders have a great deal of certainty about property values and the ability to resell properties at reasonable levels of appreciation, the negative impacts of foreclosures on a neighborhood or larger community are unlikely to be very high.

However, in low- and moderate-income neighborhoods, or neighborhoods in which residents are struggling with various forms of economic duress, foreclosures may impose significant negative externalities. Race may play a role too, as property value trajectories in minority neighborhoods may be more easily destabilized by visible, confidence-reducing events such as foreclosure sales. For example, Lauria & Baxter (1999) found that foreclosures encouraged white flight and speedier racial transition in neighborhoods that already had substantial black populations.

A chief mechanism through which foreclosures harm neighborhoods is through the triggering of extended vacancies or, worse, abandoned and blighted buildings. This is not to say that concentrated foreclosures in a middle or even upper-income neighborhood may not have a deleterious effect on property values or other negative effects. However, the concentration of foreclosures in a short period of time in such areas is less common and, even if they are subject to high levels of foreclosures over a certain period, upper- and middle-income neighborhoods are generally more resilient.

Figure 1 presents a simplified depiction of the difference in the chain of events likely to be spurred by foreclosures in a struggling, lower-income neighborhood versus an economically stronger neighborhood. In lower-income areas, a substantial percentage of foreclosures are likely to lead to buildings being vacant for some extended period of time. This extended vacancy alone may cause a partial loss of confidence among homeowners. More importantly, as some of these vacancies age, the buildings are likely to be the targets of vandalism, provide havens for criminal behavior, and generally become sources of significant negative externalities to neighboring residents. Thus, it is *through* longer-term vacancy and abandonment that foreclosures affect neighborhood crime.

In higher-income neighborhoods, foreclosures will generally lead to the property being sold fairly quickly to new homeowners. Depending on the particulars of the local housing market, some foreclosures may result in modest short-term vacancies. However, few homes will be exposed to extended vacancies and the sorts of physical blight that will sometimes occur in lower-income areas.



**Figure 1.** Results of foreclosures in lower- versus higher-income neighborhood

### From Vacancy and Abandonment to Crime

Before analyzing the effect of foreclosures on neighborhood crime, it is important to place this research in the context of a substantial literature on the effect on neighborhood crime of what sociologists refer to as social and physical disorder. Vacant and abandoned buildings are often considered a component of neighborhood *physical* disorder (as opposed to *social* disorder). Physical disorder involves “signs of negligence and unchecked decay” in a neighborhood (Skogan, 1990, p. 4). Physical disorder refers more to sustained conditions than to particular events. However, these conditions are, of course, created by events and actions. Moreover, Skogan (1990, p. 36) suggests that physical disorder is more often caused by legal, if destructive, actions by perpetrators rather than by criminals or offenders. Social disorder, on the other hand, is comprised specific undesirable events and behavior (e.g. aggressive panhandling or public drinking) that may in turn cause more serious problems, including crime, although this causation is disputed (Sampson & Raudenbush, 1999).

Several observers and researchers have argued that physical and social disorder causes crime (Kelling & Coles, 1996; Skogan, 1990; Wilson & Kelling, 1982). They argue that disorder undermines the ways in which communities maintain social control. Fewer residents are concerned about or take responsibility for disorder in public spaces outside their own households. Criminals flock to such communities because they do not fear being caught. Thus, social and physical disorder leads to more serious criminal acts.

However, Sampson & Raudenbush (1999) argue that disorder is not typically a cause of crime, but that many elements of disorder are a component—perhaps not always well measured—of crime itself. Moreover, they argue that physical disorder, such as smashed

windows and drug vials in the streets, is evidence either of crime or violations of ordinances.

Given this definition of physical disorder, vacant and abandoned houses should be seen as a phenomenon distinct from disorder. While some vacant or abandoned homes may be in violation of housing ordinances, the conditions of the homes are rarely *caused* by the violations. While such buildings may be the result of illegal activity or social disorder on the part of those having some physical presence in the neighborhood, they are generally unlikely to be. An act of arson can result in abandonment if the owner of the victimized house lacks adequate insurance. However, if a homeowner suffers a crisis of some kind and cannot pay her mortgage, her home may be foreclosed upon and the house may become vacant and then perhaps boarded up and eventually abandoned. While the effect of this calamity is to increase neighborhood blight, the causation is quite external and not caused by local crime, ordinance violations or social disorder. It may have more to do with a layoff at an employer far from the neighborhood. Likewise, if an abandoned building results from a foreclosure due to a high-risk subprime mortgage loan, no local crime or ordinance violation was instrumental in creating the problem.

Skogan (1990) argues that abandoned buildings can harm a neighborhood in different ways. First, they can harbor decay. They may be havens for trash, rats or other stray animals, squatters or even criminals. Abandoned houses may also be used as places where drugs are sold and used, or used by predatory criminals who may attack neighborhood residents. Finally, vacant or abandoned homes may be targets of vandalism, the theft of wiring or other building components, or arson. However, property theft from such buildings may be less likely to be reported than theft from occupied buildings. Indirectly, the presence of boarded-up and abandoned buildings may lead to a lack of collective concern by neighborhood residents with neighborhood crime.

### Methods and Data

To identify the effect of foreclosures on neighborhood crime, we first attempt to estimate a reduced form equation relating foreclosures and other neighborhood conditions to neighborhood crime:

$$\ln C_i = a + b_1 P_i + b_2 B_i + b_3 Z_i + b_4 F_i + \varepsilon_i \quad (1)$$

where  $\ln C_i$  is the natural log of the number of crime incidents in census tract  $i$ , which will later be disaggregated into violent and property crime.  $P_i$  is the population of the tract,  $B_i$  is the number of businesses in the tract, and  $Z_i$  is a vector of resident characteristics that might be expected to affect neighborhood crime rates based on the literature.  $F_i$  is the tract foreclosure rate, measured by the number of foreclosures divided by the number of owner-occupiable housing units in tract  $i$ .<sup>1</sup>

While some attempts to estimate neighborhood crime levels use per-capita crime rates as the dependent variable (Kubrin & Squires, 2004), in this study a less restricted specification is preferred, in which the raw number of crime incidents is a function of population level, the number of businesses and characteristics of the population. First, violent crimes occur against those who work as well as those who live in neighborhoods. Neighborhood retail centers and business clusters are frequently crime 'hot spots'. In the case of property crime, it might be expected that the number of businesses would be an especially strong factor. Ideally, the study would have additional information on the

businesses, particularly total number of employees in the tract, but such data are not available at a census tract level in the City of Chicago.

The dependent variable is transformed as the log of the raw crime figure because the crime figures are substantially skewed in their distribution. Logging these variables creates dependent variables that follow the normal distribution much more closely, fulfilling an important assumption of ordinary least squares regression. To illustrate this point, Figure 2

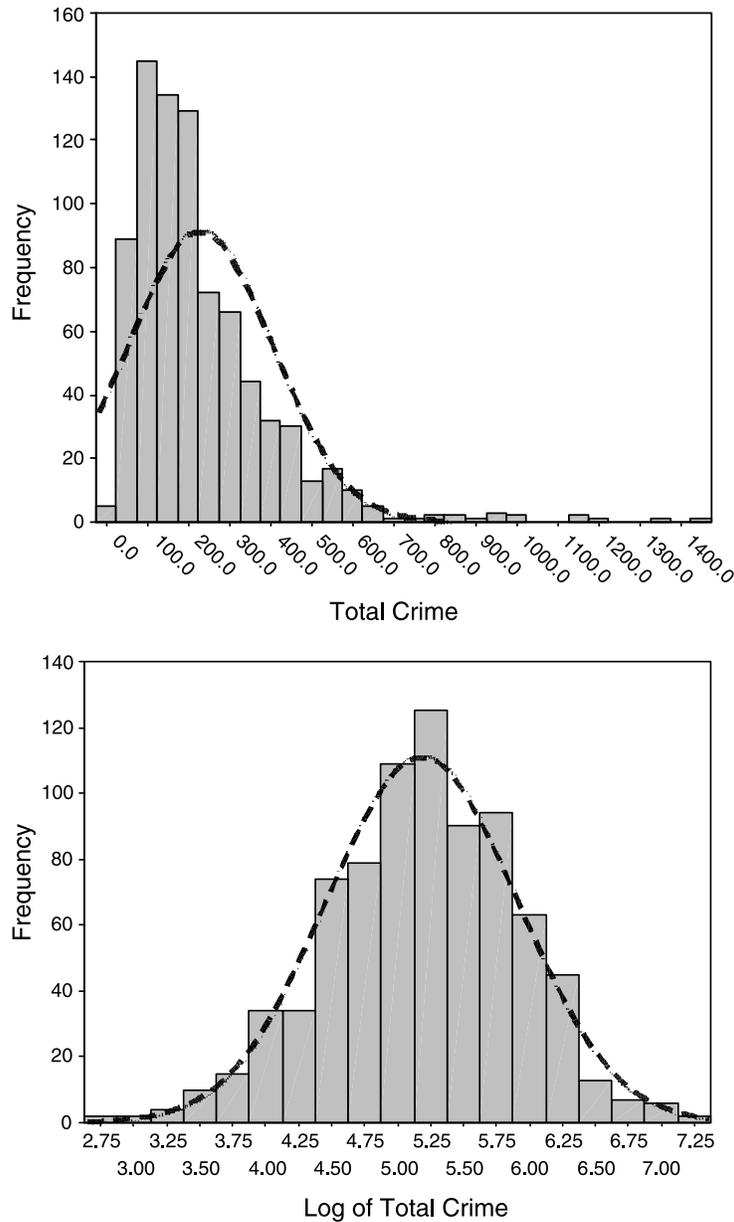


Figure 2. Frequency distributions of total crime and log of total crime

compares the distribution of total crime and the log of total crime. Coincidentally, the resulting semilog functional form provides for a convenient interpretation of the coefficients of the independent variables. That is, the coefficients represent the percentage change in absolute crime levels for a one-unit change in the independent variable.

To estimate equation (1), tract-level data from the 2000 census, business count data from Dun and Bradstreet and crime data from the Chicago police department are combined for tracts in the central city. The available police and business count data are from 2001. Crime data are aggregated into violent crime and property crime, the sum of which yields total crime. Based on recent literature on neighborhood crime (Kubrin & Squires, 2004; Morenoff *et al.*, 2001), the following variables were constructed that described resident characteristics that might be expected to affect neighborhood crime rates:

- the proportion of residents living below the poverty line in 1999;
- the proportion of residents on public assistance in 2000;
- median family income in 1999;
- the unemployment rate in 2000;
- the percentage of residents who are black;
- the percentage of residents who are Hispanic;<sup>2</sup>
- the proportion of residents who are males aged 14 to 24;
- the proportion of households headed by females and with children below 18;
- the proportion of persons aged 15 and over who are divorced;
- the proportion of persons aged 5 and above who have changed residences in the last five years (percentage of recent residents); and
- the proportion of occupied housing units occupied by renters

Table 1 gives the mean and standard deviation of the dependent and independent variables used in estimating equation (1). Table 2 gives the Pearson correlations between the dependent variables and each of the independent variables. As expected, population and

**Table 1.** Summary statistics

	Mean	Std. deviation
Log of violent crime incidents	3.5699	0.9968
Log of property crime incidents	4.9037	0.7240
Log of total crime incidents	5.1833	0.7235
Population	3520.60	2593.45
Number of businesses	85.44	220.81
Median family income in 1999	46 789	26 957
Unemployment rate	7.01%	5.39%
Proportion below poverty	0.2156	0.1524
Percent female headed households	0.2272	0.1755
Proportion 15 and over divorced	0.0894	0.0385
Proportion on Public Assistance	0.0880	0.0872
Proportion of residents who are male aged 14 to 24	0.1694	0.0713
Proportion of households that rent	0.5676	0.2206
Proportion of residents who have moved within 5 years	0.5191	0.1561
Per cent black	41.45%	43.25%
Per cent Hispanic	23.38%	28.67%
Foreclosures in 2001 per owner-occupiable structures	0.0238	0.0287

**Table 2.** Pearson correlations between independent variables and crime levels

	Log of violent crime	Log of property crime	Log of total crime
Population	<i>0.429</i>	<i>0.620</i>	<i>0.601</i>
Number of businesses	<u>0.056</u>	<u>0.344</u>	<u>0.296</u>
Median family income in 1999	– <u>0.456</u>	<u>0.058</u>	– <u>0.083</u>
Per cent unemployed	<u>0.373</u>	– 0.007	<u>0.120</u>
Proportion below poverty	<u>0.458</u>	– 0.064	<u>0.102</u>
Per cent female headed households	<u>0.542</u>	0.017	<u>0.188</u>
Proportion 15 and over divorced	<u>0.165</u>	<u>0.130</u>	<u>0.149</u>
Proportion on Public Assistance	<u>0.459</u>	– 0.044	<u>0.120</u>
Proportion of males aged 14 to 24	<u>0.161</u>	– 0.007	<u>0.035</u>
Proportion of households that rent	<u>0.252</u>	0.001	<u>0.082</u>
Proportion of residents moved within 5 yrs	– <u>0.130</u>	<u>0.081</u>	<u>0.026</u>
Per cent black	<u>0.532</u>	<u>0.052</u>	<u>0.208</u>
Per cent Hispanic	– 0.040	<u>0.003</u>	– <u>0.030</u>
Foreclosures in 2001 per owner-occupiable structures	<u>0.425</u>	– 0.018	<u>0.119</u>

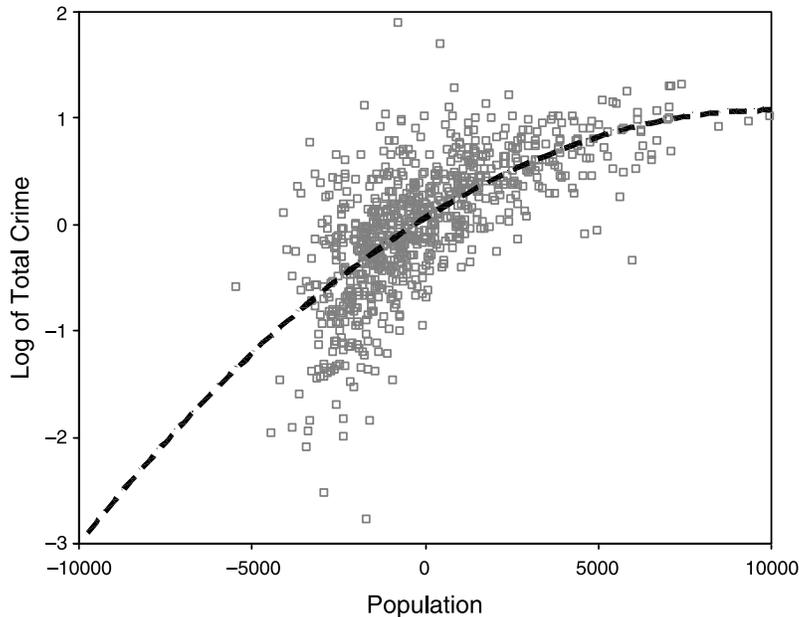
Notes: Italic and underlined = Significant at  $p < 0.01$ ; Italic = Significant at  $p \geq 0.01$  but  $p < 0.05$ ; Underlined = Significant at  $p \geq 0.05$  but  $p < 0.10$ .

number of businesses are positively correlated with crime levels, although the correlation between number of businesses and violent crime is quite weak. This is somewhat expected because businesses are a major target of property crime. Many of the demographic variables are significantly correlated at substantial levels with violent crime. These variables include proportion female headed households, percentage black, proportion on public assistance, median family income (negative sign) and, importantly, foreclosure rate. The correlations with property crime are smaller and generally at lower significance levels. Of course, these are just simple bivariate correlations and tell us relatively little about how foreclosure rate, or any of the other variables, independently affects crime.

Ordinary least squares regression was used to estimate equation (1) with all of the independent variables listed in Table 2. However, in examining the partial regression plots for all independent variables a significant non-linearity was identified for the residential population variable. Figure 3 is the partial regression plot of the total crime residual versus population, together with a fitted quadratic curve. It demonstrates the non-linear nature of the impact of population on the dependent variable. To correct for this, the square of population is added as an independent variable. This improves the regression fit significantly (from R-square = 0.717 to R-square = 0.750).

Table 3 gives the results of the estimation of equation (1) for all three dependent variables (violent crime, property crime and total crime) with the square-of-population included along with the original independent variables listed in Table 2. As predicted by the examination of the partial plots, the sign of the coefficient for population is positive, but for population squared it is negative. Therefore, crime incidents increase with population, but increase at a slower rate at higher population levels. This non-linearity appears to be somewhat stronger in the case of violent crime than in the case of property crime.

The non-linearity in the effect of population on crime may be due to a problem of crime occurring to employees working in what are essentially non-residential tracts or some



**Figure 3.** Partial regression plot of log of total crime on population (assuming exogenous variables listed in Table 2)

other phenomenon. For example, tracts with larger populations may have more street activity or ‘eyes on the street’, providing a deterrent to crime (Jacobs, 1961).

As anticipated, the number of businesses in a tract has a significant effect on crime rates. The marginal effect is substantially larger for property crime than for violent crime. Standardized coefficients suggest that variations in business counts are a substantial determinant of property crime (beta = 0.237) and also affect violent crime levels in a non-trivial way (beta = 0.119).

Six of the demographic characteristic variables are statistically significant determinants of neighborhood violent crime. These include percentage black, percentage Hispanic, the proportion below poverty, the proportion of families headed by single females, the proportion renting and the proportion that have moved in the last five years. Four demographic characteristics are statistically significant determinants of neighborhood property crime, including proportion divorced, proportion that have moved in the last five years, percentage Hispanic, and percentage black.

A word of caution is warranted in interpreting the results with regard to the demographic variables. The objective here is not to identify all of the root causes of neighborhood crime. That is left to the wider criminology literature. Rather, the goal here is to provide a measure of the impact of foreclosures on crime that is not vulnerable to charges that variables that have been found to be associated with crime have been omitted from the analysis. The most convincing evidence of an independent effect of foreclosures on crime needs to control for the impact of the neighborhood demographic factors associated with neighborhood crime in the criminology literature. The results here do not

**Table 3.** Regressions of neighborhood crime on neighborhood characteristics and foreclosure rate, City of Chicago tracts

	Log of violent crime				Log of property crime				Log of total crime			
	Coeff.	Std. error	Stdzd coeff.	Sig.	Coeff.	Std. error	Stdzd coeff.	Sig.	Coeff.	Std. Error	Stdzd coeff.	Sig.
(Constant)	<i>0.767</i>	<i>0.142</i>		<i>0.000</i>	<i>2.689</i>	<i>0.135</i>		<i>0.000</i>	<i>2.859</i>	<i>0.127</i>		<i>0.000</i>
Population	<i>4.03E - 04</i>	<i>2.08E - 05</i>	<i>1.050</i>	<i>0.000</i>	<i>3.40E - 04</i>	<i>1.98E - 05</i>	<i>1.219</i>	<i>0.000</i>	<i>3.49E - 04</i>	<i>1.87E - 05</i>	<i>1.251</i>	<i>0.000</i>
Population squared	<i>-1.93E - 08</i>	<i>1.88E - 09</i>	<i>-0.547</i>	<i>0.000</i>	<i>-1.60E - 08</i>	<i>1.79E - 09</i>	<i>-0.628</i>	<i>0.000</i>	<i>-1.65E - 08</i>	<i>1.69E - 09</i>	<i>-0.645</i>	<i>0.000</i>
Number of businesses	<i>5.37E - 04</i>	<i>8.63E - 05</i>	<i>0.119</i>	<i>0.000</i>	<i>7.76E - 04</i>	<i>8.19E - 05</i>	<i>0.237</i>	<i>0.000</i>	<i>7.54E - 04</i>	<i>7.75E - 05</i>	<i>0.230</i>	<i>0.000</i>
Median family income	<i>7.50E - 07</i>	<i>1.08E - 06</i>	<i>0.020</i>	<i>0.489</i>	<i>4.01E - 06</i>	<i>1.03E - 06</i>	<i>0.149</i>	<i>0.000</i>	<i>3.85E - 06</i>	<i>9.73E - 07</i>	<i>0.143</i>	<i>0.000</i>
Unemployment rate	<i>-4.07E - 03</i>	<i>4.84E - 03</i>	<i>-0.022</i>	<i>0.401</i>	<i>3.66E - 04</i>	<i>4.60E - 03</i>	<i>2.73E - 03</i>	<i>0.937</i>	<i>9.81E - 04</i>	<i>4.35E - 03</i>	<i>0.007</i>	<i>0.822</i>
Proportion below poverty	<i>0.804</i>	<i>0.252</i>	<i>0.123</i>	<i>0.002</i>	-0.184	0.240	-0.039	0.442	0.110	0.227	0.023	0.629
Proportion female HH	<i>0.597</i>	<i>0.251</i>	<i>0.105</i>	<i>0.018</i>	0.353	0.239	0.086	0.139	<i>0.461</i>	<i>0.226</i>	<i>0.112</i>	<i>0.041</i>
Proportion divorced	-0.225	0.596	-8.70E - 03	0.706	<i>2.451</i>	<i>0.566</i>	<i>0.130</i>	<i>0.000</i>	<i>1.758</i>	<i>0.535</i>	<i>0.094</i>	<i>0.001</i>
Proportion Public Asst	-0.300	0.403	-0.026	0.457	-0.024	0.383	-2.91E - 03	0.950	0.074	0.362	8.89E - 03	0.839
Proportion male 14-24	-0.234	0.300	-0.017	0.436	0.259	0.285	0.025	0.364	0.030	0.270	2.96E - 03	0.911
Proportion renting	<i>0.226</i>	<i>0.136</i>	<i>0.050</i>	<i>0.098</i>	-0.113	0.129	-0.034	0.384	-0.045	0.122	-0.014	0.710
Proportion moved in 5 yrs	<i>0.529</i>	<i>0.178</i>	<i>0.083</i>	<i>0.003</i>	<i>0.897</i>	<i>0.169</i>	<i>0.194</i>	<i>0.000</i>	<i>0.782</i>	<i>0.160</i>	<i>0.169</i>	<i>0.000</i>
Per cent black	<i>0.017</i>	<i>0.001</i>	<i>0.749</i>	<i>0.000</i>	<i>6.10E - 03</i>	<i>1.03E - 03</i>	<i>0.365</i>	<i>0.000</i>	<i>7.96E - 03</i>	<i>9.74E - 04</i>	<i>0.476</i>	<i>0.000</i>
Per cent Hispanic	<i>0.013</i>	<i>0.001</i>	<i>0.372</i>	<i>0.000</i>	<i>4.66E - 03</i>	<i>9.40E - 04</i>	<i>0.184</i>	<i>0.000</i>	<i>5.94E - 03</i>	<i>8.89E - 04</i>	<i>0.235</i>	<i>0.000</i>
Foreclosure rate	<i>2.328</i>	<i>0.873</i>	<i>0.067</i>	<i>0.008</i>	0.084	0.829	3.32E - 03	0.920	0.556	0.784	0.022	0.478
N	806				806				806			
R <sup>2</sup>	0.750				0.572				0.617			

Notes: Italic and underlined = Significant at  $p < 0.01$ ; Italic = Significant at  $p \geq 0.01$  but  $p < 0.05$ ; Underlined = Significant at  $p \geq 0.05$  but  $p < 0.1$ .

support a conclusion that demographic traits are root causes of crime. Rather they serve to provide a conservative measure of the impact of the foreclosure rate on crime.

Even after controlling for all of these factors, the key variable of interest, foreclosure rate, remains a statistically significant determinant of violent crime. The results for property crime are not statistically significant. Because property crime figures are higher than violent crime figures, the variable is also not significant in the total crime regression.

The nature of the semilog functional form makes the interpretation of the effect of higher foreclosure rate on violent crime relatively straightforward. However, because the independent variable never reaches a level close to one, a one-unit change in the variable is not meaningful. The mean and standard deviation of foreclosure rate are only 0.0238 and 0.0287, respectively, so instead the expected change in violent crime is considered to be due to a one standard deviation change in foreclosure rate. A 0.0287 increase in the foreclosure rate yields an expected increase in violent crime of 6.68 per cent. A smaller increase in the neighborhood foreclosure rate, of say 1 in 100 properties, would yield an increase in violent crime of 2.33 per cent.

### **Concerns about Multi-collinearity**

Although not examining the role of foreclosures, Kubrin & Squires (2004) find a similar estimation of neighborhood crime rates in Seattle to be afflicted by problems of multi-collinearity and employ principal components analysis to reduce the number of independent variables. Therefore, when estimating equation (1) diagnostics for collinearity were examined quite carefully. While significant bivariate correlations were found among some of these variables, multivariate collinearity diagnostics did not suggest that collinearity was a major problem. Variance inflation factors were examined and none exceeded 7 before the square of population variable was added. Even after this variable was added, all variance inflation factors remained under 10 and most remained under 5. Moreover, the regression was re-run using standardized independent variables to compute a collinearity condition index. The condition index was less than 10 even after the square of population variable was added. Thus, the diagnostics did not suggest that multi-collinearity was a serious problem, and no data reduction techniques were used.

### **Checking for Possible Simultaneity**

Another possible concern with the results in Table 3 is that the model used may ignore simultaneity between foreclosure rate and crime. That is, there is a look at whether violent crime could cause higher foreclosure rates as well as the other way around. If simultaneity occurs, the results in Table 3 would result in biased coefficients. To address this potential problem, a Hausman test is conducted for simultaneity (Pindyck & Rubinfeld, 1991, pp. 303–305). To do this, first it is necessary to identify an instrument that is significantly correlated with the foreclosure rate but that is uncorrelated with the residual in the results of the regression from Table 3. A variable that meets these criteria is median home value. This variable is negatively correlated with foreclosure rate ( $-0.395$ ) and uncorrelated with the regression residual. With this value the instrument and the exogenous independent variables (excluding foreclosure rate) are regressed on foreclosure rate. The resulting residual is then taken and included as an additional independent variable in the estimation of tract crime (equation (1)). The results (shown in the Appendix) of this

exercise show that the residual does not come in as a statistically significant predictor of tract crime (significance level equals 0.317). This means that there is no evidence that simultaneity is a problem in the results in Table 3.

### **Conclusions and Implications for Planning and Policy**

The problems of foreclosures are certainly not limited to impacts on crime. Foreclosures can harm the financial standing of a family, leave them without ready or quality shelter, and can have other negative impacts. Foreclosures might also make neighborhoods less appealing for reasons of aesthetics or affects on property values that have nothing to do with crime. Boarded up buildings due to foreclosures may weaken the commitment of residents to a neighborhood and weaken their interest in reinvesting in their property. But the concern over foreclosures in many communities lies in part with their effect on the safety and security of the neighborhood. More research is needed on any additional social or economic costs of foreclosures.

This study finds that higher neighborhood foreclosure rates lead to higher levels of violent crime at appreciable levels. While the effect on property crime is not found to be statistically significant, the coefficient in the regression is positive. This effect may be due to more property crimes not being reported when they are related to vacant and abandoned structures. Another possible explanation is that, because the effects are greater in lower-income neighborhoods, this finding may be due to an under-reporting of property crime in lower-income areas. Higher income areas are more likely to report crimes generally considered of less consequence compared to lower-income areas. More research is needed on the relationship between foreclosures and property crime.

A one percentage point (0.01) increase in foreclosure rate (which has a standard deviation of 0.028) is expected to increase the number of violent crimes in a tract by 2.33 per cent other things being equal. A full standard deviation increase in the foreclosure rate, other things equal, is expected to increase violent crime by 6.68 per cent.

These findings suggest that foreclosures may have important social and economic consequences on neighborhoods beyond effects on the finances of households directly affected by the foreclosure. An increase in violent crime is an important social cost, as well as an economic cost, that must be incorporated into policy making concerning real estate and mortgage lending policies and regulation.

In particular, previous research has shown that subprime mortgage lending leads to foreclosures at much higher rates than prime lending (Immergluck & Smith, 2005; Quercia *et al.*, 2005). This is the first study that systematically estimates the effect of foreclosures—many of which followed from subprime loans—on neighborhood crime rates. While the results estimating the effect of foreclosures on property crime are statistically inconclusive, the results for violent crime are significant.

One area of policy making that these findings apply to is that of mortgage lending regulation. Substantial evidence now exists that the growth of foreclosures and their concentration in lower-income and especially minority neighborhoods in recent years has been driven largely by the growth and concentration of the subprime mortgages in these areas. It has been shown that foreclosures have a significant, non-trivial impact on violent crime at the neighborhood level. Others have found that foreclosures entail substantial other costs to neighborhoods and municipalities. Apgar & Duda (2005) found that the direct costs to city government in Chicago involve more than a dozen agencies and two

dozen specific municipal activities, generating governmental costs that in some cases exceed \$30 000 per property.

Despite the evidence on the social costs of high-risk mortgage loans, federal and state regulators appear timid. Most policy debates concerning 'predatory' lending and the regulation of higher-risk loans continue to center around arguments of whether increased regulation might possibly restrict access to credit for some potential borrowers. While the potential for such effects should be studied, the types of negative effects of higher-risk lending, such as the crime effect shown here, should be cause to shift the debate more towards questions of costs versus benefits of different regulatory regimes. Perhaps some restriction of credit does occur with increased regulation, although the evidence currently is that stronger regulation does not have this result (Ho & Pennington-Cross, 2005). The findings here suggest that some reduction in high-risk credit flows may be merited, since it appears that they may be leading to social ills that impact those beyond the lender or borrower.

### Notes

- <sup>1</sup> Owner-occupiable units are calculated by taking the percentage of occupied units that are owner occupied and multiplying it by the total number of housing units in the tract, including vacant units.
- <sup>2</sup> Kubrin & Squires (2004) do not include percentage of Hispanic in their study of Seattle neighborhoods. However, in Chicago well over 20 per cent of the population is Hispanic and Hispanic segregation is significant.

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## Appendix

### A Hausman Test for Simultaneity

In the model described in equation (1), there may be a concern about reverse causality. That is, there may be a concern that crime, in fact, causes foreclosures as well as the other way around, a problem referred to as simultaneity. Crime, for example, may encourage homeowners to flee neighborhoods without paying off their loans, increasing foreclosure levels. If simultaneity occurs between crime and foreclosures, ordinary least squares would not accurately measure the effect of foreclosures on crime. If simultaneity is a problem, then, in addition the relationship hypothesized in equation (1), the complete model would require the incorporation of a second equation explaining the effect of crime on foreclosures, such as:

$$F_i = a + \beta_1 \ln C_i + \beta_2 X_i + v_i \quad (2)$$

where  $X_i$  is not correlated with the error term,  $\varepsilon$ , in the estimation of equation (1).  $X_i$  is an instrument used to adequately identify the model.  $X_i$  must be correlated with foreclosures, but not with the residual in the regression estimating equation (1). A variable that fulfills these criteria is the median housing value of the census tract. It is negatively correlated with foreclosure rate, but not correlated with the residual of the crime estimation.

To test for simultaneity with respect to the log of crime variable, in a first stage foreclosures are regressed on all the other independent variables in equation (1), plus the instrument (median home value):

$$F_i = a + \gamma_1 P_i + \gamma_2 B_i + \gamma_3 Z_i + \gamma_4 X_i + \omega_i \quad (3)$$

**Table A1.** Results of second stage of Hausman test for simultaneity (estimation of equation (1a))

	Log of violent crime			
	Coeff.	Std. error	Stdzd coeff.	Sig.
(Constant)	0.65483	0.18065		0.000
Population	4.103E - 04	2.191E - 05	1.06738	0.000
Population squared	- 1.957E - 08	1.911E - 09	- 0.55656	0.000
Number of businesses	5.367E - 04	8.628E - 05	0.11889	0.000
Median family income	1.376E - 06	1.252E - 06	0.03722	0.272
Unemployment rate	- 0.00154	0.00546	- 0.00835	0.777
Proportion below poverty	0.71623	0.26709	0.10953	0.007
Proportion female HH	0.60723	0.25140	0.10688	0.016
Proportion divorced	0.25475	0.76519	0.00984	0.739
Proportion Public Asst	- 0.83886	0.67273	- 0.07339	0.213
Proportion male 14-24	- 0.23039	0.30034	- 0.01647	0.443
Proportion renting	0.28865	0.14998	0.06388	0.055
Proportion moved in 5yrs	0.50447	0.17951	0.07901	0.005
Per cent black	0.01397	0.00346	0.60612	0.000
Per cent Hispanic	0.01223	0.00121	0.35166	0.000
Foreclosure rate	10.59037	8.30579	0.30528	0.203
Residual from stage 1 ( $\omega$ )	- 8.35434	8.35207	- 0.16934	0.317
N	806			
R <sup>2</sup>	0.750			

Then, in a second stage,  $\omega$  is included, the residual from the estimation of equation (3), as an additional independent variable in the estimation of a modified equation (1). This is done to 'correct' for simultaneity (Pindyck & Rubinfeld, p. 305). Thus, the original model is expanded as follows:

$$\ln C_i = a + b_1P_i + b_2B_i + b_3Z_i + b_4F_i + b_5\omega_i + \varepsilon_i \quad (1a)$$

If  $\omega_i$  is statistically significant in the estimation of equation (1a), the null hypothesis that there is no simultaneity can be rejected. However, as shown in Table A1, the results of estimating this new equation (shown for the log of violent crime, since that is the significant result in Table 3), indicate that this is not the case. The null hypothesis that there is no simultaneity cannot be rejected at any reasonable  $p$  value. Thus, there is no evidence of simultaneity.