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FORECLOSURE, VACANCY AND CRIME

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ABSTRACT

This paper examines the impact of residential foreclosures and vacancies on violent and property crime. To overcome confounding factors, a difference-in-difference research design is applied to a unique data set containing geocoded foreclosure and crime data from Pittsburgh, Pennsylvania. Results indicate that while foreclosure alone has no effect on crime, violent crime rates increase by roughly 19% once the foreclosed home becomes vacant – an effect that increases with length of vacancy. We find weak evidence suggesting a potential vacancy effect for property crime that is much lower in magnitude.

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I. Introduction

There are many social problems arising from foreclosure. At the household level, families undergoing foreclosure can lose accumulated home equity and access to future stable housing; on the social level, foreclosure can have implications for surrounding neighborhoods and larger communities. One potential impact of increased foreclosures in a community is crime. A recent and growing literature has documented the existence of a connection between foreclosures and crime. However, little work has been done to establish the mechanism and persistence of these effects. Working with a unique dataset from Pittsburgh, Pennsylvania which utilizes both county deed records and utility shut-off dates to identify vacancy periods, in this paper we document that foreclosure per se has little impact on crime. Instead, we find that it is foreclosure driven vacancies that lead to increased crime in the immediate neighborhood of foreclosures – these increases are on the order of 19% when comparing outcomes in a 250 foot buffer of the foreclosed home to those in the area between 250 and 353 feet away. The crime effect appears to peak and then level off at between 12 and 18 months following the initial period of vacancy and then attenuates once the house is re-occupied.

Sociologists have long theorized a link between neighborhood characteristics and the geographical distribution of crime (the social disorganization theory). For example, Shaw et al. (1929) suggested that high crime rates occur in areas that are characterized by physical deterioration. On a more conceptual level, Faris (1948) stated that crime rates are reflections of the degree of disorganization of the control mechanisms in a society. A modern version of these theories is Wilson and Kelling's (1982) broken windows theory, which posits that neighborhood-level disorder is a precursor to serious crime. Skogan (1990) further categorized disorder as social or physical. Social disorder refers to delinquent behavior, such as public drinking, and physical disorder refers to visual signs of negligence, such as abandoned buildings. The idea being that disorder reduces a community's willingness to maintain social control and provide better opportunities for crime.

Relatedly, Skogan viewed foreclosed[2] and vacant buildings as a form of neighborhood physical disorder. Neighborhood effects from foreclosure may start at the onset of the foreclosure process. Once a homeowner realizes that she faces foreclosure, she may begin taking less care of her house. Thus, while the property is still occupied, it may begin to show visible signs of disrepair. This lack of upkeep may provide a signal to potential criminals that there is a lower level of surveillance in the area and thus reduce the neighborhoods level of crime deterrence. Later in the process, if the property becomes vacant, the lack of surveillance will become more apparent. Further, neglected vacant buildings may offer criminals and/or squatters places to gather and conduct their activities. In sum, this literature suggests that both foreclosure and vacancy may be positively associated with crime rates, with vacancy possibly having a stronger impact.

While a number of recent studies by criminologists, economists and ubanists have explored the link between foreclosures and crime, less work has been done to explain the process through which foreclosure leads to crime. Using Chicago area foreclosure and crime data for the year 2001, Immergluck and Smith find that a 1 percent increase in the foreclosure rate leads to a 2.3 percent increase in violent the crime rate for a given Census Tract. However, given that this work is done using a single cross-section of Census tract-level data the authors cannot speak to the issue of causation vs. correlation. Using county-level longitudinal data, Goodstein and Lee (2010) conclude that foreclosure increases burglary and some other property crime. While this study overcomes the cross-sectional limitations of the work by Immergluck and Smith, the aggregation of their data to such a large geographic scope greatly hinders the insight that can be gained on neighborhood processes. Katz et al. (2011) undertake a block level analysis on data from Glendale, Arizona and find highly significant effects of foreclosure on violent and property crimes, but not on criminal homicide or robberies – as with Immergluck and Smith, the direction of causality in their study is unclear.

Two papers have dealt more directly with the issue of vacancy. Spelman (1993) analyzed field data on building conditions within one neighborhood and found that blocks with vacant properties have higher crime rates compared to blocks with fully-occupied buildings. Finally, in research undertaken concurrent to our analysis, Ellen et al. (2013) evaluate the impact of foreclosures on crime rates in

[2] Because there are multiple stages in the foreclosure process, there is no consensus on the exact definition of foreclosure in the literature. For the rest of this paper, we use the terms "foreclosure" and "foreclosure filing" interchangeably to refer to an earlier stage in the foreclosure process, when a lis pendens has been filed. We aware of the fact that some of the papers we cite here may define foreclosure as a later stage in which a property is sold at sheriff sale.

New York City. Their paper stands out in the extant literature for having an empirical strategy which identifies a causal link between foreclosures and crime. They use a difference-in-differences approach which evaluates the crime impact of foreclosures on a given faceblock – while controlling for faceblock fixed effects as well as neighborhood (Census Tract or Police Precinct) specific trends (quarter X neighborhood fixed effects). Ellen et al. test three different measures of foreclosure activity: the number of houses entering foreclosure in the previous 18 months; the number of currently active foreclosures; and, the number of properties that have reverted to lender ownership or REO status (a proxy for vacancy). They find crime effects of the largest magnitude when using REO status as their foreclosure metric. This result holds under the inclusion of Police Precinct specific trends. However, while the statistical significance of their first two foreclosure measures are robust (at the 10% level) to the inclusion of Census Tract-level neighborhood trends, the REO measure loses its significance when these tighter neighborhood controls are used – there are 76 Police Precincts and 2,246 census tracts in New York City. Overall, Ellen et al. find that an additional foreclosure leads to an increase in violent crimes on a given faceblock of between 1.4% and 2.6%.

Our approach is most similar in spirit to that of Ellen et al., with two key differences. First, while they succeed in identifying an overall effect of foreclosures on crime, we focus on understanding better the process through which foreclosure leads to increased crime – with special attention paid to identifying both the impact of foreclosure duration and vacancy on crime levels. Second, we take a different approach to geography, utilizing a much more restrictive notion of neighborhood when constructing our treatment and control neighborhoods. This approach allows us to evaluate each foreclosure as its own unique treatment. Specifically, we define treated neighborhoods as a 250 foot buffer surrounding each foreclosed house and define control neighborhoods an equal area donut surrounding this buffer (250 feet – 353 feet). As a result, our definition of neighborhood is much smaller than that of Ellen et al. (10.4% of the size of the average New York Census Tract and 0.4% of the size of the average New York Police District). Our experience working with data for Pittsburgh suggests that when larger neighborhood definitions are used that control and treatment neighborhood characteristics (housing and demographics) become significantly different from one another.

Our empirical analysis suggests 4 key findings: 1) the foreclosure process can lead to significant increases in violent crime rates – we estimate that, within 250 feet of a foreclosed home, the

foreclosure process leads to a roughly 19 % increase in the number of reported crimes per year (an increase of .13 crimes per year within the 250 foot circle relative to a base rate of .67 crimes per year); 2) these increases in crime are driven not by foreclosure per se, but instead by the vacancies that are associated with the foreclosure process; 3) the impact of vacancy on crime increases as the property stays vacant for longer periods of time, likely plateauing at between 12 and 18 months; and, 4) once a house is reoccupied the crime impacts of the previous vacancy are attenuated.

The remainder of the paper proceeds as follows, section II presents background information on the current foreclosure crisis and the foreclosure process in our study area, Pittsburgh, Pennsylvania. In section III, we describe the data used in this study; describe the empirical methodology and present graphical evidence on the impact of foreclosure and vacancy. Empirical results are presented in section IV and we provide a brief conclude in section V.

II. Background

Starting in 2006, the United States began a period of significantly increased home mortgage foreclosures. As of the third quarter of 2009 (roughly the end of our study period), residential mortgage delinquency rates, as reported by the Mortgage Bankers Association (MBA), stood at a seasonally adjusted 9.64 percent – higher than any previously reported level since the MBA began tracking foreclosures in 1972.

Our research considers the impact of foreclosure and vacancy in the context of Pittsburgh, Pennsylvania. In Pennsylvania all foreclosures are carried out through the court system and a lender must follow a state-level judicial process in order to foreclose on a property. The process begins when the borrower fails to make payments for at least 60 days. At that time, the lender can initiate the foreclosure process by sending a Notice of Intent to Foreclose. If the borrower pays all dues and fees within 30 days, the default is "cured." However, if the borrower is either unable or unwilling to resolve the debt, the entire balance of the mortgage becomes due immediately. The lender can then file a suit to obtain a court order to foreclose on the property (foreclosure). Sometimes the borrower resolves with the lender or successfully sells the property to another permanent owner before the sheriff sales date and the property does not become vacant. Otherwise the lender can choose to sell the property at sheriff sale, setting the opening bid for at least the outstanding loan amount. Typically under this process the property is not sold and will return to the lender (Had there been any potential

buyer for the property at a price equal to the outstanding loan amount, the owner could have sold it earlier), most of the time a bank or a mortgage company. The borrower is evicted after the sheriff sale. The foreclosed property is then classified as a real estate owned (REO) property and stays vacant until it is sold to a new permanent owner.

As described above, a typical foreclosure case consists of multiple stages: foreclosure filing, sheriff sale, and sale to a new permanent owner (REO sale). However, some foreclosures are resolved between the borrower and the lender and never reach the point of a sheriff sale. Figure 1 provides an illustration of the two most common outcomes following a foreclosure filing. In our data, 57% of the foreclosure filings result in property sale to another permanent owner before sheriff sale while 43% experience a period of vacancy until they are finally resold.

To facilitate identification of the impact of foreclosure per se as opposed to foreclosure-led vacancy, we divide the foreclosure process into four stages: pre-foreclosure, foreclosure (running from initial foreclosure filing date through either vacancy or direct sale by the borrower), vacancy (running from initial vacancy to the REO sale date), and reoccupation which begins at the REO sale date. Due to the judicial nature of foreclosure in Pittsburgh, the whole process typically takes one to two years to complete. As shown in Figure 1, the median length of foreclosure stage is 240 days for those without sheriff auction, and 262 days for those experiencing vacancy. The median length of vacancy is 231 days.

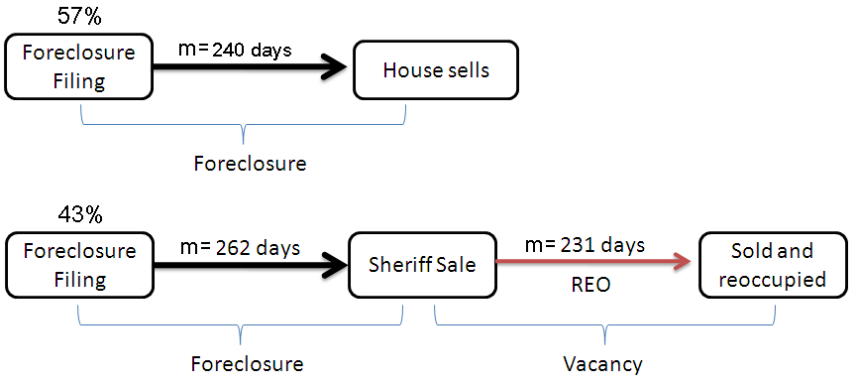


FIGURE 1 – FORECLOSURE PROCESS

Although foreclosure activity reached record highs in the third quarter of 2009, Pennsylvania was not hit as hard as many other regions. The foreclosure rate was 2.58 foreclosures per 1000 households for

Pennsylvania during the third quarter of 2009, a 15.48% increase from the third quarter of 2008, while the national average was 7.35 foreclosures per 1000 households, a 22.50% increase from the third quarter of 2008.

III. Data & Empirical Strategy

Our analysis is based primarily on the aggregation of four distinct sources of data. The sources of these data are as follows:

Crime: Crime data is obtained from the Police Department of the City of Pittsburgh. This data includes type of crime and the exact time and street address of each reported crime incident from 2005 to 2009. These records we geocoded with more than 99% success using high quality GIS parcel maps produced by the Allegheny County Assessor's Office.

Foreclosure filings: The foreclosure filing data are obtained from City of Pittsburgh court records. This file contains information on every foreclosure filing in the city from 2006 to November 2009, such as the date of filing, the parcel ID of the property receiving foreclosure filing, borrower and lender names, and the current stage of filing. Settled and discontinued cases are deleted from the sample. The locations of these foreclosures were geocoded using the same approach as for the crime data and with similar success rates (in excess of 99%). Note that only residential[3] properties are included in this analysis.

Housing transactions: The property transaction data come from Allegheny County Recorder of Deeds Office, which contains sale date, price, parcel ID and buyer and seller names for every property transaction since 1986. Foreclosure filings are linked to all subsequent property transactions by parcel ID to determine the periods of vacancy and reoccupation.

Housing and neighborhood characteristics: The housing characteristics data are obtained from Allegheny County's Office of Property Assessments. Most of the information is taken from the last county-wide reassessment in 2002. These assessment data contain housing conditions such as square feet, number of bedroom and year structure was built for every property in the city. Data on neighborhood characteristics come from two sources. Selected block-level demographic

[3] A property is defined as residential if its structure type falls into one of the following categories: single family, two to four family, row house and townhouse.

characteristics (such as race and age) are taken from the 2000 Census of Population and Housing. Information only available at more aggregate levels (such as education and income) is not included due to the lack of geographic precision. Pre-existing (2005) crime counts come from the crime data described above.

Attaching crime and vacancy data to our foreclosure sample raises some issues. We begin with the crime data. As a participant in the Uniform Crime Reporting (UCR) Program, Pittsburgh's police department follows UCR's guideline of classifying and reporting offenses. All offenses are first classified into 26 categories in a particular order, with homicide being the highest in the hierarchy. In case of a multiple-offense situation, the police department will record only one offense that is the highest on the hierarchy list and not the other offense(s) involved. For example, one crime incident described as both robbery and homicide will appear as homicide but not robbery.

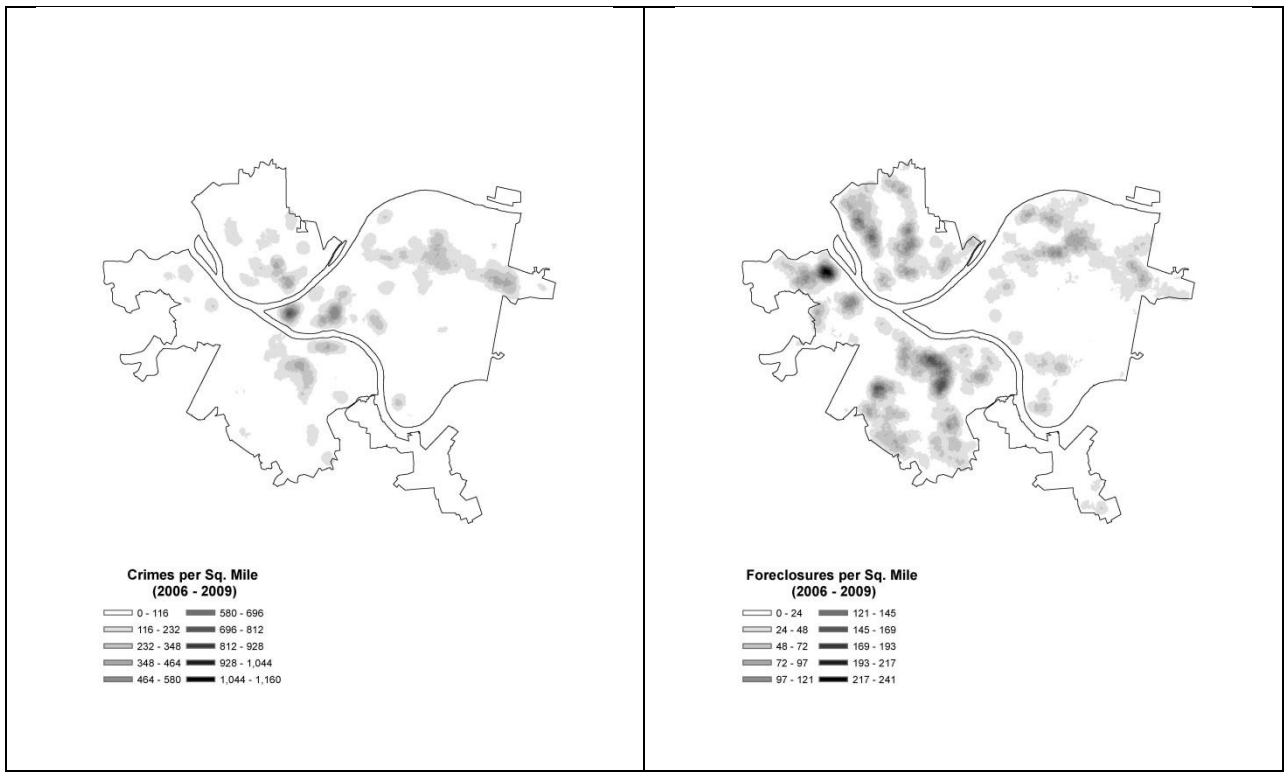
Table 1 provides a description of the 26 crime categories and percentages of each type of offense recorded in the data. Note that violent crimes are coded in highest hierarchical order, followed by property crimes. As a result the coding rule will not change the total number of violent crimes but all other crimes will be under-reported. The degree of under-reporting increases while moving down the hierarchy list.

TABLE 1 – CATEGORIES OF CRIME INCIDENTS

Crime	Code	Pct	Crime	Code	Pct
Violent		8.86%	Other		55.90%
Murder-Manslaughter	01	0.13%	Stolen property	13	0.65%
Forcible rape	02	0.25%	Vandalism	14	14.64%
Robbery	03	3.91%	Weapon violations	15	1.16%
Aggravated assault	04	4.57%	Prostitution	16	0.66%
Property		35.24%	Sex offenses	17	0.82%
Burglary	05	8.56%	Drug violations	18	6.91%
Larceny – Theft	06	21.98%	Gambling	19	0.02%
Motor vehicle theft	07	4.51%	Family violence	20	0.16%
Arson	08	0.19%	Drunken driving	21	2.46%
Other		55.90%	Liquor law violations	22	0.09%
Forgery	09	1.31%	Public drunkenness	23	0.49%
Simple Assault	10	15.78%	Disorderly conduct	24	2.96%
Fraud	11	2.36%	Vagrancy	25	0%
Embezzlement	12	0.12%	Other	26	5.33%

Due to this coding rule, we focus our analysis on violent and property crimes, as they have higher priorities to be coded, and thus provide a more accurate measure of the actual reported number of crime incidents.

Figure 2: Spatial Distribution of Crimes and Foreclosures



Percentages are calculated from all crimes in the City of Pittsburgh in 2006.

To give a sense of the spatial distribution of both crime and foreclosures, Figures 2 presents the spatial distribution of both Crime and Foreclosures in Allegheny County during our study period (2006 - 2009).

Turning to vacancies, distinguishing the impact of vacancy requires us to identify the period of vacancy for each foreclosed property. In most cases, a foreclosed property is seized by the lender at the sheriff sale, and it becomes vacant immediately thereafter. The property then stays vacant until it is resold to a new permanent owner (REO sale). As a result, the REO status can typically define most foreclosed properties' vacancy periods.

The REO status is identified by two dates: the sheriff sale date and a subsequent REO sale date. Linking foreclosure filings to home sale data enables us to track the complete transaction history of each foreclosed property. In addition, all sheriff sales in the deed record are categorized as "sheriff deed" rather than "deed", which serves as a clear identifier. Therefore, a sheriff sale date is assigned to a foreclosure if on that date the property is recorded on a sheriff deed with the seller listed as the borrower who failed to sell the house prior to the sheriff sale. An REO sale date is thus defined as a subsequent transaction date when the REO property, under the name of a bank or mortgage company, is finally sold to a new permanent owner.

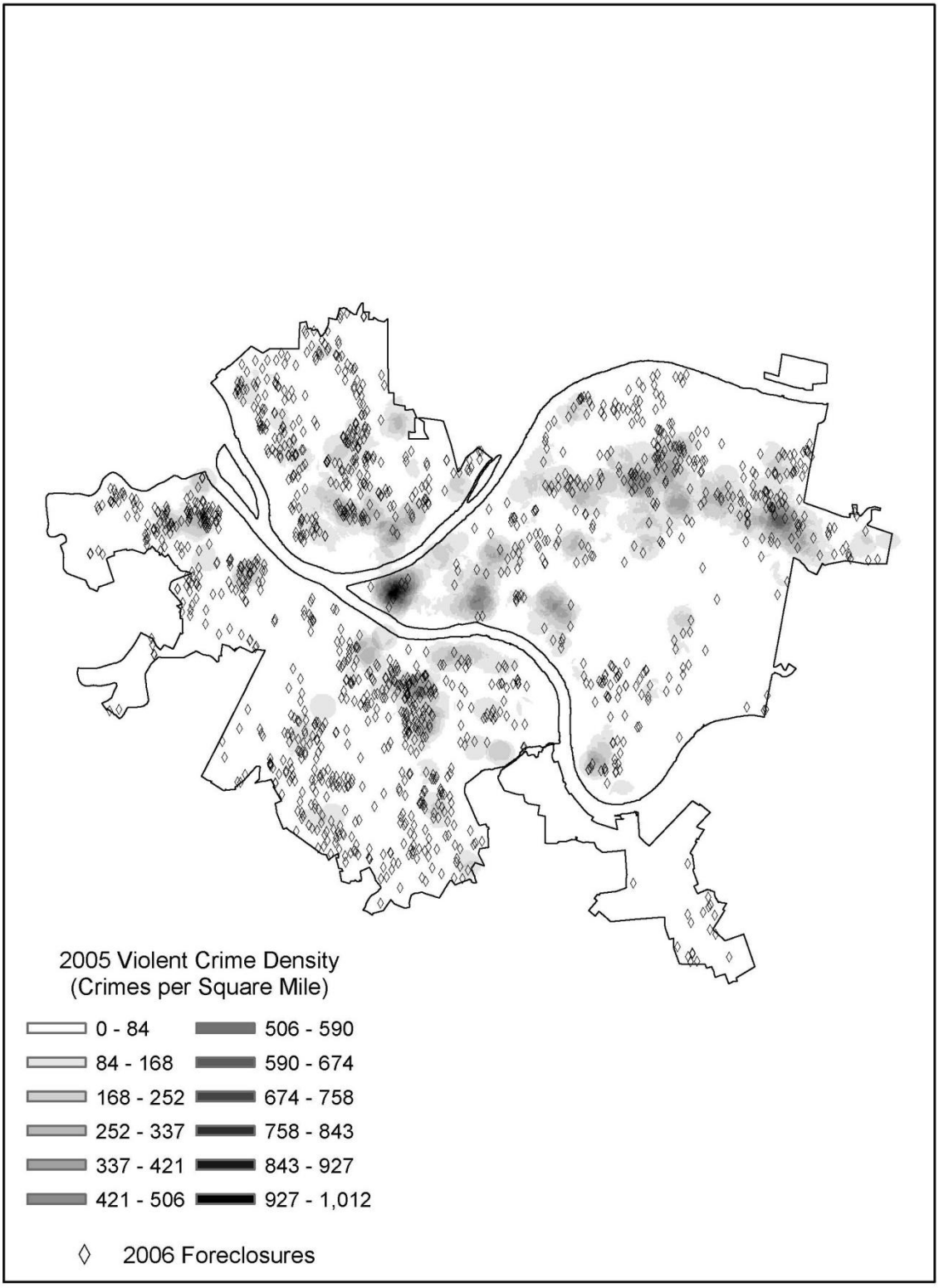
An issue arises because occasionally the REO status does not coincide with the period of vacancy, for instance, when the borrower abandons the property before the sheriff sale date. To address this issue we use data on gas shutoff dates to assist in the identification of vacant foreclosed properties. This data was obtained from the 3 major gas companies that provide service to virtually every property in the City of Pittsburgh. This data contains a list of addresses with no gas usage as of a specific day every December from 2006 to 2009.

Combining information on REO and gas shut off status, we begin by defining the starting point of vacancy as the date a foreclosed property is sold to a bank/mortgage company (sheriff sale), and the ending point of vacancy as the date of the next transaction, when the property is resold to a new permanent owner (REO sale). If the property has an REO period and the gas shutoff month occurred prior to the sheriff sale date, we assign the December 31st of the gas shut off year as the starting date of vacancy. Among the 3,282 properties foreclosed between 2006 and 2009 in Pittsburgh, 1,403 experienced vacancy. Among those, the vacancy periods of 1,213 (86%) properties are solely defined by REO status.

Nevertheless, it is likely that the method described above can only generate close approximations of the actual vacancy periods. As a result, some of the foreclosed properties may be classified as vacant when they are in fact occupied, or vice versa. To the extent that this occurs it will lead to a bias in our estimates of the differences in crime rates between vacancy and non-vacancy periods. If there is no correlation between this measurement error and other variables in the model then the bias imparted by this measurement error will attenuate our estimates.[4]

[4] Our results are robust to the exclusion of properties that experienced a vacancy prior to the sheriff's sale.

Figure 3: Foreclosures in 2006 vs. Crime in 2005



We now turn to our identification strategy. As has been well-documented,[5] foreclosures tend to cluster in lower-income neighborhoods with higher portions of minority residents and subprime mortgages. Thus, the correlation between foreclosure locations and both observable and unobservable neighborhood characteristics makes it difficult to identify the effect of foreclosure and vacancy on crime rates by simply comparing areas with and without foreclosed houses. If the locations of foreclosures correlate with some unobservable neighborhood characteristics that affect crime rates, cross-sectional analysis will yield biased estimates. Further, cross-sectional analysis cannot rule out the possibility that the observed foreclosures are the result of crime rather than the cause.

To further illustrate the general problem, figure 3 presents the location of all 2006 foreclosures in our dataset overlaid on 2005 crime density. The figure demonstrates that, while there is a reasonable amount of independent variation, there is a marked spatial correlation between crime and foreclosures at the macro level. If we aggregate crimes and foreclosures over a relatively large spatial scale (for instance at the ward or track level) and then regress 2006 foreclosure rates on 2005 crime levels, because of this correlation, we get a significant and positive coefficient suggesting that crimes cause foreclosure. This is the major challenge for our identification strategy. As we discuss in the results section below, tests for reverse causality suggest that by focusing our analysis on a very small spatial scale that we are able to overcome this problem.

While previous studies consider crime data that has been aggregated to the county, police district, census tract or block level, our data provides the specific locations and dates of all reported crimes in the city of Pittsburgh. This data allows us to compare crime rates within small proximate areas in which neighborhood characteristics are more homogenous than in the aggregate comparisons of the existing literature.

The mechanisms discussed above for relating foreclosure and crime would generally be associated with a continuously decreasing relationship between crime and distance to the foreclosure site. Ideally, our analysis would identify a clearly delineated boundary between treatment and control – the exact point at which the effect goes to zero. However, our definition of treatment area will likely be either too narrow or two broad.

[5] Examples are Gerardi, Shapiro,and Willen (2007), and Immergluck and Smith (2004).

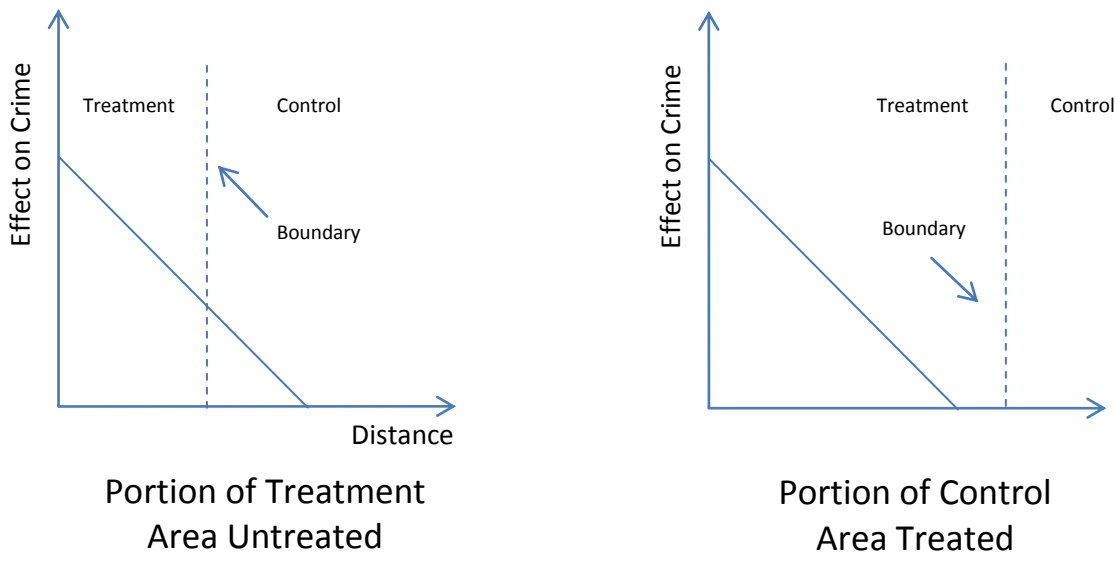


FIGURE 4 – RELATIONSHIP BETWEEN DISTANCE TO FORECLOSURE AND CRIME

Figure 4 highlights the implications of such mistakes. If we make our treatment neighborhoods too small, a portion of each control neighborhood will actually be treated. Conversely, if the treatment neighborhood is too large, a portion of each treatment area will actually be untreated. In both cases, misaligned treatment-control boundaries will lead to systematic under-estimates of the mean difference in crime counts between true treatment and control areas. Thus we expect any such errors to lead to attenuation bias in our estimates of the effect of foreclosure and vacancy on crime.

We proceed by defining as treatment areas a set of circles, one centered on each foreclosure in our dataset. We define as controls a set of rings that circumscribes each treatment circle. To facilitate direct comparisons of crime counts between treatment and control areas, control areas are defined so as to be identical in area to treatment areas, as illustrated in Figure 5.[6] For a given foreclosure, the treatment area is defined as the region within 250 feet of the foreclosed property (an area roughly consistent with that of a large single city block). The control area is then defined as the surrounding ring lying between 250 feet and 353.6 feet of the foreclosed property (these ring dimensions ensures that treatment and control regions are of the same size). In choosing treatment and control areas,

[6] We evaluate the use of different control and treatment areas as part of the sensitivity analysis contained in the empirical results section below.

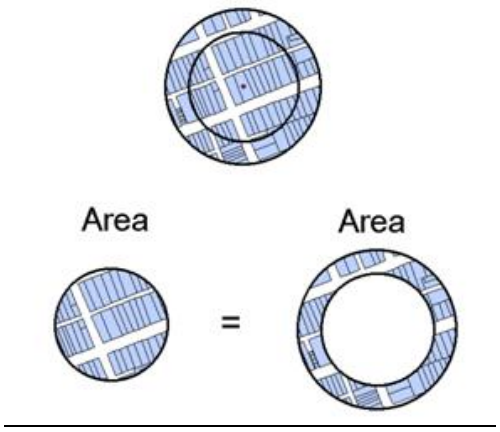


FIGURE 5 – TREATMENT AND CONTROL AREAS SURROUNDING A FORECLSOED PROPERTY

Note: The dot marks the center of the foreclosed parcel. Blank areas between blocks of parcels are streets. The radius of the inner ring is 250 feet and the radius of the outer ring is 353.6 feet. Treatment area is inside the inner ring while control area is between the two rings.

ideally the researcher would have knowledge of the true path of spatial decay and locate the treatment-control boundary precisely where treatment effects end (or possibly at a distance where there exists a steep decline in treatment effects). Given our limited knowledge of the true spatial decay process, instead the choice is driven by statistical issues. As the size of the treatment area grows larger, differences between the treatment and control areas in terms of demographics and housing stock grow -- undermining the assumption of "all else equal" between the two regions. Conversely, as treatment and control areas get smaller fewer and fewer crimes are observed in these areas, leading to much noisier estimates of the treatment and control area crime rates. The choice of treatment region was chosen to balance these two concerns.

To test how well our approach identifies similar treatment and control areas, Table 2 presents summary statistics on the characteristics of houses inside the treatment and control rings, as well as demographics from the 2000 Census and crime rates for 2005 (prior to our study period). Statistics are computed separately for treatment (Column 1) and control regions (Column 2). As a diagnostic, Column 3 reports the coefficients and standard errors from a series of regressions for each of these variables on a treatment indicator. These summary statistics suggest that our design succeeds in identifying treatment and control neighborhoods that are similar in terms of observable characteristics. All of the coefficients in Column 3 are statistically insignificant, with the exception of days since last sale. However, considering the mean difference in days since last sale is 55 days compared with a base level of 5,583 days this difference doesn't suggest a need for concern.

TABLE 2 –CHARACTERISTICS OF ALL PROPERTIES IN TREATMENT AND CONTROL AREAS

	Around Properties with Foreclosure Filings		
	Within 250 feet	Within 250-353 feet	Differences
Housing Characteristics			
Square Footage	1,582	1,597	-14.45
	(385.2)	(371.8)	(9.499)
Assessment Value	49,839	50,173	351.29
	(90,055)	(66,585)	(830.66)
Lot Area (square feet)	3,712	3,740	-53.44
	(1,977)	(4,488)	(50.30)
Year Since Built	88.07	88.05	0.063
	(16.69)	(15.85)	(0.402)
Bedroom	2.960	2.975	0.0019
	(0.503)	(0.494)	(0.0118)
Bathroom	1.358	1.369	-0.0079
	(0.307)	(0.308)	(0.0074)
Last Sale Price (pre 2005)	44,896	47,707	-2,811
	(71,496)	(84,007)	(1,958)
Days Since Last Sale (pre 2005)	5,583	5,638	-55.54**
	(1,202)	(975.1)	(27.46)
Average # of Stories	1.897	1.893	0.003
	(0.246)	(0.236)	(0.006)
Number of Houses	36,410	38,985	
Neighborhood Characteristics			
#Violent crime in 2005	0.694	0.650	0.044
	(1.332)	(1.338)	(0.033)
#Property crime in 2005	2.561	2.520	0.041
	(2.929)	(3.385)	(0.078)
% Black	27.15	27.16	-1.28e-5
	(31.64)	(31.94)	(0.008)
% Hispanic	0.93	0.98	-0.0005
	(1.03)	(1.45)	(0.0003)
% Male aged 15-24	6.48	6.53	-0.0005
	(2.51)	(2.88)	(0.0007)
Number of Census Blocks	3,282	3,282	

Standard errors are reported in parentheses. Housing is constructed based on data from the Allegheny County Assessor's Office. Information on demographics is taken from Census 2000. All neighborhood characteristics are measured at block level. Estimates in the third column are ω, the coefficient on D_i^{250} in $X_i = \alpha + \omega D_i^{250} + \varepsilon_i$.

TABLE 3 –CRIME RATES IN TREATMENT AND CONTROL AREAS

	#Observation	# Violent Crime/quarter	# Property Crime/quarter
Full sample	84,890	0.1663	0.5626
Treatment:	42,494	0.1698	0.5838
Pre-foreclosure	20,837	0.167	0.599
Post-foreclosure	12,932	0.156	0.5551
Vacancy	4,993	0.2161	0.6225
Post-vacancy	3,732	0.171	0.5464
Control:	42,396	0.1627	0.5413
Pre-foreclosure	20,797	0.1627	0.5621
Post-foreclosure	12,892	0.1628	0.5198
Vacancy	4,975	0.1779	0.554
Post-vacancy	3,732	0.1425	0.4834

Our empirical analysis requires attaching crime data to each treatment and control region. Given that treatment and control are of identical area and on average have essentially the same number of houses (see table 2), it is appropriate to directly compare crime counts between treatment and control areas. To build the panel data set that facilitates this study's difference-in-differences approach, it is necessary to aggregate crime totals for fixed time periods for each location. To this end, for each foreclosed property, quarterly crime counts in the treatment and control areas for different quarters are aggregated and attached to individual foreclosures according to the specific timing of foreclosure filing and vacancy[7]. As a result our unit of measure is the number of violent or property crimes in a treatment or control area in one calendar quarter.

As noted above, a foreclosed property can experience as many as four stages: pre-foreclosure, foreclosure, vacancy and reoccupation. We define the pre-foreclosure period as the 6 quarters before the calendar quarter a property receives a foreclosure filing. Foreclosure period is defined as the foreclosure filing quarter plus up to 8 subsequence quarters, excluding all quarters following either sale or the presale vacancy of the property (see below). The vacancy period is defined to run up to eight 8 quarters following the quarter of initial vacancy and is truncated by re-occupation. The reoccupation period covers the 4 quarters immediately following re-occupation.[8] Table 3 summarizes quarterly crime rates for our treatment and control areas by foreclosure/vacancy status.

[7] For example, crimes surrounding property i in the fourth quarter of 2006 are identified as "a quarter before foreclosure" if property i receives a foreclosure filing in the first quarter of 2007.

[8] The use of longer lags is constrained by the time period covered in our data.

We begin with a graphical analysis of the data. Figure 6 shows violent and property crime trends for both treatment and control areas, controlling for quarter-year fixed effects. The average number of violent crimes in treated areas during foreclosure quarters appears to remain largely unchanged from the pre-foreclosure quarter's baseline. Violent crime rates then increase during the quarters of vacancy and largely drops to the pre-foreclosure level after the foreclosed properties are reoccupied. These trends suggest that vacancy increases violent crime but foreclosure alone does not have a strong effect. The fact that crime rates appear to drop after re-occupancy strengthens this interpretation. The pattern appears to be similar for property crime rates, though with more noise.

While the treated community data is suggestive, to evaluate the possibility that changes in both crime and treatment status are being driven by some unobserved confounding factor, it is important to compare the trends in treatment areas to those in the adjacent control areas.

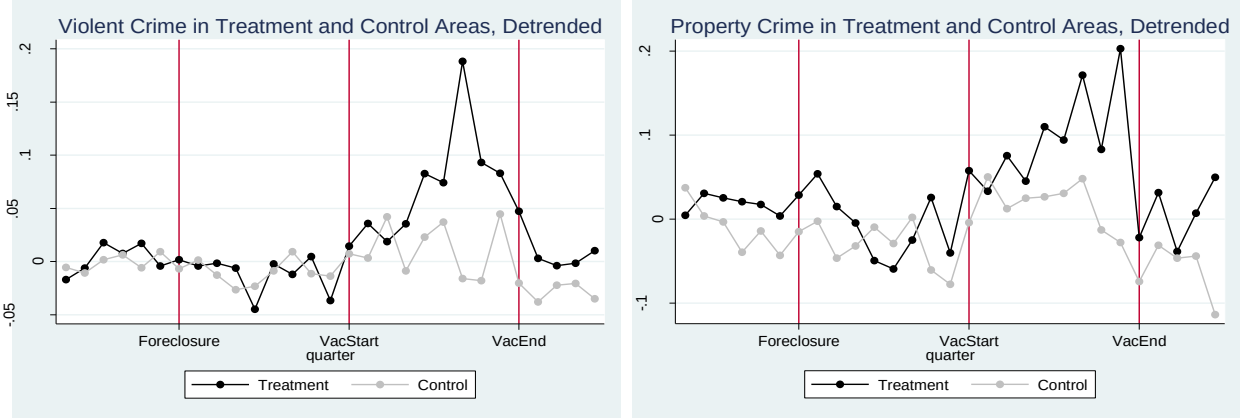


FIGURE 6 – CRIME TREND BY QUARTER FOR TREATMENT AND CONTROL GROUPS

Thus, Figure 6 provides a visual presentation of our complete identification strategy. Consistent with the notion of a continuous and decreasing spatial effect of vacancy on crime, it appears that the control areas also may experience some increase in crime rates during vacancy quarters, but at a much smaller scale than do the treatment areas. Again, there is no evidence that foreclosure per se leads to increased crime.

IV. Empirical Results

The specification for our empirical analysis is presented in equation (1) below. Our definition of treatment and control areas effectively reduces the study area to regions within 353 feet of a foreclosed and/or vacant property and includes observations only for those quarters that we identify as either pre-foreclosure, foreclosure, vacancy or re-occupation. The specification incorporates 3

indicators for the different stages of foreclosure and interactions of the treatment indicator (within 250 feet of the foreclosure sites) with each of these 3 indicators (note: pre-foreclosure then becomes the omitted category). Thus, the counterfactual change in crime rates in areas immediately surrounding foreclosure sites is estimated using crimes in areas just slightly farther away in the same periods. We also include neighborhood-quarter fixed effects (controlling for presence in one of 86 neighborhoods) as well as housing characteristics for the treatment and control areas. Finally, to flexibly control for the potential impact of additional foreclosures that occur in treatment and/or control regions during the study period, we include a vector of indicator variables for the presence of 1, 2, 3, or more than 3 foreclosures in the relevant region (control of treatment). Thus, the estimating equation is as follows:

$$(1) \quad \#(Crime_{it}) = \alpha + \beta X_i + \omega_0 D_i^{250} + \omega_1 Fore_{it} + \omega_2 Vac_{it} + \omega_3 ReOcc_{it} + \pi_1 \cdot (D_i^{250} * Fore_{it}) + \pi_2 \cdot (D_i^{250} * Vac_{it}) + \pi_3 \cdot (D_i^{250} * ReOcc_{it}) + \varepsilon_{it}$$

where, $\#(Crime_{it})$ is the number of violent or property crimes in control or treatment areas surrounding foreclosed property i in quarter t. $Fore_{it}$ equals 1 if in quarter t property i received a foreclosure filing in a previous quarter but is still occupied; Vac_{it} equals 1 if in quarter t property i is vacant as a result of foreclosure; $ReOcc_{it}$ equals 1 if property i is reoccupied in quarter t. Parameters of interest are π_1, π_2 and π_3.The estimated impact of foreclosure is given by π_1, while the impact of foreclosure-led vacancy and the impact of reoccupation are given by π_2 and π_3 respectively.

Table 4 presents the coefficients of interest from the estimation of equation (1). The dependent variable in columns (1) through (3) is a quarterly count of violent crimes. Housing characteristic controls include all average housing characteristics reported in Table 2[9]. In the first row, the coefficient on treatmentXforeclosure is small and insignificant; suggesting that foreclosure alone does not impact violent crime rates in treatment areas relative to control areas. Conversely, we find that during the time a foreclosed property stays vacant, the treatment areas have significantly more violent crimes than do the control areas. Comparing Column (1), (2) and (3), we find that adding housing controls and controls for the presence of other foreclosures, has little impact on our coefficient estimates – providing additional evidence as to the similarity of our treatment and control areas. In terms of scale, given that the average number of violent crimes within 250 feet of a foreclosed property each quarter is 0.170, the coefficient of 0.0315 in column (3) translates into an increase of roughly 19%. Table 4 also presents additional coefficients from the estimation of

[9] Including both housing and Census 2000 demographic controls in equation (1) does not change our results. We omit results with Census controls in Table IV because block level data cannot be precisely measured in our highly localized study areas.

TABLE 4 – DIFFERENCE IN DIFFERENCE PRIMARY ANALYSIS

	# Violent Crime			#Property Crime		
	(1)	(2)	(3)	(3)	(4)	(5)
Within 250 feet * foreclosure	-0.00224	-0.00269	-0.0111	0.00203	0.00180	0.000134
	(0.00789)	(0.00791)	(0.00798)	(0.0142)	(0.0143)	(0.0144)
Within 250 feet * vacancy	0.0338**	0.0324*	0.0315*	0.0245	0.0214	0.0263
	(0.0130)	(0.0129)	(0.0147)	(0.0222)	(0.0223)	(0.0246)
Within 250 feet * reoccupied	0.0269+	0.0255+	0.0224	0.0383	0.0365	0.0213
	(0.0143)	(0.0143)	(0.0142)	(0.0264)	(0.0264)	(0.0236)
Within 250 feet	0.00373	0.00493	0.00314	0.0285**	0.0221+	0.0335*
	(0.00623)	(0.00633)	(0.00544)	(0.0123)	(0.0125)	(0.0104)
Foreclosure	-0.0114+	-0.00915	-0.00459	-0.0123	-0.00659	-0.00821
	(0.00685)	(0.00680)	(0.00676)	(0.0130)	(0.0125)	(0.0121)
Vacancy	0.00182	0.000732	-0.0194	-0.0103	-0.0152	-0.0206
	(0.0109)	(0.0107)	(0.0117)	(0.0201)	(0.0190)	(0.0192)
Reoccupied	-0.0239+	-0.0240+	-0.0242*	-0.0261	-0.0265	-0.0196
	(0.0130)	(0.0126)	(0.0116)	(0.0232)	(0.0219)	(0.0194)
Neighborhood Quarter interaction	Yes	Yes	Yes	Yes	Yes	Yes
Housing characteristics		Yes	Yes		Yes	Yes
Controls for Additional Foreclosures			Yes			Yes
SD clustered by	Property Ring	Property Ring	Property Ring	Property Ring	Property Ring	Property Ring
Sample size	85,024	84,907	84,890	85,024	84,907	84,890

Standard errors clustered by property rings are reported in parentheses. Robust standard errors in parentheses
** p<0.01, * p<0.05, + p<0.1

equation (1): the effect of being treated and being in foreclosure, vacancy or reoccupation period. The coefficient on being treated is essentially 0 for violent crime. The effect of being in foreclosure period is insignificant after controlling for housing characteristics, and the effect of being in vacancy period is close to 0. Following re-occupation the point estimate of the differential between treated and un-treated areas in our most robust specification drops by 28 percent (from .0315 to .0224) and loses its significance.

We now turn to the results on property crimes presented in Column (4) through (6). The graphical evidence suggested a relationship between property crime and foreclosure driven vacancy – albeit a noisy one. The statistical analysis yields consistently positive but statistically insignificant coefficients (p-value ≈ .3). Given an average of .538 property crimes per quarter in our treatment rings, the point estimate of .0263 on treatmentXvacancy represents roughly a 5% increase in property crime.

While these findings differ from those of Ellen et al. (2013) in retrospect they are not that surprising; for three reasons. First, the hierarchical nature of crime reporting in our data may be masking a property crime impact due to the fact that whenever both a property crime and violent crime occur simultaneously the incident is reported as a violent crime and not as a property crime. Given our empirical approach, this masking of property crimes will attenuate the estimated effect.[10] Second, and perhaps more importantly, if the uptick in violent crime is being driven by the attraction of drug dealers and/or squatters to the vacant properties, it may be reasonable to expect that interactions among these individuals and between these individuals and others are the source of the uptick in violent crime. Spatially, the frequency of such interactions will be concentrated in very immediate proximity to the foreclosed house and will drop of quickly with distance from the vacant house. Conversely, if the presence of these individuals is also associated with an increase in property crimes the spatial process will likely be more diffuse – and thus more difficult to identify. Consider for example a squatter living in a vacant house who chooses to participate in either a burglary or motor vehicle theft. It is possible, and perhaps likely, that their target area for such activities would go well beyond the 250 foot buffer used in our analysis and would diffuse across the entire neighborhood. In such a case, identification of this effect will not be possible in our analysis – and will in general be quite difficult to identify cleanly. Finally, to the extent that either squatters or drug dealers who have

[10] One potential approach to this attenuation problem would be to estimate the effect of treatment *relative* to control areas. For this approach to be appropriate, we would need to know that the reporting bias for property crimes is identical in treatment and control areas. Unfortunately, our data doesn't allow us to assess this possibility.

taken up residence in the vacant property are themselves the victim of crimes, it is possible that such individuals would be less likely to report a property crime than a violent crime. Especially given that in the case of a violent crime, reports are likely to be generated through the victim's interaction with first responders and/or their access to medical care.

Specification Tests and Sensitivity Analysis

To further evaluate the robustness of our findings, we consider a number of specification tests and sensitivity analyses. Our Difference in Differences approach combines two strategies for dealing addressing unobserved confounds. First, by utilizing pairs of small-scale spatially proximate treatment and control regions, we attempt to control for spatial correlation in crimes and foreclosures that may be driven by other spatially co-varying factors. For instance, a casual review of figure 3 suggests the potential for reverse causality – foreclosures in the current year appear to be related to crime rates in the previous year. To evaluate the ability of the cross-sectional component of our empirical strategy to overcome these spatial correlations, we randomly choose 2,000 locations in the county and then place pairs of treatment circles and control rings in these locations (replicating the basic empirical strategy described above). We then compute, by year, the number of violent crimes (2005 – 2008) and foreclosures (2006-2009) that occur in each of these control and treatment rings. Using this data, table 5 presents the results of a simple regression of foreclosures/vacancies in year *t* on the number of crimes in year *t-1*. Columns (1) and (3) present regressions which don't utilize

TABLE 5 – TESTING FOR REVERSE CAUSALITY

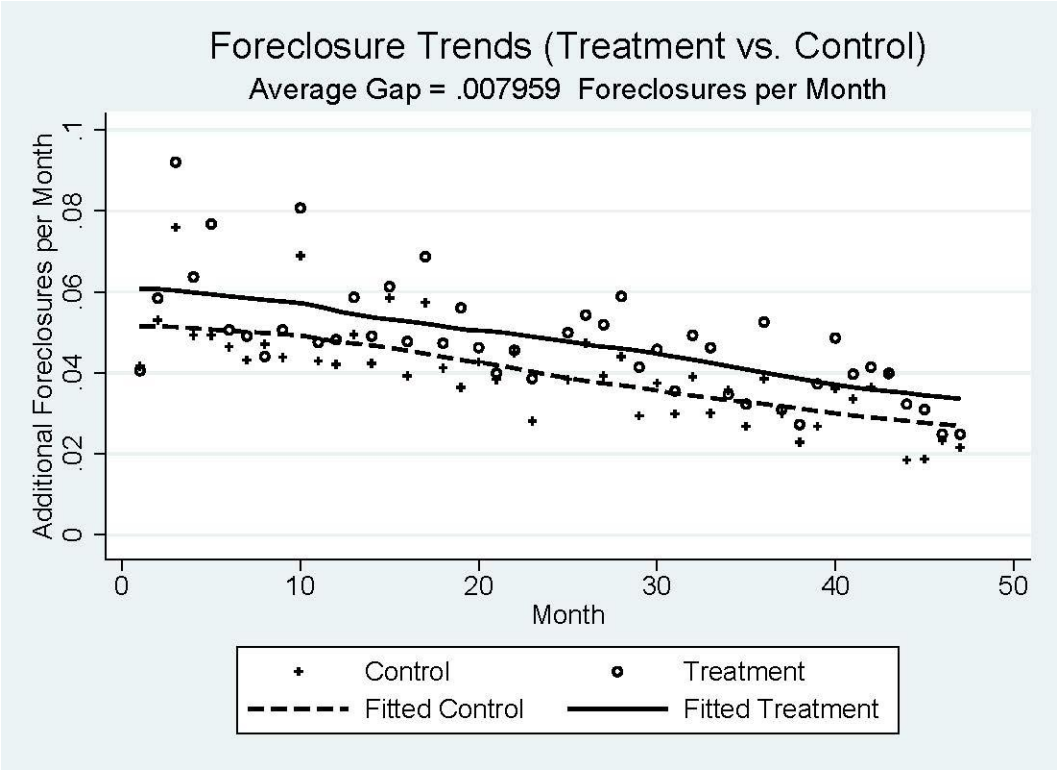
	# Foreclosures		# Vacancies	
	(1)	(2)	(3)	(4)
# of Crimes in Previous Year	0.03625***	-.005921	.012957***	-.001045
	(.003456)	(.004360)	(.001971)	(.002613)
Constant	.13581***	.1521***	.050496***	.05590***
	(.004038)	(.003844)	(.002304)	(.002303)
Fixed Effect		Yes		Yes
Sample Size	16,000	16,000	16,000	16,000

Robust standard errors in parentheses. ** p<0.01, * p<0.05, + p<0.1

the treatment/control structure of the constructed data. Given the spatial correlations that are apparent in Figure 3, it's not surprising that this analysis yields highly significant positive coefficients on the previous year's crime level. However, once we incorporate fixed effects for each

of treatment/control pairs (columns (2) and (4)). This relationship completely disappears. Suggesting that our treatment/control approach effectively controls for confounds in this setting and that reverse causality is not a concern for our analysis.

FIGURE 7 - COMPARING FORECLOSURE RATES IN TREATMENT AND CONTROL REGIONS



The second component of the D-in-D strategy leverages variation over time. A possible concern on this dimension is that there could be systematic differences in the time path of foreclosure levels in our control vs. our treatment rings. Figure 7 presents monthly data on the foreclosure rates in control vs. treatment regions for our 4 year study period.[11] There is a small difference in overall foreclosure rates, with treatment regions experiencing, on average, .008 extra foreclosures per month. However, there is no difference in the trends across the two types of regions – they track perfectly. These identical trends lend support to a causal interpretation of our Difference in Difference results.

A further concern is our choice of the scale of our treatment and control areas. The difference-in-differences approach taken here will be void of confounding observed neighborhood effects (static or

[11] By construction, the treatment rings have one more foreclosure than do the treatment rings (each treatment ring is constructed with an observed foreclosure at its center). We don't include that foreclosure in the construction of the graph. Thus, we are presenting data on additional foreclosures.

dynamic) as long as there aren't systematic and heterogeneous changes occurring in these effects within a spatial scale less than the 353 foot radius circles that encompass our treatment and control areas. The price of this strong identification strategy relative to confounds is that estimated treatment effects may be biased downward if the areas we identify as controls are actually subject to treatment (or vice versa). This problem of potentially treated controls can be reduced by defining significantly larger control areas - for instance the Police District level controls used by Ellen et al. (2013). This of course requires the stronger assumption that the immediate neighborhoods surrounding foreclosures (i.e. our 250 foot circle or Ellen et al.'s faceblocks) aren't changing in ways that are significantly different from the now much larger neighborhood. We can also overcome this potential problem by increasing the size of the treatment area, with the potential downside of including untreated locations in the treatment area. To evaluate these issues, Table 6 replicates our most robust specification, varying the size of the treatment and/or control rings.

One minor complication associated with varying the area of treatment and control areas is the fact that we now need to re-scale our crime counts by the area of the treatment and control rings. Thus, in Table 6 we report results in terms of crimes per acre. As a reference, in our baseline specification, treatment and control areas are each 4.505 acres in size. Thus, our estimated coefficient of .0315 extra counts per quarter translates to a quarterly increase of .0070 additional violent crimes per acre each quarter.

The First Two columns of Table 6 hold the size of the treatment area constant and expand the size of the control area (500 feet and 1000 feet). For violent crime, under these two models, our point estimates for the effect of vacancy shrink slightly, but remain significant at above the 5% level. For property crime, solely increasing the size of the control area has no meaningful impact on our results. We also note that offsetting potential treatment spillovers with larger control areas comes at the cost of increased heterogeneity between our treatment and control areas. For both violent crime and property crime, as we increase the area of the control areas, the baseline differences in crime rates between treatment and control areas increases substantially.

TABLE 6 - VARYING SIZE OF TREATMENT AND CONTROL REGIONS

#Violent Crime per acre per qtr	250 vs. 500 feet	250 vs. 1000 feet	500 vs. 1000 feet
Within 250 feet * Foreclosure	-0.00131	-0.00182	-0.00108
	(0.00139)	(0.00127)	(0.000725)
Within 250 feet * Vacant	0.00475*	0.00575**	0.00266*
	(0.00235)	(0.00222)	(0.00129)
Within 250 feet * Reoccupied	0.00229	0.00206	0.000568
	(0.00247)	(0.00227)	(0.00137)
Within 250 feet	0.00161	0.00400**	0.00395**
	(0.00101)	(0.000936)	(0.000601)
Foreclosure	-0.00138	-0.000758	-0.000146
	(0.000951)	(0.00063)	(0.000517)
Vacant	-0.0000903	-0.000887	0.0000632
	(0.0015)	(0.000997)	(0.000863)
Reoccupied	-0.000407	-0.000163	0.000904
	(0.00167)	(0.00102)	(0.000911)
R-squared	0.135	0.15	0.315
#Property Crime per acre per qtr	250 vs. 500 feet	250 vs. 1000 feet	500 vs. 1000 feet
Within 250 feet * Foreclosure	-0.000356	-0.00107	-0.0011
	(0.00247)	(0.00226)	(0.00131)
Within 250 feet * Vacant	-0.000511	0.00221	0.00453+
	(0.00399)	(0.00362)	(0.00235)
Within 250 feet * Reoccupied	0.00221	0.000457	-0.000967
	(0.00431)	(0.00382)	(0.00239)
Within 250 feet	0.00925**	0.0179**	0.0150**
	(0.00187)	(0.00174)	(0.00122)
Foreclosure	-0.00107	-0.000897	0.000151
	(0.00181)	(0.00127)	(0.00115)
Vacant	0.00311	-0.00013	0.000638
	(0.00286)	(0.00193)	(0.0018)
Reoccupied	0.0011	0.00163	0.00417*
	(0.00313)	(0.00202)	(0.00189)
R-squared	0.233	0.26	0.471
#Foreclosure dummy variables for treated & control rings	Yes	Yes	Yes
Housing characteristics	Yes	Yes	Yes
Neighborhood Quarter interaction	Yes	Yes	Yes
Observation	85465	85468	85400

Standard errors clustered by property rings are reported in parentheses. Robust standard errors in parentheses
** p<0.01, * p<0.05, + p<0.1

The final column of Table 6 presents results using much larger treatment and control regions (500 feet and 1000 feet). For violent crime, this change reduces the estimated magnitude of the vacancy effect. While not significantly different from the baseline results, this reduction in magnitude is suggests that the effective treatment area is smaller than 500 feet. Turning to violent crime, we now get an estimated positive effect that is significant at the 10% level. The coefficient estimate of .00453 translates to a 3.5% increase in property crime rates (relative to a baseline of .130 property crimes per acre each quarter). This estimated 3.5% increase is smaller, but of roughly similar magnitude, to the insignificant estimates presented in Table 4.

Finally, we consider the impact of different lengths of vacancy on violent crime rates. The motivation here is twofold: first, to rule out the possibility that our main results are driven by compositional effects; second, to better understand the role of vacancy length on crime rates. Given the generally insignificant and small magnitudes associated with property crime effects, we only present results for violent crimes. [12]

The potential concern regarding composition effects derives from the fact that only half of the foreclosed homes in our sample actually fall into vacancy. As a result compositional effects could potentially create spurious correlation between vacancy and crime that are actually driven by foreclosure. For example, if foreclosure leads directly to crime in cases that will eventually lead to vacancy but has no effect in cases where vacancy never occurs, the estimated coefficient on vacancy may be positive even if crime rates remained unchanged during the vacancy period.

A direct remedy is to separately estimate the effect of different stages of vacancy on subsamples of foreclosed homes that stayed vacant for various lengths of time. If the impacts of different lengths of vacancy remain positive and consistent across all subsamples, we can likely rule out the existence of this type of compositional effect. To this end, we present estimation results for equation (1) based on a group of subsamples, adding interaction terms for being in treatment areas and in different stages of vacancy. [13] We restrict the sample to all homes that experience vacancy after foreclosure, thus reducing the sample size by roughly half. The results are shown in Table 7. The coefficients are all of the expected sign and generally become larger in magnitude as the length of vacancy increases, indicating that longer-term vacancy has a stronger effect on violent crime rates. Moreover, the

[12] Property crime results in these models are consistent with the insignificant results for property crime presented in Table 4.

[13] For the remaining analyses we return to the baseline treatment and control areas on which the results in Table 4 were estimated.

estimated coefficient for all interactions equal to or greater than 6 months of vacancy are statistically significant. Note that the coefficient on foreclosure is again close to 0 and insignificant.

TABLE 7 –DIFFERENCE-IN-DIFFERENCES RESULTS BY LENGTH OF VACANCY

# Violent Crime	(1) Foreclosed Properties Ever Vacant
Within 250 feet * foreclosure	-0.00679
	(0.0119)
Within 250 feet * vacant 0-3 months	0.0173
	(0.0160)
Within 250 feet * vacant 3-6 months	0.0198
	(0.0162)
Within 250 feet * vacant 6-12 months	0.0394**
	(0.0192)
Within 250 feet * vacant12-18 months	0.0762***
	(0.0290)
Within 250 feet * vacant > 18 months	0.0499***
	(0.0182)
Observations	42,668
#Foreclosed homes	1,403

Standard errors clustered by property rings are reported in parentheses. Robust standard errors in parentheses
** p<0.01, * p<0.05, + p<0.1

It is still possible that there exists selection in terms of *the length* of vacancy. To address this potential, Table 8 reports estimates of equation (1) with subsamples of foreclosed homes experiencing different lengths of vacancy. While almost all of the coefficient estimates on vacancy are positive, most of them lose significance, likely due to the large reductions in sample sizes. For areas surrounding houses vacant for more than 18 months, the coefficients on having been vacant for longer terms are larger in magnitude and statistically significant, confirming the results in Table 7. Finally, the coefficients on foreclosure are generally small and insignificant. Overall, these results are consistent with estimates in Table 7 and confirm the absence of compositional effect in the main estimation results presented earlier.

Finally, given that there is no evidence of compositional effect, we use the entire foreclosure sample to generate more precise estimates of the way that vacancy length impacts violent crime. Results are reported in Table 9. The estimates are similar to those presented in Table 8, but obtain more statistical significance with the larger sample. The results indicate that presence of houses vacant for longer than 6 months increases violent crime rates, with the impact increasing with duration of vacancy and possibly plateauing somewhere between 12 and 18 months.

TABLE 8 –DIFFERENCE-IN-DIFFERENCES RESULTS BY LENGTH OF VACANCY (CONT.)

# Violent Crime	(1) Vacant for 0-3 months	(2) Vacant for 3-6 months	(3) Vacant for 6-12 months	(4) Vacant for 12-18 months	(5) Vacant for >18 months
Within 250 feet * foreclosure	0.0357	-0.0423*	0.00487	-0.00124	-0.0220
	(0.0291)	(0.0237)	(0.0257)	(0.0314)	(0.0339)
Within 250 feet * vacant first 3 months	0.0352	0.0171	0.0138	0.0316	0.0133
	(0.0404)	(0.0325)	(0.0313)	(0.0503)	(0.0413)
Within 250 feet * vacant for 3-6 months		0.0327	0.0598	-0.0108	-0.0153
		(0.0307)	(0.0367)	(0.0351)	(0.0365)
Within 250 feet * vacant for 6-12 months			0.0342	0.0307	0.0068
			(0.0268)	(0.0374)	(0.0299)
Within 250 feet * vacant for12-18 months				0.0618	0.0801**
				(0.0495)	(0.0367)
Within 250 feet * vacant > 18 months					0.0660**
					(0.0358)
Observations	7,560	8,754	11,106	6,706	8,542
#Foreclosed homes	278	310	364	209	242

Standard errors clustered by property rings are reported in parentheses. Robust standard errors in parentheses
** p<0.01, * p<0.05, + p<0.1

TABLE 9 –DIFFERENCE-IN-DIFFERENCES RESULTS BY LENGTH OF VACANCY (CONT.)

# Violent Crime	(1) All Foreclosed Properties
Within 250 feet * foreclosure	-0.0006
	(0.0071)
Within 250 feet * vacant 0-3 months	0.0208
	(0.0150)
Within 250 feet * vacant 3-6 months	0.0263*
	(0.0157)
Within 250 feet * vacant 6-12 months	0.0441**
	(0.0186)
Within 250 feet * vacant12-18 months	0.0792***
	(0.0283)
Within 250 feet * vacant > 18 months	0.0579***
	(0.0175)
Observations	84,907
#Foreclosed homes	3,282

Standard errors clustered by property rings are reported in parentheses. Robust standard errors in parentheses
** p<0.01, * p<0.05, + p<0.1

V. Conclusion

In this paper we use a difference-in-differences research design with tightly constrained control locations to measure the impact of residential foreclosures and vacancies on violent and property crime. Using detailed data on addresses and dates of foreclosures and crime, we estimate that, on average, violent crimes within 250 feet of foreclosed homes increases by roughly 19% once the foreclosed home becomes vacant, compared to crimes in areas between 250 and 353 feet away. Foreclosure alone is found to have no effect on violent crime. We find weak evidence of a causal link between foreclosure driven vacancies and property crime – on the order of 3.5% - 5%. As we discuss above, these weak results on property crime may reflect limitations of the crime data that we use and/or could reflect the existence of a very different spatial process for property crime (one that would be very difficult to identify using our data).

Because we exploit the exact timing and location of foreclosure, vacancy and crime by comparing crime rates in geographically small and homogenous areas at different stages of foreclosure, these results provide a significant improvement upon the existing literature that attempts to identify the impact of foreclosure and vacancy on crime with cross-sectional design or analysis at aggregate levels that are subject to considerable concerns regarding omitted variable bias. Our analysis provides the first clear evidence of the potential primacy of vacancy over foreclosure per se in leading to increases in neighborhood crime. In addition, it provides the first evidence on the impact of vacancy length on crime and concludes that longer terms of vacancy have a stronger effect on violent crime compared to shorter-terms of vacancy. One important caveat is that, while we have documented local increases in crime rates associated with foreclosure driven vacancy, our analysis can't speak to the impact of foreclosures and/or vacancies on net crime in a city.

As a policy matter, while the majority of current federal and state level foreclosure programs are focusing on loan modification, these results strongly suggest that policies aiming at post-foreclosure vacancy reduction may also warrant attention.

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