

# Deconstructing Distressed-Property Spillovers: The Effects of Vacant, Tax-Delinquent, and Foreclosed Properties in Housing Submarkets

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## Abstract

In this empirical analysis, we estimate the impact of vacancy, neglect associated with property-tax delinquency, and foreclosures on the value of neighboring homes using parcel-level observations. Numerous studies have estimated the impact of foreclosures on neighboring properties, and these papers theorize that the foreclosure impact works partially through creating vacant and neglected homes. To our knowledge, this is only the second attempt to estimate the impact of vacancy itself and the first to estimate the impact of tax-delinquent properties on neighboring home sales. We link vacancy observations from Postal Service data with property-tax delinquency and sales data from Cuyahoga County (the county encompassing Cleveland, Ohio). We estimate hedonic price models with corrections for spatial autocorrelation. We find that an additional property within 500 feet that is vacant, delinquent, or both reduces a home's selling price by 1 to 2.7 percent. In low-poverty areas, tax-current foreclosed homes have large negative impacts of 4.6 percent. In high-poverty areas, we observe positive correlations of sale prices with tax-current foreclosures and negative correlations with tax-delinquent foreclosures. This may reflect selective foreclosing on relatively high value properties. Tax delinquency could help municipalities identify recent foreclosures that have been abandoned.

Keywords: Vacancy; Property Tax Delinquency; Foreclosure; Property Values; Spatially Corrected Hedonic Price Models

JEL Codes: R1 R2 R3

# 1 Introduction

Recent events in housing markets are attracting much scholarly attention to foreclosures. One line of research that is developing rapidly focuses on the externalities associated with foreclosure, primarily a foreclosed home's impact on surrounding properties. There are two general deficiencies with this line of research. Distressed property externalities have been estimated at the regional level, obscuring important differences between the widely varied housing markets within a metropolitan area. Also, research has isolated foreclosures from related forms of property distress. This paper attempts to fill the gaps in prior research in two ways. First, it presents distressed property externality estimates for submarkets within an economically diverse urbanized county. Second, it incorporates parcel-level vacancy and real property tax delinquency (as a measure of neglect) in addition to foreclosure. We are able to estimate the impact of vacant and tax-delinquent homes on neighboring properties and correct the estimates of the impact of foreclosures by directly controlling for nearby vacant and tax-delinquent homes. We demonstrate important differences in the impact of foreclosure in different submarkets. In high poverty areas, we find evidence of selective foreclosure in a positive relationship between tax-current foreclosures and neighboring home sales. Pooling these high-poverty observations with medium and low-poverty observations hides the large negative impact of foreclosures that is measurable in mid-to-upper income areas. Finally, we discover that the coincidence of tax delinquency and foreclosure may be a useful indicator of abandoned properties, which have the greatest negative externality.

In the years following the rapid decline in housing values, hedonic price modeling has been applied to evaluate the impact of properties that have been through a foreclosure. Foreclosure sales are easily identified in county recorder or court records, so many studies have been conducted on the impact of foreclosures. Often these studies are motivated by suggesting the foreclosed properties are frequently vacant, abandoned, and blighted. However, foreclosure is a very noisy measure of the impact of vacancy and abandonment. A few of the studies have incorporated measures of vacancy and abandonment, but this has been limited by the unavailability of parcel-level vacancy data (Mikelbank, 2008; Hartley, 2010). With data on vacancy, foreclosure, and tax-delinquency, we can begin to disentangle the impact of each status on the value of neighboring properties.

In order to better understand these dynamics, this analysis is the first application of hedonic price modeling to a data set specifically representing vacancy and property-tax delinquency of residential properties. To the authors' knowledge, this is the first study to use property-tax delinquency as an objective indicator of abandonment. We use the U.S. Postal Service's (USPS) administrative records of vacancy to identify vacant properties at the address level. The records are commercially available on a monthly basis, so homes can be observed moving into and out of vacancy. The time variation in the data gives us both increased accuracy in the count of nearby vacant homes at the time of a property sale, and it creates additional variation in

the vacancy counts within neighborhoods. Focusing on within-neighborhood variation addresses some of the endogeneity issues that always challenge hedonic price analyses. We find that when foreclosure, vacancy, and property-tax delinquency are all included, the estimated impact of foreclosure on surrounding home values is reduced.

The rest of the paper proceeds as follows. In section 2, we discuss types of property distress and their relationship to one another. Section 3 reviews the relevant literature. In section 4, we discuss the empirical models we will use in estimating the externalities. Section 5 describes the data, and section 6 presents the results. In section 7, we discuss policy implications of our findings. Section 8 concludes.

## 2 Background

To place this analysis in context, this section describes the three types of property distress that we can measure, how these conditions relate to one another and how they relate to the difficult-to-measure status of abandonment. While vacancy is present in all housing markets, it is a condition property owners and neighbors usually want to end as soon as possible. Vacant homes do not contribute to the vibrancy or security of a neighborhood. In many cases, no one is attending to their appearance daily, so grass is mowed less frequently, snow is not cleared, leaves are not raked, etc. Some of this may be offset if the home is on the market and the sellers have invested in “curb appeal” cosmetic improvements. Unless the home is vacant because it is undergoing major renovations, or awaiting a rental tenant, then the home is either a unit on the market or part of the shadow inventory. The shadow inventory consists of homes owned by individuals or institutions that want to sell, but are not actively marketing because they are hoping demand will increase in the near future. When a single lender owns many delinquent loans secured by properties in close proximity to one another, and in markets where there is relatively weak housing demand, the lender may deliberately pace the marketing of foreclosed properties. In either case, these vacant homes (which are often easy to identify in person) signal to buyers that the market is flush with inventory and shadow inventory, and therefore they can bargain for low prices.

The negative externality from a tax-delinquent property is less direct. One can reasonably say that it is not visible on the street and very few people look up the tax delinquency status of neighboring homes.<sup>1</sup> For homes that are occupied but tax delinquent, we believe it serves as an objective measure of distress for the property. If the homeowner is unwilling or unable to pay their property taxes, which eventually results in tax-foreclosure, it is very likely that they are unable or unwilling to maintain the property.

As mentioned above, the most studied type of property distress is foreclosure. Foreclosures should have

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<sup>1</sup>While we are referring to the data as tax delinquency data, it does include some uncollected code violation and nuisance abatement fines as described in section 5. Since these vary widely between jurisdictions, we attempt to exclude them from the analysis. In many cases, code violations are visible from the street.

a direct impact on property values because they are a type of sales transaction, and the best indicator of the value of a house is the sale price of similar houses. In a foreclosure auction, if no third party investor bids above the lending institution's auction reserve, the reserve is recorded as the sale price and the lender takes possession of the property. The property becomes real estate owned (REO) on the lender's balance sheet. In many cases, these homes are back on the market or being held as shadow inventory by the lender (Whitaker, 2011). Foreclosures add to the supply on the market, which lowers prices if demand is unchanged. When a home is sold out of REO, a second transaction is recorded at a discounted price. The direct link between these foreclosure-related sales and other sales is the comparables or appraisal process.<sup>2</sup> The foreclosed homes will be considered by sellers, purchasers, and lenders in determining the value of a nearby non-foreclosure property.

With the exception of strategic defaults, every household that went through a foreclosure has experienced financial distress. When the homeowner accepts that they will likely or certainly lose the home, they no longer have an incentive to invest anything in maintenance.<sup>3</sup> Thus, recently foreclosed homes are more likely to be distressed due to deferred maintenance than homes that have not recently been through a foreclosure.

Vacancy is related to foreclosure to the extent that a home that has been foreclosed upon will be vacant immediately before the auction. The vacancy may be temporary because the repossessing bank or investor usually attempts to find a new owner or tenant.<sup>4</sup> Vacancy is not a result of a foreclosure in the vast majority of cases (there are seven times more vacancies than foreclosures in our data). Unlike foreclosure and tax delinquency, vacancy is not always associated with distress for a property owner. A home may be vacant while it is being marketed for sale or rent, or it may be vacant during renovations. Some vacancy is necessary for the turnover of a well functioning market.

Tax delinquency must also be understood to be distinct from foreclosure because, although counter-intuitive, most homes that go through foreclosure are never tax delinquent. It is standard industry practice for lenders and mortgage servicers to pay property taxes on mortgaged homes even while the borrower is in default. This prevents municipalities from initiating a tax foreclosure and forcing the sale of the lender's collateral. When lenders foreclose on a home and take it into their REO portfolio, they continue to pay the taxes to maintain possession of their asset. In our data, approximately 94 percent of the recently foreclosed homes are tax current. The delinquent recent foreclosures could be tax foreclosures on non-mortgaged homes,

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<sup>2</sup>Real estate appraisal guidelines allow for some discretion when selecting comparable properties. See, e.g. Uniform Standards of Professional Appraisal Practice 2010-2011, Standards 1 & 2, available at <http://www.uspap.org/USPAP/frwrdrd/uspap.toc.htm>. Thus, foreclosure liquidations and REO sales may not be used when selecting comparable properties.

<sup>3</sup>In states that allow deficiency judgments, where the lender can pursue borrowers for the difference between the amount owed on the loan and the price paid for the home at foreclosure auction, homeowners may have more of an incentive to actively maintain homes. Historically, however, deficiency judgments are not commonly pursued for many reasons. For example, homeowners who have gone through foreclosure rarely have the ability to repay a deficiency judgment, and such judgments are more easily dischargeable in bankruptcy than secured debt.

<sup>4</sup>Not all purchasers at foreclosure auctions seek to quickly fill the home. Some spend time rehabilitating it or marketing it to other property investors (Ergungor and Fitzpatrick, 2011). Some homes remain vacant for years after a foreclosure, especially high-poverty areas (Whitaker, 2011).

or the homes may have been sold out of REO to new owners that become tax delinquent. In a few cases, a mortgage servicer may have determined that an REO home has no recoverable value, and the servicer stopped making tax payments to minimize its losses.

Policymakers are concerned about the most severely distressed properties, abandoned buildings, because they receive no maintenance, and can pose dangers to their neighborhood as well as being an unsightly disamenity. Abandonment usually occurs when a property’s carrying, operating, or rehabilitation costs are too high relative to the property’s value. The property owner may expect that values in the home’s location will be declining indefinitely, or that price appreciation will return so far in the future that holding the property is not justified. The condition of abandoned property deteriorates rapidly, as there is no one maintaining or improving it. The decision to abandon property is made subjectively, and cannot be directly observed. This has led previous researchers to use subjective municipal determinations of whether a property has been abandoned (Mikelbank, 2008). These studies show that when the impact of foreclosed property on surrounding home values is not considered alongside vacant and abandoned property, it overstates the impact of foreclosure. Certain levels of tax delinquency may signal the abandonment of property by its owner. We use combinations of reproducible, objective indicators as proxies for abandonment. If we find these indicators are informative, they may be a substitute for this difficult-to-measure status.

Our study captures housing dynamics that are likely representative of most cities in the industrial Midwest and Northeast. Excess vacancy, beyond that necessary for market turnover, is caused by a mismatch between the housing stock and the population of households. If growth of a region’s housing stock exceeds the growth of its population, prices will adjust until the most desirable homes are filled (Bier and Post, 2003; Glaeser and Gyourko, 2005). The oldest, lowest quality homes are filtered out of the stock by being left vacant and eventually demolished or abandoned (Lowry, 1960). Most new housing in the US is built on the periphery of the urbanized areas, and the oldest homes are concentrated in the center of the central cities. The innermost census tracts often have declining populations even when the metropolitan population is growing.

While excess housing stock grabbed headlines in Florida and California, slow-growing northern states also built housing units faster than they added households. If we calculate the growth of housing units beyond the growth in households between 2000 and 2010, four of the ten worst showings are Michigan (201K), Ohio (175K), Illinois (150K) and New York (145K).<sup>5</sup> These states built more excess housing than #10 Arizona (103K). Wisconsin (85K) and Indiana (84K) built more excess housing units than Nevada (65K), which experienced relatively large in migration. It seems likely that many metro areas will be dealing with vacancy

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<sup>5</sup>The figures in the text are calculated for each state as

$$Excess = Housing\ Units_{2010} - \left( \frac{Households_{2010}}{Households_{2000}} * Housing\ Units_{2000} \right).$$

The data are from the decennial censuses. The other worst excess figures are Florida (439K), California (324K), Georgia (175K), Texas (132K), and North Carolina (114K). If the excess numbers are calculated as a share of the total housing stock, Michigan, Ohio, Wisconsin, Indiana, and Illinois are again with Nevada, Florida and Arizona among the worst fifteen.

and abandonment for years until the surplus units are absorbed or demolished.

The older industrial regions of the country, which our data are representative of, have also experienced the foreclosure crisis despite modest home price appreciation over the last decade. In 2010 and 2011, approximately 20 percent (774,232) of the nation's 4 million foreclosure starts were in Wisconsin, Illinois, Indiana, Michigan, Ohio, Pennsylvania and Upstate New York.<sup>6</sup> The more studied boom states of Arizona, California, Florida and Nevada had approximately 35 percent of the nation's foreclosure starts in those two years.

### 3 Literature

In the literature that addresses the externalities of distressed properties, the distress represented by a foreclosure is the most thoroughly studied. There are several studies that have estimated the effect of a foreclosed property on sale prices of nearby homes. While the methods and data sets differ, each analysis has defined a distance from the observed sales (200 yards, 1/4 mile, etc.) and counted the properties within that buffer that have been foreclosed upon within specified time periods (6 months, 2 years, etc.). Most of the results clustered around a one percent lower sale price for each nearby foreclosures (Immergluck and Smith, 2006; Schuetz et al., 2008; Harding et al., 2009; Rogers and Winter, 2009; Rogers, 2010; Campbell et al., 2011; Groves and Rogers, 2011). One study by Lin, Rosenblatt, and Yao (2009) estimated that each foreclosure liquidation can depress short-run property values of homes within a half mile as much as 8.7 percent in down markets and 5 percent in up markets.

Only two studies look beyond foreclosure and incorporate vacancy into their analysis (Mikelbank, 2008; Hartley, 2010). Mikelbank illustrates that estimating the impact of either vacant and abandoned property or residential foreclosures in isolation overstates the impact of both, based upon his empirical analysis of one year of housing sales in Columbus, Ohio (2008). The second study attempts to delineate between the "supply" and "disamenity" effects of foreclosures to determine how much of the price discount was due to each (Hartley, 2010). By looking at different types of foreclosed property in Chicago, Hartley decomposes the effects of foreclosure on nearby housing in census tracts with low and high vacancy rates. The explicit assumption in Hartley's work is that renter-occupied multi-family buildings are not substitutes for single-family homes, so a renter-occupied multi-family building foreclosure will not change the potential housing supply for persons seeking a single-family home, and vice versa. In census tracts with low vacancy rates, he finds that each foreclosed single-family home within 250 feet reduces a home's value by 1.6 percent due to an increase in supply, while the disamenity effect of the foreclosed multifamily buildings is near zero. In census tracts with high vacancy rates, he estimates the disamenity effect of a foreclosed multi-family home lowers surrounding single-family property values by about two percent, while the supply effect is near zero.

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<sup>6</sup>Foreclosure starts in New York City were subtracted from the total for the state of New York.

One issue common to all of these studies is that they acknowledge that foreclosures likely lower surrounding home values by becoming disamenities or adding supply to the market, but fail to distinguish between foreclosures that are reoccupied quickly, foreclosures that sit vacant and are well maintained, and those that become abandoned. Hartley’s results hint at the importance of this distinction by illustrating that neighborhood property values are lowered due to supply or disamenity, depending on the location (and likely the condition) of the property.

Assessing the impact of abandoned properties is challenging, and the challenge begins with the lack of a universal definition of “abandonment.” A structure is generally considered abandoned when it is chronically vacant, uninhabitable, and the owner is taking no steps to improve the property (Cohen, 2001). Unfortunately, to determine that a property is uninhabitable or in disrepair researchers rely upon assessments from municipalities, obtained through inspections (Cohen, 2001; Mikelbank, 2008). This data is often incomplete, because municipalities lack the resources to frequently survey all properties within their jurisdiction (Pagano and Bowman, 2000). Municipalities also use a period of vacancy as a proxy for abandonment, but the threshold period varies widely (Pagano and Bowman, 2000). These inconsistent definitions make it impossible to accurately compare results across cities.

Understanding the difference between foreclosed, vacant, and abandoned property is critical for policy-makers who seek to understand how to address these issues. For the purposes of this study, we use vacancy, tax delinquency, and their coincidence as measures of distress and abandonment. Tax delinquency has been referred to as “the most significant common denominator among vacant and abandoned properties,” (Alexander, 2005), and correlations exist between tax-delinquency rates and decreases in home sales prices (Simons et al., 1998). Vacancy is nearly universal among abandoned properties, as by definition they are not being cared for by either owners or inhabitants.

## 4 Empirical Methods

The methods we will employ are based in the field of hedonic models of real estate pricing. Origination of these models is generally credited to Rosen (1974). In their simplest application, the sales price of a home is regressed on indicators of the home’s characteristics, and the coefficients are interpreted as the marginal prices of those characteristics (see equation 1).  $P_i$  is a home sale price.  $z_{ij}$  are characteristics of the home and its location.

$$P_i = \alpha + \sum_{j=1}^J \beta_j z_{ij} + \varepsilon_i \quad (1)$$

The HP model relies on some standard assumptions which, nevertheless, could be violated in reality. It assumes the housing market is competitive and that both buyers and sellers are fully informed. Using a linear specification suggests that the characteristics of the home can be costlessly repackaged. This is obviously not the case, so most applications employ a semi-log specification that implicitly interacts all the characteristic measures. In this specification, the coefficients are not interpreted as prices, but rather percentage changes in the price.

$$\ln(P_i) = \alpha + \sum_{j=1}^J \beta_j z_{ij} + \varepsilon_i \quad (2)$$

Despite including a set of measures of the area surrounding an observed house sale, researchers generally suspect that there are important unobserved location factors. These include amenities and disamenities the researchers has not controlled for (the possibilities are endless). The impact of these factors is also thought to vary with distance. A home closer to the amenity or disamenity will have a larger price response. Omitting a distance-weighted indicator of the factor leaves its influence in the error term. Equation 3 is a hedonic price model that gives two options to address this (Anselin, 1988).

$$P = \lambda W_1 P + ZB + \varepsilon \quad (3)$$

$$\varepsilon = \rho W_2 \varepsilon + \mu \quad (4)$$

$$\mu \sim N(0, \sigma^2 I) \quad (5)$$

Equations 1 and 2 used summation notation to emphasize the contribution of multiple characteristics to the sale price. We switch to matrix notation (following the literature) here because the spatial models center on a spatial weight matrix.  $W_1$  is a spatial weighting matrix that gives large weight to the prices of nearby homes and small weight to the prices of faraway homes. Multiplying the price vector ( $P$ ) by  $W_1$  creates a vector of weighted averages of nearby home prices. Including these averages as a control removes the gradient between relatively high-price and low-price tracts.<sup>7</sup> The remaining variation within neighborhoods tells us approximately how much sale prices would change if we could add or remove distressed properties.  $\lambda$  relates the distance-weighted mean selling price of the other homes to the specific observation. If  $\lambda$  is significant and non-zero, the prices are said to be spatially dependent.  $W_2$  is also a distance weighting, but in this case relating the errors of the observations to one another through  $\rho$ . A non-zero  $\rho$  indicates spatial error correlation, which would be caused by unobserved amenities and disamenities contributing to the error terms of nearby homes.  $\mu$  is the normal error remaining after the spatial error has been modeled. Unfortunately,  $\rho$ ,  $\lambda$ ,  $W_1$ , and  $W_2$  cannot all be estimated at once, so researchers usually make some plausible assumption

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<sup>7</sup>The negative correlation between vacancy and price is very obvious in maps (figures 2 and 1), but it is not the relationship we are attempting to estimate.

about either the spatial weight matrices or the spatial autocorrelation coefficients, and estimate the other. Both  $W_1$  and  $W_2$  can be estimated in the same model, if the theory suggests a specific error structure that differs from the relationship between the prices. In this analysis, we do not have a theoretical reason to use a  $W_2$  different from  $W_1$ , and using the same spatial weight matrix can introduce collinearity issues. We will refer to the correction involving  $W_1$  as the spatial-lag correction and the correction employing  $W_2$  as the spatial-error correction.

In specifying the spatial models, we use a weight matrix based on inverse distances up to one kilometer. Closer sales are given larger weights and further homes are down-weighted. The weights are row-normalized to sum to one, so the product of weight matrices and the price vector or error vector are all in the same units. In the results below, several other spatial corrections are described and the consistency of the results gives us confidence that our weight matrices are reasonable and effective at removing the spatial autocorrelation bias.

The estimates presented in the results tables apply a spatial-error correction. Spatial-lag models that we estimated returned similar results. Wald tests confirm either model is significantly better than a model without a spatial structure. The test statistics suggest the spatial-error model is a better fit in each of our three main models. In our main results, (table 4), the  $\rho$  values reflect the extent to which the model's errors are geographically correlated. The values are between .46 and .68 and are highly significant. This parameter is primarily of interest as a control, with the high, significant value suggesting that it is absorbing unobserved correlation in the error structure and leading to coefficients on the treatment variables that can more plausibly be interpreted as causal. We report  $\rho$  in other models, without further discussion, for confirmation of the models' appropriateness.

If a distressed home decreases the price of a neighboring home, that neighboring home decreases the prices of homes nearby, and the prices of the homes nearby decrease the price of that neighboring home, then the coefficient from the model is understating the impact of an additional distressed home. The average direct treatment impact represents that percentage decrease in home prices if the decline is calculated to impact the neighboring home prices and then fed back into the original home sale observation (Drukker et al., 2011). The change is calculated and averaged over all observations. When we calculate the average direct treatment impact, we found that it differed from the coefficients by one tenth of a percent or less, and it would be lost in rounding. The results we present may be very slightly understating the impacts.

Two additional concerns are raised in the literature and should be kept in mind when considering this analysis. The causality between foreclosures and falling home prices can run in both directions. When home prices are falling, households in economic distress may not be able to sell their home and downsize or shift to renting. If the recent price downturn has been severe, or if the homeowner put little money down on the home, they may owe more than the home could sell for. Even if they can sell the home, they cannot

repay the mortgage unless they have other assets. If a housing market is in the self-reinforcing cycle of falling prices and rising foreclosures, these trends will introduce bias, overstating the externality of foreclosed homes. Somewhat parallel arguments could be made that falling house prices increase vacancy and tax delinquency. In our data set, we do not anticipate this being a significant problem because our time period is only fifteen months. Over those fifteen months, the stocks of vacant, delinquent, and foreclosed (within the past twelve months) homes change only modestly with no pronounced trend. Likewise, the time period is not long enough to fully reflect year-over-year price declines. We include indicators for the month of sale in all estimates. These indicators are intended to adjust for the strong seasonality in northern real estate markets, but they could also capture a secular trend. Other studies employing ten years or more of data must take additional steps to account for appreciation or depreciation over that period.

The second estimation issue involves the selection of home sales into our data set. If homes are held off the market by owners hoping for a price recovery, we will not observe their sale prices. If withholding of homes is more frequent near distressed properties, then this could lead to an underestimate of the impact of the distressed properties on neighboring property values. Lin, Rosenblatt, and Yao specified a model that estimates the selection into a sale and the implied change in the coefficient on the foreclosure count (2009). They find evidence that homes near foreclosures are more likely to be held in the shadow inventory, but the effect on estimates of a foreclosure's impact is too small to be of great concern.

Most would agree that a data set that covers an entire urbanized county, as ours does, represents several separate housing markets, rather than one. For an average buyer, many high-cost neighborhoods would offer no options within their budget constraint. Likewise, high-income buyers would not consider a home of any type or price if it is in a low-performing school district or high-crime neighborhood. When the models are estimated on a pooled data set, the coefficients are an average across all types of buyers. It is useful to know how the impact of a distressed home differs in high-income versus low-income neighborhoods, so we estimate our models on several submarkets.<sup>8</sup>

To briefly review, we expect each indicator of distress – vacancy, delinquency, and foreclosure – to be associated with lower sales prices for nearby homes after controlling for prevailing neighborhood prices and observable characteristics. We begin with separate counts of each combination of distress because we think homes in different stages of the foreclosure process will have very different impacts on nearby homes. Also, distressed properties that have not been touched by foreclosure can have their own negative externality. When past studies have estimated the impact of foreclosures, they are rolling together homes that were just

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<sup>8</sup>During the time covered by our study, the first and second Neighborhood Stabilization Programs were being implemented. The Cuyahoga County Land Reutilization Corporation (a land bank) was also starting up its operations. The impact of the programs should be reflected in the prices of neighboring sales, and therefore we are indirectly controlling for them in our analysis. Numerous Federal housing programs are always active in Cuyahoga County's high poverty areas, along with community development corporations and municipal land banks. These programs and organizations are among the dozens of amenities and disamenities we are not attempting to model, but rather control for. In the middle and lower poverty submarkets, the activities of these programs are minimal.

auctioned and are bank owned, homes sold out of REO to speculators that are vacant and delinquent, and homes sold to families that have paid the property taxes and occupied the home. Our parcel-level data with all three measures will reveal if certain combinations of distress indicators matter more than others.

## 5 Data

The bulk of the data used in our analysis is an administrative data set maintained to track property transactions, property-tax delinquency, and assessed values for taxation. These data contain a rich set of characteristics for all residences in the county. The records are used in property tax assessments and are updated triennially and with permit data.<sup>9</sup> We include measures or indicators of the following as controls: bedrooms, bathrooms, vintage, style (Cape Cod, Colonial, etc.), lot size, condition, construction quality, exterior material, heating and cooling systems, garages, attics, porches, and fireplaces. We supplement the house characteristic data with measures of the poverty rate and the college attainment rate for each census tract using estimates from the 2005-2009 American Community Surveys. The vacancy, delinquency, and foreclosure status of the property itself is included as a control. The vacancy and delinquency measures have large, highly-significant influences on the sale prices, and they improve our model over others that could only control for the foreclosure status.

The county fiscal officer also maintains records of all sales with the key elements of dollar amount, date, seller, and purchaser. Data on tax-delinquency is updated semiannually. We use two tax-delinquency files. The first is a list of parcels that were delinquent anytime in 2010, and the second is a list of properties that were delinquent at any time between January and June 2011. The delinquent amount appears in the record along with any payments that have been made toward it, even complete repayments. The dates when the properties enter or exit delinquency are not available, so these data are static within one year or the other. We identified in the data set the properties that have missed a biennial payment by flagging only observations in which the delinquency amount is at least 40 percent of the annual net tax bill. This eliminates minor accounting errors (there are hundreds of delinquencies of a few dollars or cents) and the minor code violations. Housing codes vary widely across jurisdictions in their stringency, enforcement, and recording with the county. The Cuyahoga County fiscal officer, like many county departments nationwide, makes tax delinquency data available for download.<sup>10</sup>

One novel data set that is being used for the first time (to the best of our knowledge) is the USPS vacancy data. This data set is created when postal carriers observe that a home has been vacant for 90 days and record it as such in the USPS's main address database (this data does not include short-term or seasonal

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<sup>9</sup>If a property owner requests a permit to add an addition on their house, for example, the assessor will estimate the increase in the home's value and adjust the property tax bill accordingly.

<sup>10</sup>Cuyahoga County makes its data available via Northeast Ohio Community and Neighborhood Data for Organizing (NEO CANDO). <http://neocando.case.edu/cando/index.jsp>

vacancies). This prevents mail addressed to the vacant home from continuously being sorted into the route's load and carried back at the end of the day. The address database, including vacancy status, is routinely audited and maintained at an accuracy level above 95 percent. To further increase efficiency, the USPS makes this data commercially available to direct mailers. The companies can run their mailing lists through a software program that marks each record if the address is vacant. Mailings are not prepared for these addresses, so wasted printing and postage is avoided. The USPS provides this data to private contractors who sell subscription services. For our research purposes, we have subscribed to the vacancy data since April 2010. We run our list of Cuyahoga County addresses through the software, and create a panel of vacancy indicators.

For this analysis, we use the fifteen months of sales data that we have been able to link to complete vacancy data. This covers 11,361 sales in Cuyahoga County between April 1, 2010 and June 30, 2011. We have attempted to exclude non-arms-length sales, starting by excluding sales involving personal trusts and spouses. We exclude bulk purchases, where the price paid for a bundle of properties is recorded for each property in the transaction. In these cases, it is not clear what portion of the total prices should be related to the individual properties. We exclude sheriff sales in which a bank or federal agency repurchases a home on which it holds the mortgage. These prices reflect the lender's auction reserve rather than the market value of the home. The sales data are limited to single family homes. Multifamily buildings are counted in the vacancy, delinquency, and foreclosure counts. Buildings add zero or one to the counts, regardless of how many units they have. A multi-family building is considered vacant if less than 25 percent of its units are occupied. Apartments generally pay taxes via one parcel number while condo parcels must be grouped by building to determine if the building has over 75 percent delinquent units, and thus adds to the delinquency counts of neighboring home sales.

## 5.1 Descriptive Statistics

In this section, and in the results, we will present descriptive statistics and models estimated separately in high-, medium-, and low-poverty submarkets.<sup>11</sup> By comparing the results from the submarkets with pooled results, it is evident that pooling hides important differences. Table 1 summarizes the monthly counts of distressed properties.<sup>12</sup> Note that delinquencies are the most common indicator of distress, with vacancy the next most common. The counts of distressed properties in the 500 foot buffers around the home sales are described in Table 2. The (pooled) average home sells with four vacancies, eight delinquencies and one foreclosure within 500 feet. Not surprisingly, all counts are higher in high-poverty census tracts and lower

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<sup>11</sup>The division into thirds was intended to maintain a usable sample size in each submarket estimate. It was not meant to reflect eligibility requirements of any particular housing program. The poverty rates of the census tracts in the submarkets are 11.98% to 91% (high), 5.5% to 11.96% (medium), and 0% to 5.41% (low).

<sup>12</sup>More extensive descriptive statistics with standard deviations, maximums, minimums, cross tabulations, and correlations are available from the authors upon request.

in low-poverty census tracts. To place the counts in context, we need to think about the distribution of neighboring parcels. A home in a low-density exurb may only have a handful of neighbors within 500 feet that could impact its value. In contrast, a home in the densest tract can have over 200 neighbors. The mean number of parcels in a home's 500 foot buffer is 98 and the standard deviation is 45.

Maps of one month's vacancies and median sales prices (figures 1 and 2) illustrate that the distribution of vacancies is different in low-price versus high-price areas. Maps of delinquencies and foreclosures have similar patterns. The counts of the different types of distressed homes are positively correlated with one another. Most of the observations of the counts are in the low single digits, and zeros are common. However, there are homes in distressed neighborhoods that are treated by very high counts of all types of distressed properties.

## 6 Results

### 6.1 Main Results

Table 3 presents the results of the three submarket models, and a pooled model, each with seven separate distress counts.<sup>13</sup> The coefficients on the property characteristics and month indicators (not shown) are significant in most cases and have the expected signs.<sup>14</sup> Counts of vacant (only) and delinquent (only) homes have negative impacts between 1.1 and 2.1 percent in each submarket, with five of the six estimates being statistically significant. The marginal effect, as suggested by the coefficients, of adding one distressed property of any type is conditional on the other counts of distressed properties being held constant.<sup>15</sup>

Homes that have been abandoned without going through a recent foreclosure should be counted in the vacant-delinquent category. It seems logical that vacant-delinquent homes would have at least as large an impact as a home with only one of the markers of distress. This hypothesis is supported in the medium-poverty market, but does not hold in the other two. Vacant-delinquent homes are quite common in high-poverty neighborhoods, as indicated by an average count of 4.29 VD homes near a sale in a high-poverty neighborhood (see Table 2). However, the counts of delinquent homes are even higher, and there is a correlation of .75 between the two counts. While a significant negative impact of 1 percent per additional unit is ascribed to vacant-delinquent homes in high-poverty tracts, the counts of delinquent homes explain more of the variation. In low-poverty areas, vacant-delinquent homes and tax-current foreclosures are present in similar numbers. In these areas, vacant-delinquent homes are certainly distressed, but probably not completely abandoned. The contrast between the large negative impact of the recent foreclosures and the smaller, insignificant result

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<sup>13</sup>To calculate the estimates reported here, we use a recently released routine from StataCorp. The package, called *sppack*, creates spatial weight matrices and estimates spatial models using a maximum likelihood routine (Drukker et al., 2011,?).

<sup>14</sup>A full set of coefficients are available from the authors upon request.

<sup>15</sup>Single unit differences are feasible. Although the distressed property counts are positively correlated, many combinations of the counts are supported in the data. The support is more extensive in the higher poverty submarket, where all the counts are higher.

for vacant-delinquent homes may reflect the influence of foreclosures through the use of discounted sales as comparables. Of the four measures involving foreclosure, vacant-foreclosures (tax-current) have the most significant coefficients.

When all seven distress counts are included for three submarkets, this requires presenting twenty-one coefficients of interest. Results this complex are challenging to interpret and extremely difficult to convey to a general audience, so we considered more parsimonious models that could maintain the important disaggregation.<sup>16</sup> We find that whether a recent foreclosure is vacant or not is not a consequential distinction. Dividing the foreclosure counts by vacancy status reduces the precision of the estimates. In contrast, the delinquency status of recent foreclosures is an important distinction, so we maintain these counts separately. Throughout the remainder of the results, the models are estimated with the distressed property counts placed in five categories.<sup>17</sup> Within the foreclosed home counts, we combined the counts divided by vacancy, but maintained the distinction based on tax-delinquency. The tax status of foreclosed homes proves to be a very informative distinction in high-poverty neighborhoods. In each case where the counts are combined, the resulting coefficient is a combination of the two impacts, weighted by the frequency of the distressed property treatments.

Our main results appear in table 4. The model suggests that an additional vacant property within 500 feet reduces the sales price of a home by 1.7 percent in low-poverty neighborhoods and 2.1 percent in medium-poverty neighborhoods. Tax delinquent properties have very similar impacts on a per-unit basis (1.8 and 1.9 percent respectively) , but these coefficients would be multiplied by higher counts because delinquent properties are roughly twice as numerous as vacancies. In medium- and low-poverty neighborhoods, having a recent foreclosure near a sale has a large negative impact on the sale price, as expected. A recent foreclosure within 500 feet decreases the sale price by 2.7 percent in medium-poverty tracts and 4.6 percent in low-poverty tracts. Delinquent-foreclosure counts in medium- and low-poverty neighborhoods have small to modest positive coefficients, but much larger standard errors.

Foreclosed homes in high-poverty census tracts display a different phenomenon. In poor neighborhoods, recent foreclosures display a marginally significant, positive relationship with nearby sales prices. While it is not plausible that buyers actually value buying near a recent foreclosure, this positive correlation is consistent with selective foreclosure by mortgage holders. In these census tracts, where home values are often lower than transaction and maintenance costs (under \$10,000), only homes that are in relatively good condition and on relatively desirable blocks will resell for a value high enough to justify the cost of foreclosure. In this way, a recent foreclosure is associated with higher home values among near-neighbor homes. In contrast,

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<sup>16</sup>We estimated a seven-treatment equivalent of every model for which it is possible. These estimates are available from the authors upon request.

<sup>17</sup>We formally tested if the coefficients for vacant and occupied (tax-current) foreclosures were significantly different from one another. Likewise, we tested if the vacant and occupied delinquent-foreclosure coefficients were different. In both tests within all three submarkets, the coefficients were not significantly different from one another. If the coefficients were significantly different from one another, combining the counts would be less appealing.

the impact of a tax-delinquent recent foreclosure is -7.3 percent in high-poverty neighborhoods. After the sheriff sale, if either the mortgage holder or the investor that purchased the property has decided not to pay the property taxes, it is very likely that they have abandoned the property. This result suggests that municipalities could identify the most damaging distressed properties in poor areas with two pieces of data they already have in hand, namely recent sheriff sales and the tax status of those parcels.

The contrast between the submarket results and the pooled results demonstrates the need for different approaches in different areas. Disregarding market differences with pooled results leads to the erroneous conclusion that tax-current foreclosures have no impact at all! It is also evident that tax-delinquent foreclosures in high-poverty areas are driving the negative impact that appears in the pooled results. Focusing only on tax-delinquent foreclosures in medium- and low-poverty areas would not be an effective strategy.

## 6.2 Comparison to Previous Studies

In the submarket estimates, we report three large, significant negative impacts from recently foreclosed homes. These range from 2.7 percent for a tax-current foreclosure in a medium-poverty tract to 7.3 percent for a tax-delinquent foreclosure in a high-poverty tract. Our findings are in the higher end of the range of negative impacts from a neighboring foreclosed home that were found in the previous studies discussed in section 1.1. The large coefficients on the foreclosure counts may reflect a weak housing market, deep into the housing bust. In 2010 and 2011, Cuyahoga County had a very high inventory of homes for sale. Prices had been declining for several years and showed minimal indications of recovering. Home prices are usually sticky because sellers need to repay their mortgages, and they anchor their perception of their home's value based on the price they paid. However, by 2010, many owners were capitulating and accepting lower prices. Most of the previous foreclosure impact studies were looking for lowering of values in markets with various upward pressures.

One of the contributions we promised was to correct the estimate of the impact of foreclosures by taking into account other distressed properties in the neighborhood and properties with multiple indicators of distress. In table 5, we present the results of models estimated with each of the counts alone (models I-III) and with the main model, or a non-exclusive count model (IV) demonstrates that the impact of foreclosure may be overstated in the absence of vacancy and delinquency measures.<sup>18</sup> Even after dividing the sample into submarkets and controlling for spatial correlation, part of the estimated foreclosure impact is via its serving as a proxy for nearby vacant and delinquent properties. The contrast between model III and model IV gives the best illustration of how the results of previous studies might change if they incorporated vacancy and delinquency data. In areas with relatively strong housing demand, the estimate of the impact of a recent

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<sup>18</sup>By "non-exclusive" we mean the distress counts are made separately. A home with multiple markers of distress contributes to more than one count. For example, a delinquent-foreclosed house is counted along with all other foreclosures, and the same house also adds one to the delinquency count.

foreclosure declines by 31 percent in the presence of other distress measures.

### 6.3 Other Submarket Definitions

In table 6, we present model estimates with the observations grouped by different definitions of submarkets. The first grouping is by central city, inner-ring (bordering the central city) and outer-ring suburbs. From this arrangement, we learn that the inner-ring suburbs have the strongest price penalty for a home being near a delinquent-foreclosed property. The positive correlation between foreclosure sales prices is larger in the central city model than in the high-poverty model, and it is significant at the five percent level. Tax-delinquent homes have large negative impacts in all areas (1.1 to 2.1 percent).

The next two sets of models sort census tracts by vacancy rates and the pre-existing (2006-2009) median home prices. The cut-points are selected to place approximately a third of the sales into each category. Vacancy is positively correlated with poverty, and home prices are negatively correlated with poverty. However, the correlations are not exact, so each change in the submarket definition shifts dozens of census tracts up and down. It is worth noting that submarkets defined by vacancy levels feature reduced variation of this independent variable of interest, just as defining sub-markets by price will narrow the distributions of the dependent variable.

The basic pattern of the main results is visible in both alternate market definitions. With census tracts grouped by vacancy rate, several of the coefficients are smaller than their equivalent with the poverty-level grouping. The estimated impact of vacancies, delinquencies, and foreclosures are all lower in neighborhoods defined by low vacancy compared to a sub-sample defined by low poverty. Vacant-delinquent homes have a larger negative impact if the sample is defined by medium-vacancy rather than medium-poverty.

When pre-existing home prices are used to group the census tracts, the most of the coefficients are larger in magnitude than their equivalent in the main models. The positive coefficient on foreclosures is large and significant in low-price areas, and the negative coefficients on foreclosures in medium- and high-price areas are also larger than their comparable figures from the poverty submarket (main) results. The coefficient on vacancies in medium-priced areas is surprisingly small, and the coefficient on delinquent-foreclosed homes in low-priced areas is not significant.

### 6.4 Robustness Checks

To confirm our results we ran nine additional variations. In the interest of brevity, we will describe them here but forgo the tables. All the results are available from the authors upon request.

As discussed in section 4, there are several options for addressing the spatial correlation between home prices. We attempted five alternate spatial models. In an OLS estimate that assumes no spatial correlation, the coefficients are larger than the spatially corrected models in 11 of the 15 coefficients because the distress

counts reflect the variation of other disamenities. The differences between a model estimated using a spatial-lag specification and one using a spatial-error specification are minor with the exception of the negative impact of vacant-delinquent homes in medium-poverty areas. The spatial lag model gives an estimate of -4.4 percent, 1.7 points larger than the spatial-error model estimate.

We attempted including census tract fixed effects to capture unobserved local amenities and disamenities. In high-poverty areas, the estimate with census tract indicators suggests a larger role for vacant homes, while decreasing the estimated impact of delinquent and vacant-delinquent homes relative to their main model coefficients. Forcing the model to use only the variation within census tracts is quite limiting. Approximately one quarter of the high-poverty census tracts have five or fewer sales observed. The poor neighborhoods are also usually denser, which means distressed properties treat more sales within the geographically smaller tracts. Of the seven significant coefficients in the medium- and low-poverty models, only one (vacant-delinquent in medium-poverty) becomes insignificant with tract fixed effects. The coefficients on delinquencies in medium-poverty markets and foreclosures in low-poverty markets are reduced, but remain at least marginally significant.

The data can locate each sold home in a jurisdiction, and it is reasonable to think the jurisdiction has important effects on the home price. Thus, an indicator of the jurisdiction should capture a lot of important unobserved spatial heterogeneity. In Cuyahoga County, cities correspond to significant differences in property taxes and provide very different levels of city services. These factors are known to have large impacts on home values (Oates, 1969; Downes and Zabel, 2002). When city indicators are included in the model without a spatial error correction, most of the results persist in magnitude and significance. Adding a city-specific time trend changes the results only slightly.

Most of the counts of vacancies, delinquencies, vacant-delinquencies, and tax-current foreclosures are below five, with a handful of homes being sold near 20 or even 50 distressed properties. We attempted one model including indicators for observations that are above the 95th percentile for any of these four counts. The indicator is interacted with the counts to allow for a different slope at high levels. We also estimated a model excluding the observations with the high counts.<sup>19</sup> In these models, the significant estimated impacts of vacancy, delinquency and foreclosure all maintain at least marginal significance. These results suggest it is safe to say that a few unusually high observations are not driving the findings. In the cases of vacant-delinquencies, foreclosures, and delinquent foreclosures in high-poverty areas, and foreclosures in low-poverty areas, the coefficients are larger when the highest counts are interacted or removed. This suggests the marginal impact of the first few distressed properties in these counts are underestimated because a linear fits combines their effect with the lower marginal impact of additional units in a high count.

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<sup>19</sup>These estimates also exclude observations with delinquent-foreclosures above 2. DF counts above 2 are only found in high-poverty areas, so we do not try to address them. Doing so would require including additional indicator and interaction terms in one submarket, but not the other two.

It is common in the literature to report the results in several different distance buffers to demonstrate the rate of distance decay in the impact of the distressed property. We estimated the models with two exclusive counts in a small (<250ft) and large (250-1000ft) buffer. Our results are consistent with previous research. The negative impacts of distressed properties are generally of a larger magnitude when the properties are closer to the sale.

As discussed in section 5, we excluded sales which involved a lender reclaiming a property used as collateral for a mortgage. Before this exclusion, at least 15 percent of the sales in our data involved an institutional buyer, seller, or both. If we return those sales to the data set, and estimate the models with indicators for the type of institutional buyer or seller, the treatment coefficients are similar to those of the main model.

## 7 Policy Implications

Using our main model, we attempted a simple experiment to estimate the potential benefit from eliminating some of the distressed properties. We re-predicted the sale prices five times, each time setting the counts on one of the distressed property types to zero. We sum the increase in the predicted values and divide it by the average number of units with the marker of distress in a month. This gives a predicted per-unit increase in transaction values. The values are implicitly weighted by the sales activity the distressed properties actually influenced, but they suggest a proportional increase in property values of unsold homes as well. This benefit could be weighed against the cost of a program that alleviates distress on properties.

Table 7 presents the results of the experiment. To place the table in context, the total value of all home transactions in the data set is \$1.4 billion. In per-unit terms, foreclosures lead to the largest losses of value at \$4,665 per tax-current foreclosures in medium-poverty neighborhoods to \$9,489 per tax-current foreclosure in low-poverty neighborhoods. The total values, before dividing by the units, tell a different story. The total value lost to sellers due to homes that are vacant, delinquent, or both is estimated at \$90 million versus \$12.7 million lost due to foreclosures.

If our model is correct, attempting to eliminate the approximately 3,000 foreclosures that affect the high-poverty tracts would be as fruitless as it would be overwhelming. Putting a laser focus on the approximately 300 homes that are foreclosed and delinquent in high-poverty neighborhoods is more feasible. Recovering \$1.5 million of value for sellers might not justify the expense of a program, but when the increased value of nearby homes is taken into consideration, the benefits would be much larger. A successful program would have the indirect effect of stabilizing the property tax base. In medium- and low-poverty areas, preventing foreclosures could salvage some of the \$11 million lost to sellers near foreclosed homes.

In this experiment, we are assuming a targeting by type of distress and type of neighborhood. Targeting would have to take into account equity concerns because preventing a foreclosure in a neighborhood where

homes sell for \$300,000 may have a larger percentage and dollar benefit than preventing a foreclosure in a neighborhood with \$50,000 homes, but such assistance is rarely targeted to high-income neighborhoods. While it is simple in a data set to remove vacancy or delinquency observations, designing a program to successfully eliminate these conditions in actual homes is very challenging. In the case of delinquency, policymakers should bear in mind that it is unlikely that property tax delinquency itself that lowers property values, but rather the neglect associated with property tax-delinquency. The scarce manpower for housing code enforcement could be targeted at clusters of tax delinquent properties. However, forgiving delinquent property taxes would probably not change the fact that the homeowner is unable or unwilling to invest in his or her property. “Eliminating” vacancies in homes that are not candidates for demolition would require attracting migration to the region or stimulating household formation.

Finally, if lenders are strategically foreclosing on the few desirable properties in highly distressed areas, there is no easy way for policymakers to obtain the properties that are mortgaged and in default, but not foreclosed upon. In these cases, lenders maintain their first-position security interests, which encumber properties and prevent redevelopment. Creative ways to encourage foreclosure or the surrender of the lenders’ liens would need to be pursued before the distressed property could be eliminated. When combating vacancy and abandonment, modern land banking is one strategy that shows promise. Modern land banks are public or quasi-public entities charged with acquiring, remediating, and placing vacant and abandoned homes back into productive use (Fitzpatrick, 2010). The most intriguing modern land banks are organized under Ohio law, with statutorily defined public missions, stable funding mechanisms, and significantly more power and flexibility than other modern and historic land banks. In less-robust markets like Genesee County, MI and Cuyahoga County, OH, land banks often focus upon the demolition and repurposing of older, distressed housing stock.

## 8 Conclusions

Using our unique data on parcel-level vacancies, and incorporating tax delinquency data, we have a richer understanding of the impact of distressed properties. In high-poverty neighborhoods, the sale price of a home is 1.5 percent lower with each additional delinquent home within 500 feet. Medium-poverty areas display negative impacts of 2.1 percent due to a vacant home, 1.9 percent due to a delinquent home, and 2.7 percent if a nearby home is both vacant and delinquent. The impacts of vacant and delinquent homes are similar in low-poverty neighborhoods, reducing sales prices by 1.7 to 1.8 percent per distressed property. In all areas, delinquent homes are two to three times more common than vacancies, which makes the effect of delinquent homes greater even though the per-unit coefficients are similar.

The impact of recent foreclosures is more complex than previous studies suggested. In low- and medium-

poverty tracts, we find negative impacts around 4.6 and 2.7 percent, respectively, for recent foreclosures that are not tax delinquent. In high-poverty areas, tax-current foreclosures are positively correlated with home sale prices. This could reflect selective foreclosure by lenders on homes that are in better condition or in slightly better locations. Also, the homes' tax-current state indicates that it's owner that has some financial resources and a desire to prevent a tax foreclosure. In sharp contrast, tax-delinquent foreclosed homes have large, negative effects on neighboring sale prices in high-poverty areas. We observe a discount of 7.3 percent in the presence of these likely-abandoned properties.

Homes that are vacant can lower surrounding property values, even if they have not been through a recent foreclosure and presumably have an attentive owner. Likewise, homes that are occupied by a financially-distressed household, that cannot pay its property taxes, also pull down neighboring home values. Given the high counts of vacant and delinquent homes, we estimate that these properties are doing more than foreclosures to lower surrounding property values. However, when it comes to policy responses, concentration on foreclosures with additional distress characteristics would return a far greater benefit per unit improved. The other half of the equation, the costs of improving a vacant-delinquent or delinquent-foreclosed home must be weighed once effective policies for eliminating the impact of these properties have been designed, measured, and tested.

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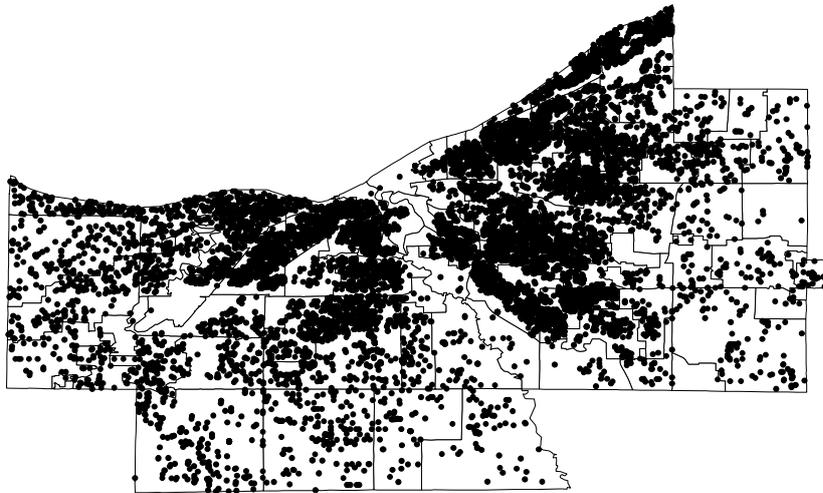


Figure 1: Residential Property Vacancies in Cuyahoga County, June 2010. Vacancy data are from the US Postal Service. Properties were recorded as vacant if they have been unoccupied for 90 days or more as of 30 June, 2010.

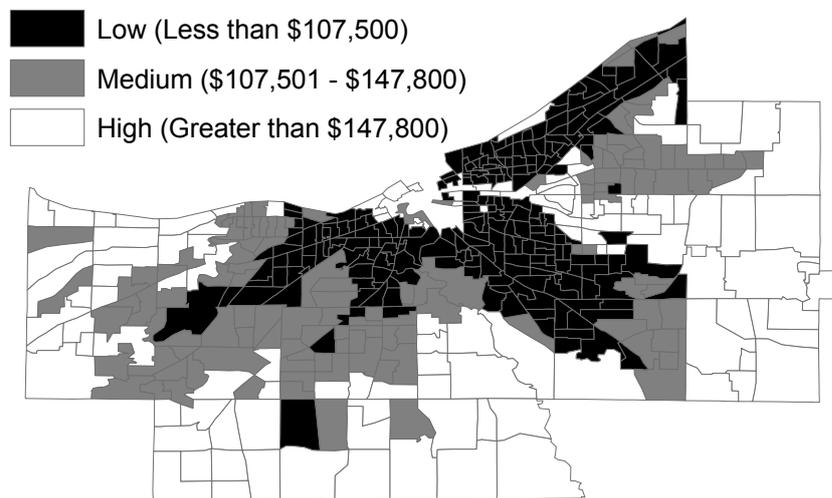


Figure 2: Median home sale price by census tract in Cuyahoga County, 2006-2009. Data are from county property transaction records.

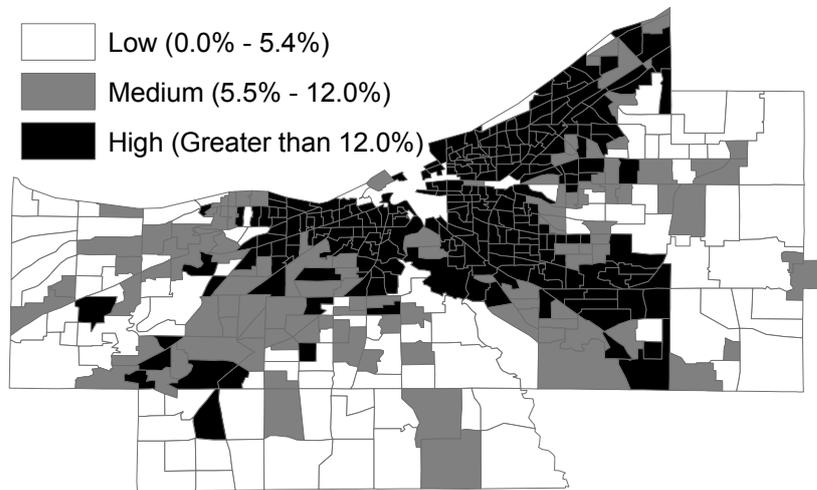


Figure 3: Poverty rate by census tract, Cuyahoga County, 2005-2009. Data are from the American Community Survey.

	High Poverty	Medium Poverty	Low Poverty	Total
Vacancies	16,478	4,633	2,839	23,950
Delinquencies	34,371	7,765	4,684	46,820
Foreclosures	3,161	1,262	663	5,087
Percent of parcels	High Poverty	Medium Poverty	Low Poverty	Total
Vacancies	9.8	3.7	2.2	5.7
Delinquencies	20.5	6.3	3.7	11.2
Foreclosures	1.9	1.0	0.5	1.2
<u>Single-Distress Properties</u>				
Vacant Only	6,778	3,168	2,258	12,204
Delinquent Only	25,636	6,774	4,316	36,726
Foreclosed Only	1,751	622	371	2,744
<u>Multiple-Distress Properties</u>				
Vac and Del	8,451	881	319	9,650
Vac and For	1,125	530	243	1,898
Del and For	160	56	30	247
Vac, Del and For	124	54	19	197
<b>Total Distressed Properties</b>	<b>44,025</b>	<b>12,086</b>	<b>7,556</b>	<b>63,666</b>

Table 1: Descriptive Statistics - Average Monthly Totals of Distressed Properties. The counts are within groups of census tracts categorized by their poverty rate as measured by the 2005 to 2009 American Community Surveys. The first three rows are frequencies of each marker of distress. In the single- and multiple-distress frequencies, a property is only counted in one category, as determined by its markers of distress. The distressed counts were calculated for each month between April 2010 and June 2011, and then averaged over the fifteen months. Vacant properties are identified in the US Postal Service database if they have been unoccupied for 90 days or more, as of the last day of the month. Tax delinquencies are properties that have missed at least one half-year property tax payment within the last year. Recently foreclosed properties are those that have been sold at a sheriff sale within the last twelve months. Tax and sales data are from Cuyahoga County administrative databases.

	High Poverty	Medium Poverty	Low Poverty
Median Log Sale Price	10.44	11.51	11.98
Median Sale Price	34,200	100,000	160,000
N	3,875	3,719	3,767
Mean counts in buffers	High Poverty	Medium Poverty	Low Poverty
Vacant	3.63	2.00	0.87
Delinquent	12.27	3.95	1.55
Foreclosure	0.88	0.39	0.15
Vac and Del	4.29	0.57	0.12
Vac and Fore	0.67	0.37	0.11
Del and Fore	0.10	0.04	0.01
Vac, Del and Fore	0.07	0.04	0.01
Treated Sales	High Poverty	Medium Poverty	Low Poverty
Vacant	3,421	2,620	1,677
Delinquent	3,756	3,239	2,517
Foreclosure	1,994	1,058	478
Vac and Del	2,844	1,138	368
Vac and Fore	1,704	937	356
Del and Fore	321	127	41
Vac, Del and Fore	249	162	31
No Distressed Neighbors	51	245	776
Sales Observed (N)	3,875	3,719	3,767

Table 2: Descriptive Statistics - Prices and Distress counts in 500 ft. Buffers around Sales. The counts are averaged within groups of census tracts categorized by their poverty rate as measured by the 2005 to 2009 American Community Surveys. The counts are the number of properties within 500 feet of a sold home that have the row-labeled marker(s) of distress. All data represent Cuyahoga County properties between April 2010 and June 2011. Vacant properties are identified in the US Postal Service database if they have been unoccupied for 90 days or more, as of the last day of the month. Tax delinquencies are properties that have missed at least one half-year property tax payment within the last year. Recently foreclosed properties are those that have been sold at a sheriff sale within the last twelve months. Tax and sales data are from Cuyahoga County administrative databases.

	High Poverty	Medium Poverty	Low Poverty	Pooled
Vacancies	-0.011 (0.007)	-0.021*** (0.005)	-0.017 ** (0.005)	-0.013*** (0.004)
Delinquencies	-0.015*** (0.003)	-0.019*** (0.003)	-0.018*** (0.004)	-0.017*** (0.002)
Foreclosures	0.015 (0.017)	-0.017 (0.013)	-0.039 ** (0.015)	0.001 (0.009)
Vac and Del	-0.010* (0.005)	-0.027* (0.011)	-0.009 (0.017)	-0.013*** (0.003)
Vac and For	0.035+ (0.020)	-0.038 ** (0.013)	-0.057 ** (0.018)	0.005 (0.010)
Del and For	-0.061 (0.044)	0.040 (0.045)	0.026 (0.054)	-0.034 (0.026)
Vac, Del and For	-0.094 (0.064)	-0.008 (0.041)	-0.033 (0.066)	-0.047 (0.034)
Property Char.	Yes	Yes	Yes	Yes
Month Indicators	Yes	Yes	Yes	Yes
Constant	10.703*** (0.140)	11.399*** (0.097)	11.338*** (0.080)	11.014*** (0.064)
$\rho$	0.461*** (0.044)	0.559*** (0.038)	0.494*** (0.031)	0.683*** (0.024)
N	3, 875	3, 719	3, 767	11, 361
Log Likelihood	-5588.798	-2702.994	-1434.135	-12158.538
$\chi^2$	2172.063	3298.377	6006.176	8842.213

Table 3: Disaggregated-Treatment Hedonic Price Models with Spatially-correlated Errors. Notes: This table reports coefficients and standard errors, in parentheses, from ML regressions of home sale prices on counts of distressed properties within 500 feet. Data represent sales of single family homes in Cuyahoga County from April 2010 through June 2011. Data are from Cuyahoga County administrative records, the USPS, and the American Community Survey. Significance key: + for  $p < .1$ , \* for  $p < .05$ , \*\* for  $p < .01$ , and \*\*\* for  $p < .001$ .

	High Poverty	Medium Poverty	Low Poverty	Pooled
Vacancies	-0.011 (0.007)	-0.021*** (0.005)	-0.017 ** (0.005)	-0.013*** (0.004)
Delinquencies	-0.015*** (0.003)	-0.019*** (0.003)	-0.018*** (0.004)	-0.017*** (0.002)
Vac and Del	-0.010* (0.005)	-0.027* (0.011)	-0.009 (0.017)	-0.013*** (0.003)
Foreclosures	0.024+ (0.012)	-0.027 ** (0.009)	-0.046*** (0.012)	0.003 (0.007)
Del and For	-0.073* (0.036)	0.012 (0.031)	0.002 (0.042)	-0.039+ (0.021)
Property Char.	Yes	Yes	Yes	Yes
Month Indicators	Yes	Yes	Yes	Yes
Constant	10.705*** (0.140)	11.399*** (0.097)	11.340*** (0.080)	11.014*** (0.064)
$\rho$	0.461*** (0.044)	0.562*** (0.037)	0.493*** (0.031)	0.683*** (0.024)
N	3, 875	3, 719	3, 767	11, 361
Log Likelihood	-5589.162	-2703.950	-1434.682	-12158.624
$\chi^2$	2169.453	3288.544	6006.131	8839.487

Table 4: Hedonic Price Models with Spatially-correlated Errors. Notes: This table reports coefficients and standard errors, in parentheses, from ML regressions of home sale prices on counts of distressed properties within 500 feet. Data represent sales of single family homes in Cuyahoga County from April 2010 through June 2011. Data are from Cuyahoga County administrative records, the USPS, and the American Community Survey. Significance key: + for  $p < .1$ , \* for  $p < .05$ , \*\* for  $p < .01$ , and \*\*\* for  $p < .001$ .

Model	Distress Counts	High Poverty	Medium Poverty	Low Poverty	Pooled
I	Vacancies	-0.016*** (0.003)	-0.028*** (0.004)	-0.023*** (0.005)	-0.020*** (0.002)
II	Delinquencies	-0.014*** (0.002)	-0.022*** (0.003)	-0.021*** (0.004)	-0.017*** (0.001)
III	Foreclosures	-0.005 (0.011)	-0.033*** (0.009)	-0.052*** (0.011)	-0.018 * * (0.006)
IV	Vacancies	-0.001 (0.004)	-0.019*** (0.004)	-0.015 * * (0.005)	-0.005+ (0.003)
	Delinquencies	-0.014*** (0.003)	-0.017*** (0.003)	-0.016*** (0.004)	-0.015*** (0.002)
	Foreclosures	0.012 (0.011)	-0.013 (0.009)	-0.036 * * (0.012)	0.001 (0.006)

Table 5: Separate Distress Counts Hedonic Price Models. Notes: This table reports coefficients and standard errors, in parentheses, from ML regressions of home sale prices on counts of distressed properties within 500 feet. Data represent sales of single family homes in Cuyahoga County from April 2010 through June 2011. Data are from Cuyahoga County administrative records, the USPS, and the American Community Survey. All models include controls for property characteristics and indicators of month of sale. Significance key: + for  $p < .1$ , \* for  $p < .05$ , \*\* for  $p < .01$ , and \*\*\* for  $p < .001$ .

	Central City		Inner Suburbs		Outer Suburbs	
Vacancies	-0.008	(0.009)	-0.008	(0.005)	-0.011*	(0.005)
Delinquencies	-0.011**	(0.004)	-0.016***	(0.004)	-0.021***	(0.004)
Vac and Del	-0.023***	(0.007)	-0.010*	(0.004)	-0.011	(0.015)
Foreclosures	0.035*	(0.014)	-0.014	(0.010)	-0.029*	(0.012)
Del and For	-0.052	(0.042)	-0.072*	(0.032)	0.029	(0.036)
N		2808		3875		4678
	High Vacancy		Medium Vacancy		Low Vacancy	
Vacancies	-0.007	(0.007)	-0.007	(0.005)	-0.013*	(0.006)
Delinquencies	-0.012***	(0.003)	-0.019***	(0.004)	-0.003	(0.005)
Vac and Del	-0.010*	(0.005)	-0.051***	(0.013)	0.015	(0.021)
Foreclosures	0.023+	(0.012)	-0.020*	(0.009)	-0.036*	(0.014)
Del and For	-0.046	(0.035)	-0.021	(0.034)	0.038	(0.049)
N		3862		3761		3738
	Low Price		Medium Price		High Price	
Vacancies	-0.012+	(0.007)	-0.005	(0.005)	-0.018**	(0.006)
Delinquencies	-0.011***	(0.003)	-0.027***	(0.004)	-0.022***	(0.004)
Vac and Del	-0.011*	(0.005)	-0.039***	(0.011)	-0.032*	(0.016)
Foreclosures	0.034**	(0.012)	-0.039***	(0.010)	-0.066***	(0.013)
Del and For	-0.054	(0.035)	-0.021	(0.035)	-0.009	(0.043)
N		3798		3701		3862

Table 6: Alternative Submarket Hedonic Price Models. Notes: This table reports coefficients and standard errors, in parentheses, from ML regressions of home sale prices on counts of distressed properties within 500 feet. Data span April 2010 to June 2011 and are from Cuyahoga County administrative records, the USPS, and the American Community Survey. The residential vacancy submarkets are defined by the ratio of vacant units to total units within each census tract, averaged over the 15-month period. The home price submarkets are defined by the census tracts' median home sale price from 2006 through 2009. Significance key: + for  $p < .1$ , \* for  $p < .05$ , \*\* for  $p < .01$ , and \*\*\* for  $p < .001$ .

	Benefit to Sellers (T)	Average Units Per Month	Per Unit Benefit
<u>High Poverty</u>			
Vacancies	\$4,772	6778	\$704
Delinquencies	\$19,123	25636	\$746
Vac and Del	\$3,092	8451	\$366
Del and Foreclosed	\$1,788	284	\$6,285
<u>Medium Poverty</u>			
Vacancies	\$12,493	3168	\$3,943
Delinquencies	\$22,057	6774	\$3,256
Vac and Del	\$3,523	881	\$3,999
Foreclosures	\$5,391	1153	\$4,678
<u>Low Poverty</u>			
Vacancies	\$7,794	2258	\$3,452
Delinquencies	\$16,523	4316	\$3,828
Vac and Del	\$498	319	\$1,563
Foreclosures	\$5,846	614	\$9,529

Table 7: Policy Simulation. “Benefit to sellers” is the sum of the differences between the predicted prices from the main model (table 4) using the original data and using data with the row-labeled type of distressed-home counts set to zero. The benefits and benefits per unit represent the increase in sales prices which the model suggests would be realized if a policy could eliminate the distressed properties.