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The Effect of Foreclosures on Nearby Housing Prices: Supply or Disamenity?

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A number of studies have measured negative price effects of foreclosed residential properties on nearby property sales. However, only one other study addresses which mechanism is responsible for these effects. I measure separate effects for different types of foreclosed properties and use these estimates to decompose the effects of foreclosures on nearby home prices into a component that is due to additional available housing supply and a component that is due to disamenity stemming from deferred maintenance or vacancy. I estimate that each extra unit of supply decreases prices within 0.05 miles by about 1.2 percent while the disamenity stemming from a foreclosed property is near zero.

Key words: foreclosure, housing prices, neighborhood effects.

JEL codes: H23, R20, R30.

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1 Introduction

As housing prices fell and foreclosure rates rose in the late 2000s, lenders were put in the position of having to liquidate ever larger inventories of foreclosed homes. A number of articles in the popular press cited a "shadow inventory" of homes, part of which was made up of homes that had been repossessed by lenders but had not been listed for sale. In a July 7, 2009 segment on National Public Radio, Yuki Noguchi reported,

> "I do know that banks are holding onto inventory, and what they're doing is they're metering them out at an appropriate level to what the market will bear," says Pat Lashinsky, chief executive of online brokerage site ZipRealty.[1]

This strategy may have implications for the property values of homes that are near the bank-owned properties. As an owner of a nearby property or as a local public official concerned about tax revenue from properties near foreclosed homes would one rather have the bank "meter out" the properties to meet demand or sell them quickly to minimize the time that they sit vacant?

The answer to this question hinges upon the mechanisms through which foreclosures decrease nearby property values and the relative size of each effect. There are two primary mechanisms which are theoretically plausible ways by which a foreclosure may lower the value of other properties nearby. The first mechanism is by way of increasing the supply of homes on the market.[2] The second mechanism operates through the dis-amenity imposed on nearby properties if a foreclosed property is not properly maintained or if it falls victim to crime or vandalism, possibly while vacant.[3] This paper attempts to measure the effect of foreclosure on nearby property values and to decompose this effect into portions attributable to the aforementioned supply and dis-amenity mechanisms.

I pursue an empirical strategy under which identification of separate supply and dis-amenity effects depends upon the degree of segmentation between the single-family

[1] The full segment can be found at http://www.npr.org/templates/story/story.php?storyId=106113137.

[2] Wheaton [1990] shows that prices fall as vacancies rise in a housing market search and matching model.

[3] Ellen et al. [2013] and Immergluck and Smith [2006b] investigate the connection between foreclosures and crime. See also Apgar et al. [2005].

and multi-family housing markets. Specifically, I consider two cases: segmentation and integration. In the segmentation case, I assume that foreclosure of a nearby single-family home affects the property values of single-family homes through both the supply and dis-amenity mechanisms. This is because foreclosure of a single-family home adds a unit of supply to the single-family market and creates the potential for a poorly maintained or vacant property. However, foreclosure of a nearby renter-occupied multi-family building affects the property values of single-family homes only through the dis-amenity mechanism. This is because, in the segmentation case, potential buyers of single-family homes do not view multi-family buildings as substitutes, so no supply is added to the single-family home market. In this case, renter-occupied multi-family building foreclosures may still affect single-family home prices but only through potential lack of up-keep and vacancy. In the integration case, the foreclosure of a nearby multi-family building will also affect property values of single-family homes through the supply mechanism. Under either assumption, identification of separate supply and dis-amenity effects hinges upon estimation of both the effect of single-family home foreclosures and the effect of renter-occupied multi-family building foreclosures on nearby single-family home prices.

I estimate the effects of single-family home and renter-occupied multi-family foreclosures on the universe of single-family home sales in Chicago between January of 2000 and May of 2011. Using a hedonic framework, I estimate the effect of single-family and multi-family foreclosures that occurred during the prior year on the log price of single-family homes within 0.05 miles. In addition to the universe of other residential foreclosures, I control for a large number of property characteristics that could affect home prices. I include month of year effects to control for seasonality of the real estate market. I also include census block * year effects to control for extremely local shocks and for spatial and temporal variation in housing prices.

I find that each foreclosure filing occurring in the previous year and within a 0.05 mile radius is associated with a reduction in the price of a single-family home of about 0.3 percent. However, I focus on comparing the effects of single-family foreclosures and multi-family renter-occupied foreclosures on nearby property values. I find that each single-family home foreclosure filing within a 0.05 mile radius occurring in the past year is associated with a reduction in the price of a single-family home of about

1.3 percent.[4] Multi-family foreclosure filings in the past year within a 0.05 mile radius are not associated with a reduction in the price of a single-family home. Subtracting the multi-family effect from the single-family effect I estimate that the supply effect is around -1.2 percent, whereas the dis-amenity effect is about zero.

The other study that attempts to separate the supply and dis-amenity effect of foreclosures is Anenberg and Kung [2014]. Anenberg and Kung [2014] look at the effect of foreclosures in multiple listing service (MLS) data on nearby asking prices for homes. They find that each additional foreclosure listed is associated with a 1.5 percent drop in sales price for homes within 0.1 miles. The authors use MLS data from the Chicago, Phoenix, San Francisco, and Washington, DC metropolitan areas. They interpret the fact that they find an effect around the foreclosure listing date and a disappearance of the effect 3 to 6 months after the foreclosed home sells as evidence that the negative price effect stems from competitive pressure driving prices down rather than a dis-amenity effect. It is reassuring that although our studies use very different empirical approaches, we find quite similar results.

2 Data

I use data from several sources. Residential property sales and foreclosure data for the City of Chicago are from a private data provision company named Record Information Services. Property characteristic data and homeowner tax exemption claim data come from the Cook County Tax Assessor's Office.

[4]This finding is in line with the findings of several other recent studies. Immergluck and Smith [2006a] find about a 1 percent reduction in the price of single-family homes in Chicago in 1999 for each foreclosure within one eighth of a mile. Schuetz et al. [2008] find a smaller effect, about a 0.2 percent reduction in price, in New York City between 2000 and 2005 in a 250 foot radius. It is not surprising that I find a larger effect. The New York City housing market was booming during their sample, whereas my sample includes the subsequent bust as well. As opposed to the hedonic framework used by the two aforementioned studies, Harding et al. [2009] and Gerardi et al. [2012] use a repeat sales approach. Harding et al. [2009] measure a discount of 1 percent per foreclosure at a distance of 300 feet (about 0.57 miles). In terms, of timing, they find that the effect peaks around the time of the foreclosure sale (when the property transfers from the owner in default to the lender or to another owner). Their sample is obtained by combining a large proprietary mortgage database which contains approximately half of all national mortgage transactions from 1989 to 2007 with other data and only using zip codes with high coverage rates (over 80 percent). Gerardi et al. [2012] use a larger and richer sample and still find an effect of -0.9 percent per foreclosure within 0.1 miles. The authors find that the negative effects peak before the properties complete the foreclosure process. Using data from Massachusetts, Campbell et al. [2011] also find a spillover effect of about -1 percent per foreclosure at a distance of 0.05 miles.

Property identification numbers allow the foreclosure and sales data to be linked to the property characteristic and tax exemption data. After geocoding the addresses, I calculate the distance between every sale and every foreclosure. Since I am interested in the effect of foreclosures on nearby properties but not on the foreclosed properties themselves, I drop any sale that is for a property identification number that appears in the foreclosure file. Table 1 presents descriptive statistics for single-family residential property transactions in the City of Chicago from January 2000 through May 2011.[5] The first four sections (in the top panel) present data regarding the number of single-family (SF), units of renter-occupied multi-family (UMFRO), units of owner-occupied multi-family (UMFOO), and condominium foreclosure filings that occurred within the past year within 5 mutually exclusive rings around each single-family property transaction: 0-0.05 miles, 0.05-0.10 miles, 0.10-0.15 miles, 0.15-0.20 miles, 0.20-0.25 miles. In order to limit the influence of outliers, all foreclosure count variables are Winsorized at their 99th percentile values. All regression specifications use Winsorized foreclosure counts and include dummy variables indicating whether the value of the original variable exceeded the 99th percentile level. The fifth section presents data regarding the sales price and structure characteristics of these properties.[6] The final section presents data regarding the year 2000 demographics of the census tracts in which the properties are located.

According to Emerson [2010], in Chicago the foreclosure process typically takes about 9 to 12 months from filing date to eviction. The foreclosure process begins when a complaint to foreclose mortgage is filed in the Chancery Division of the Circuit Court of Cook County. Foreclosure complaint filings are part of the public record. The owner is then served with foreclosure case court papers. If not challenged, a judgement of foreclosure is entered. The owner then has about 3 months to reinstate or redeem. If this does not happen, the property is sold at auction (called a judicial) sale. Public notice of the sale is given prior to the auction. The title is then transferred and an eviction order can be entered. The eviction can then occur 30 days later. At this point the owner is either the winner of the auction or the lender if the lender's reservation price was not met at the auction. When the reservation price is not met,

[5]While I use transaction data that go back to January 2000, the foreclosure data go back to January 1998, providing enough data to estimate the effect of foreclosures that occurred in the year or two years prior to a transaction that occurred in January 2000. The last full month of foreclosure data is June of 2011.

[6]Throughout this paper all prices are real, expressed in terms of year 2010 dollars.

the lender will subsequently list the property for sale using the MLS (Emerson [2010]). I do not have access to the MLS data, and thus cannot observe which foreclosures results in lender-ownership and when they are listed in the MLS.

The foreclosure data that I use contain entries for the two foreclosure-related events that are public record. These events are the initial filing of the foreclosure and the auction date of the foreclosure if an auction is ever scheduled. Among the properties for which an auction is observed the mean time from filing to auction is eleven months, the median is about nine months, the 5th percentile is 5.5 months, and the 95th percentile is about two years. Throughout this paper, I focus on the foreclosure filing date, since this is the date when the foreclosure becomes public knowledge.[7]

The sample that I use for estimation includes all single-family residential property transactions in the City of Chicago from January 2000 through May 2011 and counts of the number of initial foreclosure filings within the past year and within 0.25 miles for each of the following categories: Single-family home foreclosure, renter-occupied multi-family building foreclosure, owner-occupied multi-family building foreclosure, and condominium foreclosure.[8] The mean number of units per multi-family building is 2.6 and the standard deviation is 2.4. In this paper, I refer to several types of geographical subdivisions of the city of Chicago including community areas, census tracts, census block groups, and census blocks. Figure 1 shows a map of Chicago with community areas outlined in black, census tracts outlined in dark gray, and census blocks outlined in light gray. Table 2 shows the number of each type of geographical division and the mean number of housing units and residents in each division. While the coarsest division, community areas, correspond to neighborhoods, the finest division, census blocks, are about the size of, and mostly, correspond to actual city blocks.[9]

Most neighborhoods in Chicago contain a mixture of single-family and multi-family buildings. According to the 2000 Census, 93 percent of the Census Block Groups in the city of Chicago that contain at least one unit of housing contain at least

[7]However, my empirical specifications are not sensitive to the addition of foreclosure auctions as controls. Section 4.3 presents robustness specifications including foreclosure auction counts as controls.

[8]The specifications in column (3) of Table 5 and columns (3) and (4) of Table 6 use alternative samples that include either multi-family or condominium transactions.

[9]For more information on community areas, see http://en.wikipedia.org/wiki/Community_areas_of_Chicago

one single-family building and one multi-family building. Furthermore, 87 percent of the Chicago Census Block Groups with housing contain both owner-occupied single-family buildings and renter-occupied multi-family buildings.[10]

3 Empirical Methodology

My goals are to estimate the effect of residential foreclosures on the price of nearby property and to separate this estimate into a component due to excess supply induced by foreclosures and a component due to the dis-amenity of nearby foreclosures stemming from deferred maintenance or vacancy. Basically, my strategy is to separately estimate the effect of a single-family home foreclosure on nearby single-family home property values and the effect of a multi-family apartment building foreclosure on nearby single-family home property values. Then, with a few assumptions outlined below, I interpret the effect of a single-family home foreclosure as representing the combined effect of putting an additional single-family-home on the market and the dis-amenity effect of deferred maintenance or vacancy on the nearby properties. In comparison, under the assumption that the single-family and multi-family housing markets are segmented, I interpret the effect of a multi-family apartment building foreclosure on nearby single-family home property values as being due only to the dis-amenity effect of deferred maintenance or vacancy on the nearby properties. Let β_{SF} represent the effect of a single-family home foreclosure on nearby single-family home values and β_{MF} represent the per-unit effect of an N unit multi-family building on nearby single-family home values, then under the assumption of segmentation the impact of a single-family home foreclosure and an N unit multi-family building foreclosure on nearby single-family home values can be expressed as,

$$\beta_{SF} = S + D$$

and

$$N\beta_{MF} = N * D,$$

[10]Census Block Groups are the finest geographical unit for which the Census provides tabulations of the number of housing units by the number of units in the building where the unit is located.

where S represents the supply effect per unit of housing in foreclosure and D represents the dis-amenity effect per unit of housing in foreclosure. Thus,

$$S = \beta_{SF} - \beta_{MF} \tag{1}$$

and

$$D = \beta_{MF}. \tag{2}$$

Finally, under the assumption that single-family and multi-family housing markets are integrated, I interpret the effect of a multi-family apartment building foreclosure on nearby single-family home property values as being due to a composite effect of one additional unit of supply (the unit that could potentially become the new owner's home) and a dis-amenity effect of deferred maintenance or vacancy that is proportional to the number of units in the building. In the integration case,

$$\beta_{SF} = S + D$$

and

$$N\beta_{MF} = S + ND.$$

Thus,

$$S = \frac{N}{N-1}(\beta_{SF} - \beta_{MF}) \tag{3}$$

and

$$D = \frac{N}{N-1}\beta_{MF} - \frac{1}{N-1}\beta_{SF}. \tag{4}$$

Three assumptions are necessary in order to interpret my results in this manner. Under segmentation, the first assumption is that multi-family apartment building foreclosures do not add to the supply of single-family homes for sale. This assumption requires that potential buyers of single-family homes do not regard multi-family apartment buildings as substitutes and that sellers cannot quickly convert multi-family apartment buildings to condominiums and sell the units individually. Anecdotal evi-

dence from real estate brokers that I spoke with suggests that these assumptions hold in practice.[11] There is also evidence of demographic differences between single-family home owners and multi-family building owner-occupiers.[12]

While it is difficult to directly measure the degree to which potential buyers view a multi-family apartment building as a potential substitute for a single-family home, it is possible to assess the frequency with which multi-family apartment building foreclosures result in a renter-occupied building becoming owner-occupied. Data from the Cook County Tax Assessor on claims of the owner-occupied tax exemption for the years 2004 - 2007 reveal that only about 3.3 percent of multi-family buildings that experienced a foreclosure did not file an owner-occupied exemption in one year but did file an owner-occupied exemption in the next year. This suggests that entirely renter-occupied multi-family apartment buildings do not frequently switch to having an owner-occupied unit following a foreclosure. While I do not have direct evidence regarding the degree to which potential home-buyers regard currently owner-occupied multi-family apartment buildings as substitutes for single-family homes, it is clear that renter-occupied multi-family buildings in foreclosure are not commonly used as a substitute for a buyer in the market for a single-family home. Otherwise, the new owner-occupier would claim the tax exemption, and the transition rate of renter-occupied to owner-occupied foreclosed multi-family apartment buildings would be higher than 3.3 percent. Finally, I also consider the case of integration of single-family and multi-family housing markets. In this case, the assumption is that potential buyers of single-family homes do regard multi-family apartment buildings as substitutes, but only one household of owner occupiers can live in a multi-family building and, again, that multi-family apartment buildings cannot be quickly converted to condominiums and sold as individual units.

The second assumption is that both single-family home foreclosures and multi-family apartment building foreclosures have the potential to create dis-amenities for neighboring single-family homes because of deferred maintenance or vacancy. While

[11] Chris Young, Sales Associate, Coldwell Banker, Cambridge, MA says, "Rarely have crossover [between] owner-occupied MF and SF/Condo. During property searches, the parameters are separated Condo/SF/MF. Sometimes I get a buyer who's looking SF & Condo, but for the most part they stick with one type. Once they have one type in their head, they stay locked in."

[12] Data from the 2000 Census Public Use Microdata indicate that, after controlling for the Public Use Microdata Area of residence (the finest geographical area available), owner-occupiers of non-condominium multi-family buildings have 26 percent lower household income, on average, than owner-occupiers of single-family homes.

it is difficult to obtain historical vacancy status data for particular properties, the United States Postal Service has aggregated a number of measures of stocks and flows of vacancy by census tract at a quarterly frequency.[13] Table 3 presents estimates of the association between the number of different types of residential foreclosures and the number of residential addresses that have become vacant in the past three months. These estimates come from a regression of the number of newly vacant addresses in a census tract-quarter on a 4 quarter lag of the number of condominium foreclosure filings, single-family foreclosure filings, owner occupied multi-family foreclosure filings, and renter-occupied multi-family foreclosure filings. Year * quarter dummies are included to account for time trends in the number of new vacancies, and community area effects are included to account for differences in the number of new vacancies across neighborhoods. The data are for all census tracts in the City of Chicago and cover 2008Q1 through 2012Q2.

The estimate presented in the first row of Table 3 indicates that each additional condominium unit foreclosure filing is associated with 0.80 newly vacant units one year later. There is very clearly a positive correlation between foreclosure filings and the number of newly vacant addresses a year later. Furthermore, the coefficients on the number of single-family unit foreclosure filings and the number of multi-family renter-occupied unit foreclosure filings are 0.36 and 0.49, respectively and are not statistically different from each other at the 5 percent level.[14] This implies that single-family home foreclosures and multi-family (renter-occupied) apartment building foreclosures are associated with a similar number of newly vacant addresses on a per unit basis.

While it may seem counter-intuitive that lenders who are foreclosing on multi-family apartment buildings would move to evict rent-paying tenants, the primary motivation for eviction is that it resolves a potential informational problem faced by buyers. Knowing that a building is vacant may be more attractive to a buyer at a foreclosure auction who typically does not have a lot of information about the property and may not have enough time to examine lease contract terms and tenant credit history information. Furthermore, in the case that the lender's reservation

[13]The data are available through the HUDuser website: http://www.huduser.org/portal/datasets/usps.html

[14]This result is robust to changing the lag of the explanatory variables to 3 or 5 quarters. Furthermore, the coefficient on renter-occupied multi-family unit filings does not change much and remains significant when either or both of the time dummies and the community area fixed effects are dropped.

price is not met at auction, ownership of the property will go to the lender, who may not have expertise in the property management business. Another possibility is that tenants may choose to move out if multi-family apartment buildings are not maintained properly during the foreclosure period.[15]

The final assumption is that the dis-amenity created by deferred maintenance or vacancy stemming from a multi-family building foreclosure is comparable to the dis-amenity created by deferred maintenance or vacancy stemming from a single-family foreclosure or that these two effects can be compared after controlling for the number of units in the multi-family apartment building.

Conditional on the assumptions outlined above, my analysis relies upon obtaining credible estimates of the effect of single-family home foreclosures and multi-family apartment building foreclosures on nearby property values. To achieve this I analyze the prices of non-foreclosure-related single-family home sales in Chicago from January of 2000 through May of 2011. I compute the number of single-family, renter-occupied multi-family, owner-occupied multi-family, and condominium foreclosures in distance-based rings surrounding each transaction. The specification that I use is similar to the specification used in Campbell et al. [2011]. I estimate a number of different variations of the following specification,

$$\ln P_{i,j,t} = \beta F_{i,j,t} + \Gamma X_i + \delta C_{j,t} + \varepsilon_{i,j,t} \tag{5}$$

where $\ln P_{i,j,t}$ is the log transaction price of single-family home i, located in geographical division j, in year t. $F_{i,j,t}$ is a vector of variables indicating the number of initial foreclosure filings within a certain time and distance of property i. Two of the variables contained in the vector $F_{i,j,t}$ are $f_{SF,i,j,t}$ and $f_{MF,i,j,t}$, the number of single-family housing units scheduled for foreclosure in the past year and the number of renter-occupied multi-family housing units scheduled for foreclosure in the past year, respectively. The coefficients corresponding to these two variables are β_{SF} and β_{MF} which are two components of the vector β. X_i is a vector of property specific characteristics. $C_{j,t}$ includes a vector of month indicator variables and either a vector of year indicators or a vector of geographical division indicators interacted with year indicators.

[15] Been and Glashausser [2009] discuss the effect of foreclosures on tenants.

4 Results

In this section I present estimates of the effect of foreclosures on nearby property values using a number of different specifications. Estimating the effect of foreclosures on nearby property values is difficult due to the endogeneity of property price changes and foreclosure decisions. Falling prices erode home equity making default more beneficial from the perspective of the home-owner, thus increasing the likelihood of foreclosure. For this reason one would expect that neighborhood price declines would be correlated with foreclosures, even if foreclosures did not depress property values of nearby homes. Since I do not have an instrument for foreclosures, I employ strategies that other studies in the foreclosure literature have used to try to isolate the effect of a foreclosure on nearby prices that is not being driven by the impact of negative economic shocks. I do this by controlling for time varying unobserved factors that could influence home prices at an extremely fine scale of geography. I do this by including census block * year effects. The mean census block in Chicago contains less than 50 housing units. The trade-off involved in controlling for shocks at such a fine level is that it is hard to detect the effect of foreclosures that are not extremely close to the observed property sale. However, the benefit is that one can be much more confident that the price discounts associated with foreclosures are not being driven by unobserved shocks. I also show that once such fine geographic controls are used, including variables to control for the number of foreclosures that occur in the year following the property sale does not have a substantive impact on the results.

The specifications shown in Table 4 include increasingly fine geographic controls interacted by year to control for local economic shocks that might affect prices from the city-level to the census block-level. The last column of Table 4 switches from using mutually exclusive counts of foreclosures by distance to using the two inner-most mutually exclusive counts and the total number within 0.25 miles as a control. All specifications include month indicators to control for seasonality of the housing market. All specifications also include structure characteristics to control for differences in single-family home prices that are driven by age, size, number of bedrooms, and amenities such as garages, attics, and basements.[16]

Table 4 presents estimates of the effect of the foreclosure of all types of residences summed together (single-family, condominium, and multi-family) on nearby property

[16]The structure characteristics are listed in the notes for Table 4.

values. For each transaction, variables containing counts of the number of initial foreclosure filings in the year prior to the transaction are computed for the area within 0.05 miles of the transacted home, and each of the mutually exclusive concentric areas: 0.05-0.10 miles, 0.10-0.15 miles, 0.15-0.20 miles, and 0.20-0.25 miles from the transacted home.

Column (1) of Table 4 includes controls for changes in housing prices over time and controls for the structure characteristics of the homes, but no control for variation in land prices across the city. Foreclosures at all measured distances are associated with lower home sales prices. The magnitude of the estimates drops almost monotonically as the distance to the foreclosure increases. Column (2) uses community area * year fixed effects instead of just year fixed effects. Controlling for possible community area-level economic shocks greatly reduces the magnitude of the estimate on all of the foreclosure count variables. For example, the estimate of the price reduction associated with each foreclosure within 0.05 miles goes from -1.26 percent to -0.39 percent. The estimates for all distances remain highly statistically significant, and drop monotonically in magnitude as distance increases. Columns (3) through (5) control at increasingly fine levels of geography for local economic shocks and spatial variation in housing prices. Controlling for tract * year shocks reduces the magnitude of all of the estimates. Only the coefficients on the two closest distance rings remain highly statistically significant. Controlling for block group * year or block * year shocks further reduces the coefficients on the distance rings on all but the innermost ring. Finally, the specification in column (6) keeps the block * year controls but changes from using 5 mutually exclusive foreclosure counts to using the two innermost mutually exclusive counts and a count of the total number of foreclosures within 0.25 miles. This change has very little effect on the coefficient and standard error on the count of foreclosures within 0.05 miles. After controlling for the possibility of extremely local economic shocks, it appears that each foreclosure within 0.05 miles is associated with about a 0.3 percent reduction in single-family home prices.

In order to assess the price change associated with different types of residential property foreclosures, Table 5 repeats the specification presented in column (6) of Table 4 but replaces the count of foreclosures in the innermost ring ($F_{0-0.05}$) with counts of single-family foreclosures ($SF_{0-0.05}$), the number of units in renter-occupied multi-family building foreclosures ($UMFRO_{0-0.05}$), the number of units in owner-occupied multi-family building foreclosures ($UMFOO_{0-0.05}$), and the number of condominium

unit foreclosures ($CONDO_{0-0.05}$). The total count of foreclosures 0.05 to 0.10 miles away ($F_{0.05-0.1}$) and the total count of foreclosures 0 - 0.25 miles ($F_{0-0.25}$) are still included, but the estimates of their coefficients remain similar to column (6) of Table 4 and thus are not reported in Table 5.

Column (1) of Table 5 reveals that a 1.3 percent drop in prices is associated with each nearby single-family foreclosure filing in the previous year. The price drops associated with the other types of foreclosures are smaller in magnitude and not statistically distinguishable from zero. One problem with the specification presented in Column (1) of Table 5 is that if foreclosures tend to occur in areas (within a census block) where property values have recently switched from rising to falling, then there is a potential that the recent drop in price may be causing the foreclosure rather than the foreclosure causing the drop in price. To get a better estimate of the true change in prices from the period just before to the period just after the foreclosure, the specification in column (2) adds controls for the number of foreclosure filings in the year following the observed single-family home sale. This strategy is employed by Campbell et al. [2011] and can be viewed as a kind of time-differencing.[17]

The estimates reported for each type of foreclosure in the bottom panel of column (2) are calculated by subtracting the estimate on the count of foreclosures in the following year from the estimate on the count of foreclosures in the previous year for the relevant foreclosure type.[18] It is worth noting that the coefficient on $SF_{0-0.05}$ barely changes and remains highly statistically significant. Furthermore, the coefficient on $SF_{0-0.05} - SF^{post}_{0-0.05}$ is not dramatically different form the coefficient on $SF_{0-0.05}$ and is also highly statistically significant. The other coefficients remain statistically indistinguishable from zero. Using either the spatial differencing technique implicit in controlling for the number of foreclosures within 0.25 miles or both the spatial and time-differencing techniques produces very similar conclusions. However, the standard errors on all coefficients increase quite a bit when also using time-differencing. My estimate of -1.33 percent in column (1) is very similar to the -1.3 percent implied by the preferred specification of Campbell et al. [2011].[19] It seems that once one con-

[17] Campbell et al. [2011] attribute the inspiration for this strategy to Linden and Rockoff [2008].

[18] The point estimates and standard errors are computed using the formulas for the expectation and variance of linear combinations of random variables.

[19] Campbell et al. [2011] use a linear distance-weighted count of foreclosures from 0 to 0.1 miles. The -1.3 percent that I report above comes from multiplying their "close" estimate of -0.017 in column (4) of Table 5 by (0.1 - 0.025) / 0.1 since 0.025 is the midpoint of my innermost ring which extends to 0.05 miles.

trols for block * year economic shocks, the time-differencing strategy of controlling for subsequent foreclosures only serves to add noise to the estimate.[20] For this reason I do not use the time-differencing strategy in the remaining specifications.

Column (3) of Table 5 estimates the same specification as in column (1), but uses a different sample. Instead of using all single-family home transactions, column (3) uses all of the multi-family transactions. If the single-family and multi-family markets are segmented, then this specification provides a test. If single-family home foreclosures have a composite supply and dis-amenity effect on single-family home prices, but multi-family foreclosures have only a dis-amenity effect on single-family home prices, then it should be the case that multi-family foreclosures have a composite supply and dis-amenity effect on multi-family prices, but single-family foreclosures only have a dis-amenity effect on multi-family prices. While none of the coefficients in column (3) are statistically different from zero, it is worth noting that the sign on the coefficient for foreclosures of renter-occupied multi-family units is negative whereas the sign on foreclosures of single-family homes is not. While the results in column (3) are far too noisy to be conclusive, they are in line with the assumption that same property type foreclosures have a composite supply and dis-amenity effect, while different property type foreclosures have only a dis-amenity effect.[21]

4.1 Interpreting Results Assuming Segmentation of Single-Family and Multi-Family Markets

Column (1) of Table 6 presents estimates from the same specification as column (1) of Table 5. The first two rows of the bottom panel of Table 5 present estimates of the segmented market supply and dis-amenity effects. As shown in Equation 1, the supply effect is calculated by subtracting the estimated per-unit effect of a renter-occupied multi-family foreclosure from the effect of a single-family residence foreclosure. Thus, the supply effect shown in the first row is calculated by subtracting the multi-family effect from the single-family effect shown in the upper part of the table. Each extra unit of supply within 0.05 miles is associated with a discount of about 1.2 percent, although this estimate is not statistically distinguishable from zero.

[20] It is also worth noting that it limits the endpoint of the transactions in my sample to be one year prior to the endpoint of the foreclosures in my sample. This is the reason that the number of observations in column (2) is smaller than in column (1).

[21] I would like to thank an anonymous referee for suggesting this test.

As shown in Equation 2, the dis-amenity effect is simply the estimated per-unit effect of renter-occupied multi-family foreclosures. Each foreclosure filing is associated with a dis-amenity effect of about -0.14 percent, which is statistically indistinguishable from zero.

Column (2) repeats the specification of column (1) but clusters the standard errors at the community area * year level.[22] The standard errors are even larger when clustered.

The specification shown in column (3) of Table 6 is almost the same as that shown in column (2), but the sample now includes both single-family and condominium transactions. The slight difference in specification comes from the inclusion of an indicator variable for condominium and setting the structure characteristic variables for condominiums equal to zero. I do this because the structure characteristics are not present for condominiums in the tax assessor data. The inclusion of condominium transactions reduces the standard errors markedly.[23] The point estimates on single-family foreclosures and the number of units of multi-family renter-occupied foreclosures are quite similar to those in column (2). The estimate of the supply effect shown in the first row of the bottom panel is now statistically different from zero at the 5 percent level. Even if the coefficient on the number of units of multi-family renter-occupied foreclosures were zero rather a positive 0.28, the supply effect would be -1.37 percent, and thus still be significant at the 5 percent level. This number is very similar to the -1.2 percent estimate of the supply effect shown in columns (1) and (2).

Column (4) of Table 6 presents a specification aimed at considering an alternative to the assumption that the dis-amenity effect depends on the number of units in foreclosures of multi-family buildings. Instead, the assumption is that the effect is the same regardless of the size of the building. This change has no impact on the coefficient on single-family foreclosures and only a small effect on the coefficient on multi-family foreclosures. However, the standard error on the multi-family term grows by more than a factor of two. I interpret the fact that the zero is more precisely estimated using units than buildings and the fact that the coefficient is smaller when

[22] I experimented with various levels of clustering, including: community area, community area * year, tract, tract * year, block group, block group * year, block, and block * year. Community area * year produced the largest standard errors, but the standard errors were not much smaller using the other clustering options.

[23] I would like to thank an anonymous referee for suggesting this.

using buildings as evidence in favor of a very small dis-amenity effect that increases with the number of units.

4.2 Interpreting Results Assuming Integration of Single-Family and Multi-Family Markets

Although I find it reasonable to assume that the single-family and multi-family housing markets are segmented, it is informative to consider the case in which these markets are integrated in order to consider the impact that this would have on my estimates. The average number of units in a foreclosed multi-family building in Chicago during my sample is 2.6. If the single-family and multi-family markets were integrated, but multi-family buildings could not be converted to condominiums in the short run, then the effect of a multi-family building foreclosure would be to add one additional unit of supply to the combined single-family and owner-occupied multi-family market. With this assumption, Equations 3 and 4 can be used to calculate the supply and dis-amenity effects.

In this case, the supply effect would be about -1.9 percent within 0.05 miles (not statistically significant), and the dis-amenity effect is about 0.6 percent (not statistically significant) within 0.05 miles. These estimates are shown in the bottom two rows of cloumns (1) and (2). In summary, switching from an assumption of segmentation to integration of the single-family and multi-family housing markets changes my estimate of the supply effect from about -1.2 percent to about -1.9 percent and changes my estimate of the dis-amenity effect from about -0.14 percent to about 0.6 percent. The same calculation can be made for the specification shown in column (3), where condominiums are added to the sample. In this case, I estimate an integrated market supply effect of -2.7 percent (significant at the 5 percent level) and dis-amenity effect of 1.3 percent (not statistically different from zero). The bottom two rows of column (4) are empty because the supply and dis-amenity effects are not identified in the integrated markets case if the dis-amenity effect does not depend on the number of units in the multi-family building.

4.3 Robustness: Controlling for Numbers of Recent Foreclosure Auctions

Table 7 presents specifications demonstrating that the results of Table 6 column (2) are robust to adding controls for the number of foreclosure auctions in the past year (column 1), 6 months (column 2), and 3 months (column 3). The estimates shown in the first two rows are for exactly the same two explanatory variables shown in the first two rows of Table 6. The naming of the variables is to draw attention to the distinction between counts of foreclosure filings in the past year and counts of foreclosure auctions in the past year, 6 months, or 3 months. Including counts of the number of auctions in any of the three time windows does not have a marked effect on the estimate of the coefficients on single-family or multi-family foreclosure filings. The effect appears at the time of the foreclosure filing rather than at the time of the auction. The positive coefficients on auctions in the past 6 and 3 months imply that conditional on a foreclosure filing in the past year, the fact that there was an auction in the past 6 or 3 months is correlated with relatively high-price properties being located nearby.[24] I interpret this correlation as evidence of selection which could be brought about by banks bringing relatively higher priced properties to auction more quickly after the foreclosure filing.

5 Conclusion

In the face of falling housing prices and rising foreclosure rates, researchers have sought to determine the size and geographical extent of spillover effects from residential mortgage foreclosures. The main contribution of this paper is to decompose foreclosure spillover effects into effects that are operating through two distinct mechanisms: a supply shock mechanism and a dis-amenity mechanism.

After controlling for the possibility of extremely local economic shocks and variation in home prices, I find that each single-family foreclosure within 0.05 miles is associated with about a 1.3 percent drop in single-family home prices. In contrast, on a per-unit basis, multi-family building foreclosures are not associated with drops in nearby single-family home values. I interpret this as evidence that the supply effect

[24]The coefficient reported in the bottom row of column (3) is for the indicator of whether the variable was Winsorized. This is due to the fact that the even at the 99th percentile, the number of multi-family renter-occupied units auctioned in the past 3 months is still equal to 0.

of foreclosures on nearby home values is roughly -1.2 percent per nearby foreclosure and the dis-amenity effect is about zero.

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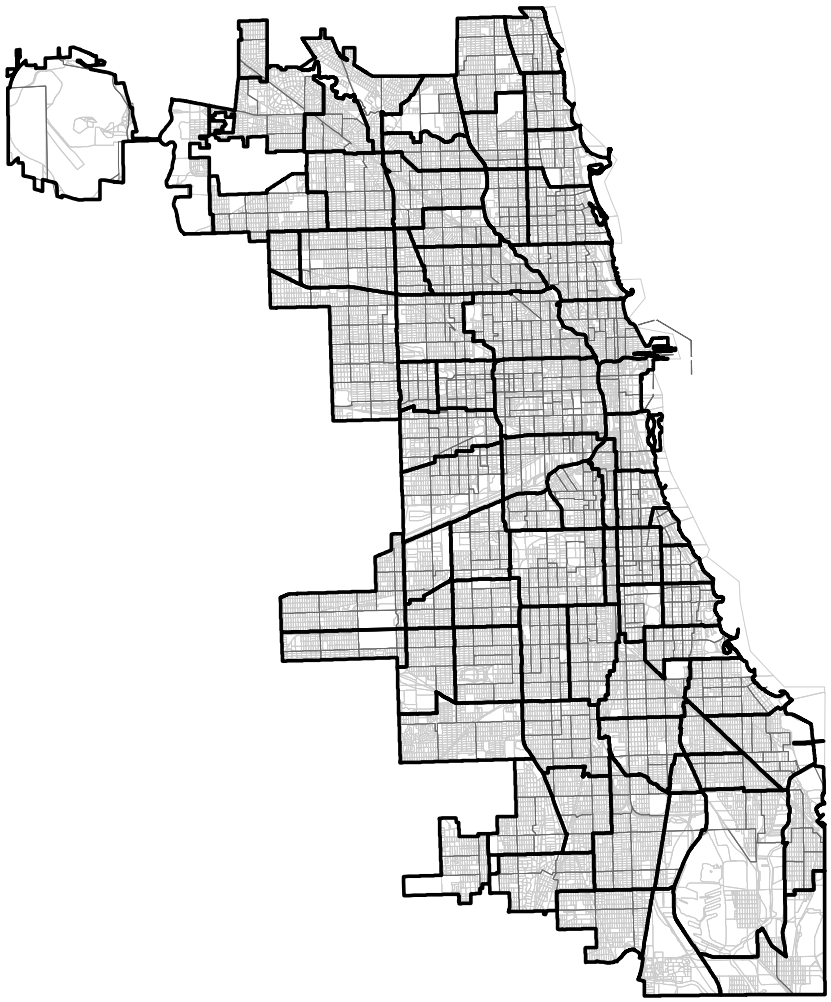

Figure 1: Geographical Divisions of Chicago: Community Areas (black), Census Tracts (dark gray), and Census Blocks (light gray)

Table 1: Descriptive Statistics for Single-Family Property Transactions

	Mean	S.D.	Min	Max
SF Filings (past year) 0 - 0.05 miles	0.32	0.70	0	3
SF Filings (past year) 0.05 - 0.10 miles	0.86	1.46	0	6
SF Filings (past year) 0.10 - 0.15 miles	1.49	2.31	0	9
SF Filings (past year) 0.15 - 0.20 miles	1.77	2.63	0	10
SF Filings (past year) 0.20 - 0.25 miles	2.08	3.06	0	12
UMFRO Filings (past year) 0 - 0.05 miles	0.10	0.50	0	4
UMFRO Filings (past year) 0.05 - 0.10 miles	0.28	1.05	0	7
UMFRO Filings (past year) 0.10 - 0.15 miles	0.53	1.71	0	11
UMFRO Filings (past year) 0.15 - 0.20 miles	0.65	1.96	0	12
UMFRO Filings (past year) 0.20 - 0.25 miles	0.79	2.28	0	14
UMFOO Filings (past year) 0 - 0.05 miles	0.03	0.25	0	2
UMFOO Filings (past year) 0.05 - 0.10 miles	0.11	0.55	0	4
UMFOO Filings (past year) 0.10 - 0.15 miles	0.21	0.80	0	5
UMFOO Filings (past year) 0.15 - 0.20 miles	0.26	0.94	0	6
UMFOO Filings (past year) 0.20 - 0.25 miles	0.32	1.10	0	7
Condo Filings (past year) 0 - 0.05 miles	0.02	0.25	0	9
Condo Filings (past year) 0.05 - 0.10 miles	0.08	0.57	0	11
Condo Filings (past year) 0.10 - 0.15 miles	0.13	0.78	0	13
Condo Filings (past year) 0.15 - 0.20 miles	0.19	1.05	0	17
Condo Filings (past year) 0.20 - 0.25 miles	0.24	1.25	0	20
Price	264,316	235,476	4,125	2,591,558
Land Square Footage	3,966	3,690	7	379,843
Building Square Footage	1,339	599	400	27,270
2 Bathrooms	0.30	0.46	0	1
3+ Bathrooms	0.13	0.33	0	1
Masonry Exterior	0.54	0.50	0	1
Frame / Masonry	0.09	0.28	0	1
Basement	0.81	0.39	0	1
Attic	0.42	0.49	0	1
Garage	0.75	0.43	0	1
Central Air	0.28	0.45	0	1
Fireplace	0.14	0.35	0	1
Age of Structure	69	32	1	188
Tract Median Household Income in 2000	55,538	18,141	3,186	254,951
Tract Median Home Value in 2000	188,402	96,003	12,746	861,094
Tract Median Rent in 2000	810	157	126	2,551
Tract Proportion African American in 2000	0.39	0.44	0	1
Tract Proportion College Grad in 2000	0.20	0.17	0	1
Tract Housing Vacancy Rate in 2000	0.06	0.05	0	0.57

Note: Table presents descriptive statistics of nearby foreclosures (top panel, Winsorized at the 99th percentile), property characteristics (middle panel) and Census Tract characteristics (bottom panel) for the sample of single-family property transactions. The sample covers single-family transaction in the City of Chicago from January 2000 through May 2011. There are 165,313 observations in the sample.

Table 2: Geographical Divisions of the City of Chicago

	City of Chicago	Community Area	Census Tract	Census Block Group	Census Block
N	1	77	873	2,496	25,611
Housing Units	1,173,352	15,238	1,344	470	46
Population	2,947,326	38,277	3,376	1,181	115

Note: This table illustrates the size of 5 increasingly fine geographical divisions of the City of Chicago from the 2000 Census. The first row shows the number of each type of geographical division, while the second and third row show the mean number of housing units and population in each division, respectively.

Table 3: Relationship Between Newly Vacant Addresses and Previous Foreclosure Filings

	# Newly Vacant Addresses in past 3 Months
Condo Unit Filings$_{t-4}$	0.80***
	(0.10)
Single-Family Home	0.36***
Filings$_{t-4}$	(0.04)
Owner-Occupied Multi Family Unit	0.29***
Filings$_{t-4}$	(0.06)
Renter-occupied Multi Family Unit	0.49***
Filings$_{t-4}$	(0.06)
R^2	0.20
N	15,696

Note: Table presents regression results documenting a correlation between the number of newly vacant addresses and the number of foreclosures four quarters in the past. The unit of observation is a census tract * quarter. The dependent variable is the number of newly vacant residential addresses in the current quarter. The explanatory variables are the 4 quarter lags of the number of each type of foreclosure filing in the tract. All Chicago census tracts are included. The time period is 2008Q1 through 2012Q4. Eicker-White standard errors clustered by tract are reported in parentheses. Community Area effects and year * quarter effects are included. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Table 4: Effects of Sum of all Nearby Foreclosure Types on Sale Price

	(1)	(2)	(3)	(4)	(5)	(6)
$F_{0-0.05}$	-1.26%***	-0.39%***	-0.24%***	-0.26%***	-0.31%**	-0.29%*
	(0.11%)	(0.08%)	(0.08%)	(0.08%)	(0.15%)	(0.16%)
$F_{0.05-0.1}$	-0.69%***	-0.24%***	-0.12%***	-0.08%*	-0.02%	-0.01%
	(0.06%)	(0.04%)	(0.04%)	(0.04%)	(0.08%)	(0.09%)
$F_{0.1-0.15}$	-0.58%***	-0.13%***	-0.05%*	-0.04%	-0.02%	
	(0.04%)	(0.03%)	(0.03%)	(0.03%)	(0.05%)	
$F_{0.15-0.2}$	-0.38%***	-0.09%***	-0.02%	-0.01%	-0.01%	
	(0.04%)	(0.03%)	(0.03%)	(0.03%)	(0.05%)	
$F_{0.2-0.25}$	-0.41%***	-0.07%***	0.00%	0.01%	-0.02%	
	(0.03%)	(0.02%)	(0.02%)	(0.02%)	(0.04%)	
$F_{0-0.25}$						-0.01%
						(0.02%)
Fixed Effect	Year	Community Area * Year	Tract * Year	Block Group * Year	Block * Year	Block * Year
R^2	0.41	0.72	0.77	0.81	0.90	0.90

Note: The specifications shown in columns (1) - (5) show regression results for log sales price on counts of all types of foreclosures in mutually exclusive concentric rings around the location of the transaction. The rings each have a width of 0.05 miles. The specifications use increasingly fine geographic controls. Column (6) keeps the 2 innermost concentric circles, but replaces the outer 3 with a count of all foreclosures within 0.25 miles of the transaction location. The sample used in all specifications include 165,313 single-family home transactions. Eicker-White standard errors in parentheses. All specifications include month of year indicators and the following structure characteristics: the log of land square-footage, the log of building square-footage, 14 roughly decadal structure age indicators, and indicator variables for the following characteristics: 2 bathrooms, 3 or more bathrooms, masonry exterior, frame and masonry exterior, basement, full basement, finished basement, attic, full attic, finished attic, garage, detached garage, 2 car or larger garage, air conditioning, fireplace. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Table 5: Effects of Each Type of Nearby Foreclosure on Sales Price

	(1)	(2)	(3)
$SF_{0-0.05}$	-1.33%***	-1.31%***	0.44%
	(0.38%)	(0.39%)	(0.80%)
$SF^{post}_{0-0.05}$		0.42%	
		(0.41%)	
$UMFRO_{0-0.05}$	-0.14%	-0.18%	-0.51%
	(0.67%)	(0.67%)	(0.65%)
$UMFRO^{post}_{0-0.05}$		1.02%	
		(1.07%)	
$UMFOO_{0-0.05}$	-0.72%	-0.90%	-2.44%
	(1.39%)	(1.44%)	(1.57%)
$UMFOO^{post}_{0-0.05}$		0.19%	
		(1.92%)	
$CONDO_{0-0.05}$	0.27%	0.79%	-0.92%
	(1.03%)	(1.17%)	(1.41%)
$CONDO^{post}_{0-0.05}$		-1.23%	
		(1.44%)	
Sample	Single-Family	Single-Family	Multi-Family
R^2	0.90	0.90	0.88
Obs	165,313	157,609	87,517
$SF_{0-0.05} - SF^{post}_{0-0.05}$		-1.74%***	
		(0.61%)	
$UMFRO_{0-0.05} - UMFRO^{post}_{0-0.05}$		-1.19%	
		(1.30%)	
$UMFOO_{0-0.05} - UMFOO^{post}_{0-0.05}$		-1.09%	
		(2.42%)	
$CONDO_{0-0.05} - CONDO^{post}_{0-0.05}$		2.02%	
		(2.12%)	

Note: Table presents regressions results of log sales price on each type of foreclosure within 0.05 miles in the past year. Controls include the sum of all types of foreclosures from 0.05 miles to 0.1 miles and the sum of all types of foreclosures from 0 miles to 0.25 miles that occurred in the year prior to the observation. Column (2) also includes these foreclosure sum variables for the year following the sale. Estimates of the difference between the coefficient on foreclosures that occurred in the past year minus the coefficient on foreclosures that occurred in the future year for each type of foreclosure are shown in the bottom panel. Column (3) estimates the same specification as column (1) on the sample multi-family property sales instead of single-family sales. Eicker-White standard errors in parentheses. All specifications include census block-year indicators, month of year indicators, and structure characteristics (see Table 4 for list). $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 6: Effects of Each Type of Nearby Foreclosure on Sales Price and Supply and Dis-amenity Effects

	(1)	(2)	(3)	(4)
$SF_{0-0.05}$	-1.33%***	-1.33%***	-1.37%***	-1.37%***
	(0.38%)	(0.50%)	(0.39%)	(0.39%)
$UMFRO_{0-0.05}$	-0.14%	-0.14%	0.28%	
	(0.67%)	(0.81%)	(0.55%)	
$MFRO_{0-0.05}$				-0.07%
				(1.16%)
Clustering of standard errors	None	Community Area * Year	Community Area * Year	Community Area * Year
R^2	0.90	0.90	0.80	0.80
N	165,313	165,313	293,082	293,082
Sample	Single-Family	Single-Family	Single-Family and Condominium	Single-Family and Condominium
Supply Effect - Segmented Markets	-1.19%	-1.19%	-1.65%**	-1.30%
	(0.77%)	(0.96%)	(0.68%)	(1.24%)
Dis-amenity Effect - Segmented Markets	-0.14%	-0.14%	0.28%	-0.07%
	(0.67%)	(0.81%)	(0.55%)	(1.16%)
Supply Effect - Integrated Markets	-1.93%	-1.93%	-2.68%**	
	(1.25%)	(1.57%)	(1.11%)	
Dis-amenity Effect - Integrated Markets	0.60%	0.60%	1.31%	
	(1.11%)	(1.36%)	(0.94%)	

Note: Table presents estimates of the supply and dis-amenity effects. Column (1) repeats the specification shown in column (1) of Table 5. For simplicity, only the coefficients on single-family and multi-family renter occupied foreclosures are presented. Column (2) repeats the specification in column (1) except that it presents standard errors that are clustered at the community area * year level. Columns (3) and (4) broaden the sample to include condominium sales as well as single-family sales. Column (4) changes the specification slightly, using the number of multi-family renter-occupied buildings in foreclosure rather than the number of units in foreclosure. Eicker-White standard errors in parentheses. All specifications include controls for the number of foreclosure filings for condo and multi-family owner-occupied properties. All specifications include census block * year indicators, month of year indicators, and structure characteristics (see Table 4 for list). ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Table 7: Effects of Each Type of Nearby Foreclosure on Sales Price: Robustness - Controlling for Auctions

	(1)	(2)	(3)
Filings in past year $SF_{0-0.05}$	-1.21%**	-1.52%***	-1.41%***
	(0.49%)	(0.51%)	(0.51%)
Filings in past year $UMFRO_{0-0.05}$	-0.23%	-0.23%	-0.20%
	(0.82%)	(0.81%)	(0.81%)
Auctions in past year $SF_{0-0.05}$	-0.27%		
	(0.77%)		
Auctions in past year $UMFRO_{0-0.05}$	0.01%		
	(1.76%)		
Auctions in past 6 months $SF_{0-0.05}$		2.71%**	
		(0.82%)	
Auctions in past 6 months $UMFRO_{0-0.05}$		6.08%	
		(6.28%)	
Auctions in past 3 months $SF_{0-0.05}$			1.40%
			(1.30%)
Indicator for any Auctions in past 3 months $UMFRO_{0-0.05}$			5.72%
			(4.74%)
R^2	0.90	0.90	0.90
N	165,313	165,313	165,313

Note: Table presents specifications demonstrating that the results presented in column (2) of Table 6 are robust to controlling for the number of foreclosure auctions in either the past year (column 1), the past 6 months (column 2), or the past 3 months (column 3). The coefficient shown in the last row of column (3) is for an indicator of whether any auctions of multi-family renter-occupied buildings occurred in the past 3 months since the 99th percentile value of this variable is zero. Since there is no variation in the Winsorized version of the variable, I present the coefficient on the indicator variable. Standard errors clustered at the community area * year level are shown in parentheses. All specifications include controls for the number of foreclosure filings for condo and multi-family owner-occupied properties. All specifications include census block * year indicators, month of year indicators, and structure characteristics (see Table 4 for list). ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.