

The Impact of Foreclosures on Nearby Property Values

Evidence from the city of Chicago: 2008-2012

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Abstract

There has been a significant increase in foreclosures after the housing bubble burst in 2006-2007. Foreclosures have negative impacts not just for the homeowner, but also on neighboring property values. This study investigates the impact of foreclosures on nearby property values in the single family housing market by analyzing a foreclosure's impact both over time, and over various neighborhood vacancy rates. Using an endogeneity-controlling hedonic model, this study finds that uncompleted foreclosures generally do not impose impacts on nearby sale prices. Once they go through auction, however, the impacts begin to increase. The peak value of this negative impact can reach a 2% discount effect about one year after the auction and then shrink to insignificant levels two years after the auction. While analyzing the foreclosure impacts by neighborhood vacancy rates, uncompleted foreclosures are found responsible for some decreases in nearby property values in low vacancy areas (0 to 50th percentile). Furthermore, during the first few quarters after the auction, the foreclosure price impacts are shown to be smaller in high vacancy (above 75th percentile) than lower vacancy areas (25 to 75th percentile). These results imply that stabilization efforts by the government would be best targeted for medium vacancy areas right after the auction.

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1. Introduction

According to a first quarter of 2013 report from RealtyTrac LLC, a leading company for foreclosure data analysis, Illinois has the third highest foreclosure rate in the nation – 1 in every 147 housing units received a foreclosure filing. Meanwhile, Chicago has the ninth highest foreclosure rate (1 in every 116 houses foreclosed) among metropolitan areas. Although foreclosures have always been a characteristic of the housing market, the number of foreclosed properties has increased dramatically since the housing bubble burst in 2006-2007. As shown in figure 1, both the number of foreclosure notices and foreclosure auctions¹ began to grow rapidly around 2005-2006. The phenomenon and consequences of foreclosures have motivated many studies that investigate the causes of foreclosures, prevention of foreclosures, and the impact of foreclosures on property values (either nearby property or the property foreclosed itself). This study builds on this literature by exploring the impact that foreclosures have on nearby property values and focuses on gaining more understanding about the magnitude and source of foreclosure impacts after the subprime mortgage crisis in areas like Chicago that have been characterized by a prolonged foreclosure process and cumulatively increasing completed foreclosures.

¹ Foreclosure notices represent the start of a foreclosure process while foreclosure auctions represent the completion of a foreclosure process in this study.

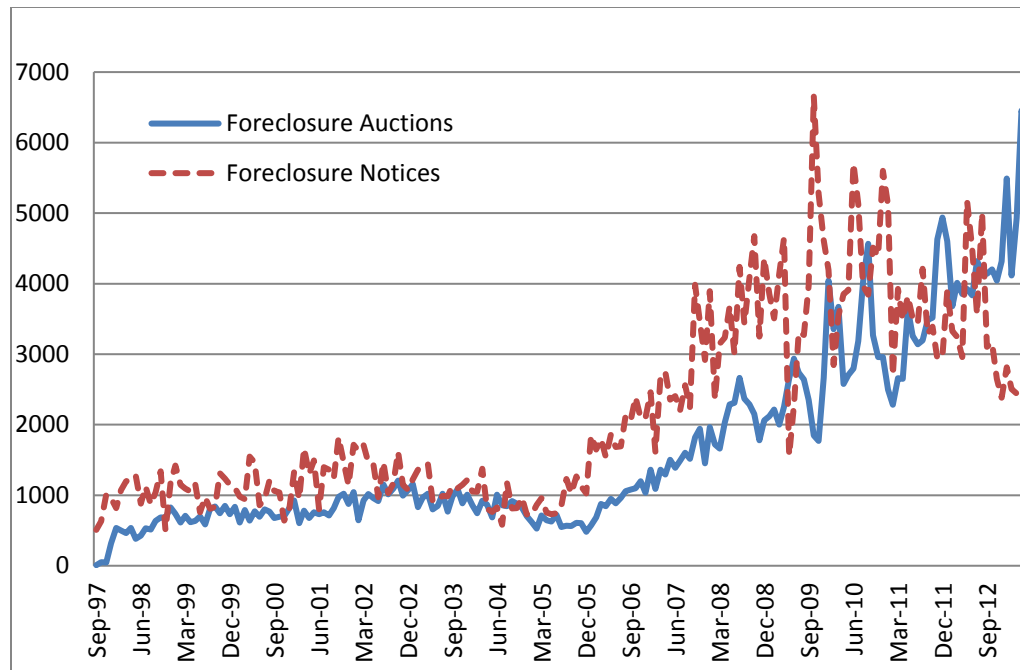


Figure 1: Cook County, Illinois Foreclosure Notices and Foreclosure Auctions

Even though foreclosure notices have slowed down starting in late 2010, foreclosure auctions are still rising. This phenomenon has been driven in part by the legal process in Illinois that was interrupted with a court order which slows down the process of foreclosures. Therefore, while new foreclosure starts are declining, foreclosed properties (from the auction) are still entering into and playing a large role in the housing market. However, only a few studies (Campbell, *et al.*, 2011, CGP hence-forth; Anenberg and Kung, 2012; Gerardi *et al.*, 2012) have used data after 2008 to estimate the impact of foreclosures on property values for areas like Chicago that have a large number of both finalized and ongoing foreclosures. Furthermore, studies on Chicago area either use an incomplete measurement of foreclosures (Immergluck and Smith, 2006; Lin, *et al.*, 2009; Hartley, 2010) or leave the endogeneity problem unresolved (Immergluck and Smith, 2006; Lin, *et al.*, 2009). Finally, there is no agreement in the literature about the source of the impact of foreclosure on property values, although there is a consensus about the negative impact of foreclosures inducing declines in housing prices by between -0.5% to -2.0% within 0.1-

0.33 miles² (Immergluck and Smith, 2006; Harding, *et al.*, 2009; Hartley, 2010; Kobie and Lee, 2011; CGP 2011; Anenberg and Kung, 2012; Gerardi *et al.*, 2012).

While it will bring meaningful policy implications to identify the source of the foreclosure impacts, most of the literature only acknowledges the difficulty of identifying the channel through which foreclosures affect nearby property values. There are two studies (Hartley, 2010; Anenberg and Kung, 2012) that attempt to distinguish the supply shock from the disamenity that a foreclosure brings. Anenberg and Kung (2012) found that foreclosed properties decrease housing prices within 0.1 miles by 1% due to this specific foreclosure-related supply effect. Hartley (2010), on the other hand, decomposes the impact of foreclosures into a supply shock and a disamenity effect while looking at the areas with high and low vacancy rates. The author finds that in high vacancy areas foreclosures decrease nearby property values by 2% due to a disamenity effect they have on the neighborhood. In low vacancy areas, however, the impact of foreclosures results only from a supply shock that decreases property values by 1.6%.

This study aims to fill the gaps in the literature in several ways. First, the dataset used in the study covers the period from 2008 to 2012, which allows for investigation of the nature of foreclosure impacts after the housing bubble burst. Secondly, a hedonic model is used, along with the identification strategy proposed by CGP (2011) that allows for control of endogeneity. However, unlike CGP (2011) who treat a foreclosure as a single event, this study treats it as a process and breaks it down into multiple, distinct phases. Thus, a more complete set of measurements of foreclosures that includes both ongoing and completed foreclosures with detailed distinction of multiple foreclosure phases is applied in the analysis. Finally, the study also attempts

² As an exception, Lin, et al. (2009) estimated the impact of foreclosures occurred in the past two years can be as large as 8.7% within 0.1 km.

to distinguish the disamenity and supply effects by foreclosure phases and vacancy rates in the areas under the study.

Empirically, this study followed Ellen *et al.* (2012) who applied the CGP (2011) identification approach to handle the endogeneity of foreclosures. Their approach differentiates itself from a traditional static hedonic model in three ways. First, the number of *preexisting* foreclosures near³ each observed sale is used as the variable of interest. In this way, the impacts of prices on foreclosures can be constrained although subsequent sales still carry information about the factors that influences earlier foreclosures. Secondly, census tract by year fixed effects are included to control for the heterogeneity of the housing market across census tracts and years. Thirdly, foreclosures from distant⁴ neighborhoods are included to investigate the spillover effects from foreclosures. Fourthly, the number of foreclosures that occur *after* each observed sale is used as a control variable for unobserved local shocks. There is a concern that unobserved factors could affect the foreclosures and housing prices at the same time and they will drive higher foreclosures and lower housing prices or the other direction. Therefore, to control for the trend of foreclosures, a *post*-foreclosures variable in contrast with the *preexisting* foreclosures variables is included in the model to capture the unobserved shocks that could influence the price trend as well.

The results of this study indicate that incomplete foreclosures (before auction) generally do not show impacts on nearby sale prices; however, once they go through an auction, the impacts start to appear. The peak value of this negative impact can reach a 2% discount effect about one year after the auction. This peak value of impacts is present for foreclosures that are in the phases

³ Within this study, the spatial scope of “near” is defined as a buffer area with a radius of 0.1 miles, which is about the size of a block in Chicago (600 feet by 600 feet).

⁴ Distant neighborhood is defined as the area outside the 0.1 mile buffer. In this study, it extends the distant neighborhood as far as 0.3 miles.

5 to 8 quarters after the auction. Beyond two years after the auction, foreclosures do not have significant impacts on nearby property values. In the areas with vacancy rates below the 25th percentile, properties in the foreclosure process (before an auction) have a significant impact on nearby sale prices likely due to supply effects. In the areas within the 25-50th and 50 -75th percentiles of vacancy rates, there are two rounds of the impact of foreclosures. The first round is present during the first two to three quarters after the auction, followed by insignificant impacts. The second round of impacts will present during the sixth to the tenth quarter after the auction. In the area with above 75th percentile vacancy rates, foreclosure impacts are basically concentrated in the third to the seventh quarter after the auction.

The rest of the paper proceeds as follows. Section 2 provides a broad overview of foreclosure impacts and process. Detailed interpretation of the model and data will be covered in sections 3 and 4, followed by a presentation and discussion of the results respectively in sections 5 and 6. The paper will conclude with summary comments and issues to be addressed in follow-up research in section 7.

2. Background

Foreclosure is a legal process for lenders to force the sale of a defaulted borrower's property to uncover the mortgage debt. Foreclosure is likely to happen when the home mortgage balance is more than the market value of the house. For instance, after the housing bubble burst in 2006-2007, the large decrease in housing prices induced a significant increase in the number of foreclosures. There are also sudden household-related events that can result in a foreclosure such as loss of a job or a divorce. Depending on the U.S. state, the process of foreclosure can be judicial or non-judicial. There are twenty-four states in the U.S. that use the judicial foreclosure procedure, including Illinois. In judicial states, a home mortgage foreclosure needs to go through a legal

process to achieve a court judgment of foreclosure, and is then followed by an auction sale. Due to the legal process, foreclosures in judicial states will take a longer time to process than in non-judicial states.

2.1 The Impact of Foreclosures

Homes in foreclosure are referred to as stressed properties that are usually sold at much lower prices than non-foreclosed properties. The price discount on a foreclosed property is due to either the need for urgent sale by lenders (Campbell, *et al.* 2011) or due to the poor condition of the properties themselves. They not only depress the median housing prices in major metropolitan markets, but also have a significant negative effect on property values at a more local level (within a metropolitan region), by lowering the prices of nearby properties.

Foreclosures can place stress on nearby property values in three different ways. First, foreclosure-related properties create a negative externality, a disamenity in their neighborhood that negatively influences the neighborhood's characteristics. The disamenity results from poor maintenance of the property and higher occurrence of crimes in the neighborhood, such as burglary and vandalism (see Immergluck and Smith 2006; Harding, *et al.*, 2009; Gerardi *et al.*, 2012). These impacts are likely to linger until a foreclosed property is resold to new buyers. Secondly, foreclosures can disturb the balance of supply and demand at the local level. Properties repossessed by lenders through foreclosures are called REO (real-estate owned) properties. Lenders prefer to sell REOs for more liquid assets rather than experience the illiquidity of the housing market (Campbell, *et al.*, 2011). These REOs can induce a local supply shock (Anenberg and Kung, 2012) that may generate a further downward shift in housing prices despite banks' efforts to manipulate the speed of their supply so that the housing prices are not dampened further. Finally, since foreclosed properties are usually sold for a lower price, they can directly lower the

prices of comparable properties that offered for sale.

2.2 Judicial Foreclosure Process

Even though states have the same foreclosure system (either judicial or non-judicial), they may still have differences in their foreclosure process. The judicial process in Illinois is described here to provide an overview of the foreclosure process. Homeowners usually have to miss mortgage payments for three months before their lenders initiate the legal process to require the homeowners to vacate the property. By the third month of the missing payment, the lender will make a foreclosure filing that indicates the start of a foreclosure process. Homeowners will have one month to reply to the summons and after the reply, the process can last various lengths of time. A bankruptcy filing by the owner can interrupt a foreclosure process temporarily; an irresponsible filling⁵ can prolong the process as well. The three months after the filling is referred to as the reinstatement period, and allows a home owner to catch up with all the deferred payments and prevent the foreclosure. If nothing is resolved by the end of the reinstatement period, the process will move on and reach a judgment of sale. A date for the auction /judicial sale will be assigned. However, before the auction date, the home owners have another three months of “grace,” called the redemption period, during which they can still save their homes and some credits by paying back all the loans they own to the lender plus other various fees and costs occurred during that period. If homeowners are not able to do this, the process will move forward to the auction. At the auction, a threshold price will be given by the bank. If there are other bids that are higher than the set price, the property will be sold to a third party. Otherwise, the lender has to take the home as its own and this repossessed property is called REOs (real estate owned).

⁵ Robo-signing scandal in late 2010 revealed a few big lending institutions prepare foreclosure documents without earnest. They sign documents without reviewing or making up fraudulent documents.

2.3 Important Dates in Foreclosure Process

Two dates during a foreclosure process are crucial for this study: the filing date as the start of the process and the auction date as the end of the process. First, the filling date is possibly the start date of disamenity effect of a foreclosure-related property. Since home-owners have little incentive to invest anything in the property that they may lose, disinvestment on the property may appear. Secondly, as the auction date approaches, more impacts of a foreclosed property may spread. Since home owners can legally stay in their foreclosed homes (for free) until fifteen days after the auction, the negative externality from vacancy and poor maintenance will not be exposed to the neighborhood until the end of the foreclosure process is reached. Further, after lenders repossess the property from the auction, they would most probably prepare to supply them to the market, with perhaps modest investment and certainly some cosmetic “clean-up,” since these REOs are liabilities on their account. However, the investments are likely to be modest and the addition of these properties onto the market could still generate negative externalities.

3. Methodology

The problem of endogeneity associated with foreclosures is the key econometric challenge that has to be addressed to accurately estimate the impact of foreclosures on housing prices. Foreclosures are more likely to occur when house prices are decreasing (Frame, 2010). As a result, it is hard to identify whether foreclosures induce lower prices or the decreasing prices induce more foreclosures, and in turn the increasing number of foreclosures further decrease the housing price. To identify how much the change of the housing price is associated with foreclosures, it will be important to control for the simultaneity between property values and foreclosures.

The ideal solution to the endogeneity problem is to find an instrument for foreclosures, but

GDP (2011) admit to the unavailability of such an instrument. To address this empirical issue, several studies (Anenberg and Kung, 2012; Hartley, 2010; Ellen, *et al.* 2012) have followed the identification approach used by CGP (2011). This paper essentially uses the CGP (2011) identification approach while following Ellen *et al.* (2012) to interpret the model.

Before the introduction of the base model, temporal dimensions used to measure the foreclosure phases and the spatial units applied to identify nearby areas are described.

3.1 Temporal Dimension

Foreclosure is a process and the measurement of it varies in the literature. Gerardi *et al.* (2012) distinguishes between flow and stock measurements of foreclosures. Flow measurement is the count of foreclosures started or completed given a period of time (applied by Immergluck and Smith, 2006; Lin *et al.*, 2009; Hartley, 2010; CGP, 2011; Anenberg and Kung, 2012). While the flow measurement does not distinguish the impacts from foreclosures by their phases, the stock measurement breaks down the foreclosure process into different phases. Stock measurement is the count of foreclosures at different phases at the time a sale occurs (applied by Harding *et al.*, 2009, Kobie and Lee, 2011 and Gerardi *et al.*, 2012). For instance, for a sale made on Feb 14, 2013, the total number of its nearby foreclosures finalized in the past twelve months is one type of flow measurement while the number of nearby foreclosures that occurred one month after filing or three months before an auction is a stock measurement of nearby foreclosures for this sale. This study looks at the impact of various phases of ongoing and completed foreclosures; thus a flow measurement is applied.

Figure 2 depicts the time segments of foreclosure phases in this study. This study tracks the impacts of foreclosures by quarterly phases over a total of three years after the auction and more than 1 year before the auction (during the foreclosure). More specifically, 15 phases are

distinguished around the foreclosure auction and each phase is 1 quarter long. For ongoing foreclosures, their phases are defined as their time distance before reaching the auction, such as less than 1 quarter (indicated as “A-1 to A”, where “A” indicates an “Auction”), between 1-2 quarters (indicated as “A-2 to A-1”) and so on. A special categorization is given to all ongoing foreclosures that are still more than 1 year to auction, indicated as “Filing to A-4.” For completed foreclosures, phases are defined as the time distance after the auction. For instance, 7 months after the auction belongs to the phase that is 2-3 quarters after the auction indicated as “A+2” to “A+3”.

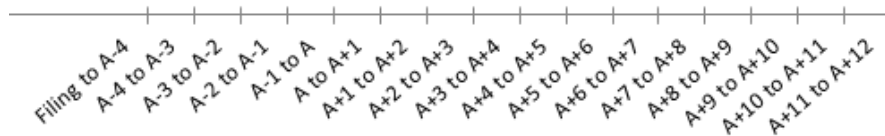


Figure 2: Time segments of foreclosure phases

3.2 Spatial Units

To measure the impact of foreclosures on nearby properties, a spatial unit needs to be determined to represent the “nearby neighborhood.” Following previous studies that generally apply a buffer with a radius that ranges between 0.1 and 0.33 miles,⁶ or is a block size of 600 by 600 feet in the city of Chicago, the spatial unit in the base model is chosen to be a buffer area with 0.1 miles radius surrounding each sale (see figure 3). As a result, the number of nearby foreclosures is counted within the area that falls in this buffer. In another specification, spillover effects of foreclosure impacts are tested by including two distant neighborhoods: 0.1-0.2 miles and 0.2-0.3 miles buffer areas.

⁶ Immergluck and Smith (2006); Campbell, Giglio and Pathak (2011); Anenberg and Kung (2012); Gerardi et al. (2012)

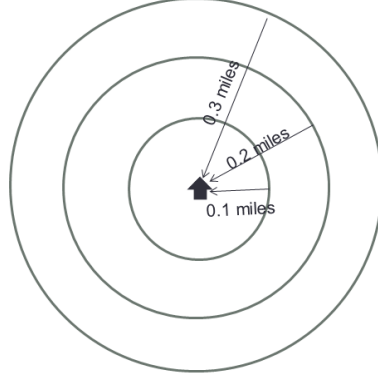


Figure 3: Spatial Scope of neighborhood

3.4 Base Model

The empirical model and identification strategy follows Ellen, *et al.* (2012) in applying and interpreting the CGP approach. Equation 1 describes the specification of the base model:

$$\log(P_{ict_0}) = \alpha + \sum_{m,n,B} X_{it_0B,A\pm m \sim A\pm n} \beta_{m,n,B} + Z_i \delta + T_{cy} + \epsilon_{ict_0} \quad (1)$$

where P_{ict_0} is the sale price of property i in census tract c sold at time t_0 . On the right hand side, $X_{it_0B,A\pm m \sim A\pm n}$ is a vector of preexisting foreclosures in buffer area B at various phases (according to their time distance, m to n quarters before or after auction “A”) referring to property i sold at time t_0 . Z_i is a vector of house structural characteristics; T_{cy} is a census tract by year dummy, indicating a fixed effect for each year in each census tract; ϵ_{ict_0} is the random error term indicating unexplained factors by the model.

The base model minimizes omitted neighborhood characteristics by including fixed effects at the census tract level interacted with year fixed effect, uses preexisting foreclosures to constrain the impact from housing prices on foreclosures, and breaks the preexisting foreclosures into different phases to investigate the various impacts of foreclosure phases before and after the auction.

First, census tract by year fixed effects are included to control for the heterogeneity in the housing markets across all census tracts by different years. Census tract fixed effects help to control for spatial features that do not change over years but vary across the micro geographic areas at the census tract level such as the distance to the central business district (CBD), lakeshore or airport that can heavily influence the value of a property. Its interaction with year fixed effects controls for the various degrees of changes each census tract experiences across years.

Secondly, preexisting foreclosures are used to limit the simultaneity between the housing price and foreclosures. All variables of interest indicating foreclosures in the base model are preexisting. Whether these foreclosures are ongoing or completed, they are all filed before the sale of property i to which they are referenced. Preexisting foreclosures are assumed to have an impact on the price of subsequent sales, while the subsequent sales influence the preexisting foreclosures with limitation. Unobserved factors at the micro level that could influence the sale price and surrounding foreclosures at the same time may exist, but the use of the preexisting foreclosures is employed to reduce the effects of those unobserved factors.

Thirdly, each preexisting foreclosure is indicated as being in a specific foreclosure phase according to their time distance to auction as described in section 3.1. In this way, the impacts of foreclosures can be tracked down to the detailed phases along the process. This can ease analyzing the source of foreclosure impacts since in various phases one certain source of the impact may dominate the total impacts. For example, foreclosures before the auction may not be ready for resale so that the source of foreclosure impacts, if any, during the foreclosure process cannot be the supply effects.

4 Data

The study uses four data sources from the city of Chicago, two of which are housing market data. The first housing market data source is from the multiple listing services (MLS). It records basic information about each transaction, including sale prices, property characteristics, date of sale, and address of the property and so on. Housing characteristics of 37,338 properties sold between 2008 and 2012 are summarized in table 1, including number of bedrooms, bathrooms and square footage. Whether a property is foreclosed⁷ before is distinguished and their characteristics are summarized and presented as two sub-samples. Properties foreclosed before have a much smaller number of characteristics than those are never foreclosed. Building age is a category variable with twenty two categories, such as “Build for 1-10 years.” According to the sale date, each sale is indicated with a quarter dummy for controlling the seasonal effect of housing price. Sales of non-foreclosed properties are more concentrated in the second and the third quarter of year, while foreclosed properties are more smoothly sold in each quarter. While more non-foreclosed properties have been sold in recent years, there are slightly more foreclosed properties sold in 2009 and 2010.

About 17,000 sales have missing values for square footage and they are imputed by fitted values from the regression of square footage on other independent variables using cases having square footage information. Further, observations with sale prices or square footage below 1 percentile or above 99 percentile of their own values are removed as outliers.

⁷ As long as a property address has foreclosure filings attached to it in the past, they are indicated as foreclosed before.

Table 1: Summary Statistics for Single Families Sold in the City of Chicago from 2008-2012

	Full Sample				Properties Not Foreclosed Before				Properties Foreclosed Before			
	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max
Sale Price	217,443	254,507	6,500	1,800,000	306,088	294,206	6,500	1,800,000	107,693	126,619	6,500	1,795,000
Bedroom	3	1	1	12	3	1	1	12	3	1	1	10
Bathroom	2	1	0	7	2	1	0	7	2	1	0	6
Square Footage	1,648	852	680	5,600	1,838	969	680	5,600	1,413	601	680	5,580
Building Age	Category variables with twenty two uneven ranges. For example, built for 1-5 years; built for 1-10 years.											
Quarter and Year of Sale	Quarter 1	20%	2008	16%	Quarter 1	18%	2008	17%	Quarter 1	23%	2008	15%
	Quarter 2	28%	2009	21%	Quarter 2	28%	2009	19%	Quarter 2	26%	2009	23%
	Quarter 3	27%	2010	21%	Quarter 3	28%	2010	21%	Quarter 3	26%	2010	21%
	Quarter 4	25%	2011	19%	Quarter 4	26%	2011	20%	Quarter 4	25%	2011	19%
			2012	22%			2012	23%			2012	21%
N	37,338				20,655				16,683			

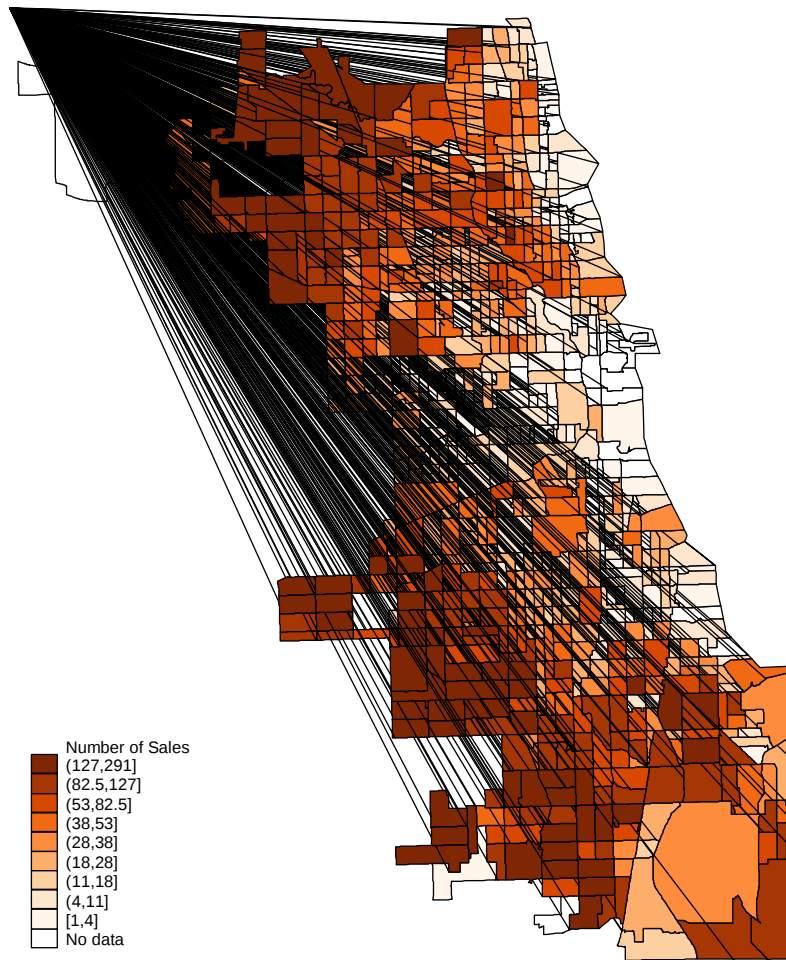


Figure 2: Sales in the City of Chicago 2008-2012 by Census Tracts

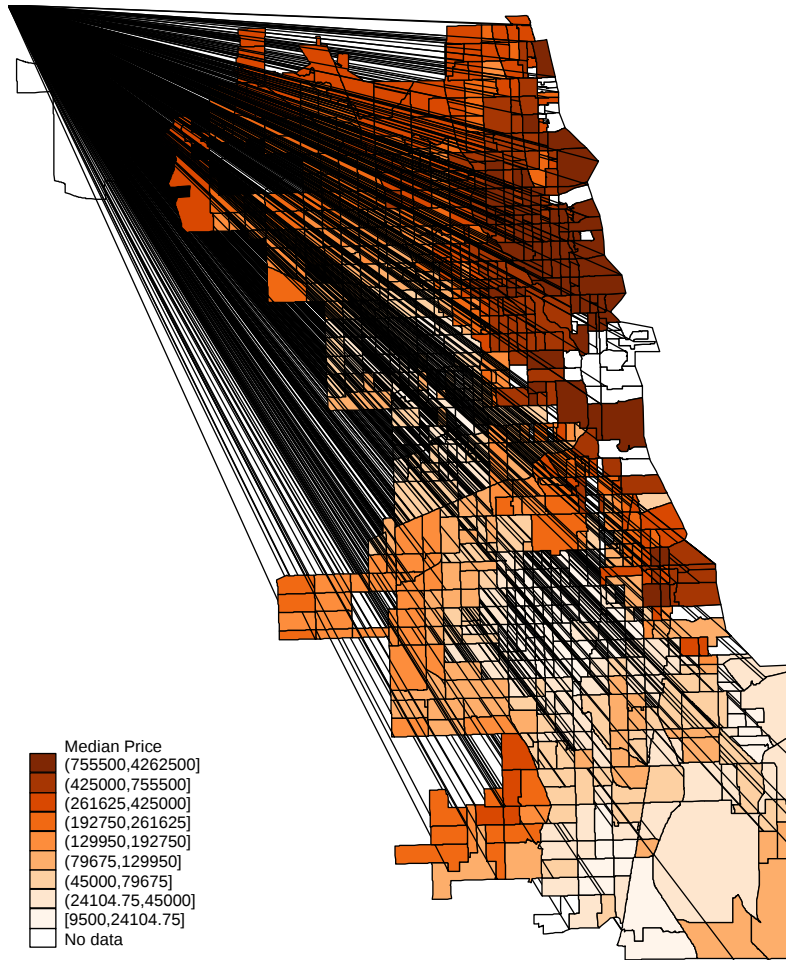


Figure 3: Median Price in the City of Chicago 2008-2012 by Census Tracts

Sales volume and median prices by census tract are shown in figures 2 and 3. Total sales from 2008 to 2012 is high in northwest and southwest, while median prices of all sales are higher in the northeastern area.

The second dataset is from Record Information Services, Inc., a private company that collects information about foreclosure-related filings from the court. This foreclosure dataset covers the period from 2004 to May 2013, involving 59,765 new foreclosure filings and 34,770

foreclosure auctions.⁸ Figure 4 shows the filings and auctions by year from 2004 to 2012. Foreclosure filings start to rise in 2005 while auctions start to increase one year after.



Figure 4: Foreclosure Filings and Auctions by year in the City of Chicago

This foreclosure dataset includes limited property information, but address and date of each legal filing are available that play important roles in identifying the spatial units and temporal dimensions respectively. The address information from the above two datasets are assisted by the publicly available Geographic Information Services (GIS) information to accomplish the use of spatial fixed effects and more importantly, to link the two datasets together using their geographic location. The date information from both foreclosure dataset and sales dataset together help define the temporal dimensions of foreclosure phases as described in methodology part.

The third set of data is the city's census tracts shape file from the City of Chicago data portal. It creates the polygon map as the base of all maps in this study, as shown in figure 2 and 3. The three datasets are linked and further processed using the GIS tool, ArcMap. Addresses of

⁸ There are many foreclosures that are disposed of through ways other than auctions, but those recordings are not available.

sold properties and foreclosed properties were geocoded under the geographic information environment, so that they can be visually observed as points in the polygon maps. Thus, foreclosure counts can be made within spatial units according to the geographic location.

The final dataset that also constructs an essential variable for this study is the quarterly vacancy data collected by the US Postal Service at the census tract level.⁹ The vacancy of a property is reported by the postman when they are delivering, usually as a result of accumulated, unclaimed mail. Figure 4 exhibits the average quarterly vacancy rate from 2008 to 2012 by census tracts. Some clusters of vacant property are shown in southern Chicago and on the west side of the city. A foreclosed property is likely to become vacant and a vacancy in a neighborhood can directly influence surrounding property values. Therefore, vacancy is related to both foreclosures and housing prices. Since census tract fixed effects and quarterly dummies are used in the model, adding vacancy rate which collected at the census tract level as a control variable will not generate much information. But it can be used to divide the study areas according to their vacancy rates and as a result, foreclosure impacts can be analyzed by areas.

⁹ Vacancy data at the individual level will be ideal, but it is not available.

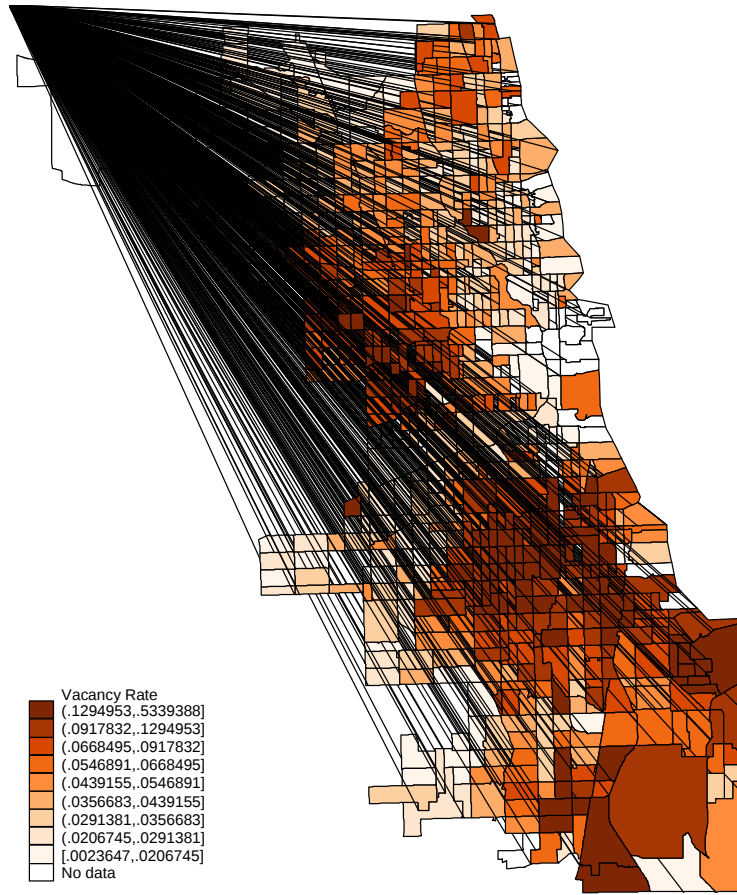


Figure 5: Average Vacancy Rates in the City of Chicago 2008-2012 by Census Tracts

5 Empirical Results

Foreclosure impacts by phases from the base model are first presented, followed by an extension of the model by adding foreclosures in more distant neighborhood (0.1-0.2 miles and 0.2-0.3 miles buffer areas). In section 5.2, the variables of foreclosure phases are interacted with vacancy rates by quantiles to investigate the variation of foreclosure impacts in the areas with different degrees of vacancy. In the final section, robustness checks are conducted.

5.1 Base Model

Table 2 presents the estimates of the impact of different phases of a foreclosure process on nearby properties within 0.1 miles obtained from four models with various controls for space and time

fixed effects. Column 1 presents the results of an intentionally naïve model that does not include fixed effects at any geographical scale. The results are much different from other columns with results from models where some degree of heterogeneity in the housing market across the space are controlled for. For example, in column 2, the estimates are derived from a model that includes community level fixed effects; all estimates retain their signs but almost all of them decrease significantly in their absolute magnitude by between 50% and 95%. The only exceptions are for the coefficients for two foreclosure phases: “filling to 4 quarters” before the auction (increase in the absolute magnitude from 0 to 1.2%) and “4 quarters before the auction” (unchanged).

When the census tract¹⁰ fixed effects, that are obviously at a smaller geographical scale than community fixed effects, are added in column 3, a few more foreclosure phases lose their significance (such as the foreclosure phase “1 quarter after the auction” whose coefficient changes from -0.019*** to -0.008), while some others further shrink in magnitude but remain significant (such as the foreclosure phase “5 quarter after the auction”, from -0.030*** to -0.020***). In contrast to column 3, where census tract and year fixed effects are included separately, census tract by year fixed effects are added to the model in column 4. This modification allows the heterogeneity across census tracts varying by years while the separate control for year and census tract fixed effects assumes the same heterogeneity pattern across census tracts for all years. Since we know different area experienced different changes in the economic downturn (some are more robust than others), the model in column 4 is preferred to the one in column 3.

Further, comparing estimates in column 4 to those in column 1, a clearer pattern of changes is observed than comparing column 3 to column 1. All insignificant coefficients in model 1 retain their insignificance in column 4, while significant ones in model 1 experience a decrease in their

¹⁰ There are 77 communities and 800 census tracts in the City of Chicago.

absolute value to a level either becoming insignificant (such as “2 quarters before auction”, from -0.032*** to -0.003) or remaining significant (such as “1 quarters after the auction”, from -0.046*** to -0.017***). Therefore, model 4 is chosen as the base model for specifying equation 1.

Table 2: Foreclosure Impacts by Various Foreclosure Phases and Space Fixed Effects

	(1) No Space FE	(2) Community	(3) Census Tract	(4) Census Tract-by- Year
Filling to 4 quarters before:0-0.1 mile	-0.000 (0.004)	-0.012** (0.004)	-0.016*** (0.003)	-0.005 (0.004)
4 quarters before auction:0-0.1 mile	0.002 (0.008)	0.002 (0.008)	-0.001 (0.006)	0.002 (0.006)
3 quarters before auction:0-0.1 mile	-0.027*** (0.006)	-0.007 (0.006)	-0.005 (0.005)	-0.008* (0.005)
2 quarters before auction:0-0.1 mile	-0.032*** (0.006)	-0.001 (0.004)	0.005 (0.005)	-0.003 (0.005)
1 quarter before auction:0-0.1 mile	-0.030*** (0.006)	-0.002 (0.006)	0.003 (0.004)	-0.002 (0.005)
1 quarter after auction:0-0.1 mile	-0.046*** (0.006)	-0.019*** (0.006)	-0.008 (0.005)	-0.017*** (0.005)
2 quarters after auction:0-0.1 mile	-0.048*** (0.006)	-0.014** (0.006)	-0.004 (0.005)	-0.010** (0.005)
3 quarters after auction:0-0.1 mile	-0.064*** (0.006)	-0.026*** (0.007)	-0.012** (0.005)	-0.016*** (0.005)
4 quarters after auction:0-0.1 mile	-0.069*** (0.006)	-0.028*** (0.007)	-0.011** (0.005)	-0.011** (0.005)
5 quarters after auction:0-0.1 mile	-0.084*** (0.006)	-0.030*** (0.005)	-0.020*** (0.005)	-0.020*** (0.005)
6 quarters after auction:0-0.1 mile	-0.079*** (0.006)	-0.032*** (0.007)	-0.019*** (0.005)	-0.015*** (0.005)

	(1) No Space FE	(2) Community	(3) Census Tract	(4) Census Tract-by- Year
7 quarters after auction:0-0.1 mile	-0.093*** (0.006)	-0.045*** (0.008)	-0.032*** (0.005)	-0.020*** (0.005)
8 quarters after auction:0-0.1 mile	-0.099*** (0.006)	-0.050*** (0.008)	-0.039*** (0.005)	-0.019*** (0.005)
9 quarters after auction:0-0.1 mile	-0.093*** (0.006)	-0.046*** (0.008)	-0.031*** (0.005)	-0.007 (0.005)
10 quarters after auction:0-0.1 mile	-0.097*** (0.006)	-0.046*** (0.007)	-0.033*** (0.005)	-0.010** (0.005)
11 quarters after auction:0-0.1 mile	-0.122*** (0.006)	-0.049*** (0.007)	-0.033*** (0.005)	-0.010** (0.005)
12 quarters after auction:0-0.1 mile	-0.128*** (0.007)	-0.042*** (0.008)	-0.022*** (0.006)	-0.008 (0.006)
Year FE	Yes	Yes	Yes	No
Standard Error	No	Community	Census Tract	Tract-by-Year
Clustered				
Observations	37338	37305	37305	37338
Adjusted R2	0.621	0.799	0.837	0.852

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: Other control variables include number of bedrooms, bathrooms, log (square footage), category variable of age, quarter dummy of each sale and foreclosure history dummy(=1 if foreclosed before).

To demonstrate the diminishing spillover effects of foreclosure impacts, foreclosures in concentric regions encircling the sale with radii between 0.1 and 0.2 miles and 0.2 to 0.3 miles are added into the base model. Coefficients for foreclosures within 0.1 miles are barely changed after this extension as can be seen from the results shown in appendix table 1A. To better view the trend of the foreclosure impact by phases and distances, the regression results are plotted in figure 6.

Foreclosures at all three distance segments reveal similar trends in their impacts. No impacts before the auction, the increase after the auction and then disappear after two years after the auction.

In detail, with foreclosure impacts within 0.1 miles, they present insignificant impacts before the

auction occurs that are followed by a jump to a significant level of effects around -1.5% right after the auction. These negative effects keep rising to their peak of around -2% in the following year and linger at that level for another twelve months before they start decreasing sharply to an insignificant level. For buffer areas in 0.1 to 0.2 mile and 0.2 to 0.3 mile range, similar trends of foreclosure impacts are observed but at a smaller level of magnitude.

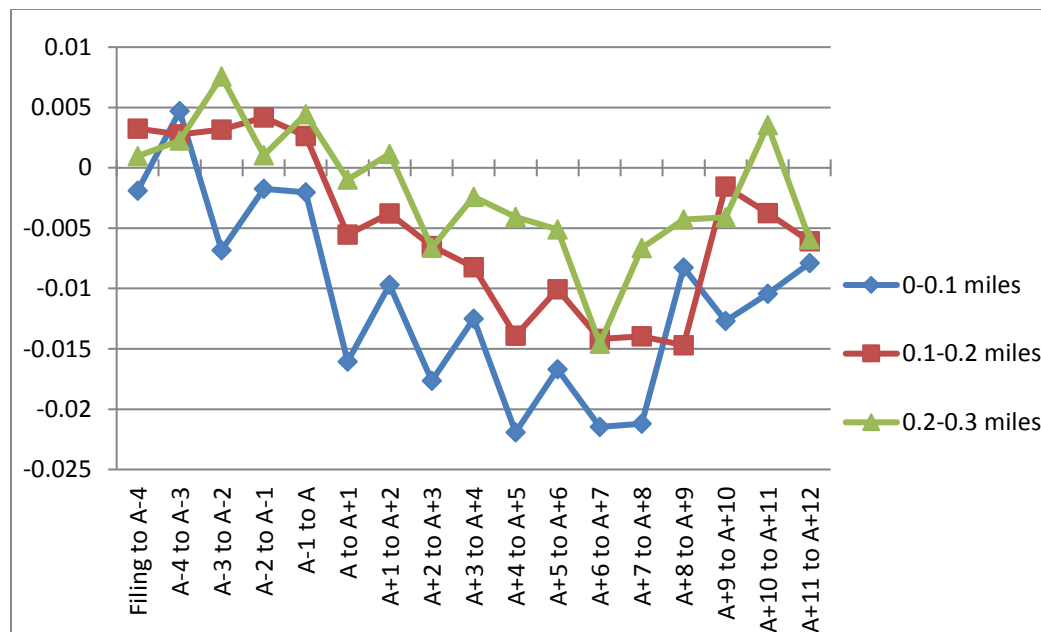


Figure 6: Impacts of foreclosures at various phases by distances

5.2 Foreclosures Interacted with Vacancy Rates by Quantiles

It is suspected that foreclosures will present different impacts on neighborhoods with different degrees of vacancy. Thus, interaction terms between all foreclosure and vacancy rate quantiles are added as a further extension to the base model. Each phase of the foreclosure process is interacted with four vacancy quantile indicators. The quantile indicators are assigned to each sale according to the quarterly vacancy rate of a census tract within which the sale occurs. For example, quantile 1 indicates census tracts with a vacancy rate below the 25th percentile and so on for the other divisions. Regression results are attached in the appendix table 2A while the marginal effects

of foreclosures by vacancy quantiles are calculated and plotted in figure 7.

No clear transitory trend across the four vacancy quantiles can be observed, but there are a few important points that need to be made. First, in the areas with the first and second quantile of vacancy rates, some foreclosure phases before the auction show significant negative impacts (-2% to -1.5%) while no effects are present in the areas with the third and fourth quantile of vacancy rates. Secondly, in the areas with vacancy rates in quantiles 2 and 3, the negative effects are likely to be significant in two periods during the whole foreclosure process. The first round of effects (-2.5% to -1.5%) are present during the first 2 or 3 quarters after the auction and the second round of effects (-3.5% to 1.5%) appears around 6 to 10 quarters after the auction. In the areas with top 25% high vacancy rates, the impacts of foreclosures are mostly concentrated in the period 3 to 8 quarters after the auction at a level between -3% to -2%.

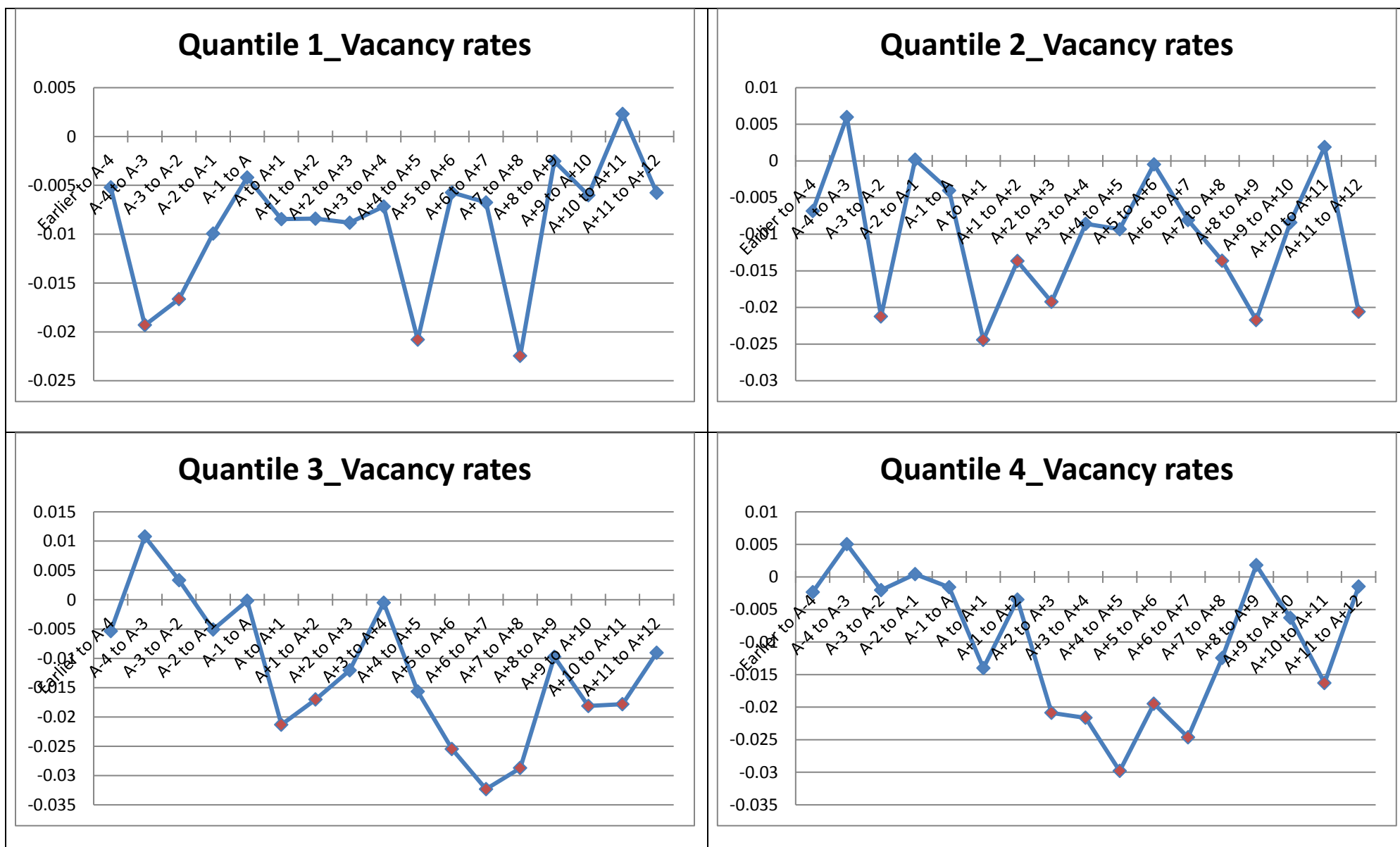


Figure 7: Impacts of various foreclosure phases by four quantiles of vacancy rates

5.3 Robustness Check

The estimates from the base model are checked in the following ways: average prices of nearby sales are included to check the potential influence from previous nearby sale prices, a phenomenon that one would suspect to be the case in practice; and reverse causality is controlled for by adding future foreclosures to check the control of unobserved time variant factors. The results of adding various robustness checks to the base model are presented in table 3. As a reference, column 1 of table 3 reports the regression results from the base model that includes census tract by year fixed effects.

5.3.1 Average Price

Column 2 and 3 of table 3 add an average price of nearby sales within 0.3 miles in the prior quarter into the base model due to the concern that in the practice, home prices are set according to recent nearby sale prices as the reference. Column 2 presents a set of simple OLS regression results by adding nearby average prices and a dummy indicating the existence of recent nearby sales. These results are barely changed compared to the base model. With the consideration of endogeneity that average prices could bring, a two-step least square regression is conducted. In the first step, the characteristics (average of number of bedrooms, bathrooms, etc.) of recent nearby sales are used as instruments for average price, since lagged housing characteristics are likely to influence the dependent sale prices merely through lagged sale prices. 2SLS results are presented in column 3 with little changes compared to the base model.

5.3.2 Unobserved Trend

The model in column 4 in table 3 controls for unobserved trends by adding post-foreclosures, a procedure adopted by Ellen *et al.* (2012) when applying the CGP (2011) identification. The

number of foreclosure nearby each sale that occurred in the 6 months¹¹ after the sale is selected as the post-foreclosures. If there exists unobserved shocks that influence the number of foreclosures and housing prices at the same time, the number of post-foreclosures is designed to pick up the effects of the shock since post-foreclosures reflect the trend of foreclosure numbers and thus indirectly pick up the trend on housing price experiences brought by the same shock.

All the estimates remain largely unchanged with the inclusion of post foreclosures. Further, the coefficient of post foreclosures is insignificant, indicating that the unobserved local factors that could affect foreclosures and housing prices at the same time are already controlled for in the base model specification.

Table 3: Robustness checks

	(1) Base	(2) Average Price of Nearby Sales ¹² OLS	(3) 2SLS	(4) Unobserved control
Earlier than 4 quarters	-0.005 (0.004)	-0.005 (0.004)	-0.005 (0.004)	-0.005 (0.004)
4 quarters to auction:0-0.1 mile	0.002 (0.006)	0.001 (0.006)	0.001 (0.006)	0.002 (0.006)
3 quarters to auction:0-0.1 mile	-0.008* (0.005)	-0.008* (0.005)	-0.008* (0.005)	-0.008* (0.005)
2 quarters to auction:0-0.1 mile	-0.003 (0.005)	-0.003 (0.005)	-0.003 (0.005)	-0.003 (0.005)
1 quarter to auction:0-0.1 mile	-0.002 (0.005)	-0.002 (0.005)	-0.003 (0.005)	-0.003 (0.005)
1 quarter after auction:0-0.1 mile	-0.017*** (0.005)	-0.017*** (0.005)	-0.017*** (0.005)	-0.018*** (0.005)
2 quarters after	-0.010**	-0.010**	-0.011**	-0.010**

¹¹ Arbitrarily picked.

¹² Average sale prices of properties sold in the prior quarter within 0.3 miles. This is due to the practice of real estate appraiser choosing the recent sale prices nearby as a price reference.

	(1) Base	(2) Average Price of Nearby Sales ¹² OLS	(3) 2SLS	(4) Unobserved control
auction:0-0.1 mile	(0.005)	(0.004)	(0.005)	(0.005)
3 quarters after auction:0-0.1 mile	-0.016*** (0.005)	-0.016*** (0.005)	-0.017*** (0.005)	-0.016*** (0.005)
4 quarters after auction:0-0.1 mile	-0.011** (0.005)	-0.010** (0.005)	-0.011** (0.005)	-0.011** (0.005)
5 quarters after auction:0-0.1 mile	-0.020*** (0.005)	-0.019*** (0.005)	-0.020*** (0.005)	-0.020*** (0.005)
6 quarters after auction:0-0.1 mile	-0.015*** (0.005)	-0.014*** (0.005)	-0.015*** (0.005)	-0.015*** (0.005)
7 quarters after auction:0-0.1 mile	-0.020*** (0.005)	-0.020*** (0.005)	-0.020*** (0.005)	-0.020*** (0.005)
8 quarters after auction:0-0.1 mile	-0.019*** (0.005)	-0.018*** (0.005)	-0.019*** (0.005)	-0.019*** (0.005)
9 quarters after auction:0-0.1 mile	-0.007 (0.005)	-0.006 (0.005)	-0.007 (0.005)	-0.007 (0.005)
10 quarters after auction:0-0.1 mile	-0.010** (0.005)	-0.010* (0.005)	-0.010** (0.005)	-0.010** (0.005)
11 quarters after auction:0-0.1 mile	-0.010** (0.005)	-0.010* (0.005)	-0.010** (0.005)	-0.010** (0.005)
12 quarters after auction:0-0.1 mile	-0.008 (0.006)	-0.008 (0.006)	-0.008 (0.006)	-0.008 (0.006)
Average Price		0.034*** (0.006)	0.013 (0.009)	
With Sales nearby=1		-0.368*** (0.079)	-0.100 (0.111)	
Average price *foreclosed sale		-0.001 (0.001)	-0.005*** (0.001)	
Post-foreclosures				0.002 (0.002)

	(1) Base	(2) Average Price of Nearby Sales ¹²	(3) OLS	(4) Unobserved control
Observations	37338	37338	37338	37338
Adjusted R^2	0.852	0.853	0.852	0.852

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: Census tract by year fixed effects are applied for all models. Other control variables include number of bedrooms, bathrooms, log (square footage), category variable of age, quarter dummy of each sale and foreclosure history dummy (=1 if foreclosed before).

6 Discussions on the Estimated Effects of Foreclosures

This section will first discuss the general trend of the estimated foreclosure impacts revealed along different phases in the process. Then, the trend will be analyzed with further details by distinguishing census tracts by their vacancy rates.

6.1 The Trend of Foreclosure Impacts

Across all neighborhoods, the housing sale prices are influenced in various ways at different phases of the foreclosure process. Within 0.1 miles around each sale, defined as nearby neighborhood in this study, any phases during the foreclosure process (before the auction) would not impose significant impacts on nearby property values. Since home-owners can still occupy the property legally before the auction, their occupancy of the property may limit any externality to the surrounding neighborhood due to the foreclosure. Although they may not actively maintain and upgrade their property facilities because of the chance to lose their home later, their occupancy itself can sustain the basic function of a housing unit in the neighborhood.

However, once a foreclosure goes through the auction, it can lead to a 1.0% to 2.0% decrease in the sale prices of nearby properties. At first, this impact sharply increases from negative 1% to 2% in the year following the auction; subsequently, at its peak level around -2%, this impact lasts for about another year and eventually declines by the ninth quarter after auction.

Fifteen days after the auction, home owners can be legally forced to move out their properties. This can lead to immediate negative impacts on the neighborhood because the physical conditions of the property deteriorate and, with continued vacancy, the prospect of burglary may increase with the lack of proper maintenance providing an indication of vacancy. Meanwhile, the negative impacts will be strengthened by the upcoming supply effects. In a few months during which lenders finalize a series of paperwork necessary for them to resell repossessed properties, it will be their preferred option to deal with these properties by feeding them back to the market. Thus, the original negative external effects of foreclosures on values of nearby houses will be compounded by their supply effects. Further, the supply effects are likely to dominate the total effects that a foreclosure brings. This is due to the potential decline in disamenity effects of a foreclosed property, as in many cases lenders or local communities will take the responsibility of monitoring and maintaining the evacuated properties. With the addition of more REOs, the impacts of foreclosures will grow.

Later on, the impact of a foreclosure will stay around its peak at -2% from the fifth to the eighth quarter after the auction. Since REOs cannot be sold¹³, it is not surprising that lenders will control the speed of listing them for sale so that no sudden increase in housing supply will further dampen the housing price. The impact will start to diminish about 2 years (about 9 quarters) after the auction. This is likely when REOs are resold to new home buyers who will start to actively repair and maintain these properties.

6.2 The Patterns of Foreclosure Impacts in Neighborhoods with Various Vacancies

Foreclosure phases before the auction only present significant impacts on nearby sales' prices in

¹³ In some cases, the lenders are not even planning to sell REOs.

the areas with the two lower quantiles (Q1 and Q2) of vacancy rates. The two potential reasons for this are the disamenity effects from poor maintenance and supply effects. First, low vacancy areas imply higher housing occupancy rates that can be a proxy for generally better maintained properties in these areas compared to those with higher vacancy areas. As a result, any slight deficiency in maintenance will become more visible in these neighborhoods while it may not be as apparent in areas with higher vacancies. However, one can also argue that a generally well maintained neighborhood as a whole could be sufficient to cover any deficiency brought by a few individual cases. Therefore, rather than disamenity effects, the more likely reason is the supply effects due to a pre-foreclosure sale before the auction. Pre-foreclosure sales are not the same as REO sales that are sold only after auctions. They are usually aggressively watched and requested by people who have been seeking for a cheaper good quality house located in a good neighborhood. In the low vacancy areas, the generally well-maintained neighborhood will increase the chance of pre-foreclosure sales. Thus, the supply effects are revealed even before the auction.

In the areas with median level of vacancy rates (Q2 and Q3), the impacts of foreclosures are present in two rounds. The first round is during the first two or three quarters after the auction and the second round of impacts appear during later periods (eight to nine quarters for Q2 vacant areas and six to eight quarters for Q3 vacant areas). It is difficult to separate the disamenity impacts from the supply effects. When a property is vacated after the auction, the property will probably become available on the market. Hence, the impacts of foreclosures are usually a mixture of sources. The explanation of the gap between the second round and the first round may be attributed to the delay of the vacancy and supply. According to a recent report from RealtyTrac LLC,¹⁴ in the Chicago metropolitan area, 45% of REOs are still occupied by previous homeowners.

¹⁴ <http://www.realtytrac.com/content/news-and-opinion/monsters-of-the-housing-market-7892>

It means some foreclosed properties are not vacant or available to the market right after the auction. Later on, when the lenders decide to sell these REOs, the second round of the impacts appear.¹⁵

In a high vacancy area (Q4), the impacts of foreclosures on nearby property values are concentrated during the third to the seventh quarter after the auction. In the early stages right after the auction, no significant impact of foreclosures is revealed. On the one hand, the majority of foreclosed properties may still be occupied by previous owners as allowed by the lenders. Due to the high vacancy in the neighborhood, lenders do not want to have more vacant properties thus further dampening the housing prices due to both the disamenity and supply effects of a vacant property. On the other hand, these properties could be empty, but perhaps do not contribute significantly to the already distressed character of the neighborhood.

7. Conclusion

This study investigates the impact of foreclosures on nearby property values within 0.1 miles in the single family housing market. The general trend of impacts during the foreclosure process is estimated by dividing the process into quarterly interval phases. Across the whole study area, incomplete foreclosures generally do not impose impacts on nearby sale prices; however, once they go through auction, the impacts will start to increase. This negative impact can reach its peak value at a level of 2% in 1 year after the auction. This peak value of impacts is present for foreclosures that are at the phases 5 to 8 quarters after the auction. Two years after the auction, no significant impacts of foreclosures are present.

Further, the foreclosure impacts in the areas with different degrees of vacancies are

¹⁵ Online forums discussed about how long it will take a REO property to be listed. People's answers vary from months to years. This link is offered as an example: <http://www.realtor.com/advice/how-long-will-it-take-for-an-reo-property-to-be-listed/>

distinguished to better analyze the source of impacts. In the areas with the two lower quantile vacancy rates, supply effects from pre-foreclosure sales are present. However, in the areas with 25-50th and 50-75th percentile vacancy rates, it is difficult to separate out the disamenity from the supply effects but a delay of REO listing by the lenders is detected. In the top 25th percentile vacant areas, foreclosed properties do not impose instant impacts after the auction, either due to the continuing occupancy by the previous homeowner of those foreclosed units or due to the already distressed character of in the hosting neighborhood.

This study followed Ellen *et al.* (2012) to apply the CGP (2011) identification approach dealing with the endogeneity of foreclosures. In the base hedonic model with census tract by year fixed effects, the number of preexisting foreclosures 0.1 miles away is chosen to be the variable of interest so that the reverse effects from housing price to foreclosures are constrained. Further, preexisting foreclosures in 0.1 to 0.2 miles and 0.2 to 0.3 miles concentric regions encircling each sale are included as an extension to the base model to explore the spillover effects of foreclosures. Finally, post foreclosures 0.1 away after each sale is used for robustness checking of the unobserved trend control in the base model.

Unlike other studies that have applied the CGP (2011) approach in the literature, this study treats the foreclosure as a process and divides the process into quarterly phases to carefully analyze the trend of foreclosure impacts. The importance of separating the impacts of the foreclosure process by phases was emphasized by Gerardi *et al.* (2012). Especially for the study object and period, the city of Chicago between 2008 and 2012, the long foreclosure process due to the judicial process and accumulatively increasing REOs make it important to investigate foreclosures as having a time-based rather than an instantaneous impact on housing prices.

Estimated results can be advanced in many ways in future studies. First, exact conditions

of foreclosed properties can help in clarifying uncertainties in this study by involving information of individual foreclosed units, such as their physical conditions, occupancy and ownership status. Secondly, broader study objects and study areas can enrich the research results. For instance, condominium apartments and housing units in suburbs could be impacted by foreclosures in different ways. Further, spatial models could possibly improve the efficiency of the specified model. Although this paper checked the estimated results with adding recent average prices nearby, the current model is still limited in covering other spatial dependence that may exist. Also, while marginal effects of foreclosures are under investigation here, the *cumulative* impacts that continued foreclosures have on neighborhoods are interested to look at.

References

- Campbell, John Y., Stefano Giglio, and Parag Pathak. 2011. Forced sales and house prices. *American Economic Review* 101 (5) (AUG): 2108-31.
- Ellen, Ingrid Gould, Johanna Lacoe, and Claudia Ayanna Sharygin. 2013. Do foreclosures cause crime? *Journal of Urban Economics* 74 (0) (3): 59-70.
- Frame, W. S. 2010. Estimating the effect of mortgage foreclosures on nearby property values: A critical review of the literature. *Economic Review* (07321813) 95 (3) (2010): 1-9.
- Gerardi, Kristopher, Eric Rosenblatt, Paul S. Willen, and Vincent W. Yao. 2012. Foreclosure externalities: Some new evidence. *Working Paper Series (Federal Reserve Bank of Atlanta)*(11) (08/15): 1-45.
- Harding, John P., Eric Rosenblatt, and Vincent W. Yao. 2009. The contagion effect of foreclosed properties. *Journal of Urban Economics* 66 (3) (11): 164-78.
- Immergluck, Dan, and Geoff Smith. 2006. The external costs of foreclosure: The impact of single-family mortgage foreclosures on property values. *Housing Policy Debate* 17 (1): 57-79.
- Kobie, Timothy F., and Sugie Lee. 2011. The spatial-temporal impact of residential foreclosures on single-family residential property values. *Urban Affairs Review* 47 (1) (SEP): 3-30.
- Lin, Zhenguang, Eric Rosenblatt, and Vincent Yao. 2009. Spillover effects of foreclosures on neighborhood property values. *Journal of Real Estate Finance & Economics* 38 (4) (05): 387-407.
- Linden, Leigh, and Jonah E. Rockoff. 2008. Estimates of the impact of crime risk on property values from Megan's laws. *American Economic Review* 98 (3) (06): 1103-27.