Foreclosure Externalities and Real Estate Liquidity

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Abstract

The real estate and urban economics literature has consistently shown that foreclosed homes adversely impact the selling price of surrounding real estate. In this study, we examine the external impact of foreclosures on nearby real estate liquidity in particular. In addition to using more traditional binary measures, we construct a continuous distance-weighted foreclosure externality measure that incorporates temporal overlap between a listed property's marketing period and nearby foreclosures. This approach allows us to estimate effects of nearby foreclosed homes at various points in a property's marketing period, allowing the spillover to vary in intuitive ways. While much of the literature shows that foreclosed properties have a modest effect on nearby home prices, our results show that foreclosed homes adversely impact the liquidity of nearby homes substantially, increasing a nearby home's time on market and significantly reducing the probability that it will sell. Further, the results suggest that foreclosure externality on liquidity is primarily driven by a disamenity effect, as the estimated external supply effect of a foreclosed property is approximately the same as a non-foreclosed property.

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I. Introduction

Foreclosed properties have long been a unique niche of the real estate market, becoming acutely more prominent in U.S. markets at the onset of the recent housing bust and financial crisis. For some buyers, foreclosures represent potentially cheaper substitutes to comparable nearby properties. In other cases, foreclosed properties may have fallen into disrepair (e.g., overgrown lawns, crumbling exterior, etc.), representing an adverse neighborhood externality. A growing body of literature has examined whether foreclosed or distressed properties have adversely impacted neighboring properties. While much of the prior literature has focused on the price spillovers of foreclosed properties, the primary objective of this study is to examine the effect of foreclosures on neighboring homes' liquidity.

In real estate markets, liquidity generally refers to the speed with which a marketed property can be sold, usually measured as time on market, and in some cases whether the property can be sold at all (given the seller's reservation price, market conditions, and other factors). Liquidity in real estate is an important outcome in its own right, and it is the key focus of this study for several reasons. First, sellers in this market clearly care about both sale price and liquidity. Sellers will often sacrifice price in order to sell their home more quickly, as illiquidity is associated with real economic costs. Second, illiquidity is a non-pecuniary cost that represents a substantial friction in the market. A seller who bears the cost of an illiquid asset does not transfer benefits to the buyer, whereas in an analogous situation a seller bearing the cost of price depreciation will pass some benefit onto the buyer in the form of a lower price. The overall market efficiency consequences for liquidity externalities are of great concern, which is an important motivator for examining this understudied topic.

This study provides several contributions to a rapidly-growing foreclosure externality literature. First, the data suggest that foreclosures may have spillover effects at any time during the marketing period, even if the foreclosed property only overlaps early in a nearby home's marketing period. A foreclosed property is an example of a dynamic externality – a spillover that may appear or disappear in any neighborhood at any time. Simple counts of foreclosed properties at one point in time in a neighborhood ignore the temporally dynamic nature of the underlying externality. Consequently, we construct a measure that accounts for (and proportionately weights) any overlap between the marketing periods of homes for sale and nearby foreclosed properties. This measure allows the effect of a foreclosure overlapping with a home's marketing period for, say, 10 days to differ from one that overlapped for 50 days or even the entire marketing period. Second, we use a full sample of homes marketed on a multiple listing service (MLS), including both sold and unsold homes, to examine foreclosure spillover effects on home liquidity (i.e., time on market and probability of sale). Studies that do not use the full sample of sold and unsold homes may suffer from a critical selection bias, as foreclosed homes, insofar as they present negative spillover effects, also impact whether a nearby home sells. Finally, MLS data allow us to condition estimates of a foreclosure spillover effect on a direct measure of total competing listings that are on the market contemporaneously. This is an important contribution because several recent papers have tried to empirically disentangle the neighborhood disamenity effect of nearby foreclosures from the market supply effect when an additional foreclosed home is put on the market.

We estimate foreclosure spillover effects on liquidity using hedonic time on market regressions, incorporating a variety of identification techniques. A common criticism of hedonic specifications to identify spillover effects is that it is vulnerable to omitted variable bias. Researchers are usually unable to observe all property and location characteristics. If unobserved property and location attributes are correlated with the variables capturing externalities, in our case the density of nearby foreclosures, the estimated coefficients on the externality variables will include a combination of the spillover effect plus the indirect effect of unobserved characteristics.

This omitted variable bias arises quite frequently in the study of urban externalities, and a number of studies have overcome this critique through careful empirical approaches. For example, Pope (2008) and Wentland et al. (2014) estimate the impact of the presence of registered sex offenders on nearby home prices. They find that sex offenders generally reside in areas with low home prices. Consequently, simply using an indicator variable to represent the presence of sex offenders may yield results that significantly overstate the effect of the sex offender. Both Pope (2008) and Wentland et al. (2014) use both the move-in and move-out timing of the externality as identification strategies. As pointed out by Gerardi et al. (2012), using the number of nearby foreclosures in a cross-sectional hedonic model is also vulnerable to the omitted variable bias because it is likely that the number of nearby foreclosures is correlated with unobserved property and location characteristics and especially the local trend in market prices. In a similar vein, Anenberg and Kung (2014) use the timing of the foreclosure listing to identify the causal effect of the foreclosure.

In this study, we employ several empirical tactics to mitigate the omitted variable problem. First, we use an identification strategy similar to Pope (2008), Wentland et al. (2014), and a number of other externality studies that use the timing of the externality's exit as a "reverse treatment," providing support that our cross-sectional results are properly identified. Second, we control for a rich set of property characteristics in our cross-sectional analysis, including both quarterly fixed effects and location fixed effect at the census block level. As defined by the U.S. Census, census tracts are "small, relatively permanent statistical subdivisions of a county...designed to be homogenous with respect to population characteristics, economic status, and living conditions." Census blocks are small subsections of census tracts, and the demographic and economic characteristics and living conditions of residence within a census block are designed to be homogeneous. While not perfect, controlling for location fixed effect at such a fine-grained level accounts for a substantial amount unobserved spatial heterogeneity, consistent with numerous externality studies that use MLS data.

An alternative to the hedonic model is the repeat sales approach. Gerardi et al. (2012) argue that the repeat sale approach mitigates the omitted variable problem. We do not use the repeated sale approach because we are examining property listings in particular, not properties themselves. This is an important distinction because determinants of property value, such as property characteristics and location attributes, either mostly remain constant over time (e.g., architectural style) or change in a predictable manner (e.g., age of the property). This is precisely why differencing two price equations at different times effectively cancel out the effects of observed and unobserved property characteristics and location attributes, and the estimated spillover effect is immune to omitted variable bias described above. However, liquidity of a home is substantially influenced by the specificity of its listing contract, market conditions, and the participants themselves. Listing contracts of the same property at different time points can be vastly different. Although repeated sales involve the same property, the seller and the real estate agents are different. Yavas and Yang (1995) show that different sellers employ different pricing strategies when setting list price, and list price affects how long it takes to find a buyer. Because property listing characteristics vary across time, we are unlikely be able to eliminate the unobserved heterogeneity on property listings using the repeat sales method. A benefit of the hedonic approach is that it allows us to control for list price, market (supply) conditions, and a variety of other relevant factors when estimating the impact of foreclosures on nearby real estate liquidity.

II. Related Literature

Several recent studies have analyzed neighborhood spillover effects of foreclosed properties. While the studies differ in the modeling of possible spillover transmission mechanisms, identification issues they choose to address, data structures, and econometric specifications, they generally find small but significant negative price externalities associated with foreclosures in the closest ring, with the spillover decaying spatially and temporally. The purpose of this section is to provide a brief (non-exhaustive) overview of the related foreclosure literature, highlighting methodological contributions and key findings. Our study utilizes listing data and focuses on the dynamic temporal and spatial nature of foreclosure externalities to estimate the effect of nearby foreclosures on housing liquidity. In our survey of the literature, we find that no studies explicitly analyze the time overlap of foreclosures and a nearby property's marketing period, or potential selection bias arising from properties that may fail to sell due to the presence of nearby foreclosed properties.

Anenburg and Kung (2014) make use of MLS data to address the disamenity vs. supply effect question. They employ a difference-in-difference approach that utilizes changes in prices for homes sold in a wider ring around the foreclosure to control for potential preexisting local trends. Listing of a bank REO property within 0.1 miles has approximately the same effect on nearby home sales prices as the listing of a non-REO property, supporting the authors' conclusion that the spillover is primarily a competitive, or supply, effect. Analysis of homes listed in the neighborhood after the foreclosed property has sold indicates that prices rebound within about 6 months. They also find that a single REO listing increases time on market by about 2%.

Gerardi, Rosenblatt, Willen, and Yao (2012) utilize repeat sale data to control for unobserved time-invariant property characteristics. Their approach is similar to Harding, Rosenblatt, and Yao (2009) but, among other differences, they use census block group rather than MSA fixed effects to control for spatial price heterogeneity. Baseline results indicate that an additional seriously delinquent mortgage within 0.1 miles has a negative effect on home transaction price. This result, with general corroboration by additional tests, leads the authors to conclude that the causal effect is an investment externality (disamenity).

Two recent studies, Li (2013) and Whitaker and Fitzpatrick (2013), utilize novel data to measure the degree of distress of foreclosed properties. Li (2013) measures housing capital investment from building permit records in Madison, Wisconsin. Employing a correction for selection bias, she finds that owners of homes which wound up in foreclosure invested less in capital improvements, suggesting that the transmission mechanism to neighborhood prices may flow through lack of investment in foreclosed homes or in other homes in their neighborhoods. Whitaker and Fitzpatrick (2013) collect monthly vacancy data from the U.S. Postal Service and tax delinquency data from local county government in Cuyahoga County, Ohio. Controlling for possible distress due to vacancy or homeowner financial difficulty, proxied by tax delinquency, they find that foreclosure status has a significant negative effect on nearby home prices.

Campbell, Giglio, and Pathek (2011) analyze effects of forced sales, including sales of foreclosed properties. To empirically disentangle causality between foreclosure status and price, they compare effects of nearby foreclosures prior to a home's sale and foreclosures in the same proximity that occur after the home has sold. Their difference-in-difference approach provides evidence that foreclosures lead falling prices rather than the reverse. They conclude that foreclosures of very close neighbors do create negative spillover effects.

Other recent studies include Fisher, Lambie-Hanson, and Willen (2014) who analyze condominium foreclosures and conclude that there is little evidence of a supply effect; Longhofer and Maness (2013) who estimate an endogenous housing supply and demand model, instrumenting supply effects with the number of deaths at the zip code level; and Turnbull and van der Vlist (2013) who estimate a foreclosure effect conditioned on the supply of homes on the market and find evidence of both disamenity and supply effects. Additional papers include Lin, Rosenblatt, and Yao (2009), Daneshvary, Clauretie, and Kader (2011), Rogers and Winter

(2009), Daneshvary and Clauretie (2012), Immergluck and Smith (2006); Scheutz, Been, and Ellen (2008); Hartley (2012); and Biswas (2013). All of these studies find significant nearby foreclosure spillovers.

Given the studies above, an important gap in the literature is that relatively little research has examined spillover effects on liquidity, an outcome central to the real estate market. Homeowners care about how long their homes are on the market and whether they sell. In the next two sections we describe our data and present the methodological approach that will be used to measure the existence of neighborhood foreclosures and to identify their effects on housing liquidity.

III. Data

We use residential real estate data from an MLS located in central Virginia, including Richmond and parts of surrounding areas. MLS data is critical for the study of foreclosures' impact on nearby real estate liquidity because it contains both the list date and sell date (or withdraw date) of residential properties, while data from proprietary loan-level, county tax, and other publically available sources usually only include the property's date of sale for non-foreclosed properties. Time (or days) on market is the typical measure of liquidity in the literature, but it requires information on the list date which is typically available only in MLS data sets. Most importantly, the MLS data includes both homes that sold and did not sell, allowing us to examine a more complete picture of the market and a critical aspect of a home's liquidity: probability of sale.

Our sample consists of listings in the residential real estate market between 2001 and 2014. Among others, Levitt and Syverson (2008) point out that MLS data are entered by real estate agents and can be incorrect or incomplete. As a result, the data were carefully examined. After culling for incomplete, missing or illogical data that suggest data entry errors, the final data set consists of approximately 300,766 homes on the market.[1] This sample includes 22,351 (7%)

[1] Consistent with other real estate studies we culled outliers, confining our data to more "typical" range of homes. We culled the top and bottom 1% of homes' list price and sale price, as well as the top 1% of the oldest homes. We also culled homes with more than 9,000 sq. ft., 7 bedrooms, 7.5 bathrooms, 40 acres, and 5 levels. For the main dependent variable, time on market, we similarly trim the 1% extremes. Generally, the findings of this study are not sensitive to dropping these observations or particular cutoffs. As an additional quality check, a sample of the MLS data was compared to county government records which contain data on selling price and housing characteristics.

foreclosures or REO properties, which are used to calculate the variables of interest.[2] The sample includes 278,415 non-foreclosed properties, with approximately 154,137 (55%) that eventually sold. The data collected from the MLS include numerous property characteristics (square footage, bedrooms, baths, age, acreage, etc.) and, of course, each property's location.

[Table I here]

The coverage of our MLS data represents a typical housing market that includes urban, suburban, and rural sales. Richmond is a medium-sized city located in the eastern part of central Virginia and the MLS covers much of the "Greater Richmond" area. The average property in our data has a listing and selling price of $230,514 and $210,195 respectively. The average listed property was 31 years of age, with 1,959 square feet, 3.4 bedrooms, and 2.2 bathrooms, and was on the market for 89.5 days. See Table I for additional descriptive statistics.

As indicated by other studies, the primary source of the foreclosure externality is its proximity to a given home on the market. Foreclosed homes often fall into disrepair and can become eyesores in the community. Intuitively, a foreclosed neighbor is more likely to have a greater impact than one located more than a mile or two away. Proximity would also be a primary driver if the transmission mechanism works through a supply effect – nearer homes are likely to be closer substitutes given the common adage in the real estate market that "all markets are local." Thus, we compute the distance from a given home in the MLS and foreclosed homes also in the MLS, using address data to code the longitude and latitude from which the straight-line distance is calculated using the great-circle formula. Following a common methodology employed in previous studies, we initially compute a dummy variable based on whether a foreclosed home was simultaneously on the market within a 0.1 mile radius. Most studies count foreclosed homes within a designated radius that were on the market simultaneously at the sale date (or, more specifically, the foreclosed home was listed prior to home *i*'s sale date and was taken off the market after home *i*'s sale date). The choice of 0.1 mile radius follows much of the literature.

[2] The Richmond MLS includes an "owned by" field that denotes whether the property is REO. We use this field, along with the comments section to code foreclosed properties. Our coding of foreclosures from the comments section is readily available upon request. As a check of accuracy, we compared a random sample of our foreclosure indicator to tax records. A relatively small percentage of homes on the market are not listed on the MLS, and as a result, these are not included in our data set.

Equipped with list and exit (sale or withdrawal) dates of all homes (foreclosed and non-foreclosed), we can examine foreclosures with overlaps that differ from those captured by more traditional approaches. Specifically, we can capture marketing period overlaps at any point during a home's marketing period. For example, our measure can account for a nearby foreclosure that was on the market simultaneously at the list date, but the foreclosure sold before a given home's sale date. Again, this measure cannot be calculated using tax data, and may illustrate the limitations of the traditional approach if this overlap is shown to have a significant impact. Intuitively, a nearby disamenity on the market when home *i* is listed may influence the seller's reservation price or the arrival rate and size of buyer offers. If that externality disappears (the foreclosed property is sold) before the sale date of home *i*, estimates using the traditional approach would suffer from selection bias. Accordingly, in the next section, we describe the construction of a continuous measure that captures the externality of foreclosures with spatial and temporal weighting during the marketing period overlap.

IV. Methodology

Our principal objective is to isolate the effect of a nearby foreclosed property on neighboring real estate liquidity. Hedonic pricing and liquidity models are commonly used to determine the value of specific property attributes and surrounding (dis)amenities by estimating their marginal effects on the sale price or time on market of the property.[3] In this section we will focus on a foreclosure's effect on a home's time on market, utilizing a cross-sectional hedonic OLS model as the baseline and then expanding our analysis within a hazard model framework. We begin by describing the baseline OLS methodology, including the home characteristics as well as the spatial and temporal controls that are used to isolate the impact of foreclosures within a cross-sectional analysis.

Modeling liquidity in a hedonic framework allows us to utilize the full sample to estimate the impact of a particular spatial externality on a home's time on market and probability of hazard (sale). According to Lancaster (1990, Ch. 8), a substantial amount of information is effectively thrown away by models that do not (or cannot) appropriately incorporate the full sample due to censoring or other data limitations. This approach incorporates information of

[3] See the literature review in Section II for an overview of related studies using hedonic or non-parametric analysis, most of which examine the effect of foreclosures on home prices.

homes that did not sell in the estimation of both parametric and semi-parametric hazard functions using the full sample of sold and unsold homes to account for such censoring issues.

IV.A Baseline Hedonic Approach Using OLS

We begin with a cross-sectional approach to estimate the effect of a nearby foreclosed property on home liquidity, utilizing a traditional hedonic model that accounts for heterogeneous characteristics of both homes and their locations. We estimate the following functional form:

$$(1) \qquad TOM_i = \varphi_{TOM}(F_i, X_i, LOC_i, LP_i) + \varepsilon$$

where TOM_i , is the time on market (in days and logged), which will also be referred to as marketing duration or a measure of liquidity. F_i, the variable of interest, is a dummy variable indicating whether at least one foreclosed property was simultaneously on the market within 0.1 mile of $home_i$, X_i is a vector of property specific characteristics and listing quarter fixed effects,[4] LOC_i is a vector for location control (i.e. census block fixed effects in our baseline regressions), LP_i is the list price of the home, and ε, is an error term. In addition to clustering at the census block level, we use robust, heteroscedastic-consistent standard errors.

IV.B Cross-sectional Identification – Comparables vs. Non-Comparables

An important question raised by the foreclosure externality literature is whether the estimated spillover reflects a disamenity effect (from blight, disrepair, etc.) or simply a market supply effect. In the latter case, any nearby house (distressed or not) can be a substitute for one's own property on the market, reducing the arrival rate of potential buyers and bidding down price. Our first step in attempting to disentangle these effects is to separately estimate two different effects: foreclosures that are "comparable" in relevant ways to potential buyers, and "non-comparable" foreclosures whose property characteristics are sufficiently different. Consider, for example, an individual or family on the market for (approximately) a 2000 sq. ft. home in a given area. When shopping for a given 2000 sq. ft. home, they may also consider a nearby (approximately) 2000 sq. ft. foreclosed property (i.e. a "comparable foreclosure"), but they may view a nearby 1500 sq. ft. foreclosed property (i.e. a "noncomparable foreclosure") as

[4] For example, we use the following property specific variables: square footage, age, acreage, number of bedrooms, bathrooms, number of levels, number of rooms, number of car-garage, number of fireplaces, whether it is vacant, has a tenant, a basement, or has a brick exterior.

sufficiently outside their home size needs. Following Turnbull and Dombrow's (2006) definition of a "comparable" home, we define a "comparable foreclosure" as a nearby foreclosed property within 0.1 mile that is within 20% of the square footage a given home *i* and we estimate the following hedonic regression with the above modifications made to the foreclosure indicator:

$$(2) \qquad TOM_i = \varphi_{TOM}(F_i^{Comparable}, F_i^{Noncomparable}, X_i, LOC_i, LP_i) + \varepsilon$$

This cross-sectional identification has a straightforward intuition. If homeowners are indeed shopping for comparably sized homes, then the "comparable foreclosure" captures both a disamenity effect and a market supply effect, while the "noncomparable foreclosure" will likely be driven primarily by the disamenity effect.[5] The degree to which these estimates differ may be one indication of the market supply effect.

For robustness, we explore alternative definitions of "comparable" homes. A family or individual looking for a three bedroom home may consider nearby homes with fewer/more bedrooms to be less substitutable. Hence, we define an alternative measure of "comparable foreclosure" as nearby foreclosed property within 0.1 mile that equal the number of bedrooms of a given home *i*, and "noncomparable foreclosures" otherwise.[6]

IV.C Intertemporal Identification – Recently Sold Foreclosures

Once a foreclosure is on the market, that home appears on the MLS and is searchable to prospective real estate buyers and sellers agents. If a nearby foreclosure creates a negative externality (i.e., treatment effect) when it is on the market, then the effect should be reversed (i.e., reverse treatment effect) when the foreclosure is off the market. When the foreclosure has exited the market, both the market supply effect and the disamenity effect disappear (provided that the new owner mows the lawn, cleans up the house, etc.). As with other externalities, failure of the reverse treatment to cancel the effect would cast doubt on the identification of a causal effect in the cross-sectional estimates, giving rise to additional concerns of omitted variables bias. Hence, we estimate the following function:

[5] It is still possible that homes that are outside the arbitrary size range will still be substitutes, so the market supply effect is likely non-zero. But, we expect homes that fall outside this range to at least have diminished substitutability compared to homes that fall within.

[6] In a future draft, we plan to explore homes that are comparable in list price and other dimensions. It is possible that individuals may decide to buy "more house" if they are able to secure a significant discount on a foreclosure.

$$(3) \qquad TOM_i = \varphi_{TOM}(F_i^{Comparable}, F_i^{Noncomparable}, F_i^{RecentlySold}, X_i, LOC_i, LP_i) + \varepsilon$$

where equation (3) is identical to equation (2) with the addition of the reversal treatment parameter $F_i^{RecentlySold}$, which is a binary indicator of whether there was a foreclosure that was sold within 365 days of home *i* was listed (and falls within 0.1 mile).[7] By controlling for the existence of contemporaneous foreclosures, the recently sold treatment compares properties for which the previous nearest foreclosure sold before property *i* was listed for sale against a control group in which there was no recent sale. This estimation provides evidence that the externality effect dissipates or even reverses quickly after the treatment has exited the market.

IV.D Time-overlap and Distance-weighted Foreclosure Measure

We use multiple measures of F_i to examine the impact of foreclosure externalities on liquidity. The foreclosure measure above is simply an indicator variable that equals one if any foreclosed property was listed within 0.1 mile contemporaneously of a given $home_i$. However, it is clear that a foreclosure that only overlapped with $home_i$ for a day may have a different impact than a foreclosure that overlapped the entire marketing period. In fact, the nature of a foreclosure externality is dynamic in that foreclosures may come on the market (and subsequently exit the market) at any point within a home's marketing period. And, if the foreclosure has an external impact, it may affect the whole trajectory of a home's market period even if it only overlaps for a fraction of the marketing period, which may not include the sale date OR list date.

The intuition behind our alternative measure is relatively straightforward. For example, if a home is listed next door to foreclosure, buyers may be deterred for some period of time. Even after the foreclosure is sold and repaired, no longer deterring buyers, there may have already been damage done to the marketing of the home for sale. The seller's holding costs may have become more strained, their bargaining position eroded, or a new stigma may become attached to the home that has already been on the market for a while. Therefore, the length of the marketing period overlap may be an important driver of the foreclosure effect and it is important to differentiate this.

[7] We also estimate a similar "recently sold" variable, defining recent as 180 days instead.

In light of the above, we develop a measure that accounts for nearby foreclosed homes that overlap at *any* stage of $home_i$'s marketing period and accounts for the varying overlaps between foreclosures and homes' market periods. While the measure seems complicated at first glance, the intuition behind it is straightforward. First, the measure, which we call "foreclosure concentration," accounts for the overlap between the marketing period and the foreclosure's marketing period in proportion to the length of the overlap. This captures the intuition above that a foreclosed home that is listed on the market during the entire, say, 90 days of a property's marketing period may have a different external effect than a foreclosed home that is off the market after 45 days. Not only is the exposure greater, but the externality itself is also more pronounced over time (e.g. a lawn may not look overgrown in a week, but it will over a few months). Secondly, proximity matters so the foreclosure concentration measure allows foreclosures to have a quadratically larger effect the closer they are to a given home on the market. The intuition here is that a foreclosure located next to a property would have a larger external effect than one located down the street, and much larger than one located on the other side of the neighborhood. Third, the foreclosure concentration measure sums the effect of multiple foreclosures by making the calculation for all foreclosures within one-tenth of a mile, accounting for the fact that a home may be located near multiple foreclosures.

With these objectives in mind, we modified a measure originally developed by Turnbull and Dombrow (2006). Their measure includes the sum of overlap days on the market of nearby competing listings, weighted by distance. It was initially created to capture market competition externalities from nearby homes contemporaneously listed on the market. Their "competition" variable is an increasing function in the number of competing properties, the number of days properties are on the market together, and their proximity. A similar measure can be adapted to any dynamic spatial externality, including foreclosures. Equation (4) below represents "foreclosure concentration" (FC) which measures a distance-weighted overlap between the days a given home *i* was on the market and in the presence of a nearby foreclosure *j*, summed across all foreclosures within 0.1 mile:

$$(4) \qquad FC(i) = \textstyle\sum_j (1 - \mathrm{D}(i, j))^2\{\min[s(i), s(j)] - \max[l(i), l(j)]\}$$

where "D(*i*, *j*)" is the distance between a given home on the market, *i*, and a given nearby foreclosure, *j*, provided that they live within a tenth-mile radius, *s(i)* is the sell date for a home *i*, *l(i)* is the listing date for home *i*, *s(j)* is the sale date or withdraw date for a given foreclosure *j*, *l(j)* is the list date for foreclosure *j*. FC is a positive function in 1) the overlap between the foreclosure's marketing period and home *i*'s marketing period, 2) the proximity to foreclosures, and 3) multiple foreclosures. Most importantly, this measure captures the overlap between the foreclosure's marketing period and a home's marketing period at any point during the marketing period, not just the sale date.

We estimate the above variable in the following hedonic function using OLS:

$$(5) \qquad TOM_i = \varphi_{TOM}(FC_i, X_i, LOC_i, LP_i) + \varepsilon$$

where FC_i (foreclosure concentration) is the variable of interest and controls are as described in equation (1). In addition, we explore a similar breakout of "comparable" and "noncomparable" foreclosure concentrations analogous to equation (2) with one caveat. We include a measure of supply on the market to control for non-foreclosure supply and to gauge an estimate of the non-distressed property externality. Hence, we estimate the following:

$$(6) \qquad TOM_i = \varphi_{TOM}(FC_i^{Comparable}, FC_i^{Noncomparable}, Comp_i^{\leq Tenthmile}, Comp_i^{>Tenthmile}, X_i, LOC_i, LP_i) + \varepsilon$$

where $Comp_i^{\leq Tenthmile}, Comp_i^{>Tenthmile}$ are market measures of comparable nearby homes contemporaneously listed on the market, where the former only includes homes within 0.1 mile and the latter only includes homes within 0.1-1.0 mile.[8] The construction of this variable is identical to the foreclosure concentration measure, except non-foreclosed homes are used instead of foreclosures. This approach helps us to further disentangle the market supply effect from the disamenity effect by obtaining a baseline estimate of non-foreclosure market supply effects.

IV.E Parametric and Semi-Parametric Hazard Models – A Multi-Distribution Approach

Numerous studies examine liquidity in other contexts using parametric (and semi-parametric) hazard models. We extend our analysis in the same vein by beginning with a parametric hazard model that assumes the baseline distribution follows a Weibull distribution

[8] This measure was initially used by Turnbull and Dombrow (2006) to identify shopping externalities associated with nearby comparable homes listed on the market. This is a distance-weighted measure of the days overlap of other homes contemporaneously listed on the market within one mile of a given home. See Turnbull and Dombrow (2006) for additional information about their measure.

(e.g. see Rutherford and Yavas (2012) or Rutherford, Springer, and Yavas (2005)). For t (time on market) measured in days, we estimate a Weibull distribution with covariates as having a conditional density:

$$(7) \quad f(t \mid x_i) = \exp(x_i\beta)\alpha t^{\alpha-1} \exp[-\exp(x_i\beta)t^{\alpha}]$$

where x_i represents the covariates FC_i, X_i, LP_i, LOC_i, $Comp_i^{\leq Tenthmile}, Comp_i^{>Tenthmile}$ defined as in the previous subsection. Thus, we estimate the following hazard, using the parameters defined above:

$$(8) \qquad \lambda(t; x_i) = \exp(x_i\beta)\alpha t^{\alpha-1}.$$

Although many real estate researchers utilize a Weibull distribution of the hazard function, our study also employs an exponential distribution to explore the degree to which results are robust to the specified distribution.[9]

To complement the parametric models, we explore a semi-parametric approach by estimating a Cox proportional hazard function, which estimates β without having to specify the baseline hazard. According to Wooldridge (2001), "the strength of Cox's approach is that the effects of the covariates can be estimated very generally," provided that the hazard model follows the functional form:

$$(9) \qquad \lambda(t; x_i) = \exp(x_i\beta)\lambda_0 t$$

where all variables are as specified above and $\lambda_0 t$ describes how the hazard changes over time at the baseline levels of covariates.[10] Given its less restrictive functional form, we use the Cox estimation as a robustness check, providing additional evidence that the results are not particularly sensitive to the underlying distributional assumption of the hazard model.

[9] See Chen and Rutherford (2010) for further discussion of a multi-distribution approach.
[10] The results are obtained by using Breslow's method for handling ties, the default in Stata.

V. Results

V.A Initial OLS Estimates of the Impact of Foreclosures on Liquidity

The initial OLS estimates show that nearby foreclosures adversely impact the liquidity of nearby homes (or lengthen the time it takes for a home to sell). The results from estimating equation (1) are displayed in Column [1] in Table II. The coefficient estimate for the variable of interest indicates that a home spent approximately 33% longer on the market if there was at least one simultaneously listed foreclosed home within a 0.1 mile radius. Given an average days on market of approximately 90 days, this amounts to one month of additional time on market for an average home.

[Table II here]

If the spatial externality is dynamic in the sense that the location(s) and duration(s) of the externality could change throughout the home's marketing period, then the total effect of the externality may include how many foreclosures are nearby, how long they overlap with the property, and the distance to the property. In an attempt to capture all of these aspects, column [1] of Table III shows the estimate of the alternative measure that accounts for all nearby foreclosures that may have had an impact on a home's liquidity., Qualitatively, the results are consistent with the simpler measure in Table II, showing that an increase in the foreclosure concentration around a particular home subsequently increases a home's time on market. Quantitatively, the exact interpretation is slightly more nuanced.

An example could help clarify the interpretation of the coefficient in Column [1] in Table III. The average home in our data set spends approximately 90 days on the market before it is sold (or withdrawn). Suppose a foreclosure j goes on the market next door to home i just prior to its listing and resides there during the entirety of the home's time on the market. From equation (4) above, the first term, $(1 - D(i, j))^2$, is approximately one, given the distance (D) is close to zero. Because the foreclosure's marketing period and the time on market overlap completely, the second term equals 90. If no additional foreclosures are near the home, the effect of an additional foreclosure concentration of 90 on time on market would be approximately 34% for the average home.

[Table III here]

Another advantage of this measure is that, if the effect is linear, we can apply this interpretation to homes located near multiple foreclosures or near foreclosures that overlapped during only part of the marketing period. For example, if another nearby foreclosure went on the market halfway into the marketing period (45 days), the cumulative effect of both foreclosures would lengthen time on market by approximately 51%, which are effects missed by the traditional binary treatment effect measure. Given these results, the binary approach produces relatively conservative results by representing only very narrow instances of the externality.

V.B Disentangling Disamenity from Supply Effects

When the foreclosure measure is separated into "comparable foreclosures" and "noncomparable foreclosures," Table II columns [2] and [3] provide initial evidence that the foreclosure externality is driven by the disamenity effect. Specifically, there is a 31% increase in time on market associated with having at least one comparable foreclosure (in terms of square footage or number bedrooms) simultaneously listed on the market. However, there is still a 28%-29% increase for noncomparable foreclosures. The 2-3% difference suggests that a foreclosure's market supply effect on home liquidity is likely small. The noncomparable foreclosure estimates imply that these properties, which are not as likely to be syphoning off buyers because they are less comparable in terms of square footage or number of bedrooms, still present a large negative externality for nearby homes' liquidity.

In a number of studies, a critical component is sometimes left out of estimations of externalities: the supply of other homes on the market. Column [2] of Table III incorporates a measure of market competition, which an adaptation of the foreclosure concentration measure, but for non-distressed properties. Without accounting for other homes on the market, column [2] of Table III illustrates that the initial (naïve) estimates are likely too large (i.e. biased upward), which could be a major omitted variables issue for any externality study that does not account for contemporaneous supply conditions. However, column [3] of Table III confirms the broader takeaway from above. The external effect of a comparable foreclosure on an average home's liquidity (if they were adjacent and overlapped for 90 days) is approximately 16%, while the effect is still 14% for noncomparable foreclosures. The difference between these two effects (i.e.

foreclosure supply effect) effect nearly equals the external effect of a non-foreclosed property estimated in column [3]. Taken together, the results from Table III suggest that the external market supply effect for foreclosed properties is approximately equal to that of non-foreclosed properties. That is, foreclosure supply effects are not really different than non-foreclosure supply effects in the market we study. Moreover, the primary driver of the foreclosure externality on liquidity is the disamenity effect.

V.C. Identification and Recently Sold Foreclosures

Results from the final two columns in Table II and the final column in Table III provide evidence that the cross-sectional results are properly identified. That is, if the cross-section results represent a treatment effect, then removing the treatment ought to either reverse or halt the effect. This is precisely what we find. Specifically, column [4] of Table II shows that liquidity rebounds strongly just after (or within 6 months of) a nearby foreclosure sale, selling about 19% faster than otherwise comparable homes. When the timeframe is extended out to a year, the final columns in Tables II and III show little lasting external effect of foreclosures on liquidity in this market.

V.D. Spatial Robustness – A Caveat

To this point we have used census blocks as a control for spatial heterogeneity, given that hedonic analysis must control for the so-called three most important aspects of any real estate market: location. We use census block to control for unobserved heterogeneity across these areas so that the explanatory variables' effects are identified from variation within a given area (or even in a given quarter, given time fixed effects). As noted above, census blocks are small geographic areas determined by the U.S. Census, where in an urban area this may encompass a single block, and in less dense areas this may encompass a neighborhood or subsection therein. In total, our data set includes 19,051 census blocks.

[Table IV here]

Externality studies are not uniform in their use of location controls. Some studies use larger areas depending on their degrees of freedom within the data, including census block groups, census tracts, and zip codes. In Table IV, we estimate the same regression as column [2] in Table III, except that we alter the location controls used in each regression (census block groups, census tracts, and zip codes respectively). Although finer spatial controls marginally reduce estimated spillover effects, we find that our results are robust and not particularly sensitive to the choice of location control.

V.E. Hazard Results – Robustness Across Multiple Distributional Assumptions

In the final subsection of our results, we turn to a hazard model approach that estimates another important liquidity-related outcome: whether a home sells. Table V shows the log relative-hazard form estimates for the Weibull and exponential parametric hazard models (columns [1] and [2]), along with the Cox proportional hazard model (column [3]). The results show that there is a strong negative relationship between the presence of a nearby foreclosure and a home's hazard (sale) rate, which remains very consistent across all three models. Each estimated β_j represents the semielasticity of the hazard (rather than days on market) with respect to x_j for small values of β_j.[11] Specifically, column [1] in Table V shows that a foreclosure located next to an average home (on the market for 90 days) reduces the hazard by approximately 29%. The results from the semi-parametric Cox model tell an identical story, with nearly identical coefficient estimates. The consistency across models indicates robustness in the sense that these estimates are not highly sensitive to the nature of the underlying distributional assumptions of the particular hazard model. Both parametric and semi-parametric hazard estimates reveal that, for a given time on market, the presence of nearby foreclosures has a large, statistically significant negative impact on the hazard (or sale) rate.[12]

VI. Discussion and Future Research

The foreclosure spillover literature has consistently found that nearby foreclosures adversely affect price, but the price effect is generally quite modest. Consistent with other studies, we find that foreclosures adversely affect nearby real estate, but, specific to our study, we find a large, significant effect on property liquidity. Based on both OLS and hazard model results, a typical home located next to a foreclosure may take 16% longer to sell than an

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[11] By default, Stata does not exponentiate the coefficients, so for a given β_j we can multiply the coefficient by 100 to obtain the TOM's semielasticity with respect to x_j, provided that β_j is small. For larger values of β_j, the coefficient should be exponentiated and one should subtract unity.

[12] These results are also qualitatively consistent with logit, probit, and linear probability models run with the same data and covariates.

otherwise comparable home not located near one, and may be 29% less likely to sell at all (after controlling for contemporaneous supply and a variety of other factors). Our results suggest that the supply effect of a comparable foreclosure is nearly identical to the supply effect of a non-foreclosed home. We find that the foreclosure externality on liquidity is primarily driven by the disamenity effect, and, to a much lesser extent, a market supply effect. Further, we find that liquidity rebounds after a nearby foreclosure is sold, providing evidence that our cross-sectional results are properly identified.

While we condition on census blocks and quarterly time trends, we intend to explore additional controls and identification strategies used within this literature that may account for other market factors and heterogeneity (e.g. localized price trends, unique timing effects, etc.). In addition, we intend to explore a repeat sales approach. Methodologically, if the results are properly identified, they will be consistent across numerous common approaches used in the literature.

One possible explanation for the modest spillover effects found in the literature is that other studies may only account for a subset of the possible foreclosure spillovers. Often foreclosures are represented in a binary or count measure, which does not account for the length of time the foreclosure actually impacted a given home on the market. We fill this gap by offering an alternative way to approach measuring such spillover effects using MLS data. The measure used in this study addresses the possibility that homes might be affected by nearby foreclosures that overlapped with their marketing period at various times, and in proportion to this overlap. While the measure we constructed is based on other measures in the literature, we would like to explore additional foreclosure timing issues, (ideally) using a number of alternative measures incorporating loan-level data that allows for a differentiated impact across the foreclosure process. Indeed, further exploration of this topic will yield a deeper understanding of how foreclosures impact nearby real estate, which has important, broader consequences for market efficiency and public policy.

References

Anderson, R., R. Brastow, G. Turnbull and B. D. Waller. 2013. Seller Over-Pricing and Listing Contract Length: The Effects of Endogenous Listing Contracts on Housing Markets. *Journal of Real Estate Finance and Economics*, 2013, 1-17.

Anenberg, Eliot and Edward Kung. 2014. Estimates of the Size and Source of Price Declines Due to Nearby Foreclosures. *American Economic Review*, 104(8): 2527–2551.

Biswas, Arnab. 2012. Housing Submarkets and the Impacts of Foreclosures on Property Prices. *Journal of Housing Economics*, 21 (2) 235-45.

Campbell, John Y. and Stefano Giglio and Parag Pathak. 2011. Forced Sales and House Prices. *American Economic Review*, 101 (5) 2108–2131.

Coulson, E. and E. Bond, A Hedonic Approach to Residential Succession, *The Review of Economics and Statistics*, 72, 3 (1990), 433-444.

Daneshvary, Nasser and Terrance M. Clauretie. 2012. Toxic Neighbors: Foreclosures and Short-Sales Spillover Effects from the Current Housing-Market Crash. *Economic Inquiry*, 50 (1) 217-231.

Daneshvary, Nasser, Terrance M. Clauretie, and Ahmad Kader. 2011. Short-Term Own-Price and Spillover Effects of Distressed Residential Properties: The Case of a Housing Crash. *Journal of Real Estate Research*, 33 (2) 179-207.

Fisher, Lynn, Lauren Lambie-Hansen, and Paul Willen. 2014. The Role of Proximity in Foreclosure Externalities: Evidence from Condominiums. *American Economic Journal: Economic Policy,* forthcoming.

Gerardi, Kristopher, Eric Rosenblatt, Paul Willen, and Vincent Yao. 2012. Foreclosure Externalities: Some New Evidence. *Atlanta Federal Reserve Bank Discussion Paper* 2012-05.

Harding, J.P., E. Rosenblatt, and V.W. Yao. 2009. The Contagion Effect of Foreclosed Properties. *Journal of Urban Economics* 66(3): 164–78.

Hartley, Daniel. 2012. The Effect of Foreclosures on Nearby Housing Prices: Supply or Disamenity? *Cleveland Federal Reserve Bank Discussion Paper*.

Immergluck, Dan and Geoff Smith. 2006. External Costs of Foreclosure: The Impact of Single-Family Mortgage Foreclosures on Property Values. *Housing Policy Debate*, 17 (1) 57-79.

Kuminoff, N., C. F. Parmeter and J. C. Pope, 2010. Which Hedonic Models Can We Trust to Recover the Marginal Willingness to Pay for Environmental Amenities?' *Journal of Environmental Economics and Management*, 60(3), 145-160.

Lancaster, T. 1990. The Econometric Analysis of Transition Data. Cambridge University Press: New York.

Levitt, S.D. and C. Syverson. 2008. Market Distortions When Agents Are Better Informed: The Value Of Information In Real Estate Transactions. *The Review of Economics and Statistics* 90(4): 599-611.

Li, Lingxiao. 2013, Why are Foreclosures Contagious? Unpublished manuscript.

Lin, Z. E. Rosenblatt, and V.W. Yao. 2009. Spillover Effects of Foreclosures On Neighborhood Property Values. *Journal of Real Estate Finance and Economics* 38(3): 387–407.

Longhofer, S. D. and A. S. Maness. 2013. Competition and Home Prices: Measuring the Supply Effect. Working paper.

Pope, Jaren. 2008. Fear of crime and housing prices: Household reactions to sex offender registries. *Journal of Urban Economics*, 64: 601-614.

Rogers, William and William Winter. 2009. The Impact of Foreclosures on Neighboring Housing Sales. *Journal of Real Estate Research*. 31 (4) 455-479.

Rutherford, R.C., T.M. Springer, and A. Yavas. 2005. Conflicts Between Principals and Agents: Evidence from Residential Brokerage. *Journal of Financial Economics* 76(3): 627 - 65.

Rutherford, R.C., and A. Yavas. 2012. Discount Brokerage in Residential Real Estate Markets. *Real Estate Economics*, 1-28.

Schelling, T. C. 1969. Models of Segregation. *American Economic Review*, *59*(2), 488

Schuetz, J., V. Been, and I.G. Ellen. 2008. Neighborhood Effects of Concentrated Mortgage Foreclosures. *Journal of Housing Economics* 17(4) 306–319.

Turnbull, G., and J. Dombrow. 2006. Spatial Competition and Shopping Externalities: Evidence from the Housing Market. *Journal of Real Estate Finance and Economics* 32:4, 391-408.

Turnbull, G. and A. J. van der Vlist. 2013. Foreclosures and Spillovers: Externality or Supply Effect? University of Central Florida Discussion Paper 1304.

Wentland, Scott, Bennie Waller, and Ray Brastow. 2014. Estimating the Effect of Crime Risk on Property Values and Time on Market: Evidence from Megan's Law in Virginia. Real Estate Economics, 42(1), 223-251.

Whitaker, Stephan and Thomas Fitzpatrick. 2013. Deconstructing Distressed Property Spillovers: The Effects of Vacant, Tax-Delinquent, and Foreclosed Properties in Housing Submarkets. *Journal of Housing Economics*, 22 (2) 79-91.

Wooldridge, J.M. 2001. Econometric Analysis of Cross Section and Panel Data. MIT Press: Cambridge.

Yavas, A. and S. Yang. 1995. The Strategic role of listing prices in marketing real estate: theory and evidence. *Real Estate Economics*, 23, 347-368.

Tables

Table I
Summary Statistics

Variable Name	*Mean*	*Std. Dev.*
Property Characteristics		
Sale Price	$210,195	123,569
List Price	$230,514	142,422
Time on Market	89.5	85.39
Bedrooms	3.40	0.83
Bathrooms	2.24	0.93
Age	31.53	28.07
Number of levels	1.75	0.65
Square feet	1,959	872.92
Basement (= 1 if the property has a basement, 0 otherwise)	0.17	0.37
Garage size (number of cars)	0.83	0.99
Number of fire places	0.65	0.71
Vacant (= 1 if the property is vacant, 0 otherwise)	0.38	0.48
Tenant (= 1 if the property has a tenant, 0 otherwise)	0.03	0.19
Brick (= 1 if the property has a brick exterior, 0 otherwise)	0.30	0.46
Acreage	0.88	2.77
Foreclosure variables		
Foreclosure (property characteristic)	0.07	0.25
Foreclosure within 0.1 mile (= 1 if at least one nearby foreclosure is listed simultaneously, 0 otherwise)	0.11	0.30
"Comparable Foreclosure" within 0.1 mile (within +/- 20% sq. ft.)	0.07	0.24
"Noncomparable Foreclosure" within 0.1 mile (within +/- 20% sq. ft.)	0.05	0.21
"Comparable Foreclosure" within 0.1 mile (same num. of bedrooms)	0.06	0.24
"Noncomparable Foreclosure" within 0.1 mile (more/less bedrooms)	0.05	0.22
Recently Sold Foreclosure within 0.1 mile (6 months)	0.11	0.31
Recently Sold Foreclosure within 0.1 mile (Year)	0.17	0.37
Foreclosure Concentration (overall sample)	7.72	36.41
"Comparable" Foreclosure Concentration	4.35	25.55
"Noncomparable" Foreclosure Concentration	3.37	21.83
Non-foreclosure Competition within 0.1 mile	110.14	346.86
Non-foreclosure Competition within 0.1 mile-1.0 mile	383.00	605.01
Foreclosure Concentration (if FC>0)	74.95	92.75

Table II
The Effect of a Nearby Foreclosure on a Home's Days on Market:
Baseline OLS Models

	OLS Dependent Variable: ln(TOM)	OLS Dependent Variable: ln(TOM)	OLS Dependent Variable: ln(TOM)	OLS Dependent Variable: ln(TOM)	OLS Dependent Variable: ln(TOM)
	[1]	[2]	[3]	[4]	[5]
Foreclosure within 0.1 mile	0.3302*** (31.74)			0.3465*** (32.51)	0.4231*** (37.53)
"Comparable Foreclosure" within 0.1 mile (within +/- 20% sq. ft.)		0.3081*** (25.22)			
"Noncomparable Foreclosure" within 0.1 mile (within +/- 20% sq. ft.)		0.2927*** (23.29)			
"Comparable Foreclosure" within 0.1 mile (same num. of bedrooms)			0.3166*** (25.35)		
"Noncomparable Foreclosure" within 0.1 mile (more/less bedrooms)			0.2807*** (23.25)		
Recently Sold Foreclosure within 0.1 mile (6 months)				-0.1938*** (-17.81)	
Recently Sold Foreclosure within 0.1 mile (Year)					-0.0385*** (-4.23)
Property Characteristics	✓	✓	✓	✓	✓
Census Block Fixed Effects	✓	✓	✓	✓	✓
Quarter Fixed Effects	✓	✓	✓	✓	✓
Observations	278,415	278,415	278,415	278,415	278,415
R-squared	0.1333	0.1336	0.1336	0.1344	0.1333

Notes. This table shows the effect of foreclosure spillovers on time on market. There is a breakout of "comparable foreclosures" vs. "noncomparable foreclosures," and estimated of the effect of recently sold foreclosures.
Robust t-statistics in parentheses (Errors Clustered by Census Block)
*** $p<0.01$, ** $p<0.05$, * $p<0.10$

Table III
The Effect of a Nearby Foreclosure on a Home's Days on Market:
Alternative Measures and Comparable Effects

	OLS Dependent Variable: ln(TOM)	OLS Dependent Variable: ln(TOM)	OLS Dependent Variable: ln(TOM)	OLS Dependent Variable: ln(TOM)
	[1]	[2]	[3]	[4]
Foreclosure Concentration (FC)	0.0038*** (17.12)	0.0017*** (5.87)		
"Comparable" Foreclosure Concentration			0.0018*** (5.29)	0.0018*** (5.41)
"Noncomparable" Foreclosure Concentration			0.0016*** (5.16)	0.0016*** (5.15)
Non-foreclosure Competition within 0.1 mile		0.0003*** (4.77)	0.0003*** (10.94)	0.0003*** (4.76)
Non-foreclosure Competition within 0.1 mile-1.0 mile		0.0007*** (10.94)	0.0007*** (19.66)	0.0007*** (10.94)
Recently Sold Foreclosure within 0.1 mile (Year)				-0.0108 (-1.08)
Property Characteristics	✓	✓	✓	✓
Census Block Fixed Effects	✓	✓	✓	✓
Quarterly Fixed Effects	✓	✓	✓	✓
Observations	278,415	278,415	278,415	278,415
R-squared	0.1367	0.1736	0.1736	0.1737

*Note*s. This table shows the effect of alternative foreclosure measures on time on market. An increase in foreclosure concentration consistently increases time on market, and the effect dissipates after foreclosures are sold.
Robust t-statistics in parentheses (Errors Clustered by Census Block)
*** p<0.01, ** p<0.05, * p<0.10

Table IV
The Effect of a Nearby Foreclosure on a Home's Days on Market:
Alternative Location Fixed Effects

	OLS Dependent Variable: ln(TOM)	OLS Dependent Variable: ln(TOM)	OLS Dependent Variable: ln(TOM)
	[1]	[2]	[3]
Foreclosure Concentration (FC)	0.0019***	0.0019***	0.0020***
	(4.58)	(4.53)	(6.94)
Non-foreclosure Competition within 0.1 mile	0.0002***	0.0002***	0.0002***
	(4.19)	(3.98)	(10.15)
Non-foreclosure Competition within 0.1 mile-1.0 mile	0.0007***	0.0006***	0.0005***
	(7.31)	(7.22)	(35.94)
Property Characteristics	✓	✓	✓
Block Group Fixed Effects	✓		
Census Tract Fixed Effects		✓	
Zip Code Fixed Effects			✓
Quarterly Fixed Effects	✓	✓	✓
Observations	278,415	278,415	278,415
Number of Groups	1,831	901	595
R-squared	0.1830	0.1847	0.2089

Notes. This table shows the effect of foreclosure concentration on time on market, controlling for alternative location fixed effects. The results are broadly consistent across specifications, and the differences between the coefficient estimates of the variable of interest are small.

Robust t-statistics in parentheses (Errors Clustered by Location Unit)

*** p<0.01, ** p<0.05, * p<0.10

Table V
The Effect of a Nearby Foreclosure on a Hazard Rate (Probability of Sale):
A Multi-distributional Approach

	Weibull Distribution Coefficients Dependent Variable: Sold	Exponential Distribution Coefficients Dependent Variable: Sold	Cox Proportional Hazard Model Coefficients Dependent Variable: Sold
	[1]	[2]	[3]
Foreclosure Concentration (FC)	-0.0032***	-0.0036***	-0.0031***
	(-20.07)	(-20.76)	(-19.60)
Non-foreclosure Competition within 0.1 mile	-0.0003***	-0.0004***	-0.0003***
	(-18.15)	(-21.01)	(-17.33)
Non-foreclosure Competition within 0.1 mile-1.0 mile	-0.0005***	-0.0006***	-0.0005***
	(-42.35)	(-43.93)	(-41.90)
/ln_p	-0.2284***		
	(-98.16)		
p	0.7957		
Property Characteristics	✓	✓	✓
Zip Code Fixed Effects	✓	✓	✓
Quarterly Fixed Effects	✓	✓	✓
Observations	274,873	274,873	274,873
Sold Homes ("Failures")	154,137	154,137	154,137

Notes. This table shows the effect of foreclosure concentration spillovers on probability of sale, showing a consistent association between nearby foreclosure and lower hazard (sale) rates. The estimates are derived from hazard models, using different distribution assumptions (listed above) and are in log relative hazard form. Robust z-statistics in parentheses (Errors Clustered by Zip Code)

*** $p<0.01$, ** $p<0.05$, * $p<0.10$