Foreclosed and Sold:

An Examination of Community and Property Characteristics Related to the Sale of REO

Properties

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Abstract

Foreclosure affects not only the foreclosing homeowner but also the surrounding residential neighborhood. Prior work has found that the negative neighborhood impacts of foreclosed properties that remain as real-estate-owned (REO) properties persist until the property is re-sold. Further, negative neighborhood price externalities are more substantial the longer a home spends in REO stock. This paper used foreclosure data from Dallas County, Texas to examine how both housing and neighborhood characteristics are related to the possibility of the sale of a foreclosed property out of REO stock. The findings from the Cox proportional hazard model indicate that homes in low-income minority neighborhoods and homes with property characteristics associated with a need for more preventative maintenance were slower to sell. Results have the potential to provide insight into how housing and neighborhood characteristics might help to explain part of the uneven geographic distribution of foreclosure impacts following the 2007-2009 financial recession.

Key Words

Foreclosure, Survival Analysis, REO

Introduction

From 2008 to 2010, the number of foreclosures in the United States increased 22% and approximately 88% of these occurred in urban communities (RealtyTrac 2014). These foreclosures and the related market failure have been associated with negative impacts for multiple parties. First, households that defaulted on their mortgages were negatively impacted through loss of their home and more long-term financial consequence as a result of a blemished credit history. Secondly, banks holding the failed mortgages experienced a financial loss. Finally, other homes in the neighborhoods surrounding the foreclosed homes often experienced a decline in home value. These negative neighborhood externalities have been a prime focus from a policy perspective. Negative neighborhood price externalities have the potential to increase the likelihood of other neighborhood foreclosures and propagate deleterious neighborhood social and physical conditions.

The extant literature examining the negative neighborhood externalities associated with foreclosure is rich and has included an examination of the effects of foreclosure on neighborhood house prices (e.g., Lee 2008), crime rate (Williams et al. 2014; Immergluck and Smith 2006b; Ellen et al. 2013), and municipal revenues (Apgar et al. 2005). Taken together, prior work has suggested that the duration of the foreclosure process—defined here as the time from default until a home was re-sold in the market to a third party buyer—was a significant correlate of the severity of neighborhood externalities during the financial recession. However, no study has examined how housing and neighborhood characteristics might have impacted the likelihood of sale of foreclosed properties out of Real Estate Owned (REO) stock. Our study will focus on understanding this relationship. Results will inform how physical and geographic characteristics of the housing asset itself, independent of mortgage lending practices, may have been an

underlying correlate of the uneven geographic clustering of foreclosure impacts experienced during the 2007-2009 financial recession.

Foreclosure process

Typically, foreclosure has been defined as a singular event whereby a mortgaged property was repossessed after payments were not met. However, in reality, the foreclosure event involved a lengthy process. This process began when the homeowner missed one or more monthly payments and was declared to be in default. The process ended when the home was returned to use in the housing stock through the sale of the property to a third party. Hereafter, we will refer to this entire period, from default until third-party market sale, as the “foreclosure process”.

There are two main ways in which the foreclosure process is initiated: judicial and non-judicial. Both methods require public notices to be issued and all parties involved to be notified regarding the proceedings. However, judicial foreclosures are mediated by the judicial court system while non-judicial foreclosures are not. In both cases, once necessary notices (non-judicial foreclosure) or legal suits (judicial foreclosure) are brought, the foreclosure process continues via one of two paths: the bank holding the failed mortgage sells the property through a short sale or the property is put up for auction¹.

Figure 1 describes the different paths that a property may take during the foreclosure process. The short sale is generally the quickest mechanism for completing the foreclosure process and has been associated with fewer neighborhood price externalities (Daneshvary, et al. 2011). Following an auction, there are many possible paths through the foreclosure process. At auction, if the bank does not receive a sufficiently high bid, then the bank maintains ownership of the property and the property becomes part of the bank’s REO stock. Homes that are kept in

REO stock usually have the longest time period from foreclosure to final resolution. In other cases, the bank may sell REO properties directly to a final user. Alternatively, an investor may buy the home out of the initial foreclosure auction and later sell the home to a final user.

Both judicial and non-judicial foreclosures are possible in Texas (the location of our study); however, the non-judicial process is significantly more common. Non-judicial foreclosures are the most common type of foreclosure in 64% of states in the US. While non-judicial foreclosures generally proceed more quickly because court intervention is not required, the process is generally lengthy. Under “normal” market conditions the average home foreclosure in Texas took 245 days to advance from default to REO (TDHCA 2006).

The duration of the foreclosure process is related to the path a home takes through the foreclosure process, and home characteristics may be related to the likelihood of following certain foreclosure paths. For instance, homes in good condition and likely to command a market price that will cover the outstanding mortgage are more likely to be put up for short sale. Similarly homes most attractive to investors are more likely to be sold to an investor during the foreclosure auction. The percentage of properties owned by a bank (REO) after an auction is usually high²; most foreclosed properties become REO. This paper focuses on properties that have been in REO stock. The term “foreclosure resolution” used henceforth in the paper refers to final sales of REO stock as recorded in the local multiple listing service. This sale could have been to owners or investors as indicated by the top two scenarios in Figure 1³.

There are many reasons why banks should be motivated to quickly liquidate REO properties by selling them to an investor or third party. First, REO properties are illiquid assets (Campbell et al. 2011). The liquidity of a house depends on many factors and is not limited to

the price of the property alone (Kluger and Miller 1990). Second, REO properties have low revenue potential and have relatively high maintenance costs because they are more prone to crime related activities and increased neighborhood social disorder (Goodstein and Lee 2010; Cui and Walsh 2014). For all of these reasons financial institutions have a reduced financial incentive to hold on to REO properties. .

However, these factors alone may not outweigh the costs associated with selling properties out of REO stock. Selling properties generally involves contracting with a third party real-estate broker or agent who will list the house and advertise it to potential buyers. Once potential buyers have been identified, negotiations are necessary to establish a final transaction price. This process has the characteristics of the classic principle-agent problem. Banks must incur costs to motivate and monitor real-estate agents in order to properly manage their REO stock. While there are significant advantages to liquidating REO stock quickly, there are also significant costs with liquidating the REO stock if the agent is unreliable. During times of increased foreclosure activity, banks generally see a large rise in REO stock, which demands additional services of agents. At the same time, the principle-agent problem is exaggerated because housing market volatility makes agent monitoring more difficult.

Therefore, the length of time a property spends in REO stock is likely a function of financial incentives of the bank for liquidating the property and the magnitude of the principle-agent problem. Both of these factors are related to the strength and stability of the housing market in the neighborhood of the REO property. For example, the principle-agent problem may be more extreme in some low-income or culturally distinct neighborhoods because fewer agents specialize in these markets. Additionally, REO properties in a gentrifying neighborhood may be viewed as likely to gain value, so the financial incentives for rapid liquidation are reduced.

Furthermore, there may be some housing characteristics that make properties more costly to liquidate and hence contribute to a longer foreclosure resolution independent of the bank's financial incentives or the principle-agent problem. For example, properties with a slab foundation require more routine maintenance than those without. Due to the soil composition and dry summer heat in Dallas, TX, slab foundations will frequently crack and require costly repairs if homeowners do not water the ground surrounding the foundation. In work funded by the federal Neighborhood Stabilization Program, Habitat for Humanity noted foundation repairs as a frequent use of NSP funding when rehabilitating foreclosed properties in Dallas County (Dallas Area Habitat for Humanity 2011).

Anecdotal news reports during the financial recession illustrate that these factors were in fact influential. For example, it was reported that in the later years of the recession and post-recession period, banks began adopting strategies of holding onto REO stock longer, presumably in an attempt to wait for a deeper recovery in the housing market⁴. In summary there are many factors related to expectations about how properties with particular housing and neighborhood characteristics will fair in the current market that potentially influence the length of time that a house is held in REO stock.

Neighborhood Foreclosure Price Externalities

Foreclosures have been associated with marked increases in neighborhood crime (Williams et al. 2014; Immergluck and Smith 2006b; Ellen et al. 2013) and significant increases in local tax burdens (Apgar et al. 2005). Additionally, many studies have estimated negative price effects on other nearby property sales (e.g. Immergluck and Smith 2006a; Schuetz et al. 2008; Harding et al. 2009; Leonard and Murdoch 2009; Lin et al. 2009; Rogers and Winter 2009; Daneshvary et al. 2011; Kobie and Lee 2011; Wassmer 2011; Daneshvary and Clauretie 2012). Lee's (2008)

review of 10 empirical foreclosure studies showed that the estimated negative price effects of nearby foreclosures ranged from 0.9% to 8.7%. Additionally, foreclosures within approximately 500 feet of a single-family residence have been associated with declines of 0.9% in Chicago, IL (Immergluck and Smith 2006a), 0.2% to 0.4% in New York City (Schuetz et al. 2008), 1% in St. Louis County, Missouri (Rogers and Winter 2009), 0.61% in Sacramento California (Wassmer 2011) and 0.5% in Dallas County, TX (Leonard and Murdoch 2009).

The negative price externalities of foreclosure vary both across and within housing markets. Examining within-housing market heterogeneity, researchers have found several correlates of increased price externalities. Properties with a larger degree of deterioration or blight (Fisher et al. 2015) and properties with lower relative home values (Zhang and Leonard 2014) were associated with greater declines in neighborhood home values. Additionally, longer duration of the foreclosure process (Zhang et al. 2015; Daneshvary and Clauretie 2012) was associated with increased foreclosure externalities. The authors assert that the mechanism underlying the relationship between duration of the foreclosure process and foreclosure externalities is likely related to blight and neighborhood factors which may have made properties more difficult to sell. Thus a clearer understanding of the determinants of the likelihood that properties will exit the foreclosure processes will improve our understanding of the link between the physical and geographic characteristics of the housing asset and foreclosure price externalities.

There are three primary channels through which foreclosures have been hypothesized to produce neighborhood externalities: blight, valuation, and supply (Lee 2008). The blight channel occurs when foreclosed houses are poorly maintained and generate negative visual externalities. The valuation channel is caused by downward pressure on the nearby house sales because

foreclosed houses generally sell at a discount. The supply channel occurs because foreclosed homes increase market supply. Zhang, et al. (2015) found that most of the estimated externalities were associated with the blight channel, and the foreclosure price effects have been shown to diminish quickly after a foreclosed property has been transferred to a new final user. Once transferred, the property can be productive and the new owners can engage in maintaining the property. Prior to being transferred, price declines were more severe and vandalism or blight were potentially more problematic (Zhang and Leonard 2014; Zhang, et al. 2015; Campbell et al. 2011). Thus faster resolution of foreclosure has the potential to reduce the negative neighborhood impact of foreclosure.

Geographic distribution of foreclosure impacts

The geographic distribution of foreclosures and neighborhood foreclosure impacts during the financial recession were uneven. Foreclosures were concentrated in urban minority neighborhoods (Lichtenstein and Weber 2014; Hall, Crowder, and Spring 2015) and in neighborhoods characterized by increased blight, higher crime, greater disorder, concentrated disadvantage, and lower levels of political capital (Bess 2008; Kirk and Hyra 2012). Authors have offered numerous viable explanations for these geographic patterns including predatory lending, clustering of higher-risk households, and historic racism. However, another potential underlying mechanism that has not been explored is the possibility that homes in these neighborhoods do not sell quickly. If homes do not sell quickly out of REO stock, then the neighborhood effects of foreclosure have been shown to be more severe. In fact, within Dallas, TX, Zhang et al. (2015) found that foreclosed properties with longer durations in the foreclosure process were more concentrated within the southern sector of the city where lower-income minority neighborhoods are most predominate.

In this paper we examine neighborhood and property characteristics related to the likelihood of resolution of the foreclosure process, where resolution of the foreclosure process is indicated by the sale of the property to a new third-party owner. Sale of the property was characterized by a sale recorded by the local multiple listing service. Due to geographic clustering of some housing characteristics and neighborhood types, the results may shed light on some possible underlying causes of geographic clustering of more severe foreclosure externalities. Thus they may point to areas for future study to understand the extent to which the geographic distribution of different types of housing characteristics may be related to geographic clustering of severe foreclosure impacts. This is distinct from previous work that has focused on the distribution of financial products as determinants of geographic clustering of foreclosure impacts. A better characterization of the possible role that neighborhood and housing characteristics might play in increasing the degree to which foreclosures produce negative neighborhood price externalities offer some additional factors that banks might consider in their strategic decisions regarding their REO stock. For example, results might suggest that banks should be more willing to engage in short sales or allocate additional maintenance to some properties while they are in REO stock.

Theory and Methodology

We used survival analysis to calculate the survival or risk rates associated with resolution of the foreclosure process through a market sale of a property out of REO stock.

We denoted the time from foreclosure to resolution as T , a strictly positive random variable. The distribution function of T is given by

$$F(t) = \int_0^t f(u)du = Pr(T \leq t) \quad (1)$$

The probability distribution is characterized by a probability density function $f(t)$

$$f(t) = \frac{dF(t)}{dt} = F'(t) \quad (2)$$

The survivor function $S(t)$ can then be expressed as

$$S(t) = 1 - F(t) = \Pr(T \geq t) \quad (3)$$

The survivor function is the probability that an REO property has not yet sold to a final user at period t . The survivor function is a monotone non-increasing function in time.

The hazard rate, $h(t)$, indicates the instantaneous resolution rate, given that an REO property has not yet resolved at time t . It is the conditional probability that the resolution event will occur in an interval $[t, t+\Delta t]$.

$$h(t) = \lim_{\Delta t \rightarrow 0} \frac{P(t \leq T \leq t + \Delta t | T \geq t)}{\Delta t} \quad (4)$$

The hazard rate may also be expressed as the ratio of the failure time and the survival function:

$$h(t) = \frac{f(t)}{S(t)} \quad (5)$$

Hazard rates vary from zero to infinity. A zero hazard rate indicates that the REO property has no probability of resolution in the time interval $[t, t+\Delta t]$ and infinity indicates the certainty of resolution at that instant itself.

Zuehlke (1987) presented a search theory for market sales of non-foreclosed homes in a housing market. The optimal search strategy can also be applied to housing markets in the presence of foreclosed properties. In searching for a house to purchase, buyers obtain all the available information from the market, including, housing characteristics, neighborhood characteristics, and current macroeconomic conditions. The buyer has an incentive to search for

houses that have been on the market the longest in order to find a seller with a relatively low reservation price. This leads to an increase in the probability of sale over time. At the same time, a relatively long time on market may be a signal of a high reservation price from the seller. This would decrease the possibility of sale over time. Thus time on market is endogenous to the search process. We propose a reduced form model for the potential determinants of the probability of sale (or resolution of the foreclosure process) that includes those factors that are exogenous to the search process. Our choice of housing and neighborhood characteristics are drawn from review of the hedonic price literature and our own work specifically studying the housing market in Dallas County (e.g., Chau and Chin 2003; Leonard and Murdoch 2009; Zhang and Leonard 2014; Leonard et al. 2015; Zhang et al. 2015; Leonard et al. 2016). We assert, based upon the common interpretation of hedonic price estimates as a marginal willingness to pay for housing characteristics, that characteristics commonly associated with statistically significant hedonic price effects are also likely to influence the probability of a house experiencing a market sale.

We used a Cox proportional hazard model to estimate the relationship between covariates and the hazard rate. The Cox model was chosen because it required minimal assumptions about the underlying hazard process. It allowed us to estimate hazard rates without making assumptions about the functional form for the baseline hazard function.

We estimated the rate of resolution at time t in months, given that the REO property had not resolved prior to t . $t=0$ represented the notice of sale. The hazard rate h for each foreclosed property i in neighborhood n , depended on the baseline hazard $h_0(t)$, and an expression parameterized in terms of housing characteristics (C), neighborhood characteristics (N), and geographic and time fixed effects (α).

$$h_{in}(t, C, N) = h_0(t) \exp(\beta_1 C_{in} + \beta_2 N_n + \alpha) \quad (6)$$

The focus of our study was on the estimated coefficients for the housing and neighborhood characteristics, $\widehat{\beta}_1$ and $\widehat{\beta}_2$, respectively. We included geographic (School District) and time (Foreclosure Year) fixed effects to control for broad housing market trends that may confound our results if excluded from the model.

Data

The data used for this study contained foreclosure data, house sales data, and data for neighborhood characteristics in Dallas County, Texas. The main source for the sales data was the University of Texas at Dallas Real Estate Research Database. It included a detailed list of variables such as the account number, latitude and longitude coordinates, housing characteristics, historic sale prices and sales data for Dallas County. Variable descriptions and summary statistics of the major housing characteristics are listed in Table 1 – Part A. School district dummies, house condition dummies and year of foreclosure dummies were also included but not reported in Table 1. School district boundaries in Dallas County are large and include multiple neighborhoods. House condition was obtained from the central appraisal districts' assessment of the condition of the house based upon an external inspection. Condition of the house structure was measured using an eight-point scale ranging from unsound to excellent. These conditions have been robustly associated with home prices in hedonic studies (Zhang and Leonard 2014).

The list of foreclosures from 2005-2010 came from the RealtyTrac database. RealtyTrac is a commercial database containing U.S real estate and other related data. It recorded all filings made on a property as it went through the foreclosure process including default notice, auction sale notification and bank repossession (Kan 2008). We obtained the foreclosure date and

location of all REO properties in Dallas County, TX from RealtyTrac. This data was geocoded and spatially merged into the real estate database to determine when the foreclosure resolution occurred. The resolution event was a market sale that took place after the foreclosure, but before our last observed sale in July, 2012. Foreclosures starting/sold in the middle of a month were treated as an occurrence in that particular month. Among all 30,547 foreclosures, 20.6%, 24.4%, 21.3%, 18.6% and 11.7% started foreclosure process in 2005, 2006, 2007, 2008, and 2009 separately. The other 3.3% started the process between January 2012 and March 2013. By July, 2012, 21,811 (71.4%) foreclosures had been resolved, and the remaining 8,736 (28.6%) were unresolved.

Considering only properties that entered REO stock, there remains significant heterogeneity in the time to foreclosure resolutions. Figure 2 shows the time to resolution in Dallas County. Among the total resolved foreclosures, about 73% were sold to final users within 10 months. The foreclosed properties were geographically clustered and were more likely to be located in southern Dallas County.

Neighborhood characteristics were collected from the US Census block group data of the American Community Survey 2006-2010 5-year estimates. Characteristics selected for inclusion in our analysis were based upon previous work (Leonard et al. 2015; Dubin and Sung 1990; Harris 1999; Seo and Rabenau 2010). This work supports the notion that presence of children, the racial composition of neighborhoods and neighborhood physical and social disorder are all important covariates affecting home prices; thus they are likely to also affect the likelihood that a property will exit the foreclosure process. We, unfortunately, did not have detailed data regarding social and physical disorder, but we used block group poverty level to proxy for this

important covariate. Additionally, we used block group level race, the percentage of school-aged children and percentage of older adult residents' to characterize neighborhoods. Variable description and summary statistics of the neighborhood characteristics are listed in Table 1 - Part B.

Figure 3 displays the Kaplan-Meier survival curve for the data set and the number of subjects at risk for each time period. On the x-axis, the time to resolution is displayed in number of months and on the y-axis the survivor function is displayed. Table 2 shows the Kaplan-Meier estimates. At the beginning, total number of unresolved properties was 30,547. After 20 months elapsed, 18,600 properties were resolved, while 11,947 properties were left unresolved. After 80 months, there were only 2,567 properties that had not been sold to final users.

Estimation and Results

We estimated a Cox proportional hazard model specified in (6) that does not include school district and year of foreclosure fixed effects (Model 1). Then we estimated a Cox model with year of foreclosure, but without school district school district fixed effects (Model 2) and a Cox model with school district but without year of foreclosure fixed effects (Model 3). Last, we estimated a Cox model with both school district and year of foreclosure fixed effects (Model 4)⁵. We conducted global chi-square tests on all of the models using Schoenfeld residuals. We are unable to reject the null hypothesis of a zero slope, which indicates no evidence for deviation from the proportional hazard assumption.

A language issue needs clarification before we proceed. The hazard ratio reflects the possibility of sale of a given property in time t relative to the average foreclosed property, conditioned on property characteristics and the property remaining in REO until time t . In what

follows, for simplicity, we simply refer to this conditional probability as the probability of resolution of the foreclosure process. However, this and the next entire section indeed concern the *conditional* impact of housing or neighborhood characteristic on the probability of resolution.

Coefficient estimates obtained from the Cox proportional hazard models are reported in Table 3. The associated hazard ratios are reported in Table 4. The hazard ratio is simply the exponential value of the coefficient (i.e. $h_k(t) = e^{\beta_k}$). A hazard ratio greater than 1 implies that the independent variable increases the chance of the foreclosure being resolved in period t . A hazard ratio below one implies that the independent variable decreases the probability of the foreclosure being resolved. For example, a hazard ratio of 0.94 for a binary variable means that the presence of that characteristic will decrease the conditional probability of a property being resolved in time t by 6%. The estimated hazard ratio of a continuous variable, such as the living area, can be interpreted as the impact that a one-square foot increase in living area would have on the conditional probability of being resolved in t .

The estimated hazard ratios from the Cox models 1 – 4 are statistically significant for most housing and neighborhood variables. Most of the signs of the estimates are the same, however, the magnitudes are different across models. Compared to Model 1, the condition dummies become significant when year of foreclosure fixed effects are included in Model 2. The estimate of Major Black decreases dramatically when school district fixed effects are included in Model 3. Estimates for Models 1 through 3 suggest that without considering geographic and time fixed effects, the estimation results may be biased.

We then focus on Model 4 in which both school district and year of foreclosure fixed effects are controlled. As shown in Tables 3 and 4, having a pool, central heat, central air

conditioning, and increases in the amount of living area all significantly increase the chance of a foreclosure resolution. For example, a house with a pool is associated with a 7.5% increased likelihood of the foreclosure process being resolved at time t . The results from the Cox model find that when the living area is increased by 1000 square feet, the conditional likelihood of the property being resolved at time, t , increases by 11.4%.

Housing characteristics, such as slab foundation, size of the lot, and effective age, are all significant but are related to a decreased likelihood of foreclosure resolution. Compared to the reference category - attached garage, detached and attached carport both significantly decrease the likelihood that the foreclosure process will be resolved. Compared to one story houses, houses with one and a half or two stories are less likely to be resolved. Additionally, larger lot areas are related to a decreased probability of foreclosure resolution.

The coefficient and hazard ratio for the effective age variable imply that each additional year added to the property will decrease the chance of that property being resolved in a given period, t , by approximately 0.4%. This marginal impact is relatively small, but considering large time horizons the magnitude is more impactful. Foreclosure of a 30 year old home will have a 12% lower chance of resolution in a given period, t , than that of a new home.

The condition dummy variable capturing the quality of the house has some interesting results. Three conditions are statistically associated with an increased likelihood of foreclosure resolution: very good, fair and poor. A house in very good condition is associated with an increased probability of being resolved by 14%, fair condition by 19% and poor condition by 12% relative to houses that are in unsound condition (the reference category). According to the results, a poor conditioned house is more likely to be resolved than a house in very good condition. One possibility for this comparative difference could be related to preferences and marginal

willingness to pay that varies across the continuum of home conditions. Banks may be more likely to accept a lower price for low quality homes, and buyers may similarly be more willing to purchase these low quality homes if the price allows for them to refurbish the home after purchase.

Most of the coefficient estimates for neighborhood characteristics tested in Model 4 are significant with the exception of the variables Major Hispanic, Major Asian, and Older than 60. Major White and Major Black are statistically significant at a 10% level. Both of these neighborhood types are associated with a higher possibility of being resolved than racially mixed neighborhoods (the reference category).

The result for Below Poverty implies that if a foreclosed house is located in an area with more households in poverty, it is also less likely to resolve. In comparison, foreclosure processes are likely to resolve sooner if the neighborhood has more school aged children. This may be due to correlates between household age profiles and the ability and willingness of residents to invest in neighborhood upkeep or social cohesiveness.

In addition to neighborhood demographics at the block group level, we also controlled for the number of nearby foreclosures to capture the foreclosure spillover effect. The variable Foreclosure is a simple count of foreclosures within 250 feet in the same foreclosure year as property *i*.⁶ The hazard ratio for Foreclosure in Table 4 is less than one and statistically significant at a 1% level, indicating that REO properties are less likely to resolve in neighborhoods with more nearby foreclosures. Each additional foreclosure within 250 feet within the same year decreases the odds of a foreclosed property selling by approximately 4%.

Discussion

The main purpose of this study was to examine the correlates of the probability of resolution of the foreclosure process for REO properties. In particular, we examined physical and geographic characteristics of the housing asset to better understand how asset characteristics might impact the length of the foreclosure process, which is in turn associated with the severity of foreclosure neighborhood price impacts. We were able to identify characteristics that are associated with faster resolution of the foreclosure process given that the property has not been resolved. Both housing and neighborhood characteristics were demonstrated to be significantly associated with the possibility of resolution of the foreclosure process among foreclosed properties in Dallas County, TX.

Housing characteristics, such as pool, central heat, central air conditioning, living area, one story, and fair house condition, were all significantly associated with higher probability of foreclosure resolution. On the other hand, housing characteristics, such as detached carport, houses with a slab foundation and the older effective age of the house, were significantly associated with lower probability of foreclosure resolution. These associations may be a result of preferences of market participants (i.e. in Texas central heat and air are highly preferred housing characteristics). However, some characteristics may be related to the probability of foreclosure resolution through their relationship with resilience to blight. For example, slab foundations were associated with a lower probability of foreclosure resolution. Slab foundations if left unattended (i.e the lawn (and hence the earth under the home is not watered)) during the summer in Dallas County, TX are prone to cracking resulting in a need for expensive repairs. Additionally, older homes generally require more routine maintenance and hence are likely to show the signs of blight more substantially.

Neighborhood characteristics, such as the percentage of school-aged children in the neighborhood and the percentage of households below the poverty line, were both highly significantly associated with the likelihood of foreclosure resolution. More neighborhood school aged children was associated with a higher probability of foreclosure resolution, and a higher proportion of households with annual income below poverty was associated with lower probability of foreclosure resolution. Additionally, neighborhoods with majority Black households were associated with a lower probability of foreclosure resolution.

Our results are comparable to other studies in the literature. Previous research (Kluger and Miller 1990, Rutherford et al. 2007, Hui et al. 2012, among others) utilized hazard models to investigate housing/neighborhood characteristics, and other factors' impact on property time-on-market. Kluger and Miller (1990) used a similar set of variables to our study, thus the results are most comparable to ours. Kluger and Miller (1990) reported how having an extra bedroom can increase the chance of a property being sold. Even though our study does not have a separate bedroom variable, we find similar results for living area, which is highly correlated with the number of bedrooms. Kluger and Miller (1990) also found that the lot area had a negative impact on the time on market for a property that was similar in magnitude to our results.

Our results, however, should be viewed in light of study limitations. Foreclosure is an outcome of an inherently endogenous process. Thus our results are particular to homes at risk of foreclosure in Dallas County. Additionally, we consider the potential problem of endogeneity in light of theoretical evidence for the foreclosure selection process. The literature robustly highlights two factors necessary for foreclosure: (1) low or negative equity in the home so that the home cannot be sold for a high enough amount and in sufficient time to cover the outstanding mortgage balance; and (2) lack of household income to cover the mortgage payments (Kau, et al.

1994). Each factor, taken alone, is a necessary but not sufficient condition for foreclosure. While condition (1) is endogenously related to housing characteristics, condition (2) is often a result of a random shock to household income or a combined result of reset of interest rates on adjustable rate mortgages and low-income. This limits the degree to which homes are endogenously “selected” for foreclosure.

Additionally, the maintenance behavior of homeowners may also be a source of endogeneity. However, evidence suggests that the majority of U.S. homeowners actually increased routine maintenance expenditures on their homes during the financial recession. The exception were homeowners with very low income and very low home equity (Leonard 2013). Thus it is possible that the estimated impact of high poverty neighborhoods on the probability of resolution of the foreclosure process might be upward biased to the extent low household income is correlated with declines in routine home maintenance. The estimated impact of low-poverty neighborhoods on the likelihood of foreclosure resolution should be interpreted as an upper bound.

An additional study limitation is related to the generalizability of study results to other housing markets. Our study data were from Dallas County, TX. The results provide insight into the correlates of the length of foreclosure resolution for urban housing markets, but probably have extremely limited external validity for rural markets where housing density, differentiation, and market thickness are quite different. Additionally, urban housing markets differ substantially and external validity of results across urban markets should be considered in light of similarities to the Dallas, TX housing market. Compared to other U.S. housing markets, the Dallas housing market has been remarkably stable during the study period. Additionally, the

area is characterized by a high degree of home ownership, moderate housing prices, and relatively low density of residential housing compared to other urban markets.

The results have implications for both public policy and financial institutions wishing to efficiently manage their REO stock. First, our results suggest that programs that have a potential impact of increasing the probability of resolving the foreclosure process should target low-income and majority Black neighborhoods. For example, the Neighborhood Stabilization Program explicitly targeted foreclosed properties in low-income neighborhoods for rehabilitation to hasten their return to the active housing stock (Joice 2011), which is in line with the policies we recommend. Second, to the extent that some housing characteristics are associated with lower probability of resolution because they indicate properties that are more susceptible to blight, financial institutions holding REO stock could engage in strategic approaches to maintaining these properties. Older homes and those with slab foundations, for example, could be identified and upkeep could be more targeted. These incremental changes may have significant financial benefits if they lead to faster resolution times.

William, et al. (2013) found that foreclosure was a leading indicator of neighborhood decline, and it temporally preceded several other indicators such as property crime. Thus there might be additional benefits associated with policies aimed at reducing the negative impacts of foreclosure. Policy focused on increasing the likelihood of foreclosure resolution in vulnerable neighborhoods might also serve as preventative measures for reducing property crime and other deleterious neighborhood conditions.

A consideration of future research is the role of the real-estate agent in managing REO stock. The estimated impact of neighborhood characteristics on foreclosure resolution processes may be confounded by the behavior of real-estate agents that specialize in different types of

neighborhoods. For example, a potential causal mechanism giving rise to the association between higher probability of foreclosure resolution and low-income, majority Black neighborhoods might be related to systematic behavior differences among real estate agents. It is possible that real estate agents charged with managing REO stock in low-income, majority Black neighborhoods systematically underperform—either because the agents are inefficient or because the bank is poorly monitoring or selecting agents in these neighborhoods. The role of the real estate agent in the likelihood of resolution of the foreclosure processes should be further examined because it may be an important modifiable factor contributing to inequities in foreclosure impacts.

Additionally, there are important equity considerations that are raised by the results of our work. In particular, homes in high poverty neighborhoods experienced a lower probability of foreclosure resolution. This indicates the unfortunate fact that the neighborhoods impacted by foreclosures the most are those where the most vulnerable populations reside. However, the results also provide a hint towards some policies that may help to insulate against this phenomenon. Low-income and affordable housing designs should incorporate characteristics that require minimal preventive maintenance and are associated with higher probability of foreclosure resolution. To the extent that such designs are more costly, these more robust housing features may be justified in terms of their ability to sustain home values that are important considerations for both neighborhood quality and local property tax receipts. Interestingly, most housing features associated with a higher probability of foreclosure resolution have also been found to be associated with a higher home sale price (Zhang, et al. 2015).

Conclusions

Municipal fiscal health and the viability of urban neighborhoods have been profoundly impacted by the foreclosure epidemic during the 2007-2009 financial recession. Our results contribute to the literature that attempts to investigate mechanisms to explain why certain neighborhoods and particular communities were more or less resilient during this volatile macro-economic time period. Specifically, our results suggest housing and neighborhood characteristics contribute to the explanation for why foreclosure processes varied, even within a given urban housing market. This alongside other studies examining the distribution of mortgage lending patterns adds additional insight in explaining the uneven distribution of foreclosure impacts.

Overall, our results suggest that urban communities benefit from investing in housing stocks that have lower required maintenance. Further, foreclosed homes located in low-income and majority Black neighborhoods were less likely to resolve. The mechanism underlying the correlation between these neighborhood characteristics and foreclosure resolution is unclear. However, results do suggest a mechanism that operates through the housing market that may explain uneven geographic distribution of foreclosure impacts. Further study of the joint impact of the likelihood of resolution of the foreclosure process in low-income minority neighborhoods alongside lending patterns to prospective homeowners in these same neighborhoods is warranted. The results of such studies are important to ensuring equitable treatment and maintaining municipal fiscal health during times of volatile housing markets.

Notes

¹ Source: <http://www.realtytrac.com/real-estate-guides/foreclosure/judicial-vs-non-judicial-foreclosure/>

² Estimate from HUD's NSP data shows between June 2009 and July 2010, approximately 2.1 million homes started the foreclosure process and approximately 1 million had entered REO status.

³ Due to data restrictions we are not able to distinguish if a foreclosed house was purchased by an owner-occupant or investor. In either case, prior literature has shown that the new purchaser will likely begin maintaining the property and negative externalities on nearby housing will diminish.

⁴ Source: <http://www.aol.com/article/2012/07/13/shadow-reo-as-much-as-90-percent-of-foreclosed-properties-are-h/20276304/>

⁵ We use Breslow method to handle tied values.

⁶ Zhang, et al. (2015) indicate the negative externalities of foreclosure is strongest within 250 feet from the reference property, and the effect quickly diminishes when the foreclosure is located beyond 250 feet.

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Figure 1 Foreclosure Ownership Transfer Process

Figure 2: Time to Resolution

Figure 3: Kaplan-Meier Survival Estimate

Table 1 - Part A: Variable Description and Summary Statistics - Housing Characteristics

Variable	Description	Mean	Std. Dev.	Min	Max
Housing Characteristics (C)					
Attached Garage	House with attached garage	0.7821	0.4128	0	1
Detached Garage	House with detached garage	0.0925	0.2897	0	1
Attached Carport	House with attached carport	0.0473	0.2124	0	1
Detached Carport	House with detached carport	0.0221	0.1469	0	1
Pool	House with swimming pool	0.0802	0.2717	0	1
Slab	House with slab foundation	0.7585	0.4280	0	1
Central Heat	House with central heat	0.9150	0.2789	0	1
Central AC	House with central ac	0.9009	0.2988	0	1
Baths	Number of baths	2.0297	0.6892	0	8.5
Lot Area	Size of lot area in thousands of square feet	9.5838	10.0212	1.0349	468.1696
Living Area	Size of living area in thousands of square feet	1.7978	0.7970	0.528	11.014
Fireplace	House with a fire place	0.6463	0.4781	0	1
Story 1	House with one story	0.7650	0.4240	0	1
Story1.5	House with one and a half stories	0.0976	0.2968	0	1
Story 2	House with two stories	0.1374	0.3442	0	1
Effective Age	Years since last refurbished/ built	35.9604	20.0890	6	115
Winter	House foreclosed in winter	0.2727	0.4454	0	1
Unsound	=1 if condition is unsound	0.0155	0.1237	0	1
Poor	=1 if condition is poor	0.0474	0.2125	0	1
Fair	=1 if condition is fair	0.1379	0.3448	0	1
Average	=1 if condition is average	0.2421	0.4284	0	1
Good	=1 if condition is good	0.2392	0.4266	0	1
Very good	=1 if condition is very good	0.1712	0.3767	0	1
Excellent	=1 if condition is excellent	0.1468	0.3539	0	1

Table 1 - Part B: Variable Description and Summary Statistics - Neighborhood Characteristics

Variable	Description	Mean	Std. Dev.	Min	Max
Neighborhood Characteristics (N)					
School Age	The percentage of residents at school age (5-17) in the block group	0.2109	0.0699	0	0.4712
Older than 60	The percentage of residents who are 60 and above in the block group	0.0809	0.0639	0	0.5963
Below poverty	The percentage of residents who are below the poverty line in the block group	0.1375	0.1282	0	0.8397
Major White	Majority (>50%) of the residents in the block group is non-Hispanic white	0.2373	0.4254	0	1
Major Black	Majority (>50%) of the residents in the block group is non-Hispanic black	0.2566	0.4368	0	1
Major Hispanic	Majority (>50%) of the residents in the block group is Hispanic	0.2486	0.4322	0	1
Major Asian	Majority (>50%) of the residents in the block group is non-Hispanic Asian	0.0019	0.0432	0	1
Foreclosures	# of foreclosures within 250 feet of the property in the same year	0.6166	0.8980	0	15

Note: Variables also include school district dummies, and year of foreclosure dummies, but they are not reported in this table.

Table 2: Kaplan-Meier Estimates

Months	Number at Risk	Survival Probability	Std. Error	95% Conf. Int.	
10	15305	0.4782	0.0029	0.4726	0.4838
20	11947	0.3868	0.0028	0.3813	0.3922
30	10811	0.3579	0.0027	0.3525	0.3633
40	9322	0.3371	0.0027	0.3318	0.3425
50	8075	0.3191	0.0027	0.3138	0.3243
60	6653	0.3013	0.0027	0.296	0.3065
70	5307	0.2838	0.0027	0.2786	0.2891
80	2567	0.2643	0.0028	0.2589	0.2697
90	7	0.2461	0.0033	0.2397	0.2525

Table 3: Cox Proportional Hazard Models - Coefficient Estimates

	Model 1		Model 2		Model 3		Model 4	
	Coeff.	Std Error	Coeff.	Std Error	Coeff.	Std Error	Coeff.	Std Error
Detached Garage	-0.0644**	0.0280	-0.0464*	0.0280	-0.0578**	0.0281	-0.0398	0.0281
Attached Carport	-0.1040***	0.0344	-0.1167***	0.0344	-0.1048***	0.0344	-0.1165***	0.0344
Detached Carport	-0.2978***	0.0526	-0.3585***	0.0525	-0.2879***	0.0526	-0.3447***	0.0526
Pool	0.0633**	0.0254	0.0642**	0.0254	0.0733***	0.0256	0.0720***	0.0256
Slab	-0.0617***	0.0225	-0.0811***	0.0224	-0.0745***	0.0232	-0.0937***	0.0232
Central Heat	0.1401***	0.0451	0.1697***	0.0446	0.1482***	0.0450	0.1797***	0.0445
Central AC	0.1821***	0.0427	0.1989***	0.0423	0.1781***	0.0427	0.1956***	0.0423
Baths	-0.0229	0.0176	-0.0191	0.0176	-0.0134	0.0178	-0.0113	0.0178
Lot Area	-0.0024***	0.0008	-0.0024***	0.0008	-0.0023***	0.0008	-0.0024***	0.0008
Living Area	0.1128***	0.0154	0.1017***	0.0154	0.1191***	0.0156	0.1077***	0.0155
Winter	0.0431***	0.0151	0.0241	0.0158	0.0434***	0.0151	0.0248	0.0158
Fireplace	-0.0348*	0.0185	0.0162	0.0185	-0.0343*	0.0187	0.0171	0.0186
Story 1.5	-0.0947***	0.0246	-0.0804***	0.0246	-0.1108***	0.0248	-0.0962***	0.0248
Story 2	-0.0974***	0.0238	-0.1049***	0.0237	-0.1089***	0.0239	-0.1160***	0.0239
Effective Age	-0.0038***	0.0006	-0.0037***	0.0006	-0.0038***	0.0006	-0.0037***	0.0006
Foreclosures	-0.0528***	0.0081	-0.0420***	0.0080	-0.0509***	0.0081	-0.0397***	0.0080
Major White	-0.0458**	0.0200	-0.0297	0.0199	-0.0440**	0.0206	-0.0368*	0.0206
Major Black	-0.0946***	0.0193	-0.0915***	0.0193	-0.0482**	0.0238	-0.0441*	0.0236
Major Hispanic	-0.0153	0.0212	0.0022	0.0211	-0.0166	0.0222	0.0010	0.0221
Major Asian	0.0065	0.1472	0.0989	0.1472	0.0014	0.1523	0.0666	0.1524
School Age	0.2943***	0.1070	0.3071***	0.1070	0.3407***	0.1103	0.3485***	0.1102
Older than 60	-0.0642	0.1136	-0.0394	0.1138	-0.2030*	0.1187	-0.1867	0.1188
Below Poverty	-0.3350***	0.0652	-0.4494***	0.0654	-0.3350***	0.0691	-0.4556***	0.0692
Condition								
Poor	0.0689	0.0642	0.1334**	0.0643	0.0739	0.0643	0.1401**	0.0643
Fair	0.0596	0.0592	0.1853***	0.0593	0.0638	0.0593	0.1934***	0.0594
Average	-0.0818	0.0581	0.0168	0.0584	-0.0762	0.0583	0.0262	0.0586
Good	-0.0847	0.0583	0.0108	0.0587	-0.0760	0.0585	0.0223	0.0588
Very good	0.0122	0.0590	0.1074*	0.0595	0.0199	0.0592	0.1189**	0.0596
Excellent	0.0005	0.0601	0.0333	0.0606	0.0106	0.0602	0.0475	0.0607
School District	No		No		Yes		Yes	
Yr of Foreclosure	No		Yes		No		Yes	
# of Observations	30,547		30,547		30,547		30,547	
# of Sold	21,811		21,811		21,811		21,811	

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

The reference categories are attached garage, one story, and the worst condition (unsound).
The standard errors are clustered at the school district level.

Table 4: Cox Proportional Hazard Models - Hazard Ratio Results

	Model 1	Model 2	Model 3	Model 4
	Hazard Ratio	Hazard Ratio	Hazard Ratio	Hazard Ratio
Detached Garage	0.9376**	0.9547*	0.9438**	0.9609
Attached Carport	0.9012***	0.8898***	0.9005***	0.8900***
Detached Carport	0.7424***	0.6987***	0.7498***	0.7085***
Pool	1.0653**	1.0663**	1.0760***	1.0746***
Slab	0.9402***	0.9221***	0.9283***	0.9106***
Central Heat	1.1504***	1.1850***	1.1597***	1.1969***
Central AC	1.1997***	1.2201***	1.1950***	1.2160***
Baths	0.9774	0.9811	0.9867	0.9887
Lot Area	0.9976***	0.9976***	0.9977***	0.9976***
Living Area	1.1194***	1.1070***	1.1265***	1.1137***
Winter	1.0440***	1.0244	1.0443***	1.0251
Fireplace	0.9658*	1.0163	0.9663*	1.0173
Story 1.5	0.9096***	0.9227***	0.8951***	0.9083***
Story 2	0.9072***	0.9004***	0.8968***	0.8904***
Effective Age	0.9962***	0.9963***	0.9962***	0.9963***
Foreclosures	0.9486***	0.9588***	0.9504***	0.9611***
Major White	0.9553**	0.9708	0.9570**	0.9639*
Major Black	0.9097***	0.9125***	0.9529**	0.9569*
Major Hispanic	0.9848	1.0022	0.9836	1.0010
Major Asian	1.0066	1.1039	1.0014	1.0689
School Age	1.3422***	1.3595***	1.4059***	1.4170***
Older than 60	0.9378	0.9614	0.8163*	0.8297
Below Poverty	0.7153***	0.6380***	0.7153***	0.6341***
<i>Condition</i>				
Poor	1.0713	1.1427**	1.0767	1.1504**
Fair	1.0614	1.2036***	1.0659	1.2133***
Average	0.9215	1.0170	0.9267	1.0265
Good	0.9188	1.0108	0.9269	1.0225
Very good	1.0123	1.1133*	1.0201	1.1262**
Excellent	1.0005	1.0339	1.0106	1.0487
School District	No	No	Yes	Yes
Yr of Foreclosure	No	Yes	No	Yes
# of Observations	30,547	30,547	30,547	30,547
# of Sold	21,811	21,811	21,811	21,811

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

The reference categories are: Attached Garage, one story, and the worst condition unsound for the Housing Condition dummies.