The Recent Pervasive External Effects of Residential Home Foreclosure

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Abstract

The United States has faced an ongoing foreclosure crisis in the late 2000s that resulted in an unprecedented number of families losing their homes. Federal and state governments responded with public policies designed to reduce foreclosures, but have faced criticism in doing so. Such policies are economically appropriate if the external neighborhood effects of mortgage foreclosure are greater than the public cost to implement them. A hedonic home price regression calculates the value of these external effects for a large United States Metropolitan Area (Sacramento) in the late 2000s.

The selling price of non-real estate owned homes, due to the foreclosure of neighboring homes, on average fell by $48,827 per home or 31.9 percent. This estimate of the external neighborhood effect far exceeds similar estimate made from previous regression studies using data from before the late 2000s foreclosure crisis and likely justifies public intervention into the curtailment a foreclosure crisis of this magnitude.

Key Words

Foreclosure, Housing, Neighborhood, Policy
The quickest way to end up underwater is to live in a neighborhood that is plagued by foreclosures. ...As homes go into foreclosure, they create a domino effect, lowering home values throughout a neighborhood in a cascade beyond homeowner’s control.”
Anna Maries Andriotis (2009) in Smart Money

But by making these investments in foreclosure prevention today, we will save ourselves the costs of foreclosure tomorrow – costs that are borne not just by families with troubled loans, but by their neighbors and communities and by our economy as a whole.
President Obama (2009) introducing his Making Home Affordable Plan

Introduction

During the last half of the first decade of the 21st Century, the United States faced an ongoing foreclosure crisis that resulted in an unprecedented number of families losing their homes (Nelson, 2010). In 2006, about 7 percent of United States’ homeowners owed more on a single-family residential mortgage than what the property could have sold for (Calculated Risk, 2007). By 2010, estimates of those “underwater” on their home mortgage had risen to between 20 and 25 percent (Streitfield, 2010 and The Economist, 2010). Haughwout and Okah (2009) calculate this percentage to be even larger in some metropolitan areas in the United States. This severe loss in homeowner equity sprang from a combination of factors (Immergluck, 2008). Low mortgage interest rates, growth in secondary mortgage markets and expansionary mortgage access policies, increased both the price of homes and home ownership rates in the first half of the 2000s. Housing prices then drastically fell between 2006 through 2009, at the same time that credit and employment markets tightened. Many homeowners found themselves in the difficult situation of both owing more on their home than it was worth and not being able to meet their scheduled mortgage payments. Such homeowners often faced involuntary foreclosure, or sometimes even walked away from their homes as a strategic financial decision. Federal and state governments responded with direct aid and policy reforms designed to reduce this new wave of foreclosures. However, such policies came under attack from both those who viewed
them as public dollars inappropriately spent and from others who wanted even greater public resources devoted to curtailing the crisis.

If the effects of a home foreclosure extend beyond the two parties involved in the decision to foreclose, there may be a role for greater government involvement in the foreclosure process. Economists define the hurt that a foreclosure can place on neighbors as a “negative externality” whose cost is not considered by the mortgage recipient or mortgage holder when deciding whether foreclosure is the appropriate course of action. Using just a simple benefit cost assessment of whether a residential property should go into foreclosure, foreclosure rationally occurs if the benefits to the private parties involved exceed their private costs (for a technical treatment of this decision see Ambrose and Capone, 1996). The private parties in the foreclosure decision ignore the additional public cost that a foreclosure can impose upon neighboring properties. If such an external cost is present, a greater than socially optimal number of homes will enter foreclosure. Moreover, if the magnitude of this negative externality is large enough, microeconomic theory suggests a role for government in getting the private parties to internalize this public cost into the private parties’ decision to foreclose upon a mortgage.

The statements offered at the start of this paper reflect this economic line of thinking. Both Smart Money and President Obama recognize that a foreclosure can exert a negative neighborhood influence that extends beyond the foreclosed property itself. What they, and most others claiming this negative neighborhood effect as justification for government intervention, fail to do is to quantify its magnitude. By not doing this, those opposed to greater government involvement in foreclosure decisions can claim that such effects are nonexistent or very small, and thus not greater than the cost to the taxpayer of further public involvement.
As discussed below, empirical evidence exists on the direct influence that mortgage foreclosure has on the selling price of a home undergoing it and the indirect influence it has on the selling price of homes near a foreclosure. However, the derivation of this evidence predates the most recent foreclosure crisis. This is important since the severity of foreclosures in this current crisis, especially in certain regions of the United States, far exceeds that observed in the past. Therefore, an extrapolation of the indirect effects of foreclosure from past studies, applied to the current crisis, may not be wholly appropriate. Offered here is an updated empirical estimate of neighborhood foreclosure effects from a January 2008 to June 2009 data set on single-family home sales from the Sacramento, California Metropolitan Area. This region of the United States was one of hardest hit by foreclosures over this period.

In the remainder of this paper, I proceed with a review of the previous empirical literature of how foreclosure affects the own selling price of a home, and the selling price of homes in proximity to a foreclosed home. Scanning this literature reveals the previous magnitudes calculated and the appropriate regression technique to calculate similar magnitudes for the more recent data set used here. In addition, I offer a background on the foreclosure process, foreclosure activity in the Sacramento Area during the period under consideration, and the necessary summary of the housing data used in this study. A description of the regression model follows and then a separate section offers the results of the regression analysis. Finally, I conclude with a section on policy implications for public programs designed to assist mortgage holders threatened with default.

**The effects of residential foreclosure**

*The effect of foreclosure status on home price*
Holding other characteristics constant, there are two theoretical reasons that a home in foreclosure sells for less. First, the previous homeowner is likely to anticipate the foreclosure of their mortgage, spend less on maintenance, and relinquish to the lender of her foreclosed mortgage a lower maintained house. Second, the lender that now holds a foreclosed house faces the stigma of buyers knowing that the incentive for them to sell the house is greater than that for an owner-occupied house. Most previous studies of the influence of mortgage foreclosure on a home’s selling price have not separated out the calculation of these two effects and have not tried to account for the influence of neighboring homes in foreclosure.

As summarized by Clauretie and Daneshvary (2009, Table 1, p. 45), previous studies found foreclosure sale discounts in the low- to mid-20 percent range. Rogers (2008) controls for the influence of neighboring homes in foreclosure and finds an own-price foreclosure discount of 27 percent. Using a similar control of neighboring homes in foreclosure, Campbell, Giglio, and Pathak (2008) report a foreclosure discount of 28 percent. Clauretie and Danshevary (2009) control for the influence of neighboring homes in foreclosure, but also add measures of property condition as explanatory variables in their hedonic home price regression. After doing this, they obtain a distressed sale discount that is about one-third less.

**The effect of proximity to residential foreclosure on home price**

As summarized by Lee (2008), a home in foreclosure can exert three different forms of negative external effects on the selling price of nearby homes: blight, valuation, and supply. A bank-owned home is more likely to suffer physical neglect before and after repossession. Such neglect can encourage nearby homeowners to neglect their homes. The result being increased neighborhood blight and perhaps greater crime. The second effect described as valuation arises because of the comparable prices taken by a real estate agent to set the sales price of home and/or
an appraiser seeking to qualify a new mortgage. Foreclosure lowers the own-price of a home undergoing it, and through comparable pricing, can lower the appraised prices of nearby homes. Finally, foreclosure is usually a forced act and thus unnaturally raises the supply of homes in a neighborhood. Since prospective homebuyers usually shop by neighborhood, this supply increase lowers the prospective selling price of all homes in a neighborhood due to the expansion of choices available to the same buyers shopping that neighborhood.

Immergluck and Smith (2006) are widely cited as one of the first to use hedonic regression analysis to estimate the external costs of foreclosure on surrounding property sales. By means of a 1999 data set from 9,600 single-family property transactions in Chicago, they found that a foreclosed property within one-eighth of a mile of home reduces its selling price by 1.1 percent, while foreclosed properties between one-eighth and one-quarter mile reduce it by 0.3 percent. Lin, Rosenblatt, and Yao (2007) offer a greater accounting of the influence of time on the effect that foreclosure proximity has on selling price. Using a United States sample of nearly 30,000 home sales drawn from both 2003 and 2006, they find a statistically significant effect of a foreclosure on nearby home prices within a radius of a half mile and up to five years after the liquidation. Using the 2006 housing data, the most severe impact is an 8.7 percent discount for each foreclosure that declined to 1.7 percent for foreclosures five years in the past. Calculated external foreclosure discounts when using housing data from the 2003 boom year, as compared to the 2006 bust year, were half the magnitude. Based upon 130,000 home sales in St. Louis County, Missouri for 2000 to 2002, Rogers (2008) finds that one foreclosure within a tenth of a mile reduces a residential property’s sales price by 0.9 percent. Campbell, Giglio, and Pathak (2009), using a 1987 to 2008 data set of nearly 1.8 million Massachusetts home sales, finds a
residential foreclosure within a twentieth of a mile of a home reducing its sales price by about one percent.

Harding, Rosenblatt, and Yao (2009) extend this line of empirical research by using a 1989 to 2007 data set of over 400,000 repeat housing sales covering 37 different metropolitan statistical areas from 13 states. The use of repeat sales allows for a finding of the influence of foreclosure proximity on the sales price trend of the same home. They find a 1.3 percent discount per foreclosure within a twentieth of a mile, which falls to 0.6 percent for between a twentieth and a tenth of a mile. These negative external effects linger for up to a year after the foreclosure sale. Leonard and Murdoch (2009), observing 23,000 plus homes sales in 2006 for Dallas County, Texas, record a 0.5 selling price discount for a home within 0.14 mile of a foreclosure; and 0.1 percent discount for each home within 0.28 to 0.57 miles; and the same foreclosure discount for between 0.57 to 0.85 miles. Schuetz, Been, and Ellen (2008) differ from previous studies in its calculation of the effect of a notice of intent (as opposed to a full foreclosure sale) to begin foreclosure being given to a property on surrounding properties. They use threshold levels as opposed to a continuous measure of this notice. Using a 2000 to 2005 data set of around 57,000 home sales in New York City, they find that one or more of these notices within a twentieth of a mile of a property reduce its sales price by 1.8 percent. While within a twentieth to tenth (tenth to fifth) of a mile, six (11) or more notices reduce selling price by 4.7 (3.5) percent.

The appropriate regression technique

Immergluck and Smith’s (2006) research on the external costs of foreclosure offers an excellent example of the appropriate statistical technique to determine the direct and indirect effect of residential foreclosure on the selling price of homes. They use a hedonic regression model to
estimate the impact of nearby foreclosure activity on the selling price of single-family properties in the City of Chicago while holding other causal factors constant. The hedonic regression model assumes that housing is a composite product and typically uses a log-lin functional form where the dependent variable (selling price of a home) is in natural log form and the explanatory variables are unaltered. Regressing the attributes of a house against its selling price results in an estimation of the marginal contribution of each attribute to its selling price. The categories of explanatory variables expected to influence the selling price of a home include property characteristics (measures of home and lot square footage, bedrooms, bathrooms, construction, etc), location characteristics (measures of neighborhood density, income, race, etc.; or a set of neighborhood dummy variables), and sales environment characteristics (measures of time on the market, date sold, real estate agent experience, etc.). The foreclosure status of the home and its proximity to other homes in foreclosure, respectively fall in the sales and location characteristics that can theoretically influence selling price.

A concern increasingly raised in the estimation of hedonic regression models of housing price is the possibility of spatial autocorrelation. This occurs when observations in a regression’s data set that are physically close to each other produce correlated error terms and thus violate a necessary assumption regarding the validity of this statistical technique (Anselin, 2002). As noted by Lochl (2007), this is of particular concern in a housing data set drawn from a region because of the geographic, governance, and economic factors that are more likely to be similar the closer that one home sale is to another. If not fully accounted for in the choice of explanatory variables, shared location characteristics are likely to produce positively correlated error terms based upon proximity. Few of the previous regression-based studies of the effect of foreclosure on housing price have corrected for spatial autocorrelation. However, Rogers (2008)
does find the presence of spatial autocorrelation in his study of neighborhood foreclosure effects using a 1996 to 2007 data set from St. Louis County, Missouri. After correcting for it, both the magnitude and statistical significance of some of his regression estimates change. Clauretie and Daneshvary (2009) and Leonard and Murdoch (2009), find the same for regression based tests of neighborhood foreclosure effects for housing data sets respectively drawn from 2004 to 2007 home sales in two Sun Cities in the Las Vegas Area, and 2006 home sales in Dallas County, Texas.

**Background**

*Foreclosure process*

Foreclosure is the legal procedure that a mortgage lender must follow to take possession of a home whose owner has not satisfied the requirements of a mortgage contract. In most states, foreclosure is a five-stage process that begins with a homeowner missing a scheduled loan payment. After three consecutive months of such default, the lender may file a legal intent (*Lis Pendens*) to foreclose upon the mortgage and offer the home for sale. In the third-stage of foreclosure, the mortgage lender can negotiate the possibility of either a restructured loan or a “short sale” by which the property is sold for less than the amount owed on the mortgage and with terms on who is responsible for the difference. If these negotiations fail, the property goes to the fourth stage of foreclosure, which is an auction requiring a minimum bid set to cover the distressed mortgage’s loan balance and fees. If the minimum is not met, in the fifth and final stage of the foreclosure process the property reverts to the lender and it considered real estate owned (REO). With the exception of Schuetz, Been, and Ellen (2008) that examined the influence of nearby properties receiving a notice of *Lis Pendens*, the research described earlier all looked at the external influence of REO properties on the selling price of nearby homes.
United States, California, and Sacramento Area foreclosure activity

Kingsley, Smith, and Price (2009, p. 1) believe that the first decade of the 21st Century is likely to be the most tumultuous to date in the history of United States housing markets. As reported by the National Mortgage Professional (2010), 2.21 percent of all United State’s single-family housing units received a Lis Pendens in 2009. This was up from 1.84 percent in 2008, 1.03 percent in 2007, and just 0.58 percent in 2006. Nevada led the states in 2009 with just over 10 percent of its housing units receiving a foreclosure notice. Arizona and Florida were ranked next with around six percent of their housing units receiving these notices, while California followed at 4.75 percent. Regarding California, the Federal Housing Finance Agency (2009, p. 3) notes that between the first quarter of 2000 and the fourth quarter of 2006, around five percent of all residential real estate sales in the state were distressed sales (ones that had proceeded within a year of foreclosure notice). By the first quarter of 2009, this percentage had risen astoundingly to 45 percent. For the nation’s 100 largest metropolitan areas, Immergluck (2008, p. 10) notes that the Sacramento Metropolitan Area produced the fourth largest increase (at 162 percent) in foreclosure filings between mid-2006 and mid-2007. And in 2009, the Sacramento Metropolitan Area still remained in the top 20 such areas in the United States for housing foreclosure notices with 5.6 percent of the area’s homeowners receiving them (Market Watch, 2010).

Sacramento housing data

Given what has just been described, residential sales from the Sacramento Metropolitan Area from 2008 and the first half of 2009 represent a reasonable sample to use in a hedonic regression study designed to gather a more contemporary measure of the negative neighborhood effects
Figure 1: Distribution of Sacramento Region Home Sales

Zip Code Boundaries in Salmon, County Boundaries in Blue, Home Sales Dots in Orange
of foreclosure. For this study, the Sacramento Metropolitan Area consists of El Dorado, Nevada, Placer, Sacramento, Yolo, and Yuba Counties. The Multiple Listing Service data (www.mlslistings.com) from all zip codes in these six counties that had more than 50 sales over each of the six quarters under consideration, yield home specific data on sales price and characteristics. As illustrated in Figure 1, the result being information from 35,822 single-family homes sales occurring in 61 different zip codes spread over six different counties. Seventy three percent of the observations are from Sacramento County.

The average selling price of a Sacramento Metropolitan Area home between 2008 and mid-2009 was $255,908. Like most of the previous research, foreclosure activity is accounted for here by a dummy variable that records if a home was real estate owned (REO) when sold. In the first quarter of 2008, 55.3 percent of the homes in the Sacramento Area sold fell into this category. In the four quarters following, the percentage of sales falling into the REO category rose consistently from 59.9, to 62.2, to 66.7, to 70.2. In the last quarter under observation (April-May-June of 2009), the percentage of sales REO declined to 57.0 percent.

Regression model

Since the purpose of this study is to produce estimates of the influence of foreclosure activity on surrounding home sales comparable to estimates produced earlier, the regression model used here is similar to that used previously. By means of the hedonic pricing model, the natural log of a home’s selling price is a function of its property, location, and sales environment characteristics. I account for each of these characteristics through a choice of variables available in the Multiple Listing Service for residential home sales in the Sacramento Area. The general formulation of the regression model is:

\[
\log (\text{Selling Price}) = f (\text{Property Characteristics, Location Characteristics, Selling Environment Characteristics}), \quad (1)
\]
where;

**Property Characteristics** = f (Home Sq Feet 1000s, Lot Sq Feet 1000s, One Story Dummy, No Garage Dummy, No Fireplace Dummy, Bedrooms, Full Baths, Half Baths, Sewer Dummy, Wood Ext Dummy, Brick Ext Dummy, Lap Ext Dummy, Vinyl Ext Dummy, Tile Roof Dummy, Metal Roof Dummy, Slate Roof Dummy, Shake Roof Dummy, Contemporary Dummy, Mediterranean Dummy, Victorian Dummy, Years Old, Years Old Squared, Years Since Remodeled),  

(2)

**Location Characteristics** = f (Horse Property Dummy, Community Service District Dummy, Covenant Restriction Dummy, Neighborhood Association Dummy, Neighborhood Association Dues, Tenth Mile REOs in Quarter, Quarter Mile REOs in Quarter, One Mile REOs in Quarter, Fraction Zip REO in Quarter, Set of 60 Zip Code Dummies),  

(3)

**Selling Environment Characteristics** = f (Own REO Dummy, Days on Market 100s, Quarter Two Dummy, Quarter Three Dummy, Quarter Four Dummy, Quarter Five Dummy, Quarter Six Dummy)  

(4)

The property characteristics included in the regression model take full advantage of the richness of the Multiple Listing Service data used. The excluded exterior, roof material, and architectural style characteristics are respectively stucco, composite shingle, and ranch. The squared value of years old is included in anticipation that at some age a home’s value stops declining based upon consumer preference for older preserved homes.

Location characteristics include all zoning, taxing, and neighborhood association characteristics included in the Multiple Listing Service data. A Community Service District in California taxes residential property for local infrastructure projects outside of the restrictive property tax system of post-Proposition 13 California. The number of REOs at various distances measures the influence of nearby properties that are bank owned and calculated for the quarterly period that the property under consideration sold. Distance choices follow previous conventions and measure REO occurrence within a tenth of a mile, a tenth to quarter mile, and a quarter mile to one mile. Unique to this analysis, I include a broad measure of the percentage of home sales...
bank owned for a quarterly period, in the entire zip code that is the location of the home. Sixty zip code dummy variables control for neighborhood characteristics not otherwise accounted for. The excluded zip code 95616 represents the City of Davis, well known for the quality of its public schools and subsequently high property values.

Finally, the environment within which a home sale occurred influences its sales price. Whether the home itself was bank owned and the number of days in hundreds that it was on the market, are both important determinants of the environment that generates its selling price. Particularly important for the period under consideration are the controls for which quarter the home sold in. Since the first quarter (Jan-Feb-March of 2008) is the excluded dummy category, and the economy was in continual recession over the following 18-month period observed, the signs on the included time dummies will likely be negative.

Since the functional form of the hedonic regression is log-lin, a simple transformation of a regression coefficient yields the percentage change in the selling price of home following a one-unit change in the respective explanatory variable. The necessary transformation is the natural exponent of the log-lin regression coefficient, less one, all multiplied by 100 (http://www.sportsci.org/resource/stats/logtrans.html).

Two other econometric concerns that arise in a regression of this sort are heteroskedasticity and spatial autocorrelation. Heteroskedasticity occurs when the residual values calculated from the regression are not independent and instead related to another variable. In predicting home prices, this is likely to occur in relation to the size variables for either the structure or lot, and if present yields regression estimates that are not the best linear unbiased estimates. In the earlier literature review, I raised the issue of the likelihood of spatial
autocorrelation and the need to account for it. Both heteroskedasticity and spatial autocorrelation are present in the estimation of this regression model and appropriately corrected.

**Data and regression results**

The process of preparing the data from the Multiple Listing Service for nearly 36,000 home sales in the Sacramento Metropolitan Area for all of 2008 and half of 2009 involved first the geocoding of all home addresses and loading this into ARCMAP. A home’s location then became a point in space and the number of bank-owned sales that occurred within the desired distances from a home, for the quarter that the home sold, calculated. In addition, ARCMAP calculations yielded the percentage of home sales that were REO in each zip code, for each quarter. Descriptive statistics for all the explanatory variables are in Table 1.

GEODASpace (available from the GEODA Center at Arizona State University [http://geodacenter.asu.edu/software](http://geodacenter.asu.edu/software)) produced the log-lin hedonic regression estimates. This software estimates robust standard errors standard errors in the presence of heteroskedasticity for both an ordinary least squares estimation and a two-stage least squares regression method that accounts for spatial autocorrelation. For comparison purposes, both results are in Table 2. As summarized in Lochl (2007), the incorporation of spatial effects into regression estimation involves either a spatial lag or a spatial error model. As stated by Anselin (2002), the spatial lag model assumes that a spatially weighted value of surrounding home prices is a factor in the determination of home price. While the spatial error model assumes that spatial dependence in the regression estimation is present in the error term in the form of the price of a home being a function of the omitted variables at neighboring locations. To use either of these models, a weight matrix must specify the method of inclusion of neighboring properties. Either a k-nearest neighbor or Euclidian distance approach is possible. In previous research, Lochl (2007) chose
Table One: Descriptive Statistics for Explanatory Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean (Minimum, Maximum)</th>
<th>Variable</th>
<th>Mean (Minimum, Maximum)</th>
<th>Variable</th>
<th>Mean (Minimum, Maximum)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home Square Feet 1000s</td>
<td>1.78 (0.40 10.61)</td>
<td>Tile Roof Dummy</td>
<td>0.3960</td>
<td>Neighborhood Assoc. Dummy</td>
<td>0.1455</td>
</tr>
<tr>
<td>Lot Square Feet 1000s</td>
<td>186.53 (0 866,408)</td>
<td>Metal Roof Dummy</td>
<td>0.0034</td>
<td>Neighborhood Assoc. Dues</td>
<td>24.06 (0 9,999)</td>
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<tr>
<td>One Story Dummy</td>
<td>0.6748</td>
<td>Slate Roof Dummy</td>
<td>0.0021</td>
<td>Tenth Mile REOs in Quar.</td>
<td>8.78 (1 60)</td>
</tr>
<tr>
<td>No Garage Dummy</td>
<td>0.0220</td>
<td>Shake Roof Dummy</td>
<td>0.0535</td>
<td>Quarter Mile REOs in Quar.</td>
<td>27.41 (0 120)</td>
</tr>
<tr>
<td>No Fireplace Dummy</td>
<td>0.2177</td>
<td>Contemporary Dummy</td>
<td>0.2322</td>
<td>One Mile REOS in Quar.</td>
<td>313.44 (0 1,012)</td>
</tr>
<tr>
<td>Bedrooms</td>
<td>3.3842 (0 9)</td>
<td>Mediterranean Dummy</td>
<td>0.0301</td>
<td>Fraction Zip REO in Quar.</td>
<td>0.6125 (0 1)</td>
</tr>
<tr>
<td>Full Baths</td>
<td>2.0804 (0 7)</td>
<td>Victorian Dummy</td>
<td>0.0014</td>
<td>Own REO Dummy</td>
<td>0.6235</td>
</tr>
<tr>
<td>Half Baths</td>
<td>0.2172 (0 5)</td>
<td>Years Old</td>
<td>27.28 (0 134)</td>
<td>Days on Market 100s</td>
<td>1.01 (0 7.6)</td>
</tr>
<tr>
<td>Sewer Dummy</td>
<td>0.9899</td>
<td>Years Old Squared</td>
<td>1,214.46 (0 17,956)</td>
<td>Quarter Two Dummy</td>
<td>0.185</td>
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<tr>
<td>Wood Ext Dummy</td>
<td>0.1673</td>
<td>Years Since Remodeled</td>
<td>25.88 (0 133)</td>
<td>Quarter Three Dummy</td>
<td>0.218</td>
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<tr>
<td>Brick Ext Dummy</td>
<td>0.0039</td>
<td>Horse Prop Dummy</td>
<td>0.0136</td>
<td>Quarter Four Dummy</td>
<td>0.175</td>
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<td>Lap Ext Dummy</td>
<td>0.0355</td>
<td>Comm. Serv. Dist. Dummy</td>
<td>0.0600</td>
<td>Quarter Five Dummy</td>
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<td>Covenant Rest. Dummy</td>
<td>0.8330</td>
<td>Quarter Six Dummy</td>
<td>0.160</td>
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<td>Explanatory Variable</td>
<td>Ordinary Least Squares Coefficient (Elasticity)</td>
<td>Spatial Error Model Coefficient (Elasticity)</td>
<td></td>
<td></td>
<td></td>
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<td>-----------------------------</td>
<td>-------------------------------------------------</td>
<td>---------------------------------------------</td>
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<td></td>
</tr>
<tr>
<td>Constant</td>
<td>12.9375***</td>
<td>12.972***</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Home Sq Feet 1000s</td>
<td>0.2729*** (31.37)</td>
<td>0.2573*** (29.34)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lot Sq Feet 1000s</td>
<td>0.0000001</td>
<td>0.0000001</td>
<td></td>
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<tr>
<td>One Story Dummy</td>
<td>0.0564*** (5.80)</td>
<td>0.0510*** (5.23)</td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>No Garage Dummy</td>
<td>-0.1776** (-16.27)</td>
<td>-0.1482** (-13.78)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Fireplace Dummy</td>
<td>-0.1001*** (-9.53)</td>
<td>-0.0820*** (-7.88)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bedrooms</td>
<td>0.0041</td>
<td>0.0118*** (1.18)</td>
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<td></td>
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<tr>
<td>Full Baths</td>
<td>0.0605*** (6.24)</td>
<td>0.0569*** (5.85)</td>
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</tr>
<tr>
<td>Half Baths</td>
<td>0.0492*** (5.05)</td>
<td>0.0464*** (5.85)</td>
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<td></td>
</tr>
<tr>
<td>Sewer Dummy</td>
<td>0.1264*** (13.48)</td>
<td>0.1061*** (11.19)</td>
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<td>Wood Exterior Dummy</td>
<td>-0.0306** (-3.02)</td>
<td>-0.0291** (-2.87)</td>
<td></td>
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</tr>
<tr>
<td>Brick Exterior Dummy</td>
<td>0.0647*** (6.68)</td>
<td>0.0877*** (9.17)</td>
<td></td>
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<tr>
<td>Lap Exterior Dummy</td>
<td>-0.0043</td>
<td>0.0002</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Vinyl Extiotor Dummy</td>
<td>-0.0084</td>
<td>-0.0053</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tile Roof Dummy</td>
<td>0.0506*** (5.19)</td>
<td>0.0359*** (3.66)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metal Roof Dummy</td>
<td>0.1014*** (10.67)</td>
<td>0.0598*** (6.16)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slate Roof Dummy</td>
<td>0.0854*** (8.91)</td>
<td>0.0655*** (6.77)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shake Roof Dummy</td>
<td>0.0788*** (8.20)</td>
<td>0.0496*** (5.09)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contemporary Dummy</td>
<td>0.0120*** (1.21)</td>
<td>0.0085*** (0.85)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mediterranean Dummy</td>
<td>0.0011</td>
<td>0.0025</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explanatory Variable</td>
<td>Coefficient</td>
<td>Standard Error</td>
<td>t-Value</td>
<td>P-Value</td>
<td></td>
</tr>
<tr>
<td>----------------------</td>
<td>-------------</td>
<td>----------------</td>
<td>---------</td>
<td>---------</td>
<td></td>
</tr>
<tr>
<td>Victorian Dummy</td>
<td>0.0889**</td>
<td>(9.29)</td>
<td>0.0161</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Years Old</td>
<td>-0.0052****</td>
<td>(-0.52)</td>
<td>-0.0061****</td>
<td>(-0.61)</td>
<td></td>
</tr>
<tr>
<td>Years Old Squared</td>
<td>0.00005***</td>
<td>(0.005)</td>
<td>0.00005***</td>
<td>(0.005)</td>
<td></td>
</tr>
<tr>
<td>Years Since Remodeled</td>
<td>-0.0039***</td>
<td>(-0.39)</td>
<td>-0.0037***</td>
<td>(-0.37)</td>
<td></td>
</tr>
<tr>
<td>Horse Property Dummy</td>
<td>0.1671***</td>
<td>(18.20)</td>
<td>0.1550***</td>
<td>(16.76)</td>
<td></td>
</tr>
<tr>
<td>Community Service District Dummy</td>
<td>-0.0315***</td>
<td>(-3.10)</td>
<td>-0.0202***</td>
<td>(-2.00)</td>
<td></td>
</tr>
<tr>
<td>Covenant Restriction Dummy</td>
<td>0.0009</td>
<td></td>
<td>0.0002</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neighborhood Association Dummy</td>
<td>-0.0084*</td>
<td>(-0.83)</td>
<td>-0.0034</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neighborhood Association Dues</td>
<td>0.00003</td>
<td></td>
<td>0.00003**</td>
<td>(0.003)</td>
<td></td>
</tr>
<tr>
<td>Tenth Mile REOs in Quar.</td>
<td>-0.0059***</td>
<td>(-0.59)</td>
<td>-0.0061***</td>
<td>(-0.61)</td>
<td></td>
</tr>
<tr>
<td>Quarter Mile REOs in Quarter</td>
<td>-0.0018***</td>
<td>(-0.18)</td>
<td>-0.0019***</td>
<td>(-0.19)</td>
<td></td>
</tr>
<tr>
<td>One Mile REOS in Quarter</td>
<td>-0.0003***</td>
<td>(-0.03)</td>
<td>-0.0003***</td>
<td>(-0.03)</td>
<td></td>
</tr>
<tr>
<td>Fraction Zip REO in Quarter</td>
<td>-0.0556**</td>
<td>(-5.41)</td>
<td>-0.0431**</td>
<td>(-4.22)</td>
<td></td>
</tr>
<tr>
<td>Own REO Dummy</td>
<td>-0.1803***</td>
<td>(-16.50)</td>
<td>-0.1574***</td>
<td>(-14.56)</td>
<td></td>
</tr>
<tr>
<td>Days on Market 100s</td>
<td>-0.0134***</td>
<td>(-1.33)</td>
<td>-0.0110***</td>
<td>(-1.10)</td>
<td></td>
</tr>
<tr>
<td>Quarter Two Dummy</td>
<td>-0.0468***</td>
<td>(-4.57)</td>
<td>-0.0492***</td>
<td>(-4.80)</td>
<td></td>
</tr>
<tr>
<td>Quarter Three Dummy</td>
<td>-0.1010***</td>
<td>(-9.61)</td>
<td>-0.1029***</td>
<td>(-9.78)</td>
<td></td>
</tr>
<tr>
<td>Quarter Four Dummy</td>
<td>-0.1808***</td>
<td>(-16.54)</td>
<td>-0.1778***</td>
<td>(-16.29)</td>
<td></td>
</tr>
<tr>
<td>Quarter Five Dummy</td>
<td>-0.2830***</td>
<td>(-24.65)</td>
<td>-0.2799***</td>
<td>(-24.42)</td>
<td></td>
</tr>
<tr>
<td>Quarter Six Dummy</td>
<td>-0.3052***</td>
<td>(-26.30)</td>
<td>-0.3023***</td>
<td>(-26.09)</td>
<td></td>
</tr>
<tr>
<td>R-Squared</td>
<td>0.8725</td>
<td></td>
<td>0.8716</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lamda</td>
<td>--</td>
<td></td>
<td>0.2564***</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Two-tailed statistical significance: *** >= 99th percentile, ** = 95th to 99th percentile, * = 90th to 95th percentile.
A full set of 60 zip code dummies included, but results not recorded.

A unit increase in respective explanatory variable yields this percentage increase in home price.
the k-nearest neighbor approach with two neighbors, Clauretie and Daneshvary (2009) used eight neighbors, and Leonard and Murdoch (2009) included all neighbors within 2000 feet because this gave every house sale in their data set at least one neighbor.

For the spatial regression results recorded in Table 2, I ran both the spatial lag and spatial error model. The Akaike Information Criterion and the log likelihood statistics calculated for these models indicate that the spatial error model is the more appropriate and thus reported here (Lochl, 2007 also found the spatial error model more appropriate). Regarding the suitable number of neighbors to include in the weight matrix when running the spatial error model, I allowed k to vary from one to 12 neighbors. The Moran’s I statistic calculated for each regression that used a different value of k identified the most appropriate number of neighboring houses for inclusion as one.

The statistical significance (always defined here at the 90 percent or better confidence level in a two-tailed test) of the Lamda regression coefficient in the spatial error model indicates the presence of spatial autocorrelation in the ordinary least squares estimation. Its positive sign indicates that errors made in the prediction of neighboring home prices, positively influence the error made in the prediction of a home’s price. Thus, as compared to ordinary least squares (OLS), the spatial error model results are the more appropriate to consider. As shown in Table 2, they differ from the OLS results in that two explanatory variables (Victorian Dummy and Neighborhood Association Dummy) lost statistical significance, while two other variables (Neighborhood Association Dues and Bedrooms) gained it. Of the explanatory variables found statistically significant in both regression models, the elasticity of the vast majority of these declined in the spatial error model.
The statistically significant elasticities recorded in Table 2 for the spatial error model are all reasonable in sign and magnitude. The calculated effect of a two percent decrease in the price of a home in a community service district is logical if the typical homeowner values the additional services available in such a district, less than the increased fees levied on the home to finance them. While the positive influence of neighborhood association dues – a $100 increase in these yearly dues raising selling price by 0.3 percent – shows that neighborhood associations offer positive value to a home the more they do (as measured by the amount of dues collected to do it). The statistical significance and the respective positive and negative directional effects on Years Old and Years Old Squared, indicate that the vintage of a home has a decreasing negative effect on its selling price until it is around 61 years old. Similar quadratic specifications were tried for the explanatory variables Years Since Remodeled and Days on Market, but in both cases the quadratic variable was statistically significant.

The own effect of a home being REO when sold is a 14.6 percent decrease in price from a home with the same characteristics controlled for in the regression specification. This is lower than the 20 to 27 percent REO discount calculated in earlier studies. However, it does match the expectation put forward by Claretie and Danshevary (2009) that if controlling for property condition – as at least partially done here with Years Since Remodeled – the REO effect is expected to be about one-third of that if not controlled for.

Getting to the explanatory variables of interest for the primary purpose of this paper, all of the measures of the external neighborhood effects of foreclosure are statistically significant. An additional home within a tenth of a mile, sold by a financial institution that had taken possession of it through mortgage foreclosure, reduced the selling price of a home by 0.61 percent. Between a tenth and a quarter mile, the effect of an additional REO home sale reduced
selling price by 0.19 percent. Between a quarter mile and a mile, the neighborhood effect per REO sale fell to a 0.03 percent reduction. This last effect may seem small, but note that the average number of REO homes within a mile of the homes in this data set is 313; thus, on average this results in 9.4 percent reduction in selling price.

In comparison, the -0.61 percent external effect of a foreclosed home within a tenth of mile, and the 0.19 effect for between a tenth and quarter mile, are near or slightly below the magnitudes calculated for similar distances in earlier studies. What is unique here is that the third ring of calculated external effects extends to as far as one mile from the home sold. Only the research of Leonard and Murdoch (2009) found a significant effect of neighboring REO sales in a zone that extended as far as 0.85 miles from a sales location. Most other studies found neighborhood foreclosure effects that only extended as far as a quarter mile. Even more important to the claim of an external effect more pervasive in this sample than in the past is the finding that the neighborhood effect extends throughout a zip code. Never detected before, and over and above the within one mile external neighborhood effects already discussed, the sales price of a home in the Sacramento Region in the late 2000s is expected to fall have fallen in percentage terms by the decimal percentage of homes sold in the same zip code and quarter, multiplied by 4.22. Thus, if 61 percent of the homes in a zip code are REO sales (as was the average observed here), home price on average declined about 2.6 percent from the influence of the sale of bank-owned homes in a zip code.

Conclusion

Under restrictive assumptions, it is reasonable to argue that the decision to offer and accept a residential mortgage is a private market activity not needing government interference. However, economists point out that this is only the case if information asymmetry and negative external
effects are insubstantial in the private mortgage market. Information asymmetry exists when one party to the mortgage process knows more about the details and risks of the transaction. As Immergluck (2008) describes, the growth in the proportion of subprime and exotic mortgages held by the poor and less educated is likely, in part at least, due to financial institutions knowing more about the details and risk of these instruments than those using them as a way to finance home ownership. Thus, government intervention in the form of greater third-party counseling to prospective mortgage borrowers on choosing a mortgage form and/or regulation on who can use a particular form of a mortgage is likely in order. However, the intent of this research is not to investigate information asymmetry in mortgage lending, but instead an empirical examination of a second form of market failure that also justifies government involvement in private mortgage markets. Specifically this research uses regression analysis to document the existence and magnitude of the negative neighborhood effects of mortgage foreclosure for a United States metropolitan area hit particularly hard by it during the crisis of the late 2000s.

If you or your financial institution’s choice of a new mortgage instrument, or decision to foreclose on a mortgage, affects third parties that are not involved in these decisions, then there may be a role for public intervention into private mortgage markets. A personal explanation of this economic logic is that even if your home faces no possible threat of foreclosure, you would rationally support public policies that reduce neighboring foreclosures if the external cost of these foreclosures to you is greater than your cost as a taxpayer to put the policies in place. However, to make such an assessment accurately you need to know the cost of nearby foreclosures on your home’s value. An estimate of such for a major United States metropolitan area hit particularly hard by the foreclosure crisis that struck the entire country in the second half of the 2000s is possible using the regression findings just offered.
Calculating the external effects of residential foreclosure in the Sacramento Metropolitan Area

For the 18-month period from January 2008 until June of 2009, 36,833 single-family homes sold in 61 different Sacramento Metropolitan Area zip codes. The total market value of these transactions was $9.0874 billion. Only 38 percent of these home sales were non-REO. The market value of these non-REO home sales was $4.5530 billion.

The hedonic regression analysis just described found that the selling price of these non-REO homes, holding all else constant, were lower due to at least four distinct external effects: (1) each REO sale within a tenth of a mile in the quarter a home sold, reduced its sales price by 0.61 percent, (2) each REO sale between a tenth and quarter of mile in the quarter a home sold, reduced its sales price by 0.19 percent, (3) each REO sale between a quarter and one mile in the quarter the home sold reduced its sales price by 0.03 percent, and (4) each percentage point rise in the percentage of home sales in zip code that are REO reduced sales price by 0.04 percent. Using these statistically significant effects and the average measures of the prevalence of foreclosure for each residential property by distance or throughout the zip code, the external effect of REOs is around a $1.1012 billion\(^1\) reduction in the price of non-REOs over the 18-month period observed for the Sacramento Area. This loss in value represents a 31.9 percent \([-\frac{1.1012}{4.553}+1.1012]\) drop in market value from what non-REO homes would have sold for if no REO sales occurred in the same quarter. Since there were 22,553 non-REO homes sold over this period, this price decline averaged $48,827 per home. For comparison sake, this per-home estimate far exceeds the $7,200 per home price decline in the United States (a $14,891 decline for California) due to nearby foreclosures that the Center for Responsible Lending (2009) estimated for 2009. The basis of such estimates being effects drawn from an approximation

\(^1\) Calculated as \([\frac{4.5530}{1+(0.6125*-0.0422)}] - 4.5530\] + \([\frac{4.5530}{1+(8.78*-0.0061)}] - 4.5530\] + \([\frac{4.5530}{1+(27.41*-0.0019)}] - 4.5530\] + \([\frac{4.5530}{1+(313.44*-0.0003)}] - 4.5530\]
taken from of the previously described regression studies that utilized data sets from before the late 2000s foreclosure crisis.

Furthermore, the approximate $1.1 billion reduction in the sales price of 22,000 plus Sacramento Area non-REO homes during the 18 months under consideration is a low-end estimate. It does not account for two other external effects that exist, but whose size is impossible to calculate with the empirical methods used here. The first is a similar per-home loss in market value to all other non-REO homes in the area not sold over this period. Of course, this is an unrealized loss, but it still is a negative external effect imposed upon those looking to tap into the reduced value of their home’s equity after neighbors default on their mortgage. In addition, unrealized losses in market value likely reduce the amount of local property tax revenue collected. In California – in which local government after Proposition 13 are required to use acquisition value based assessment in the collection of property taxes – this is most likely to affect jurisdictions with a high proportion of homes that sold just before or at the start of the housing downturn. Such homeowners are more likely able to appeal successfully their acquisition-based property assessment to a lower value. The result being lower local property tax bases, with no ability in post-Proposition 13 California for local jurisdictions to raise the one percent rate applied to them, and subsequently a reduction in locally provided public services that fall upon all homeowners. This is a second external effect of a home under no threat of mortgage foreclosure being in proximity to REO home sales.

Policy implications

This paper has described the magnitude of the foreclosure crisis that struck the United States in the second half of the 2000s, and hit some metropolitan areas like Sacramento particularly hard. The major policy implication to take away from this investigation is that the calculated external
effects of this crisis are very likely large enough to justify government actions to curtail foreclosure activity when it reaches the magnitude of foreclosure activity observed in the Sacramento Region.

Others (Immergluck, 2008; Kingsley, Smith, and Price, 2009; and Nelson, 2009) have already described the three different forms that government intervention into private single-family mortgage markets could take. The first is trying to slow foreclosures among existing mortgage holders. Government policies in this form include encouragement and/or regulation directed at financial institutions for greater modification of existing mortgage terms, greater short sales, greater allowance for qualified buyers to assume previously classified non-assumable mortgages, and greater forgiveness of debt on properties with underwater mortgages. The second form of public intervention is reducing the likelihood of future foreclosure for those not yet holding a mortgage. Policy options in this form include greater regulation of subprime, exotic, and even high-risk prime mortgage lending; offering Community Reinvestment Act credit to a financial institution for overall responsible mortgage practices and/or refinancing a previously “predatory” loan, and even reconsidering the previous housing policy push of encouraging home ownership for all. Finally, a third form of public intervention after foreclosure occurs is encouraging/requiring the institutional owner of the vacant property to sell it sooner. A reduction in vacancy rates in a neighborhood should reduce the external effects of greater blight and crime that high vacancy rates can spawn.

As of mid-2010, the major federal programs in place to curtail foreclosures include the United States Federal Housing Authority (2010) Hope for Homeowners Program and the United States Treasury (2009) Making Home Affordable Plan. Operating with extensive restrictions on who can qualify and using federal financial backing that amounts to hundreds of billions of
dollars, the intent of both of these federal interventions is to make it easier for a mortgage holder to refinance an existing balance at terms that are more desirable. As noted by Simon (2009), the success of these federal programs has been limited. Many observers believe this is the case because most holders of underwater mortgage find it unpalatable to refinance a home with a mortgage loan greater than the home’s market value. Instead, most prefer instead to default on an underwater mortgage. Understanding this, a more appropriate intervention would be instead to forgive mortgage principal. This is exactly the tactic taken by new public policies designed to curtail this foreclosure crisis at both the federal and state levels in mid-2010 (Streitfeld, 2010; and Wasserman, 2010).

In conjunction with federal and state policies designed to slow mortgage foreclosures, that usually entail an infusion of new public dollars or new mortgage regulations, it is also important to consider more localized efforts. Immergluck (2008) describes the role that local planning policy can play in curtailing foreclosure. Johnson, Turcotte, and Sullivan (2010) specifically prescribe a methodology to determine the foreclosed homes a municipality should purchase to stabilize a neighborhood. Furthermore, Kingsley, Smith, and Price (2009) stress the importance of developing a coordinated local response to variation in the causes of home mortgage foreclosure that occurs across neighborhoods. Quercia and Cowan (2008) offer evidence on the positive impact of such a response in Minnesota communities. To increase the efficacy of such efforts, one reform the federal or state governments may want to consider is a requirement for mandatory mediation in the foreclosure process. As observed by Jakabovics and Cohen (2009) for the Center for American Progress, in the late 2000s at least 80 percent of United States’ homeowners at risk of default had not discussed the situation with their mortgage lender. Such non-communication illustrates the need for a structured mediation process between
mortgage lender and holder at least once after the filing of *Lis Pendens*, and before the foreclosure sales takes place. They point to the success of such mediation in curbing the number of foreclosures in the City of Philadelphia and State of Connecticut.

**References**


Harding, John, Eric Rosenblatt, and Vincent Yao. 2009. The contagion effect of foreclosed


Wasserman, Jim. 2010, June 24. California to offer program to trim underwater mortgages. The Scaramento Bee.  