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Estimates of the Size and Source of Price Declines Due to Nearby Foreclosures

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Estimates of the Size and Source of Price Declines Due to Nearby Foreclosures: Evidence from San Francisco *

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Abstract

Using a novel dataset which merges real estate listings with real estate transactions in San Francisco from 2007-2009, we present new evidence that foreclosures causally depress nearby home prices. We show that this decrease occurs only after the foreclosed home is listed for sale, which suggests that the effect is due to the additional housing supply created by foreclosure rather than from neglect of the foreclosed property. Consistent with a framework where a foreclosed home simply increases supply, we find that new listings of foreclosed homes and non-foreclosed homes each lower sales prices of homes within 0.1 miles of the listing by 1 percent.

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1 Introduction

Since 2007, house prices have fallen and foreclosures have surged in many parts of the United States. Two questions that have received much attention from policy makers are whether foreclosures are contributing to, or are merely a symptom of, the price decline, and if so, how? The answers to these questions are important because foreclosure externalities may justify government intervention into the housing and mortgage markets, and the appropriate type of intervention depends crucially on the source of the externality.[1]

There are two main mechanisms through which foreclosures may reduce house prices. The first, which we call the "disamenity effect", is that the owners of foreclosed properties may not maintain the homes, and the associated neglect and vandalism may create a negative externality on nearby homes. The second, which we call the "competitive effect", is that foreclosures increase the supply of homes on the market, which should lower prices in a standard model of differentiated products price competition. This effect may be especially strong if banks price their homes more aggressively because they are more motivated to sell than the typical seller (Campbell et al. [2011], Springer [1996]). However, we should not take the presence of either of these effects as given. First of all, banks ultimately need to sell the foreclosed properties, and so they have an incentive to maintain the condition of the property. Second, housing markets are characterized by significant search frictions (Wheaton [1990], Krainer [2001], Novy-Marx [2009]), and so the predictions of standard price competition models need not apply.[2]

Several studies in recent years have focused on estimating the effect of foreclosures on house prices using rich micro data on housing transactions (Lin et al. [2009], Immergluck and Smith [2006], Harding et al. [2009], Campbell

[1] See the motivation for the Obama Administration's *Making Home Affordable* plan (US Treasury 2009) and a Federal Reserve staff paper to the Congress ("The U.S. Housing Market: Current Conditions and Policy Considerations" January 2012) as examples of how these issues are attracting much attention from policy makers.

[2] For example, Turnbull and Dombrow [2006] find evidence that more supply induces more buyers to shop for homes, which has the potential to offset the negative competition effect.

et al. [2011]).[3] These studies are largely distinguished by how each deals with a difficult identification problem: given that price decline is a necessary condition for foreclosure, homes that are nearby foreclosures will have lower prices for reasons that are independent of the foreclosure itself. Two prominent papers, Campbell et al. [2011] and Harding et al. [2009], both find that a foreclosure reduces nearby house prices by about 1 percent. Harding et al. [2009] use a repeat sales approach to control for time-invariant unobserved home quality of homes nearby foreclosures, although they only allow prices to trend differentially at the MSA level, and thus it is difficult to separate their interpretation from a preexisting downward price trend in neighborhoods that are nearby foreclosures. Campbell et al. [2011] use a difference-in-difference approach to better control for this. For homes within 0.1 miles of a foreclosure, they compare sales prices for homes that sell a year before and a year after the foreclosure. They use price changes for homes within a broader radius to control for preexisting local price trends. However, there is still the concern that homes in their treatment group trend differently from homes within their control group, as the authors themselves acknowledge, and they are unable to decompose their estimate into a disamenity effect and/or a competitive effect. To summarize these and other existing papers, there is some evidence that foreclosures reduce nearby house prices, although causality is not definitive, and there is little evidence on the source of the price decline.[4]

In this paper, we address these outstanding questions by supplementing the type of housing transaction data used in the existing studies with new data from the Multiple Listing Service (MLS), which is the dominant platform through which homes for sale are advertised in the US. Our combined dataset, which covers the universe of single-family home listings in the San Francisco

[3]There is a related literature that studies the impacts of foreclosures on other outcomes, including crime (Ellen et al. [2011]), racial composition of neighborhoods (Lauria and Baxter [1999]), and health (Currie and Tekin [2011]). Goodstein et al. [2011] and Guiso et al. [2009] look at whether foreclosures lead to more foreclosures.

[4]Harding et al. [2009] concludes that the root cause of the externality is the disamenity effect because the contagion effect is largest during the year preceding the foreclosure sale. The data in Harding et al. [2009] is from 7 MSAs across the country. The data in Campbell et al. [2011] is from Massachusetts.

metro area from January 2007 - June 2009, provides two pieces of information that have not been available to previous studies: the dates that REOs are on the market for sale, including the entry and exit date, and the list prices for all active home listings at any given week.[5] We use this new information to make three main contributions to the literature. First, by exploiting the exogeneity of the precise timing of a new listing, we present new evidence that foreclosures have a causal effect on nearby house prices. Second, we show that the competitive effect, rather than the disamenity effect, is the important source of price declines in our sample. Third, we show that on average, the local effects of new REO supply are comparable in magnitude to the local effects of new non-REO supply. There is no evidence that aggressive pricing by motivated lenders leads to extraordinarily stiff competition, on average.

We find strong evidence that the local market responds to the REO rather than the reverse or to some correlated unobservable when we compare local list prices immediately before and after a new REO listing. List prices, which are recorded every week that a home is on the market and for all homes, regardless of whether they eventually sell, provide enough observations within short time periods and narrow geographic areas to get precise estimates. We find that sellers are 12 percent more likely to adjust their list price downwards in the exact week that a single REO enters the market nearby; they are no more likely to adjust their list prices in the several weeks before and after entry. Our preferred specification includes week and city fixed effects, and we present several findings in support of the identification assumption that the precise timing of a listing is not correlated with a local shock that causes nearby listings to lower their list prices.

Having established new evidence of causality, we use the difference-in-difference framework of Campbell et al. [2011] to test for the effects of REO listing on sales prices over time. The main difference relative to Campbell et al. [2011] is that we look before and after the listing date, rather than the foreclosure sale date, to isolate the time period when the REO is compet-

[5]REO stands for Real Estate Owned, and is the classification used after the foreclosure sale is completed and the property is owned by the lender.

ing against neighborhood listings for buyers. Any price differential that we find centered around the listing date should not be due to a disamenity effect because any disincentives to maintaining the property should have begun to emerge closer to the foreclosure date, which is usually multiple months before the listing date. Once the property is listed for sale, the seller (and potentially the listing agent) has more incentive to preserve the quality of the property as potential buyers may be visiting and inspecting the house.

Our estimates of the competitive effect are very comparable to the total foreclosure externalities estimated in Campbell et al. [2011] and Harding et al. [2009]. We find that while a single REO is on the market for sale, the sales price of a typical home within 0.1 miles of the REO is 1 percent lower on average. The cumulative effect is -3.2% for exactly two REO listings and -5% for more than two. These price declines are temporary. After the REO sells, prices recover to the pre-listing levels within 6 weeks for a single REO listing and within 12 weeks for multiple REO listings.

To further investigate the nature of the competitive effect, we compare the neighborhood response to new REO listings with the neighborhood response to new non-REO listings. If the price effects that we find in response to new REO listings are truly due to a competitive effect, then the price response to new non-REO listings should have a similar pattern. This is exactly what we find in the data. Sellers adjust their list prices downwards in the exact week that the new non-REO listing hits the market, sales prices decline while the non-REO remains listed for sale, and then recover once the property sells.

We find that the magnitude of the sales price decline in response to a single new, non-REO listing is comparable to the decline from a new, single REO listing. However, when we condition on whether the new listing is a close substitute with the neighboring listings, we find that an REO that is similar in observables to its neighbors depresses local prices by 1.4 percent more than a comparable non-REO listing. Placed within the context of a model of differentiated products price competition, this finding combined with our other results suggests that banks tend to price their homes more aggressively than the typical non-REO seller, but that the extra competitive effect of this aggressive pricing is softened by the fact that REO homes tend to be more differentiated from their neighbors.

Our results indicate the presence of a competitive effect. We test for a disamenity effect by testing for price changes during the months before foreclosure, and the months after foreclosure but before the foreclosure is listed for sale on the MLS. This is when delinquency and eviction occur, and is precisely when the condition of the property is likely to deteriorate. We do not find any evidence that the average home nearby a single foreclosure declines in price during the 10 months before foreclosure, or in the 6 months after foreclosure and before listing. Thus, for the typical foreclosure, we find that the competitive effect is a significantly more important externality than the disamenity effect.

Finally, we test whether foreclosures affect other selling outcomes in addition to sales price. We find that a single new REO listing increases the time to sell (also called time on market (TOM)) of nearby homes by about 3.5 percent. Multiple new REO listings increase TOM by about 15 percent. Estimates of the effects of foreclosures on TOM are new to the literature, and are important because it is usually costly for sellers to keep their homes on the market.

Our findings suggest that new REO and non-REO listings have a similar effect on *local* prices. However, this insight does not imply that new REO and non-REO supply have the same effect on aggregate prices. In the case of non-REO sales, the seller often offsets the supply externality in one local area with an increase in demand in another when purchasing the next house. For REO sales, the delinquent borrower is unlikely to re-enter the housing market as a buyer.[6] Thus, our estimates for REOs may be closer to the total effect of an additional foreclosure on the housing market, while our estimates for non-REOs probably overstate the aggregate effect of additional supply.

A recently released working paper by Gerardi et al. [2012] tests for foreclosure externalities using additional information on delinquency dates and a wider sample of cities.[7] The authors' conclusions on disamenity effects are

[6]See Molloy and Shan [2011] for empirical evidence of this.

[7]If delinquency, rather than foreclosure, is the event that triggers reduced investment

similar to ours: they find that disamenity effects are not a significant source of price decline on average.[8] While they do not find any evidence of a competitive effect, we argue that our identification strategy for the competitive effect is more powerful since we have access to listing data, which reports the exact dates that the REO is on the market and competing for buyers. Mian et al. [2012] and Hartley [2010] also find evidence of a competitive effect using different identification strategies. We are currently working to acquire listing and transaction data for an additional set of cities to test whether our findings depend on any unique features of the San Francisco market.

This paper proceeds as follows. Section 2 provides background information on the foreclosure process in California since the timing of this process is key for understanding our identification strategy. Section 3 introduces the data and present summary statistics. Sections 4 and 5 investigate the effects of REO listings on list price changes, sales prices, and TOM. Section 6 compares these competitive effects to the competitive effects of non-REO listings. In Section 7, we test for a disamenity effect, and Section 8 concludes the paper.

2 Background on the Foreclosure Process in California

Almost all foreclosures in California are handled out of court. After the borrower misses a mortgage payment, the lender issues the borrower a notice of default. If no foreclosure avoidance plan has been worked out and if the borrower does not cure the default within 90 days of the notice, a note is posted on both the property and in one public location announcing that the home will be auctioned off in no less than 21 days. The auction is public, and the lender typically makes an opening bid equal to the amount of the loan balance plus costs that accrue during the foreclosure process. Ownership of the property

in the property, then an identification strategy that exploits price differences around delinquency dates is a more powerful test for disamenity effects than the one used in this paper.

[8]The authors' differences-in-differences estimate is -.5 percent while ours is statistically significant.

is transferred to the winning bidder, which is usually the lender, at a closing following the foreclosure auction.[9] The date of this closing is often called the foreclosure sale date. If the delinquent borrower(s) are still present after the sale, the new owner must follow California legal procedures for eviction. This process usually takes about 30-45 days. In some cases, however, the delinquent borrower will accept a "cash-for-keys" payment to bypass the eviction process. The entire foreclosure process typically takes about 4-7 months.[10] The foreclosure process in non-judicial states like California is typically faster than in judicial states.[11]

If the lender receives control of the property after the auction, they typically transfer it to their REO department, which prepares it for sale on the market to the general public. In most cases, the lender will work with a realtor to get the property listed on the MLS. Our data suggests that REOs appear on the MLS 3 months after the foreclosure auction on average, although there is a significant amount of variation in this window length.

3 Data

We use home sale and listing data for the core counties of the San Francisco Bay Area: Alameda, Contra Costa, Marin, San Francisco, San Mateo, and Santa Clara. The listing data comes from Altos Research, which provides information on the universe of single-family home listed for sale on the Multiple Listing Service (MLS) from January 2007 - June 2009. According to the National Association of Realtors, over 90 percent of arms length home sales were listed on the MLS in 2007. Every Friday, Altos Research records the address, mls id, list price, and some characteristics of the house (e.g. square feet, lot size, etc.) for all houses listed for sale. From this information, it is easy to infer the date of initial listing and the date of delisting for each property.[12] A property is

[9]Campbell et al. [2011] find that this happens in 82 percent of cases.

[10]http://www.foreclosures.com/foreclosure-laws/california/.

[11]See Pence [2006] and Lender Processing Services Monitor monthly reports.

[12]The initial listing date is censored for properties that are already on the market when our sample begins, and the delisting date is censored for those that are still on the market

delisted when there is a sale agreement or when the seller withdraws the home from the market. Properties are also sometimes delisted and then relisted in order to strategically reset the TOM field in the MLS. We consider a listing as new only if there was at least a 180 day window since the address last appeared in the listing data.[13] The MLS data alone does not allow us to distinguish between delistings due to sales agreements or withdrawals, nor does it identify which listings are REO listings.

For these reasons, we supplement the MLS data with a transactions dataset from Dataquick that contains information about the universe of housing transactions in the SF metro area from 1988-2009. In this dataset, the variables that are central to this analysis are the address of the property, the date of the transaction, the sales price, the latitude and longitude of the property, the name of the buyer and seller, and an indicator for whether the transaction is arms length.

Using the address, we merge the listing data with the transaction data. The data appendix describes the details of the merge and how we use the variables in the transaction data to identify REO listings and sales. Since foreclosures are typically recorded and thus appear in our transaction data prior to the listing of the REO on the MLS as discussed in Section 2, the availability of the transaction data back to 1988 ensures that there are no censoring issues in our identification of new REO listings. The data appendix also describes minor restrictions to the estimation sample (e.g. exclude properties with zero square feet).

Another advantage of MLS data is that we can observe the date when the buyer and seller agree on the sales price.[14] We use the agreement date as the sale date in all of our analyses since the sales price reflects housing market

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when our sample ends. We account for this censoring in our analyses below. See the Data Appendix for more details.

[13]If the window is less than 180 days, we assume the property remained on the market during that interval at a list price equal to the list price in the final week before the gap begins. We tried a window size of 90 days and the main results are unchanged.

[14]We assume that the agreement date is the date that the property is delisted from the MLS since the Bay Area MLS has a system of rules and fines in place to ensure that listings are updated promptly when a sale agreement occurs. See www.bareis.com for details.

conditions at the time of agreement. The existing literature uses the closing date, which is the date when the buyer takes ownership of the home, to classify sales into, for example, pre and post foreclosure. Since closing dates lag agreement dates and the length of the lag is idiosyncratic to each transaction (see Table 1), the additional information provided by the agreement date reduces measurement error as well as bias in estimators that use a before and after comparison.

3.1 Summary Statistics

Table 1 presents summary statistics broken out by listing category for the data used in the analyses below. 30 percent of all sales are REOs in our sample. The median sales price of REOs is $315,000 compared to $725,000 for non-REOs. When we control for observable house characteristics and zip code by quarter fixed effects, the foreclosure sales price discount narrows, but is still economically and statistically significant at 15 percent (not reported).[15] This estimate is difficult to interpret because both low unobserved house quality and the fact that banks have relatively high holding costs potentially contribute to the price discount. Theoretically, we should expect banks to have higher holding costs because they are not receiving any rental income while the home is for sale. The typical non-bank seller lives in the home while it is for sale and thus continues to receive the consumption benefits from the house each period that it does not sell. A higher holding cost should translate into lower prices in an illiquid market such as the housing market. That REOs are more likely to change the list price and are more likely to be sold rather than withdrawn as shown in Table 1 is consistent with a model where banks are more motivated to sell than the typical seller, on average (see Anenberg [2012]).[16]

Table 2 shows the count of REO and non-REO transactions by county during our sample period. REOs tend to occur in areas where average house prices and incomes are lower than average. Relative to the entire country, the

[15]The discount is the same when we use the list price rather than the sales price as the dependent variable.

[16]See footnote 24 for an explanation of why REO TOM is high.

San Francisco area experienced high price declines and high foreclosure rates during our sample period. From 2007 to 2009, nominal prices, as reported by the Case-Shiller index, fell 36 percent in San Francisco compared to 28 percent in the 20-city composite. The foreclosure rate per household was higher than the national average in 4 of the 6 counties in our sample.[17]

4 Testing for a Causal Effect

We cannot identify foreclosure externalities by simply comparing sales prices of homes nearby foreclosures with prices of homes further away. Households that do not have enough wealth to absorb negative income shocks are more likely to default, and these very households are more likely to live in lower-amenity neighborhoods where the homes are of lower quality. Table 1 illustrates the importance of controlling for differences in homes nearby foreclosures. Houses that sell within 0.1 miles of a REO listing tend to be smaller and of significantly lower value. We can control for some of the differences in attributes, but we should be concerned that these homes differ along unobserved attributes as well.

One way to control for this is to compare sales prices before and after foreclosure, as in Campbell et al. [2011]. Due to the thinness of sales volume in local areas, the before and after periods need to be long – a year each in Campbell et al. [2011] – in order to have enough precision. However, this introduces an additional source of endogeneity. Since price decline is a necessary condition for foreclosure, a foreclosure will tend to occur in a neighborhood that is declining in price at a faster than average rate. Endogeneity and the causal effect both create a correlation between the presence of a foreclosure and neighborhood price declines, and thus this approach cannot be definitive on whether foreclosures causally affect neighboring prices.

[17] Data comes from RealtyTrac Foreclosure Market Report from 2008. The two counties where the foreclosure rate is lower are San Francisco and Marin.

4.1 Econometric Specification

To control for these concerns, we look at the likelihood that homes on the market that are nearby new REO listings adjust their list price during a short window around the week that the REO is first listed for sale. If the exact week that the REO hits the market is not correlated with a local shock that causes nearby sellers to adjust their list prices, then any movement in list price is strong evidence that existing listings are responding to the entry of the REO. List prices, which are recorded every week that a home is on the market and for all homes, regardless of whether or not they eventually sell, provide enough observations within short time periods and narrow geographic areas to get precise estimates using this type of regression discontinuity design.

Table 1 shows that 9 percent of sellers adjust their list price in a given week and the average list price change is -7 percent. Only 4 percent of list price changes are increases. The correlation between list price at the time of sale and sales price is 0.98, and the correlation between list price at the time of listing and the eventual sale price is 0.95. These statistics suggest that list price changes are a useful metric for analyzing changes in home values.

This motivates estimation of the following linear probability model:

$$y_{i,j,t} = \sum_{m=>0,>1} (\delta_{1,m} NearbyREO^m_{i,j,t-4} + ... + \delta_{9,m} NearbyREO^m_{i,j,t+4} + \delta_{10,m} NearbyREO^m_{i,j,t} * Dist_i) + \alpha_j + \gamma_t + \beta X_{i,t} + \epsilon_{i,j,t} \quad (1)$$

where y_{ijt} is an indicator variable equal to 1 if house i in neighborhood j in week t changes its list price. $NearbyREO^{>0}_{i,j,t}$ is a dummy variable equal to one if listing i is within 0.5 miles of at least one (> 0) new REO listing that enters the market in week t. Thus, we estimate the propensity to change the list price in the 4 weeks before ($NearbyREO_{t+1}, ..., NearbyREO_{t+4}$) and the 4 weeks after ($NearbyREO_{t-1}, ..., NearbyREO_{t-4}$) REO entry in addition to the actual week of entry. $NearbyREO^{>1}$ denotes that a listing is nearby more than one new REO listing, and allows for multiple REO listings to have a different effect than a single REO single. $Dist_i$ is the distance (or average distance if there are multiple REOs), in miles, of house i to the REO. α_j is a set of neighborhood fixed effects, γ_t is a set of week fixed effects, and X_{it} is a vector of controls, which includes an indicator for whether the listing is an REO and the number of weeks that the home has been on the market.

$\delta_{5,>0}+\delta_{10,>0}Dist_i$ is the change in the propensity to adjust list price in week t if 1 REO $Dist_i$ miles from i enters in week t. $\delta_{5,>0}+\delta_{5,>1}+(\delta_{10,>0}+\delta_{10,>1})Dist_i$ is the change in the propensity to adjust list price in week t if multiple REOs at an average of $Dist_i$ miles from i enters in week t.

4.2 Results

Column (1) of Appendix Table 1 presents the results where neighborhood is defined as a city. Standard errors are clustered at the city level. The coefficients on the *Nearby* dummies are plotted in Figure 1 for distance=0. Sellers are no more likely to change their list prices in the 4 weeks before and the 4 weeks after a new REO listing. However, during the exact week of the REO entry, the probability that a seller adjusts their list price in response to an REO listing at a distance of zero increases by .007. Relative to the constant, this is an increase of 12 percent. The propensity to adjust price is declining in distance from the REO. An REO listing at a distance of .5 miles increases the propensity to adjust list price by only .002, and this estimate is not statistically significant.

As we would expect, the results are even stronger when multiple REOs are simultaneously listed for sale. When more than 1 new REO enters at a distance of zero, sellers are 28 percent more likely to adjust their list price in the exact week of entry relative to the weeks before and the weeks after.

We also run (1) with quarter-by-zip code fixed effects and house fixed effects in columns (2) and (3) of Appendix Table 1. The results are not sensitive to the type of fixed effects included. In Column (4) we change the dependent variable to the percentage change in list price conditional on a change in list price. The results show that sellers are indeed adjusting their list prices *downwards*, rather than upwards, when new REOs enter the market. Multiple REO listings elicit larger list price changes than single REO listings.

4.3 Discussion

The downwards price movements here are consistent with a competitive effect since the date when the REO enters the MLS is the date when the REO begins competing with nearby listings for buyers. In Appendix 1, we present a simple 2-seller model where in equilibrium, REOs do not affect prices until the time of listing even if one seller is informed about the REO listing date in advance. When the elasticity of the probability of sale with respect to the list price is sufficiently low, the informed seller finds it optimal to price as if he has no information about the impending REO listing. If both agents are uninformed, then this pricing pattern will emerge as well.

The price movements are not consistent with a disamenity effect. It is unlikely that disamenities would emerge over the course of a single week, and even if they do, there is no reason to expect that it would be correlated with the week that the house is first marketed for sale. This evidence alone does not imply that a disamenity effect does not exist. We describe how we test for the presence of a disamenity effect in Section 7.

That the competitive effect of multiple REO listings extends to a broader area than the effect of a single REO listing is consistent with a model of differentiated products price competition. For example, consider a static, logit demand model where buyer utility is a function of price, distance from the buyer's preferred location, and a logit error reflecting taste heterogeneity. Multiple properties further away can have a similar competitive effect as a single property closer-by. That the competitive effect declines with distance is also consistent with this type of model.

One potential concern is that REOs are more likely to enter the market during weeks when the local housing market conditions are particularly strong. However, we would expect to see upwards movement in list prices (or no movement since list prices are sticky) during the week of listing if this were the case.

In general, our identification assumption is reasonable because the precise timing of a listing is largely influenced by exogenous factors, such as when work to get the house "ready to show" is completed and the timing of various stages of the foreclosure process.[18]

5 Estimating the Size of the Competitive Effect

The previous section established new evidence that foreclosures themselves, rather than correlated unobservables, have a causal effect on the selling behavior of nearby listings. The particular effect that we identified above is most likely due to the increased competition from additional homes listed for sale. In this section, we estimate the effect of this increased competition on sales prices and marketing time of nearby home listings.

5.1 Econometric Specification

We use a difference-in-difference specification that closely follows Campbell et al. [2011]. We compare sales prices before the REO is listed for sale with sales prices during the listing period, before the REO sells or is withdrawn. Any price differential that we find here should not be due to a disamenity effect because any disincentives to maintaining the property should have begun to emerge closer to the foreclosure date. Once the property is listed for sale, the seller (and potentially the listing agent) has more incentive to preserve the quality of the property as potential buyers may be visiting and inspecting the house.

We use prices of homes within 0.333 miles of a foreclosure as a control group, and identify the competitive effects off of differences in prices of homes

[18]Our week fixed effects control for any market-wide shock, as well as any seasonality in listings and demand. In addition, banking supervisory policy typically encourages banks to sell REOs as quickly as possible, which limits the scope for strategic timing of listings (FRB staff Paper 2012).

within 0.1 miles.[19] The two key assumptions are that 1) homes values within 0.1 miles of the REO would not have been trending differently from home values within 0.333 miles of the REO listing in the absence of the foreclosure and 2) within this small geography, a REO should have differential effects on the prices of houses that are within even closer proximity. Our findings that the propensity to adjust list price is decreasing in distance from the REO supports assumption 2). We present evidence that supports assumption 1) below. Our main estimating equation is:

$$
\begin{aligned}
log(P_{ijt}) = & \sum_{m=>0,>1} (\delta_{\frac{1}{3},B,M} Before_{ijt}^{\frac{1}{3},M} + \delta_{\frac{1}{3},D,M} During_{ijt}^{\frac{1}{3},M}) + \\
& \sum_{m=>0,>1,>2} (\delta_{\frac{1}{10},B,M} Before_{ijt}^{\frac{1}{10},M} + \delta_{\frac{1}{10},D,M} During_{ijt}^{\frac{1}{10},M}) \\
& + \alpha_{jt} + \beta X_{it} + \epsilon_{ijt}. \quad (2)
\end{aligned}
$$

The variables within the summation are dummy variables and take on the value 1 when:

- $Before_{ijt}^{k,m}$: Sale i occurs between 1 and 45 days before m REOs enter the MLS. i is also within k miles of the REO listings.
- $During_{ijt}^{k,m}$: Sale i occurs during the listing period of m REOs (i.e. after the REOs enter, but before they sell or withdraw). i is also within k miles of the REO listings.

In the control group, we allow for different price trends in areas that experienced one or multiple foreclosures. In the treatment group, we further distinguish between the effect of one, two, and more than two local foreclosure listings as shown in the notation below the summation on the second line of equation (2).

The estimates of interest are:

[19] When we use a 0.25 mile radius for the control group as in Campbell et al. [2011], all of the main results are unchanged, except our estimates are less precise.

- $\delta_{\frac{1}{10},D,>0} - \delta_{\frac{1}{10},B,>0}$: The estimated effect of 1 REO listing on homes values of properties located within 0.1 miles of the listing, relative to homes within 0.1-0.33 miles of the listing.

- $(\delta_{\frac{1}{10},D,>0} + \delta_{\frac{1}{10},D,>1}) - (\delta_{\frac{1}{10},B,>0} + \delta_{\frac{1}{10},B,>1})$: The estimated effect of two REO listings on homes values of properties located within 0.1 miles of the listing, relative to homes within 0.1-0.33 miles of the listings.

- $(\delta_{\frac{1}{10},D,>0} + \delta_{\frac{1}{10},D,>1} + \delta_{\frac{1}{10},D,>2}) - (\delta_{\frac{1}{10},B,>0} + \delta_{\frac{1}{10},B,>1} + \delta_{\frac{1}{10},B,>2})$: The estimated effect of more than 2 REO listings on homes values of properties located within 0.1 miles of the listing, relative to homes within 0.1-0.33 miles of the listings.

In practice, instances where there are several simultaneous foreclosure listings within a local area are rare in our sample. For 27.5 percent of sales, $During^{\frac{1}{10},>0} = 1$. For 13.1 percent of sales, $During^{\frac{1}{10},>1} = 1$. For 6.8 percent of sales, $During^{\frac{1}{10},>2} = 1$.

The controls in equation (2) are a set of quarter-by-zip code fixed effects, property characteristics, an REO dummy, and TOM.

5.2 Results

5.2.1 Baseline Results

Table 3 reports the estimates from this model with standard errors clustered at the zip code-quarter level. We highlight several difference-in-difference estimates and their p-values in the panel above the full detail. The direct effect of an REO listing on home values for the average home within .1 miles of the REO relative to homes in the control group is about -1% and this diff-in-diff is statistically significant. The effect of two local REO listings is -3.2% and statistically significant. The effect of more than two REO listings is -5.2% and statistically significant.

Home prices within 0.1-0.33 miles decline by .6% ($\delta_{\frac{1}{3},D,>0} - \delta_{\frac{1}{3},B,>0}$) after an REO listing. Recall that this estimate combines any direct effect and an exogenous downward trend in home prices in neighborhoods nearby foreclosures.

These results suggest that our -1% estimate from above is close to the total spillover effect, and that beyond 0.1 miles the spillover effect is significantly diminished. Harding et al. [2009] also finds very small spillover effects for properties located beyond 0.1 miles of the foreclosure. For multiple REOs, the price decline in the 0.1-0.33 group is larger. This evidence combined with the evidence presented above that multiple REO listings elicit list price changes even at distances beyond 0.33 miles suggests that foreclosure externalities do extend beyond the 0.1 mile radius when multiple foreclosures are simultaneously listed for sale within a local area. Our identification strategy only allows us to identify an upper-bound for this particular externality of -2.5 percent $((\delta_{\frac{1}{3},B,>0} + \delta_{\frac{1}{3},B,>1}) - (\delta_{\frac{1}{3},D,>0} + \delta_{\frac{1}{3},D,>1}))$.

5.2.2 Similarity to REO

A model of differentiated products price competition, which is consistent with the findings presented so far, predicts that the competitive effect should be stronger when the REO is a closer substitute with the competing homes for sale. We test this prediction by categorizing sales that occur nearby an active REO listing as similar or dissimilar in observables to the REO listing. Specifically, we define the dummy variable

$$similar_{it} = I[\sum_{j=1}^{J_{it}}(\frac{|sqft_i - sqft_j|}{J_{it}}) < 130] * I[\sum_{j=1}^{J_{it}}(\frac{|yrblt_i - yrblt_j|}{J_{it}}) < 3] \quad (3)$$

where $sqft$ denotes square feet, $yrblt$ denotes year built, and J_{it} denotes the number of active REO listings within .1 miles of sale i at the time, t, that i sells. $similar = 1$ in 20 percent cases where $During^{\frac{1}{10},>0} = 1$. We add this variable to equation (2) along with an analogous variable measuring similarity of homes that sell in the $Before$ period.[20] This latter variable controls for the possibility that homes in more homogeneous areas tend to have higher or

[20] Specifically, this variable takes on the value 1 when a sale occurs 1-45 days before a nearby REO enters the market, and the sale is similar in observables to the impending REO listing.

lower prices than average. The similarity effect is identified off of the difference between the estimated coefficients on these two variables. The results, shown in Column 2 of Table 3, imply that the effect of an REO on nearby sales prices is -.7 percent when the nearby sale is not similar in observables to the REO, versus -2.1 percent (-.7-.014) when the nearby sale is similar.[21]

5.2.3 Effects after REO Exits the Market

An alternative interpretation for the results in Figure 1 and Table 3 is that a new REO listing depresses prices because it sends a negative signal to buyers and sellers about the future quality of the neighborhood.[22] We can distinguish between these competing explanations by looking at price movements after the REO exits the market. If the price effect we are picking up is truly a competitive effect, then prices should eventually recover once the foreclosure no longer competes with existing listings for buyers.[23] If we are instead picking up an information effect, then prices should remain depressed even after the REO sells.

We test this by augmenting our baseline diff-in-diff specification with the following indicator variables for $k = \frac{1}{10}, \frac{1}{3}$ miles and $m = > 0, > 1$ REO listings:

- $SoonAfter_{ijt}^{k,m}$: Sale i occurs between 1 and 45 days after m REOs exit the market. i is also within k miles of the REO listings.

- $After_{ijt}^{k,m}$: Sale i occurs between 46 and 90 days after m REOs exit the market. i is also within k miles of the REO listings.

The results are presented in Column 3 of Table 3. During the 45 days after a single REO sale, prices completely recover to their pre listing level. This recovery is statistically significant. When there are multiple REO sales,

[21] Precision is an issue in this specification. Thus, we chose the square feet and age thresholds to balance a tradeoff (that we find empirically) between the number of observations in the similar category versus strength of the effect.

[22] We view this as a less likely explanation given that foreclosures are made public well before the listing date, as discussed in Section 2, but we consider it nonetheless.

[23] The price recovery need not be immediate because the decrease in supply may be offset by the absorption of demand from the REO that sells.

prices also recover, but take longer to do so. There is a statistically significant increase in local prices soon after the sales, but we cannot reject the null that prices equal their pre-listing level until 46-90 days after the sales.

5.2.4 Time on Market

In addition to affecting price, competition can also affect how long it takes a listing to sell.[24] We test this in Column (4), which switches the dependent variable in equation (2) to $log(TOM)$. The diff-in-diff estimate for a single REO listing is relatively modest at 3.5%. However, the effect of multiple REOs is much larger at 15 percent, and is statistically significant. A 15 percent increase amounts to an additional 2.5 weeks of marketing time for the typical listing in our sample. As with sales prices, TOM recovers to its pre listing levels once the REOs leave the market.

That new REO listings increase the marketing time of nearby listings is economically important for at least two reasons. First of all, it is costly for sellers (and realtors) to keep their homes on the market. These costs include keeping the home and family ready for visitors as well as opportunity costs associated with being unable to liquidate the house. Secondly, lack of liquidity in a local area can get amplified into the broader market given that sellers usually cannot buy a new home until they are able to sell their current one.[25]

6 The Effects of non-REO Listings on Selling Behavior

In this section we compare the effects of new REO listings with the effects of new non-REO listings. This exercise is useful for two reasons. First of all, it tests the robustness of our conclusions about the competitive effect. If the price effects that we find in response to new REO listings are truly

[24]For example, suppose a fixed number of potential buyers inspect the homes listed for sale in a local area each period. The more homes there are to choose from, the less likely it is that a buyer will choose any specific house, which should increase time to sale.

[25]See Ortalo-Magne and Rady [2006] and Anenberg and Bayer [2011].

due to a competitive effect, then the price response to new non-REO listings should have a similar pattern. Secondly, it allows us to determine whether REOs present especially stiff competition, or whether the competitive effect of a new REO listed for sale is comparable to the effect of any home listed for sale. Section 3.1 discussed reasons why REOs may present especially stiff competition.

6.1 List Prices

We begin by testing whether list prices respond similarly. We augment specification (1) with an additional set of dummy variables for new non-REO listings:

$$\begin{aligned} y_{i,j,t} = & \sum_{m=>0,>1} (\delta_{1,m} NearbyREO^m_{i,j,t-4} + ... + \delta_{9,m} NearbyREO^m_{i,j,t+4} \\ & + \delta_{10,m} NearbyREO^m_{i,j,t} * Dist_i + \delta_{11,m} NearbyNonREO^m_{i,j,t-4} + ... \\ & + \delta_{19,m} NearbyNonREO^m_{i,j,t+4} + \delta_{m,20} NearbyNonREO^m_{i,j,t} * Dist_i) \\ & + \alpha_j + \gamma_t + \beta X_{i,t} + \epsilon_{i,j,t}. \end{aligned} \quad (4)$$

As in equation (1), y is an indicator variable equal to 1 if there is a list price change. $NearbyNonREO^m_{i,j,t}$ is a dummy variable equal to one if listing i is within 0.5 miles of m new non-REO listings that enters the market in week t.

Figure 2 plots the coefficients on the Nearby dummies for the case of a single REO and non-REO listing for distance=0. Appendix Table 2 shows the full detail. Neighborhood listings respond to new non-REO listings in the same way that they respond to new REO listings. All of the action occurs in the exact week of listing, not in the weeks before or the weeks after listing. In the exact week of listing, the propensity to change list price for listings at distance=0 from the REO and non-REO increase by .0066 and .0065, respectively. There is no economically or statistically significant difference between the two. The effect of multiple listings and the effect of distance is also the same.

Appendix Table 2 columns 1-3 reports the results with week and city, house, and quarter-by-zip code fixed effects, respectively. The results are similar across all three specifications. Column (4) changes the dependent variable to the percentage change in list price conditional on a change in list price. Sellers adjust their list prices downwards by a larger amount when there are multiple new REO listings, but this difference is not statistically significant.

6.2 Sales Prices and Time on Market

To compare the effect of REO and non-REO listings on sales prices, we use the same differences-in-differences specification as in equation (2) with an additional set of dummy variables that categorize sales as before, during, or after non-REO listings. Table 4 presents the results. The effect of an non-REO listing on home values for the average home is -.89% and this difference is statistically significant. At -.89% for non-REO versus -.96% for REO, the effect of a non-REO listing is very comparable and statistically indistinguishable from the effect of an REO listing.[26] The difference is larger for multiple REO listings relative to multiple non-REO listings, but we still cannot reject the null that the differences are significant.

Column (2) tests for effects on TOM. A single new REO and non-REO listing increases neighborhood TOM by a small and comparable amount. As with price, multiple REO listings have a larger cumulative effect on TOM than multiple non-REO listings (15 percent versus 6 percent for the two REO listing case). Here, we are able to reject the null that the difference-in-difference-in-difference is the same.

In Column (3) we include our measure of similarity as defined in equation (3). For REOs, similarity increases the magnitude of the competitive effect by 1.4 percent. This is unchanged from the estimate presented in Section

[26] In some cases, we observe a house come onto the MLS before it is foreclosed upon, go off the market while the foreclosure occurs, and then come back onto the market after the foreclosure. A realtor tells us that these are failed short sales. If the off-market window is less than 180 days, our algorithm treats this entire listing as REO. This tends to increase the TOM of REOs, as shown in Table 1. We re-estimated Table 4 treating these as 2 separate listings, the one before the foreclosure as non-REO and the one after the foreclosure as REO. The results are qualitatively the same.

5. For non-REOs, however, similarity only increases the magnitude of the competitive effect by .2 percent, and this estimate is imprecise.

6.3 Discussion

Our results show that when we condition on substitutability, REOs have a stronger competitive effect than non-REOs. Unconditionally, however, the competitive effects are similar. A likely explanation for these results is that banks price their homes more aggressively for the reasons discussed in Section 3, so that conditional on substitutability, the competitive effect from REOs is stronger. However, if REOs tend to be more differentiated from their neighbors than non-REOs, the unconditional competitive effects can be similar.

We do find evidence of higher degrees of differentiation for REOs. We show this by calculating for each new listing the average percentage difference (in absolute value) between the list price of the new listing and the list prices of the active listings within 0.1 miles of the new listing.[27] We use list prices to account for both observed and unobserved heterogeneity in housing characteristics.[28] Across all new listings, the standard deviation of this difference is about 20 percent. This illustrates that there is a significant amount of differentiation even among homes within 0.1 miles of each other. The median difference is 18 percent for a new REO listing versus 14 percent for a new non-REO listing, which is consistent with a higher degree of differentiation for REOs.

7 Testing for a Disamenity Effect

The previous sections have presented strong evidence that foreclosures depress nearby house prices through a competitive effect. We now test whether an additional externality arises through the disamenity effect.

[27]That is, for each new listing i, we calculate $\frac{1}{J_i}\sum_{j=1}^{J_i}|p_j^L - p_i^L|$ where J_i denotes the number of active listings within 0.1 miles of i and p^L is the log list price. When $J_i = 0$ this difference is treated as missing for observation i.

[28]Unobserved housing characteristics are particularly relevant here because foreclosed properties are probably less likely to have renovations, show well, etc. This should be reflected in the list price level.

A disamenity effect may emerge during two time periods. The first is prior to foreclosure as the borrower realizes that foreclosure is imminent and has less incentive to maintain the property condition. For example, the owner may be more likely to let the grass grow long and the paint chip. The second is after the foreclosure, which is when the property is often vacant. Vacancy potentially attracts vandalism, crime, and squatters.

To test for the disamenity effect, we add dummy variables to the diff-in-diff specification (2) that further categorize sales according to whether they occur in the 10 months prior to a foreclosure and/or in the 6 months after a foreclosure but before the house is listed on the MLS. We include separate dummy variables for each two month window during this 16 month period. We continue to distinguish between sales within .1 and sales within .33 miles of a foreclosure to control for exogenous trends in neighborhoods where foreclosures tend to occur. The identification assumption is that the disamenity effect, if present, has a stronger effect on home prices within 0.1 miles of the foreclosure relative to home prices within 0.33 miles. Any significant price decline during this pre-listing period could be interpreted as a disamenity effect.

7.1 Results

The results are summarized in Figure 3. The full set of results with all of the explanatory variables are reported in Appendix Table 3. Figure 3 shows that sales prices of homes within .1 miles of a single foreclosure do not depend on the timing of the sale in relation to the foreclosure phase. None of the changes in the pre-listing period are statistically significant. The detailed results show some evidence of price decline when there is more than 1 foreclosure in the post-foreclosure, pre-listing phase; however, the estimates are imprecise.

7.2 Discussion

Our results suggest that the average foreclosure does not depress nearby house prices through a disamenity effect.[29] We emphasize that our identification strategy does not allow us to distinguish whether this is because most neglected houses do not depress neighboring prices, or whether most foreclosed properties are not neglected.

Our results in this section also support the first identification assumption from Section 5 that homes values within 0.1 miles of an REO would not have been trending differently from home values within 0.33 miles of an REO listing in the absence of the listing. If this assumption is false, then we would expect to see different trends during the year before listing as well.[30] The results here also support our claim that the source of price decline during the listing period is due to increased supply rather than the disamenity effect. A disamenity effect that only emerges long after the foreclosure process is complete contradicts most accounts of when physical neglect of foreclosed properties occurs in practice.

8 Conclusion

In this paper, we use a new dataset from the MLS to show that foreclosures do indeed have a causal effect on nearby house prices, and that the competitive effect rather than the disamenity effect is the important source of price declines. A new foreclosure listing lowers nearby house prices by 1 percent, which is a significant effect given that 1) 27.5 percent of sales in our sample are of homes

[29] One reason that Harding et al. [2009] find a contagion effect in the year prior to the foreclosure could be that many foreclosures are listed on the market as short sales prior to foreclosure. Thus, the pre-foreclosure price decline that they find could be due to the competitive effect of the short-sale listing rather than the disamenity effect as they conclude. These types of listings do not affect our estimate of the disamenity effect as we require the pre and post-foreclosure windows to be before the initial listing. See footnote 24 for more details. In addition, the conclusions in Harding et al. [2009] are established based on averages across 7 MSAs. At the MSA level, their results on pre-foreclosure price declines are quite imprecise (their Table 4).

[30] The results are also inconsistent with a pre-listing price decline due to anticipation of the competitive effect.

nearby an active foreclosure listing and 2) houses in our sample typically sell for over a half million dollars. We find that on average, new REO listings have a comparable effect on local prices as new non-REO listings. We find that the high degree of differentiation between REO properties and nearby homes softens the extra competitive pressure from banks that price aggressively.

Our sample covers home listings in the 6 core counties of the San Francisco bay area from 2007-2009. The foreclosure process in California and during our sample period was relatively quick. Thus, there are fewer instances where multiple properties in the same local area are simultaneously in the post-delinquency, pre-listing phase. If there is a non-linearity in the disamenity effect, as some evidence in Section 7 suggests, then in judicial states or in 2010-2011 when legal and regulatory issues slowed foreclosures, the disamenity effect could be more important. We are currently working to acquire listing and transaction data for an additional set of cities to test whether our findings depend on any unique features of the San Francisco market.

References

Elliot Anenberg. Information frictions and housing market dynamics. Working Paper 48, Federal Reserve Board, August 2012.

Elliot Anenberg and Patrick Bayer. Endogenous cycles in housing markets. *mimeo Duke University*, 2011.

John Campbell, Stefano Giglio, and Parag Pathak. Forced sales and house prices. *American Economic Review*, 2011.

Janet Currie and Erdal Tekin. Is the foreclosure crisis making us sick? Working Paper 17310, National Bureau of Economic Research, August 2011.

Ingrid Gould Ellen, Johanna Lacoe, and Claudia Sharygin. Do foreclosures cause crime. *mimeo New York University*, 2011.

Kristopher Gerardi, Eric Rosenblatt, Paul Willen, and Vincent Yao. Foreclosure externalities: Some new evidence. Working Paper 12, Federal Reserve Bank of Atlanta, August 2012.

Ryan Goodstein, Paul E. Hanouna, Carlos D. Ramirez, and Christof W. Stahel. Are Foreclosures Contagious? *SSRN eLibrary*, 2011.

Luigi Guiso, Paola Sapienza, and Luigi Zingales. Moral and social constraints to strategic default on mortgages. Working Paper 15145, National Bureau of Economic Research, July 2009.

John P. Harding, Eric Rosenblatt, and Vincent W. Yao. The contagion effect of foreclosed properties. *Journal of Urban Economics*, 66(3):164 – 178, 2009.

Daniel Hartley. The effect of foreclosures on nearby housing prices: Supply or disamenity. *Cleveland Fed Working Paper*, 2010.

Dan Immergluck and Geoff Smith. The external costs of foreclosure: The impact of single-family mortgage foreclosures on property values. *Housing Policy Debate*, 17(1):57–79, 2006.

John Krainer. A theory of liquidity in residential real estate markets. *Journal of Urban Economics*, 49(1):32 – 53, 2001.

Mickey Lauria and Vern Baxter. Residential mortgage foreclosure and racial transition in new orleans. *Urban Affairs Review*, 34(6):757–786, 1999.

Zhenguo Lin, Eric Rosenblatt, and Vincent Yao. Spillover effects of foreclosures on neighborhood property values. *The Journal of Real Estate Finance and Economics*, 38:387–407, 2009.

Atif R. Mian, Amir Sufi, and Francesco Trebbi. Foreclosures, house prices, and the real economy. *NBER Working Paper*, w16685, 2012.

Raven Molloy and Hui Shan. The post-foreclosure experience of u.s. households. *mimeo Federal Reserve Board*, 2011.

Robert Novy-Marx. Hot and cold markets. *Real Estate Economics*, 37(1): 1–22, 2009.

Board of Governors of the Federal Reserve System. The u.s. housing market: Current conditions and policy considerations. Staff paper, January 2012.

Francois Ortalo-Magne and Sven Rady. Housing market dynamics: On the contribution of income shocks and credit constraints. *Review of Economic Studies*, 73(2):459–485, 2006.

Karen M. Pence. Foreclosing on opportunity: State laws and mortgage credit. *Review of Economics and Statistics*, 88:177–182, 2006.

Thomas M. Springer. Single-family housing transactions: Seller motivations, price, and marketing time. *The Journal of Real Estate Finance and Economics*, 13:237–254, 1996. ISSN 0895-5638.

Geoffrey Turnbull and Jonathan Dombrow. Spatial competition and shopping externalities: Evidence from the housing market. *The Journal of Real Estate Finance and Economics*, 32:391–408, 2006. ISSN 0895-5638.

William C. Wheaton. Vacancy, search, and prices in a housing market matching model. *Journal of Political Economy*, 98(6):pp. 1270–1292, 1990.

A Appendix

A.1 Model of Price Setting in Response to New REO Listing

Here we present a stylized model to understand how the pricing pattern in Figure 1 emerges in equilibrium. Suppose there are two players $i = 1, 2$ and two time periods $t = 1, 2$. Each player has a single house of identical quality to sell. The demand for house i can be summarized by the function

$$\gamma(p^L_{it}, p^L_{-it}, R_t) \tag{5}$$

where $\gamma()$ denotes the probability that player $i's$ house sells given each players' list price, p^L, and R, which is a dummy variable equal to one if there is an REO listing, exogenous to the model, to compete with. We assume that

1. $\frac{\partial \gamma}{\partial p_i^L} < 0$
2. $\frac{\partial \gamma}{\partial p_{-i}^L} > 0$
3. $\gamma(p_i^L, p_{-i}^L, 1) < \gamma(p_i^L, p_{-i}^L, 0)\ \forall p_i^L, p_{-i}^L$

We assume that $R_1 = 0$ and $R_2 = 1$. R_t is observable to both players at time t. We impose the following information asymmetry at $t = 1$: one of the players knows that $R_2 = 1$ whereas the other player does not know R_2, but believes that R_2 is Bernoulli. Otherwise, the two players are identical.

We assume that if a home sells, it sells at its list price. For simplicity we assume that the discount factor equals one. We write player $i's$ expected profit function in $t = 1$ as

$$\Pi_i^1 = \gamma(p_{i1}^L, p_{-i1}^L, 0) * p_{i1}^L + (1 - \gamma(p_{i1}^L, p_{-i1}^L, 0)) * \Pi_i^2. \tag{6}$$

Π_i^2 takes a similar form, except if the home does not sell, the seller receives some exogenous terminal utility x. Consider the informed player's optimal choice of period 1 price in a pure-strategy Bayesian Nash equilibrium. He can pretend he is not informed about R_2, and price according to the equilibrium that would arise if both players are symmetrically uninformed about R_2. Alternatively, he could lower his price to increase his chances of selling in $t = 1$ since he knows demand in $t = 2$ will be low. It is straightforward to show that this is exactly what he would do if he were a monopolist. However, by lowering his price, the informed player signals to the uninformed player that demand will be low, which would cause the uninformed player to lower his period 1 price in equilibrium. Thus, some of the gains that the informed seller would get from lowering his price are competed away.

Whether the informed player prices low or high depends on the elasticity of $\gamma()$ with respect to price. For $\gamma()$ sufficiently inelastic, the informed player will not adjust his period 1 price for the impending REO listing. In period 2, both players will lower their prices once $R_2 = 1$ becomes common knowledge. Under this parametrization, the equilibrium price pattern is just as it appears in Figure 1.

A.2 For Online Publication Only: Data Appendix

We first describe how we merge the listing data from Altos Research with the transaction data from Dataquick. The listing data contains separate variables for the street address, city, and zip code of each listing. The address variable contains the house number, the street name, and the street suffix in that order as a single string. We alter the street suffixes to make them consistent with the street suffixes in the transaction data (e.g. change "road" to "rd", "avenue" to "ave", etc). In some cases, the same house is listed under 2 slightly different addresses (e.g. "123 Main" and "123 Main St") with the same MLSIDs. We combine listings where the address is different, but the city and zip are the same, the MLSids are the same, the difference in dates between the two listings is less than 3 weeks, and at least one of the following conditions applies:

1. The listings have the same year built and the ratio of the list prices is greater than 0.9 and less than 1.1.

2. The listings have the same square feet and the ratio of the list prices is greater than 0.9 and less than 1.1.

3. The listings have the same lotsize and the ratio of the list prices is greater than 0.9 and less than 1.1.

4. The first five characters of the address are the same.

The address variables in the transaction data are clean and standardized because they come from county assessor files. We merge the listing data and the transaction data together using the address. We classify a listing as a sale if there is a match and the difference in closing date (the date in the transaction data) and the agreement date (the date the property is deslisted from the MLS) is greater than zero and less than 365 days. If a listing merges with an observation in the transaction data that does not satisfy this timing criteria, we record the latitude and longitude coordinates of the property but do not treat the listing as a sale. We drop all listings that do not match to at least 1 record in the transaction data because we do not have the latitude and longitude for these listings.[31] Listings do not match to a sales record for one of two reasons: a listing last sold prior to 1988 or there is a quirk in the way the address is recorded in the transaction or listing data. Before we do the merge, we flag properties that sold more than once during a 1.5 year span during our sample period. To avoid confusion during the merge that can arise from multiple sales occurring close together, we drop any listings that merge to one of these flagged properties (< 1 percent of listings). We also drop listings where the ratio of the minimum list price to the maximum list price is less than the first percentile.

For the list price specifications, we do not treat listings where the initial listing date is the first week in our dataset as a new listing. We do this because we do not know whether these listings truly began in the initial week of the sample, or whether they had been on the market previously. For the specifications that use sales prices and TOM as the dependent variable, we make the following restrictions to the estimation sample:

1. Drop sales with prices that are below 50000 or above 2875000 (1st and 99th percentiles, respectively). Drop sales with square feet equal to zero or greater than 5000.

2. Drop sales where the TOM is greater than 2 years (< 10 sales).

We spent a great deal of time familiarizing ourselves with the data to develop the following algorithm that we believe to be highly accurate in identifying REO listings. We classify a listing as an REO if it merges with a non-arms length sales record where the following conditions hold:

[31]This eliminates about 15 percent of listings. These dropped listings do not include REO listings because an observation appears in the transaction data at the foreclosure sale date.

1. The buyer's name does not have a comma, which always separates a last name and a first name in our dataset. This suggests that the buyer is not an individual and perhaps is a bank.

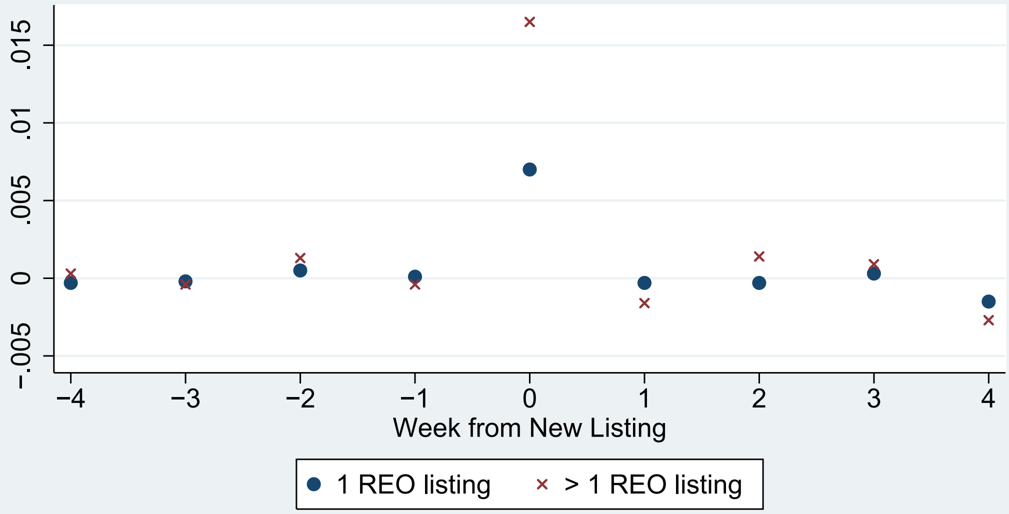
2. The buyer's name does not contain the strings "ESTATE", "FAMILY", "LIVING", "RELOC".

3. The buyer's name contains strings that suggest it is a bank, mortgage servicing company, or GSE (e.g. "BANK", "MTG", "FANNIE").

These non-arms length transactions are the transfer of ownership when a foreclosure occurs. In most cases, an arms length transaction occurs within a couple years of this transfer where the seller is a non-individual. This subsequent sale is the REO. We use the transfer rather than the REO sale to identify REO listings because our transaction data is right-censored. We do, however, use the seller names for the REO sales that we observe to help generate a list of strings that we search for in the buyer's name in the algorithm described above.

Figure 1

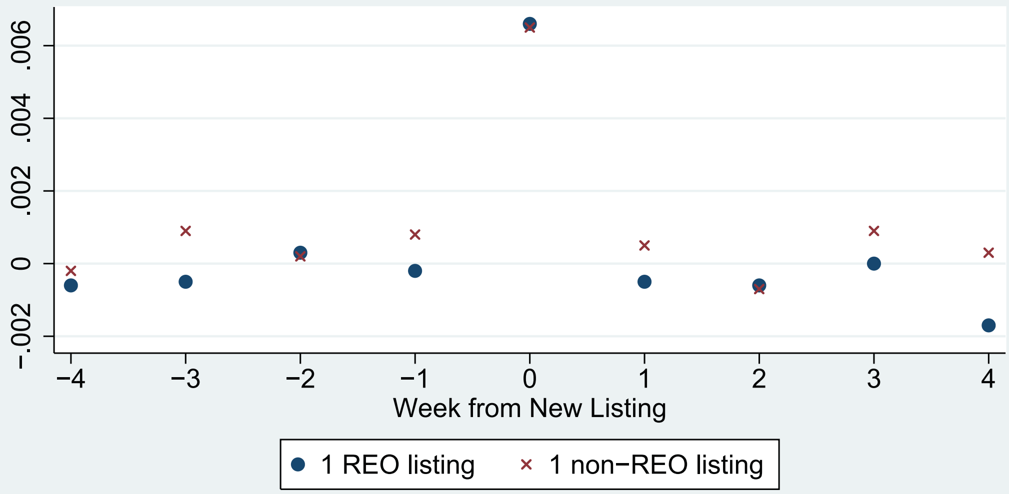
Change in Propensity to Adjust List Price Around New REO Listing



Note: This figure shows the change in the propensity to adjust list price in the 4 weeks before, the week of, and the 4 weeks after local, new REO listing(s). The propensity to adjust list price is allowed to vary linearly with distance from the REO listing. The coefficients reported here are for distance = 0 miles. The detailed regression output is reported in Appendix Table 1. All changes are relative to a baseline of .059.

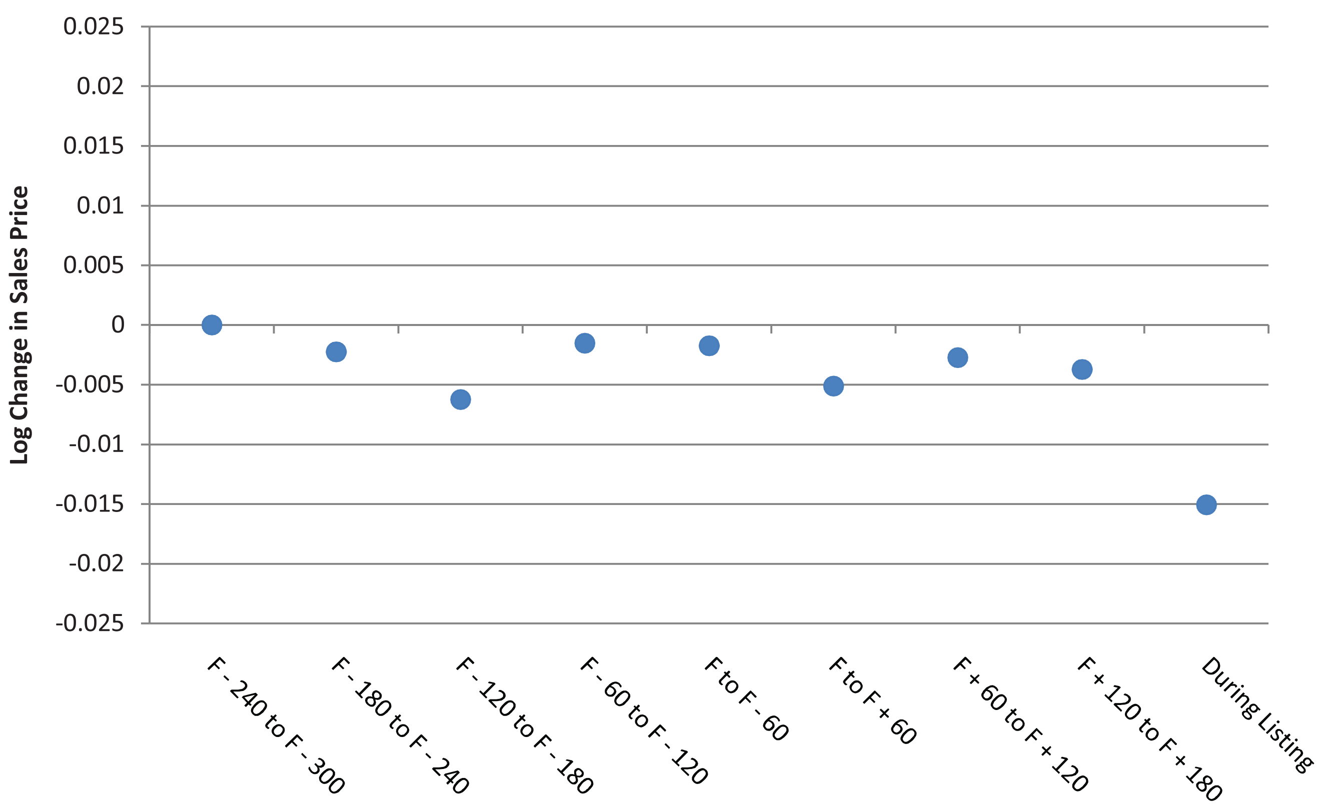
Figure 2

Change in Propensity to Adjust List Price Around New Listing



Note: This figure compares the change in the propensity to adjust list price in response to 1 local, new REO and to 1 local, new non−REO listing. Effects are plotted for the 4 weeks before, the week of, and the 4 weeks after the new listing. The propensity to adjust list price is allowed to vary linearly with distance from the REO listing. The coefficients here are for listings that are 0 miles from the REO listing. The detailed regression output is reported in Appendix Table 2. All changes are relative to a baseline of .059.

Figure 3: Price Effect from 1 Foreclosure by Foreclosure Phase



This figure shows how sales prices within .1 miles of a single foreclosure depend on the timing of the sale in relation to the phase of the foreclosure process. F denotes the date of the foreclosure and During Listing denotes the time period after the foreclosure is listed on the MLS but before it sells or is withdrawn. The numbers in the x-axis are in days. All sales between F - 300 and F + 180 are also restricted to be before the foreclosure is listed on the MLS. All estimates are indexed to the estimate for F - 240 to F - 300, which is normalized to 0. The detailed regression output is reported in Appendix Table 3.

Table I : Summary Statistics by Listing Category

		Sale Price ($)	Square Feet	Age	# Bathrooms	Time on Market (Weeks)	Closing Gap[1] (Days)	Sale/List Price (Ratio)	I[List Price$_t$!= List Price$_{t-1}$][2] (Fraction)	I[List Price$_t$ > List Price$_{t-1}$][3] (Fraction)	Δ List Price[4] (%)
REO,	Mean		1607	45	2.0	19			0.09	0.0047	-0.088
No Sale	p25		1112	23	1.0	4			0	0	-0.111
(N=9,120)	p50		1400	48	2.0	12			0	0	-0.058
	p75		1869	61	2.5	28			0	0	-0.032
REO,	Mean	349,848	1589	41	2.0	23	46	0.99	0.11	0.0039	-0.094
Sale	p25	210,000	1123	19	1.0	4	24	0.95	0	0	-0.114
(N=19,235)	p50	315,000	1404	43	2.0	15	38	1.00	0	0	-0.059
	p75	438,000	1849	57	2.5	37	54	1.03	0	0	-0.034
Non-REO,	Mean		1892	42	2.2	18			0.07	0.0038	-0.057
No Sale	p25		1228	19	2.0	6			0	0	-0.074
(N=39,061)	p50		1641	43	2.0	13			0	0	-0.042
	p75		2290	57	2.5	25			0	0	-0.023
Non-REO,	Mean	811,852	1844	45	2.1	12	38	0.97	0.09	0.0040	-0.055
Sale	p25	540,000	1266	28	2.0	3	12	0.95	0	0	-0.069
(N=44,739)	p50	725,000	1623	47	2.0	7	26	0.98	0	0	-0.041
	p75	965,000	2135	58	2.5	16	38	1.00	0	0	-0.024
Nearby REO[5],	Mean	367,019	1553	41	2.0	22	52	0.97	0.11	0.0039	-0.092
Sale	p25	215,500	1119	18	1.0	5	20	0.94	0	0	-0.111
(N=17,486)	p50	325,000	1380	44	2.0	15	35	0.99	0	0	-0.058
	p75	462,000	1813	57	2.5	34	56	1.02	0	0	-0.033
Total	Mean	672,942	1798	43	2.1	17	40	0.98	0.09	0.0040	-0.070
(N=112,155)	p25	365,000	1205	21	1.5	4	14	0.95	0	0	-0.087
	p50	600,000	1568	45	2.0	10	28	0.98	0	0	-0.049
	p75	850,000	2123	58	2.5	23	42	1.01	0	0	-0.027

1. Defined as closing date - agreement date.
2. Takes on the value 1 if the list price does not equal the list price in the week before.
3. Takes on the value 1 if the list price exceeds the list price in the week before.
4. Conditional on a price change occurring.
5. The sale is within 0.1 miles of an active REO listing.

Table 2: Number of REO and non-REO Sales by County

County	REO	non-REO	Share REO	Median Price
Alameda	4757	10938	0.303	$530,000
Contra Costa	9229	9178	0.501	$360,000
Marin	214	2194	0.089	$840,000
San Francisco	253	3041	0.077	$832,000
San Mateo	912	5777	0.136	$803,000
Santa Clara	3870	13611	0.221	$700,000
Total	19235	44739	0.301	$600,000

Table 3: Effects of REO Listings

	Dependent Variable			
	(1)	(2)	(3)	(4)
Diff-in-Diffs of Interest (p-values in italics)	Log sales price	Log sales price	Log sales price	Log time on market
During 1 REO Listing Relative to Before Listing	-0.0099	-0.0073		0.0356
	0.0431	*0.1680*		*0.1283*
During 2 REO Listing Relative to Before Listing	-0.0322			0.1516
	0.0019			*0.0018*
During >2 REO Listing Relative to Before Listing	-0.0518			
	0.0369			
During 1 REO Listing Relative to Before Listing, .1-.33 miles	-0.0055			
	0.1723			
During >1 REO Listing Relative to Before Listing, .1-.33 miles	-0.0254			
	0.0001			
Soon After 1 REO Sale Relative to During Listing			0.0093	
			0.0510	
Additional Effect when Similar to 1 REO		-0.0142		
		0.0711		
Full Detail				
I[Before >0 REO listing, far]	-0.0270***	-0.0245***	-0.0224***	0.0064
	(0.0031)	(0.0030)	(0.0029)	(0.0133)
I[Before >1 REO listing, far]	-0.0419***	-0.0344***	-0.0306***	0.0422**
	(0.0048)	(0.0045)	(0.0043)	(0.0186)
I[Before >0 REO listing, close]	-0.0134***	-0.0158***	-0.0111***	0.0161
	(0.0039)	(0.0042)	(0.0038)	(0.0174)
I[Before >1 REO listing, close]	-0.0154*	-0.0154*	-0.0155*	-0.0427
	(0.0087)	(0.0085)	(0.0094)	(0.0416)
I[Before >2 REO listing, close]	-0.0116	-0.0071		0.0226
	(0.0222)	(0.0225)		(0.0692)
I[During >0 REO listing, far]	-0.0325***	-0.0320***	-0.0310***	0.0612***
	(0.0034)	(0.0034)	(0.0033)	(0.0140)
I[During >1 REO listing, far]	-0.0618***	-0.0525***	-0.0489***	0.0562***
	(0.0049)	(0.0045)	(0.0043)	(0.0167)
I[During >0 REO listing, close]	-0.0233***	-0.0231***	-0.0191***	0.0516***
	(0.0033)	(0.0035)	(0.0032)	(0.0161)
I[During >1 REO listing, close]	-0.0377***	-0.0322***	-0.0410***	0.0734***
	(0.0051)	(0.0051)	(0.0054)	(0.0227)
I[During >2 REO listing, close]	-0.0312***	-0.0224***		0.0254
	(0.0067)	(0.0068)		(0.0261)
I[Soon after >0 REO sale, far]			-0.0294***	0.0352**
			(0.0035)	(0.0142)
I[Soon after >1 REO sale, far]			-0.0353***	0.0099
			(0.0048)	(0.0191)
I[Soon after >0 REO sale, close]			-0.0099***	-0.0063
			(0.0037)	(0.0192)
I[Soon after >1 REO sale, close]			-0.0339***	-0.0445
			(0.0076)	(0.0299)
I[After >0 REO sale, far]			-0.0197***	
			(0.0035)	
I[After >1 REO sale, far]			-0.0345***	
			(0.0054)	
I[After >0 REO sale, close]			-0.0096**	
			(0.0038)	
I[After >1 REO sale, close]			-0.0209***	
			(0.0067)	
I[Similar before REO listing]		0.0195***		
		(0.0069)		
I[Similar during REO listing]		0.0053		
		(0.0047)		
Square feet	0.5911***	0.5936***	0.5832***	-0.0826***
	(0.0183)	(0.0186)	(0.0182)	(0.0314)
Square feet * square feet	-0.0545***	-0.0551***	-0.0534***	0.0419***
	(0.0034)	(0.0035)	(0.0034)	(0.0069)
REO dummy	-0.1327***	-0.1286***	-0.1281***	0.0515***
	(0.0049)	(0.0046)	(0.0045)	(0.0162)

# weeks from initial listing	-0.0008***	-0.0008***	-0.0008***	
	(0.0001)	(0.0001)	(0.0001)	
Constant	12.5124***	12.5182***	12.5469***	1.9778***
	(0.0209)	(0.0218)	(0.0215)	(0.0357)
Zip code by quarter fixed effects	X	X	X	X
Observations	63457	61789	63457	63457
Adjusted R-squared	0.900	0.901	0.901	0.225

Clustered standard errors in parentheses; p-values in italics.
*** p<0.01, ** p<0.05, * p<0.1
1. The "before" period is 1-45 days before an REO enters the MLS database.
2. The "during" period is after a listing, but before the property is delisted
3. "Soon after" and "after" are differentiated to mean 1-45 days and 46-90 days after an REO sale, respectively.
4. "Far" and "close" signify a sale within .33 and .1 miles of an REO sale, respectively
5. Similar is a dummy variable equal to 1 when the sale is similar in observables to the REO listing. See text for exact definition
6. The number of observations in specification 2 is lower because we need to omit observations where

Table 4: Effects of non-REO and REO Listings

	Dependent Variable		
	(1)	(2)	(3)
Diff-in-Diffs of Interest (p-values in italics)	Log sales price	Log time on market	Log sales price
During 1 REO Listing Relative to Before Listing	-0.0096	0.0357	-0.0073
	0.0467	*0.1273*	*0.1713*
During 1 non-REO Listing Relative to Before Listing	-0.0089	0.0260	-0.0072
	0.0125	*0.0881*	*0.0668*
During 2 REO Listing Relative to Before Listing	-0.0285	0.1509	
	0.0056	*0.0019*	
During 2 non-REO Listing Relative to Before Listing	-0.0156	0.0593	
	0.0088	*0.0593*	
Additional Effect when Similar to 1 REO			-0.0143
			0.0688
Additional Effect when Similar to 1 non-REO			-0.0021
			0.6827
Full Detail			
I[Before >0 REO listing, far]	-0.0235***	0.0098	-0.0239***
	(0.0030)	(0.0133)	(0.0030)
I[Before >1 REO listing, far]	-0.0352***	0.0447**	-0.0344***
	(0.0044)	(0.0186)	(0.0044)
I[Before >0 REO listing, close]	-0.0109***	0.0156	-0.0154***
	(0.0039)	(0.0174)	(0.0042)
I[Before >1 REO listing, close]	-0.0136	-0.0417	-0.0155*
	(0.0086)	(0.0415)	(0.0085)
I[Before >2 REO listing, close]	-0.0080	0.0219	-0.0068
	(0.0222)	(0.0691)	(0.0226)
I[During >0 REO listing, far]	-0.0304***	0.0636***	-0.0304***
	(0.0033)	(0.0139)	(0.0033)
I[During >1 REO listing, far]	-0.0535***	0.0581***	-0.0519***
	(0.0044)	(0.0167)	(0.0044)
I[During >0 REO listing, close]	-0.0205***	0.0513***	-0.0226***
	(0.0032)	(0.0162)	(0.0035)
I[During >1 REO listing, close]	-0.0324***	0.0735***	-0.0322***
	(0.0050)	(0.0227)	(0.0051)
I[During >2 REO listing, close]	-0.0249***	0.0263	-0.0223***
	(0.0066)	(0.0261)	(0.0068)
I[Soon After>0 REO sale, far]	-0.0309***	0.0364**	
	(0.0036)	(0.0141)	
I[Soon After>1 REO sale, far]	-0.0437***	0.0120	
	(0.0052)	(0.0191)	
I[After>0 REO sale, close]	-0.0104***	-0.0060	
	(0.0038)	(0.0191)	
I[After>1 REO sale, close]	-0.0208**	-0.0421	
	(0.0085)	(0.0299)	
I[After>2 REO sale, close]	-0.0540***	0.0457	
	(0.0159)	(0.0529)	
I[Before >0 non-REO listing, far]	0.0004	-0.0519***	0.0013
	(0.0033)	(0.0135)	(0.0032)
I[Before >1 non-REO listing, far]	0.0037	-0.0013	0.0038
	(0.0027)	(0.0118)	(0.0026)
I[Before >0 non-REO listing, close]	0.0009	-0.0169	-0.0020
	(0.0025)	(0.0117)	(0.0028)
I[Before >1 non-REO listing, close]	0.0088*	-0.0188	0.0102**
	(0.0049)	(0.0263)	(0.0051)

I[Before >2 non-REO listing, close]	0.0146	-0.0156	0.0192*
	(0.0098)	(0.0576)	(0.0108)
I[During >0 non-REO listing, far]	-0.0114**	-0.0099	-0.0097**
	(0.0047)	(0.0200)	(0.0047)
I[During >1 non-REO listing, far]	-0.0075**	0.0046	-0.0090**
	(0.0037)	(0.0150)	(0.0037)
I[During >0 non-REO listing, close]	-0.0079***	0.0091	-0.0092***
	(0.0024)	(0.0105)	(0.0025)
I[During >1 non-REO listing, close]	0.0021	0.0144	0.0042
	(0.0038)	(0.0157)	(0.0039)
I[During >2 non-REO listing, close]	0.0033	-0.0025	-0.0003
	(0.0052)	(0.0244)	(0.0054)
I[Soon After>0 non-REO sale, far]	-0.0023	0.0017	
	(0.0034)	(0.0143)	
I[Soon After>1 non-REO sale, far]	0.0080***	-0.0017	
	(0.0028)	(0.0115)	
I[Soon After>0 non-REO sale, close]	-0.0001	0.0007	
	(0.0023)	(0.0111)	
I[Soon After>1 non-REO sale, close]	0.0033	-0.0399*	
	(0.0045)	(0.0239)	
I[Soon After>2 non-REO sale, close]	-0.0108	0.0221	
	(0.0108)	(0.0548)	
I[Similar before REO listing]			0.0184***
			(0.0069)
I[Similar during REO listing]			0.0041
			(0.0046)
I[Similar before non-REO listing]			0.0093**
			(0.0041)
I[Similar during non-REO listing]			0.0072**
			(0.0034)
Square feet	0.5842***	-0.0793**	0.5935***
	(0.0180)	(0.0313)	(0.0187)
Square feet * square feet	-0.0535***	0.0409***	-0.0551***
	(0.0033)	(0.0069)	(0.0035)
REO dummy	-0.1292***	0.0507***	-0.1283***
	(0.0046)	(0.0162)	(0.0046)
# weeks from initial listing	-0.0008***		-0.0008***
	(0.0001)		(0.0001)
Constant	12.5505***	2.0164***	12.5323***
	(0.0229)	(0.0412)	(0.0233)
Zip code by quarter fixed effects	X	X	X
Observations	63457	63457	61789
Adjusted R-squared	0.901	0.225	0.901

Clustered standard errors in parentheses;p-values in italics.

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

1. The "before" period is 1-45 days before a listing enters the MLS database.
2. The "during" period is after a listing, but before the property is sold.
3. "Soon after" and "after" are differentiated to mean 1-45 days and 46-90 days after a sale, respectively.
4. "Far" and "close" signify a sale within .33 and .1 miles of a sale, respectively.
5. Similar is a dummy variable equal to 1 when the sale is similar in observables to the listing. See text for exact definition.
6. The number of observations in specification 2 is lower because we need to omit observations where the square footage or age is missing.

Online Only Appendix Table 1: Effects of REO Listing on List Prices

	(1)	(2)	(3)	(4)
Dependent Variable	I[Change List]	I[Change List]	I[Change List]	Δ List Price[1]
I[4 weeks before >0 REO listing]	-0.0003	0.0002	-0.0005	-0.0021***
	(0.0007)	(0.0007)	(0.0007)	(0.0006)
I[3 weeks before >0 REO listing]	-0.0002	0.0010	0.0003	-0.0026***
	(0.0006)	(0.0006)	(0.0007)	(0.0006)
I[2 weeks before >0 REO listing]	0.0005	0.0018***	0.0009	-0.0034***
	(0.0006)	(0.0006)	(0.0007)	(0.0005)
I[1 week before >0 REO listing]	0.0001	0.0010	0.0000	-0.0013
	(0.0005)	(0.0006)	(0.0006)	(0.0009)
I[1 week after >0 REO listing]	-0.0003	0.0008	0.0001	-0.0018***
	(0.0009)	(0.0006)	(0.0007)	(0.0006)
I[2 weeks after >0 REO listing]	-0.0003	0.0006	-0.0003	-0.0029***
	(0.0007)	(0.0006)	(0.0007)	(0.0009)
I[3 weeks after >0 REO listing]	0.0003	0.0019***	0.0011	-0.0019**
	(0.0008)	(0.0007)	(0.0007)	(0.0008)
I[4 weeks after >0 REO listing]	-0.0015**	-0.0001	-0.0007	-0.0032***
	(0.0006)	(0.0007)	(0.0006)	(0.0010)
I[4 weeks before >1 REO listing]	0.0006	0.0002	-0.0004	-0.0039**
	(0.0009)	(0.0009)	(0.0009)	(0.0017)
I[3 weeks before >1 REO listing]	-0.0002	-0.0000	-0.0008	-0.0052***
	(0.0009)	(0.0009)	(0.0009)	(0.0017)
I[2 weeks before >1 REO listing]	0.0008	0.0012	0.0002	-0.0024***
	(0.0013)	(0.0009)	(0.0010)	(0.0009)
I[1 week before >1 REO listing]	-0.0005	0.0003	-0.0010	-0.0039***
	(0.0009)	(0.0009)	(0.0010)	(0.0008)
I[1 week after >1 REO listing]	-0.0013	-0.0011	-0.0021*	-0.0044**
	(0.0012)	(0.0009)	(0.0011)	(0.0018)
I[2 weeks after >1 REO listing]	0.0017**	0.0021**	0.0012	-0.0029***
	(0.0009)	(0.0009)	(0.0009)	(0.0009)
I[3 weeks after >1 REO listing]	0.0006	0.0013	0.0003	-0.0042***
	(0.0010)	(0.0009)	(0.0010)	(0.0010)
I[4 weeks after >1 REO listing]	-0.0012	-0.0005	-0.0013	-0.0034*
	(0.0010)	(0.0009)	(0.0009)	(0.0017)
I[Same week as >0 REO listing]	0.0070***	0.0098***	0.0092***	-0.0033*
	(0.0013)	(0.0015)	(0.0017)	(0.0018)
I[Same week as >1 REO listing]	0.0095***	0.0103***	0.0107***	-0.0081***
	(0.0034)	(0.0031)	(0.0033)	(0.0030)
I[Same week as >0 REO listing]*distance	-0.0097***	-0.0090**	-0.0098**	-0.0030
	(0.0035)	(0.0042)	(0.0041)	(0.0058)
I[Same week as >1 REO listing]*distance	-0.0114	-0.0067	-0.0118	0.0158
	(0.0087)	(0.0095)	(0.0096)	(0.0114)
# weeks from initial listing	0.0000	0.0001***	0.0000**	-0.0005***

	(0.0000)	(0.0000)	(0.0000)	(0.0001)
REO Dummy	0.0175***		0.0176***	-0.0115***
	(0.0031)		(0.0009)	(0.0014)
Constant	0.0589***	0.0798***	0.0779***	-0.0206***
	(0.0029)	(0.0007)	(0.0006)	(0.0035)
Week and city fixed effects	X			X
House fixed effects		X		
Zip code by quarter fixed effects			X	
Observations	1787711	1787711	1787711	155320
Adjusted R-squared	0.005	0.008	0.004	0.107

Clustered standard errors in parentheses.

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

1. Conditional on a price change occurring.

Online Only Appendix Table 2: Effects of non-REO Listing on List Prices

Dependent Variable	(1) I[Change List]	(2) I[Change List]	(3) I[Change List]	(4) Δ List Price[1]
I[4 weeks before >0 REO listing]	-0.0006	0.0001	-0.0008	-0.0024***
	(0.0007)	(0.0007)	(0.0007)	(0.0006)
I[3 weeks before >0 REO listing]	-0.0005	0.0009	-0.0001	-0.0030***
	(0.0006)	(0.0006)	(0.0007)	(0.0006)
I[2 weeks before >0 REO listing]	0.0003	0.0018***	0.0006	-0.0038***
	(0.0007)	(0.0006)	(0.0007)	(0.0006)
I[1 week before >0 REO listing]	-0.0002	0.0009	-0.0003	-0.0016*
	(0.0005)	(0.0006)	(0.0006)	(0.0009)
I[1 week after >0 REO listing]	-0.0005	0.0008	-0.0002	-0.0022***
	(0.0009)	(0.0006)	(0.0007)	(0.0006)
I[2 weeks after >0 REO listing]	-0.0006	0.0006	-0.0006	-0.0033***
	(0.0007)	(0.0006)	(0.0007)	(0.0009)
I[3 weeks after >0 REO listing]	0.0000	0.0018***	0.0007	-0.0023***
	(0.0008)	(0.0007)	(0.0007)	(0.0008)
I[4 weeks after >0 REO listing]	-0.0017***	-0.0002	-0.0011*	-0.0035***
	(0.0006)	(0.0007)	(0.0006)	(0.0010)
I[4 weeks before >1 REO listing]	0.0005	0.0002	-0.0006	-0.0041**
	(0.0009)	(0.0009)	(0.0009)	(0.0017)
I[3 weeks before >1 REO listing]	-0.0003	-0.0001	-0.0010	-0.0054***
	(0.0009)	(0.0009)	(0.0009)	(0.0017)
I[2 weeks before >1 REO listing]	0.0007	0.0011	-0.0000	-0.0026***
	(0.0013)	(0.0009)	(0.0010)	(0.0009)
I[1 week before >1 REO listing]	-0.0006	0.0003	-0.0011	-0.0041***
	(0.0009)	(0.0009)	(0.0010)	(0.0008)
I[1 week after >1 REO listing]	-0.0015	-0.0012	-0.0024**	-0.0047**
	(0.0012)	(0.0009)	(0.0011)	(0.0018)
I[2 weeks after >1 REO listing]	0.0016*	0.0020**	0.0010	-0.0031***
	(0.0008)	(0.0009)	(0.0009)	(0.0009)
I[3 weeks after >1 REO listing]	0.0004	0.0011	-0.0000	-0.0046***
	(0.0010)	(0.0009)	(0.0010)	(0.0010)
I[4 weeks after >1 REO listing]	-0.0014	-0.0007	-0.0016*	-0.0037**
	(0.0010)	(0.0009)	(0.0009)	(0.0017)
I[4 weeks before >0 non-REO listing]	-0.0002	0.0003	-0.0005	-0.0000
	(0.0006)	(0.0005)	(0.0005)	(0.0008)
I[3 weeks before >0 non-REO listing]	0.0009*	0.0019***	0.0010*	0.0012*
	(0.0005)	(0.0005)	(0.0005)	(0.0006)
I[2 weeks before >0 non-REO listing]	0.0002	0.0013**	0.0002	0.0006
	(0.0006)	(0.0005)	(0.0006)	(0.0005)
I[1 week before >0 non-REO listing]	0.0008*	0.0017***	0.0006	0.0019***
	(0.0005)	(0.0005)	(0.0005)	(0.0004)
I[1 week after >0 non-REO listing]	0.0005	0.0016***	0.0007	0.0014**
	(0.0004)	(0.0005)	(0.0005)	(0.0006)
I[2 weeks after >0 non-REO listing]	-0.0007	0.0001	-0.0008	0.0011
	(0.0007)	(0.0005)	(0.0006)	(0.0009)
I[3 weeks after >0 non-REO listing]	0.0009**	0.0021***	0.0012**	0.0016***
	(0.0004)	(0.0005)	(0.0005)	(0.0004)
I[4 weeks after >0 non-REO listing]	0.0003	0.0013**	0.0004	-0.0002
	(0.0006)	(0.0005)	(0.0005)	(0.0007)
I[4 weeks before >1 non-REO listing]	-0.0008	-0.0012*	-0.0013*	0.0017
	(0.0006)	(0.0007)	(0.0007)	(0.0011)
I[3 weeks before >1 non-REO listing]	0.0000	0.0004	0.0003	0.0010
	(0.0007)	(0.0007)	(0.0007)	(0.0007)

I[2 weeks before >1 non-REO listing]	0.0010*	0.0010	0.0006	0.0013*
	(0.0006)	(0.0007)	(0.0008)	(0.0007)
I[1 week before >1 non-REO listing]	-0.0018**	-0.0015**	-0.0020**	0.0007
	(0.0008)	(0.0007)	(0.0008)	(0.0005)
I[1 week after >1 non-REO listing]	0.0001	-0.0004	-0.0006	0.0018*
	(0.0005)	(0.0007)	(0.0008)	(0.0009)
I[2 weeks after >1 non-REO listing]	0.0004	0.0002	-0.0001	0.0012
	(0.0007)	(0.0007)	(0.0007)	(0.0008)
I[3 weeks after >1 non-REO listing]	-0.0002	0.0005	0.0002	0.0016***
	(0.0007)	(0.0007)	(0.0007)	(0.0006)
I[4 weeks after >1 non-REO listing]	0.0006	0.0008	0.0004	0.0018***
	(0.0006)	(0.0007)	(0.0008)	(0.0006)
I[Same week as >0 REO listing]	0.0066***	0.0094***	0.0085***	-0.0036*
	(0.0012)	(0.0015)	(0.0016)	(0.0018)
I[Same week as >1 REO listing]	0.0089***	0.0096***	0.0099***	-0.0082***
	(0.0033)	(0.0031)	(0.0033)	(0.0030)
I[Same week as >0 non-REO listing]	0.0065***	0.0090***	0.0087***	0.0007
	(0.0015)	(0.0012)	(0.0012)	(0.0012)
I[Same week as >1 non-REO listing]	0.0113***	0.0147***	0.0128***	-0.0015
	(0.0027)	(0.0026)	(0.0027)	(0.0029)
I[Same week as >0 REO listing]*distance	-0.0099***	-0.0089**	-0.0099**	-0.0036
	(0.0035)	(0.0042)	(0.0041)	(0.0059)
I[Same week as >1 REO listing]*distance	-0.0077**	-0.0066**	-0.0085***	-0.0015
	(0.0035)	(0.0034)	(0.0032)	(0.0034)
I[Same week as >0 non-REO listing]*distance	-0.0112	-0.0063	-0.0116	0.0154
	(0.0086)	(0.0095)	(0.0096)	(0.0113)
I[Same week as >1 non-REO listing]*distance	-0.0120*	-0.0160**	-0.0112	0.0111
	(0.0061)	(0.0077)	(0.0078)	(0.0081)
# weeks from initial listing	0.0000	0.0001***	0.0000**	-0.0005***
	(0.0000)	(0.0000)	(0.0000)	(0.0001)
REO Dummy	0.0177***		0.0175***	-0.0113***
	(0.0031)		(0.0009)	(0.0014)
Constant	0.0540***	0.0704***	0.0741***	-0.0242***
	(0.0029)	(0.0009)	(0.0008)	(0.0031)
Week and city fixed effects	X			X
House fixed effects		X		
Zip code by quarter fixed effects			X	
Observations	1787711	1787711	1787711	155320
Adjusted R-squared	0.005	0.009	0.004	0.108

Clustered standard errors in parentheses.

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

1. Conditional on a price change occurring.

Only Only Appendix Table 3: Disamenity Effects of REO's

	(1)
Dependent Variable	Log sales price
I[During >0 REO listing, far]	-0.0270***
	(0.0032)
I[During >1 REO listing, far]	-0.0419***
	(0.0043)
I[During >0 REO listing, close]	-0.0178***
	(0.0031)
I[During >1 REO listing, close]	-0.0255***
	(0.0048)
I[During >2 REO listing, close]	-0.0126**
	(0.0063)
I[During >0 non-REO listing, far]	-0.0108**
	(0.0046)
I[During >1 non-REO listing, far]	-0.0015
	(0.0036)
I[During >0 non-REO listing, close]	-0.0061***
	(0.0024)
I[During >1 non-REO listing, close]	0.0042
	(0.0037)
I[During >2 non-REO listing, close]	0.0077
	(0.0052)
I[F to F+60, >0, far]	-0.0183***
	(0.0030)
I[F to F+60, >1, far]	-0.0198***
	(0.0050)
I[F+60 to F+120, >0, far]	-0.0206***
	(0.0035)
I[F+60 to F+120, >1, far]	-0.0182**
	(0.0072)
I[F+120 to F+180, >0, far]	-0.0254***
	(0.0043)
I[F+120 to F+180, >1, far]	-0.0307***
	(0.0096)
I[F to F+60, >0, close]	-0.0079*
	(0.0045)
I[F to F+60, >1, close]	-0.0246**
	(0.0106)
I[F to F+60, >2, close]	-0.0334
	(0.0241)
I[F+60 to F+120, >0, close]	-0.0055
	(0.0068)
I[F+60 to F+120, >1, close]	-0.0188
	(0.0226)
I[F+60 to F+120, >2, close]	-0.0209
	(0.0406)
I[F+120 to F+180, >0, close]	-0.0064
	(0.0077)
I[F+120 to F+180, >1, close]	0.0335

	(0.0299)
I[F+120 to F+180, >2, close]	0.0341
	(0.0730)
I[F to F-60, >0, far]	-0.0184***
	(0.0032)
I[F to F-60, >1, far]	-0.0154***
	(0.0047)
I[F-60 to F-120, >0, far]	-0.0207***
	(0.0032)
I[F-60 to F-120, >1, far]	-0.0006
	(0.0043)
I[F-120 to F-180, >0, far]	-0.0127***
	(0.0032)
I[F-120 to F-180, >1, far]	0.0015
	(0.0041)
I[F-180 to F-240, >0, far]	-0.0160***
	(0.0036)
I[F-180 to F-240, >1, far]	0.0069
	(0.0048)
I[F-240 to F-300, >0, far]	-0.0161***
	(0.0036)
I[F-240 to F-300, >1, far]	0.0041
	(0.0044)
I[F to F-60, >0, close]	-0.0045
	(0.0048)
I[F to F-60, >1, close]	-0.0106
	(0.0102)
I[F to F-60, >2, close]	-0.0025
	(0.0203)
I[F-60 to F-120, >0, close]	-0.0042
	(0.0042)
I[F-60 to F-120, >1, close]	-0.0090
	(0.0094)
I[F-60 to F-120, >2, close]	-0.0163
	(0.0169)
I[F-120 to F-180, >0, close]	-0.0090**
	(0.0039)
I[F-120 to F-180, >1, close]	-0.0028
	(0.0100)
I[F-120 to F-180, >2, close]	-0.0212
	(0.0154)
I[F-180 to F-240, >0, close]	-0.0050
	(0.0036)
I[F-180 to F-240, >1, close]	-0.0057
	(0.0110)
I[F-180 to F-240, >2, close]	-0.0109
	(0.0192)
I[F-240 to F-300, >0, close]	-0.0027
	(0.0040)
I[F-240 to F-300, >1, close]	-0.0093
	(0.0090)
I[F-240 to F-300, >2, close]	-0.0008

	(0.0207)
I[Soon After >0 REO sale, far]	-0.0267***
	(0.0035)
I[Soon After >1 REO sale, far]	-0.0337***
	(0.0051)
I[Soon After>0 REO sale, close]	-0.0086**
	(0.0038)
I[Soon After>1 REO sale, close]	-0.0168**
	(0.0085)
I[Soon After>2 REO sale, close]	-0.0490***
	(0.0163)
Square feet	0.5748***
	(0.0181)
Square feet * square feet	-0.0521***
	(0.0033)
REO dummy	-0.1257***
	(0.0045)
# weeks from initial listing	-0.0008***
	(0.0001)
Constant	12.5823***
	(0.0233)
Zip code by quarter fixed effects	X
Observations	63457
Adjusted R-squared	0.902

Clustered standard errors in parentheses; p-values in italics.
*** p<0.01, ** p<0.05, * p<0.1
1. The "during" period is after a listing, but before the property is sold.
2. "Soon after" and "after" are differentiated to mean 1-45 days and 46-90 days after an REO sale, respectively.
3. "Far" and "close" signify a sale within .33 and .1 miles of an REO sale.
4. F denotes the date of the foreclosure. The numbers relative to F are in days. For example, $I[F \text{ to } F\text{-}60, >0, \text{close}]_{it}=1$ if t is within the 2 month window prior to >0 foreclosures that are within .1 miles of sale i.