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Foreclosure Contagion and REO versus non-REO Sales

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We examine the real estate owned (REO) discount by using ZIP code-level data on foreclosure rates, distressed and non-distressed sales in Chicago, Illinois. We find significant differences in price between distressed and non-distressed properties in high- versus low-foreclosure rate neighborhoods. We expand this analysis to determine if trends in the REO discount can be explained by trends in foreclosure rates and if this correlation can be used to identify a 'tipping point' in foreclosure rates. We identify key relationships between trends in the REO discount, the proportion of REO sales to total sales, and sales volume.

Keywords:

REO; Foreclosure; Contagion

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1.   Introduction

There have been a number of accounts in the mainstream media with regards to foreclosures concentrated in particular neighborhoods or geographic regions. In some cases, a surge in foreclosures appears to have led to the demise of entire towns. [1] Given this anecdotal evidence, our primary research question asks, 'Is there a tipping point in foreclosure rates above which the foreclosure rate increases at an increasing rate?'   That is, is there some threshold in foreclosures above which a neighborhood or town may be considered at risk of failure?

This question is important because if we can identify such a tipping point and the factors that lead certain areas to reach that tipping point more quickly than others, then relief efforts and future crisis prevention efforts may be appropriately targeted.

Single-family foreclosure rates have significantly increased nationwide since 2007. Figure 1 shows this trend in Chicago, Illinois. Here, foreclosure rates across Chicago neighborhoods average 1.41 percent in the fourth quarter of 2006 and rise to 5.59 percent in the fourth quarter of 2008. Often, these foreclosures lead to a public auction where the lender purchases the home, changing the status of the property to real estate owned (REO). Ultimately, these properties are eventually sold – frequently at greatly reduced prices – and these sales are accounted for as REO sales. These distressed sales appear to have a negative impact on overall sales indices. Figure 2 shows this effect when REO sale prices per square foot are separately depicted from non-distressed sale prices in Chicago, Illinois. The median price per square foot for all properties in Chicago from 1999 to 2008 is $196.79, while non-distressed properties sell for a slightly higher price of $200.93/sq. ft., but distressed properties sell for much less at $115.11/sq. ft.

When we compare neighborhoods with high foreclosure rates to neighborhoods with low foreclosure rates, we find evidence that the former has a smaller gap between distressed and non-distressed prices than the latter. Figures 3 and 4 provide examples of high foreclosure rate neighborhoods versus low foreclosure rate neighborhoods and their corresponding price gaps. Figure 3 focuses on the five-digit ZIP code 60621. This is an inner-city neighborhood on the south side of Chicago near the University of Chicago. Here, the average foreclosure rate is 6.72 percent across the period from 2003 to 2008. Figure 3 shows the price gap between REO and non-REO properties over the 10-year period from 1999 to 2008 in this south side neighborhood. This gap averages $28.48 per square foot. At the other end of the spectrum, Figure 4 depicts the five-digit ZIP code 60647. This is an upper scale

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[1] See   Schwartz (2007) for an anecdotal example of the neighborhood impact of foreclosure.

neighborhood called Bucktown. Here, the average foreclosure rate is 0.67 percent across the period from 2003 to 2008. Figure 4 shows the price gap between REO and non-REO properties over the 10-year period from 1999 to 2008 in Bucktown. Due to the low volume of REO sales, there are some periods where there is no REO sales price data. However, the average price gap in the periods where there are both distressed and non-distressed sales is $90.39 per square foot.

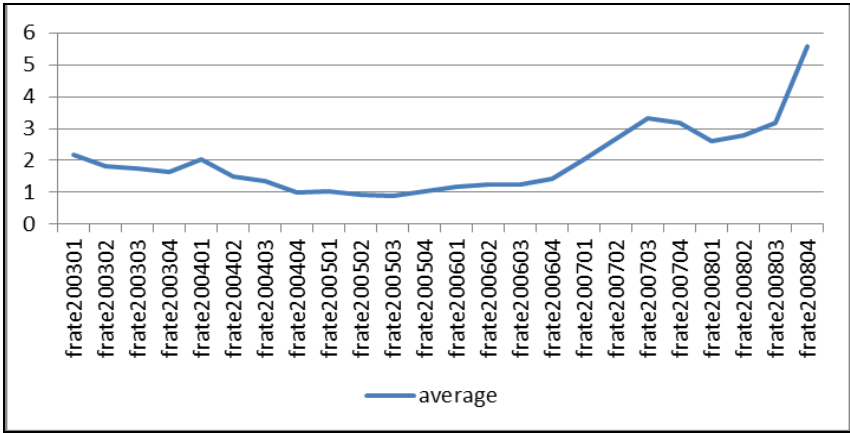**Figure 1   Chicago, IL Average Foreclosure Rates**

Figure 2   Chicago, IL Median Price per Square Foot
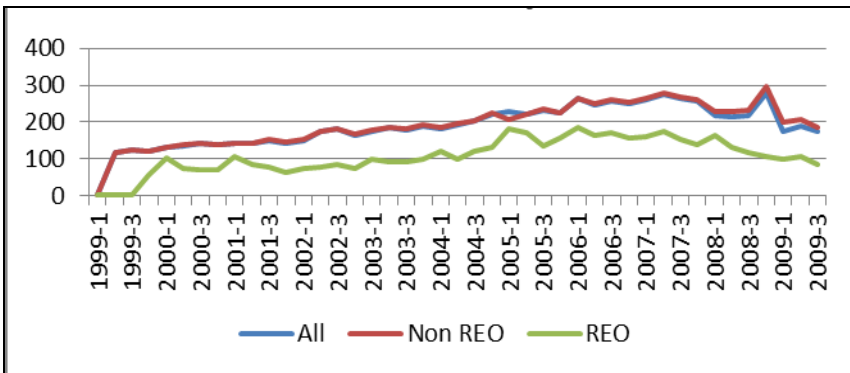
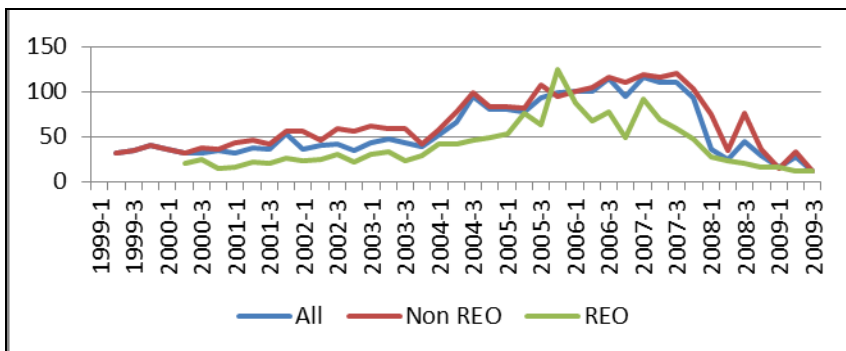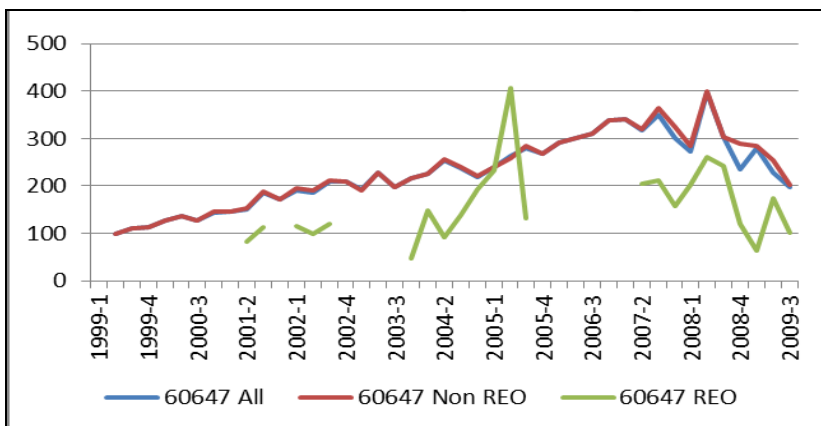**Figure 3   60621 Median Price per Square Foot**

Figure 4   60647 Median Price per Living

We argue that the difference in the size of this price gap – which is referred to as the REO discount – is indicative of foreclosure contagion and its impact on home values. Furthermore, we argue that a close examination of the trend in the REO discount in a particular neighborhood is useful for determining the tipping point in foreclosure. We maintain that REO discounts are high when foreclosure rates are low because distressed sales are an unusual phenomenon that justifies a significant market discount. However, when foreclosure rates are high, distressed sales are more commonplace and do not require large REO discounts in order for the properties to be sold. It should follow that when foreclosure rates increase due to contagion, there should be a point when the REO discount begins to fall due to market saturation, i.e., a

distressed sale becomes more the norm than an anomaly. We argue that the point at which the rate of change in the REO discount reverses is the tipping point in foreclosure rates.

The section that follows reviews the relevant literature in this area. The next section describes the data and methodology that we use to test our hypotheses. We conclude with a presentation and discussion of our results.

2.   Review of the Literature

Our examination of foreclosure focuses on the impact of foreclosure on individual neighborhoods. Our specific focus is on foreclosure density as compared to the price gap between distressed and non-distressed sales. A growing body of work examines the neighborhood effects of foreclosure from various perspectives[2]. Much of that work focuses on the price/value impact of foreclosed properties on neighboring homes. Other work examines REO properties that have been repossessed by banks.

With regard to price effects, research in this area provides evidence that the price or value impact of neighboring foreclosures is anywhere from 1 to 10 percent or about $5,000 on average. Immergluck and Smith (2006) find that each conventional foreclosure within an eighth of a mile of a single-family home results in a decline of 0.9 percent in value. Leonard and Murdoch (2008) estimate that the direct effect of an increase in foreclosures is between $1,320 and $2,020, and the spatial reach of this impact is 250 feet. The Center for Responsible Lending (CRL) estimates that 40.6 million neighboring homes will experience devaluation because of subprime foreclosures that take place nearby. This decline, the CRL estimates, is valued at $202 billion. This translates into a $5,000 decline on average for a homeowner living near a foreclosed property. Lin, Rosenblatt and Yao (forthcoming) find that the spillover effect results in as much as a 9.7 percent discount in home prices for homes located within a 0.1 km (300 feet) radius from a foreclosed property. Furthermore, they find that the spillover effect is always significant for distances within 0.9 km (3,000 feet). Rogers and Winter (2008) find a foreclosure effect of as much as 5.3 percent at 100 yards and six months. They find that the negative impact of foreclosures does extend at least 400 yards and 18 months. They do not, however, find evidence of a 'tipping point,' where at some point sales decline rapidly. Instead, they find evidence of a diminishing marginal effect of foreclosure – the opposite effect. Harding, Rosenblatt and Yao (2008) find evidence that nearby distressed properties have significant negative contagion effects over and above the overall trend in house prices of approximately 1 to 1.5 percent per

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[2] See Miller, Rauterkus and Sklarz (2008) for a detailed description of current foreclosure research.

foreclosure. They find three things: 1) the foreclosure effect is greater, the longer it takes to sell the foreclosed property; 2) it peaks at the time of the REO sale; and 3) it lingers beyond the REO sale. Calomiris, Longhofer and Miles (2008) find that the impact of foreclosure on prices is negative and significant, but small in magnitude. The authors estimate that the national average price decline for houses from second quarter 2007 to fourth quarter 2009 will be approximately 5.5 percent. Furthermore, they conclude that the future path of housing prices will be flat for the next two years.

REO research provides evidence that foreclosures are concentrated in the inner city and certain states. The Initiative for a Competitive Inner City (ICIC) (2008) provides statistics that indicate .63 percent of housing units in the inner city are REOs versus .31 percent in the rest of the United States. Furthermore, the paper reports that there are 9.2 REOs per square mile in the inner city compared with 0.2 REOs per mile in the rest of the United States. The ICIC finds the highest REO rates in Detroit, Cleveland, Atlanta, Indianapolis and Akron, all with over 1.5 percent of owner-occupied housing units in REO. We obtained current foreclosure data from the Federal Reserve Bank of New York in order to extend the ICIC analysis of REO rates. The data suggest that the subprime foreclosure fallout is very concentrated. We see this concentration by state and within states and cities. We see 75 percent of the subprime foreclosures in only 12 states.[3]

3.   Data

We focus our study on Chicago, IL. We use a dataset from LPS Analytics that contains loan-level data provided by mortgage servicers. This dataset contains both static and dynamic variables related to these loans at origination (static variables) and as of specific points in time (dynamic variables). We obtain a sample of all Chicago mortgages in the dataset from January 2003 through to December 2008. We also use a dataset from Collateral Analytics that contains ZIP code-level sales data for distressed (REOs and short sales) and non-distressed sales in the city of Chicago from 1999 through to 2008.[4]

By using the loan-level dataset, we calculate monthly foreclosure rates by five-digit ZIP code for all three cities. We calculate foreclosure rates as $\frac{\# \ of \ loans \ in \ foreclosure}{\# \ of \ loans \ in \ the \ dataset}$ for each ZIP code. From our ZIP code-level sales data, we calculate average sales price per square foot by ZIP code and quarter. We

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[3] These 12 states are California, Florida, Texas, New York, Michigan, Ohio, Illinois, Pennsylvania, Georgia, Arizona, Indiana and New Jersey.

[4] Despite the use of separate sources for foreclosure and REO data, our merged dataset is consistent because of the comparable nature of the coverage rates for each source in the markets that we study.

also calculate the proportion of distressed (REO) sales to total sales by ZIP code and quarter.

Table 1 describes our data. We notice a marked difference in the trends from 2003 – 2005 versus the trends from 2006 – 2008. The REO discount, proportion of distressed sales and foreclosure rates steadily increased in the latter period, while these trends tended to decline in the earlier subperiod. Also, we see a significant difference in the size of the REO discount after taking sales volume into consideration to yield a sales-weighted REO discount. The discount tends to be more than 10 percent higher after accounting for sales volume. However, this trend also differs across the two subperiods. The sales-weighted REO discount is 14 percent higher on average than the non-sales-weighted REO discount from 2003-2005 while it is less than 8 percent higher during the period from 2006 – 2008.

4.   Methodology

We test for the contagion effect by using this data. Our hypothesis is that in markets dominated by foreclosures, all homes are affected and non-distressed sales will be discounted the same as distressed sales. However, in markets with fewer foreclosures, we should see larger gaps in pricing. That is, a greater density and number of foreclosures within a ZIP code means a smaller gap between the pricing of distressed and non-distressed sales. We hypothesize that in markets with a lot of foreclosures, all properties are contaminated, even if they are not distressed sales. This is due to the effect noted by Immergluck and Smith (2006) and others, which indicates the price impact of nearby foreclosures. Furthermore, in our second hypothesis, we argue that a glut of foreclosed properties overwhelms the market and depresses sales volume until financial institutions are left with substantial REO inventory that subsequently must be sold. Continuing with this chain of events, our third hypothesis argues that as it becomes harder and harder to sell these distressed homes, financial institutions must increase the discount that they are willing to accept for these homes.

Specifically, we test the following hypotheses.

> H_1: The REO discount increases with the proportion of sales that are distressed in a given area up to a saturation point after which the discount reverses.

> H_2: Increases in foreclosure rates lead REO sales.

> H_3: The REO discount increases as sales volume decreases.

Table 1   Descriptive Statistics
This table describes the data used in our study of 57 unique ZIP codes in Chicago, Illinois.

	2003	2004	2005	2006	2007	2008
All Sales $/sq. ft.	180.37	199.44	226.61	254.45	263.39	232.09
% Change in all sales $/sq. ft.	8.31	10.57	13.63	12.28	3.51	-11.88
Regular price/sq. ft.	184.37	202.64	222.62	256.12	266.93	246.85
% Change in regular $/sq. ft.	9.12	9.91	9.86	15.05	4.22	-7.52
Distressed $/sq. ft.	95.19	117.31	160.60	169.30	156.50	128.82
% Change in $/sq. ft.	23.85	23.24	36.90	5.42	-7.56	-17.69
REO discount ($)	89.18	85.34	62.02	86.82	110.42	118.03
REO discount (%)	48.37	42.11	27.86	33.90	41.37	47.81
% Change in REO discount	-3.17	-4.31	-27.32	39.99	27.18	6.89
Sales-Weighted REO discount ($)	107.70	100.84	91.48	93.46	107.87	113.63
Sales-Weighted REO discount (%)	61.56	54.49	44.93	42.74	48.11	54.81
% Change in Sales-Weighted REO discount	-4.94	-11.48	-17.54	-4.88	12.57	13.92
Regular sales volume	13,841	17,505	20,205	15,635	10,134	5,616
% Change in regular sales volume	4.00	26.47	15.42	-22.62	-35.18	-44.58
Distressed sales volume	1,067	1,095	967	762	932	1,728
% Change in distressed sales volume	21.39	2.62	-11.69	-21.20	22.31	85.41
Proportion of distressed sales to total sales	7.16	5.89	4.57	4.65	8.42	23.53
% Change in proportion of distressed sales	15.53	-17.75	-22.42	1.75	81.23	179.37
Foreclosure rate(%)	1.82	1.88	1.05	1.32	2.91	5.53
% Change in foreclosure rate		2.89	-44.12	25.50	121.32	90.01

We can then find the tipping point by graphing the density or percentage of properties in a ZIP in foreclosure against the gap in pricing. Graphically, the tipping point is the point at which foreclosure rates begin to increase at an increasing rate. By simultaneously examining other data and confirming a relationship between these phenomena and foreclosure rates, we can determine the point at which other economic conditions can produce this tipping point. We limit our focus to the REO discount and the proportion of REO sales to total sales.

To confirm the relationship between foreclosure rates and the REO discount, we estimate a time series regression. We model it as LN_foreclosure_rate = α + βREO_Discount where LN_foreclosure_rate = the natural log of the proportion of foreclosures in a ZIP code and REO_discount = measures the difference between average distressed sales prices and average non-distressed sales prices. This discount is then expressed as a ratio in the subsequent analysis.

To further define the point at which there is a significant change in the foreclosure rate acceleration, we estimate the logistic equation $Y^* = a + bX$ where $Y^* = \ln(K/Y -1)$, K is an asymptote that represents the maximum realistic value for Y, X is an explanatory variable (REO discount or proportion of REO sales) and Y is the foreclosure rate. After estimating the parameters for a and b, we insert these values into our original regression equation and calculate its first and second derivatives. After setting the second derivative equal to zero, we find a value for X which can be identified as the foreclosure rate tipping point.

5.   Results

We separate the ZIP codes in our sample into quartiles based on the average foreclosure rate across the sample period. Figure 5 compares the REO discount in the quartile with the highest foreclosure rates to the REO discount in the quartile with the lowest foreclosure rates. In most periods, the REO discount is higher in the low foreclosure rate neighborhoods with four brief periods where the two trend lines cross. We conduct a *t*-test to determine if there is a significant difference in the average REO discounts in high- and low-foreclosure rate areas. The results of this *t*-test are shown in Table 2. The *t*-statistic of -4.30 (and p-value of 0.00) indicates that the average REO discount in high foreclosure rate ZIPs is significantly lower than the average REO discount in low foreclosure rate ZIPs. The *t*-test also reveals that the volatility of the REO discount in high foreclosure rate ZIPs is nearly six times the volatility in low foreclosure rate ZIPs.

Table 2   Difference in Mean REO Discount

	High Foreclosure Rate ZIPs	Low Foreclosure Rate ZIPs
Mean	0.18372	0.379548
Variance	0.068433	0.012151
Observations	34	34
Pearson Correlation	0.176914	
Hypothesized Mean Difference	0	
df	33	
t Stat	-4.30417	
P(T<=t) one-tail	7.04E-05	
t Critical one-tail	1.69236	
P(T<=t) two-tail	0.000141	
t Critical two-tail	2.034515	

Figure 5   Chicago, IL REO Discount in High versus Low Foreclosure Rate ZIP Codes
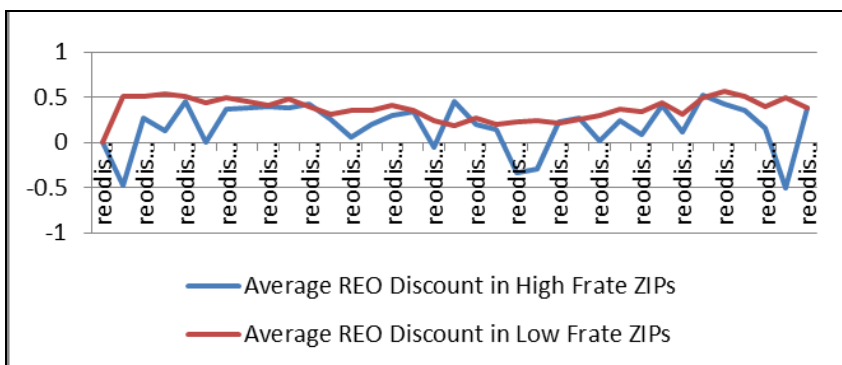
After finding evidence that the REO discount is higher for low foreclosure rate neighborhoods than high foreclosure rate neighborhoods, we test our first hypothesis that this relation leads to a trend reversal in the REO discount as foreclosure rates increase above a certain level.

A depiction of the results of H_1 is shown in Figure 6. This figure shows, particularly after 2005, that the REO discount increases with the proportion of REO sales to total sales. Over time, this discount considerably fluctuates, which ranges from just over 1 percent to just under 70 percent. As noted in the descriptive statistics, the sales-weighted REO discount tends to be higher

than the non-sales-weighted REO discount over time.   However, this difference lessens after 2005 and the sales-weighted REO discount even dips below the non-sales-weighted REO discount at the end of 2008. What is not clear from Figure 6 is a reversal in the REO discount although a trend reversal does appear to be evident in the proportion of REO sales.   We therefore conduct further analysis of the nature of the relationship between the REO discount and the proportion of REO sales. Figure 7 shows a scatter plot of our entire sample of data. Here, we do not see evidence of a non-linear relationship between these two factors.   Due to the extreme differences in market conditions after 2005, we separate our sample into two subsets. The first subset includes observations through to December 2005 and the second subset includes only observations after 2005. Figure 8 is a scatter plot of the post-2005 subsample.   Here, the relationship between the two variables appears to be much the same as in the full sample.

Despite the persistence of a linear trend in the data, we consider the possibility of a logistic relationship between the REO discount and the proportion of REO sales. The results of our logistic regressions are shown in Table 3. A graph of these results for a range of values of the proportion of REO sales, is shown in Figure 9.   Again, we do not see clear inflection points which indicate a reversal in the REO discount at some level of REO sales.

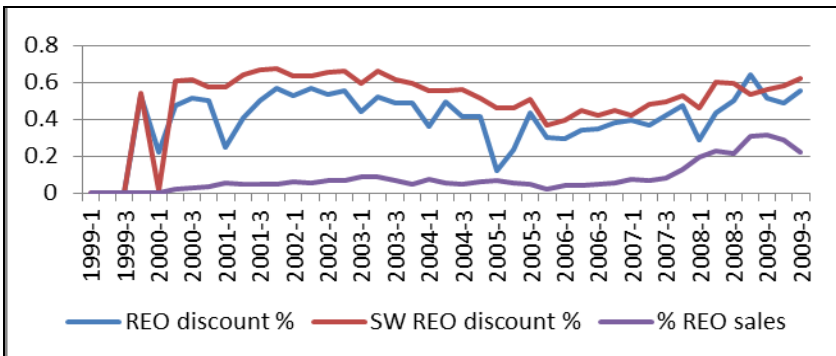**Figure 6   Chicago, IL REO Discount vs. REO Sales to Total Sales**

Figure 7   Relationship Between REO Discount and Proportion of REO Sales to Total Sales (Full Sample)
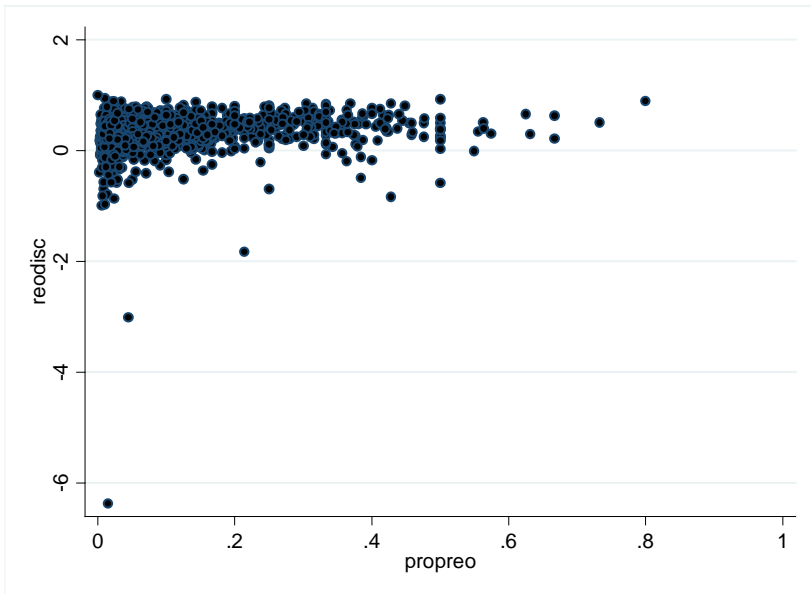

Figure 8   Relationship Between REO Discount and Proportion of REO Sales (after 2005)
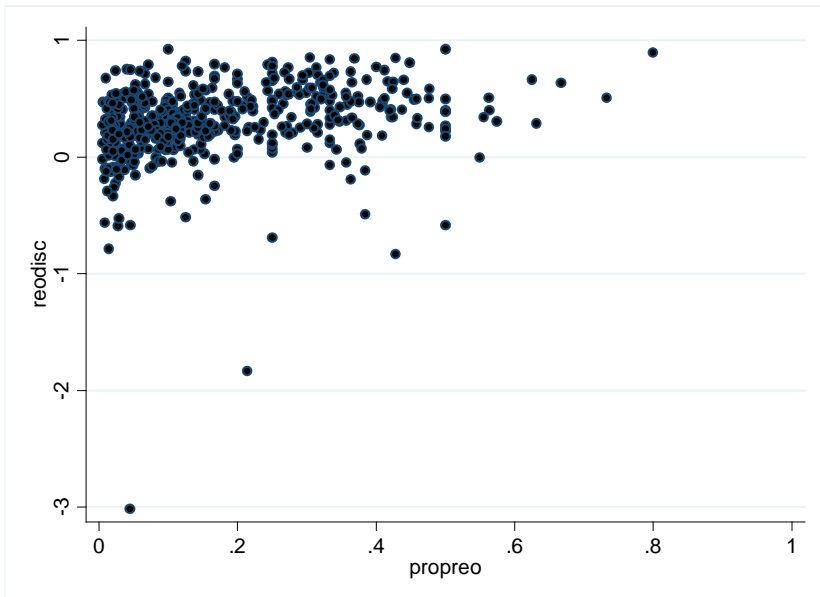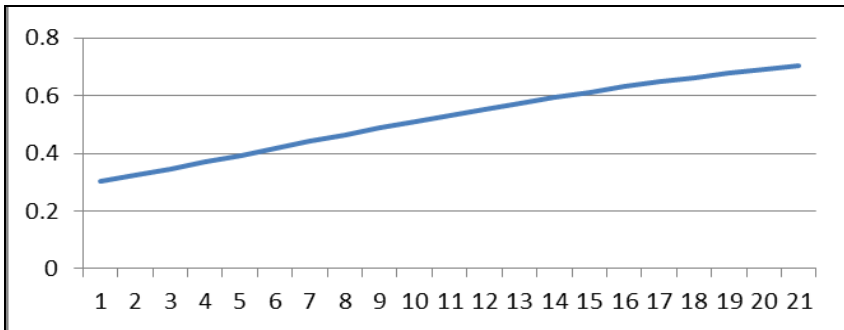
Table 3   **Logistic Regression Results**
The dependent variable in all regressions is REO discount.

	Full Sample	Pre-2006 Sub-Sample	Post-2005 Sub-Sample
Propreo	-2.2837 (-7.17)***	-2.9752 (-4.91)***	-2.5662 (-6.31)***
Constant	0.5633 (9.80)***	0.5080 (6.55)***	0.7592 (8.19)***
N	982	537	445
R^2	0.0498	0.0432	0.0825

Figure 9   **Chicago, IL Logistic S Curve, REO Discount vs. Proportion of REO Sales**

In our second hypothesis, we propose that increases in foreclosure rates lead REO sales. Figure 10 shows the trend in foreclosure rates from 2003 to 2008. Here, we notice that average foreclosure rates in Chicago hit a peak in the third quarter of 2007 and then experienced two consecutive quarters of decline followed by a sharp upswing in late 2008. A visual analysis indicates that a change in the acceleration rate in foreclosure appears to occur in the third quarter of 2008. We conduct a time-series regression analysis to determine the extent to which foreclosures lead REO sales. The results of those regressions are shown in Table 4. After testing one-, two- and three- period lags, we find evidence that foreclosure rates lead REO sales by at least one period that corresponds to a quarter.[5]

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[5] Keep in mind that these results are for Chicago and subject to the regulations for the state of Illinois. In other states where foreclosures take longer to process, a longer lead should be expected. California, New York, Florida, Maryland, and Massachusetts are among the nation's slowest according to LPS Applied Analytics.

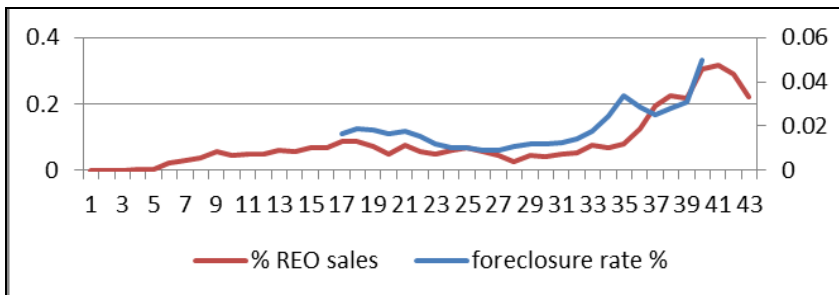**Figure 10   Chicago, IL Foreclosure Rates vs. REO Sales**

Table 4   Panel Regression Results
The dependent variable in all regressions is REO discount.

	Model 1	Model 2	Model 3
	Panel A: Full Sample		
Lnfratelead1	0.0538 (3.71)***		
Lnfratelead2		0.0293 (1.96)*	
Lnfratelead3			0.0056 (0.37)
Constant	0.2673 (10.72)***	0.2663 (10.39)***	0.2650 (10.35)***
N	709	702	690
Wald χ^2	13.74***	3.85**	0.14
R^2	0.0513	0.0342	0.0248
	Panel B: Pre-2006 Sub-Sample		
Lnfratelead1	0.0805 (3.08)***		
Lnfratelead2		0.0586 (2.25)**	
Lnfratelead3			0.0491 (1.90)*
Constant	0.3120 (9.50)***	0.3112 (9.32)***	0.3410 (9.91)***
N	354	381	333
Wald χ^2	9.48***	5.05**	3.62*
R^2	0.0453	0.0398	0.0622
	Panel C: Post-2005 Sub-Sample		
Lnfratelead1	0.0925 (4.42)***		
Lnfratelead2		0.0843 (3.65)***	
Lnfratelead3			0.0291 (1.73)*
Constant	0.2127 (7.96)***	0.1973 (6.79)***	0.2554 (11.71)***
N	355	321	388
Wald χ^2	19.51***	13.35***	3.00*
R^2	0.0833	0.0661	0.0155

Finally, we consider the relationship between the REO discount and sales volume. We hypothesize an inverse relationship which indicates that the REO discount is larger in thinner housing markets. Figure 11 shows the trends in the REO discount compared to sales volume. Here, we see that in times that the REO discount is high, sales volume is lower as in the period prior to 2004 and after 2005. Also, we see that at times when the REO discount is low, sales volume is higher, as in the period from 2004 to 2005. We estimate a time-series regression to further understand the relationship between the REO discount and sales volume. The results of those regressions are shown in Table 5. As expected, the sign of the coefficient for *lnsalesvolume* is negative in all periods. These results are strongest in the period prior to 2006.
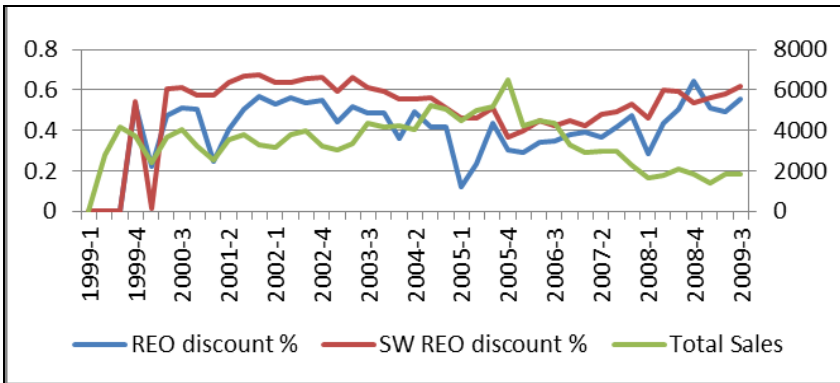
Figure 11   Chicago, IL REO Discount vs. Sales Volume

Table 5   Table 5. REO Discount and Sales Volume
The dependent variable in all regressions is REO discount.

	Full Sample	Pre-2006 Sub-Sample	Post-2005 Sub-Sample
Lnsalesvolume	-0.0513 (03.65)***	-0.0609 (-2.76)***	-0.0447 (-2.57)***
Constant	0.4966 (8.61)***	0.5532 (5.75)***	0.4641 (6.93)***
N	1,114	609	505
Wald χ^2	13.34***	7.64***	6.62**
R^2	0.0099	0.0188	0.0051

6.   Discussion and Conclusions

In our first formal hypothesis, we propose that the REO discount increases with the proportion of sales that are distressed in a given area, but once the market reaches a saturation point, this trend dampens and the REO discount declines.   While we find evidence that the REO discount, measured in percentage terms, is high when foreclosure rates are low and vice versa, the discount never disappears.   There may be a number of explanations for this phenomenon.   We discuss two strong possibilities here.   First, this type of trend reversal may only occur under the most extreme circumstances.   In the Chicago market, the ZIP code with the greatest difference between the lowest and highest periodic foreclosure rates posted a difference of over 8 percent. While an 8 percentage point shift in foreclosure rates appears to be significant, the lowest foreclosure rate for this ZIP code during the sample period is over 3 percent.   Given such a high starting point, it may be that this is a case of a distressed neighborhood simply getting worse.   Our hypothesis seeks to explain the case of a 'less distressed' neighborhood that turns into a 'distressed' neighborhood due to foreclosure contagion.   Our sample does not appear to have any non-distressed cases as a starting point for analysis.

Second, our foreclosure rate data covers the period from 2003 to 2008. Foreclosure rates began to spike in late 2006 and early 2007.   At the end of 2008, average foreclosure rates in Chicago continued to climb.   The only trend reversals that we see are in the proportion of REO sales to total sales and this may be due to external forces, such as the inability of the lenders to process the foreclosures and the delays caused by concerns over due process for borrowers.   Given the extreme nature of the relationships that we seek to verify, we may need more data to conduct a thorough analysis.   That is, we may not find a reversal in the REO discount because that reversal has not yet occurred in the Chicago market.

We are also certain that increases in foreclosure rates will lead to increases in REO sales, but it is important to understand and quantify the lead time for those who wish to forecast future price trends.   We find evidence that foreclosures lead REO sales by one to two quarters in Chicago and much longer periods in many other markets.

Finally, we hypothesize that ceteris paribus the REO discount must be higher in thinner markets.   That is, the sales price on distressed properties must be lowered in markets where sales are soft.   Thus, the REO discount is high when the sales volume is low and vice versa.   We do find evidence of this inverse relationship between the REO discount and sales volume.

Our overall model fit parameters (R^2 values) are admittedly low.   However, given the nature of the analysis, this is to be expected.   We recognize that there are many omitted variables that affect sales price per square foot and

thus we tolerate a great deal of noise in our price estimate.   At the same time, our variables of interest are highly significant and we know they affect prices. Should we be estimating value and value trends as the primary goals, our variables would add explanatory power.

Our results provide evidence that foreclosure contagion is raging, but not in all submarkets. It is highly concentrated. Loan modifications will not do much to curtail defaults without significant mortgage principal reduction and mortgage rate reductions.   This can only be accomplished by significant subsidy or a trade-off providing shared appreciation to third party investors in exchange for buying down part of the mortgage.

What may seem counter intuitive is quite logical, that areas with very few foreclosures will observe larger spreads between prices achieved on distressed sales versus non-distressed sales compared to markets where foreclosures are raging.   Where foreclosures are low as a percent of sales and rare, they do not seem to have the contagion effect on other regular sales, but when foreclosure rates are very high, say 30% of all sales or higher, we will tend to see less of a discount as all properties are affected by the contagion of the distressed sales.

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