

**The Spatial Aspects of the Foreclosure Crisis:
A Look at the New England Region**

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Introduction

The United States is currently undergoing the deepest recessions since the Great Depression of the 1930s. Home foreclosures are an important factor in this recession. According to one measure, more than 2.3 million properties faced foreclosure in 2008, an 81 percent increase in total properties from 2007 and a 225 percent increase in total properties from 2006 (RealtyTrac 2009). Despite the recent efforts by the federal government to address the housing crisis, there are scores of households that are on the brink of losing their homes. Much of this assistance to date has not been geographically targeted, focusing instead on broad national eligibility and mortgagees and mortgagors opting in to the programs voluntarily. An exception is the Neighborhood Stabilization Program (NSP), distributed by competition to specific localities or as a block grant according to formula, using state and local foreclosures and vacancy rates as well as economic indicators such as unemployment. But at \$5.9 billion in two separate iterations of the program this program makes up little of the overall response to the crisis, which now totals over \$3 trillion¹ (a total of \$11.3 trillion has been pledged to various programs) (Trumbull, 2009).

To date, there has been some descriptive research on the socio-demographic characteristics of the neighborhoods affected by foreclosures and the spillovers of foreclosures on surrounding houses. There has been considerably less research on the issue of whether foreclosures disperse and spread across neighborhoods.

This paper presents an exploratory spatial- temporal data analysis of foreclosures in four New England states (New Hampshire, Massachusetts, Rhode Island and Connecticut). The time period

¹ It is difficult to tease out exactly how much of this has been for general, geographically untargeted foreclosure prevention and mitigation. For example, \$300 billion set aside for the Hope for Homeowners program has gone largely unspent as the program has failed to perform as expected. The Obama administration recently announced a \$75 billion Making Home Affordable plan.

examined covers five quarters, from January 2007 through March 2008. The spatial analysis is done at the level of the census tract.²

The purpose of this study is to inform policies aimed at identifying, containing and preventing foreclosures and at revitalizing communities. More specifically, it attempts to better understand both how and where to invest limited resources to most effectively ameliorate the current foreclosure situation. In order to more fully understand the effect of foreclosure on households and communities, as opposed to loan portfolios, we conduct the analysis using both structure and unit level foreclosure indices.

We start by providing a short literature review of the studies investigating the neighborhood and spatial aspects of foreclosures. This is followed by a basic, a-spatial descriptive analysis of the characteristics and trends in foreclosure affected neighborhoods in New Hampshire, Massachusetts, Rhode Island and Connecticut. We analyze the foreclosure inventory by structure type and track developments over the five quarters. Employing a series of t-tests for each of the analyzed quarters, we identify the socio-demographic characteristics of the high foreclosure level neighborhoods. Moreover, we investigate the effect of the tenure characteristics (% rental occupied) of a neighborhood on its foreclosure level.

We then introduce the spatial dimension into our analysis, looking at the neighborhood patterns and trends of foreclosure contagion. We define foreclosure contagion as an increase in neighborhood foreclosures that spreads over time from neighborhood to adjoining neighborhood. More formally in this paper we measure whether tract-level foreclosures show increasingly positive spatial association over time. Positive spatial association means that tracts are surrounded by other tracts with similar characteristics, in this case, levels of foreclosure. Though we use the terminology of immunology we limit ourselves here to measuring the extent and the process of contagion and do not speculate at this point on the mechanisms by which one tract may infect another. Over the period examined, we find evidence of contagion in that there is an increase in the degree of positive spatial association and the number of neighboring tracts with foreclosures increases.

² We use the census tract as the equivalent of neighborhood in this paper.

In section four we identify foreclosure “hotspots” and “coldspots.” Foreclosure hotspots are areas with high values of foreclosures that are surrounded by areas with high foreclosure levels. Foreclosure coldspots are areas with low values of foreclosures that are surrounded by areas with low foreclosure levels. This section also investigates the socio- demographic characteristics (race and income level) of these spots, and how these attributes vary by structure type and over time. The effects on the rental market are analyzed in section five.

1. Literature Review

The US housing market is seen as the initial and most important catalyst in the current economic downturn. At the center of the growing economic storm is a cycle of falling home prices and failing mortgages leading to foreclosures, tightening credit, job cuts, and lower economic activity, which all leads to further property price declines. Stopping this cycle and stopping the spread of foreclosure to new communities has become a policy priority from the federal to the local level. Understanding the spatial characteristics of the crisis thus far – e.g. where foreclosures have been concentrated (and where they are not) and how and where they spread or recede – would seem essential to an efficient and effective policy response, one that gets out ahead of the crisis.

It is well understood that foreclosures are highly concentrated in particular urban areas (Gramlich 2007). Some recent studies have looked at the spatial neighborhood effects through foreclosures. Leonard and Murdoch (2008) used foreclosures as a proxy for changes in neighborhood quality contributions. Their results show that foreclosures produce externalities which are capitalized into the prices of other properties in the neighborhood. As Can (1998, p. 68) conjectures, foreclosures are likely to be spatially contagious in nature:

“An abandoned property resulting from foreclosure in a neighborhood acts as a catalyst by reducing the expected return on investment on surrounding properties. Homeowners and investors adjacent to abandoned or vacant properties are less likely to invest because of the anticipated spillover effects of these properties on the value of their property. This will start the familiar self fulfilling prophecy of less investment, leading to lower quality, lower demand, lower price, higher LTV, and finally foreclosure and abandonment.”

This “spatial contagion effect” has been observed across the country during the recent crisis. Coulton et al (2008, p.13), found out that an additional foreclosure within 500 feet increased the hazard of a mortgage to foreclose by 40 percent in Northern Ohio (Cleveland and Cuyahoga Counties), using data from 2005-2008. Dubin (2008) found that foreclosures in Cleveland neighborhoods negatively affect sales prices of nearby properties. Using Columbus as a case, Mikelbank (2008) found that a foreclosure has a significant impact on a neighbor house sale up to 1,000 feet. Duda and Apgar (2005), using earlier data (2000-2005), found that the prelude to the foreclosure boom was impacting neighborhoods across the Atlanta metropolitan area.

While foreclosure contagion affects all types of neighborhoods, some socio-demographic groups and structure types appear to have been particularly affected. The early evidence from Atlanta (2000-2005), shows that foreclosure filings concentrate in lower-income, minority communities with older housing stock (Duda and Apgar 2005). Research on the effect of subprime mortgages on foreclosures in Northern Ohio found that ethnic minorities have been disproportionately affected by high cost subprime originated foreclosures (Coulton et al 2008). In addition, evidence from Chicago shows that last stage foreclosures affect increasingly multi-unit properties (Smith and Duda 2008). Foreclosures on multi-unit structures constrain the rental market supply. This result negatively impacts renters who are displaced as a result of foreclosures and former homeowners of foreclosed properties who re-enter the rental market.

The foreclosure crisis in New England has been the focus of a number of papers recently. The Federal Reserve Bank of Boston has started a research project on the state of Massachusetts foreclosures since March 2007. Their primary focus has been on the subprime mortgage outcomes (Foote et al 2008a, Gerardi et al 2008), the subprime mortgages and inner city neighborhoods (Gerardi and Willen 2008) and on the relation between house prices and foreclosures (Foote et al 2008b). Wardrip and Pelletiere (2008a, b), using New England data, found that the foreclosure rate is disproportionately high in neighborhoods with high levels of poverty. All these studies use the Warren Group registry of deeds data.

This study builds on work done previously in this area, with a focus on the space-time dimension of the problem. While the latest study produced by the Federal Reserve Bank of Boston (Gerardi

and Willen 2008), deals with the issue of concentration of subprime originated foreclosures in urban neighborhoods and the effect on multi-unit dwellings. The existing spatial analyses of foreclosures spillover effects (Mikelbank 2008, Lin et al 2009), do not present a temporal dimension or deal with the differences of single unit versus multi-unit properties. Our research goes a step further employing an explicitly spatial-temporal analysis.

This paper presents preliminary and illustrative results. At this stage, we do not present any causal conclusions concerning the role of house prices in the foreclosure crisis (Foote et al 2008b), general causes of foreclosures (Gramlich 2007) or the spatial aspects of the housing prices bubble (Schintler et al. 2008).

2. General Characteristics of Foreclosure

This analysis evaluates data from The Warren Group on nearly 15,000 residential properties that entered the second stage of the foreclosure process (Bank Owned and Auction) in these four states during 2007 and the first quarter of 2008.³ Temporal analysis is done by quarter.

We differentiate between “units” and “structures”. As Table 1 indicates, the analyzed structures represent an estimated 22,942 units. At an average of 1.6 units per structure, it results that multi-unit buildings are a significant part of the foreclosure crisis in New England. The purpose of this classification is to identify the foreclosure impact on units (households) in a neighborhood.

Table 1: Foreclosures in CT, MA, NH, and RI, Q1 2007 to Q1 2008

Foreclosed properties	14,645
Foreclosed units	22,942
Total households in region (2000)	4,628,280

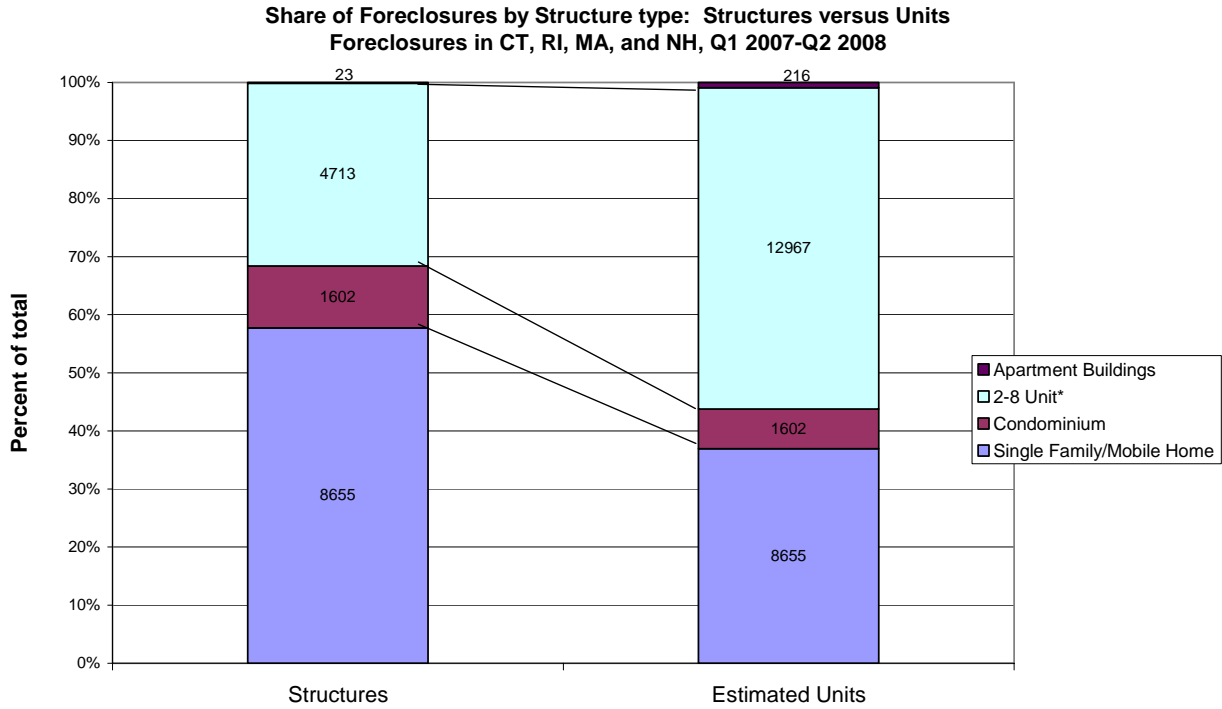
Source: Wardrip and Pelletiere, 2008b

The static analysis shows that households living in multi-unit structures have been the most affected. While the largest share of foreclosures has been in single family residential structures

³ See Appendix 2 for an explanation of the data, definitions and methodology.

(59%), in terms of properties, when the analysis is done by the number of units, the majority of units are in multi-unit dwellings (See Figure 1).⁴

Figure 1: Multiunit Buildings contain a Majority of Estimated Units in Foreclosure



Source:Warrip and Pelletiere 2008a

*252 properties and 630 estimated units are coded ambiguously as 1-4 units.

We identify the socio-economic characteristics of the foreclosure affected neighborhoods and how they change over time. While we use neighborhoods as a unit of analysis, the spatial aspect is not taken into account in the results. The variables we investigate are: race (percent white, percent black, Asian, Hispanic of any race, and “other”⁵), median age and average family size. A series of t-tests comparing the characteristics of the top quartile of foreclosure neighborhoods

⁴ We consider the properties distribution between single unit and multi unit as given in New England region during the five quarters analyzed, due the existing constraints on the housing supply (zoning rules, limited availability of greenfield).

⁵ This is based on the ethnicity of the head of household.

with both the non-zero foreclosure census tracts and the region as a whole provide the results of our analysis. We conducted the tests for each of the five quarters.

Using Census 2000 data, the most affected foreclosure neighborhoods are inhabited by younger and larger black and Hispanic families at the beginning of the decade. Foreclosures do not appear to be a problem in neighborhoods that were predominantly Asian or white. While these characteristics were not determined simultaneously, they sketch a portrait of the affected neighborhoods.

The dynamic analysis indicates that the number of foreclosures has increased dramatically over the time period analyzed (See Figure 1). Here again, the greatest impact appears to have been in the multi-unit stock. The highest average quarterly rate of growth has been in multi-unit dwellings. Single family foreclosures have increased around 40%. Overtime, the neighborhoods affected by increasing foreclosures have been more likely to have had higher shares of black and Hispanic households in 2000.

3. Foreclosure Contagion

Foreclosures in the New England region tend to exhibit a high degree of spatial association. Employing a Global Moran's I Statistic (Moran 1950) by structure type, we found that the degree of positive spatial association increases over time for both types of structures (Table 2). We use first-order "rook" contiguity⁶ to generate the statistics.

⁶ Rook contiguity for a geographic unit (e.g., census tract) is defined by neighboring units above, below and to the sides, but not on the diagonal. First-order refers to the immediately adjacent neighbors.

Table 2: Spatial Autocorrelation by Structure Type

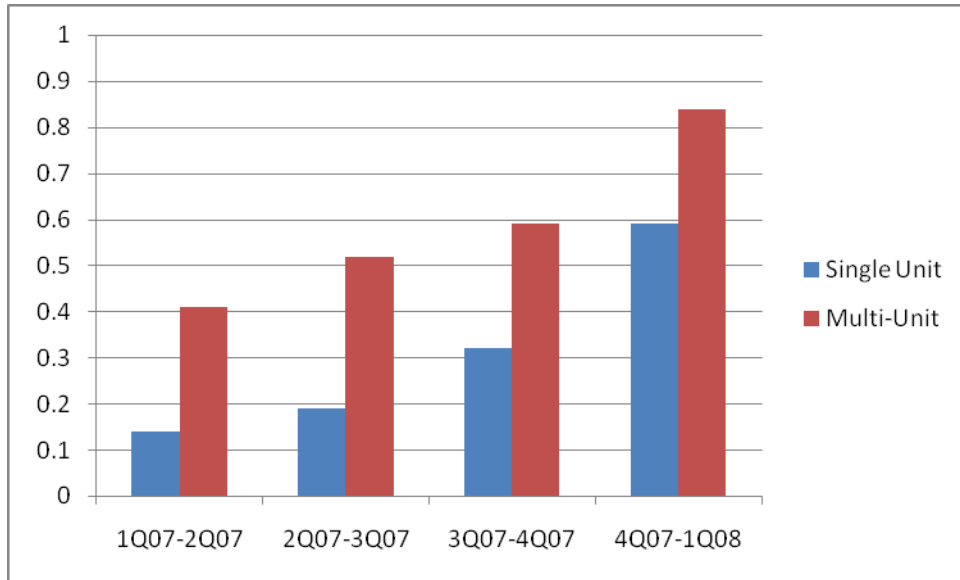
Quarter	Single Unit	Multi-Unit
1 st Q, 2007	0.1822	0.1618
2 nd Q, 2007	0.1746	0.27772
3 ^d Q, 2007	0.2138	0.3541
4 th Q, 2007	0.311	0.4328
1 st Q, 2008	0.381	0.5013
Average Quarterly Change	21.82%	41.97%

A series of correlation analyses indicates that the spatial pattern of foreclosures is stabilizing in New England over the period analyzed. Overall, the correlation coefficients between total foreclosure levels in subsequent time periods show that foreclosures level off (Figure 2). Both the single unit and multi-unit properties foreclosures levels become increasingly similar over time.

A similar analysis taking into account the spatial aspect depicts an identical trend (Figure 2). The Local Indicators of Spatial Association (LISA) (Anselin, 1995, 2005) of neighborhood foreclosures⁷ become more alike over time, given the increasing correlation coefficients between two subsequent periods. This shows that foreclosures in the New England region tended to reoccur in the same neighborhoods over time. The spatial reinforcement appears to have increased over time for both types of structures. This finding may suggest limits to contagion among like properties or borrowers.

⁷ Local Moran's I statistic was used in this case.

Figure 2: Correlation of Local Spatial Autocorrelation over Time by Structure Type



The pattern of spatial association of single unit foreclosures is increasingly similar to that associated with the multi-unit dwellings (see Table 3). The correlation coefficients between the Local Moran’s I statistics for the two structure types for each quarter increase in value from 0.05 to 0.20 over five quarters. The trend suggests that foreclosures for the two structure types are increasingly occurring in the same neighborhoods.

Table 3: Correlation of Local Spatial Autocorrelation Between Single Unit and Multi-Unit Foreclosures

Quarter	Correlation
1 st Q, 2007	0.051466
2 nd Q, 2007	0.063137
3 ^d Q, 2007	0.046137
4 th Q, 2007	0.139195
1 st Q, 2008	0.213098

Our analysis shows that the spatial pattern of foreclosures has increasingly become more concentrated. Both single unit and multi-unit dwellings foreclosures experienced this phenomenon, with multi-unit properties reaching the spatial stabilization faster. There is also a certain degree of spatial homogeneity between residential structures foreclosures.

4. Foreclosure Hotspots

The contagion of foreclosures in New England may be analyzed at the neighborhood level. Again using Anselin's LISA indicators, we can identify foreclosure hotspots and coldspots and investigate contagion from these nodes (see Figures 3a to 4b). Foreclosure hotspots are clusters of neighborhoods with high foreclosure levels, where a tract with high foreclosures is adjacent to other tracts with high foreclosures. Foreclosure coldspots are therefore clusters of tracts with low values of foreclosures, where tracts with low foreclosure levels are adjacent to tracts with low levels. Tracts with high levels of foreclosures surrounded by tracts with low levels (high-low) and vice versa (low-high) are what we term as transitory hotspots.

For the discussion that follows, it is important to remember, being a coldspot means that is in an area of relatively low foreclosure activity not that there is no foreclosure activity and though the level of activity may be relatively low in the current period it may be increasing (or decreasing). The coding for the LISA categories in the tables and figures in this section is the following: "1" Hotspots, "2" Coldspots, "3" is Transitory, low to high and "4" Transitory, high to low. The residual category, "0" tracts, exhibit no significant spatial association with their neighbors (significance level greater than 10%).

The emergence of foreclosure hotspots and their changing configuration shows how foreclosure contagion has advanced during this time period in New England. We conduct this analysis by residential structure type. Tables 4a and 4b (next pages) show the number and share of tracts that fell into each category for each quarter for single unit and multi unit dwellings.

Table 4a: Share of Census Tracts by LISA Category, Quarter, Single Unit

LISA Category	Q1 2007	Q2 2007	Q3 2007	Q4 2007	Q1 2008	Average Rate of Change in Share
High-High	100 (3.73%)	137 (5.12%)	185 (6.91%)	210 (7.84%)	204 (7.62%)	20.67%
Low-Low	2 (0.07%)	14 (0.52%)	85 (3.17%)	192 (7.21%)	259 (9.67%)	316.98%
Low-High	77 (2.88%)	88 (3.29%)	77 (2.88%)	81 (3.02%)	28 (1.05%)	-14.16%
High-Low	166 (6.20%)	148 (5.56%)	114 (4.26%)	67 (2.50%)	80 (1.05%)	-13.98%
Not Significant	2333 (87.12%)	2290 (85.51%)	2217 (82.79%)	2128 (79.46%)	2107 (78.87%)	-2.51%

Note: shares are in parentheses

Table 4b: Share of Census Tracts by LISA Category, Quarter, Multi-Unit

LISA Category	Q1 2007	Q2 2007	Q3 2007	Q4 2007	Q1 2008	Average Rate of Change in Share
High-High	53 (1.98%)	96 (3.58%)	153 (5.71%)	164 (6.12%)	167 (6.24%)	37.38%
Low-Low	0 (0.00%)	0 (0.00%)	0 (0.00%)	2 (0.07%)	11 (0.41%)	112.50%
Low-High	71 (2.65%)	83 (3.10%)	91 (3.40%)	77 (2.88%)	75 (1.42%)	2.14%
High-Low	196 (7.32%)	126 (4.71%)	77 (2.88%)	61 (2.28%)	38 (1.42%)	-33.72%
Not Significant	2358 (88.05%)	2373 (88.61%)	2357 (88.01%)	2374 (88.65%)	2387 (89.13%)	0.13%

Note: shares are in parentheses

For single unit structures, new hotspots and coldspots appeared from transitory neighborhoods (low-high and high-low tracts) (Figures 3a and 3b). Over the time period examined, single unit foreclosures occur increasingly more in coldspots than hotspots and they are consistently more prevalent in the coldspots. This finding could mean that single unit foreclosures are occurring in lower-density neighborhoods though warrants further investigation.

<<Insert Figures 3a and 3b about here>>

The multi-unit properties show a different pattern of foreclosure contagion (Figures 4a and 4b, next page). In this time period, areas showing an increase in foreclosures were already affected by foreclosures in Q1 2007. The number of hotspots, however, rose three fold over the five quarters, perhaps originating from the adjacent high- low transitory hotspots. Some of the high-low areas cooled down, even to the point of having no foreclosures. A small number of high-low transitory hotspots became low-high, showing a resolution of the foreclosure problem in one neighborhood but a deterioration in the contiguous areas. This result may be explained by the more dense spatial pattern of the multi-unit properties versus the single- unit structures.

<<Insert Figures 4a and 4b about here>>

4.1 Socio- Demographic Characteristics of the Foreclosure Hotspots

An analysis of the neighborhood characteristics of foreclosure hotspots over time, that is how the average characteristics of the hot spots change as they add new neighborhoods through contagion and some previously hot neighborhoods cool down, shows the socio-economic characteristics of the most affected has changed considerably over this period, in some cases spreading to areas with different populations in others becoming more concentrated in neighborhoods with similar populations.

Again we conduct the analysis by residential structure type. From Tables 5, we observe that the initial single unit foreclosure hotspots are generally white and a quarter of them are home to low income households (based on Census 2000 data). Over time, as new hotspots are added and others cool down as a group they become less white and slightly more black and Hispanic. Both the high income and the low income households grow slightly as a share of the single unit foreclosure hotspots, as foreclosure moved beyond its origins in lower middle class homeowner neighborhoods.

Single-unit coldspots in the first quarter of 2007 have larger shares of blacks and Hispanics than the hotspots and lower shares of low income households. By the end of first quarter of 2008, these neighborhoods with low levels of foreclosures, surrounded by low foreclosures areas, tend to be more white and Asian and as blacks and Hispanic neighborhoods were more likely to transition to being hotspots. The income trend is also interesting. Coldspot neighborhoods

becoming increasingly high income, with a seven fold increase in the average share of high income households in coldspots.

An interesting point in the single unit foreclosure analysis is the case of Asians. While the average share of Asian households in the hotspots has remained relatively constant over the five quarters, their share in the coldspot neighborhoods increased three fold. This may be partly explained by the spread of the foreclosures to areas not affected previous 2007.

Table 5 Neighborhoods Characteristics by Structure Type, LISA Category – Single Unit

LISA Category	White	Black	Asian	Hispanic	High Income (>\$75,000)	Low Income (Poverty)	% Rent
1Q_07							
Not Significant	82.89%	6.99%	3.09%	8.45%	10.01%	24.85%	29.78%
High-High	90.39%	3.36%	1.61%	4.22%	6.20%	24.94%	6.12%
Low-Low	76.85%	11.79%	2.06%	16.07%	1.81%	22.91%	55.59%
Low-High	88.41%	4.02%	2.13%	5.27%	6.70%	26.81%	17.27%
High-Low	80.91%	8.75%	2.65%	9.02%	8.50%	24.02%	28.42%
2Q_07							
Not significant	83.19%	6.82%	3.06%	8.41%	10.05%	24.75%	29.82%
High-High	84.96%	6.16%	1.90%	6.62%	6.31%	25.91%	12.70%
Low-Low	80.45%	6.78%	6.38%	7.51%	12.96%	29.35%	43.77%
Low-High	86.82%	4.93%	1.89%	6.12%	6.18%	27.15%	15.19%
High-Low	82.54%	8.04%	3.37%	6.38%	8.65%	24.22%	26.76%
3Q_07							
Not significant	83.32%	6.66%	3.05%	8.36%	9.79%	24.96%	29.34%
High-High	85.86%	6.81%	1.51%	5.59%	6.59%	25.47%	13.42%
Low-Low	75.34%	11.38%	5.94%	8.89%	13.29%	25.15%	46.76%
Low-High	88.19%	4.37%	1.70%	5.68%	7.78%	24.77%	12.40%
High-Low	83.27%	6.73%	2.56%	10.04%	10.35%	23.51%	30.33%
4Q_07							
Not significant	83.43%	6.82%	2.84%	8.27%	9.32%	24.85%	28.56%
High-High	86.03%	5.88%	1.81%	6.33%	6.66%	26.38%	9.42%
Low-Low	79.85%	6.93%	6.13%	8.89%	16.63%	24.64%	45.82%
Low-High	86.69%	5.27%	1.49%	6.41%	6.51%	26.69%	18.42%
High-Low	83.05%	7.13%	2.88%	8.29%	10.94%	23.23%	30.53%
1Q_08							
Not significant	83.29%	6.88%	2.82%	8.48%	9.28%	25.04%	29.03%
High-High	87.26%	5.14%	1.60%	5.90%	6.52%	25.80%	4.99%
Low-Low	79.75%	7.53%	5.71%	8.29%	15.24%	23.55%	43.78%
Low-High	89.29%	4.21%	1.55%	3.87%	8.35%	25.70%	11.01%
High-Low	85.45%	5.93%	2.09%	7.50%	8.66%	22.94%	30.48%

The multi- unit foreclosure hotspots present different characteristics and evolution than the single-units. In the initial period, the population of multi-unit foreclosure hotspots, according to the 2000 Census, is less than half white, about a quarter Hispanic and more than a quarter black. The hotspot tracts are less white and more racially and ethnically diverse than the single unit foreclosures hotspots. On average, one-third of their households are low income, a much higher percentage than their single unit hotspot counterparts. Over time, however, the multi-unit hotspots change their configuration to include increasingly white, slightly more Hispanic and less black tracts. From the income point of view, there is a slight increase in high income households as a share of the multi-unit foreclosure hotspots.

Table 6 Neighborhoods Characteristics by Structure Type, LISA Category – Multi- Unit

LISA Category	White	Black	Asian	Hispanic	High Income (>75,000)	Low Income (Poverty)	% Rent
1Q_07							
Not Significant	85.43%	5.74%	2.92%	7.12%	10.35%	24.31%	27.49%
High-High	45.17%	28.31%	3.94%	23.54%	2.07%	33.36%	43.42%
Low-Low	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Low-High	69.76%	13.12%	3.20%	15.59%	4.36%	29.59%	31.38%
High-Low	84.12%	5.69%	2.94%	9.28%	5.28%	26.97%	27.94%
2Q_07							
Not Significant	85.83%	5.56%	2.87%	6.80%	10.34%	24.20%	27.06%
High-High	47.72%	24.82%	4.44%	26.29%	2.17%	33.63%	41.15%
Low-Low	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Low-High	66.22%	15.83%	3.36%	17.34%	3.56%	31.44%	35.63%
High-Low	82.80%	5.34%	3.13%	10.72%	6.57%	26.42%	31.44%
3Q_07							
Not Significant	86.02%	5.51%	2.89%	6.69%	10.35%	24.21%	26.79%
High-High	48.58%	24.37%	3.69%	26.46%	2.58%	33.51%	43.78%
Low-Low	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Low-High	69.57%	11.12%	4.59%	18.42%	3.94%	31.09%	35.63%
High-Low	87.30%	4.83%	2.28%	5.53%	7.21%	24.52%	29.53%
4Q_07							
Not Significant	86.09%	5.37%	2.88%	6.76%	10.26%	24.17%	26.88%
High-High	49.62%	24.75%	4.42%	23.88%	2.59%	32.90%	41.14%
Low-Low	81.94%	8.48%	5.21%	4.67%	23.23%	20.93%	29.99%
Low-High	65.55%	14.84%	3.35%	19.98%	4.47%	33.36%	40.94%
High-Low	88.36%	3.42%	1.92%	7.17%	8.22%	25.39%	27.80%
1Q_08							
Not Significant	85.77%	5.54%	2.89%	6.87%	10.20%	24.29%	27.53%
High-High	50.60%	23.23%	4.33%	24.90%	2.57%	33.24%	37.40%
Low-Low	89.38%	3.29%	4.38%	3.19%	18.93%	25.92%	28.15%
Low-High	71.61%	12.33%	2.83%	18.00%	4.58%	28.48%	33.82%
High-Low	87.72%	5.14%	2.06%	6.19%	7.77%	25.71%	22.81%

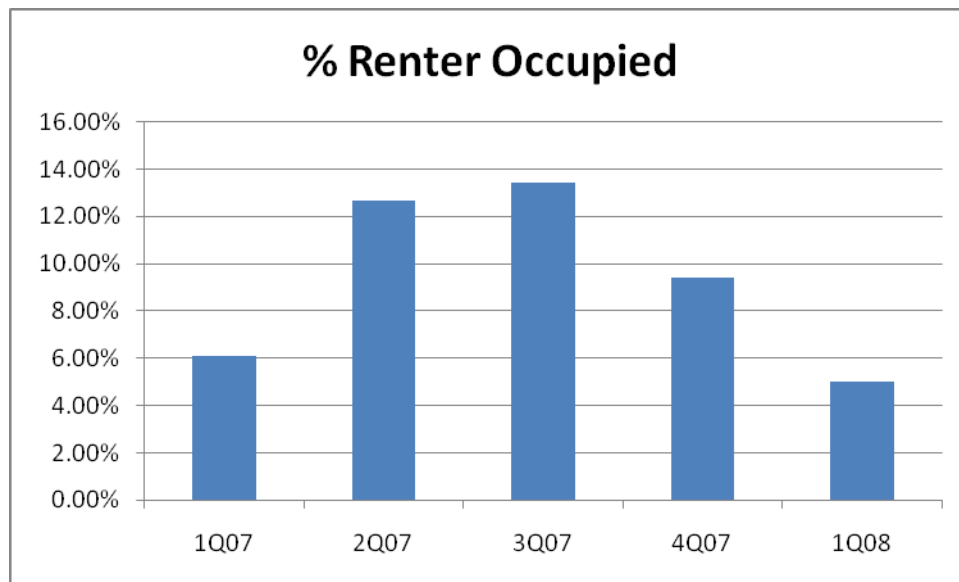
n/a = no census tracts fell into the LISA category

5. The Rental Market

We investigate the effect of foreclosures on the general tenure, expressed as the ratio of the rental occupied out of all households. Using a t-test comparing the tenure of the top quartile of foreclosure neighborhoods with both the non-zero foreclosure census tracts and the region as a whole, we find that foreclosures tend to occur in neighborhoods with higher shares of renters. In addition, the level of statistical significance of the effect increases over time. Our results confirm previous findings on the New England foreclosures (Wardrip and Pelletiere, 2008; Gerardi and Willen, 2008).

The foreclosure hotspot analysis by structure type presents some interesting findings (See Tables 5 and 6). As might be expected, multi-unit foreclosures tend to occur in neighborhoods with high shares of renter households. Of interest though is that single unit foreclosures coldspots are consistently in neighborhoods with relatively high shares of renters. In first quarter of 2007, the share of renters in single unit coldspots was greater than one-half. The share declines slightly though to 43% by Q12008.

Over the five quarters analyzed, single unit hotspots are initially increasingly located in rental neighborhoods. However this trend eventually reverses (see Figure 5). In the third quarter of 2007, single unit foreclosure hotspots were in neighborhoods with 13.7% renters, on average. The share reduces by more than half by the end of 2008 (see Figure 5).

Figure 5 Average Share of Renter Occupied Units in Single-Unit Coldspots

The declining effect on the rental market is observed also in the multi-unit foreclosures. The multi-unit foreclosure hotspots are almost half rental properties at the beginning of 2007. The average rental share declines slightly by Q12008. The coldspots have lower shares of rental; coldspots are consistently in neighborhoods with only about one-third renters on average. The share declines also somewhat by the end of the analyzed period.

6. Policy Recommendations

While this preliminary research can not speak to the effectiveness of any specific intervention, it does indicate a spatial pattern and evolution of foreclosure that policy might seek to disrupt or even reverse. In the New England states in this time period it is possible to identify, adjoining tracts of higher than average foreclosure activity, what we term foreclosure hotspots. It is in these areas that foreclosures are becoming *more* concentrated over time. Foreclosure is, however, dynamic over space and it appears, at least superficially, that these hotspots infect adjoining tracts. Similarly, cold spots tended to remain cold until adjoining tracts became hotspots. And for the period of this study, immune tracts appeared to be just that, immune. To our minds this adds support to the notion that proactive interventions in foreclosures policy with limited resources can and should be targeted spatially, at the neighborhood level.

7. Conclusion

1. Foreclosures in New England show a high and increasing degree of spatial association. High foreclosure neighborhoods in period one continue to experience relatively high levels of foreclosures.
2. Households living in multi-unit structures were the most affected by foreclosure between Q12007-Q12008, showing the most rapid increase in foreclosures.
3. Based on Census 2000 data, the most affected foreclosure neighborhoods were inhabited by younger and larger families and foreclosure is spreading to increasingly more black and Hispanic neighborhoods.
4. While single-unit foreclosures were slightly more spatially associated than multi-unit foreclosures in the 1st Quarter of 2007, the hotspots for multi-unit foreclosures appear to be more contagious, with increases in foreclosures spreading more quickly to spatially contiguous tracts, at a rate nearly double that of the single unit dwellings.
5. Overall, single unit foreclosure neighborhoods generally have higher shares of whites than multi-unit foreclosure areas. Further, coldspots have the highest share of minorities over time, among all the single unit foreclosure areas. Multi-unit foreclosures hotspots are more ethnically balanced, with the share of blacks declining over time.
6. Foreclosures tend to occur in neighborhoods with higher shares of renters. However, as contagion occurred and the number of hotspots increased, the average rental share in these hotspots declined.
7. Troubled neighborhoods appear to be both identifiable and “contagious,” and therefore a useful and perhaps necessary unit for policy intervention to stop the increase in foreclosures from spreading.
8. There is evidence of both local AND regional contagion. The regional contagion is reflected in the increasing Moran's I statistic and the expansion of the hotspots and coldspots to include more census tracts. Local contagion, however, is reflected in the spatial-reinforcement of foreclosures within tracts - i.e., even as a heightened level of

foreclosures spreads to new adjacent tracts, foreclosures continue to also occur in the same census tracts such that foreclosures actually become more concentrated within these tracts.

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Appendix

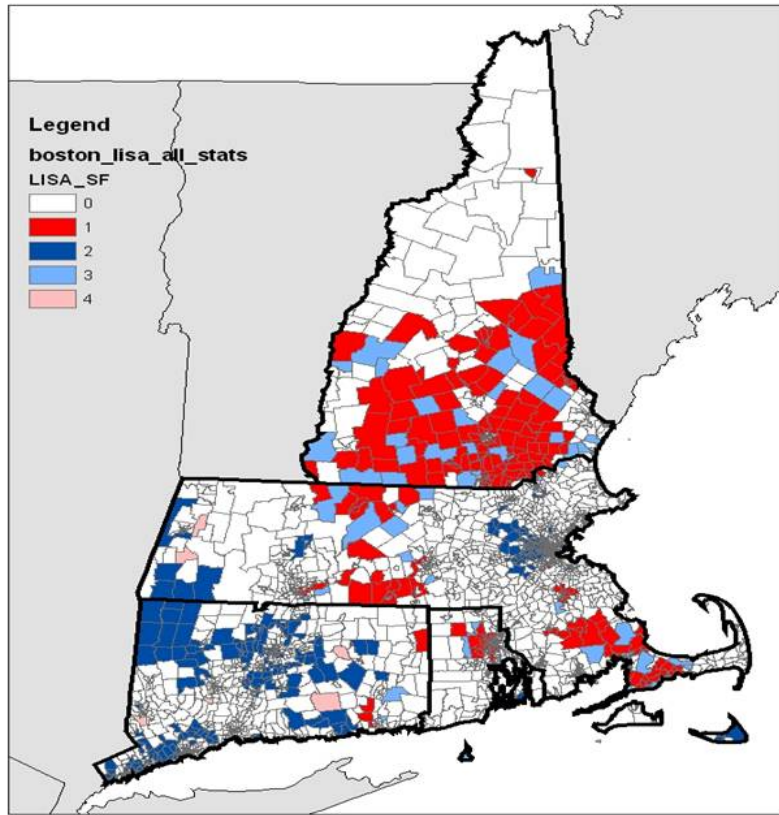
Table 1A: Summary of T-Test Results

Variable	Quarter	T-Statistic	P-Value
% White	1Q07	-3.47	0.007
	2Q07	-4.25	0.002
	3Q07	-4.58	0.001
	4Q07	-5.93	0.000
	1Q08	-8.05	0.000
% Black	1Q07	2.59	0.029
	2Q07	3.03	0.014
	3Q07	3.54	0.006
	4Q07	5.03	0.000
	1Q08	8.42	0.000
% Asian	1Q07	-0.460	0.653
	2Q07	-3.01	0.015
	3Q07	-2.84	0.019
	4Q07	-1.80	0.106
	1Q08	-2.21	0.055
% Hispanic	1Q07	1.73	0.118
	2Q07	3.76	0.004
	3Q07	5.00	0.001
	4Q07	4.29	0.002
	1Q08	6.98	0.000
% Other	1Q07	2.64	0.027
	2Q07	4.45	0.002

DRAFT for comment only

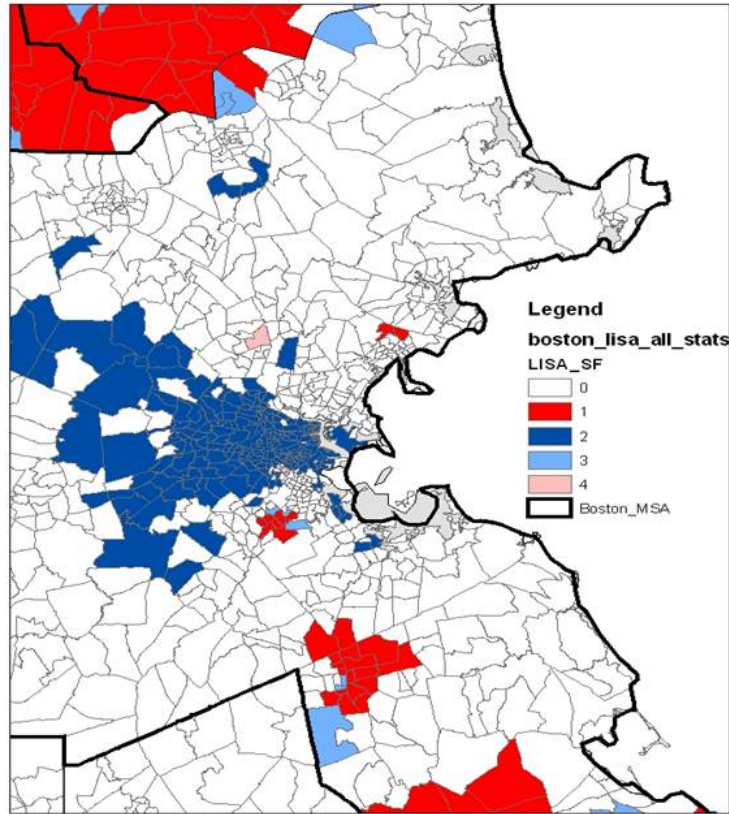
	3Q07	5.52	0.000
	4Q07	5.42	0.000
	1Q08	6.47	0.000
Median Age	1Q07	-3.79	0.004
	2Q07	-4.66	0.001
	3Q07	-7.09	0.000
	4Q07	-5.82	0.000
	1Q08	-7.62	0.000
Av. Family Size	1Q07	4.27	0.002
	2Q07	6.33	0.000
	3Q07	7.84	0.000
	4Q07	7.49	0.000
	1Q08	7.71	0.000
% Renter	1Q07	1.97	0.081
	2Q07	2.55	0.031
	3Q07	4.35	0.002
	4Q07	3.87	0.004
	1Q08	6.27	0.000

Figure 3a Foreclosure Hotspots in New England, Single Unit (1st Q 2007 – 1st Q 2008)*



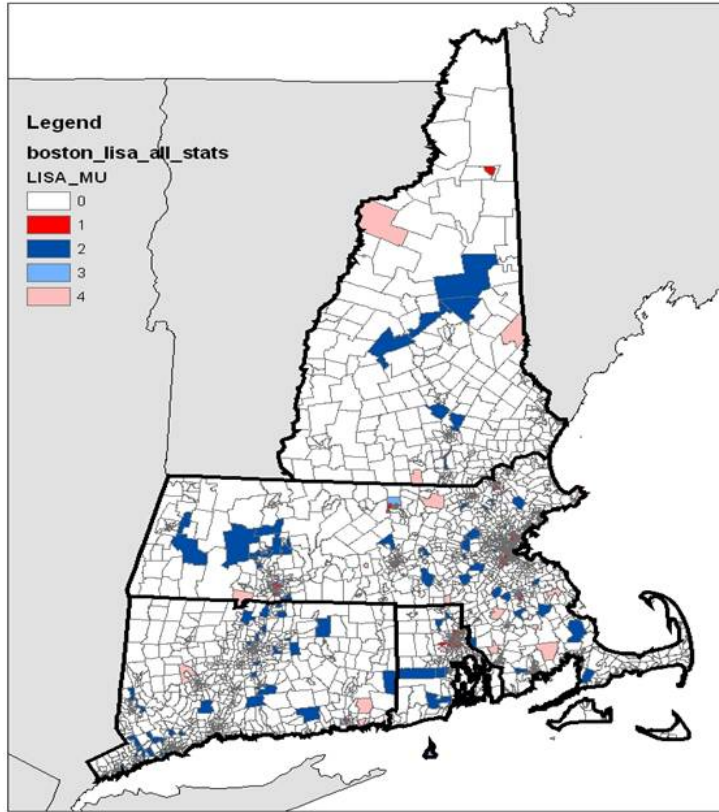
*“1” Hotspots, “2” Coldspots, “3” is Transitory, low to high and “4” Transitory high to low.

Figure 3b Foreclosure Hotspots in New England, Single Unit: Zoom-in on Boston, MSA (1st Q 2007 – 1st Q 2008)*



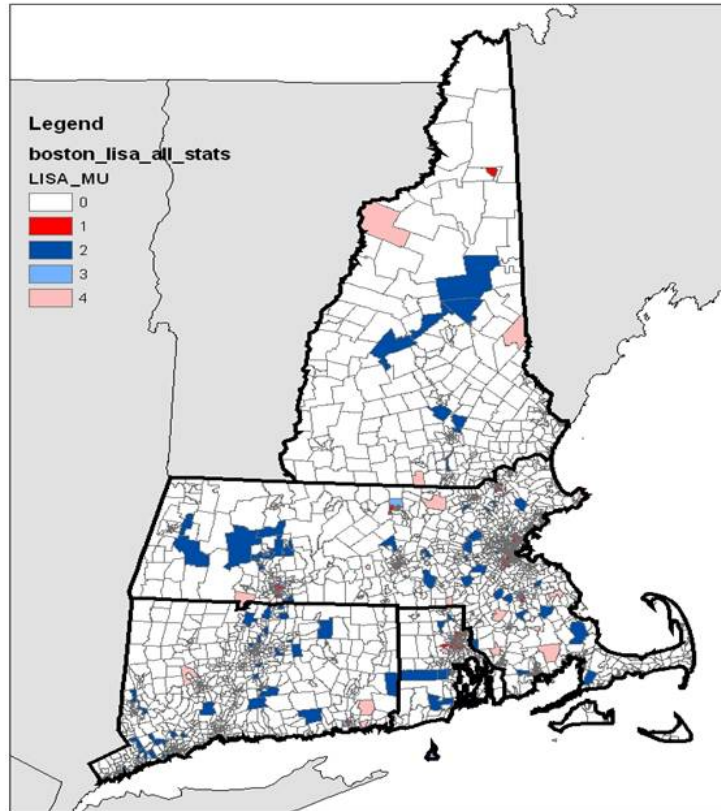
*“1” Hotspots, “2” Coldspots, “3” is Transitory, low to high and “4” Transitory high to low

Figure 4b Foreclosure Hotspots in New England, Multi-Unit (1st Q 2007 – 1st Q 2008)



*“1” Hotspots, “2” Coldspots, “3” is Transitory, low to high and “4” Transitory high to low

Figure 4b Foreclosure Hotspots in New England, Multi-Unit: Zoom-in on Boston, MSA (1st Q 2007 – 1st Q 2008)*



*“1” Hotspots, “2” Coldspots, “3” is Transitory, low to high and “4” Transitory high to low