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Is there a Link Between Foreclosure and Health?

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Abstract

We investigate the relationship between foreclosures and hospital visits using data on all foreclosures and all hospital and emergency room visits from four states that were among the hardest hit by the foreclosure crisis. We find that living in a neighborhood with a spike in foreclosures is associated with significant increases in urgent unscheduled visits, including increases in visits for preventable conditions. The estimated relationships cannot be accounted for by increasing unemployment, declines in housing prices, migration, or by people switching from out-patient providers to hospitals.

Foreclosure rates reached historically high levels in the United States during the recent economic crisis. According to Realtytrac, a leading firm that monitors and markets foreclosed homes, a record 2.82 million homes faced foreclosure in 2009, a 21 percent rise from 2008 and a huge 120 percent jump from 2007.[1] One in 45 homes (2.23 percent of all housing units in the U.S.) received at least one foreclosure filing during 2010. As policymakers have debated measures to stabilize the housing market and minimize the damage to the U.S. economy, researchers have turned their attention to understanding the consequences of rising foreclosures.

While a number of studies have investigated the effect of the foreclosure crisis on outcomes such as home prices and sales, residential investment, and durable consumption (e.g., Immergluck and Smith, 2006; Calomiris, Longhofer, and Miles, 2008; Rogers and Winter, 2009; Harding, Rosenblatt, and Yao, 2009; Mian, Sufi, and Trebbi, 2010), there has been no large-scale investigation of the effect of the crisis on health. The foreclosure crisis represents a significant shock to the financial well-being of many households, and thus provides a fresh opportunity to examine the relationship between financial distress and health. Financial distress may have direct effects on health, but can also cause changes in health behaviors, which in turn can have negative health consequences.

The goal of this paper is to investigate whether the foreclosure crisis had an adverse effect on health. To accomplish this goal, we assemble quarterly data on all foreclosures, all

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[1]See http://www.realtytrac.com/content/foreclosure-market-report.

Emergency Room (ER) visits, and all hospitalizations from four states (Arizona, California, Florida, and New Jersey) which are among the 10 states that have been hardest hit by the crisis. Unfortunately, there are no large individual-level longitudinal sources of data linking foreclosure and health. In the absence of such data, we match data on foreclosures, hospitalizations, and ER visits at the zip code level.

Our main specifications control for zip code fixed effects, zip code specific linear time trends, and county by quarter by year fixed effects so that our estimates are identified by changes *within* zip codes (rather than comparisons of, for example, rich and poor neighborhoods). We find strong evidence that increases in foreclosure are associated with increases in non-elective (i.e. urgent and unscheduled) hospital and ER visits and with increases in visits that could be prevented by appropriate preventive care. While it is difficult to identify the causal mechanism underlying these relationships given the available data, we consider several possibilities.

First, it is possible that for many people, ill health causes foreclosure. However, the huge run-up in foreclosures over the period we examine was unlikely to be caused by an epidemic of ill health among American homeowners. Thus, the foreclosure crisis offers a way to rule out this hypothesis as a major explanation for our results, and allows us to focus on the question of whether foreclosures affect health rather than vice versa.

Second, given the previous literature linking unemployment and ill health, it might be the case that the relationship we observe represents a response to unemployment rather than to foreclosure per se. It is worth noting that while unemployment increased two to three times in our study states, foreclosure rates increased by a factor of 10. We will also show below that the beginning of the foreclosure crisis preceded the increase in unemployment, and that for the sub-period from the second quarter of 2005 to the fourth quarter of 2007, foreclosures were rising while unemployment was steady or falling. We show that the relationship between foreclosure and hospital visits was as strong or stronger during this sub period. Also note that our baseline models include interactions of county, quarter, and year in order to account for all time-varying features of local labor markets including unemployment rates.

A third possibility is that people in financial distress may stop going to outpatient providers and visit emergency rooms instead. That is, the increases in visits that we see could represent patients switching venues rather than an increase in actual health conditions that warrant medical care. We address this concern by estimating models using a subset of serious acute conditions that almost always result in emergency visits to the hospital, so that there is little scope for venue switching. These conditions include: Heart attack, stroke, respiratory failure, gastrointestinal hemorrhage, and kidney failure. We find that foreclosures are associated with significant increases in hospitalizations for all of these conditions.

A fourth possibility is that the composition of a zip code changes during a foreclosure crisis, so that the people who remain in the zip code are less healthy than those who leave. In order to deal with this possibility and given the available data on population, we examine foreclosures and visits relative to the population of the zip code in 2000. Thus, it is not

possible for people exiting the zip code to increase the visit rate, even if the remaining people are less healthy. We also directly examine the predicted change in hospitalization and ER visit rates given changes in population characteristics between 2005 and 2010, and show that there was little relationship between this predicted change and changes in foreclosure rates.

Foreclosure represents a source of financial distress for many people including those who were not themselves subject to foreclosure, but who saw the value of their housing fall. In order to investigate this potential mechanism, we estimate models that control for housing prices as well as vacancies. This specification change has little effect on the estimated impact of foreclosure.

Our findings indicate that a rise in foreclosures is associated with significant increases in hospital and emergency room visits for conditions including mental health problems, heart attack, and stroke, as well as for conditions such as hypertension, that could be prevented by appropriate care. We find statistically significant effects for all age groups including children and the elderly.

The rest of the paper is laid out as follows. In Section I, we provide some background information about the foreclosure crisis, and previous work on the relationship between economic activity and health. We then discuss our data in Section II and methods in Section III, followed by the results in Section IV and extensions in Section V. We provide a brief conclusion in Section VI.

I. Background

Whatever the root causes, delinquencies and foreclosures soared starting in late 2006 (Campbell, Giglio, and Pathak, 2009; Calomiris, Longhofer, and Miles, 2008, Harding, Rosenblatt, and Yao, 2009, Lin, Rosenblatt, and Yao, 2009; Immergluck and Smith, 2006).[2] The turmoil in the housing market spread to capital markets and helped to generate the current continuing economic malaise (e.g., Green, 1997; Leamer, 2007; Gauger and Snyder, 2003).

a) How Could Foreclosures Affect Health?

Before considering how foreclosure could affect health, we acknowledge the literature arguing that ill health is an important cause of foreclosure (e.g. Warren et al., 2007; Pollack and Lynch, 2009).[3] We argue however, that the foreclosure crisis represents an increase in financial distress that has not been caused by a sudden epidemic of ill health among U.S. homeowners. Moreover, while in hindsight many commentators have said that a crash was inevitable, the timing and severity of it were certainly a surprise to almost all observers

[2]Explanations that have been offered for the foreclosure crisis include a relaxation in underwriting standards and the expansion of mortgage credit to subprime borrowers (e.g., U.S. Department of Housing and Urban Development, 2009; Dell'Ariccia, Igan, and Laeven, 2008; Demyanyk and Van Hemert, 2011), mortgage securitization having an adverse effect on the screening practices of lenders (e.g., Keys et al., 2010), widespread negative equity caused by the willingness of mortgage lenders to issue mortgage-debt on homes in which the owners had little or no equity (e.g., Gerardi, Ross, and Willen, 2009, 2011), and a rapid increase in interest rates after a period of historically low levels that fueled a housing bubble (e.g., Mayer and Hubbard, 2008).

[3]See Deaton (2002) for a concise survey of the literature linking health and wealth.

(Mian and Sufi, 2010; Calomiris, Longhofer, and Miles, 2008; Demyanyk and Van Hemert, 2011). It is this feature of the foreclosure crisis that presents a unique opportunity to explore the consequences of foreclosure on health. While it is reasonable to suppose that there is always a baseline level of foreclosures that is caused by misfortunes including ill health, there is no reason to suppose that the spike in foreclosures was caused by the health problems of individual homeowners.

High levels of foreclosure in a neighborhood may affect health because housing is the major source of wealth for most people. Therefore, declines in housing prices represent a significant negative shock to wealth and a potential source of financial distress, not just for those who suffer foreclosure, but also for their neighbors. For example, Mian, Sufi and Trebbi (2011) conclude that a one standard deviation increase in foreclosures in a zip code results in a growth rate in housing prices that is two-thirds of a standard deviation lower.

There is a very large literature on the relationship between income and health, too large to be properly reviewed here (See Smith, 1999). This literature must confront the problem that low income individuals may have other attributes besides low income that contribute to poor health, and truly exogenous changes in wealth are hard to find. Two recent papers (Hoynes, Miller, and Simon, in press; Evans and Garthwaite, in press) examine large increases in the Earned Income Tax Credit and find positive effects on the health of infants, and mothers respectively. The later also shows some evidence of improvements in biomarkers associated with stress.

A second potential mechanism is through stress. Stress is thought to affect health both by depressing the immune system and through the direct action of “stress hormones” on factors such as blood pressure and cardiovascular health (McEwen, 1998a, 1998b). Stress can also have harmful consequences through psychological responses such as depression. A growing literature suggests that stressful life experiences are associated with both physical and mental illnesses (Goldberger and Breznitz, 1993; McEwen, 1998a, 1998b; Cooper, 2005; Schneiderman, Ironson, and Siegel, 2005). In related work, Deaton (2011) finds negative effects of the Lehman Brother’s failure on self-reported stress and well-being.

While the press has focused on reports of homeowners being victimized by unscrupulous lenders, it is possible that others who were foreclosed were property speculators with little money at stake, and who may not have found the process particularly stressful. Bajari, Chu, and Park (2008) consider two broad categories of foreclosures: Those among homeowners who rationally decide to “walk away” from a mortgage when it is no longer in their interest to pay; and those who lose their homes due to short-term liquidity constraints caused by conditions such as the credit freeze, interest rate “resets”, and balloon mortgages. Bajari, Chu, and Park conclude that short-term liquidity constraints were at least as important as the decline in housing prices in explaining the increase in defaults. Furthermore, many homeowners might not be aware of their option to strategically walk away from their mortgages or of the cost thereof (Goodstein et al., 2011). There is evidence that the majority of defaults are not strategic. For example, Guiso, Sapienza, and Zingales (2009) find the rate of strategic default to be 26%. Analyses of credit bureau data conducted between 2009 and 2011 suggest that 12–19% of mortgage defaults may have been strategic (Experian and

Oliver Wyman, 2009, 2010, 2011; Morgan Stanley, 2010; Fair Isaac, 2011, Riley (in press)). Hence, it is reasonable to believe that many homeowners were “in over their heads” and likely to find the experience of foreclosure stressful.

Reductions in wealth can also affect health through changing health behaviors. Several studies have linked economic crisis to reductions in the utilization of medical care (e.g., Lusardi, Schneider, and Tufano, 2010; Williams and Collins, 1995; Feinstein, 1993). As we will see below, foreclosures are linked to increases in visits to hospitals and ERs for preventable conditions, suggesting that some people are cutting back on preventive care and/or increasing unhealthy behaviors in response to financial stress.

b) Effects of Unemployment on Health

While the health effects of foreclosure have been ignored, there is an extensive and related literature examining the effects of unemployment and job loss on health. Ruhm (2000, 2003, 2006), Ruhm and Black (2002), Neumayer (2004), and Gerdtham and Ruhm (2006) find that higher unemployment is associated with lower mortality rates, while Dehejia and Lleras-Muney (2004) find that higher unemployment improves infant health. These patterns have been attributed to recession-induced changes in health behaviors, though the evidence on this channel is mixed (see Xu and Kaestner (2010) and Deb et al. (2011)). Miller et al. (2009) argue that cyclical changes in mortality are concentrated in the young and the old and so are unlikely to represent changes in health behaviors among working age adults. Their finding of age-related patterns in the health effects of unemployment provides a further rationale for our examination of age-related patterns in the effects of foreclosures below.

Sullivan and Wachter (2009) follow a large sample of individuals subjected to mass layoffs and find significantly higher death rates due to accidents and heart conditions. Eliason and Storrie (2009a, b) examine data from plant closings in Sweden in 1987 and 1988 and find increases in suicide, self harm, accidents, and alcohol-related causes in the 12 years following job displacement. Browning and Heinesen (2012) report similar results for plant closings in Denmark.

While foreclosure and unemployment are both negative economic shocks, they differ in key respects: Foreclosure does not entail increases in leisure and unemployment does not generally have spillovers in terms of other peoples’ wealth (though a mass layoff might). Still, the literature suggests that unemployment can have negative health effects. Since the foreclosure crisis was followed by the worst recession since the Great Depression, it is reasonable to wonder whether the health effects that we find are primarily due to unemployment rather than foreclosure.

Figure 1A shows the unemployment rate and the proportion of foreclosures as a fraction of outstanding mortgages in our four analysis states between the second quarter of 2005 and the second quarter of 2009. In Figure 1B, we present the same information separately for each of these states. The figures show that the rise in foreclosures preceded the increase in unemployment in all four states. One way we will try to distinguish between the effects of unemployment and the effects of foreclosure is by conducting a sub-analysis on the period from 2005 through fourth quarter 2007 when unemployment was largely constant or falling

and foreclosures were rising. However, it is important to note that our zip-code level models include indicators for each combination of county and time period in our models, which control for the effects of county unemployment rates and all other time-varying county-level characteristics. Any effects of foreclosure that we find are net of these controls.

Figure 1B suggests that while the unemployment rate evolved fairly similarly across the four states, there were dramatic differences in the pattern of foreclosures. In Florida, foreclosures rose to 10 percent of mortgage filings, whereas in New Jersey, which experienced similar levels of unemployment in 2009, foreclosures hovered at slightly over 4 percent of mortgage filings. Figure 2 focuses on the variation in foreclosure rates in states with similar levels of unemployment, bringing in data for all 50 states. More specifically, we estimated a regression of foreclosures as a percentage of all mortgages in each state and year on the unemployment rate for each state and year. In this regression, we use all U.S. states and data on the foreclosure inventory and outstanding mortgages drawn from the National Delinquency Survey of the Mortgage Bankers Association of America. As shown in Figure 2, there is considerable variation in the rate of foreclosure across states (especially after 2008) even after accounting for the variation in unemployment rates.

II. Data

a) Data from the Panel Study of Income Dynamics

One of the major difficulties to be overcome in a study of the relationship between foreclosures and health is that there are no large longitudinal data sets that have information both about foreclosure and health. The Panel Study of Income Dynamics (PSID) added questions about foreclosure in 2009, but the sample size is small enough that only 327 families had experienced a foreclosure since 2001.[4] A sample of this size is far too small to analyze the relationship between foreclosure and health, though the PSID can be used to provide a portrait of what type of households are most likely to suffer foreclosure.

The PSID Housing Distress and Mortgages supplement in 2009 included questions about the family's foreclosure history over the past decade[5]. The PSID also asks about general health questions (on a five point scale) and whether a doctor has ever told respondents that they have a number of specific health conditions. Our PSID sample had 8,682 respondents in 2009. Of these respondents, 8,355 had no foreclosure in their family since 2001.

Table 1 provides an interesting starting point for our analysis. The first two columns divide the sample into those who ever experienced foreclosure (since 2001) and all others. The questions pertain to the household head. Those who have suffered foreclosure are generally younger, with relatively few elderly people in that group.[6] Whites are under-represented in the ever foreclosure group, while blacks and Hispanics are over-represented. Those who have been foreclosed are somewhat less likely to be married, but more likely to have

[4]The PSID is a biannual survey of American households conducted by the University of Michigan's Institute for Social Research since 1968.

[5]Specifically, the four questions are: "Has your bank or lender started the process of foreclosing on your home? –First/Second Mortgage". "In what month and year did the foreclosure start? –First/Second Mortgage". "During the last 8 years, that is, since 2001, have you, or anyone in your family living there ever owned a home on which a foreclosure was started?" and "In what month and year did the foreclosure start?" The respondents are family heads and the foreclosure questions pertain to anyone living in the same family.

children under age 18 in the household. They are less likely than others to report excellent health, but only slightly more likely to report that their health is poor. They are much more likely to smoke, but somewhat less likely to drink than others.

The next four columns of the table look at foreclosure status in 2009. A few points stand out: First, one reason that the elderly respondents are less likely than others to be in foreclosure is that they are more likely to own their homes free and clear. This finding suggests that while elderly people might be impacted by falling housing prices, they would not be as likely as younger households to suffer short-term credit constraints due to changes in the terms of a mortgage. Second, while households with a head who is unemployed are disproportionately more likely than others to be in foreclosure, only 16 percent of those households currently in foreclosure have unemployed heads. Hence, many employed people are also experiencing foreclosure, or living with the threat of foreclosure. A third observation is that those who are currently in foreclosure report worse health than others.

These comparisons are suggestive of a negative relationship between foreclosure and health and helpful for determining what demographic groups might be most affected by foreclosure, but the small numbers of foreclosures in the PSID makes it difficult to analyze this relationship in a multivariate model. Hence, we turn to administrative hospital records for that analysis.

b) Foreclosures, Hospitalizations, and Emergency Room Visits

We focus on the states of Arizona, California, Florida, and New Jersey for several reasons. First, we wish to focus on states that have recently had high levels of foreclosures. Together these four states comprised almost 50 percent of all the foreclosure filings in the U.S. in 2008 (RealtyTrac Press Release, January 15, 2009). They were all in the top 10 foreclosure states, posting the third, first, second, and tenth largest totals of foreclosures in the country in 2010, respectively. Second, we wish to use hospital discharge and emergency room data for entire states, rather than from a sample of hospitals.[7] Thus, the data we have assembled from these four states include every hospitalization and every emergency room visit. Third, we wish to focus our analysis at the zip code level, because, as shown in Figure 3, there is a great deal of variation in foreclosure rates within counties. The figure shows the number of foreclosures divided by population in the zip code (from the 2000 Census) in Florida. The heavy black lines show the county boundaries. Clearly, there is a good deal of variation between zip codes within a county, and even within the boxed area showing central Florida, which was particularly hard hit overall.

It is important to include ER visits in addition to hospitalizations, because financial constraints can affect whether the person first presents at the ER, as well as the probability

[6]This finding accords with other available evidence. See Cunningham and Capone (1990) and Anderson and VanderHoff (1999). Shelton (2008) analyzed a random sample of 2.5 million persons from Experian, the credit rating agency. She finds that three quarters of foreclosures in the second half of 2007 were among homeowners aged less than 50. Other work suggests that financial decision making usually improves with age (e.g. Agarwal et al., 2007) and that older people are less likely to borrow on the equity in their homes (e.g., Duca and Kumar, 2010).

[7]For example, the National Inpatient Database has a 20 percent sample of hospitals and it is not possible to tell if changes in hospitalizations or ER visits at hospitals in the sample might be counter-balanced by changes in these outcomes at other hospitals outside the sample.

that someone on the margin is admitted to the hospital if they do appear at the ER. These four states were the only high foreclosure Healthcare Cost and Utilization Project (HCUP)[8] states to both make ER data available and to include the zip code of each patient's residence over our period.

Foreclosure data are available at the zip code level monthly between April 2005 through December 2009 from RealtyTrac. RealtyTrac is a leading foreclosure monitoring and marketing company, which collects data from public records at the local level, which is where legal documents for foreclosures are recorded, posted, and published. With coverage that accounts for more than 90 percent of the U.S. population, the RealtyTrac data have been widely used by the media as well as researchers studying foreclosures (e.g., Mian, Sufi, and Trebbi, 2011; Pettit et al., 2009; Gaffney, 2009).

The foreclosure data include information about both a notice of trustee sale (NTS) and/or a notice of foreclosure sale (NFS). A state generally has either NTS or NFS and this depends on whether the state uses a judicial or a non-judicial process in foreclosures, so we construct measures of foreclosures as NTS+NFS.[9] A judicial process requires court action on a foreclosed home, which usually takes longer. In general, NTS is available only for non-judicial states, while NFS is only available for judicial states. Among our sample states, FL and NJ are judicial foreclosure states. For example, while the length of the foreclosure process in judicial states depends on the court's caseload, the quickest foreclosure usually takes about 135 days in Florida and 270 days in New Jersey. On the other hand, in our non-judicial states, Arizona and California, the process can take about 90 and 117 days from notice to sale, respectively (RealtyTrac, 2013). Zip code level data on housing prices in each quarter come from Zillow. Zillow does not compile data for smaller zip codes so including this variable reduces our sample size. Another limitation of Zillow compared to, for example, the Case-Shiller housing price indices that are available for selected metropolitan statistical areas, is that Zillow does not adjust the index to reflect changes in the properties being sold.

Stress and financial losses associated with foreclosure may differ depending on whether an individual loses a primary residence, vacation home, or an investment property. Moreover, the effects of foreclosure on owners of vacation or investment properties may be felt not in the areas where the properties are located, but in the areas where the owners reside. Therefore, including zip codes with a large concentration of vacation and investment properties in the analysis sample may bias the estimates toward zero. To guard against such bias, we use Census data on seasonal and occasional housing to identify zip codes with a high proportion of investment properties.[10] We exclude zip codes in the top 10 percent of the distribution of houses for seasonal and occasional use in 2010. The excluded zip codes

[8]Visit http://www.ahrq.gov/data/hcup/ for more information on HCUP databases. Data on ER visits comes form the State Emergency Department Databases (SEDD), which capture discharge information on all emergency department visits that do not result in an admission. Hospitalization data come from the State Inpatient Databases (SID), which hold the universe of inpatient discharge abstracts. In order for a discharge record to exist, the patient must have been admitted to the hospital; hence the SID contains records of patients who require more intensive treatment or for whom treatment cannot be provided on an outpatient basis.

[9]Mian, Sufi, and Trebbi (2011) define foreclosures as NTS+NFS+REO using data from the RealtyTrac. However, since we use quarterly data rather than monthly data (because Florida hospital data is not available monthly), there is a possibility that the same property could be counted both as NTS or NFS and as REO. We have also estimated our models including REO as a separate variable and obtained results very similar to those reported below.

are illustrated in red in Figure 4. As shown in the figure, the excluded areas appear to match well with one's expectations regarding the location of seasonal and occasional properties in these states. For example, the excluded zip codes in New Jersey are along the Jersey Shore and in the Delaware water gap, while those in Florida are along the coasts and in the Orlando area. We also estimated all of our models without excluding these zip codes (results are in Table 8). Confirming our expectations, estimates are smaller and somewhat less precisely estimated when zip codes with many vacation homes or investment properties are included, although they are qualitatively similar to the results excluding vacation homes.

Our health measures come from administrative state data bases. States collect information about every hospital inpatient and ER visit, which they use to regulate hospitals. Participating states make these data available to researchers through the HCUP, a Federal-State-Industry partnership. These data consist of individual visit level records. They include detailed diagnostic and procedure codes, and a few demographic characteristics (age, race, gender, and the patient's zip code of residence).[11]

We combine ER visits that did not result in hospitalizations, plus all hospitalizations other than those for childbirth, contraception, andabortion. We excluded these procedures because fertility may itself respond to foreclosure. In what follows, we treat ER visits and hospital admissions together, because wealth, demographic characteristics, or changes in health insurance status might be correlated with the decision to admit a patient presenting at the ER, at the margin. HCUP classifies diagnoses using a tool called Clinical Classification Software (CCS).[12] The CCS takes thousands of International Classification of Disease (ICD) codes and groups them into clinically meaningful categories. We use the single level diagnosis codes, and group them into larger aggregates using information from the multi-level diagnosis codes. For example, single codes for Pneumonia, Influenza, Tonsillitis, Bronchitis, and other respiratory infections are grouped together in a category we call "Respiratory Infections", while heart attacks, strokes, chest pain, dysrhythmias and other heart problems are grouped together as "Heart Problems". More information about our aggregates is in the appendix.

The proportion of total visits that are inpatient hospital visits is stable and very similar over the analysis period among our analysis states with an average of about 28%. Accordingly, emergency room visits comprise the remaining 72% of all visits. In terms of visits as a fraction of state populations, the rates of emergency room visits and inpatient hospital visits in 2009 are about 29% and 11% for AZ, 26% and 9% for CA, 33% and 13% for FL, and 32% and 11% for NJ.

An additional hospitalization category that we consider is an index of "Prevention Quality Indicators" (PQIs). These indicators are published by the U.S. Agency for Healthcare

[10]Census data on seasonal and occasional use can be accessed through the American FactFinder portal operated by the Census Bureau. See http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml for more information.

[11]We actually use Zip Code Tabulation Areas (ZCTAs) rather than zip codes as these are the units reported by the Census and remain consistent between Censuses. Zip codes are constructed by the postal service and frequently change. Using ZCTAs allows us to merge population estimates from the 2000 Census to our data. We drop about 10% of the sample that could not be matched to ZCTAs. The final number of ZCTAs in our analysis sample is 3,525.

[12]More information is available at http://www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp#download.

Research and Quality (AHRQ) and are based on International Classification of Disease diagnosis codes (ICD-9 CM). PQIs are index conditions for which good outpatient care can prevent the need for hospitalizations or ER visits, or for which early intervention can prevent complications or more severe diseases. Hospitalizations and ER visits for many other conditions may also be preventable to some extent, but PQIs are those which can almost always be prevented with appropriate care. To the extent that individuals who suffer foreclosure have fewer preventive doctor visits, stop adhering to prescription medicine regimes, or otherwise stop looking after themselves, underlying health problems may be exacerbated by foreclosure activity. Hence, it is particularly interesting to look at PQIs because they reflect patient behavior. The PQI category includes short and long-term complications of diabetes, amputations due to diabetes, and uncontrolled diabetes, perforated appendix, chronic obstructive pulmonary disease, hypertension, congestive heart failure, dehydration, bacterial pneumonia, urinary tract infection, angina without procedure, and adult asthma.

In order to match the hospitalization data and the foreclosure data, we calculate the total number of hospitalizations in each category for each zip code and quarter. Similarly, we calculate the total number of foreclosures for each zip code and quarter. We impute zeros for zip codes that appear in RealtyTrac but have no hospitalizations. The result is a balanced panel of 3,370 zip codes with 19 time periods for a total of 64,030 observations.

Table 2 shows means for all zip codes, as well as for those that were in the top and bottom fifths of the distribution of foreclosures per capita in 2009. While the average zip code in our sample had 43.35 foreclosures per quarter in 2009, zip codes in the top fifth of the distribution in 2009 had 115.45 foreclosures compared to 1.24 foreclosures per quarter in the least impacted zip codes. The table shows that the number of foreclosures increased more than 15 fold in the most highly impacted zip codes, but only tripled (from very low levels) in the least impacted zip codes between 2005 and 2009. Housing prices also fell more precipitously in the most impacted zip codes, from $350,000 to $204,000, compared to a decline from $495,000 to $437,000 in the least impacted zip codes.

The middle panel of Table 2 shows that high foreclosure zip codes are more densely populated, have lower income, a slightly higher percentage of African-Americans, and much higher percentages of Hispanics (21.73 vs. 9.72%) than low foreclosure zip codes. There is little difference in the fraction of elderly people between zip codes with high and low foreclosure rates.

The ER and hospitalization data are explored in the last panel of Table 2. The first column shows the overall rates, while the second and third columns of Table 2 show rates for people in zip codes in the bottom and top fifths of foreclosure activity (as of 2009). Comparing high and low foreclosure zip codes, we see that high foreclosure zip codes have a slightly greater rate of non-elective visits and that this difference is largely accounted for by a higher rate of visits for respiratory conditions.

III. Research Design and Methods

We estimate a series of models that relate the rate of hospital and ER visits at time t to the rate of foreclosures in the past year. Specifically, we estimate models of the form:

$$H_{zqt}=\alpha_0+\alpha_1 F_{zqt-1}+\alpha_2 F_{zqt-2}+\alpha_3 F_{zqt-3}+\alpha_4 F_{zqt-4}+\mu_z+\mu_z*t+\lambda_{cqt}+\varepsilon_{zqt}, \quad (1)$$

where H_{zqt} is one of our outcome measures in zip code z in quarter q in year t. The variables of interest in equation (1) are $F_{zqt-1...}$ F_{zqt-4}, the rates of foreclosures per 100,000 persons in the zip code in the last four quarters. Within a particular quarter, a foreclosure may have taken place after a hospitalization, which is why we focus on lagged values. We took an agnostic, practical approach to determining lag length. Below we show models with one lag as well as models with four lags. We found that adding more lags beyond the four we show here reduces the length of the time series available and adds little explanatory power.

The unit of analysis in equation (1) is a zip code, quarter, and year. The data is weighted using the zip code population for the relevant demographic group from the 2000 Census.[13] Indicators for each zip code, μ_z, are included to control for any time-invariant zip code level factors that may be correlated with both foreclosures and health. The μ_z*t represents the vector of zip code specific linear time trends, accounting for time varying characteristics of zip codes that may be associated with foreclosures and health and are trending linearly during the analysis period. The vector λ_{cqt} includes an indicator for each possible combination of county, quarter, and year.[14] These indicators control for any time varying county level factors that are correlated with both foreclosures and health. For example, the λ_{cqt} absorb the effects of county unemployment in addition to all other characteristics of a county, year, and quarter. There are 161 counties included in our analysis. Therefore, the number of binary indicators for county by year by quarter is 3,059 (161*19). Finally, the vector ε_{zqt} represents an idiosyncratic random error term. To adjust for correlations within a county, standard errors are clustered at the county level.

Note that we have specified equation (1) in terms of rates per 100,000 persons. It is important to keep in mind that accurate data on population is only available at the zip code level from the decennial Census. Therefore, the measure of population used to construct the rates comes from the 2000 Census. Both foreclosures and hospitalizations might be increasing in zip codes where the population has also been growing. While forcing the population to be constant over time may fail to account for this correlation, the inclusion of zip code specific linear time trends should address this concern to some extent. Moreover, including the zip code fixed effect accounts for the fact that some zip codes are much larger than others. If, on the other hand, the levels of population are fairly constant during our analysis period, then equation (1) is equivalent to a model specified in levels. Estimating models using levels rather than rates did not change the implications of results presented here.

[13] Unweighted regressions produced very similar results.
[14] In zip codes that covered more than one county, we assign the zip to the county that represented most of its population.

An important concern about (1) is that people who suffer foreclosure may leave the area. Since we do not follow individuals over time, we have no way of determining if the individuals who go to the hospital are the same individuals who suffered foreclosure (or their family members, or their neighbors). Equation (1) captures the effect of the last year's foreclosure auctions on those who remain in the neighborhood. The existing literature suggests that while those who suffer foreclosure are more likely to move than others, many of them are likely to remain in the neighborhood for some time.

Molloy and Shan (2011) find that half of those who begin foreclosure proceedings are still at the same address two years after the process began.[15] The process takes longer in judicial states than in non-judicial states, so we estimate separate models for the two groups of states as a robustness check below. We also check the robustness of our results to using foreclosure starts (i.e. the number of households being notified that the foreclosure process is beginning) rather than foreclosure auctions. If it is primarily foreclosure auctions that matter rather than foreclosure starts (many of which do not end up in auctions), then the length of time it takes to get to the auction may be less relevant.

If foreclosure does have negative effects on health and those who have suffered foreclosure are more likely to leave, then estimating models at the zip code level is conservative and will tend to underestimate the effects of foreclosure on health.

A related concern is that the demographic profiles of zip codes might have changed differentially in high foreclosure zip codes. While yearly demographic information at the zip code level does not exist, data from 2000 and 2010 Censuses show that correlations in the demographic composition of zip codes over time are large. The interesting question is whether these correlations are different for areas that experienced high and low foreclosure rates? Appendix Table 1 shows correlations for the zip codes that were most and least affected by foreclosures in 2009. The correlations are uniformly high, suggesting that a high foreclosure rate is not normally associated with a wholesale change in the composition of the neighborhood.

In another effort to assess whether the demographic composition of high foreclosure zip codes changed over time in a way that would be predictive of different hospital and ER visit patterns, we regressed the number of hospital visits in 2005 on a vector of zip code level demographic characteristics, measured by the average of these characteristics from the 2000 and 2010 Censuses, including: percentage white, black, and Hispanic; percentage of the population aged 20–49, 50–64, and 65+; and percentage with less than high-school degree, high-school degree, college, and a graduate degree. We then used the coefficient estimates from this equation (shown in Appendix Table 3) to obtain a predicted rate of hospital visits in each zip code in 2005 and 2010, using measures of demographics from the average of the 2000 and 2010 Censuses and from the 2010 Census, respectively. Finally, we regressed the change in the predicted rate of hospital and ER visits between 2010 and 2005 on the change in foreclosure rates between 2009 and 2005. These results are presented in Appendix Table

[15]They do not know whether a foreclosure start pertains to a person's residence so they limit their sample to people with only one large mortgage.

2. Interestingly, all of the coefficients are *negative* though only two of them are statistically significant at the 90% level of confidence. These results suggest that demographics do not shift greatly in high foreclosure neighborhoods, and that when they do shift, they shift in a way that would have predicted fewer hospital visits. Appendix Table 4 presents the correlations between changes in characteristics and changes in foreclosures. It suggests that areas with high foreclosure rates tended to be come slightly less white and less elderly, which would be expected to lead to lower (not higher) visit rates.

We estimate separate models by age group and by characteristics of the neighborhood including race and ethnicity, and income. We disaggregate by age because people in different age groups suffer from different health conditions and have differential access to public health insurance. The age groups we use are: 0 to 19, 20 to 49, 50 to 64, and aged 65 plus.

We estimate separate models for zip codes with high and low fractions of black and Hispanic residents because minority and low-income groups are thought to have been particularly hit hard by the foreclosure crisis (Rugh and Massey, 2010). It has been argued that lenders targeted low-income minority neighborhoods for risky loans (Avery, Brevoort, and Canner, 2007; Bocian, Ernst, and Li, 2008; Calem, Gillen, and Wachter, 2004; Mayer and Pence, 2008; Squires, 2008). Bowdler, Quercia, and Smith (2010) argue that Latinos have been particularly strongly affected.

Finally, in order to evaluate the possibility that our results are driven by people switching providers, we estimate a set of models using visits for serious acute conditions that would almost always result in a hospital or ER visit. For example, when people suffer a heart attack or respiratory failure, they go to the hospital, not to their primary care physician. Hence, there is little scope for “provider switching” for these diagnoses. We will show that foreclosure is associated with significant increases in visits for these conditions.

IV. Results

Table 3 provides an overview of our main results. The first panel shows estimates of an equation with one lag for all non-elective procedures, the subset of non-elective procedures that are preventable, and four specific types of conditions. The estimates suggest that each additional foreclosure per 100,000 persons in a zip code is associated with 1.500 additional non-elective visits, including 0.135 preventable visits. In terms of types of visits, the effect is largest for respiratory infections (with a coefficient of 0.225) and is statistically significant at the 99 % level of confidence for all of the conditions listed in the table.

The second panel of Table 3 shows estimates of (1), that is the model with four lags for foreclosure. The point estimates suggest that the effect of foreclosure is positive at (t-1) and typically increasing through (t-3). By (t-4), the effect has faded out considerably. The estimates suggest that an additional foreclosure in a given quarter would lead to 0.631, 0.520, 0.03, and −0.402 additional hospital or ER visits in the following four quarters, respectively, resulting in a net increase of 0.783 additional visits during the course of a year.

It seems clear that in models with only one lag, the coefficient on the one lag may be picking up the effect of past foreclosures. Hence, in most of the remaining tables, we focus on models with four lags and present the sum of the coefficients on four lags of foreclosure and the P-value for whether this sum is significantly different than zero.

Effects of Housing Prices

Table 4 shows alternative models that include housing prices.[16] The first panel repeats the main results from Table 3 for ease of comparison. The second panel shows estimates from a model similar to (1) except that we use housing prices rather than foreclosure. The results in the second panel show estimates using only housing prices rather than foreclosure, and the third panel shows models estimated using both prices and foreclosure. Perhaps surprisingly, adding prices appears to have little effect on the estimated effect of foreclosure (and vice versa).

The estimates in the first column of the third panel of Table 4 suggest for example, that a one standard deviation increase in the foreclosure rate (810.5 per 100,000) would lead to an increase of 623 non-elective visits, while a one standard deviation increase in housing prices ($275,222) would lead to a decrease of 660 in non-elective visits. These results suggest that the estimated effects of foreclosure are not simply reflecting spillover effects through lower housing prices.[17]

Results by Age and Health Insurance Status

Table 5 presents estimates of the effects of foreclosure by age and health insurance status. Since the vast majority of the elderly have public health insurance through the Medicare program, the analysis of health insurance coverage is confined to those less than 65. Table 5 suggests that there are increases in some types of non-elective hospital and ER visits in all four age groups. For example, for individuals 50 to 64, an additional foreclosure is associated with 1.470 additional total visits over the next four quarters. There are also significant positive effects on visits for preventable conditions, heart problems and mental health problems in all age groups. The effect on heart problems is particularly large for the elderly, suggesting that an additional foreclosure would be associated with an additional 0.310 visits for heart problems over the course of the next four quarters. It is not surprising that the effect of foreclosure is larger among older Americans despite the fact that foreclosure is less common among this group since these individuals are more likely to have chronic health problems and more vulnerable to health shocks (Alley et al., 2011).

Turning to results by insurance status, a striking result is that most of the increase in visits is accounted for by people with public health insurance. Although they are mostly not statistically significant, the point estimates suggest there may even be declines in visit rates among people with private health insurance. This could reflect switching from private to public health insurance as a result of financial hardship. Finally, we see little impact on visits

[16]Models using log (housing prices) produced similar results.
[17]Note that the housing price data from Zillow do not account for compositional changes in demographic characteristics over time. To the extent that these compositional changes are important, decreasing housing prices may not be capturing changes in wealth accurately.

among those without health insurance, although this is a relatively small group, and one that is disproportionately composed of healthy prime aged individuals.

Estimates by characteristics of zip codes

Table 6 shows estimates for subsets of zip codes defined by the fraction minority, or by mean income. The first panel shows estimates for the subset of zip codes that were greater than 70% African-American or Hispanic in the 2000 Census. The estimates are generally similar to those in the full sample, but are much less precisely estimated given the small sample size. These results suggest that although minority areas may have been hit harder in terms of foreclosure rates, the impact per foreclosure may be quite similar to that in other areas. The second panel shows estimates for zip codes with few minority residents. Again, the estimates are generally similar to those shown in Table 3, suggesting that the estimated effects of foreclosure are similar across race and ethnic groups.

The third and fourth panels of Table 6 compare zip codes with the lowest quartile of mean income to those with the highest quartile. Except for cancer, the estimates are larger in high income zip codes. It is possible that high income people are less vulnerable to a given shock measured in dollars, but that the size of losses due to foreclosure was higher in higher income neighborhoods.

Estimates for the Most Serious Acute Conditions

Table 7 focuses on a set of serious acute conditions that would normally cause people to seek hospital care: Heart attack and stroke; severe respiratory conditions; and gastrointestinal hemorrhage and kidney failure. Table 7 shows that the sum of the four lags of foreclosure is statistically significant in all three models. The fact that we find significant effects on visits for these serious conditions suggests that our effects reflect underlying health effects rather than changes in care-seeking behaviors such as patients switching away from other providers to hospitals and emergency rooms.

Additional Estimates

Because the “Great Recession” followed the foreclosure crisis, and because there is a great deal of research linking unemployment and health, it may be tempting to conclude that the estimated relationship between foreclosure and health only reflects a relationship between unemployment and health. The first panel of Table 8 presents models estimated using data for the second quarter of 2005 through the fourth quarter of 2007, so that data from the “Great Recession” period when unemployment sky-rocketed has been excluded. The estimated effects of foreclosure are, if anything, stronger than those presented above, suggesting that effects of foreclosure were apparent even in the low unemployment environment that prevailed through the end of 2007.

Panels 2 and 3 of Table 8 present estimates for judicial and non-judicial states separately. As discussed above, the literature suggests that people in judicial states are able to stay in their homes longer after foreclosure so we might expect to see larger effects of foreclosure in those states. Table 8 suggests that this is indeed the case. Moreover, the estimates are the largest on the 4^{th} lag for judicial states, while they appear to die out more rapidly in non-

judicial states. However, there are of course many other differences between the states in our sample that could affect responses to the foreclosure crisis (for example, Florida and Arizona have large numbers of retirees, and each state has different methods of financing indigent care); hence, with only two states of each type, it is hard to conduct a definitive test of the effect of different foreclosure mechanisms.

Panel 4 of Table 8 presents models that use foreclosure starts rather than foreclosure auctions. One difficulty with thinking about foreclosure as an event is that the process typically takes a long time. A homeowner might begin to feel stress when he or she first becomes delinquent on a mortgage (which we do not observe). This stress might escalate when foreclosure is initiated, and reach a peak at the time of the foreclosure auction. There is little a priori evidence to support this type of time line, although we do know that many foreclosure starts do not lead to auctions because homeowners are able to save their homes. It is also plausible that the stress associated with foreclosure is most severe at the beginning of the process as individuals are shocked with the fear of losing their homes, but eventually develop mechanisms to cope with this stress. Panel 4 shows that models estimated using foreclosure starts produce estimates that are in line with our baseline model.

Panel 5 of Table 8 shows results from a sample that includes all the zip codes in our four analysis states, without excluding zip codes with a high proportion of vacation and investment properties. The estimates in Panel 5 are qualitatively similar to those of Table 3 but uniformly smaller in size, consistent with the idea that losing a vacation home may have less negative effects than losing a primary residence. Panel 6 shows estimates using only zip codes with high proportions of vacation and investment properties. We do not see any statistically significant effects in these models, though this may be in part due to small sample size.

V. Discussion and Conclusions

This study examines the relationship between foreclosures and hospital and ER visits at a neighborhood level. Our results suggest that individuals in communities that have suffered high rates of foreclosure are more likely to seek treatment in hospitals and emergency rooms for a variety of conditions such as mental health conditions, heart attack and stroke, as well as for conditions that could be prevented by appropriate care such hypertension.

Our results contribute to the growing literature documenting a relationship between wealth and health, and between changes in wealth and changes in health. Given that both health and wealth are generated by complex processes, and causality may run in either direction, it is generally difficult to interpret the relationship as causal. However, to the extent that the reader is willing to believe that the unprecedented run up in foreclosures that began in 2005 was not itself caused by changes in population health, we believe our results suggest that the foreclosure crisis had negative effects on health.

Our results raise obvious questions about mechanisms. It cannot be the case that the huge increase in foreclosure in heavily affected neighborhoods was due to a wave of ill health among homeowners in those neighborhoods. We also show that the effects cannot be

explained by unemployment alone. That is, showing a relationship between foreclosure and health is not merely another way of measuring the relationship between unemployment and health. In fact, we see even stronger effects of foreclosure in models estimated on data prior to the end of 2007, when unemployment in our four states was relatively low and stable. Similarly, the estimates are not explained solely by our measure of housing prices: Adding housing prices to the model has little impact on the estimated effect of foreclosure.

We have also considered the question of whether our results could be biased due to migration, since we do not observe individual health before and after foreclosure. However, an examination of Census data does not suggest large changes in the demographics of affected areas.

An additional concern is that the results could be driven by patients who switch from seeing providers outside of hospital settings to hospital and ER visits. We address this concern by examining a subset of visits for the most serious illnesses, those which would almost always result in hospital visits. There is little scope for provider switching with respect to these conditions, yet we still see increases in visits for heart attacks and stroke, gastrointestinal hemorrhage and kidney failure, and acute respiratory failure.

Our estimates imply that an additional foreclosure in zip code results in 0.783 additional non-elective hospital or ER visits over the following four quarters. Hence, the estimates imply that 2.82 million foreclosures in 2009 resulted in an additional 2.21 million non-elective visits which can be compared to a baseline of approximately 26 million non-elective hospital admissions plus 130 million ER visits (Morganti et al, 2013; Centers for Disease Control, 2010). While the cost data available from HCUP is imperfect and covers only hospital costs, a crude cost analysis suggests that non-elective visits impose a cost of an average of $2,521 (in 2009 dollars). Thus, taken literally our estimates imply that additional visits due to the foreclosure crisis increased the costs of hospitalizations for non-elective conditions by more than $5.57 billion in 2009 alone.[18]

Our estimates imply that many distressed homeowners suffer disruptions in access to preventive medical care so that maintaining access to such care could be a beneficial focus of policy. To the extent that the cost of additional hospital visits is an externality that places costs on the general public (either directly through the provision of indigent care, or indirectly through higher insurance premiums) it may also provide an additional rationale for public interventions into housing markets.

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[18]HCUP cost data do not include physician costs, which are usually billed separately. Other limitations are that cost data are not available for ER visits in California, so that we had to exclude CA from our calculations of the average cost of a visit. Also, data are presented in terms of “total charges,” essentially a list price which few people pay, and “cost-to-charge” ratios (CCR) for the hospital or for groups of hospitals. One must multiply the total charge by the CCR in order to approximate the actual cost of the visit.

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Appendix: Aggregating CCS Single-Diagnosis Codes into Broader Aggregates

We exclude induced abortion (178), normal pregnancy and delivery (196), live born (218), and contraception, complications of pregnancy/abortion (codes 176–195). We have examined all of the categories below, but focus on the categories that are bolded (Cancer, mental health problems, heart problems, and respiratory problems). We found positive effects of foreclosure on visits for most other categories. Note that hypertension, diabetes, and asthma are included in the PQI (preventable) category. The more specific conditions we examine correspond to smaller groups of codes, as described in the text.

1. Infectious Disease – codes 1–10
2. Cancer and Benign Neoplasms– codes 11–45, 46–47
3. Diabetes-codes 49,50
4. Other Endocrine/Metabolic disorders – codes 48, 51–58
5. Hematologic Disorders, disorders of veins – codes 59–64, 188–121
6. Anxiety related Mental Health-codes 651, 657, 660–661
7. Suicide-code 662
8. All other mental health-codes 650, 652–656, 658, 659, 663, 670
9. Headache-code 84
10. Other Central Nervous System-codes 76–83, 85, 95
11. Eye and Ear-codes 86–94
12. Heart Attack and Stroke-codes 97, 100, 101, 103, 104, 107–117
13. Heart valve disorders, Nonspecific Chest Pain, Conduction Disorders, Dysrhthmias– codes 96, 102, 105, 106
14. Hypertension – code 98, 99
15. Upper Resp. Infection (Pneumonia, Influenza, Tonsillitis, Bronchitis, Other)-codes 122–126
16. Other Resp. excluding Asthma-codes 127, 129–134
17. Asthma-code 128
18. Gastrointestinal including appendicitis-codes 135–155
19. Kidney and Urinary Tract (including urinary tract infections) -codes 156–163

20. Genital disorders (including inflammation and menstrual disorders) -codes 164–175
21. Skin infections, inflammatory conditions, ulcers, other skin-codes 197–200
22. Bone disease and musculoskeletal disease (including arthritis, lupus) -codes 201–212
23. Injuries-codes 225–244
24. Malaise (Miscellaneous symptoms including Fever of unknown origin, lymphadenitis, nausea, abdominal pain, malaise, allergic reactions) -codes 245–253
25. Other (including rehabilitation care, social admissions, medical evaluation, unclassified) -codes 254–259

See http://www.hcup-us.ahrq.gov/toolssoftware/ccs/AppendixASingleDX.txt for a complete list of CCS codes and their mapping into ICD codes.

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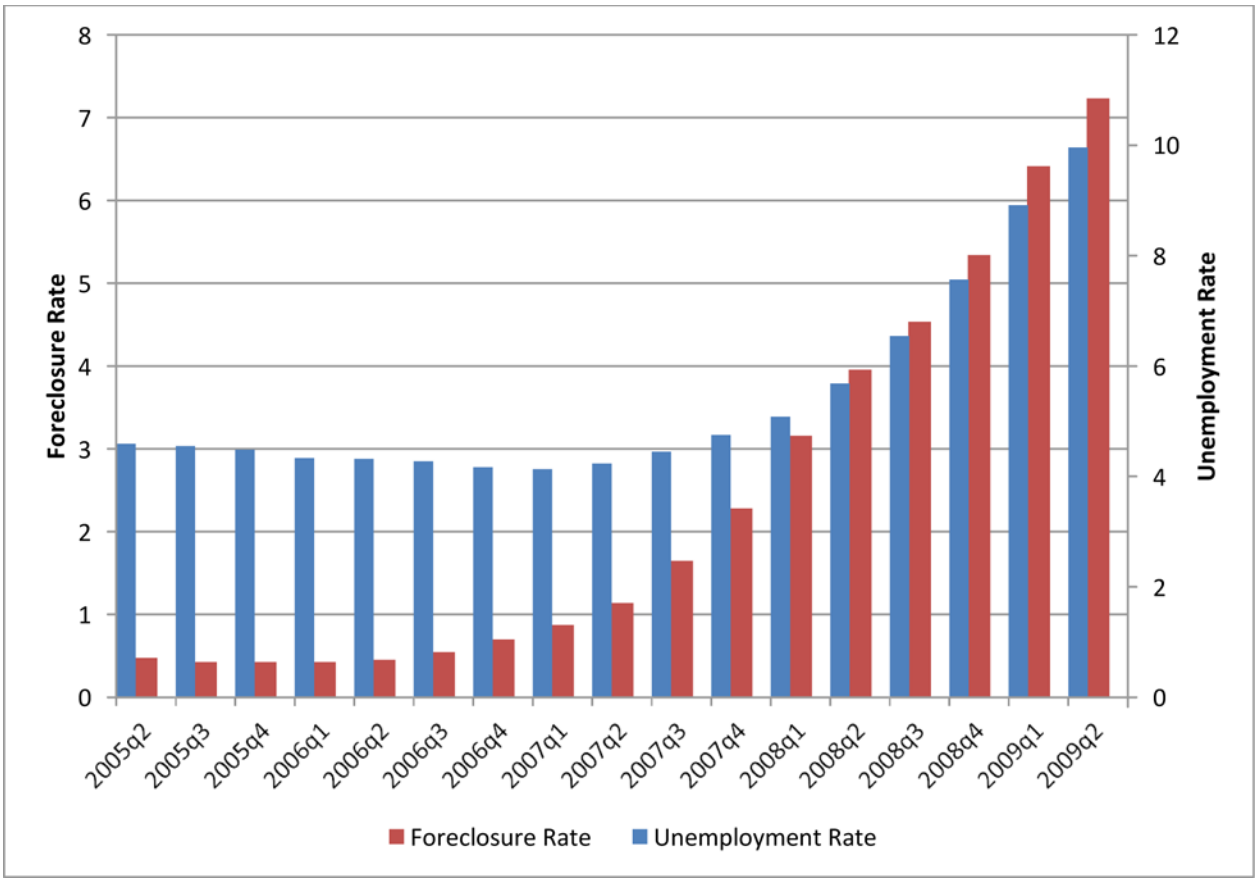

Figure 1A. Average of Unemployment and Foreclosure Rates for Analysis States 2005–2009
Source: Foreclosure rates are drawn from the National Delinquency Survey of the Mortgage Bankers Association. Unemployment rate come from the Bureau of Labor Statistics.

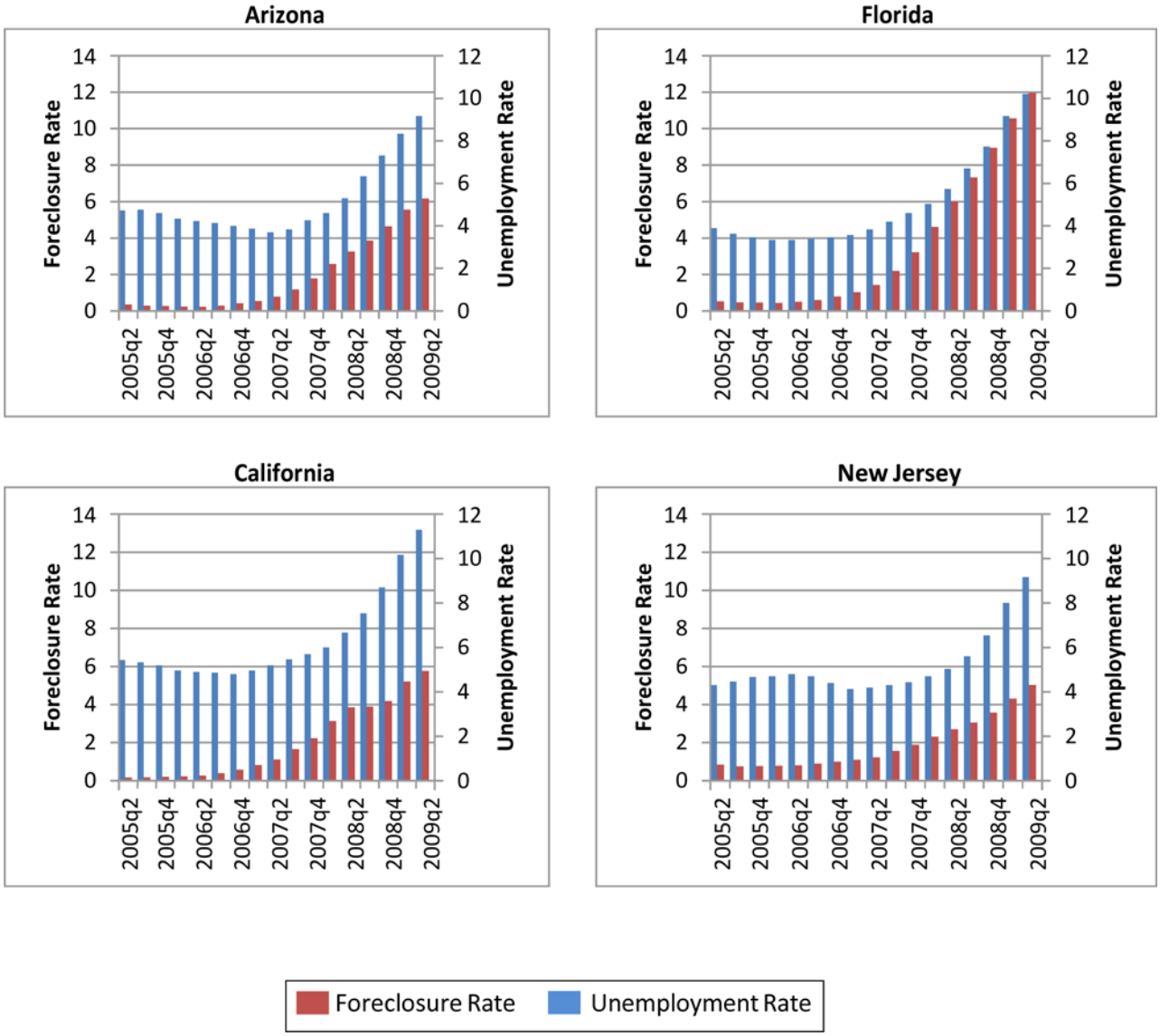

Figure 1B. Unemployment and Foreclosure Rates Separately for Four States 2005–2009

Source: Foreclosure rates are drawn from the National Delinquency Survey of the Mortgage Bankers Association. Unemployment rate come from the Bureau of Labor Statistics.

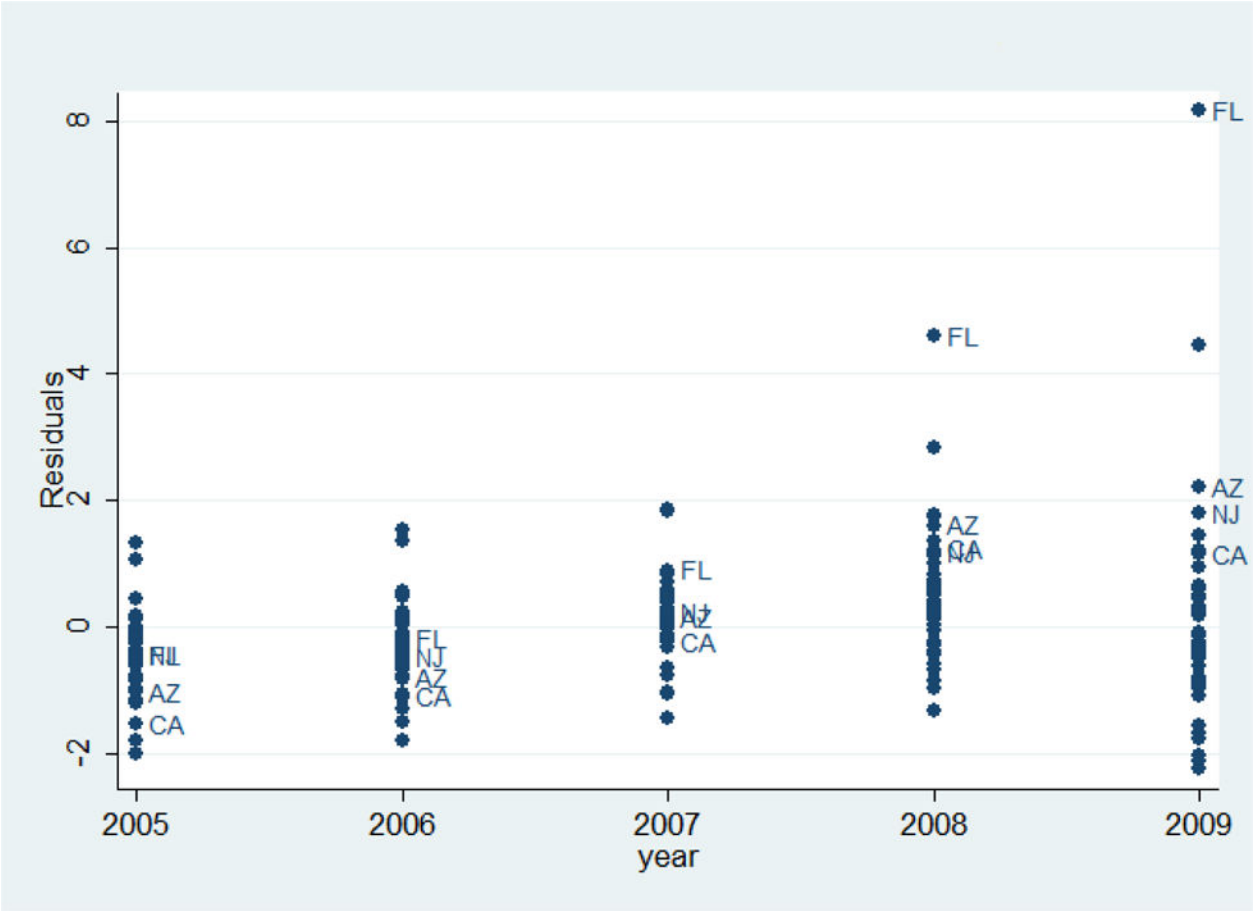

Figure 2. Residual Foreclosure Rates after Controlling for Unemployment

Source: Foreclosure rates are drawn from the National Delinquency Survey of the Mortgage Bankers Association. Unemployment rate come from the Bureau of Labor Statistics.

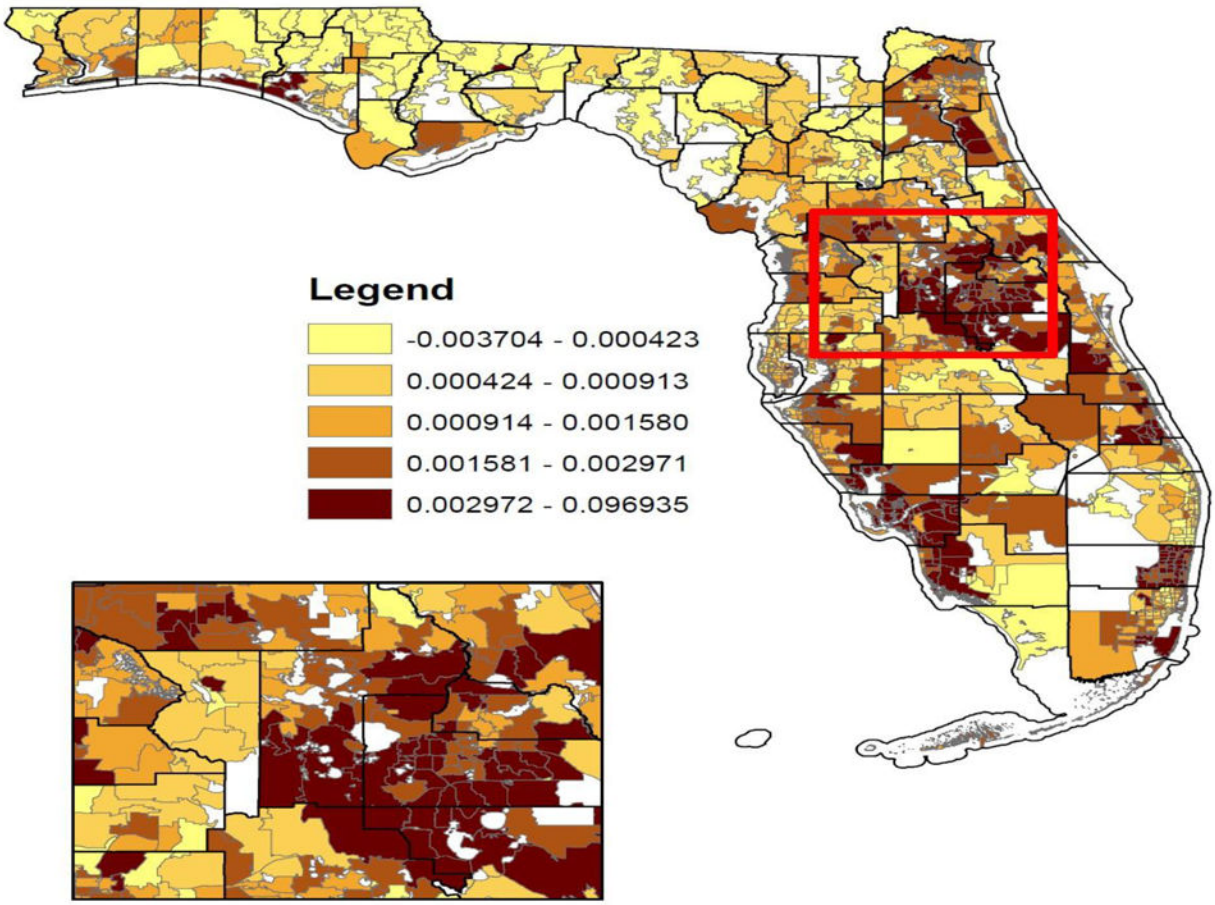

Figure 3. Foreclosures by Zip Code Within Counties, Florida 2009

Source: RealtyTrac. White areas are places that are not covered by a ZCTA, and include places such as large bodies of water or national/state parks.

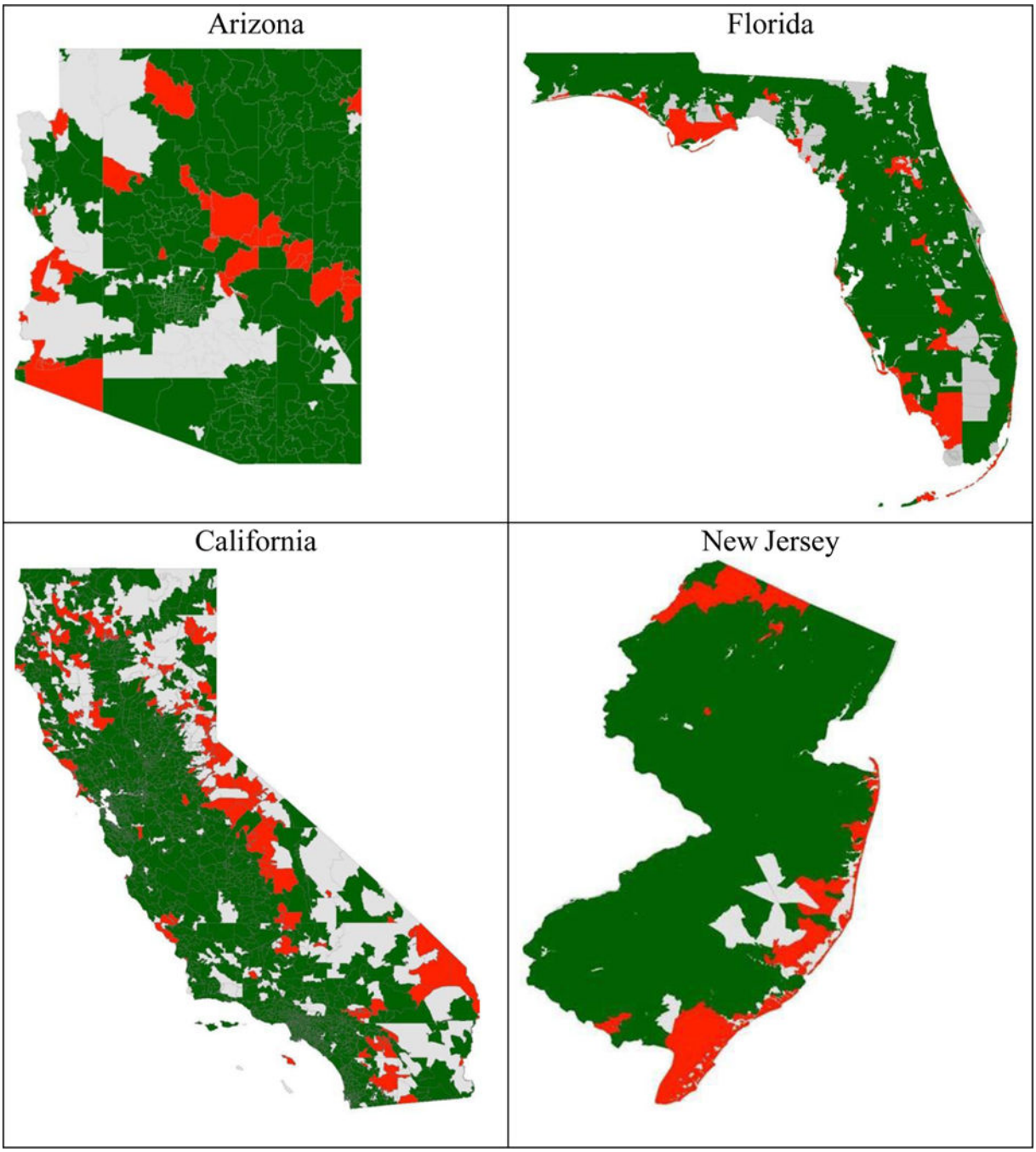

Figure 4. Concentration of Seasonal and Occasional Houses Based on 2010 Census Data

Note: Red areas represent ZCTAs that rank in the top 10% of zips for seasonal housing units. Grey areas are places that are not covered by a ZCTA, and include places such as large bodies of water or national/state parks. Source: U.S. Census Bureau.

Table 1

Characteristics of Those With and Without Foreclosure (PSID)

	Never Foreclosure	Ever Foreclosure	2009 No Foreclosure	2009 Current Foreclosure	2009 Own, No Mortgage	2009 Rent
Age 20–49	0.490	0.648	0.515	0.489	0.140	0.668
Age 50–64	0.285	0.277	0.358	0.422	0.314	0.188
65 and over	0.222	0.075	0.127	0.090	0.546	0.138
Non-Hispanic Whit	0.744	0.651	0.788	0.693	0.849	0.620
African American	0.145	0.197	0.094	0.171	0.072	0.252
Hispanic	0.086	0.129	0.087	0.136	0.058	0.108
Head Unemployed	0.070	0.107	0.045	0.159	0.028	0.105
Married	0.473	0.431	0.675	0.470	0.564	0.203
Children Under 18	0.287	0.506	0.396	0.463	0.128	0.279
Health is Excellent	0.178	0.095	0.214	0.059	0.131	0.159
Health is Poor	0.052	0.073	0.025	0.109	0.082	0.058
Head Smokes	0.197	0.315	0.147	0.218	0.134	0.285
Head Drinks	0.650	0.609	0.710	0.631	0.561	0.637
# Observations	8,355	327	3445	41	1,204	3,273

Notes: The number of obs. in the first two columns sums to 8682. The number of observations in columns 3 through 6 also sum to 8682. Each of the 8682 respondents answers on behalf of their household. Means are weighted using 2009 PSID sample weights

Table 2

Zipcode Means by Rate of Foreclosure in 2009

	All Zipcodes	Zips in Bottom 5th Foreclosures	Zips in Top 5th Foreclosures
Quarterly # of foreclosures 2009	50.81	1.88	141.25
Quarterly # of foreclosures 2005	3.75	0.57	5.88
Housing Prices 2005 ($1000s)	417	497	368
Housing Prices 2009 ($1000s)	302	438	191
Characteristics of Zip Codes in 2000			
Mean population	17983	9543	15564
Mean Household Income	62504	71934	61553
Percent Black	7.14	5.94	5.96
Percent Hispanic	18.22	9.46	19.00
Percent Over 65	14.48	13.04	15.74
(Hospitalizations and ER Visits by Type/Population in 2000) * 100			
Total Non-Elective	10.92	10.70	14.13
Selected Categories of Non-Elective Visits			
Preventable Visits	1.01	0.95	1.31
Cancer	0.09	0.08	0.11
Any Heart/Stroke	0.98	0.95	1.26
Mental Health	0.45	0.45	0.53
Respiratory Infection	1.42	1.33	1.87

Notes: Characteristics of zip codes come from the 2000 Census.

N=3,370 zip codes (ZCTAs). For hospitalizations, N=3370*19 quarters = 64030 zip code level observations. Standard deviations are in parentheses.

Table 3

Effects of Foreclosures by Zip Code

	Non-Elective	Preventable	Cancer	Heart	Mental	Respiratory Infection
Zip Code Level, N=56,088, Mean Population in a Zip Code=19,750						
Foreclosure Rates (t-1)	1.4996*** (0.1378)	0.1347*** (0.0137)	0.0064*** (0.0017)	0.1136*** (0.0118)	0.0651*** (0.0076)	0.2252*** (0.0539)
Number Visits per 100k per Quarter	10580	972	85	935	438	1385
Model with Four Lags, N=46,740						
Foreclosures Rates (t-1)	0.6309*** (0.1910)	0.0714*** (0.0097)	−0.0002 (0.0027)	0.0459*** (0.0168)	0.0293*** (0.0082)	0.0932** (0.0441)
Foreclosures Rates (t-2)	0.5200*** (0.1393)	0.0637*** (0.0085)	0.0066 (0.0080)	0.0387*** (0.0084)	0.0027 (0.0079)	0.2062*** (0.0621)
Foreclosures Rates (t-3)	0.0340 (0.1609)	−0.0180** (0.0082)	−0.0034*** (0.0012)	0.0005 (0.0059)	0.0139*** (0.0048)	−0.0846 (0.0679)
Foreclosures Rates (t-4)	−0.4019 (0.5145)	−0.0265 (0.0257)	0.0004 (0.0052)	0.0059 (0.0104)	0.0135** (0.0058)	−0.1935 (0.2188)
Sum of lags	**0.7830**	**0.0906**	0.0034	**0.0909**	**0.0594**	0.0213
P value for all lags=0	**0.0826**	**0.0009**	0.3332	**0.0000**	**0.0000**	0.9224
# Visits per 100k per Year	42817	3911	334	3764	1794	5581

Notes: Regressions of hospitalization plus ER rates on foreclosure rates also included zip code fixed, effects, county*quarter*year effects and time trends for clusters of zip codes. Standard errors in parentheses. ***, **, and * indicate that the estimate is statistically significant at the 99th, 95th, and 90th percent level of confidence. Bold face indicates that the sum of lags is significantly different than zero.

Table 4

Zip-Code Level Estimates of Effects of Foreclosures, Housing Prices, and Vacancies

	Non-Elective	Preventable	Cancer	Heart	Mental	Respiratory Infection
Number Visits in Year	42817	3911	334	3764	1794	5581
Baseline Zip Code Level Model, N=46,740, Mean Population=19,750						
Sum of 4 Lags Foreclosure	**0.7831**	**0.0906**	0.0034	**0.0909**	**0.0594**	0.0213
P value for sum=0	**0.0826**	**0.0009**	0.3332	**0.0000**	**0.0000**	0.9224
Zip Code Level Model with House Prices Rather than Foreclosures, N = 37,635, Mean Population =23,454						
Sum of 4 Lags House Prices	**−0.0032**	**−0.0004**	**0.0000**	**−0.0002**	−0.0001	**−0.0013**
P value for sum=0	**0.0000**	**0.0000**	**0.0305**	**0.0000**	0.1589	**0.0000**
Zip Code Level Model Including Both Foreclosures and House Prices, N = 37,635, Mean Population =23,454						
Sum of 4 Lags Foreclosure	**0.7683**	**0.0703**	0.0027	**0.0762**	**0.0531**	0.0363
P value for sum=0	**0.0672**	**0.0003**	0.3694	**0.0000**	**0.0000**	0.8706
Sum of 4 Lags House Prices	**−0.0024**	**−0.0003**	**0.0000**	**−0.0001**	0.0000	**−0.0012**
P value for sum=0	**0.0000**	**0.0000**	**0.0774**	**0.0007**	0.4974	**0.0000**

Notes: Regressions of hospitalization plus ER rates on foreclosure rates included zip code fixed, effects, county*quarter*yea effects and time trends for clusters of zip codes. Standard errors in parentheses. ***, **, and * indicate that the estimate is statistically significant at the 99th, 95th, and 90th percent level of confidence. Bold face indicates that the sum of lags is significantly different than zero.

Table 5

Zip-Code Level Estimates of Effects of Foreclosures by Age and Insurance Status

	Non-Elective	Preventable	Cancer	Heart	Mental	Respiratory Infection
Age: 65+, N=46,740						
Sum of 4 Lags Foreclosure	**2.0390**	**0.2992**	**0.0264**	**0.3099**	**0.0490**	**0.1771**
P value for sum=0	**0.0000**	**0.0000**	**0.0018**	**0.0000**	**0.0361**	**0.0000**
# Visits per 100k per Year	7905	1292	151	1625	160	978
Age: 50–64, N=46,740						
Sum of 4 Lags Foreclosure	**1.4701**	**0.1499**	−0.0006	**0.2730**	**0.0762**	0.0919
P value for sum=0	**0.0001**	**0.0011**	0.9151	**0.0000**	**0.0003**	0.3952
# Visits per 100k per Year	6512	665	87	928	326	651
Age: 20–49, N=46,740						
Sum of 4 Lags Foreclosure	0.5736	**0.0632**	**0.0063**	**0.0586**	**0.0628**	−0.0867
P value for sum=0	0.1412	**0.0167**	**0.0000**	**0.0031**	**0.0000**	0.6221
# Visits per 100k per Year	16145	1057	63	950	956	1611
Age: 0–19, N=46,740						
Sum of 4 Lags Foreclosure	0.4288	**0.0497**	−0.0081	**0.0141**	**0.0456**	0.0576
P value for sum=0	0.5234	**0.0268**	0.1651	**0.0005**	**0.0000**	0.8654
# Visits per 100k per Year	10215	718	15	92	219	2116
Public Health Insurance, All < 65, N=46,740						
Sum of 4 Lags Foreclosure	**0.9486**	**0.0824**	**0.0018**	**0.0465**	**0.0310**	**0.1844**
P value for sum=0	**0.0000**	**0.0000**	**0.0166**	**0.0000**	**0.0000**	**0.0000**
# Visits per 100k per Year	12016	1044	62	648	621	1960
Private Health Insurance, All < 65, N=46,740						
Sum of 4 Lags Foreclosure	−0.4330	−0.0244	−0.0014	0.0151	**0.0181**	−0.2042
P value for sum=0	0.3171	0.4323	0.4954	0.3752	**0.0000**	0.2394

	Non-Elective	Preventable	Cancer	Heart	Mental	Respiratory Infection
# Visits per 100k per Year	14042	945	83	972	468	1614
No Health Insurance, All < 65, N=46,740						
Sum of 4 Lags Foreclosure	0.1419	0.0093	**0.0009**	**0.0093**	**0.0106**	0.0269
P value for sum=0	0.0644	0.1081	**0.0003**	**0.0044**	**0.0175**	0.2761
# Visits per 100k per Year	6669	439	20	338	404	788

Notes: Regressions of hospitalization plus ER rates on foreclosure rates also included zip code fixed, effects, county*quarter*year effects and time trends for clusters of zip codes. Standard errors in parentheses. ***, ** and * indicate that the estimate is statistically significant at the 99th, 95th, and 90th percent level of confidence. Bold face indicates that the sum of lags is statistically significantly different than zero.

Table 6

Effects of Foreclosures by High and Low Minority, and Low, Medium, and High Income Zip Code

	Non-Elective	Preventable	Cancer	Heart	Mental	Respiratory Infection
Zip Codes with >70% African-American or Hispanic Residents, N= 4,365, Mean Population= 30,840						
Sum of 4 Lags Foreclosure	1.2590	**0.1575**	0.0062	0.0745	**0.0769**	0.2087
P value for sum=0	0.2533	**0.0934**	0.3852	0.5214	**0.0928**	0.5302
# Visits per 100k per Year	45338	4566	344	3494	2015	6884
Zip Codes with <10% African-American or Hispanic Residents, N=15,075, Mean Population=11,359						
Sum of 4 Lags Foreclosure	**1.1770**	**0.1124**	0.0042	**0.0729**	**0.0529**	**0.3732**
P value for sum=0	**0.0000**	**0.0000**	0.3712	**0.0000**	**0.0501**	**0.0000**
# Visits per 100k per Year	42999	3773	362	4077	1786	5067
Zip Codes in the Lowest Quartile of Income, 2000 Census, N=11,445, Mean Population=20,148						
Sum of 4 Lags Foreclosure	0.8779	0.0895	0.0039	0.0601	**0.0316**	0.2725
P value for sum=0	0.1753	0.1012	0.3263	0.2464	**0.0134**	0.1446
# Visits per 100k per Year	49218	4711	334	3894	1905	7215
Zip Codes in the Highest Quartile of Income, 2000 Census, N=11,670, Mean Population=18,580						
Sum of 4 Lags Foreclosure	**1.2560**	**0.1023**	0.0036	**0.0950**	**0.0782**	**0.3096**
P value for sum=0	**0.0000**	**0.0000**	0.5932	**0.0000**	**0.0000**	**0.0004**
# Visits per 100k per Year	32921	2773	313	3187	1573	3560

Notes: Regressions of hospitalization plus ER rates on foreclosure rates included zip code fixed, effects, county*quarter*yea effects and time trends for clusters of zip codes. Standard errors in parentheses. ***, **, and * indicate that the estimate is statistically significant at the 99th, 95th, and 90th percent level of confidence. Bold face indicates that the sum of lags is significantly different than zero.

Table 7

Effects of Foreclosures on Severe Conditions

	Heart Attack & Stroke	Acute Respiratory	Acute Gastro & Kidney
Zip Code Level, N=46,740, Mean Population=18,988			
Foreclosures (t-1)	0.0014 (0.0027)	0.0012 (0.0011)	0.0077*** (0.0019)
Foreclosures (t-2)	0.0056** (0.0024)	−0.0004 (0.0026)	0.0021 (0.0024)
Foreclosures (t-3)	0.0007 (0.0048)	0.0038 (0.0045)	−0.0002 (0.0017)
Foreclosures (t-4)	0.0060 (0.0039)	0.0019 (0.0015)	−0.0017 (0.0033)
Sum of lags	**0.0137**	**0.0065**	**0.0078**
P value for all lags=0	**0.0000**	**0.0005**	**0.0004**
# Visits per 100k per Year	648	231	386

Notes: Regressions of hospitalization plus ER rates on foreclosure rates also included zip code fixed, effects, county*quarter*year effects and time trends for clusters of zip codes. Standard errors in parentheses. ***, **, and * indicate that the estimate is statistically significant at the 99th, 95th, and 90th percent level of confidence. Bold face indicates that the sum of lags is significantly different than zero.

Table 8

Alternative Zip-Code Level Estimates of Effects of Foreclosures

	Non-Elective	Preventable	Cancer	Heart	Mental	Respiratory Infection
Second Quarter 2005 through Fourth Quarter 2007, N=21,812						
Sum of 4 Lags Foreclosure	**3.9707**	**0.2657**	0.0012	0.0378	**0.1143**	**0.7726**
P value for sum=0	**0.0000**	**0.0000**	0.9122	0.5356	**0.0001**	**0.0000**
# Visits per 100k per Year	41784	3840	331	3696	1712	5419
Judicial States Only (NJ and FL), N=20,340						
Foreclosures Rates (t-1)	0.1889 (0.1586)	0.0388*** (0.0073)	0.0043 (0.0033)	0.0289** (0.0134)	−0.0008 (0.0057)	0.0109 (0.0225)
Foreclosures Rates (t-2)	0.2124 (0.2265)	0.0371*** (0.0136)	−0.0014 (0.0040)	0.0418*** (0.0156)	0.0197* (0.0104)	0.1019 (0.0739)
Foreclosures Rates (t-3)	0.1151 (0.1200)	−0.0179 (0.0341)	−0.0061 (0.0046)	−0.0039 (0.0163)	0.0050 (0.0097)	0.0406 (0.0927)
Foreclosures Rates (t-4)	0.7490*** (0.1539)	0.0469 (0.0282)	0.0141*** (0.0027)	0.0378* (0.0206)	0.0063 (0.0102)	0.2928*** (0.0659)
Sum of 4 Lags Foreclosure	**1.2654**	**0.1049**	**0.0110**	**0.1046**	**0.0302**	**0.4462**
P value for sum=0	**0.0164**	**0.0058**	**0.0150**	**0.0139**	**0.0574**	**0.0015**
# Visits per 100k per Year	45732	4062	368	4244	1874	5850
Non-Judicial States Only (AZ and CA), N=26,400						
Foreclosures Rates (t-1)	0.8579*** (0.0900)	0.0864*** (0.0054)	−0.0008 (0.0030)	0.0523** (0.0211)	0.0393*** (0.0079)	0.1583*** (0.0204)
Foreclosures Rates (t-2)	0.6184*** (0.1505)	0.0712*** (0.0090)	0.0086 (0.0098)	0.0386*** (0.0093)	−0.0019 (0.0076)	0.2358*** (0.0772)
Foreclosures Rates (t-3)	0.0396 (0.2377)	−0.0154* (0.0092)	−0.0026** (0.0013)	0.0040 (0.0057)	0.0176** (0.0067)	−0.1086 (0.0977)
Foreclosures Rates (t-4)	−0.8935** (0.4194)	−0.0575*** (0.0161)	−0.0036 (0.0066)	−0.0079 (0.0118)	0.0115* (0.0066)	−0.3867** (0.1605)
Sum of 4 Lags Foreclosure	0.6224	**0.0847**	0.0016	**0.0870**	**0.0665**	−0.1012
P value for sum=0	0.1703	**0.0042**	0.6244	**0.0000**	**0.0000**	0.5731
# Visits per 100k per Year	38549	3620	310	3265	1683	5016

	Non-Elective	Preventable	Cancer	Heart	Mental	Respiratory Infection
Using Foreclosure Starts vs. Foreclosure Auctions, N=46,740						
Sum of 4 Lags Starts	**1.1180**	**0.1153**	**0.0063**	**0.0955**	**0.0480**	**0.2383**
P value for sum=0	**0.0000**	**0.0000**	**0.0043**	**0.0000**	**0.0000**	**0.0000**
# Visits per 100k per Year	42817	3911	334	3764	1794	5581
Including High Vacation Home Zip Codes, N=52,875						
Sum of lags	0.6230	**0.0752**	0.0028	**0.0745**	**0.0534**	0.0135
P value for all lags=0	0.1710	**0.0071**	0.4570	**0.0000**	**0.0000**	0.9490
# Visits per 100k per Year	42074	3847	334	3738	1766	5445
High Vacation Home Zip Codes Only, N=5,205						
Sum of lags	−0.1302	−0.0280	−0.0012	−0.0598	0.0119	0.0612
P value for all lags=0	0.7371	0.5254	0.9412	0.4411	0.7232	0.6663
# Visits per 100k per Year	34956	3237	331	3472	1499	4128

Notes: Regressions also included zip code fixed, effects, county*quarter*year effects and trends for clusters of zip codes. Standard errors in parentheses. Bold face indicates that the sum of lags is significantly different than zero.

Appendix Table 1

Correlations between 2000 and 2010 Zip Code Demographics

	Income	%White	%Black	%Hispanic	%Dropout	%College
Less than 20th Percentile 2009 Foreclosures	0.9049	0.9589	0.9337	0.9601	0.805	0.7489
Greater than 80th Percentile 2009 Foreclosure	0.8618	0.9509	0.9529	0.958	0.899	0.8734
Less than 20th Percentile Foreclosure Change	0.9479	0.9631	0.9802	0.9779	0.8769	0.8621
Greater than 80th Percentile Foreclosure Chan	0.8544	0.9513	0.9213	0.9696	0.8509	0.7558

Notes: The table shows simple correlations between zip code level census characteristics in 2000 and 2010 for zip in the lowest quintile for foreclosures in 2009, and for zip codes in the highest quintile of foreclosure rates in 2009

Appendix Table 2

Correlation Between Change in Predicted Visit Rates and Change in Foreclosures

VARIABLES	Change in Non-Elective	Change in Preventable	Change in Cancer	Change in Heart	Change in Mental Health	Change in Respiratory Infection
Change in Foreclosure	−0.0258	−0.0029	−0.0004*	−0.0043*	−0.0006	−0.0025
	(0.0199)	(0.0023)	(0.0002)	(0.0024)	(0.0009)	(0.0030)
Observations	3,091	3,091	3,091	3,091	3,091	3,091

Notes: These estimates were derived in three steps. In the first step, hospitalization rates in 2005 were regressed on the demographic characteristics of the zipcode in 2005 (measured by taking averages of the 2000 and 2010 characteristics in the respective Censuses). In the second step, coefficient estimates from the first step were used to predict the hospitalization rate in each zipcode in 2010 and 2005, using demographic information from 2010 or from the average of the Censuses. The change in predicted hospitalization rates was then calculated as the difference between the 2010 and the 2005 predicted rates. In the third step, the change in the predicted hospitalization rate is regressed on the change in foreclosures between 2009 and 2005. The demographic variables included were %black, white, hispanic; %20–49, 50–64, 65+; and %dropout, highschool, some college, and college. See text for further details. Notes: Standard errors in parentheses. ***, **, and * indicate that the estimate is statistically significant at the 99th, 95th,

Appendix Table 3

Regression of Visit Rates in 2005 on Census Tract Characteristics

	Non-Elective	Preventable	Cancer	Heart	Mental Health	Respiratory Infection
White	249.3916***	11.7857*	−0.1263	18.4967***	−2.7781	27.3032***
	(73.2312)	(6.5994)	(0.8224)	(6.7940)	(2.5941)	(9.5945)
Black	418.8893***	39.8882***	1.7927*	31.6486***	14.0216***	62.3734***
	(89.8534)	(8.0973)	(1.0091)	(8.3361)	(3.1829)	(11.7723)
Hispanic	−64.3462	6.6495	2.4954***	1.3130	−3.7465	0.7246
	(71.1406)	(6.4110)	(0.7989)	(6.6000)	(2.5201)	(9.3206)
0 to 19	691.6471**	67.7887**	1.0675	81.8017***	−26.7543**	136.5971***
	(307.5060)	(27.7115)	(3.4533)	(28.5286)	(10.8930)	(40.2886)
20–49	925.2823***	84.8386***	6.3100**	117.4058***	30.3877***	119.3286***
	(275.5851)	(24.8349)	(3.0948)	(25.5672)	(9.7623)	(36.1064)
50–64	1,035.1007***	129.1728***	13.5541***	202.0951***	13.6235	156.2463***
	(335.3912)	(30.2245)	(3.7665)	(31.1157)	(11.8808)	(43.9420)
Less than high school	−208.6894	−18.3290	−6.0807***	−17.4018	−3.0874	−18.2604
	(184.4640)	(16.6233)	(2.0715)	(17.1135)	(6.5344)	(24.1679)
Highschool	404.5997*	66.2063***	9.2884***	91.7581***	−2.6362	63.7602**
	(218.9826)	(19.7341)	(2.4592)	(20.3160)	(7.7572)	(28.6905)
College	−1,357.7829***	−131.1541***	−10.6263***	−106.0406***	−34.8658***	−178.8389***
	(248.4575)	(22.3902)	(2.7902)	(23.0505)	(8.8013)	(32.5522)
Graduate Degree	707.7379***	106.1527***	13.7691***	125.4178***	4.0367	101.9507***
	(207.1331)	(18.6662)	(2.3261)	(19.2166)	(7.3374)	(27.1380)
Constant	−33,653.0973	−4,193.3930*	−206.1705	−8,774.6146***	1,915.0245**	−6,531.2238*
	(27,128.2240)	(2,444.7146)	(304.6522)	(2,516.8018)	(960.9842)	(3,554.2627)
Observations	3,091	3,091	3,091	3,091	3,091	3,091
R-squared	0.0643	0.0888	0.0533	0.0996	0.0562	0.0788

Notes: These are regressions of hospitalizations in 2005 on the average census tract characteristics from the 2000 and 2010 Censuses. The coefficients show change in the number of visits per 1,000 with a one pp change in the indicated characteristics. These coefficient estimates were used to create the predicted change in hospitalization rates used in Appendix Table 2.

For race, the omitted categories are Asian, Other and Native American. For Hispanic, the omitted category is non-Hispanic.

Appendix Table 4

Correlations between Changes in Demographic Characteristics and Changes in Foreclosure Rates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Change in:	White	Black	Hispanic	0–19	20–49	50–64	65 plus	< HS	High School	Some Coll.	College	Grad. Degree
Per capita foreclosure	−10.2725***	5.9819***	5.4094	5.7910*	5.7791	−6.3009***	−5.2691***	−3.4613*	−11.2405***	2.6315	6.3601**	5.6924***
	(3.2201)	(2.1734)	(3.9524)	(3.2135)	(5.0040)	(2.3748)	(1.8848)	(1.9011)	(2.4865)	(2.2724)	(2.7381)	(1.8798)
Constant	0.2442**	1.1992***	6.0603***	−2.3154***	−3.1469***	4.5199***	0.9425***	−4.9994***	0.7179***	−0.6010***	3.3909***	1.4922***
	(0.1179)	(0.0668)	(0.1035)	(0.0642)	(0.0878)	(0.0581)	(0.0703)	(0.1214)	(0.1373)	(0.1243)	(0.1152)	(0.0861)
Observations	3,094	3,094	3,094	3,094	3,094	3,094	3,094	3,106	3,106	3,106	3,106	3,106
R-squared	0.0076	0.0082	0.0028	0.0097	0.0056	0.0132	0.0057	0.0008	0.0066	0.0005	0.0033	0.0041

The table shows coefficients from a regression of changes in the demographic characteristic in the column head, and the change in foreclosure rates between 2005 and 2009. Robust standard errors in parentheses. The estimates indicate that an increase of one foreclosure per capita was associated with a 10.3 percentage point decline in the fraction of white residents and an increase of 6 percentage points in the fraction of black residents.