Forced Sales and House Prices

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Abstract

This paper uses data on house transactions in the state of Massachusetts over the last 20 years to show that houses sold after foreclosure, or close in time to the death or bankruptcy of at least one seller, are sold at lower prices than other houses. The discount for these forced sales, particularly foreclosures, is substantial and time-varying. After aggregating to the zipcode level and controlling for regional trends in house prices, the prices of forced sales are mean-reverting, while the prices of unforced sales are close to a random walk. At the zipcode level, this suggests that unforced sales take place at approximately efficient prices, while forced-sales prices reflect time-varying illiquidity in neighborhood housing markets. At a more local level, however, we find that foreclosures that take place within a quarter of a mile of a house lower the price at which it is sold.

1 Introduction

How does an urgent desire to sell a house affect the price that the owner can get for it? And how does the price of such an urgent, or "forced", sale relate to the prices at which other similar houses are subsequently sold?

If an asset is traded in a liquid market, it can be sold rapidly with a minimal impact on its own price or those of close substitutes. The market for residential real estate, however, is a classic example of an illiquid market. Houses are expensive indivisible assets, so households normally own only one or perhaps two. Intermediation is costly, both because there are significant direct costs associated with transferring ownership of a house, and because an intermediary must either hold a house without using it, thereby losing the flow of housing services it provides, or rent it out for a short period of time which incurs further transactions costs. Because of these costs of intermediation, houses are normally traded directly between end users without passing into the hands of dealers or marketmakers. Each house has certain unique characteristics which are likely to appeal to certain potential buyers and not to others. Under these circumstances, one would expect that the desire to sell a house rapidly would lower the price that it fetches.[2]

There is evidence that certain seller characteristics influence selling price and time on the market in opposite directions, as would be expected if an urgent desire to sell lowers the price that a house fetches. Genesove and Mayer (1997) show that homeowners with larger mortgages relative to their home values set higher asking prices, realize higher prices if they sell, but keep their homes on the market longer than homeowners with smaller mortgages. More precisely, they find that a house with a loan-to-value ratio of 100% sells for 4% more but stays on the market 15% longer than a house with a loan-to-value ratio of 80%. Levitt and Syverson (2008) show that realtors selling their own houses get higher prices and keep their homes on the market longer than their clients do. The price differential is about 4%, and the time on the market differential is about 10%, numbers which are roughly comparable to those reported by Genesove and Mayer.

We add to this evidence by studying several categories of sales which plausibly

[2] A related literature in corporate finance argues that assets with limited alternative uses appeal to relatively few buyers and are correspondingly less valuable when they must be urgently sold. This affects the debt contracts that can be used to finance such assets (Shleifer and Vishny 1992). Benmelech, Garmaise, and Moskowitz (2005) apply this insight to commercial real estate.

are more urgent than normal. We first link data on house transactions in the state of Massachusetts, over the period 1987 to March 2008, to information on deaths and bankruptcies of individuals. By matching names and addresses across datasets, we are able to identify transactions as forced sales if they occur close in time to the death or bankruptcy of at least one seller. We use hedonic regressions with neighborhood fixed effects, standard in the real estate literature, to control for heterogeneity in the characteristics of houses. Consistent with the results of Genesove and Mayer (1997) and Levitt and Syverson (2008), we find that forced sales take place at price discounts of about 3-7%.

One concern about this finding is that it might reflect unobserved effects of death or bankruptcy on the quality of a house, in particular deferred maintenance by homeowners with health or financial problems. In order to explore this issue, we examine how discounts vary with the timing of sales in relation to the seller's death or bankruptcy, we separate the deaths of younger and older sellers, and we distinguish between houses that have only one seller and those that have two sellers. We find that death-related discounts peak somewhat before the seller's death, whereas bankruptcy-related discounts peak immediately after bankruptcy. Death-related discounts are larger when the seller is over 70, which suggests that older sellers may have less well maintained houses. All these effects are magnified when a house has only one seller rather than two.

Foreclosures are another important category of forced sales, and we find that these have much larger price discounts of about 32%. The incidence of foreclosure sales is highly variable over time and space, but in some areas at some times foreclosures account for a large fraction of total sales. This allows us to study the relations between forced sales prices and the subsequent transactions prices of other houses in the same neighborhood.

We contrast two extreme views of the relation between forced and unforced sales prices for houses. The first view is that unforced transactions take place at efficient prices, which evolve following a random walk, while forced sales take place at lower prices. If the housing market were a dealer market with a bid-ask spread, we could think of unforced transactions as revealing the efficient price at the midpoint of the spread, while forced transactions reveal the lower bid price. If the bid-ask spread is variable over time, then large discounts of forced from unforced sales prices should predict increases in forced sales prices, but should have no implications for future prices of unforced transactions. That is, bid-ask bounce (Roll 1984) affects the prices of forced sales but not those of unforced sales.

The opposite extreme view is that forced sales convey information about the future prices of unforced transactions. There are several reasons why this might be the case. First, forced sales may perform the function of price discovery, revealing the prices at which buyers are willing to enter the market. Particularly in down markets, homeowners without urgent motives to sell may set unrealistically high prices, perhaps because their expectations lag the market or because they use their purchase price as a reference price (Genesove and Mayer 2001). In this situation, unforced transactions may take place only when particularly enthusiastic buyers appear. If the housing market had a bid-ask spread, we could think of forced transactions as revealing the efficient price at the midpoint of the spread, while unforced transactions reveal the higher ask price. If the bid-ask spread varies over time, a large discount of forced from unforced prices would predict declines in unforced sales prices.

There could also be causal effects of forced sales on the general level of house prices. Forced sales could absorb demand, reducing the prices of those houses that come to market later. Forced sales could affect the reference prices that buyers and sellers use as "comparables" when they negotiate prices. In the case of foreclosures, there is widespread concern that there may be direct negative effects of foreclosures on neighborhoods. Foreclosures typically involve periods during which houses stand empty, reducing the visual appeal and social cohesion of the neighborhood and encouraging crime (Immergluck and Smith 2005, 2006).

Despite the plausibility of these concerns, we find that at the zipcode level, the prices of forced sales have relatively little predictive power for the prices of other transactions in the housing market. The discount between urgent sales prices and other sales prices is stationary, so when it widens, it normally narrows again. But this primarily occurs through an increase in the prices of forced sales, not through a decrease in the prices at which other transactions occur.

In order to detect spillover effects from forced sales to unforced sales, we look at foreclosures that take place within a quarter of a mile of each transaction in our dataset. At this highly local level, we do see some evidence that foreclosures lower house prices, and the effect is economically significant during foreclosure waves.

The organization of the paper is as follows. Section 2 describes our data and the procedures we have used to clean it. Section 3 presents our hedonic regression methodology and uses it to estimate the discounts of forced sales from unforced sales.

Section 4 studies the ability of forced and unforced sales prices to predict future changes in house prices within the same zip codes, and more local spillover effects from foreclosures to house prices in the immediate neighborhood. Section 5 concludes.

2 House Price and Forced Sale Data

2.1 House prices

We begin with a dataset on changes in ownership of residential real estate, provided to us by the Warren Group. The data cover the period 1987 to March 2008, and are the entire state of Massachusetts. Figure 1, which shows the number of transactions by zip code, illustrates the geographical coverage of the data.

The Warren Group data record basic characteristics of the houses involved in each transaction, as well as the sales price and the names of buyers and sellers. We have carefully cleaned the data to remove transactions that appear to be intra-family transfers of ownership rather than arms-length transactions, and duplicate transactions that reflect intermediation or corrections of public records. The online appendix to this paper (Campbell, Giglio, and Pathak 2008) describes our data cleaning procedures in detail.

We remove outliers from the Warren Group data in several steps. We exclude transactions in properties that cannot be classified as either single family, multifamily, or condominiums, and transactions that take place at extreme prices, below the 1st or above the 99th percentile of the distribution of raw prices. Where the dataset reports impossible property characteristics (for example, zero rooms), we treat these characteristics as missing. Finally, we winsorize reported square footage at the 1st and 99th percentiles and reported numbers of rooms at the 99th percentile.

The top panel of Table 1 reports summary statistics for the resulting dataset of 1,783,360 transactions. The median house, across all houses in all years, has 1,535 square feet of living area on a 9,452 square foot lot; it is 38 years old with 6 rooms, 3 bedrooms, and 2.0 bathrooms, and sells for a nominal price of $175,800. The means of these characteristics are slightly higher than the medians, indicating right skewness of the distribution, for all these characteristics except age.

In the bottom panel of Table 1 we match addresses to census tracts, and associate each house with the characteristics of its tract, as measured in the 2000 census. Then we report the distribution of these neighborhood characteristics across the transactions in our database. The median house is in a census tract with a median income of more than $55,000, with a population that is 2% Hispanic, 1% African-American, 24% under age 18, 13% over age 65, 4% in female-headed households, 20% with a college degree, 11% with a graduate degree, and 10% with no high school degree. However, these characteristics vary widely across neighborhoods.

2.2 Forced sales

In order to identify forced sales, we obtain data on deaths and bankruptcy filings from the Death Master File of the Social Security Administration and Lexis/Nexis, respectively. These data give us names, addresses, and dates which can be matched to the names and addresses of house sellers in the Warren Group data. Many houses have two joint sellers, and we classify the sale as forced if we can match the name of at least one of these sellers to a death or bankruptcy filing within three years of the house sale. Although our bankruptcy data include some corporate bankruptcy filings, only personal bankruptcies end up matched to house sales.

The algorithm we use for name matching is described in detail in the online appendix. We match based on last name, first name, and zip code. We then use sensible priority rules, based on match quality, middle initials, and event dates, to eliminate multiple matches.

We also identify forced sales related to foreclosures. The Warren Group data report transfers of ownership that take place through foreclosure. In most cases, the first transfer of ownership is to the mortgage lender, who subsequently sells the house on the open market. In a minority of cases, however, a foreclosure auction results in the purchase of the house by a third party at a price that pays off the mortgage. In the first, more common case, we treat the subsequent sale of the property by the mortgage lender as an urgent or forced sale; in the second case, we treat the foreclosure transaction itself as a forced sale. We distinguish the two cases by looking at the identity of the acquirer and the financing of the foreclosure transaction. In the 18% of cases where the acquirer is an individual or a realty trust, or takes out a mortgage to finance the purchase, we assign the case to the second category; we assign the remaining 82% of cases to the first category.

In cases where a sale is both foreclosure-related and linked to a death or bankruptcy, we retain the foreclosure classification. If a sale is linked to both a death and a bankruptcy, we use priority rules, based on match quality and event dates, to classify it as either death-related or bankruptcy-related.

The top panel of Table 2 reports the frequency of each type of forced sale for each year in our data set. The first column of the table shows the total number of housing transactions in the Warren Group data in each year. We have just over 22 years of data and a total of 1,783,360 transactions, for an average of just over 81,000 transactions per year. Of these, 5.6% are forced transactions: 3.1% related to foreclosures, 1.7% related to deaths, and 0.8% related to bankruptcies. The fraction of forced sales is highly variable over time, in part because of an increase in death-related sales during the housing boom of the early 2000's and an upward shift in the incidence of bankruptcy in the late 1990s, but primarily because of two waves of foreclosures during the housing downturns of the early 1990s and the last two years. The incidence of foreclosure-related forced sales was negligible in 1987, rose to 9.7% in 1993, then receded to under 1% in the mid-2000's before rising again to reach a record level of 12.7% in the first quarter of 2008.

The bottom panel of Table 2 categorizes forced sales according to the date of the death, bankruptcy, or foreclosure in relation to the house sale. In the case of death, we find that house sales within one year of the death of a seller are more common than house sales two or three years before or after the death of a seller; however sales are almost equally common the year before a seller's death and the year after. In the case of bankruptcy, we find that house sales are relatively rare during the three years before a bankruptcy filing, but the sales incidence spikes up the year after the filing and then gradually declines. Foreclosure-related sales cannot occur before the underlying foreclosure, and tend to take place rapidly thereafter. Of the 3.1% of foreclosure-related sales in our dataset, 2.6% occur within one year, 0.3% in the second year, 0.1% in the third year, and the remainder with a longer lag.

Table 3 shows how our transactions are divided among single family houses, multifamily houses, and condominiums, and what fraction of them take place in the city of Boston as opposed to the rest of the state. We find that in the complete dataset, 64% of transactions are in single family houses, 11% in multifamily houses, and 25% in condominiums. Among forced sales, however, multifamily houses are more common (20%) and condominiums are less common (18%). The paper reports an analysis of the entire dataset, but we have verified that the results are qualitatively similar when we separately analyze single family houses, multifamily houses, and condominiums.

The city of Boston accounts for 8% of all sales and 10% of forced sales. Boston's modestly greater share of forced sales is entirely caused by a higher incidence of foreclosures in Boston (13% of foreclosures are in the city). Death- and bankruptcy-related sales are actually less common in Boston than elsewhere. Figure 2 gives a richer picture of the geographic distribution of forced sales, plotting by zip code the share of forced sales in total sales. The paper reports an analysis of the entire dataset, but we have verified that the results are qualitatively similar when we run separate analyses for eastern and western Massachusetts.

Table 4 summarizes the distribution of house characteristics for forced sales. The top panel of the table has exactly the same format as Table 1, and the bottom panel reports the ratio of each number in the top panel to the corresponding number in Table 1. The median forced sale takes place at a price of $116,100, only 58% of the median sales price reported in Table 1. This is true despite the fact that the median forced sale is of a somewhat larger house on a larger lot than the median sale.

At first sight, the lower median price for forced sales suggests that these transactions take place at a large price discount. However, one cannot reach this conclusion on the basis of Table 4 alone. The incidence of forced sales was much greater in the early 1990's, when the overall level of prices was depressed; and forced sales are more likely to take place in low-income minority neighborhoods, where prices are likely to be lower for any given size of house. The next step in our analysis is to control for these effects by using a hedonic regression.

3 Measuring the Forced Sale Discount

3.1 Static hedonic regression

Hedonic regression is a standard approach for estimating the relationship between the prices of houses and their characteristics. Tables 5 and 6 report the results of regressing the log of each transactions price onto control variables for the overall level of local prices, the effects of measured house characteristics, and dummies indicating forced sales. We include a separate dummy for each zipcode-year, thus controlling for all house price variation over time at the zipcode level. We also include a rich set of house characteristics including interior area, lot area, numbers of rooms, bedrooms, and bathrooms, the age of the house and its square, categorical variables for the type of heating, style of house, recent renovation, a dummy for condominiums, and dummies for winsorization of these characteristics. To control for neighborhood characteristics within zipcodes, we include data on the census tracts where each house is located, including median income and the population shares of Hispanics, African-Americans, minors, seniors, female-headed households, and groups with different levels of education. The coefficients on these control variables, reported in Table 5, have the expected signs and plausible magnitudes. The entire list of controls is presented in the Appendix.

Table 6 reports the coefficients on our forced sale dummies. When we include a single dummy for all categories of forced sales, we find a large and precisely estimated coefficient of -0.199, corresponding to a price discount of $1 - \exp(-0.199) = 18.0\%$. This effect is primarily driven by foreclosure-related sales. When we include separate dummies for young and old death-related, bankruptcy-related, and foreclosure-related sales, we find coefficients of -0.051, -0.068, -0.032, and -0.323, respectively. The coefficient for foreclosure implies a large price discount of 27.6%.

Table 6 also shows how these effects vary with the timing of the underlying event that causes a forced sale. We consider two groups of death-related sales. The young seller group includes cases in which the seller dies when he or she is less than 70 years old, while the old seller group includes deaths of sellers aged over 70. In both cases of a death-related sale, the effect seems to be fairly insensitive to the timing of the death, from 3 years before to 2 years after the sale. In fact, when we include dummies for deaths more than three years before or after the sale (which would not be classified as forced sales), we find that these also enter the regression significantly. This raises the suspicion that the estimated price effect may not be directly related to the urgency of the sale, but may result from some omitted factor correlated with the death of a seller, such as the seller's age. If older people fail to maintain their houses, for example, the dummies for death-related sales may be picking up unmeasured variation in housing quality. The fact that the discounts are slightly larger for deaths of older sellers, even though these deaths may be better anticipated, suggests that this is a relevant alternative hypothesis.

The timing pattern for bankruptcy-related sales is more suggestive of a true forced-sale effect. The largest coefficient is for a sale that occurs within one year after a bankruptcy filing, and this coefficient, at -0.053, is more than twice as large as those estimated for sales that occur before bankruptcy.

In the case of foreclosures, the timing pattern is U-shaped. The coefficient is -0.315 for foreclosure-related sales within one year of foreclosure, -0.452 for sales 1 to 2 years after foreclosure, and -0.472 for sales 2 to 3 years after foreclosure. In the case of sales more than 3 years after foreclosure, the coefficient is -0.216. Since most foreclosure-related sales occur close to the date of foreclosure, the deeper price discounts for the relatively small number of sales that occur with a delay of a year or more may reflect difficult market conditions that reduce the ability of a lender to dispose of a foreclosed property in a timely manner.

In Table 7 we look separately at houses with a single seller and with two sellers. We find a much larger discount for death-related sales when the house has a single seller than when it has two sellers. In the former case the discount coefficients are -0.082 and -0.095 for young and old sellers respectively, while in the latter case they are -0.035 and -0.053. The price discount is largest when a house is sold by a single seller one or two years before his death, suggesting that ill health may provoke urgent sales. We also find a considerably larger discount for bankruptcy-related sales when there is only one seller.

3.2 Persistence of the forced sale discount

In this section we have estimated significant effects of forced sales on house prices. An interesting question is to what extent these effects persist. If the same house is sold again after a forced sale, does it continue to have a lower price or does its price return to the level predicted by the hedonic regression? In Table 8 we re-estimate our hedonic regressions including information on the price at which each house was previously sold. We first identify the date of the most recent previous sale of each house in our transactions dataset, the price of that previous sale, and whether the previous sale was forced. We create dummy variables for previous sales that took place within the year before the current sale, one to three years before the current sale, three to five years before the current sale, and five years or more before the current sale. Then we interact the previous sales price, and dummies indicating whether the previous sale was forced, with these dummies for the timing of the previous sale.

Table 8 shows that previous sales prices do have a persistent effect, which seems almost invariant to the length of time since the last sale. The coefficient on the previous sales price of about 0.15 implies that a 10% lower price at the time of the last sale, unexplained by the other variables in the hedonic regression, is associated with a 1.4% lower price at the time of the current sale. This persistent price effect, which is exploited by repeat-sales house price indexes (Case and Shiller 1987, 1989), could reflect unmeasured quality differentials across houses or the use of previous prices as reference prices in bargaining by sellers and buyers.

Controlling for the general persistence of house prices, we do not find that death-related or bankruptcy-related sales have any unusual dynamic effects. The fact that the previous sale was death- or bankruptcy-related appears to be irrelevant for the price of the current sale. Thus, if lack of maintenance is partly responsible for the measured death-related price discount, it appears to be rectified by the next owner of the property.

We do, however, find a significant positive effect of a previous foreclosure-related sale on the current price of a house. This may reflect a tendency for buyers of foreclosed properties to invest in them, upgrading their quality in ways that we do not directly measure; alternatively, it may reflect mean reversion in house prices in neighborhoods with large numbers of foreclosures, relative to other neighborhoods within the same zipcode.

4 Forced Sales and Neighborhood House Prices

4.1 Zipcode-level price dynamics

In this section we ask how the incidence and prices of forced sales relate to the prices of unforced sales. We begin by aggregating house prices to the zipcode-year level and examining the dynamics of zipcode-level house prices. In each zipcode in each year, we weight each transaction equally and calculate the average price of forced sales, the average price of unforced sales, and the share of forced sales. Table 9 reports summary statistics for this dataset. Once again we see that forced sales take place at lower prices. The distribution of the forced-sales share is extremely right-skewed, with a median of only 4% but a 99th percentile of 34%. We winsorize the fraction of forced sales at this level.

Table 10 presents regressions that describe the dynamics of house prices at the zipcode level. To eliminate zipcode fixed effects, we difference the levels of log prices to obtain house price growth rates in each zipcode. We also cross-sectionally demean the data to control for the general evolution of house prices in Massachusetts.

Our first regression does not distinguish between forced and unforced sales prices. When price growth is regressed on lagged price growth, we obtain a negative coefficient of about -0.44, indicating that zipcode-level price variation is mean-reverting. This result contrasts with the price momentum, or positive serial correlation of price changes, observed in citywide, statewide, or national house price indexes (Case and Shiller, 1989). However, the explanatory power of this regression is modest, about 20%.

Next we separate log forced and unforced sales prices, and estimate an error-correction model for the two of them. More specifically, we estimate a first-order vector autoregression (VAR) for the change in log forced sales prices and the level of the forced sales discount, that is, the difference between log unforced and forced sales prices. This procedure is appropriate if the forced sales discount is stationary, so that log forced and unforced sales prices are cointegrated (Campbell and Shiller 1987, Engle and Granger 1987). The estimated VAR implies time-series behavior for the omitted variable, in this case the log unforced sales price.[3]

We find a strong tendency for reversal in forced sales price growth. Lagged forced price changes predict forced price changes with a coefficient of -0.08. In addition, a large discount of forced sales prices from unforced prices predicts that forced sales prices will increase. These two effects together explain about 46% of the variation in forced sales price growth. The forced sales discount is mean-reverting, with a coefficient of 0.07 on its own lag. The discount also has a coefficient of 0.05 on lagged forced sales price growth, implying that the discount is more likely to narrow if it reached its previous level through a recent decline in forced sales prices; this is another manifestation of reversal in forced sales price growth. The equations for these two variables imply only very modest predictability for unforced sales prices, with negative coefficients of -0.03 on lagged forced sales prices and -0.09 on the lagged discount, and an R^2 statistic of 9%.

These VAR results imply that both forced and unforced sales prices move in such

[3]If enough lags are included in the system, the implied dynamics are the same whether one omits the unforced or the forced sales price. We obtain broadly consistent results if we estimate a VAR for the change in log unforced sales prices and the level of the forced sales discount, including either one or two lags.

a way as to narrow unusually large forced sales discounts. However, the explanatory power of the regression is much greater for forced sales prices, at 46%, than for unforced sales prices, at 9%. Zipcode averages of unforced sales prices appear to be much closer to a random walk than are zipcode averages of forced sales prices. This result supports the view that on average within each zipcode, unforced sales take place at approximately efficient prices, while forced sale prices are mean-reverting because they reflect time-varying illiquidity in zipcode-level housing markets.

The variation over time in the incidence of forced sales allows us to ask whether zipcode-level house price dynamics are affected by this incidence. In the first panel of Table 11, we add the share of forced sales as a variable in the VAR system. We find that the forced sales share is highly persistent, with a coefficient of 0.52 on its own lag, and that it depresses forced sales price growth (with a coefficient of -0.63) and widens the forced sales discount (with a coefficient of 0.61). Once again, this VAR implies very little predictability in the growth rate of unforced sales prices.

Finally, we consider the possibility that a high share of forced sales affects the dynamics of forced sales prices not only by directly predicting price changes, but by altering the coefficients on the other variables of the VAR system. In the second panel of Table 11, we regress the forced sales share, the change in the log forced sales price, and the forced sales discount on their own lags and the interaction of the lagged forced sales share with the other two explanatory variables. We find that a high forced sales share reduces the tendency for forced sales price growth to reverse, and reduces the response of forced sales price growth to the forced sales discount. Consistent with this, a high forced sales share increases the persistence of the forced sales discount. The autoregressive coefficient for the forced sales discount increases from 0.07, in an environment with an average 5% share of forced sales, to 0.37, in an environment with a share of forced sales at the 34% winsorization point. In other words, a location with a high share of forced sales is likely to have persistently depressed forced sales prices and high forced sales discounts.

In all these specifications, we continue to find that unforced sales price growth is hard to predict. The R^2 statistic for unforced sales price growth is never more than 14% in models with single lags, and even if we add one more lag of each variable the R^2 statistic never exceeds 20%. The limited predictability of zipcode-level house price movements, when sales are unforced, is a robust result across all the models we estimate.

4.2 Local effects of foreclosures

Even though forced sales do not seem to drive large predictable movements in average unforced sales prices within the same zipcode, it is possible that there are more local effects of forced sales on neighboring houses that do not show up in data aggregated to the zipcode level. A particular concern is that houses vacated during the foreclosure process drive down neighborhood house prices. In this section we use data on the precise location of each house transaction in our dataset to try to identify such effects. Our main approach is to add variables to our hedonic regression that measure the number of foreclosures, defined as cases in which ownership of neighboring houses has been transferred to mortgage lenders, causing them to enter an urgent sales process. We find considerable evidence that foreclosures within 0.25 mile, and particularly within 0.1 mile, lower the price at which a house can be sold.

A challenge in interpreting this result is that local economic shocks, such as plant closings, may drive both house prices and foreclosures. Furthermore, foreclosures are endogenous to house prices because homeowners are more likely to default if they have negative equity, which is more likely as house prices fall. Ideally, we would like an instrument that influences foreclosures but that does not influence house prices except through foreclosures; however, we have not been able to find such an instrument. Instead, we compare the effects of foreclosures before and after each transaction, and the effects of extremely close foreclosures (under 0.1 mile from the target house) with those that occur further away within the 0.25 mile radius.

Leigh and Rockoff (2008) use such a comparison to identify the effect of sex offenders on house prices. They perform a difference-in-difference analysis, comparing house prices before and after a sex offender moves into a neighborhood, and house prices closer to the sex offender's address with those further away. The difference between house price growth in the sex offender's immediate neighborhood and house price growth in the sex offender's broader neighborhood is an estimate of the effect of the sex offender's arrival on house prices. We have imitated Leigh and Rockoff's methodology, treating foreclosures as negative events analogous to sex offender arrivals, and averaging the residuals from hedonic house-price regressions during the year before and after each foreclosure, and within an inner circle of radius 0.1 mile and an outer ring obtained by removing the inner circle from an outer circle of radius 0.25 mile. When we do this, we obtain a difference-in-difference estimate that a foreclosure lowers the price of neighboring houses by about 1%.

A limitation of the difference-in-difference approach is that it does not readily handle the fact that foreclosures are clustered, so many houses are close neighbors of multiple foreclosures. (This is a much less serious problem in the case of sex offenders.) In the presence of clustering, the difference-in-difference estimate will misstate the effect of each foreclosure, since low house prices caused by multiple foreclosures are attributed to each one independently; clustering also complicates the calculation of standard errors. For this reason, we return to our hedonic regression, in which the sales price of a house is the dependent variable, and include measures of nearby foreclosures as explanatory variables.

Table 12 reports the results. All the previous hedonic variables are included in the regressions of this table, but with the exception of the dummies for foreclosure-related sales, they are not reported. In the first column, we add the number of foreclosures that have occurred within 0.25 mile of each house during the year before its date of sale. Because the distribution of foreclosures is extremely right-skewed, we winsorize it at the 99th percentile (10 foreclosures) so that a few outliers do not dominate the results. We are, however, particularly interested in the effects of foreclosure waves on house prices, so we include dummy variables for cases where the number of foreclosures within 0.25 mile lies between the 99th and 99.5th percentile (10-15 foreclosures), between the 99.5th and 99.9th percentile (15-28 foreclosures), and above the 99.9th percentile up to the sample maximum (28-73 foreclosures).

We also include an indicator of extremely close foreclosures, a weighted sum of foreclosures within 0.1 mile of the target house, where the weight is 0.1 less the distance to the foreclosure in miles, divided by 0.1. This indicator gives a weight of 1 to a foreclosure at the same location (which can occur in a condo complex), a weight of 0.5 to a foreclosure 0.05 miles away, and a weight of zero to a foreclosure 0.1 miles away. It is also winsorized at the 99th percentile (1.49), and we include dummies for extreme cases (1.49-2.42, 2.42-7.83, and 7.83-50.95). We include this variable because it is plausible that spillover effects of foreclosures on crime and the social cohesion of neighborhoods are extremely local, more so than common economic shocks that might drive both foreclosures and house prices.

In the second column, we control for average prices of unforced sales within the 0.25 mile radius during the previous year. We calculate a weighted average of log prices (a geometric average price), using a linear weighting scheme that gives a weight of 0.25 less the distance to the house in miles, divided by 0.25. By contrast with the local foreclosure indicator, this is a weighted average, not a weighted sum, so it divides by the sum of the weights. We set the variable to zero in cases where no unforced transaction has occurred within 0.25 miles during the previous year, and include a dummy for these cases.

The third and fourth columns repeat the first two columns, adding foreclosure variables and average neighborhood house prices during the year after each transaction. If unobserved local shocks drive both prices and foreclosures, or if foreclosures react to prices with a lag, we would expect that future foreclosures would have at least as much explanatory power for house prices as lagged foreclosures.

The results of Table 12 imply that recent neighborhood foreclosures are highly relevant for predicting the price at which a house will sell. The basic effect of each foreclosure within a 0.25 mile radius of a given house is to lower its log price by 1.8% in column 1, or 1.1% in column 2 when we control for the average level of recent unforced sales prices in the neighborhood. Foreclosures within a 0.1 mile radius have an even stronger effect, lowering the log price of a house by 9.3% if the foreclosure is at zero distance, or 7.5% when we control for recent unforced sales prices. For both variables, but particularly the local foreclosure indicator, we find extremely powerful effects in the right tail of the distribution. A house in the top 0.1% of the distribution for both variables has an implied price discount of almost 50% in column 1, or 40% in column 2.

In columns 3 and 4, we add foreclosures that take place in the year after a house is sold. The linear variables enter the regression with negative signs, but with smaller coefficients than on the corresponding lagged variables. The tail dummies enter the regression with signs that are almost always positive. Including future foreclosures reduces the coefficients on lagged foreclosures only modestly.

In Table 13 we ask whether neighborhood foreclosures affect the discount at which foreclosure-related sales take place. The overall discount estimates are fairly stable with respect to the specifications we explore in Table 12, but these specifications do not allow the foreclosure discount to vary with neighborhood conditions. The four columns of Table 13 report interactions of our four foreclosure dummies with the neighborhood foreclosure variables and tail dummies from Table 12. The first column of Table 13 is the most important, as the great majority of foreclosure-related sales take place within a year of the transfer of ownership to the mortgage lender.

Table 13 shows that foreclosures within 0.25 mile of a house tend to increase the discount at which a foreclosed house is sold relative to comparable unforced sales, but foreclosures within 0.1 mile tend to reduce that discount. This finding is consistent with the view that highly local foreclosures reduce the prices of all houses, whether or not they are being urgently sold, and thus reduce the price gap between foreclosure-related sales and other sales.

The results of this section cannot prove causality from foreclosures to house prices, but the combination of timing effects (stronger from lagged foreclosures than from future foreclosures) and geographical effects (stronger at extremely short distances) suggests that there is reason to be concerned about spillovers from foreclosures to neighboring houses despite the reassuring zipcode-level results reported in the previous section.

5 Conclusion

This paper uses data on almost 1.8 million house transactions in Massachusetts to show that houses sold after foreclosure, or close in time to the death or bankruptcy of at least one seller, are sold at lower prices than other houses. After aggregating to the zipcode-year level and controlling for movements in the overall level of Massachusetts house prices, we find that the prices of unforced transactions are close to a random walk, while forced sales take place at a substantial and time-varying discount. This discount is larger and more persistent when the share of forced sales is higher.

These results suggest that most unforced transactions in residential real estate take place at efficient prices, at least relative to the general level of house prices in Massachusetts. Forced sales take place at lower prices, which one might think of as revealing a "bid price" for houses as in the finance literature on the bid-ask spread in dealer markets (e.g. Roll 1984). When many homeowners are selling urgently, the implied bid-ask spread widens for housing.

We also look for evidence that forced sales have spillover effects on the prices of local unforced sales. This question is of particular interest given the increase in the foreclosure rate in the current housing downturn (Willen, Gerardi, and Shapiro 2007, Calomiris, Longhofer, and Miles 2008).

We find that foreclosures predict lower prices for houses located within a quarter of a mile, and particularly within a tenth of a mile. Although foreclosures and prices are both endogenous variables, the fact that foreclosures lead prices at such short distances does reinforce the concern that foreclosures have negative external effects in the housing market.

References

Benmelech, Efraim, Mark J. Garmaise, and Tobias J. Moskowitz, 2005, "Do Liquidation Values Affect Financial Contracts? Evidence from Commercial Loan Contracts and Zoning Regulation," *Quarterly Journal of Economics* 120, 1121–1154.

Calomiris, Charles W., Stanley D. Longhofer, and William Miles, 2008, "The Foreclosure-House Price Nexus: Lessons from the 2007–2008 Housing Turmoil", NBER Working Paper No. 14294.

Campbell, John Y., Stefano Giglio, and Parag Pathak, 2008, "Appendix", available online at http://kuznets.fas.harvard.edu/~campbell/papers.html.

Campbell, John Y. and Robert J. Shiller, 1987, "Cointegration and Tests of Present Value Models", *Journal of Political Economy* 95, 1062–1088.

Case, Bradford and John M. Quigley, 1991, "The Dynamics of Real Estate Prices", *Review of Economics and Statistics* 73, 50–58.

Case, Karl E. and Robert J. Shiller, 1987, "Prices of Single-Family Homes Since 1970: New Indexes for Four Cities", *New England Economic Review*, September/October, 45–56.

Case, Karl E. and Robert J. Shiller, 1989, "The Efficiency of the Market for Single-Family Homes", *American Economic Review* 79, 125–137.

Engle, Robert F. and Granger, Clive W. J., 1987, "Cointegration and Error-Correction: Representation, Estimation, and Testing", *Econometrica* 55, 251–276.

Genesove, David and Christopher J. Mayer, 1997, "Equity and Time to Sale in the Real Estate Market", *American Economic Review* 87, 255–269.

Genesove, David and Christopher J. Mayer, 2001, "Loss Aversion and Seller Behavior: Evidence from the Housing Market", *Quarterly Journal of Economics* 116, 1233–1260.

Gerardi, Kristopher, Adam Shapiro, and Paul Willen, 2007, "Subprime Outcomes: Risky Mortgages, Homeownership Experiences, and Foreclosures", unpublished paper, Federal Reserve Bank of Boston.

Immergluck, Dan and Geoff Smith, 2005, "There Goes the Neighborhood: The Effect of Single-Family Mortgage Foreclosures on Property Values", unpublished paper, Woodstock Institute, Chicago, IL.

Immergluck, Dan and Geoff Smith, 2006, "The Impact of Single-Family Mortgage Foreclosures on Neighborhood Crime", *Housing Studies* 21, 851–866.

Levitt, Steven D. and Chad Syverson, 2008, "Market Distortions When Agents Are Better Informed: The Value of Information in Real Estate", *Review of Economics and Statistics* 90, 599–611.

Linden, Leigh and Jonah E. Rockoff, 2008, "Estimates of the Impact of Crime Risk on Property Values from Megan's Laws", *American Economic Review* 98, 1103–1127.

Meese, Richard A. and Nancy E. Wallace, 1997, "The Construction of Residential Housing Price Indices: A Comparison of Repeat-Sales, Hedonic-Regression, and Hybrid Approaches", *Journal of Real Estate Finance and Economics* 14, 51–73.

Roll, Richard, 1984, "A Simple Implicit Measure of the Effective Bid-Ask Spread in an Efficient Market", *Journal of Finance* 39, 1127–1139.

Shleifer, Andrei and Robert W. Vishny, 1992, "Liquidation Values and Debt Capacity: A Market Equilibrium Approach", *Journal of Finance* 47, 143–166.

Springer, Thomas M., 1996, "Single-Family Housing Transactions: Seller Motivations, Price, and Marketing Time", *Journal of Real Estate Finance and Economics* 13, 237–254.

Table 1 - Descriptive statistics

	Min	Max	Mean	Stdev	1%	25%	50%	75%	99%
Price ($1000)	6.80	1,820.00	225.40	169.18	23.50	117.00	175.80	289.90	860.00
Total rooms	2	16	7	3	3	5	6	8	16
Full bathrooms	0.0	4.0	1.6	0.7	1.0	1.0	2.0	2.0	4.0
Half bathrooms	0.0	2.0	0.4	0.5	0.0	0.0	0.0	1.0	2.0
Bedrooms	1.0	9.0	3.1	1.3	1.0	2.0	3.0	4.00	8.00
Lotsize	0	261,360	20,781	36,493	0	2,875	9,452	22,005	229,997
Interior Square Ft	509	4,627	1,725	823	509	1,122	1,535	2,145	4,404
House age	0	356	48	42	0	14	38	78	184
Median Income	2,499	200,001	58,945	23,376	16,861	43,385	55,521	70,250	131,823
% Hispanic	0.00	1.00	0.05	0.09	0.00	0.01	0.02	0.04	0.50
% Black	0.00	0.95	0.04	0.10	0.00	0.00	0.01	0.03	0.59
% 0-17 yo	0.00	0.49	0.23	0.07	0.04	0.20	0.24	0.28	0.37
% 65+ yo	0.00	0.71	0.14	0.07	0.03	0.09	0.13	0.17	0.39
% Female-headed HH	0.00	0.48	0.06	0.05	0.01	0.03	0.04	0.07	0.26
% with Bachelor’s degree	0.00	0.73	0.21	0.10	0.02	0.13	0.20	0.28	0.45
% with graduate degree	0.00	0.72	0.15	0.12	0.00	0.06	0.11	0.20	0.52
% with less than high school degree	0.00	1.00	0.13	0.11	0.00	0.06	0.10	0.17	0.50

Notes: dataset is an extract of the residential real estate changes of ownership file from the Warren Group for Greater Boston. The details for creating the extract are contained in the data appendix. The upper panel of the table reports values per sale, while the lower panel reports 2000 census data at the tract level for each sale.
Last updated 10/29/08

Table 2 - Frequency of forced sales

Panel A

	Total Obs	Deaths	Bankruptcies	Foreclosures	Total Forced
1987	89,596	1.0%	0.0%	0.0%	1.0%
1988	79,684	0.9%	0.0%	0.1%	0.9%
1989	66,762	0.9%	0.0%	0.3%	1.2%
1990	54,635	0.9%	0.0%	1.2%	2.1%
1991	57,571	1.1%	0.1%	5.3%	6.4%
1992	68,878	1.2%	0.2%	8.3%	9.8%
1993	74,756	1.6%	0.3%	9.7%	11.6%
1994	81,205	1.8%	0.5%	8.4%	10.7%
1995	76,104	1.8%	0.6%	7.1%	9.4%
1996	84,319	1.6%	0.7%	5.0%	7.3%
1997	90,403	1.8%	0.8%	4.3%	6.9%
1998	99,945	1.9%	0.9%	3.0%	5.7%
1999	103,375	1.8%	1.1%	2.2%	5.2%
2000	95,452	1.9%	1.1%	1.8%	4.8%
2001	89,956	2.0%	1.1%	1.4%	4.5%
2002	92,989	2.2%	1.2%	1.2%	4.6%
2003	94,987	2.3%	1.4%	0.7%	4.5%
2004	106,077	2.5%	1.4%	0.7%	4.5%
2005	102,492	2.1%	1.3%	0.8%	4.2%
2006	86,924	1.8%	1.2%	1.6%	4.5%
2007	78,001	1.6%	0.9%	5.2%	7.7%
2008	9,249	1.0%	0.8%	12.7%	14.5%
Total	1,783,360	1.7%	0.8%	3.1%	5.6%

Panel B

Group	Death	Bankruptcy	Foreclosure
sale 3 yrs before event	0.21%	0.08%	
sale 2 yrs before event	0.26%	0.08%	
sale 1 yr before event	0.35%	0.07%	
sale 1 yr after event	0.50%	0.24%	2.64%
sale 2 yrs after event	0.26%	0.17%	0.29%
sale 3 yrs after event	0.13%	0.13%	0.06%

Notes: data on deaths from the Social Security Death Master file and data on bankruptcies obtained from the MA Bankruptcy Court. Panel A reports the percentage of observations that are classified as deaths, bankruptcies, or foreclosures each year. An observation is assigned to one of the mutually exclusive categories according to the rules described in Appendix A. For deaths and bankruptcies, a sale is considered forced if the sale happens within 3 years before or after the sale. For foreclosures, a sale is considered forced whenever the sale occurs after the auction (or at the auction itself if successful). For each type of forced sale, Panel B reports how the forced sales as a percentage of total observations are distributed before and after the event which forces the sale.
Last Updated: 10/29/08

Table 3 - Other characteristics of forced sales

	% of total obs	Property type (% of firesale type)			% Boston	% of each type also:	
		Single family	Multifamily	Condo		Death	Bankruptcy
All observations	100.0%	64.4%	11.1%	24.5%	8.1%		
Unforced	94.4%	64.6%	10.5%	24.9%	8.0%		
Forced	5.6%	62.2%	19.7%	18.0%	9.7%		
--- Death	1.7%	76.6%	14.5%	9.0%	5.3%		0.7%
--- Bankruptcy	0.8%	71.3%	15.3%	13.4%	5.5%	1.1%	
--- Foreclosure	3.1%	52.1%	23.7%	24.2%	13.2%	0.5%	3.1%

Notes: the first column reports the fraction of observations identified as forced, following the matching process described in the data appendix. The next three columns report the property type composition, while the fifth column reports the fraction of observations in Boston. The last two columns report, for each category, how many matches were also matched as another type of forced sale before applying the rules we use to classify the transaction in these cases.
Last updated: 10/29/08

Table 4 - Descriptive statistics for forced sales

Panel A	Min	Max	Mean	Stdev	1%	25%	50%	75%	99%
Price ($1000)	7.15	1,675.00	151.46	126.82	13.50	68.00	116.00	197.00	600.00
Total rooms	2	16	7	3	3	5	6	8	16
Full bathrooms	0.0	4.0	1.6	0.7	1.0	1.0	1.0	2.0	4.0
Half bathrooms	0.0	2.0	0.3	0.5	0.0	0.0	0.0	1.0	2.0
Bedrooms	1.0	9.0	3.4	1.6	1.0	2.0	3.0	4.00	9.00
Lotsize	0	261,360	16,524	31,105	0	3,825	7,508	16,117	185,086
Interior Square Ft	509	4,627	1,713	850	509	1,090	1,480	2,128	4,374
House age	0	341	59	40	0	53	91	106	341
Median Income	7,271	200,001	50,613	19,766	15,268	37,143	48,269	61,047	115,456
% Hispanic	0.00	0.96	0.07	0.12	0.00	0.01	0.02	0.08	0.59
% Black	0.00	0.95	0.07	0.15	0.00	0.01	0.02	0.05	0.83
% 0-17 yo	0.00	0.49	0.24	0.07	0.05	0.21	0.24	0.28	0.40
% 65+ yo	0.00	0.71	0.14	0.07	0.03	0.09	0.13	0.17	0.37
% Female-headed HH	0.00	0.48	0.08	0.06	0.01	0.04	0.06	0.09	0.29
% with Bachelor's degree	0.00	0.73	0.17	0.10	0.01	0.10	0.15	0.23	0.43
% with graduate degree	0.00	0.72	0.10	0.09	0.00	0.04	0.08	0.14	0.44
% with less than high school degree	0.00	0.83	0.17	0.12	0.01	0.08	0.14	0.24	0.55

Panel B: Ratio with Table 1	Min	Max	Mean	Stdev	1%	25%	50%	75%	99%
Price ($1000)	1.05	0.92	0.67	0.75	0.57	0.58	0.66	0.68	0.70
Total rooms	1.00	1.00	1.06	1.19	1.00	1.00	1.00	1.00	1.00
Full bathrooms		1.00	0.98	1.04	1.00	1.00	0.50	1.00	1.00
Half bathrooms		1.00	0.76	0.95				1.00	1.00
Bedrooms	1.00	1.00	1.07	1.20	1.00	1.00	1.00	1.00	1.13
Lotsize		1.00	0.80	0.85		1.33	0.79	0.73	0.80
Interior Square Ft	1.00	1.00	0.99	1.03	1.00	0.97	0.96	0.99	0.99
House age		0.96	1.22	0.95		3.79	2.39	1.36	1.85
Median Income	2.91	1.00	0.86	0.85	0.91	0.86	0.87	0.87	0.88
% Hispanic		0.96	1.50	1.26	1.07	1.15	1.37	1.94	1.20
% Black		1.00	1.71	1.52		1.32	1.43	1.72	1.41
% 0-17 yo		1.00	1.04	0.95	1.15	1.06	1.01	1.01	1.06
% 65+ yo		1.00	0.99	0.98	1.04	0.99	0.99	1.00	0.96
% Female-headed HH		1.00	1.33	1.31	1.54	1.19	1.27	1.40	1.12
% with Bachelor's degree		1.00	0.81	0.96	0.53	0.74	0.76	0.82	0.94
% with graduate degree		1.00	0.71	0.78		0.68	0.68	0.69	0.84
% with less than high school degree		0.83	1.33	1.17		1.40	1.42	1.37	1.10

Notes: sample is subset of transactions which are deaths and bankruptcies within 3 year from the sale, plus foreclosures. Panel A is analogous to Table 1. Panel B reports the ratio of values in Panel A with the corresponding values in Table 1.
Last updated: 10/29/08

Table 5 - Hedonic regression coefficients

Variables at transaction level	
Lot size (x10,000)	**0.001 *****
	(0.0002)
Bedrooms	**0.023 *****
	(0.0005)
Total number of rooms	**0.013 *****
	(0.0003)
Full Bathrooms	**0.098 *****
	(0.001)
Half Bathrooms	**0.094 *****
	(0.001)
Interior Square Feet (x10,000)	**0.765 *****
	(0.01)
House Age (x10)	**-0.015 *****
	(0.0002)
House Age Squared	**0.0005 *****
	(0)
Condominium	**-0.205 *****
	(0.002)
High number of Rooms Dummy	**-0.083 *****
	(0.004)
High number of Bedrooms Dummy	**-0.076 *****
	(0.004)
High number of Full Bathrooms Dummy	**-0.089 *****
	(0.003)
High number of Half Bathrooms Dummy	**-0.082 *****
	(0.003)
High square feet Dummy	**-0.163 *****
	(0.009)
Low square feet Dummy	**-0.643 *****
	(0.008)
Renovated in the last 10 years	**0.055 *****
	(0.002)
Renovated 10 to 20 years before	**0.009 *****
	(0.003)
Renovated 20 to 30 years before	**0.007 ***
	(0.003)
Renovated more than 30 years before	**0.004**
	(0.004)
Variables at census tract level	
% Hispanic	**-0.22 *****
	(0.008)
% Black	**-0.136 *****
	(0.008)
% Less than 17yo	**-0.205 *****
	(0.011)
% More than 65yo	**0.388 *****
	(0.007)
% Female-headed household	**-0.065 *****
	(0.015)
Median Income	**0.018 *****
	(0)
% Bachelor Degree	**0.224 *****
	(0.006)
% Graduate Degree	**0.346 *****
	(0.006)
% Less than High School Diploma	**-0.102 *****
	(0.007)
Number of Observations	1,783,360
R-squared	0.718

Notes: the table reports the coefficients and standard errors (in parenthesis) of a regression of log house price on house and census characteristics and disaggregated forced sale indicators (reported in the third specification of Table 6). The regression includes zip code-year fixed effects. *** significance at 1%, ** significance at 5%, and * significance at 10%.

Last updated: 10/29/08

Table 6 - Price discount for forced sales

	[1]	[2]	[3]
Forced (-3 years;+3 years)	**-0.199 *****		
	(0.0013)		
Young seller (<70yrs)			
Death (-3;+3)		**-0.051 *****	
		(0.0052)	
Sale more than 3 yrs before death			**-0.046 *****
			(0.006)
Sale 3 yrs before death			**-0.062 *****
			(0.014)
Sale 2 yrs before death			**-0.062 *****
			(0.013)
Sale 1 yr before death			**-0.069 *****
			(0.011)
Sale 1 yr after death			**-0.042 *****
			(0.011)
Sale 2 yrs after death			**-0.047 *****
			(0.014)
Sale 3 yrs after death			**-0.029 ***
			(0.018)
Sale more than 3 yrs after death			**-0.024 *****
			(0.004)
Old seller (>70yrs)			
Death (-3;+3)		**-0.068 *****	
		(0.0024)	
Sale more than 3 yrs before death			**-0.098 *****
			(0.003)
Sale 3 yrs before death			**-0.088 *****
			(0.007)
Sale 2 yrs before death			**-0.101 *****
			(0.006)
Sale 1 yr before death			**-0.083 *****
			(0.005)
Sale 1 yr after death			**-0.048 *****
			(0.004)
Sale 2 yrs after death			**-0.061 *****
			(0.006)
Sale 3 yrs after death			**-0.059 *****
			(0.009)
Sale more than 3 yrs after death			**-0.024 *****
			(0.003)

	[1]	[2]	[3]
Bankruptcy (-3;+3)		**-0.032 *****	
		(0.0033)	
Sale more than 3 yrs before bankruptcy			**-0.008 ***
			(0.0043)
Sale 3 yrs before bankruptcy			**-0.022 ****
			(0.0103)
Sale 2 yrs before bankruptcy			**0.000**
			(0.0103)
Sale 1 yr before bankruptcy			**-0.015**
			(0.011)
Sale 1 yr after bankruptcy			**-0.053 *****
			(0.006)
Sale 2 yrs after bankruptcy			**-0.044 *****
			(0.007)
Sale 3 yrs after bankruptcy			**-0.025 *****
			(0.0078)
Sale more than 3 yrs after bankruptcy			**-0.0207 *****
			(0.0038)
Foreclosure		**-0.323 *****	
		(0.002)	
Sale 1 yr after foreclosure			**-0.315 *****
			(0.002)
Sale 2 yrs after foreclosure			**-0.452 *****
			(0.005)
Sale 3 yrs after foreclosure			**-0.472 *****
			(0.012)
Sale more than 3 yrs after foreclosure			**-0.216 *****
			(0.008)
R-squared	0.716	0.718	0.718
# young deaths (+3;-3)		5,311	
# old deaths (+3;-3)		25,100	

Notes: table reports the coefficients and standard errors (in parenthesis) of a regression of log house price on house and census characteristics and disaggregated forced sale indicators. Coefficients on house and census characteristics for the third specification are reported in Table 5. Death, bankruptcy and foreclosure indicators are mutually exclusive. The regression includes zip code-year fixed effects. *** significance at 1%, ** significance at 5%, and * significance at 10%.

Last updated: 10/09/08

Table 7 - Number of sellers effects

	ONE SELLER		TWO SELLERS	
Young seller				
Death (-3;+3)	**-0.082** ***		**-0.035** ***	
	(0.009)		(0.006)	
Sale more than 3 yrs before death		**-0.085** ***		**-0.005**
		(0.008)		(0.008)
Sale 3 yrs before death		**-0.091** ***		**-0.045** **
		(0.024)		(0.018)
Sale 2 yrs before death		**-0.109** ***		**-0.029** *
		(0.02)		(0.017)
Sale 1 yr before death		**-0.117** ***		**-0.031** **
		(0.017)		(0.015)
Sale 1 yr after death		**-0.051** **		**-0.039** ***
		(0.022)		(0.012)
Sale 2 yrs after death		**-0.039**		**-0.05** ***
		(0.025)		(0.016)
Sale 3 yrs after death		**-0.052** *		**-0.017**
		(0.029)		(0.022)
Sale more than 3 yrs after death		**-0.0562** ***		**-0.0066**
		(0.007)		(0.005)
Old seller				
Death (-3;+3)	**-0.095** ***		**-0.053** ***	
	(0.0041)		(0.003)	
Sale more than 3 yrs before death		**-0.129** ***		**-0.053** ***
		(0.004)		(0.004)
Sale 3 yrs before death		**-0.111** ***		**-0.064** ***
		(0.01)		(0.01)
Sale 2 yrs before death		**-0.119** ***		**-0.083** ***
		(0.009)		(0.009)
Sale 1 yr before death		**-0.113** ***		**-0.05** ***
		(0.007)		(0.008)
Sale 1 yr after death		**-0.063** ***		**-0.044** ***
		(0.01)		(0.005)
Sale 2 yrs after death		**-0.064** ***		**-0.06** ***
		(0.013)		(0.007)
Sale 3 yrs after death		**-0.07** ***		**-0.053** ***
		(0.016)		(0.011)
Sale more than 3 yrs after death		**-0.055** ***		**-0.007** **
		(0.004)		(0.003)
Bankruptcy (-3;+3)	**-0.061** ***		**-0.013** ***	
	(0.0052)		(0.004)	

Sale more than 3 yrs before bankruptcy	**-0.038** ***	**0.027** ***
	(0.006)	(0.006)
Sale 3 yrs before bankruptcy	**-0.071** ***	**0.007**
	(0.017)	(0.013)
Sale 2 yrs before bankruptcy	**-0.023**	**0.013**
	(0.017)	(0.013)
Sale 1 yr before bankruptcy	**-0.04** **	**0**
	(0.018)	(0.013)
Sale 1 yr after bankruptcy	**-0.068** ***	**-0.041** ***
	(0.009)	(0.008)
Sale 2 yrs after bankruptcy	**-0.077** ***	**-0.022** **
	(0.011)	(0.009)
Sale 3 yrs after bankruptcy	**-0.059** ***	**-0.004**
	(0.013)	(0.01)
Sale more than 3 yrs after bankruptcy	**-0.051** ***	**-0.004**
	(0.006)	(0.005)

Notes: table reports coefficients and standard errors (in parenthesis) of hedonic regression of log price with interactions of the forced sale variables with dummies for one and two sellers. 42% of the sample has two sellers. The two columns belong to the same specification, but are reported adjacent to one another. The regression includes the house and census characteristics in Table 5, and the foreclosure and bankruptcy dummies of the third specification of Table 6. *** significance at 1%, ** significance at 5%, and * significance at 10%.

Last updated: 11/04/08

Table 8 - Previous forced sale effects

Previous sale was a **young** death firesale, within a year	**0.002**
	(0.023)
within 1 and 3 years	**0.012**
	(0.018)
within 3 and 5 years	**0.014**
	(0.019)
more than 5 years before	**0.023** *
	(0.014)
Previous sale was a **old** death firesale, within a year	**0.023** **
	(0.011)
within 1 and 3 years	**0.014** *
	(0.008)
within 3 and 5 years	**0.011**
	(0.009)
more than 5 years before	**0.045** ***
	(0.007)
Previous sale was a bankruptcy, within a year	**-0.037** ***
	(0.012)
within 1 and 3 years	**-0.004**
	(0.01)
within 3 and 5 years	**0.006**
	(0.012)
more than 5 years before	**0.022** *
	(0.012)
Previous sale was a foreclosure, within a year	**0.011** **
	(0.005)
within 1 and 3 years	**-0.028** ***
	(0.005)
within 3 and 5 years	**-0.018** ***
	(0.005)
more than 5 years before	**0.033** ***
	(0.004)
Previous price interacted with distance between sales (1 year)	**0.154** ***
	(0.001)
within 1 and 3 years	**0.155** ***
	(0.001)
within 3 and 5 years	**0.156** ***
	(0.001)
more than 5 years before	**0.156** ***
	(0.001)

Notes: table reports coefficients and standard errors (in parenthesis) of hedonic regression of log price with indicators of forced sales in the previous transaction, decomposed into different windows depending on the time since the last transaction. The regression includes the house and census characteristics in Table 5, and the foreclosure and bankruptcy dummies of the third specification of Table 6. *** significance at 1%, ** significance at 5%, and * significance at 10%.
Last updated: 10/29/08

Table 9 - Neighborhood summary statistics

	Min	Max	Mean	Stdev	1%	25%	50%	75%	99%
Overall Price	7.50	1500.00	218.89	142.09	53.50	120.93	173.23	277.34	708.34
Unforced	0.00	1500.00	220.87	142.54	53.17	122.68	174.44	279.47	712.84
Forced	0.00	1425.00	145.49	138.62	0.00	53.23	115.33	205.47	637.56
Share	0.00	0.34	0.05	0.06	0.00	0.01	0.04	0.07	0.34

Notes: summary statistics on the neighborhood house price panel dataset at the zipcode-year level. Statistics are reported for both forced and unforced sale at this level of aggregation. Prices are in the thousands of dollars.
Last updated: 11/11/08

Table 10 - VAR for neighborhood house prices

	Dp(t)	Dpf(t)	Disc(t)	Dpu(t)
Dpf(t-1)		**-0.075*****	**0.046*****	**-0.029*****
		(0.012)	(0.012)	(0.004)
Disc(t-1)		**0.832*****	**0.077*****	**-0.090*****
		(0.015)	(0.015)	(0.005)
Dp(t-1)	**-0.443*****			
	(0.0090)			
Observations	9820	6801	6801	6801
R-squared	0.204	0.463	0.220	0.089

Notes: table reports coefficients and standard errors (in parenthesis) of VAR of percentage change in average forced and unforced house prices at the zipcode-year level, cross-sectionally demeaned. P(t) is the average price at time t, Pf(t) is the average price of forced sales, and pu(t) is the average price of unforced sales. Each specification includes neighborhood fixed effects. *** significance at 1%, ** significance at 5%, and * significance at 10%.
Last updated: 11/11/08

Table 11 - Neighborhood VAR with share of forced sales

Panel A

	sf(t)	Dpf(t)	Disc(t)	Dpu(t)
sf(t-1)	**0.519*** **	**-0.628*** **	**0.609*** **	**-0.02**
	(0.012)	(0.084)	(0.083)	(0.031)
Dpf(t-1)	**0**	**-0.068*** **	**0.040*** **	**-0.029*** **
	(0.002)	(0.012)	(0.012)	(0.004)
Disc(t-1)	**0.009*** **	**0.850*** **	**0.061*** **	**-0.090*** **
	(0.002)	(0.017)	(0.017)	(0.006)
Observations	6801	6801	6801	6801
R-squared	0.614	0.468	0.227	0.089

Panel B

	sf(t)	Dpf(t)	Disc(t)	Dpu(t)
sf(t-1)	**0.496*** **	**-0.378*** **	**0.500*** **	**0.122*** **
	(0.012)	(0.086)	(0.086)	(0.031)
Dpf(t-1)	**-0.002**	**-0.051*** **	**0.028** **	**-0.023*** **
	(0.002)	(0.012)	(0.012)	(0.004)
Disc(t-1)	**0.011*** **	**0.831*** **	**0.072*** **	**-0.097*** **
	(0.002)	(0.017)	(0.017)	(0.006)
sf(t-1) x Dpf(t-1)	**-0.052* **	**-0.039**	**-0.460** **	**-0.499*** **
	(0.031)	(0.219)	(0.218)	(0.079)
sf(t-1) x Disc(t-1)	**0.200*** **	**-2.432*** **	**0.884*** **	**-1.548*** **
	(0.035)	(0.243)	(0.242)	(0.088)
Observations	6801	6801	6801	6801
R-squared	0.618	0.479	0.231	0.132

Notes: table reports coefficients and standard errors (in parenthesis) of VAR of percentage change in average forced and unforced house prices at the zipcode-year level, cross-sectionally demeaned. P(t) is the average price at time t, Pf(t) is the average price of forced sales, pu(t) is the average price of unforced sales, and Sf(t) is the share of forced sales in zipcode at time t. Each specification includes neighborhood fixed effects. *** significance at 1%, ** significance at 5%, and * significance at 10%.
Last updated: 11/10/08

Table 12 - Spillover effects

	[1]	[2]	[3]	[4]
Far, unweighted, before	-0.018 *** (0)	-0.011 *** (0)	-0.015 *** (0)	-0.006 *** (0)
Far, unweighted, after			-0.006 *** (0)	-0.002 *** (0)
Far 99.0, before	0.020 *** (0.005)	0.003 (0.005)	0.016 *** (0.005)	-0.008 (0.005)
Far 99.0, after			0.049 *** (0.005)	0.014 *** (0.005)
Far 99.5, before	-0.028 *** (0.006)	-0.028 *** (0.006)	-0.033 *** (0.006)	-0.031 *** (0.006)
Far 99.5, after			0.059 *** (0.006)	0.023 *** (0.006)
Far 99.9, before	-0.114 *** (0.012)	-0.088 *** (0.012)	-0.121 *** (0.012)	-0.072 *** (0.012)
Far 99.9, after			0.049 *** (0.012)	0.027 ** (0.011)
Close, linear, before	-0.093 *** (0.002)	-0.075 *** (0.002)	-0.084 *** (0.002)	-0.061 *** (0.002)
Close, linear, after			-0.065 *** (0.002)	-0.044 *** (0.002)
Close 99.0, before	-0.024 *** (0.005)	-0.022 *** (0.005)	-0.017 *** (0.005)	-0.015 *** (0.005)
Close 99.0, after			0.005 (0.005)	0.002 (0.005)
Close 99.5, before	-0.118 *** (0.006)	-0.098 *** (0.005)	-0.089 *** (0.006)	-0.068 *** (0.006)
Close 99.5, after			0.002 (0.006)	0.007 (0.005)
Close 99.9, before	-0.259 *** (0.011)	-0.187 *** (0.011)	-0.212 *** (0.012)	-0.125 *** (0.012)
Close 99.9, after			-0.020 * (0.012)	0.016 (0.011)
Average price, before		0.269 *** (0.001)		0.190 *** (0.001)
Average price, after				0.206 *** (0.001)
No transaction before		3.247 *** (0.012)		2.286 *** (0.013)
No transaction after				2.516 *** (0.013)
Sale 1 yr after foreclosure	-0.287 *** (0.002)	-0.283 *** (0.002)	-0.287 *** (0.002)	-0.278 *** (0.002)
Sale 2 yrs after foreclosure	-0.410 *** (0.005)	-0.404 *** (0.005)	-0.410 *** (0.005)	-0.396 *** (0.005)
Sale 3 yrs after foreclosure	-0.429 *** (0.012)	-0.419 *** (0.012)	-0.429 *** (0.012)	-0.406 *** (0.012)
Sale more than 3 yrs after foreclosure	-0.208 *** (0.008)	-0.186 *** (0.008)	-0.208 *** (0.008)	-0.177 *** (0.008)

Notes: table reports coefficients and standard errors (in parenthesis) of hedonic regression of log price with the the unweighted number of foreclosures in the 0.25mi area around the house sold (winsorized at the 99th percentile), and the linearly weighted number of foreclosures in the 0.1mi area (also winsorized at the 99th percentile), for the year before and after the sale. We also add dummies for the 99th, 99.5th and 99.9th percentile of thoise variables. Finally, columns 2 and 4 add the distance-weighted average log price of neighboring houses (0.25mi), in the year before and after the sale, and a dummy for the cases where there are no transactions in the neighborhood, for that time frame. The regression includes the house and census characteristics in Table 5, and the foreclosure and bankruptcy dummies of the third specification of Table 6. *** significance at 1%, ** significance at 5%, and * significance at 10%. Last updated 11/30/08

Table 13 - Interactions with own foreclosure

	Years between foreclosure and sale			
	1 yr	2 yrs	3 yrs	4+ yrs
Far, unweighted, before	-0.017 ***	-0.024 ***	-0.023 ***	-0.036 ***
	(0.001)	(0.002)	(0.005)	(0.005)
Far 99.0, before	-0.012	0.026	-0.064	0.067
	(0.012)	(0.028)	(0.062)	(0.085)
Far 99.5, before	-0.083 ***	-0.079 ***	-0.197 ***	-0.188 *
	(0.013)	(0.027)	(0.061)	(0.109)
Far 99.9, before	-0.055 **	0.008	0.352 ***	-0.522 **
	(0.023)	(0.045)	-0.1010	(0.231)
Close, linear, before	0.002	0.053 ***	0.020	0.056
	(0.007)	(0.018)	(0.039)	(0.036)
Close 99.0, before	0.050 ***	-0.043	-0.081	0.166 **
	(0.013)	(0.032)	(0.067)	(0.08)
Close 99.5, before	0.102 ***	0.042	0.144 **	0.106
	(0.013)	(0.03)	(0.066)	(0.081)
Close 99.9, before	0.400 ***	0.377 ***	0.376 ***	0.220
	(0.023)	(0.045)	-0.0940	(0.207)

Notes: table reports coefficients and standard errors (in parenthesis) of the hedonic regression of Table 12, with the addition of the interactions between the number of foreclosures in the year before and the dummies of forced sale due to foreclosure, disaggregated by the years between the foreclosure and the related sale. *** significance at 1%, ** significance at 5%, and * significance at 10%. Last updated 11/30/08

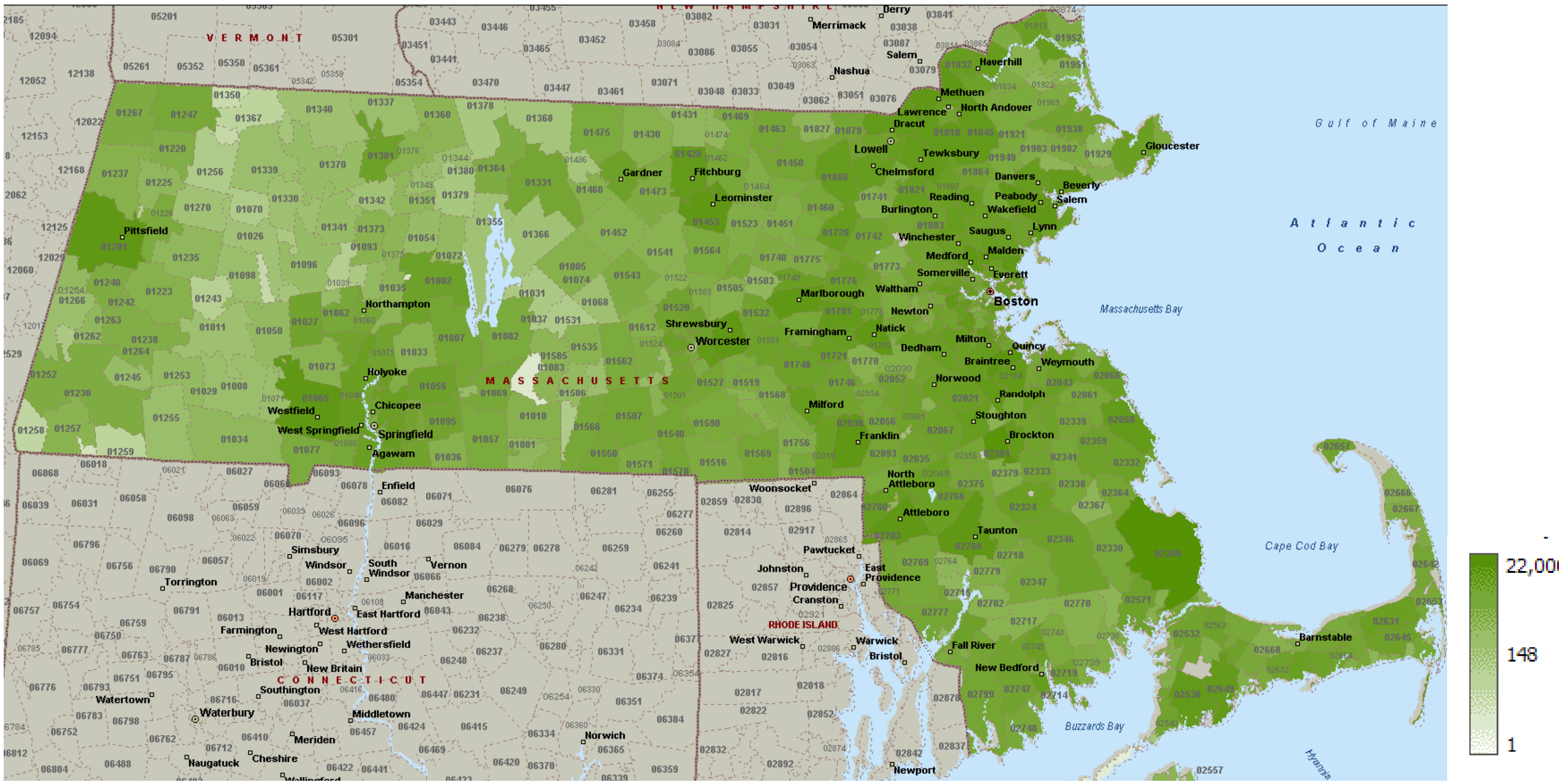

Figure 1: Geographic Distribution of Housing Transactions by Zip Code

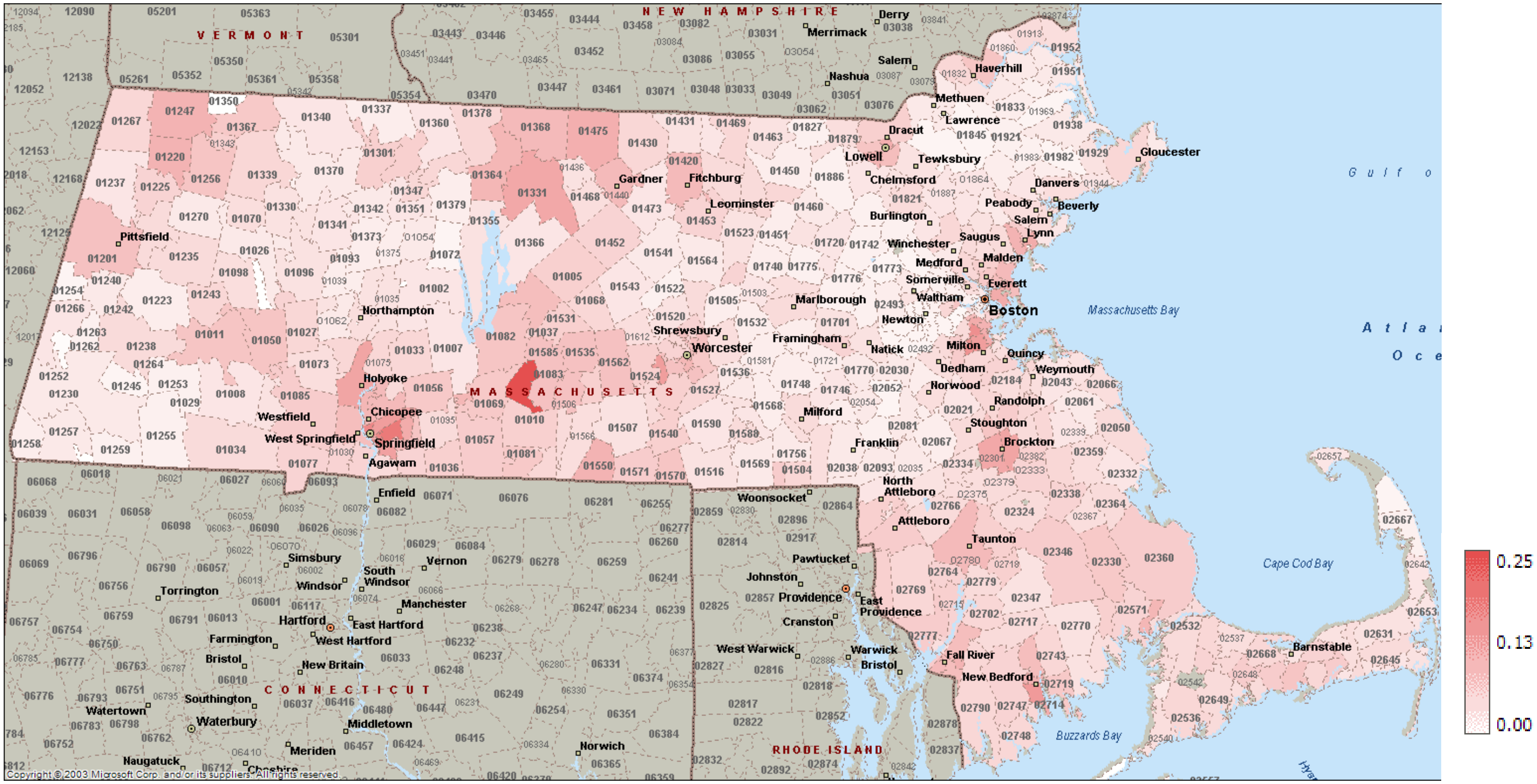

Figure 2: Geographic Distribution of Percentage of Housing Transactions that are Forced Sales by Zip Code