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ABSTRACT

States without a judicial requirement for foreclosures are twice as likely to foreclose on delinquent homeowners. Comparing zip codes close to state borders with differing foreclosure laws, we show that foreclosure propensity and housing inventory jump discretely as one enters non-judicial states. There is no jump in other homeowner attributes such as credit scores, income, or education levels. The increase in foreclosure rates in non-judicial states persists for at least five years. Using the judicial/ non-judicial law as an instrument for foreclosures, we show that foreclosures lead to a large decline in house prices, residential investment, and consumer demand.

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The post-2006 collapse in the U.S. housing market led to a 35% drop in house prices and an increase in mortgage delinquency rate that reached over 10% in 2009 (Figure 1). Mortgage contracts give lenders the right to foreclose on a home if the homeowner defaults on his payment obligations. However, when a major shock hits the economy and millions of homeowners default simultaneously default, the fire sale of foreclosed homes can lead to a further reduction in house prices and threatens real activity such as residential investment and consumer demand.[1]

This paper investigates the effect of foreclosures on house prices and real activity during the recent Great Recession. The question is important for understanding the transmission and amplification of financial shocks into the real economy. However, isolating the causal effect of foreclosures is difficult because of omitted variables and reverse causality. The latter effect is especially important: a homeowner will only allow a foreclosure to occur if he or she is underwater on their mortgage. As a result, house price declines will be strongly correlated with foreclosures even if foreclosures have no direct effect on house prices.

In this paper we attempt to estimate the causal effect of foreclosures on economic outcomes by taking advantage of differences in state laws in the foreclosure process. In particular, some states require that a foreclosed sale must take place through the courts (*judicial foreclosure* states). In these states, a lender must sue a borrower in court before conducting an auction to sell the property – a lengthy and costly process. Other states do not have such a requirement (*non-judicial foreclosure* states) and give lenders the automatic right to sell the delinquent property after providing only a notice of sale to the borrower. As first highlighted in the economics literature by Pence (2006), the 21 states that require judicial foreclosure impose substantial costs and time on lenders seeking to foreclose on a house.

[1] Models that emphasize amplification of shocks from the leverage-induced forced sale of durable goods include Shleifer and Vishny (1992), Kiyotaki and Moore (1997), Krishnamurthy (2003, 2009), and Lorenzoni (2008)

Do legal differences in foreclosure laws effect the propensity to foreclose on a home? We find that the answer is a resounding yes. States with non-judicial foreclosure laws are *twice* as likely to foreclose on a delinquent home. For example, there are 2.3 foreclosures per homeowner with a mortgage in the 2008-09 period in judicial states versus 4.7 in non-judicial states. This large difference in foreclosure rate exists despite essentially identical mortgage default rates in judicial and non-judicial states (9.2% and 9.6% respectively).

Zip code level analysis provides additional evidence on the differences in foreclosure rates between judicial and non-judicial states. Using zip code level data and focusing on zip codes near the border of two states with different foreclosure laws, we find a sharp discontinuous jump in foreclosure propensity for zip codes located on the non-judicial side of the state border. Moreover, using separate zip code level data on MLS listings we show that housing inventory also "jumps" when one crosses into a non-judicial state.

The higher foreclosure rate in non-judicial states is also highly persistent. Both state level and state-border discontinuity analysis shows that for five straight years – from 2007 through 2011 (the end of our sample period) – foreclosure rates in non-judicial states remain much higher. In other words, the higher foreclosure rate in non-judicial states is not a short-run phenomenon. In sum, higher foreclosure rates in non-judicial states directly translate into higher housing supply in the market and this expansion in housing supply lasts at least five years.

Does the higher rate of foreclosures and for-sale inventory in non-judicial states translate into a steeper decline in house prices? We can answer this question using state foreclosure laws as an instrument for the incidence of foreclosures. State foreclosure laws provide a compelling instrument: not only do they strongly predict foreclosures, but they are also uncorrelated with other variables that might directly impact the foreclosure rate.

In particular, state level analysis shows that there are no significant differences between judicial and non-judicial states in mortgage defaults, house price growth from 2002 to 2005, level of house prices in 2005, leverage or debt-to-income growth from 2002 to 2005, fraction subprime, income, pre-crisis unemployment rate, racial mix, poverty, or education. Similarly the sharp discontinuity in zip code level analysis exists *only* in foreclosure propensity: there is no equivalent jump in other zip code level attributes including credit scores, income, race, education, default rate or 2002-05 house price growth.[2]

Using state foreclosure law as an instrument for foreclosures, we estimate the causal effect of foreclosures on house prices and find a large effect. Moving from the median to the 90th percentile of the foreclosure per homeowner distribution leads to eight percentage point lower house price growth from 2007 to 2009. Our back of the envelope calculation suggests that the foreclosure-induced increase in supply of housing can plausibly explain the entire house price effect of foreclosures. For example, our estimates imply that a persistent foreclosure-induced increase of 12.6% in the supply of housing in non-judicial states decreased house prices by 5.3 percentage points.

Does the foreclosure-induced reduction in house prices lead to a reduction in real activity as well? A significant drop in house prices deteriorates the balance sheet of *all* households in the neighborhood and threatens to reduce residential investment and consumer demand (see Mian, Rao, and Sufi (2012) and Mian and Sufi (2012a) for related evidence). Using foreclosure law as an instrument, we find that a one standard deviation increase in foreclosures per homeowner

[2] We also analyze at length any ex-ante differences in availability of credit between judicial and non-judicial states, and find no significant differences during the credit boom years of 2001-2005. See section III for further discussion.

leads to a 1/2 to 2/3 standard deviation decrease in permits for new residential construction and a 2/3 to 1 standard deviation decline in auto sales.[3]

We use our microeconomic estimates to quantify the aggregate effects of foreclosure on the macro-economy. From 2007 to 2009, our estimates suggest that foreclosures were responsible for 20 to 30% of the decline in house prices, 15 to 25% of the decline in residential investment, and 20 to 35% of the decline in auto sales over the same period. The details of this calculation are in Section V.

While our paper finds strong effect of foreclosures on house prices and real activity, we do not take a stand on whether foreclosures help to bring house prices, durable consumption, or residential investment closer to or further from their-long-run socially efficient levels. For example, in the absence of foreclosures, house prices may display downward rigidity given loss aversion (Genesove and Mayer (2001)). Alternatively, house prices may be kept above their socially efficient level by government support. But our estimates suggest that foreclosures lead to more abrupt declines in these outcomes than would be observed in the absence of foreclosures, and these declines are likely to be more painful in the midst of a severe recession. This is consistent with the amplification mechanisms emphasized in Kiyotaki and Moore (1997) and Krishnamurthy (2003).

Our findings are most closely related to recent studies on foreclosures and house prices (Calomiris, et al (2011), Campbell, et al (2010), Foote, et al (2008), Hartley (2010a)). One advantage of our study relative to the existing literature is comprehensiveness: our analysis covers the entire United States as opposed to one state or one city and we examine foreclosures

[3] We conduct a number of robustness tests for these results. As a placebo test, we show that non-judicial states did not experience a relative decline in durable consumption or residential investment during the 2001 recession when foreclosures were negligible. We also show that our results are similar if we exclude Arizona and Nevada, the two states with the highest foreclosure rates. Further, our results are similar if we change the classification of some states--particularly Massachusetts--based on the legal filing requirement for a foreclosure. See Section VI.

all the way through the end of 2010.[4] Relative to these studies, we are the first to examine the effect of foreclosures on real economic activity.

We are also the first to use state laws on judicial requirement for foreclosure to identify the effect of foreclosures on house prices. The importance of an instrument for foreclosures is mentioned prominently in the literature.[5] Further, our results show the powerful effect of the legal environment on foreclosure incidence, a fact that is important to know for those designing laws related to household defaults.

The paper is organized as follows. In the next section, we discuss the data and summary statistics. Section II discusses identification and the empirical strategy we employ. Sections III and IV present and discuss our main empirical results on house prices, residential investment, and durable consumption. Section V provides robustness tests, and Section VI concludes.

I. Data and Summary Statistics

A. Data

We use data from a number of sources. Foreclosure data from RealtyTrac.com, one of the leading foreclosure listing websites, are available to us at the zip code level at annual frequency for 2006 through 2010. RealtyTrac.com collects data from legal documents that are submitted by lenders during the foreclosure process. There are five types of filings collected by RealtyTrac.com. The first two are filings that are done before a foreclosure auction: a notice of default (NOD) and a *lis pendens* (LIS). Two of the filings are directly associated with a foreclosure auction: a notice of trustee sale (NTS) and a notice of foreclosure sale (NFS).

[4] One important disadvantage is that many of these studies have individual level data on foreclosures and house prices, whereas we have only zip code level data.

[5] As Campbell, et al (2010) note, "…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 price except through foreclosures; however, we have not been able to find such an instrument" (15). We find that the unconditional OLS estimate of the effect of foreclosures on house prices is 50% larger than 2SLS estimate.

Finally, RealtyTrac.com collects information on whether the foreclosed home is purchased by the lender at auction, or real-estate owned (REO).

For every zip code, we have the total number of filings for each of these five categories. To avoid double-counting filings for the same property, RealtyTrac.com provided us totals for the last filing in the process for a given property in a given year. For example, if a borrower received a notice of default and a notice of trustee sale in the same year, RealtyTrac.com records one notice of trustee sale for the property.

The term "foreclosure" requires some additional definition. The foreclosure process is initiated when a lender files a pre-auction filing (i.e., a *lis pendens* or a notice of default). However, these filings on their own do not represent a foreclosure. A pre-auction filing does not by itself lead to a sale or an eviction, and it does not necessarily mean the house will be acquired or sold by the lender. Instead, a foreclosure represents the forced sale of a property by the lender for the purpose of reimbursing the claim. This is best measured by the filing that directly precedes the auction itself. As a result, our measure of total foreclosures in a zip code is the total number of notices of trustee sale, foreclosure sales, or real estate owned (NTS+NFS+REO).[6]

Data on house prices at the zip code-quarter level are from Fiserv Case Shiller Weiss and Zillow.com. An excellent description of the differences and similarities between FCSW and Zillow.com is available in the appendix of Guerrieri, et al (2010). New residential permit data is from the Census and is available at the county-annual level. Auto sales data are from R.L. Polk and are available at the county-monthly frequency. For more information on the R.L. Polk data, see Mian and Sufi (2012b).

[6] We are grateful to Tyler White for providing us with information on the foreclosure data from RealtyTrac.com. Readers interested in acquiring the foreclosure data should contact tyler.white@realtytrac.com.

We supplement foreclosure, house price, residential investment, and auto sales data with zip code-quarterly level information on delinquencies from Equifax.[7] The Equifax data also allow us to measure at the zip code level the fraction of borrowers that had credit scores below 660 as of 2000. Finally, we supplement the zip code level data with demographic information from the 2000 Decennial Census.

Given the availability of variables at different levels of geographic aggregation, we construct final data sets at the state, CBSA, and zip code level. The underlying zip code level data covers approximately 31,000 zip codes, which represent the entire United States. Zip codes are matched to states, counties, and CBSAs using a data set from zip-codes.com.

The main restriction on the data is the availability of zip code house price indices. Zillow.com zip code level house price data are available for 8,900 zip codes in our sample, and FCSW house price data are available for 4,199 zip codes. Zip code level data are available from one of these two sources for 9,213 zip codes. These zip codes represent 65% of the total U.S. population, 81% of total home-related debt as of 2005, and 83% of total foreclosures in 2008 and 2009. By far the largest observable difference between zip codes for which we do and do not have data is whether the zip code is in an urban area. Almost 80% of zip codes for which we have house price data available are in urban areas; only 19% of zip codes for which we do not have house price data are in urban areas.

B. Summary Statistics

The top panel of Table 1 presents summary statistics of the state level data used in the analysis. The average number of foreclosures per homeowner in 2008 and 2009 is 0.037. The number of homeowners is approximated using the number of mortgage accounts as of 2005 according to Equifax. The number of 60 days past due delinquent mortgage or home equity

[7] See Mian and Sufi (2009) and Mian, Sufi and Trebbi (2010) for more information on the Equifax data.

accounts per homeowners is 0.095, which implies an average pass-through from delinquency to foreclosure close to 40%.

Data on house prices and residential investment show the dramatic turn of events starting in 2006 and 2007. From 2007 to 2009, house prices dropped by 10 to 20% depending on the data source. Residential investment at the state level dropped by 80% as measured by the Census data on permits for new residential construction. Auto sales dropped by 41%.

Table 1 also presents summary statistics at the CBSA level. The patterns in foreclosures, delinquencies, house price growth, residential investment growth, and auto sales growth are similar. Table 1 also contains information on other important variables, including the increase in the debt to income ratio from 2002 to 2005, the fraction of consumers that were subprime borrowers as of 2000, and the unemployment rate as of 2000.

II. State Foreclosure Laws And Propensity To Foreclose

Since we are interested in estimating the impact of foreclosures on house prices and real activity, we need an instrument that changes foreclosure propensity across otherwise similar neighborhoods. One possible candidate for such an instrument is the difference in state laws that determines the ease with which a lender may foreclose on a property.[8] We discuss this difference below.

A. Judicial Versus Non-Judicial Foreclosure States

The ease with which a lender can sell a delinquent property through foreclosure depends on the laws governing a particular state. There are two types of foreclosure laws – Judicial and Non-judicial - prevalent in states across the U.S. Lenders in states with a *judicial foreclosure* requirement must file a notice with a judge providing evidence regarding the amount of the debt,

[8] General information on the foreclosure process presented in this section comes from Pence (2003, 2006), http://www.all-foreclosure.com/judicial.htm, http://en.wikipedia.org/wiki/Foreclosure, and http://www.calculatedriskblog.com/2007/04/foreclosure-sales-and-reo-for-ubernerds.html.

the delinquency of the debt, and why the delinquency should allow the lender to sell the property. This filing is typically called a *lis pendens*. The borrower is notified of the filing and has a chance to respond. If the court finds that the lender is accurate in their claim, a property will move to the auction stage of the process.

In a *non-judicial foreclosure*, the lender does not need court approval to auction a property. Lenders use rights that they have obtained in the original mortgage document allowing sale of the property if the borrower is delinquent on the account. In a non-judicial foreclosure, a lender sends a *notice of default* to the borrower, and the notice is typically also filed with the jurisdiction authority (i.e., county, municipality, etc.).[9] If the borrower fails to pay the debt or dispute the notice, a *notice of sale* is subsequently filed which begins the auction process.

A large body of evidence suggests that costs to lenders are substantially higher for judicial versus non-judicial foreclosures (Wood (1997), Ciochetti (1997), Pence (2003), Pennington-Cross (2004)). Websites covering the mechanics of foreclosure frequently cite that judicial foreclosures are expensive for lenders. For example, a reputable blog calculatedriskblog.com writes: "Non-judicial foreclosure is almost always faster and cheaper for the lender than a judicial foreclosure." [10] The October 2010 temporary foreclosure moratorium by JPMorgan-Chase, GMAC, and Bank of America highlights the costs to lender in states that require judicial foreclosure. Given problems with the verification of documents, these servicers temporarily stopped foreclosure activity in states that require judicial foreclosure.[11]

Figure 2 shows the variation across U.S. states in classification of foreclosure laws, with judicial foreclosure states shaded in dark gray. The classification of states comes from

[9] According to RealtyTrac, there are 16 non-judicial states that do not require a notice of default before the auction filing. See the appendix for more information.
[10] http://www.calculatedriskblog.com/2007/04/foreclosure-sales-and-reo-for-ubernerds.html
[11] See http://www.nytimes.com/2010/10/08/business/08frozen.html .

RealtyTrac.com. While the majority of states that require judicial foreclosure are located in the upper Midwest and Northeast, there is geographical variation outside this area as well.

There is a certain degree of subjectivity in the classification of state laws requiring judicial approval for a foreclosure. We follow RealtyTrac for the following reasons. First, the information from RealtyTrac is publicly available, concrete, and justified--we have no ability to manipulate the classification and other researchers can examine the precise reasons for the classification at RealtyTrac's website.[12] Second, RealtyTrac specializes in the collection of legal filings on foreclosures and our data on foreclosures are from RealtyTrac; it is therefore natural to use their classification of foreclosure laws. Nonetheless, we perform an extensive set of robustness checks using alternative classifications of state foreclosure laws in Section V and the Appendix.

B. Do Foreclosure Laws Effect Foreclosure Propensity?

Do state laws influence the rate of foreclosure? Figure 3 shows that the answer is a resounding yes. The left panel plots the foreclosures per delinquent account ratio for every state. States shaded in black require judicial foreclosure. The foreclosure rate in non-judicial states is clearly much higher. The 13 states with the highest foreclosure to delinquent account ratios all allow non-judicial foreclosure. Of the 22 states with the highest pass-through rate from delinquencies to foreclosures, only 1 requires judicial foreclosure.

The right panel of Figure 3 plots foreclosures per homeowner against delinquencies per homeowner. Judicial states are plotted as triangles, and non-judicial states are plotted as circles. Consistent with the left panel, non-judicial states convert defaults into foreclosures at a much higher rate (gradient of 0.77 versus 0.35 for judicial states).

[12] See http://www.realtytrac.com/foreclosure-laws/foreclosure-laws-comparison.asp.

Panel A of Table 2 runs the formal first stage of foreclosure laws on the propensity to foreclose. We regress foreclosures on an indicator variable for whether the state requires judicial foreclosure. Column 1 shows that states with a judicial foreclosure requirement have a foreclosure per homeowner-with-a-mortgage ratio in 2008 and 2009 that is 0.024 lower than the foreclosure per homeowner ratio of 0.047 in non-judicial states. Thus foreclosure rates are *twice* as high in non-judicial states compared to judicial states.

The higher foreclosure rate in non-judicial states is not driven by higher default rates. Column (2) shows that default rates in 2008 and 2009 are not statistically different between judicial and non-judicial states. Hence including default rate in column (3) to the regression in column (1) does not change the coefficient on judicial law dummy. Column (4) regresses foreclosures per delinquent account on the foreclosure law dummy. As already seen in Figure 3, foreclosures per delinquent account are twice as high in non-judicial states compared to judicial states.

Figure 3 and Table 2 illustrate the remarkable impact of foreclosure laws on the propensity to foreclose. Foreclosure rates in non-judicial states are twice as high as in judicial states despite having the same level of mortgage defaults on average. Our analysis focused on 2008 and 2009, and commuted the total number of foreclosures over this period since these years represent the heart of the housing crisis. However, our underlying data on foreclosures is at an annual frequency and covers the period 2006 to 2011.

Panel B of Table 2 regresses foreclosures per homeowner on judicial foreclosure dummy and default per home owner separately for each year. The difference between judicial and non-judicial foreclosure rates increases sharply in 2008 and 2009 and remains elevated until the end of our sample period in 2011. The impact of foreclosure laws on foreclosure propensity is not

only strong but highly persistent – lasting for at least four straight years (2008 to 2011). Consequently the effect of foreclosure laws should not be seen as temporary or relevant only in the short run.

C. Are Judicial and Non-judicial States Systematically Different?

One potential concern with the evidence in Figure 3 and Table 2 could be that states with non-judicial foreclosure laws and higher levels of foreclosure are possibly different on other important dimensions. For example, higher foreclosure rates in non-judicial states may have nothing to do with state laws if non-judicial states also happen to have more subprime borrowers. In other words, for foreclosure laws to be a legitimate instrument, we need to convince ourselves of the exclusion restriction: judicial and non-judicial states do not differ along another attribute that *independently* influences the foreclosure rate.

We have already seen in column (2) of Table 2, Panel A that there is no significant difference in the initial impact of mortgage defaults in judicial and non-judicial states. This result is heartening as any differences in borrower attributes between judicial and non-judicial states should have translated into systematically different default rates in the two types of states.

Table 3 tests if other relevant characteristics are different across judicial and non-judicial states by regressing each characteristic on a dummy for judicial foreclosure law. We use an exhaustive list of fifteen different variables, including delinquencies per homeowner in 2006 and 2009, growth in house prices from 2002 to 2005, level of house prices in 2005, leverage or debt to income growth between 2002 and 2005, fraction of consumers that are subprime in 2000 (i.e. have a credit score below 660), level of income in 2005, unemployment rate in 2000, fraction below poverty, fraction black and Hispanic, fraction with less than high school education and fraction that lives in urban areas.

Remarkably *none* of the aforementioned variables are significantly different across judicial and non-judicial states, and the estimated standard errors are reasonably tight. For every variable except FCSW house price growth (for which the sample is only 24 states), we can reject at the 10% level of confidence that judicial requirement states are different by a 3/4 standard deviation. We can thus be reasonably confident that otherwise similar states differ in their foreclosure laws, probably due to historical factors unrelated to contemporary economic conditions.

D. State-Border Discontinuity Test for the Effect of State Laws on Foreclosures

We provide additional evidence on the legitimacy of the judicial foreclosure requirement instrument based on a state-border discontinuity design. The discontinuity test uses much finer zip code level data on foreclosures and tests if foreclosure rates are significantly different in zip codes across state borders that differ in their foreclosure laws.

In order to conduct this analysis, we focus on zip codes that are close to the border of two states that differ in whether judicial foreclosures are required. Table 4 lists the state borders that are included in the border analysis, along with the number of zip codes within 25 and 10 miles of the border.

Using this sample, we ask the following question: as one moves from a judicial state into a non-judicial state, does the foreclosure rate "jump" at the border? Under the assumption (which we test) that zip codes on either side of the border are otherwise similar, the only change that happens when one crosses the border is the change in state laws applicable to delinquent mortgages.

Formally, we estimate the following specification:

$$FORCLOSURERATE_{zbsx} = \alpha_{bsx} + \sum_{i=-50}^{50} \gamma^i * D_{zbsxi} + \varepsilon_{zbsx} \quad (1)$$

where $FORCLOSURECRATE_{zbsx}$ represents foreclosures per delinquent account for zip code *z* that is located within 50 miles of border *b* in state *s*, and lies on a 10-mile broad strip *x* of the border. The 10-mile broad strips are constructed such that they run perpendicular to the direction of the state-border. The specification includes fixed effects at the level of border-state times 10-mile strips (α_{bsx}). These fixed effects ensure that we compare zip codes that lie on the same 10-mile broad strip running across the state border in question.[13]

The dots in Figure 4 represent the coefficient estimates of γ^i on the indicators D_{zbsxi}, which are indicators for each one mile on either side of the border, with negative values being in the state that requires judicial foreclosure. These coefficient estimates represent the average foreclosures per delinquent account ratio for one mile wide bands around the border of a judicial state and non-judicial foreclosure state, after controlling for (border state*10 mile strip) fixed effects.

Figure 4 plots the estimates of $\gamma^i$for the foreclosures per delinquent account for 2006 through 2011. Consistent with the state level analysis in Figure 3, there is a very sharp jump in the foreclosure to delinquent account ratio as one crosses the border from a judicial requirement state into a non-judicial requirement state. The difference in the foreclosure rate increases in 2008 and 2009, and remains persistently high even into 2011.

One can formally test for a jump at state borders in the foreclosure rate by estimating a modified version of equation (1) that allows for foreclosure rate to vary flexibly – but continuously – with distance from border, and tests for a jump at the border. Formally this translates into estimating the equation:

[13] The 10 mile strip indicator variables control non-parametrically for omitted variables among zip codes that are close to one another and equidistant from the border. These are important given that some states border one another in very different geographical areas.

$$FORCLOSURERATE_{zbsx} = \alpha_{bsx} + \beta_1 * DIST_{zbsx} + \beta_2 * DISTSQ_{zbsx} + \beta_3 * DISTCUBE_{zbsx} + \beta_4 * JUDICIAL_s + \varepsilon_{zbsx} \quad (2)$$

$DIST$ represents the distance in miles of a zip code from state-border, with distance in judicial states represented by a negative number. *DISTSQ* and *DISTCUBE* represent squared and cubic terms of this distance variable. The polynomial specification allows foreclosure rate to vary in a flexible non-linear fashion. The coefficient β_4 on *JUDICIAL* dummy tests for any discontinuity at the state border. We estimate equation (2) separately for each year from 2006 through 2011. The standard errors are clustered at the state-border level, with 40 total clusters.

The coefficients are reported in Panel A of Table 5. The number of zip codes in each regression varies by year because the dependent variable is not defined for zip code with zero mortgages in default. The results show that the jump in foreclosure rate at the state border is small and not statistically significant at the 10% level in 2006. However, it quickly increases in magnitude and remains large and statistically significant from 2007 through 2011 – as seen in Figure 4 as well.

While foreclosure propensity jumps at the border, there is no such pattern in other economic and social attributes. Figure 5 estimates equation (1) for alternative outcomes including delinquency rate, subprime share, income, poverty incidence, minority share, and education. The plots show that there is no discernible jump in any of these variables at the border.

III. The Effect of Foreclosures on Housing Inventory And House Prices: A 2SLS Approach

The preceding section shows that non-judicial foreclosure laws double the propensity to foreclose despite judicial and non-judicial states being very similar along all other dimensions. Evidence supporting the legitimacy of the instrument was provided by the state-border discontinuity analysis. As a result, we estimate the effect of foreclosures on house prices and real activity using the following two stage least squares specification:

$$Ln(Y2009_{gs}) - Ln(Y2007_{gs}) = \alpha + \beta * \widehat{Foreclosures}0809_{gs} + \Gamma * X_{gs} + \varepsilon_{gs} \quad (3)$$

$$Foreclosures0809_{gs} = \pi + \theta * JudicialForeclosureRequirement_s + \Lambda * X_{gs} + \eta_{gs} \quad (4)$$

Equation (4) represents the first stage. We regress foreclosures in 2008 and 2009 scaled by the number of homeowners with a mortgage as of 2005 in geographical unit *g* (which can be a state or CBSA) on an indicator variable for whether the geographical unit is in a state *s* that requires judicial foreclosure. If the level of analysis is the state level then the *g* subscript is redundant. The second stage in equation (3) regresses the growth rate in outcome *Y* in geographical unit *g* from the end of 2007 to the end of 2009 on the predicted value of foreclosures from the first stage. Outcomes include real estate listings, house prices, residential investment, and auto sales. Control variables are in the matrix *X*.

A. Do Foreclosures Lead to a Net Increase in Market Inventory?

State foreclosure laws have a powerful effect on foreclosure propensity. However, for foreclosures to have an effect on house prices it is important that foreclosures lead to a net increase in the supply of houses for sale in the market. Is there independent evidence of this in the data? If more houses come on the market due to foreclosures, some of the non-distressed homeowners might decide not to put their houses for sale on the market. As a result, the equilibrium net effect of foreclosures on the supply of housing inventory might be muted.

We utilize a separate zip code level data set from Target Data Inc that records the number of new "for sale" listings from Multiple Listing Service (MLS) for 2009 and 2010.[14] In 2009, the fraction of new listings to homeowners is on average 6% across the states in the sample. In

[14] See http://www.targetdata.net/ for more details. The data for years before 2009 are not available.

order to isolate the net supply effect, we use the number of new listings per homeowner as an independent variable.

Column (1) of Panel B in Table 5 shows that the cumulative number of new listings per homeowner for sale in 2009 and 2010 is 10.8 percent (-0.0126/0.116) lower in judicial states that have lower rates of foreclosure. Column (2) estimates the 2SLS effect of foreclosures on new listings and finds that one unit increase in foreclosures per home owner leads to a 0.46 unit increase in the number of new listings. Column (3) adds default rate as a control variable and results are similar.

Since the underlying data of new listings is available at the zip code level, we can replicate the state-border discontinuity analysis summarized by equation (1) using the number of new listings per home owner as the dependent variable. Figure 6 shows that there is strong evidence of a sharp increase in listings when one enters the non-judicial state.

Columns (4) and (5) confirm the statistical significance of the jump. As in panel A, standard errors are clustered at the state-border level with 40 borders in total. The number of listings jumps by 1.9 and 1.6 percentage points in 2009 and 2010 respectively. These are large effects giving that zip code level listings per capita have a mean of 5.1 and 4.8 in 2009 and 2010 respectively. There is therefore strong and persistent evidence that foreclosures increase the net supply of houses on the market.

While there may be other channels through which foreclosures affect house prices, the evidence in this sub-section suggests an important role for the foreclosure-induced expansion in the supply of inventory. As we will show below, the very large increase in supply in inventory can plausibly explain the entire decline in house prices. This evidence is consistent with Hartley (2010) who finds that the supply effect dominates the disamenity effect in most areas.

B. The Effect of Foreclosures on House Prices

Figure 7 presents the reduced form version of our two-stage least squares estimation. It plots house price growth in states with and without a judicial foreclosure requirement from 2004 onwards. For both the FCSW (top) and Zillow.com (bottom) indices, there is a larger drop in house prices in states that do not require judicial foreclosure. The magnitude of the relative decline is significantly larger using the FCSW index. For the FCSW index, house prices in non-judicial states fell by 43% from the middle of 2006 to the beginning of 2009. They fell by only 28% in judicial states. The top right panel plots the difference over time. The drop using Zillow.com from the second quarter of 2007 to the third quarter of 2009 is about 4%.[15] Further, there is no systematic evidence of differential house price trends before the foreclosure crisis. Finally, the difference in house price growth between the two states moderates in 2010, a result we will return to later in this section.

Table 6 presents the second stage estimates of the effect of foreclosures on house price growth. Columns 1 through 3 focus on house price growth measured by Zillow.com from 2007 to 2009. As the estimates show, there is a strong negative effect of foreclosures on house price growth.[16] The estimates in columns 1 through 3 imply that a one standard deviation increase in foreclosures per homeowner in 2008 and 2009 leads to an 5 to 7% relative drop in house price growth, which is 2/5 to 3/5 a standard deviation decrease in house price growth. The estimate in column 1 implies that moving from the state with median foreclosure rate to a state with the 90th percentile foreclosure rate leads to 8% lower house price growth from 2007 to 2009.

[15] In Appendix Figure 1, we replicate Figure 7 using publicly available data from the FHFA and the S&P Case Shiller 20 MSA indices. The results are qualitatively similar.

[16] For both Zillow and FCSW, the 2SLS estimate of the effect of foreclosures on house prices conditional on delinquencies is slightly larger than the OLS correlation conditional on delinquencies. If we do not condition on delinquencies in either the OLS or the 2SLS (unreported), the OLS coefficient increases sharply and is 50% larger than the 2SLS coefficient. This is consistent with a bias in the OLS that overstates the negative effect of foreclosures on house prices.

The inclusion of control variables does not have a large effect on the magnitude of the estimates. These results are consistent with evidence in Section II that states with and without judicial foreclosure requirement are similar on observable characteristics. The estimates are similar for the FCSW house price measure. The statistical power is weaker, especially in column 6, given that FCSW data is available for only 24 states in the sample.

In Table 7, we replicate the specifications using CBSA level data. While the variation in judicial requirement for foreclosures in the first stage is at the state level, the CBSA level-analysis allows us to control for other characteristics at a more granular level. The estimates imply a negative effect of foreclosures on house prices that is statistically significant at the 10% level in all specifications except for column 3. The magnitude of the coefficient estimates is slightly smaller in the CBSA level analysis. The estimate in column 2 implies that a one standard deviation increase in foreclosures per homeowner leads to a 1/3 standard deviation lower house price growth.[17]

C. Analysis of Zip Codes Near the Border for House Price Effect

In this section, we examine house price growth patterns in zip codes that are near the border of two states with differing state laws. The first stage effect in Figure 4 (discussed above) shows a very sharp increase in foreclosures per delinquent account as one crosses the border from a judicial to a no judicial requirement state. What is the effect on house prices?

Even with the sharp discontinuity in foreclosures and a true effect of foreclosures on house prices, one would not expect a sharp discontinuity in house price growth around the

[17] The reduced form graphs in Figure 7 suggest a larger decline in house prices using the FCSW indices relative to Zillow, yet the 2SLS magnitudes for both indices are similar. This is driven by two effects. First, Figure 7 does not condition on delinquencies whereas the 2SLS specification does. Conditioning on delinquencies does not change the Zillow reduced form, but decreases the FCSW reduced form by about 25%. Second, the FCSW indices are only available for 24 states, and the first stage is stronger among these states. Given that the 2SLS estimate is based on the ratio of the reduced form coefficient to the first stage, the 2SLS estimate for FCSW is similar given the larger first stage.

border. The main reason is that housing markets are not sharply divided by a border between two states. If home-buyers view houses in zip codes across a state border as close substitutes, a foreclosure-induced drop in house prices on the non-judicial side of the border will have spillover effects onto the housing markets on the judicial side of the border.

The two panels of Figure 8 show this effect. The plots are for house price growth from 2008 to 2009 for FCSW (left) and 2008 to 2009 for Zillow (right). The plots are created with the same estimation as in equation (1) of Section II. Both plots show a pattern that is consistent with higher foreclosures in the non-judicial state leading to lower house prices. As one goes from 25 miles away from the border in the judicial state toward the border, house prices begin to drop reflecting the spillover from foreclosures on the other side of the border. There is some evidence of a sharp drop in house prices right at the border (although less clear using Zillow). House prices continue to decline as one goes further into the non-judicial state.

As a statistical test of the pattern in Figure 8, we test whether we can reject the hypothesis of equivalent house price growth in zip codes 10 miles on each side of the border. This translates to a test of whether the difference in the average of the coefficients on the mile indicator variables 10 miles within the non-judicial and 10 miles within the judicial is zero. We can reject this hypothesis at the 99% confidence level for the FCSW data, and at the 95% level for the Zillow house price data. Recall from Figure 5 that zip codes on either side of the border are similar on most other characteristics.

The spillover effects of housing markets on either side of the border prevents a traditional regression discontinuity approach for evaluating the effect of foreclosures on house prices. Nonetheless, the patterns in Figure 8 are consistent with the view that foreclosures are disproportionately affecting housing markets on the non-judicial side of the state border.

D. Timing of the House Price Decline

One final question regarding the effect of foreclosures on house price growth is timing. As Figure 7 shows, house price growth in 2010 and 2011 was no different in judicial versus non-judicial states. We also confirmed this result statistically in a two-stage least squares setting. There is no difference in house price growth despite the fact that the first stage continues to be strong in 2010 and 2011.

Foreclosure rates continue to be higher in 2010 and 2011 in non-judicial states but house prices do not further decline. Why? One possible interpretation of this result is based on expectations and the possible increase in house prices once the foreclosure wave dies down after 2011. In particular, in order to absorb the sharp rise in foreclosures in non-judicial states, two incentives need to be given to potential buyers, (i) a reduction in price as reflected by the extra drop in house prices between 2007 and 2009, and (ii) the expectation of a larger price increases once the foreclosure wave passes and housing inventory returns to more normal levels.

The lion's share of the aggregate rise in foreclosures occurred in 2008 and 2009 (see Figure 1), and market participants in non-judicial states may have fully incorporated both present and future higher foreclosure rates in non-judicial states into house prices as of the end of 2009. Further reduction in house prices is not needed to clear the continuing high level of foreclosures in 2010 and 2011 if the anticipation of higher prices once foreclosure wave passes keeps prices from dipping even further.

IV. The Effect of Foreclosures on Residential Investment and Durable Consumption

A. Two-stage least squares estimates

The results in the above section document a large negative effect of foreclosures on house prices. A central idea in macroeconomic research is that a sharp negative movement in the

relative price of durable goods can amplify shocks and lead to a reduction in real economic activity. This section explores this idea in the context of residential investment and durable consumption.

Figure 9 presents the reduced form version of our two-stage least squares specification. The top panel plots residential investment growth in non-judicial and judicial states from 2004 to 2010 as measured by new residential construction permits collected by the Census. The data used in the top panel are at the annual frequency.[18] The top left graph is in natural log scale with the natural log of the level of residential investment in 2004Q1 subtracted from the series.

Residential investment patterns were similar through 2007, at which point there was a larger drop in residential investment in non-judicial states through 2009. The significance of the relative decline appears muted given the very large overall decrease in residential investment in all states. However, in the top right panel we show the difference between non-judicial and judicial states. Residential investment dropped by 8 percentage points more in non-judicial states relative to judicial states from 2007 to 2008 and remained significantly lower in 2009. There is some evidence of a relative rebound from 2009 to 2010 in non-judicial states, although it is not statistically significant.

The bottom panel of Figure 9 plots auto sales. It shows a smaller decline in auto sales in states that require judicial foreclosure. As the bottom right panel shows, auto sales in each quarter from 2008Q2 to 2010Q4 were 5 to 10% lower in non-judicial versus judicial states relative to their 2004Q1 respective values. It is important to note that both the residential

[18] Permits for new residential construction are available from the Census at a monthly frequency. However, there are two disadvantages with the monthly data. First, monthly data are available for only 2/3 of the underlying counties for which the annual data are available. Second, the seasonal pattern in residential construction is so strong that it is difficult to discern differences using data at a frequency less than annual.

investment and auto sales data are flows, not stocks. So the cumulative difference over 2008 and 2009 in auto sales and residential investment between judicial and non-judicial states is large.

The first three columns of Table 8 present the state-level two-stage least squares estimates for residential investment as measured by new residential construction permits. The estimate in column 1 on foreclosures per homeowner implies that a one standard deviation increase in foreclosures leads to a 2/5 standard deviation decrease in residential investment growth from 2007 to 2009. Alternatively, moving from the median to the 90th percentile of the distribution of foreclosures leads to 23 percentage points lower residential investment growth from 2007 to 2009. The CBSA level estimates imply a similar magnitude. Both the state and CBSA level estimates are sensitive to the inclusion of the full set of control variables in column 3, but the CBSA level results remain significant at the 12% confidence level.

Table 9 presents the corresponding results for auto sales. The estimate in column 2 implies that a one standard deviation increase in foreclosures leads to a 3/5 standard deviation decrease in auto sales growth from 2007 to 2009. Alternatively, moving from the median to the 90th percentile of the foreclosures distribution leads to 12 percentage points lower auto sales growth from 2007 to 2009.[19]

B. Macroeconomic Implications

We can use the estimates obtained in Tables 6, 7, 8, and 9 to inform the debate regarding the effect of foreclosures on the macro-economy. However, it is critical to emphasize that the estimated marginal effects are driven by variation in foreclosures that comes from the judicial foreclosure requirement in certain states. Given that the local average treatment effect (LATE) is

[19] Unlike the house price data which are available at the zip code level, residential investment and auto sales data are only available at the county level.

driven by this very specific source of variation, we urge caution in using the full distribution of foreclosures to estimate aggregate impacts.[20]

Our strategy to estimate the aggregate effect of foreclosures relies only on the variation in foreclosures that is driven by the judicial foreclosure requirement. This corresponds to the first stage estimate of the effect of judicial foreclosure requirement on foreclosures that is reported in Table 2 for the state level data. The advantage of this approach is that it utilizes variation that can be explained with the first stage, and is therefore analogous to an "in-sample" treatment effect where judicial foreclosure requirement states represent the control group. The estimate is -0.024, which implies that foreclosures per homeowner are 2.4 percentage points lower in judicial foreclosure requirement states.

We multiply the foreclosure coefficient estimates in Tables 6, 7, 8, and 9 with the 2.4 percentage point difference in foreclosure rates to estimate the aggregate impact of foreclosures on house prices, residential investment and auto sales. For house prices, the estimate in column 2 of Table 6 implies that house price growth from 2007 to 2009 was (-1.4*-0.024 =) 3.4 percentage points lower in non-judicial versus judicial states. The average decline in the sample is 12 percentage points, which implies that foreclosures can explain about 28% of the decline in house prices. The CBSA calculation leads to an estimate that foreclosures explain 22% of the decline.

For residential investment, the state-level estimate in column 2 of Table 8 suggests that residential investment growth from 2007 to 2009 was (-5.2*-0.024 =) 12 percentage points lower in non-judicial versus judicial states. The average decline in the sample is 77 percentage points, which implies that foreclosures can explain about 15% of the overall decline in residential investment. A similar calculation using the CBSA-level estimate in column 5 of Table 8 implies that foreclosures can explain 25% of the overall decline in residential investment.

[20] For more on this issue, see Chapter 4 of Angrist and Pischke (2009).

For auto sales, the estimate in column 2 of Table 9 implies that auto sales growth from 2007 to 2009 was (-3.3*-0.024 =) 8 percentage points lower in non-judicial versus judicial requirement states. The average decline in the sample (from Table 1) is 41 percentage points, which implies that foreclosures can explain about 20% of the overall decline in auto sales. Using the CBSA-level estimate in column 5 of Table 9 implies that foreclosures can explain 35% of the overall decline in auto sales from 2007 to 2009.

Overall, our analysis implies that foreclosures can explain 20 to 30% of the aggregate house price decline, 15 to 25% of the decline in residential investment from 2007 to 2009 and 20 to 35% of the decline in auto sales over the same period.

V. Further Robustness Checks

Our results on the effect of foreclosures on house prices, residential investment and durable consumption are based on using state foreclosure laws as an instrument for foreclosures. We discussed a number of results that confirm the legitimacy of the instrument. First, both state level comparison and state-border discontinuity tests showed the strong impact that state laws have on foreclosure intensity. Second, the foreclosure law impact is persistent and lasts for at least five years - highlighting the scale of the mortgage default crisis. Third, despite stark differences in foreclosure intensity, judicial and non-judicial states are remarkably similar otherwise, providing support for the exclusion restriction.

In this section we provide additional robustness checks regarding the validity of our empirical analysis. In the interest of brevity we only provide a brief summary of the robustness checks in this section, and relegate the details in the online appendix that accompanies this paper.

A. Alternative Foreclosure and House Price Data

Our foreclosure data comes from RealtyTrac which is the primary source of foreclosure data in the country. An alternative possible source is data on foreclosure starts at the state level is from the Mortgage Bankers' Association (MBA). However, the MBA data are not well-suited for our analysis because they do not differentiate a foreclosure *start* from a foreclosure *auction.* The RealtyTrac data allow us to separate out the auction stage, which is the focus of our analysis here (see Appendix Table 1 for more details).

We also report our house price results in Appendix Figure 1 using the publicly available FHFA house price data and the Case Shiller 20-city indices. Unlike the Zillow and FCSW data, these publicly available versions are available only at the CBSA (city) level. The results are similar using these two data sources.

B. Ex-ante Credit Supply

Perhaps the biggest concern for the exclusion restriction is the ex ante differential incentives of lenders to supply credit in judicial versus non-judicial states. Given that lenders can more easily foreclose on collateral in non-judicial states, they should be more willing to supply credit for borrowers in those states. A potential concern is that the higher credit supply during the housing boom in non-judicial states is responsible for the outcomes we find. Support for this concern comes from Pence (2006), who uses a census tract border discontinuity design in 1994 and 1995 data and finds that individual mortgages are 3 to 7% smaller in judicial versus non-judicial states (see also Benmelech, et al (2005) on commercial mortgages).

We explore this concern using the border sample, which is similar to the strategy used in Pence (2006). In Appendix Table 2 we show that during the 1990s there is some evidence of higher credit supply to states with no judicial foreclosure requirement. But by the late 1990s into

the 2000s, there is no evidence that lenders were willing to lend higher amounts in states with no judicial foreclosure requirement.

Why does the Pence (2006) result weaken over time? Why did lenders from 2000 to 2005 not extend more credit to borrowers in non-judicial states where the costs of foreclosure are lower? One reason is that, during the housing boom, lenders and intermediaries assigned a very low probability to states of the world in which house prices declined substantially (Gerardi, et al (2008)). If lenders assign a very low probability to default states, then the loss given default would play a negligible role in lending decisions.

Another reason is lack of due diligence by purchasers of securitized mortgage backed securities, who may not have fully understood the ex post differences in foreclosure rates across states. Related, most of the loans originated in general, i.e. the conforming loans, are guaranteed by the GSEs against default. There is no evidence that GSE insurance premiums differ by the foreclosure laws in a given state. As a result, originators would be indifferent between judicial and non-judicial states when it comes to evaluating the loss given default in different states.

Finally, we find that the ease of foreclosure leads to larger price declines. If banks ex-ante understand this general equilibrium effect of forced sales, they will weigh the ease with which they can grab the delinquent home against the lower price they get in the event of a sale.[21] The net effect of these two forces may be neutral.

C. Other State Laws

One concern with regard to the exclusion restriction is whether other laws related to foreclosures are correlated with the judicial versus non-judicial difference, and whether these other laws are responsible for our results. In Appendix Table 3, we examine this issue in detail

[21] The house price drop due to foreclosures is an externality from the perspective of the individual decision of a bank to foreclose or not. Therefore, in the event of default, ex-post competition across banks will lead them to foreclose without internalizing the impact on house prices.

and find that the difference in foreclosure rates across judicial and non-judicial states is robust to the consideration of other laws such as the right to cure, deficiency judgment rules and others.

D. Alternative State Foreclosure Law Classifications

We use of RealtyTrac's classification of judicial versus non-judicial states and discuss reasons for doing so in section II. However, there are some disagreements concerning RealtyTrac's definition. In particular, RealtyTrac classifies Massachusetts as a judicial state but other sources count it as a non-judicial state. We explore this issue at length in the appendix (see discussion of Appendix Tables 4-5, and Appendix Figures 2 in the online appendix). We discuss why RealtyTrac lists Massachusetts as a non-judicial state, justify the classification based on the data, and show that the results are similar if we switch Massachusetts to be classified as a state with no judicial requirement.

E. House Price Effect and Strategic Default

We show in Section II that mortgage defaults in 2008 and 2009 are similar in both judicial and non-judicial states. We also show that non-judicial state experience a larger decline in house prices due to higher rate of foreclosures. If house prices drop further in non-judicial states, then more households are likely to be underwater and therefore susceptible to strategic default on their mortgages. Is there any evidence of this in the data? Our default rate data runs until the end of 2011, and until the end of 2011 there is no significant difference in default rates between judicial and non-judicial states.

What explains the lack of difference in default rates despite the steeper house price declines in non-judicial states? An important offsetting effect is that households in non-judicial states may be less willing to strategically default because of the ease of foreclosure. Evidence supporting this view comes from the most recent 2011Q4 report from CoreLogic on negative

equity. It shows that mortgages in non-judicial states were more likely to be underwater. In particular, CoreLogic reports that 20.5% of mortgages are underwater or near underwater in judicial states while 25.7% of mortgages are underwater or near underwater in non-judicial states.

There is therefore a larger number of people in non-judicial states who continue to service their mortgages despite being underwater. It is likely that these two effects--non-judicial states see sharper price declines but higher penalties from delinquency--offset one another and lead to similar delinquency rates in judicial and non-judicial states.

F. Other Robustness Checks

We also perform the following additional robustness checks. First, Appendix Table 6 shows that our core results are robust to the exclusion of the two states with the highest foreclosure rates (Arizona and Nevada). Second, Appendix Table 7 shows that we do not see a similar reduction in real economic activity in states with no judicial requirement during the 2001 recession when foreclosures were negligible. This latter test refutes the hypothesis that states with no judicial requirement are inherently more cyclical or prone to boom-bust cycles.

Third, we test if higher mobility out of non-judicial states explains the drop in real activity in these areas. It turns out this is not the case. In particular, while it is true that MSAs which experienced large declines in house prices experienced a reduction in the average likelihood of staying in the same house, the drop is driven by people who moved but remained in the same county. We perform this test using individual level data first used in Mian and Sufi (2011) that tracks individual mobility. Thus our state level analysis on real outcomes is unaffected by mobility concerns.

Fourth we assessed the issue of possible weakness of our instrumental variable. In general we observe F statistics above Stock and Yogo (2005) weak identification critical values, rejecting the hypothesis that the IV is weak. We also verified that all our results were robust to weak instruments by employing the approach in Moreira (2003, 2009), which produces tests and confidence sets with correct size when instruments are arbitrarily weak for the just-identified case of a single endogenous variable.

VI. Conclusion

A large body of theoretical research in macroeconomics emphasizes how the leverage-induced forced sale of durable goods can (1) lead to negative price effects and (2) reduce economic output. Many academics, policy-makers, and regulators have emphasized these models in building an understanding of the recession of 2007 to 2009. Yet, to our knowledge, there is limited empirical evidence that directly links a specific financial friction to the real economy.

We bridge this gap by examining the price and real effects of foreclosures using variation in state-specific laws as an instrument. We find that foreclosure-induced increase in the supply of houses for sale has a large negative impact on house prices. The drop in housing wealth generates further drops in durable consumption and residential investment. Our findings suggest that foreclosures may have been an important factor in explaining the length and depth of the recession of 2007 to 2009.

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Table 1
Summary Statistics

This table presents summary statistics for the state and CBSA level data used in the analysis. Foreclosures are measured by RealtyTrac.com as new foreclosure filings. Delinquencies represent the number of delinquent accounts 60 days past due as measured by Equifax. The scalar homeowner represents the number of mortgage accounts as of 2005 as measured by Equifax. Subprime consumer fraction is the fraction of consumers with a credit score less than 660 as measured by Equifax. Residential permits represent the value of permits for new residential construction as measured by the Census. Auto sales are measured by R.L. Polk.

	N	Mean	SD	10^{th}	50^{th}	90^{th}
State level data						
Foreclosures per homeowner, 2008 and 2009	51	0.037	0.034	0.009	0.030	0.071
Delinquencies per homeowner, 2008 and 2009	51	0.095	0.042	0.058	0.086	0.133
Zillow house price growth, 2002 to 2006	45	0.326	0.163	0.133	0.330	0.588
Zillow house price growth, 2006 to 2007	47	-0.018	0.047	-0.083	-0.014	0.041
Zillow house price growth, 2007 to 2009	48	-0.119	0.126	-0.268	-0.091	0.012
FCSW house price growth, 2002 to 2006	24	0.364	0.199	0.094	0.347	0.674
FCSW house price growth, 2006 to 2007	24	-0.070	0.069	-0.194	-0.049	-0.002
FCSW house price growth, 2007 to 2009	24	-0.205	0.162	-0.475	-0.177	-0.065
Residential permits growth, 2002 to 2006	51	0.289	0.275	-0.071	0.245	0.656
Residential permits growth, 2006 to 2007	51	-0.198	0.141	-0.339	-0.191	-0.037
Residential permits growth, 2007 to 2009	51	-0.768	0.270	-1.082	-0.726	-0.496
Auto sales growth, 2004 to 2006	51	-0.020	0.123	-0.116	-0.046	0.093
Auto sales growth, 2006 to 2007	51	-0.022	0.056	-0.104	-0.019	0.050
Auto sales growth, 2007 to 2009	51	-0.413	0.157	-0.578	-0.399	-0.238
CBSA level data						
Foreclosures per homeowner, 2008 and 2009	958	0.029	0.032	0.003	0.020	0.063
Delinquencies per homeowner, 2008 and 2009	958	0.092	0.044	0.050	0.083	0.140
Zillow house price growth, 2002 to 2006	339	0.349	0.195	0.106	0.338	0.611
Zillow house price growth, 2006 to 2007	356	-0.028	0.090	-0.147	-0.020	0.058
Zillow house price growth, 2007 to 2009	364	-0.148	0.151	-0.341	-0.120	0.013
FCSW house price growth, 2002 to 2006	121	0.387	0.213	0.094	0.396	0.676
FCSW house price growth, 2006 to 2007	120	-0.098	0.112	-0.249	-0.060	0.009
FCSW house price growth, 2007 to 2009	120	-0.201	0.159	-0.444	-0.160	-0.039
Residential permits growth, 2002 to 2006	946	0.317	0.567	-0.311	0.281	1.010
Residential permits growth, 2006 to 2007	947	-0.159	0.442	-0.559	-0.179	0.264
Residential permits growth, 2007 to 2009	945	-0.771	0.517	-1.480	-0.757	-0.138
Auto sales growth, 2002 to 2006	958	-0.049	0.121	-0.170	-0.060	0.079
Auto sales growth, 2006 to 2007	958	-0.024	0.080	-0.125	-0.020	0.072
Auto sales growth, 2007 to 2009	958	-0.420	0.153	-0.624	-0.413	-0.227
New mortgages/income, 2005	958	0.113	0.094	0.038	0.082	0.235
Debt to income increase, 2002 to 2005	958	0.193	0.325	-0.087	0.190	0.481
Subprime consumer fraction, 2000	958	0.343	0.094	0.236	0.328	0.474
Ln(Income, 2005)	958	3.757	0.215	3.542	3.722	4.015
Fraction with income less than 25K, 2005	958	0.470	0.062	0.401	0.469	0.540
Unemployment rate, 2000	958	0.061	0.022	0.038	0.057	0.089
Poverty fraction, 2000	958	0.138	0.056	0.079	0.128	0.211
Black fraction, 2000	958	0.084	0.121	0.002	0.028	0.276
Hispanic fraction, 2000	958	0.060	0.120	0.005	0.019	0.140
Less than high school education fraction, 2000	958	0.210	0.077	0.127	0.194	0.320
Urban fraction, 2000	958	0.617	0.188	0.362	0.612	0.881

Table 2
Judicial Foreclosure Requirement Instrument

Panel A presents coefficients from the first stage regression of foreclosures during 2008 and 2009 on whether a state requires a judicial foreclosure. Panel B repeats the first stage regression separately for each year from 2006 through 2011. Standard errors are heteroskedasticity-robust.

Panel A: First Stage

	(1) Foreclosures per homeowner 08-09	(2) Delinquencies per homeowner 08-09	(3) Foreclosures per homeowner 08-09	(4) Foreclosures per delinquency 08-09
Judicial foreclosure requirement	-0.024**	-0.004	-0.021**	-0.192**
	(0.008)	(0.012)	(0.005)	(0.038)
Delinquencies per homeowner, 08-09			0.618**	
			(0.109)	
Constant	0.047**	0.096**	-0.013	0.384**
	(0.007)	(0.008)	(0.009)	(0.032)
N	51	51	51	51
R^2	0.121	0.003	0.700	0.286

Panel B: First Stage By Year

	(1)	(2)	(3)	(4)	(5)	(6)
	Foreclosure per homeowner in Year:					
	2006	2007	2008	2009	2010	2011
Judicial foreclosure requirement	-0.003*	-0.005**	-0.009**	-0.013**	-0.013**	-0.012**
	(0.001)	(0.001)	(0.003)	(0.003)	(0.003)	(0.003)
Delinquencies per homeowner	0.226**	0.326**	0.416**	0.407**	0.436**	0.314**
	(0.063)	(0.069)	(0.094)	(0.068)	(0.057)	(0.099)
Constant	-0.001	-0.003	-0.004	-0.006	-0.005	-0.001
	(0.002)	(0.002)	(0.005)	(0.005)	(0.004)	(0.006)
N	51	51	51	51	51	51
R^2	0.429	0.467	0.6	0.717	0.689	0.495

**,*,+ Coefficient statistically different than zero at the 1%, 5%, and 10% confidence level, respectively

Table 3
Are Judicial Foreclosure Law States Different?

Each row of the table represents an univariate regression of the variable in the first column on whether a state requires a judicial foreclosure. Standard errors are heteroskedasticity-robust.

	Judicial foreclosure requirement	N	R^2
Delinquencies per homeowner, 06	0.0014	51	0.003
	(0.004)		
Delinquencies per homeowner, 09	-0.0028	51	0.001
	(0.010)		
Log Zillow house price, 2005	-0.0023	47	0.00
	(0.13)		
Zillow house price growth, 2002 to 2005	-0.001	45	0.000
	(0.051)		
FCSW house price growth, 2002 to 2005	0.049	24	0.018
	(0.073)		
Debt to income increase, 2002 to 2005	-0.026	51	0.007
	(0.042)		
Subprime consumer fraction, 2000	-0.0161	51	0.014
	(0.018)		
Ln(Income, 2005)	0.0332	51	0.010
	(0.050)		
Fraction with income less than 25K, 2005	-0.0046	51	0.003
	(0.012)		
Unemployment rate, 2000	-0.0046	51	0.029
	(0.004)		
Poverty fraction, 2000	-0.0078	51	0.014
	(0.009)		
Black fraction, 2000	0.0103	51	0.002
	(0.030)		
Hispanic fraction, 2000	0.0050	51	0.001
	(0.021)		
Less than high school education fraction, 2000	0.0013	51	0.000
	(0.012)		
Urban fraction, 2000	0.0266	51	0.007
	(0.046)		

**,*,+ Coefficient statistically different than zero at the 1%, 5%, and 10% confidence level, respectively

Table 4
List of Borders of States with Different Foreclosure Rules

This table shows the borders of states where the judicial foreclosure requirement laws differ. It also shows the number of zip codes in the sample that are near those borders.

		Number of zip codes		
		Within 50 miles of border	Within 25 miles of border	Within 10 miles of border
	State Border			
1	AL-FL	182	94	41
2	AR-LA	103	57	28
3	AZ-NM	85	53	12
4	CO-KS	47	27	11
5	CO-NE	68	31	14
6	CO-NM	93	48	12
7	CT-RI	150	82	40
8	DC-MD	215	128	64
9	FL-GA	199	101	30
10	GA-SC	308	170	77
11	IA-IL	353	192	85
12	IA-NE	301	167	83
13	IL-MO	556	345	176
14	IL-WI	371	162	70
15	IN-MI	268	140	50
16	KS-MO	415	252	131
17	KS-OK	269	124	56
18	KY-MO	62	38	14
19	KY-TN	467	198	77
20	KY-VA	239	165	78
21	KY-WV	286	172	66
22	LA-MS	354	139	51
23	LA-TX	234	115	40
24	MA-NH	295	226	88
25	MA-RI	277	201	83
26	MD-VA	487	321	166
27	MD-WV	152	114	70
28	ME-NH	200	124	63
29	MI-OH	337	134	56
30	MN-ND	201	110	50
31	MO-NE	41	25	11
32	MT-ND	53	28	10
33	NC-SC	458	253	115
34	ND-SD	134	64	30
35	NE-SD	171	97	47
36	NE-WY	37	21	5
37	NH-VT	300	206	99
38	NM-TX	145	89	38
39	OH-WV	496	251	136
40	PA-WV	565	246	72
	Total	9,974	5,510	2,445

Table 5
Foreclosures and New for Sale Listings

Panel A presents test for discontinuity in foreclosure rate at the state border using zip code level data. Distance is define in miles divided by 1,000 from the border and is multiplied by -1 for judicial states. Column 1 of Panel B presents the reduced form relation between the judicial foreclosure requirement and new for sale listings. Columns 2 and 3 present coefficients of the second stage of a 2SLS specification of the number of new for sale listings on foreclosures. The first stage regresses foreclosures on whether a state has a judicial foreclosure requirement. The right hand side variables are measured as of the same year as the left hand side. Columns (4) and (5) repeat the state-border discontinuity test for new listings per homeowner. Standard errors for all zip code level regressions are clustered at the state-border level (40 clusters in total).

Panel A: Foreclosure State-Border Discontinuity Test

	(1)	(2)	(3)	(4)	(5)	(6)
	Foreclosure per delinquent mortgage in Year:					
	2006	2007	2008	2009	2010	2011
Judicial foreclosure requirement	-0.079	-0.153*	-0.200*	-0.150**	-0.184**	-0.183**
	(0.049)	(0.059)	(0.080)	(0.049)	(0.056)	(0.066)
Distance	-1.548	-2.289	-3.217	-1.607	-2.857+	-0.847
	(1.529)	(2.253)	(2.214)	(1.468)	(1.683)	(1.843)
Distance Squared	-2.306	-15.547	-22.851	-21.233	-19.518	-8.542
	(20.257)	(27.621)	(25.572)	(14.696)	(18.335)	(14.120)
Distance Cubed	202.609	299.474	360.832	188.935	639.149	-63.303
	(636.396)	(1106.476)	(1114.953)	(537.227)	(672.016)	(695.386)
State-Border * 10-mile Strips FE	Yes	Yes	Yes	Yes	Yes	Yes
N	4,918	5,314	5,638	6,036	5,987	5,831
R^2	0.438	0.419	0.388	0.418	0.45	0.515

Panel B: New For Sale Listings

	(1)	(2)	(3)	(4)	(5)
	New for sale listings per homeowner in Year:				
	2009 and 2010			2009	2010
Judicial foreclosure requirement	-0.013+			-0.019**	-0.016**
	(0.007)			(0.004)	(0.005)
Foreclosures per homeowner		0.457*	0.446*		
		(0.182)	(0.191)		
Delinquencies per homeowner			0.107		
			(0.206)		
Constant	0.116**	0.091**	0.083**		
	(0.004)	(0.008)	(0.010)		
Distance				-0.132	-0.192
				(0.181)	(0.223)
Distance Squared				-2.903	-1.306
				(2.973)	(2.677)
Distance Cubed				27.679	-1.871
				(109.898)	(120.909)
State-Border * 10-mile Strips FE				Yes	Yes
N	51	51	51	8,235	8,235
R^2	0.063	0.433	0.458	0.327	0.313

**,*,+ Coefficient statistically different than zero at the 1%, 5%, and 10% confidence level, respectively

Table 6
Foreclosures and House Prices, State-Level 2SLS

This table presents coefficients of the second stage of a 2SLS specification of house price growth on foreclosures. The first stage, reported in Table 2, regresses foreclosures on whether a state has a judicial foreclosure requirement. Standard errors are heteroskedasticity-robust.

	Zillow house price growth, 07-09			FCSW house price growth, 07-09		
	(1)	(2)	(3)	(4)	(5)	(6)
Foreclosures per homeowner, 08-09	-1.904*	-1.446*	-1.685*	-1.860*	-1.351+	-5.429
	(0.859)	(0.635)	(0.721)	(0.873)	(0.713)	(4.117)
Delinquencies per homeowner, 08-09	-1.188*	-0.512	-0.741	-1.402*	-0.143	6.837
	(0.582)	(0.533)	(1.531)	(0.594)	(0.584)	(12.365)
House price growth, 02-06		-0.141+	-0.230*		-0.133	-0.436
		(0.081)	(0.098)		(0.105)	(0.441)
House price growth, 06-07		0.931**	0.437		1.175*	1.341
		(0.231)	(0.296)		(0.583)	(1.494)
Delinquencies squared, 08-09			0.645			-12.758
			(4.034)			(28.174)
New mortgages/income, 2005			0.135			0.696
			(0.335)			(1.790)
Debt to income increase, 02-05			-0.072			-0.207
			(0.097)			(0.319)
Subprime consumer fraction, 2000			-0.137			-0.617
			(0.261)			(1.120)
Income, 2005			0.052			-0.798
			(0.122)			(0.506)
income < 25K fraction, 2005			-0.172			-4.635
			(0.535)			(3.117)
Unemployment rate, 2000			0.139			-6.050+
			(1.581)			(3.105)
Poverty fraction, 2000			1.144			3.298*
			(0.790)			(1.486)
Black fraction, 2000			0.055			-0.460
			(0.123)			(0.590)
Hispanic fraction, 2000			-0.080			1.007
			(0.179)			(1.265)
< high school education fraction, 2000			0.025			1.324
			(0.330)			(1.248)
Urban fraction, 2000			-0.149+			-0.196
			(0.082)			(0.343)
Constant	0.067*	0.049+	-0.039	0.048	0.011	4.892+
	(0.028)	(0.028)	(0.653)	(0.038)	(0.046)	(2.946)
N	48	45	45	24	24	24
R^2	0.677	0.806	0.868	0.750	0.836	0.822

**,*,+ Coefficient statistically different than zero at the 1%, 5%, and 10% confidence level, respectively

Table 7
Foreclosures and House Prices, CBSA-Level 2SLS

This table presents coefficients of the second stage of a 2SLS specification of house price growth on foreclosures. The first stage regresses foreclosures on whether a state has a judicial foreclosure requirement. Standard errors are heteroskedasticity-robust and clustered at the state level.

	Zillow house price growth, 07-09			FCSW house price growth, 07-09		
	(1)	(2)	(3)	(4)	(5)	(6)
Foreclosures per homeowner, 08-09	-1.196+	-1.403**	-0.864	-1.562+	-1.185+	-2.959*
	(0.656)	(0.533)	(0.656)	(0.930)	(0.697)	(1.285)
Delinquencies per homeowner, 08-09	-1.397**	-1.033**	-1.836**	-1.055+	-0.524+	-0.286
	(0.321)	(0.276)	(0.514)	(0.584)	(0.313)	(0.798)
House price growth, 02-06		-0.223**	-0.146**		-0.199*	-0.403**
		(0.043)	(0.047)		(0.086)	(0.085)
House price growth, 06-07		-0.139	-0.359**		0.282*	0.126
		(0.098)	(0.067)		(0.141)	(0.222)
Delinquencies squared, 08-09			1.572+			0.190
			(0.951)			(1.510)
New mortgages/income, 2005			-0.321**			0.472*
			(0.120)			(0.237)
Debt to income increase, 02-05			-0.087**			-0.097+
			(0.018)			(0.056)
Subprime consumer fraction, 2000			0.414**			0.047
			(0.149)			(0.375)
Income, 2005			-0.099*			-0.242**
			(0.042)			(0.081)
income < 25K fraction, 2005			-0.124			-1.059*
			(0.228)			(0.520)
Unemployment rate, 2000			0.105			-0.443
			(0.422)			(0.748)
Poverty fraction, 2000			-0.337			1.202*
			(0.334)			(0.602)
Black fraction, 2000			0.053			-0.182
			(0.093)			(0.293)
Hispanic fraction, 2000			0.142*			0.059
			(0.062)			(0.118)
< high school education fraction, 2000			-0.341*			0.297
			(0.157)			(0.233)
Urban fraction, 2000			0.053+			0.108
			(0.030)			(0.074)
Constant	0.057**	0.097**	0.536*	0.021	0.037	1.259**
	(0.014)	(0.017)	(0.210)	(0.036)	(0.035)	(0.438)
N	364	339	339	120	120	120
R^2	0.597	0.677	0.769	0.693	0.771	0.796

**,*,+ Coefficient statistically different than zero at the 1%, 5%, and 10% confidence level, respectively

Table 8
Foreclosures and Residential Investment, 2SLS

This table presents coefficients of the second stage of a 2SLS specification of residential investment growth on foreclosures. The first stage regresses foreclosures on whether a state has a judicial foreclosure requirement. Standard errors are heteroskedasticity-robust. Standard errors in columns 4 through 6 are clustered at the state level.

	Residential Permits Growth, 2007 to 2009					
	State-level 2SLS			CBSA-level 2SLS		
	(1)	(2)	(3)	(4)	(5)	(6)
Foreclosures per homeowner, 08-09	-5.841*	-5.239*	-2.351	-8.951*	-7.753+	-7.159
	(2.590)	(2.384)	(2.875)	(4.294)	(4.137)	(4.521)
Delinquencies per homeowner, 08-09	-0.515	-0.948	-10.905*	0.927	-0.323	-2.608
	(1.672)	(1.499)	(4.094)	(1.987)	(1.927)	(2.011)
Residential permits growth, 02-06		-0.100	-0.209		-0.075*	-0.064
		(0.106)	(0.227)		(0.034)	(0.046)
Residential permits growth, 06-07		-0.060	-0.146		-0.374**	-0.369**
		(0.188)	(0.248)		(0.062)	(0.067)
Delinquencies squared, 08-09			27.705*			7.144
			(12.090)			(5.427)
New mortgages/income, 2005			-0.447			-0.378
			(1.058)			(0.558)
Debt to income increase, 02-05			-0.085			0.084
			(0.391)			(0.056)
Subprime consumer fraction, 2000			-0.481			0.588
			(1.482)			(0.399)
Income, 2005			-0.413			-0.437*
			(0.576)			(0.194)
income < 25K fraction, 2005			-1.546			0.110
			(3.287)			(0.899)
Unemployment rate, 2000			-6.740			0.258
			(4.571)			(1.513)
Poverty fraction, 2000			3.947			-0.818
			(3.575)			(0.696)
Black fraction, 2000			0.898			-0.198
			(0.662)			(0.263)
Hispanic fraction, 2000			0.314			0.089
			(0.786)			(0.270)
< high school education fraction, 2000			-0.309			-0.325
			(1.673)			(0.542)
Urban fraction, 2000			0.427			0.471**
			(0.261)			(0.135)
Constant	-0.501**	-0.465**	2.188	-0.595**	-0.551**	0.865
	(0.082)	(0.074)	(3.519)	(0.080)	(0.078)	(0.972)
N	51	51	51	945	943	943
R^2	0.464	0.491	0.623	0.071	0.186	0.236

**,*,+ Coefficient statistically different than zero at the 1%, 5%, and 10% confidence level, respectively

Table 9
Foreclosures and Durable Consumption, 2SLS

This table presents coefficients of the second stage of a 2SLS specification of auto sales growth on foreclosures. The first stage regresses foreclosures on whether a state has a judicial foreclosure requirement. Standard errors are heteroskedasticity-robust. Standard errors in columns 4 through 6 are clustered at the state level.

	Auto Sales Growth, 2007 to 2009					
	State-level 2SLS			CBSA-level 2SLS		
	(1)	(2)	(3)	(4)	(5)	(6)
Foreclosures per homeowner, 08-09	-2.906+	-3.310+	-3.756+	-7.105*	-6.324*	-4.946*
	(1.559)	(1.694)	(2.135)	(3.122)	(2.485)	(2.019)
Delinquencies per homeowner, 08-09	-0.490	0.108	-2.226	1.774	1.385	0.351
	(1.008)	(1.037)	(4.377)	(1.475)	(1.174)	(0.877)
Auto sales growth, 04-06		0.180	0.513**		-0.324*	-0.202+
		(0.209)	(0.135)		(0.149)	(0.112)
Auto sales growth, 06-07		0.700	0.636		-0.335*	-0.079
		(0.471)	(0.486)		(0.139)	(0.103)
Delinquencies squared, 08-09			11.493			3.395+
			(11.124)			(1.832)
New mortgages/income, 2005			-0.592			-0.049
			(0.809)			(0.265)
Debt to income increase, 02-05			0.423			0.039
			(0.297)			(0.028)
Subprime consumer fraction, 2000			-0.662			-0.246+
			(0.949)			(0.135)
Income, 2005			-0.249			-0.140+
			(0.327)			(0.076)
income < 25K fraction, 2005			-0.648			0.050
			(1.835)			(0.343)
Unemployment rate, 2000			1.169			0.204
			(2.186)			(0.434)
Poverty fraction, 2000			-0.086			-0.264
			(1.726)			(0.231)
Black fraction, 2000			0.365			-0.101
			(0.396)			(0.100)
Hispanic fraction, 2000			-0.107			-0.155+
			(0.476)			(0.081)
< high school education fraction, 2000			0.479			-0.281+
			(1.054)			(0.161)
Urban fraction, 2000			0.104			0.184**
			(0.237)			(0.042)
Constant	-0.258**	-0.280**	1.047	-0.376**	-0.387**	0.218
	(0.050)	(0.050)	(1.907)	(0.054)	(0.049)	(0.383)
N	51	51	51	958	958	958
R^2	0.378	0.425	0.584			0.222

**,*,+ Coefficient statistically different than zero at the 1%, 5%, and 10% confidence level, respectively

Figure 1
Foreclosures, House Prices, Residential Investment, and Durable Consumption
The top panel shows aggregate foreclosures from RealtyTrac.com and the household default rate from Equifax. House price growth in the bottom panel is from S&P/Case Shiller.

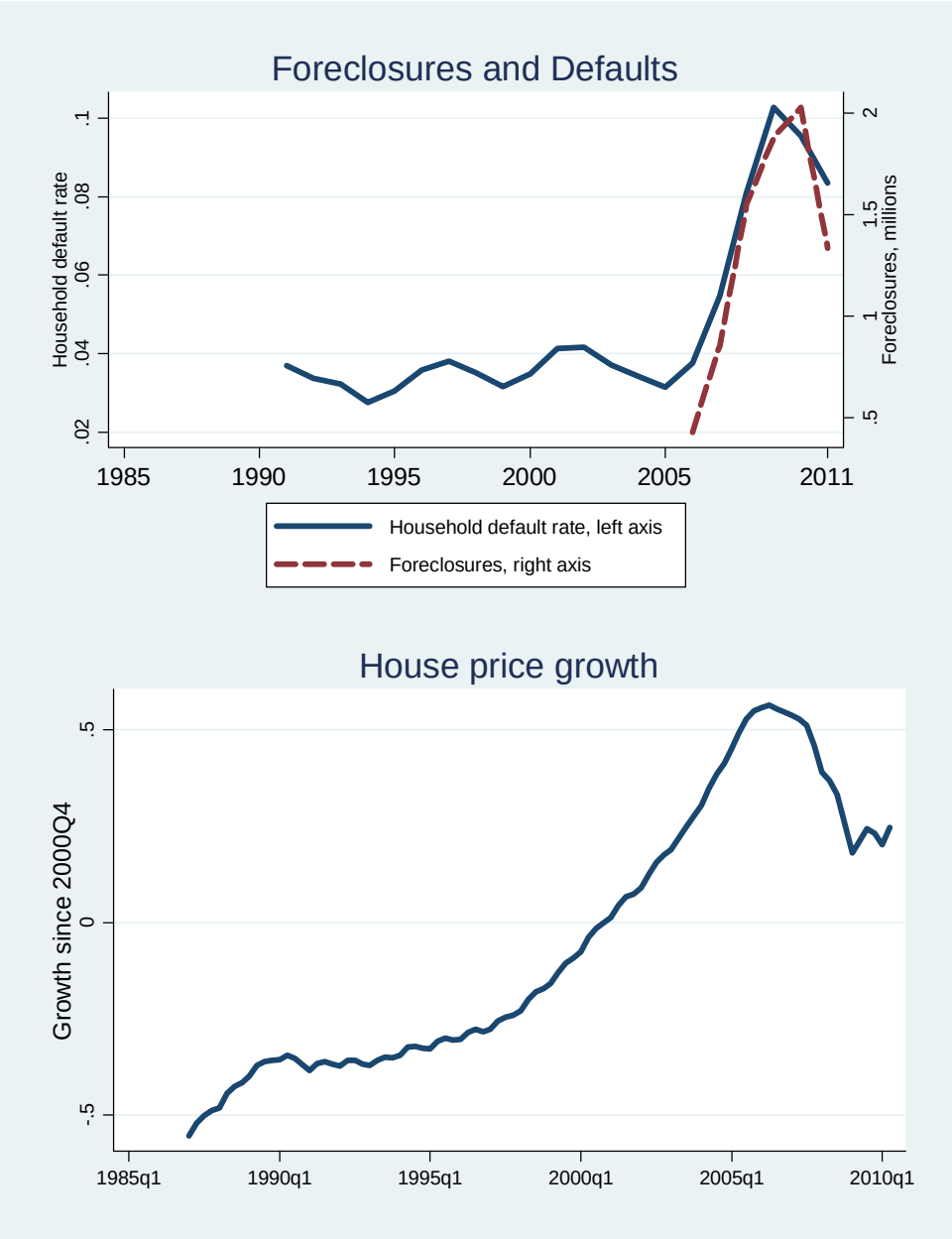


Figure 2
States with Judicial Foreclosure Requirement

States shaded in dark gray require judicial foreclosure. The data come from RealtyTrac.com and are available at: http://www.realtytrac.com/foreclosure-laws/foreclosure-laws-comparison.asp

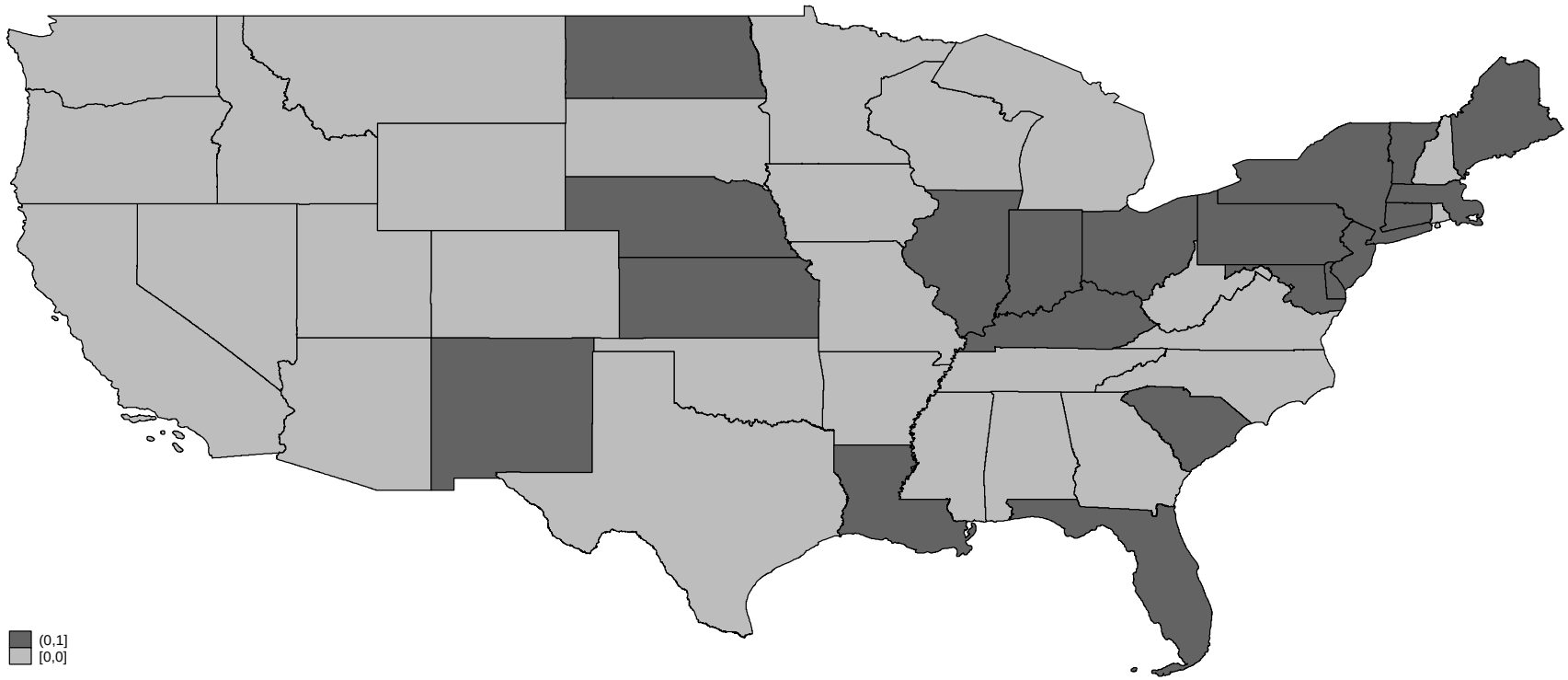


Figure 3

The Effect of Judicial Foreclosure Requirement on Actual Foreclosures

The left panel plots the foreclosures per delinquent account ratio for 2008 and 2009 by state. States that require a judicial foreclosure are shown in black. The middle panel plots foreclosures against delinquencies, where the sample is split by whether the state requires a judicial foreclosure. The right panel shows the first stage coefficients for state level regressions relating foreclosures per homeowner in a given year to whether the state requires judicial foreclosure. The regressions also include a control variable for delinquencies per homeowner.

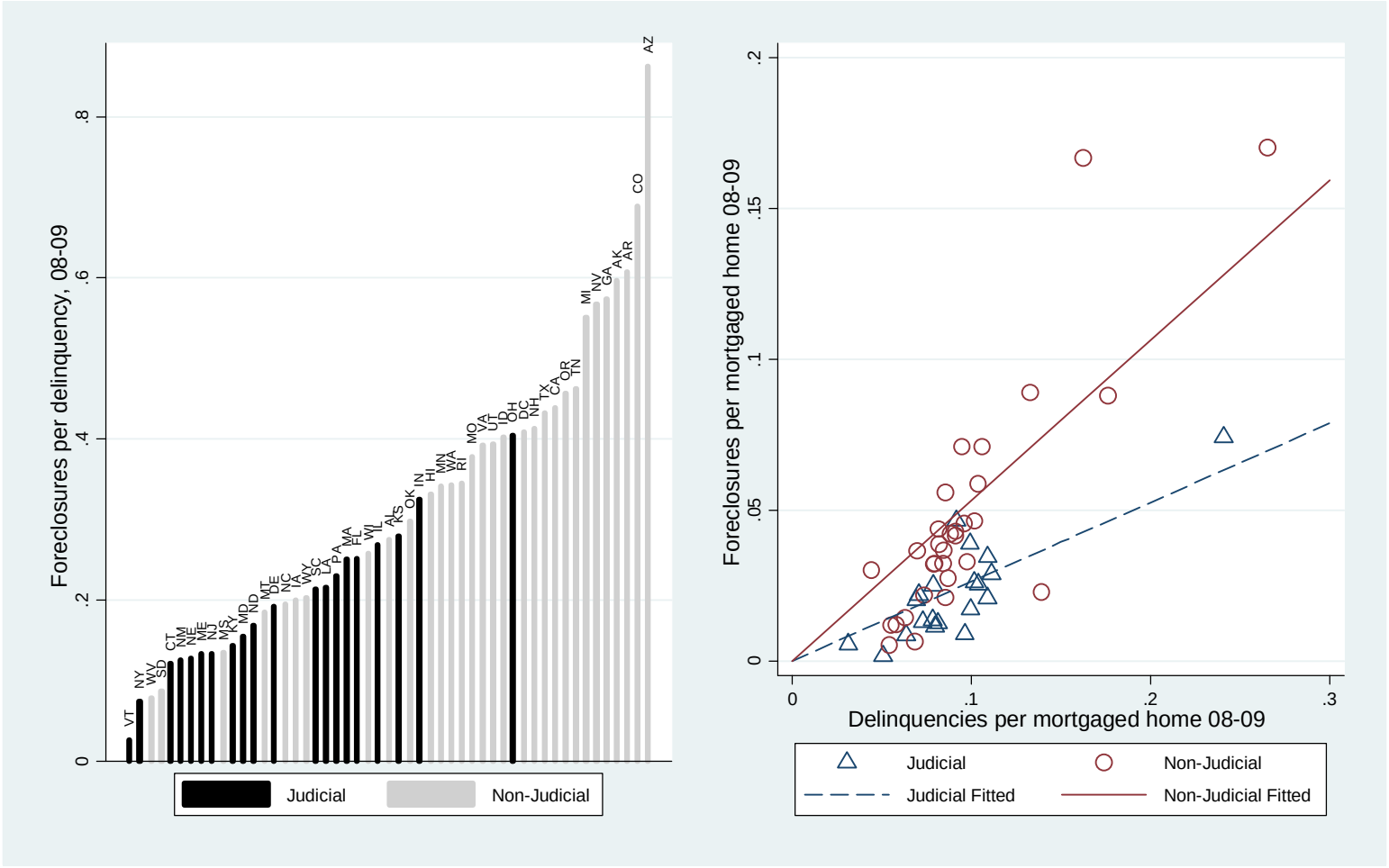


Figure 4

Foreclosures and Judicial Requirement: Zip Codes Near the Border Sample

These figures plot averages of foreclosures near borders where the judicial requirement regime changes across states. We generate the graphs by regressing the variable of interest on state-border-group FE and on 1-mile band distance-to-the-border dummies (where the dummies are negative for judicial states) and then plot the coefficients on the distance-to-the-border dummies. The border is at 0, the omitted category.

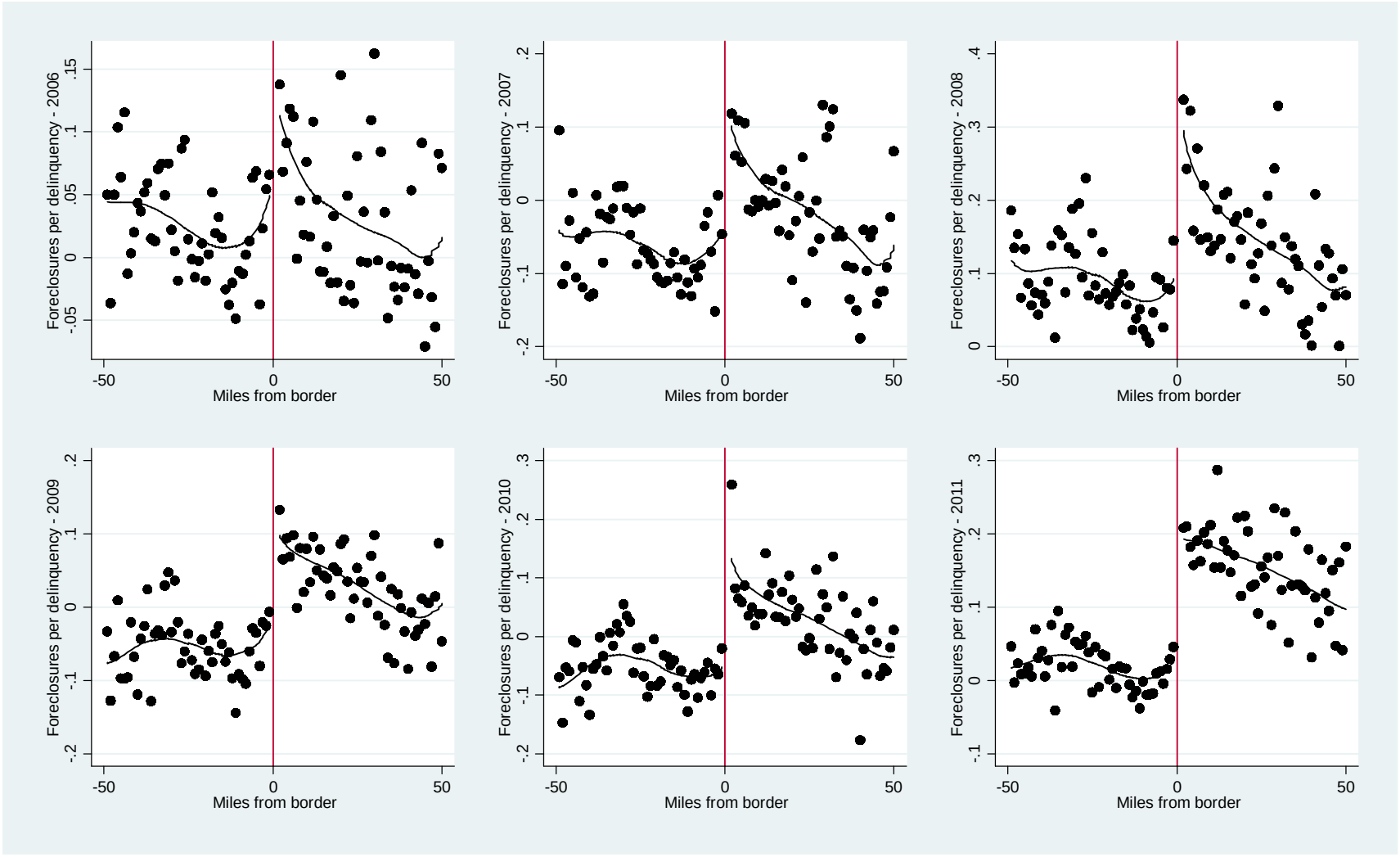


Figure 5
Other Variables and Judicial Requirement: Zip Codes Near the Border Sample

These figures plot averages of variables near borders where the judicial requirement regime changes across states. We generate the graphs by regressing the variable of interest on state-border-group FE and on 1-mile band distance-to-the-border dummies (where the dummies are negative for judicial states) and then plot the coefficients on the distance-to-the-border dummies. The border is at 0, the omitted category.

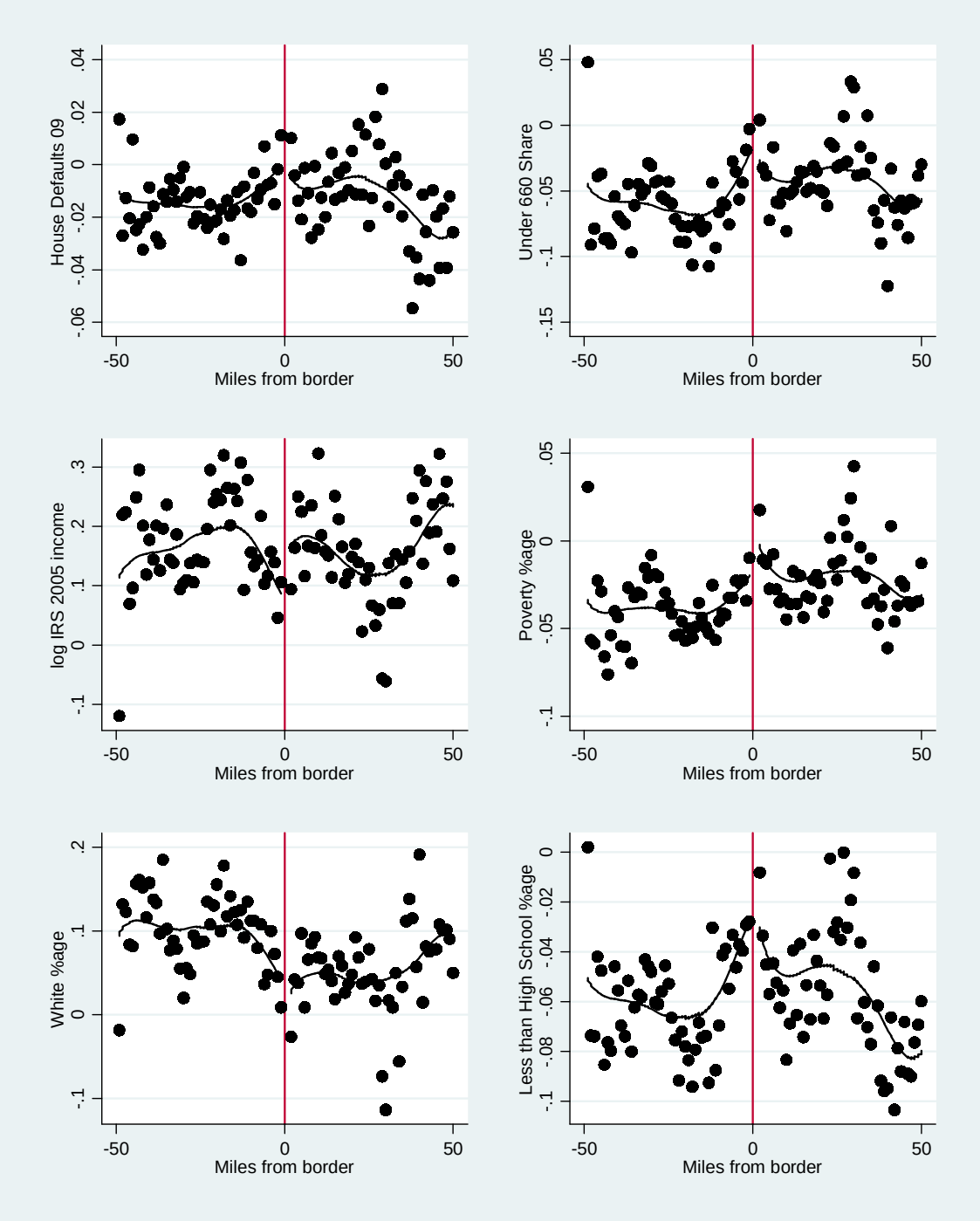


Figure 6
New For Sale Listings: Zip Codes Near Border Sample

The figure plots the number of houses newly listed for sale per homeowner in 2009 and 2010 for zip codes that are near borders where the judicial requirement regime changes across states. We generate the graphs by regressing the outcome variable on state-border-group FE and on 1-mile band distance-to-the-border dummies (where the dummies assume negative values for judicial states) and then plot the coefficients on the dummies. The border is at 0, the omitted category.

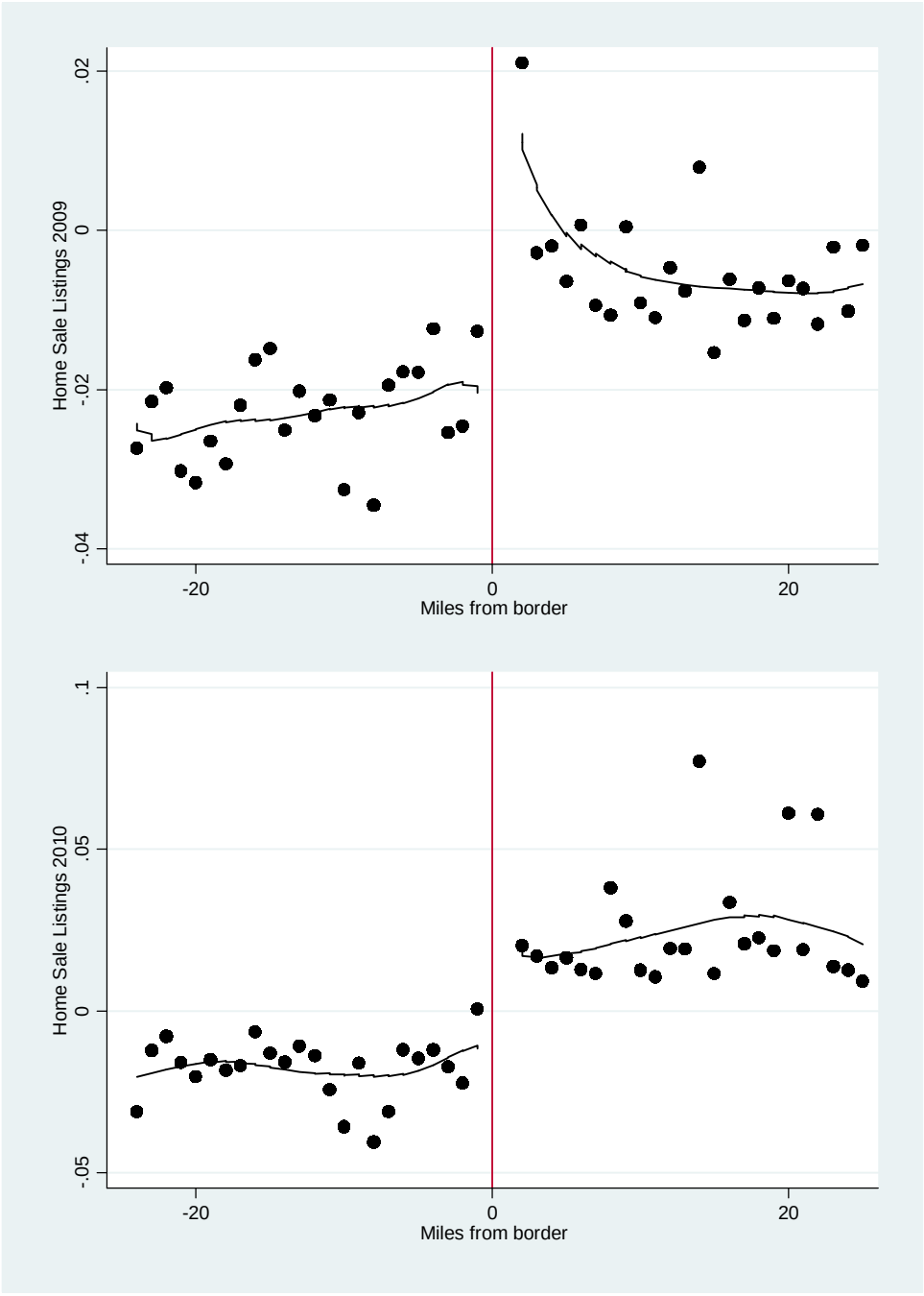


Figure 7
Foreclosures and House Prices, Reduced Form

The figures plots house price growth in judicial and non-judicial states from 2004 to 2011. The averages are weighted by total population.

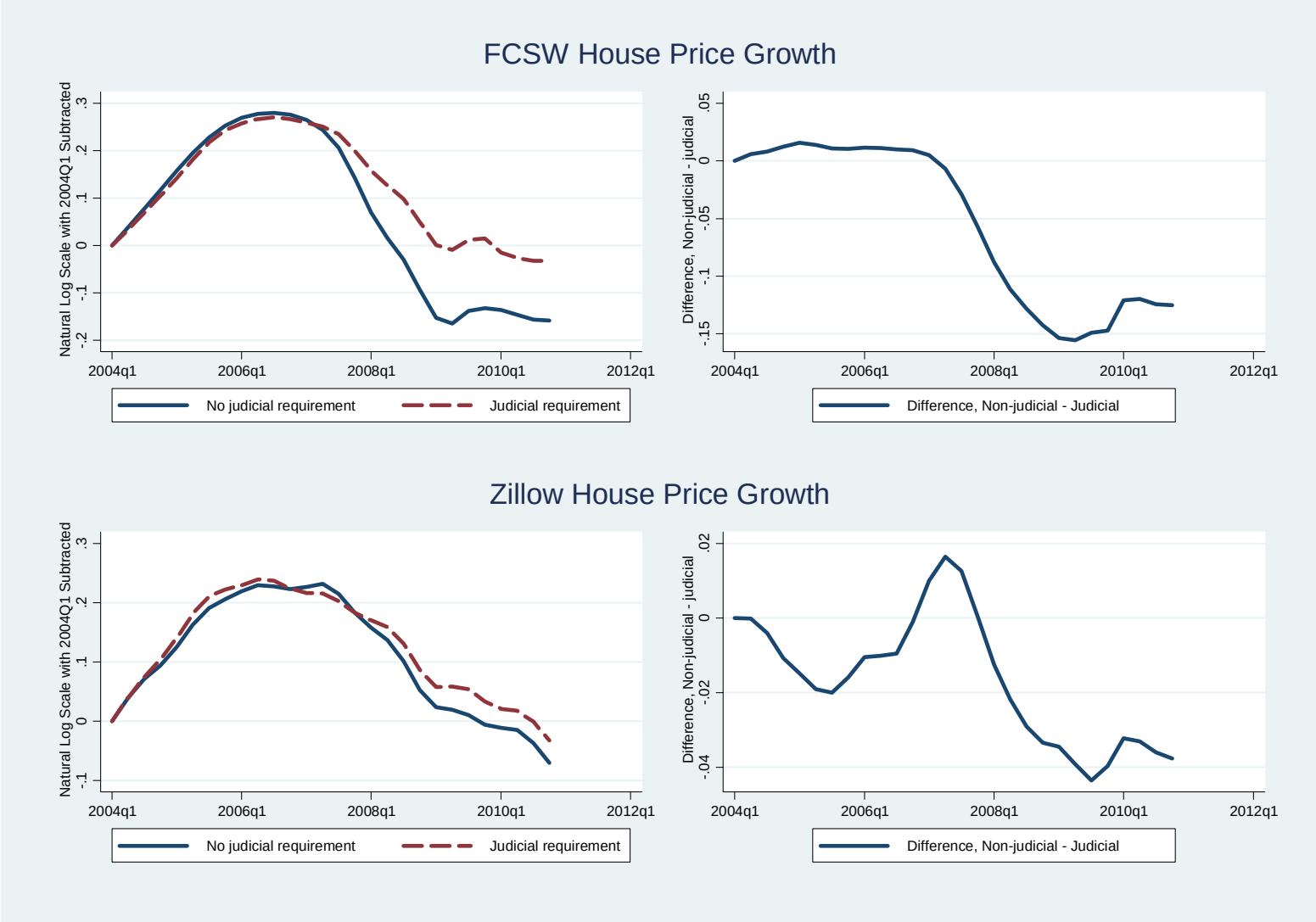


Figure 8
House Price Growth 2008-09: Zip Codes Near Border Sample

The figure plots house price growth from 2008 to 2009 for zip codes that are near borders where the judicial requirement regime changes across states. We generate the graphs by regressing the outcome variable on state-border-group FE and on 1-mile band distance-to-the-border dummies (where the dummies assume negative values for judicial states) and then plot the coefficients on the dummies. The border is at 0, the omitted category.

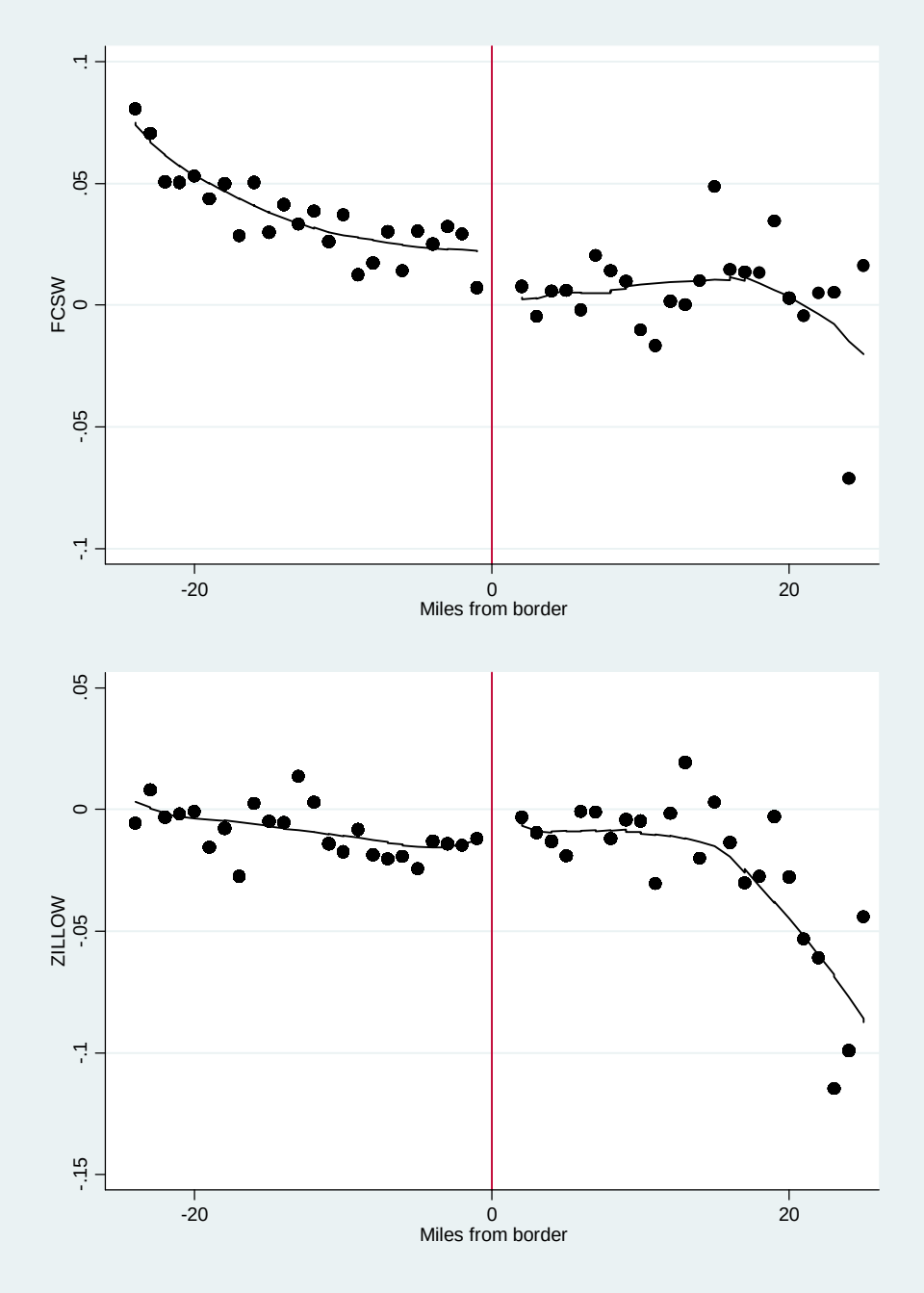
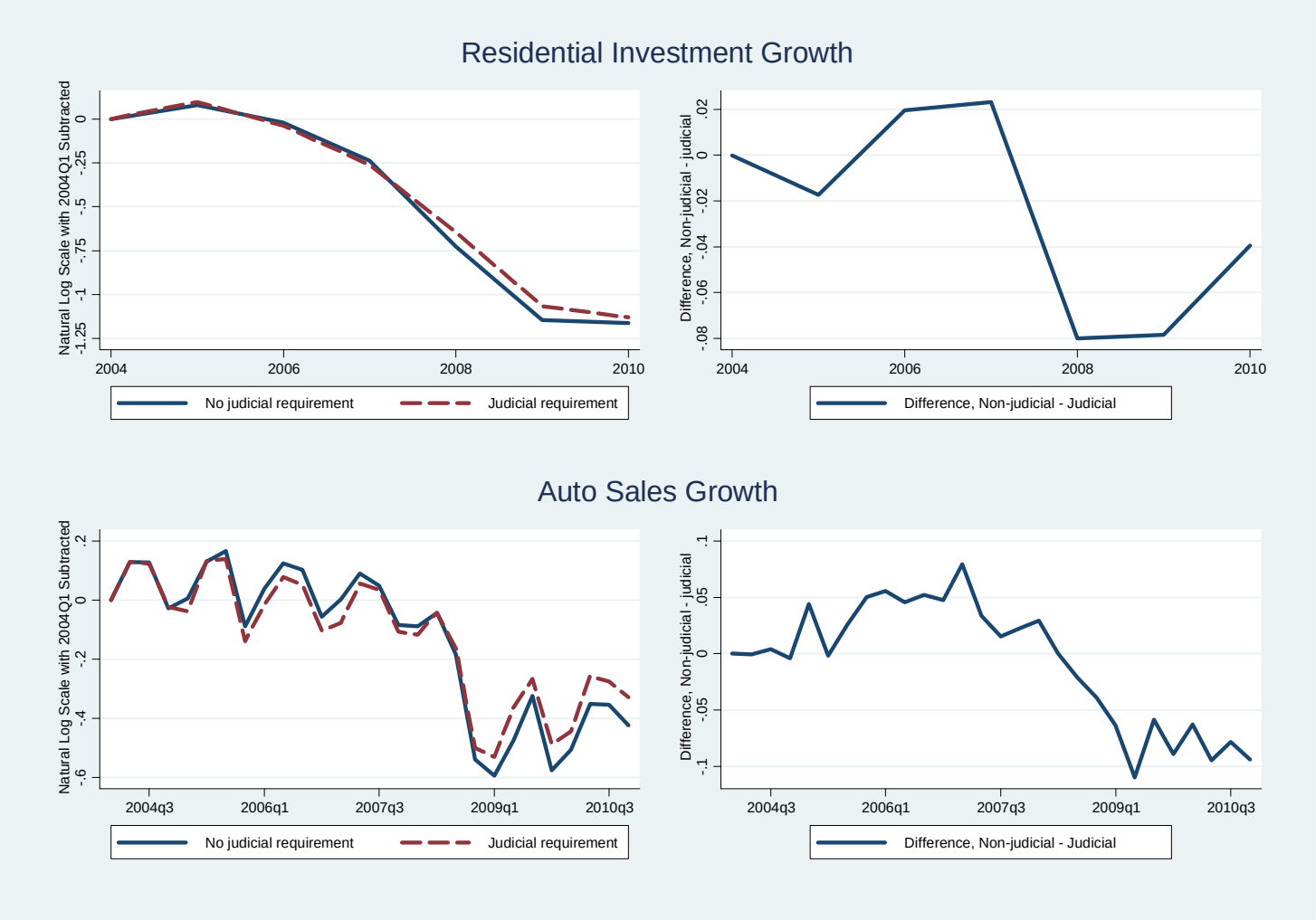


Figure 9

Foreclosures, Residential Investment, and Durable Consumption, Reduced Form

The figures plot residential investment (top) and auto sales (bottom) growth in judicial and non-judicial states from 2004 to 2010. The averages are weighted by total population.



ONLINE APPENDIX
"Foreclosures, House Prices, and the Real Economy"
Atif Mian
Amir Sufi
Francesco Trebbi

[NOT FOR PUBLICATION]

Appendix Table 1: Addressing the Mortgage Bankers Association Data

The Mortgage Bankers' Association makes available state by year data on foreclosure starts. The MBA leaves it to servicers to report whether they have initiated a foreclosure. However, the advice they provide is that a foreclosure start represents any time a servicer has made a decision that a foreclosure is going to be initiated either through a referral or a court filing. As a result, a foreclosure start in the MBA data will be very closely linked to the initial legal filing that begins the foreclosure process.

It is crucial to understand that there are two stages of the foreclosure process: the pre-auction stage (a "notice of default" or "lis pendens" filing) and the auction stage (a "notice of trustee sale" filing or a "notice of foreclosure sale" filing). As explained in Section I, our analysis is focused on foreclosures at the auction stage where foreclosed homes come to the market.

Unfortunately, the MBA data do not measure what is crucial for our analysis: when a home enters the auction stage of the foreclosure process. Instead, the MBA data are more accurate in measuring when the foreclosure process starts, which will often be when an initial pre-auction filing occurs.

More specifically, in states where a pre-auction filing is required, the MBA data will report a foreclosure start before the auction stage that we would like to measure. It is for this reason the RealtyTrac data are so valuable. They allow us to measure when the foreclosure process reaches the auction stage. In general, the MBA data do not measure the relevant stage of foreclosure for our analysis.

Further, this measurement problem means that one cannot use the MBA data to measure foreclosure auction differences across judicial and non-judicial states. Doing so leads to a mechanical and systematic bias. The reason is two-fold. First, all states that require a judicial foreclosure require a pre-auction filing. Of the 30 states that do not require a judicial foreclosure, 16 do not require a pre-auction filing. As a result, if one incorrectly uses the MBA data to measure foreclosure auctions, he would systematically and mechanically overstate the number of foreclosure auctions in judicial states relative to non-judicial states. Because many non-judicial states do not require a pre-auction filing, the MBA data will mechanically show lower foreclosure starts in non-judicial states.

Second, even if all non-judicial states required a pre-auction filing, we know from Section I that foreclosures move from the pre-auction stage to the auction stage much more quickly in non-judicial states. As a result, the foreclosure start data from the MBA for non-judicial states would

more accurately reflect actual auctions, whereas they would systematically overstate auctions for judicial states.

Appendix Table 1 shows evidence supporting the arguments above. In column 1, we repeat the first stage regression relating foreclosure auctions per homeowner in 2008 to the judicial requirement indicator variable. It shows the negative and statistically significant coefficient that is the basis of our empirical strategy. Column 2 reports the same specification but with the left hand side being pre-auction filings per homeowner as of 2008 according to RealtyTrac. It shows a positive and statistically significant coefficient. This reflects a *mechanical* result given that 16 states with no judicial requirement do not require a pre-auction filing. In column 3 we exclude these 16 states and the coefficient is cut by 60% and is statistically insignificant.

In column 4, we use as the left hand side variable foreclosure starts from the MBA, which is measured as a fraction of total mortgages serviced in their survey. It shows a coefficient of 0. This should not be surprising given the analysis above. The MBA data are measuring foreclosure starts and not foreclosure auctions.

There is another implication of these facts that is worth mentioning: the foreclosure inventory data from the MBA--which measures foreclosures that have not yet reached the auction stage--will also be mechanically higher for judicial states. This is because some non-judicial states do not require a pre-auction filing. For these non-judicial states, many foreclosures will never enter the MBA inventory because the first filing will be the auction filing. There is therefore higher inventory in judicial states, but this is mechanical. Alternatively, even in non-judicial states that require a pre-auction filing, we know that the total time from pre-auction filing to auction is faster in non-judicial states. Again, this will mean that there will be higher foreclosure inventory in judicial states at any point in time, as foreclosures leave the inventory after the auction. As a result, part of the MBA-measured higher foreclosure inventory in judicial states will be mechanical, and part will be a function of the faster time to foreclose in non-judicial states.

Appendix Table 2: Ex Ante Credit Supply

In Appendix Table 2, we report results from our estimation of the following equation:

$$Outcome_{zbsx} = \alpha_{bsx} + \theta * JudicialForeclosureRequirement_s + \eta_{zbsx}$$

where an outcome in zip code *z* near state border *b* in state *s* is regressed on a border-state-10-mile strip fixed effect and the judicial foreclosure requirement indicator variable. In Panel A of Appendix Table 2, we first replicate the first stage where the outcome variable is the foreclosure rate. As column 1 shows, the foreclosure rate per homeowner is significantly lower in judicial states. The magnitude of the effect is similar to the state level evidence in Table 4. Column 2 shows that the foreclosure per delinquency ratio is also much lower in zip codes on the judicial state side of the border.

In column 3, we examine whether the average mortgage for home purchase in a zip code is smaller if the zip code is in a judicial state. This specification is similar to the one reported in Pence (2006) except we are using the average in a zip code instead of the underlying loans and we are examining the 2005 loans instead of 1994 and 1995 loans. The mortgage data come from

HMDA. In column 4, we use an alternative left hand side variable, which is the total amount of mortgages for home purchase in a zip code scaled by total income from the IRS in that zip code. As the estimates in columns 3 and 4 show, we find no evidence that average loan sizes or total lending are significantly lower in judicial states, despite the fact that ex post foreclosure rates are significantly lower. The standard errors are sufficiently small that we can reject at the 10% level the hypothesis that loans sizes or loans to income are 3/4 standard deviation lower in zip codes on the judicial state side of the border.

To further explore this issue, Panel B presents the same coefficients as in columns 3 and 4 but for every year going back to 1992. While statistical power is clearly an issue, we find very similar point estimates as Pence (2006) in the early part of the sample: lenders extended smaller and fewer loans to zip codes in judicial states. However, beginning in the middle 1990s and lasting throughout the housing boom, the coefficient estimates move toward zero and then turn positive. In other words, lenders during the housing boom did not take into account the ex post differences in foreclosure rates between judicial and non-judicial states.

We also isolate the sample to loans that were not sold to GSEs given the argument that GSEs may not discriminate between judicial and non-judicial foreclosure states. The results are similar. The standard errors across all specifications are small enough that we can reject at the 10% level of confidence that lenders extended loan amounts or loan sizes to judicial states in any year from 2000 to 2004 that were 1/2 standard deviation lower than non-judicial states.

We conclude based on this evidence that there is no differential credit supply effect in non-judicial versus judicial states in the years before the foreclosure crisis.

Appendix Table 3: Other state-level foreclosure and delinquency laws

State laws requiring foreclosures to take place through courts are only one of many legal differences in mortgage markets across states. To assess the importance of the additional legal differences, we employ the Rao and Walsh (2009) taxonomy of consumer protection clauses included in state foreclosure statutes.[1] Our goal is to examine whether other legal differences are (1) responsible for our results on judicial foreclosure requirement and (2) important in their own right.

Rao and Walsh (2009) list the following six pre-sale protections: Access to court review; loss mitigation requirement before foreclosure; right to cure before acceleration; right to reinstate before sale; personal service requirement for complaint or sale notice; and housing emergency assistance fund. They also list four common post-sale protections: Right to redeem; deficiency judgments; accounting of sale proceeds; prompt return of surplus. While some of these dimensions correlate quite highly with judicial foreclosures (access to court review has a positive correlation of 69%), others display almost no correlation (right to reinstate before sale has a negative correlation of -1%).

[1] We thank Christopher James for pointing us in this direction.

In regressions some of which are reported in Appendix Table 3, we estimate augmented versions of the four main specifications in the top panel of Table 4. We regress the outcomes of interest on an indicator variable for whether the state requires judicial foreclosure with the addition of a discrete control variable taking value 1 if any of the ten consumer protection clauses in Rao and Walsh (2009) is present in a strong form, 1/2 if present but weak, and 0 if missing. We add each clause individually to the specification and the whole set of ten clauses simultaneously. This latter case is reported in the appendix.

Examining the foreclosure per homeowner ratio in 2008 and 2009, the judicial foreclosure indicator maintains its original size and significance in each of the ten augmented specifications and in the specification with all clauses simultaneously (column 1). Foreclosure rates appear significantly lower in judicial foreclosure states. The judicial foreclosure variable eliminates the statistical significance of all of the other Rao and Walsh (2009) clauses except for the "right to redeem." The results are similar if we control for delinquencies per homeowner in 2008 and 2009 and when the left-hand-side variable is the foreclosure per delinquency ratio in 2008 and 2009.

Mortgage delinquencies do not display a correlation with whether states require judicial foreclosure, and they also display no strong correlation with any of the ten consumer protection clauses in Rao and Walsh (2009). We are unable to reject at the 10% level the hypothesis that delinquencies per homeowner are significantly different along any of these ten legal dimensions. In sum, we find that the judicial foreclosure requirement is the most relevant legal difference for explaining foreclosure rates and we find no evidence that any other legal difference is polluting our first stage estimate.

Appendix Tables 4-5, Appendix Figure 2: The Classification of Massachusetts

RealtyTrac classifies Massachusetts as a state that requires judicial approval for a foreclosure. Their justification for this classification is as follows:

"While Massachusetts provides for a non-judicial foreclosure, prior to sale, an action must be filed with the Land Court to obtain a judgment that the owners of the subject property are not protected under the Soldiers' and Sailors' Civil Relief Act of 1940, as amended. A complaint is filed with the Land Court and the court provides an Order of Notice which must be served, published and recorded prior to judgment entering."

The foreclosure rate evidence strongly supports the view that foreclosures in Massachusetts take more time and are less likely than in other non-judicial states in the region. There are two states that border Massachusetts (New Hampshire and Rhode Island) that are unambiguously states that do not have a judicial foreclosure requirement. According to RealtyTrac, the period of time it takes to conduct a foreclosure is longer in Massachusetts than in either New Hampshire or Rhode Island.

In Appendix Table 4 Panel A, we show using our data that foreclosure rates per homeowner are in fact significantly lower in Massachusetts than in New Hampshire and Rhode Island, two states

that unambiguously do not require a legal filing for foreclosure. Massachusetts has a foreclosure rate per homeowner that is 2.5% compared to 3.6% in New Hampshire and 4.5% in Rhode Island. In fact, New Hampshire has a *lower* number of delinquencies than Massachusetts despite having a *higher* number of foreclosures. The pass-through rate to foreclosure is much lower in Massachusetts than in either New Hampshire or Rhode Island.

In Panel B, we use zip codes in these three states to show that foreclosures per homeowner are statistically and economically significantly lower in Massachusetts than New Hampshire and Rhode Island. After conditioning on delinquencies and all control variables, Massachusetts continues to show a 1.3% lower rate of foreclosures per homeowner, which is over 1/3 the mean in the zip code level sample.

Further, as columns 3 and 4 show, the rate of delinquencies is close to identical in the three states. So the evidence is incontrovertible that foreclosures are lower in Massachusetts than New Hampshire and Rhode Island, and this difference is not a function of delinquencies or a large set of control variables. It seems reasonable that the RealtyTrac classification is correct in that the legal filing requirement in Massachusetts is an impediment to a quick foreclosure.

Regardless, in Appendix Table 5 we replicate the state level coefficients of the core results switching Massachusetts from a judicial to a non-judicial state. The results are largely similar. Appendix Figure 2 shows that the border sample first stage graphs look very similar even when classifying Massachusetts as a non-judicial state.

In summary, the RealtyTrac classification of Massachusetts as a judicial requirement state is consistent with the lower foreclosure rate in Massachusetts relative to New Hampshire and Rhode Island. This lower foreclosure rate is not driven by delinquencies or other control variables. Further, our results are qualitatively similar even if we classify Massachusetts as a non-judicial state.

Appendix Table 6: Exclusion of Arizona and Nevada

Appendix Table 6 presents the main results of the paper with the exclusion of Arizona and Nevada. We exclude these two states because they have very high rates of foreclosure relative to other states. All results are materially unchanged. The only results that show some movement in the coefficients are the house price growth results using FCSW. Recall that FCSW is only available for 24 states in the sample, and so a reduction in the sample size of 2 is a significant reduction.

Appendix Table 7: 2001 Placebo Test

Appendix Table 7 presents the 2001 placebo test. The concern we are addressing is that non-judicial states are inherently more cyclical and therefore more prone to booms and busts. We use the 2001 recession as a placebo test because we know that house price declines and foreclosures were largely absent relative to the 2007 to 2009 recession. As the results show, the reduced form

relation between auto sales and residential investment growth and judicial foreclosure requirement is positive and significant during the 2007 and 2009 recession. But there is no correlation during the 2001 recession. The standard errors are small and we can reject at the 5% level of confidence the hypothesis that the coefficient is the same during the 2001 recession as the 2007 to 2009 recession. This placebo test mitigates the concern that states without a judicial requirement for foreclosure are inherently more cyclical.

Appendix Figure 1: S&P 17 and OFEHO

Given that the zip code level FCSW and Zillow house price indices are not available for public use, in Appendix Figure 1 we replicate our findings using publicly available S&P/Case-Shiller and FHFA CBSA level data. For the S&P CS indices, we exclude three MSAs that cross the borders of states that differ in their judicial foreclosure requirement laws (Chicago, IL; Charlotte, NC; and Washington, DC). The relative drop in non-judicial states using the S&P CS publicly available data is 12%, and the relative drop using FHFA is 3%. FHFA data excludes non-conforming (mostly subprime and jumbo loans) loans in its construction and hence tends to underestimate house price changes driven by the mortgage crisis. This figure corresponds with Figure 7 in the text.

References:

Rao, John and Geoff Walsh, 2009, “Foreclosing a Dream” National Consumer Law Center Inc.

Appendix Table 1
Exploration of MBA foreclosure start data

This table relates foreclosure filings as measured by RealtyTrac (RT) and the Mortgage Bankers' Association National Delinquency Survey to whether a state has a judicial requirement for foreclosure.

	(1) Foreclosure auction filings per homeowner, RT, 2008	(2) Foreclosure pre-auction filings per homeowner, RT, 2008	(3) Foreclosure pre-auction filings per homeowner, RT, 2008	(4) Foreclosure starts per mortgage, MBA, 2008
Judicial foreclosure requirement	-0.009**	0.005*	0.002	-0.000
	(0.003)	(0.002)	(0.002)	(0.000)
Delinquencies per homeowner, 2008	0.416**	0.285**	0.356**	0.144**
	(0.054)	(0.038)	(0.039)	(0.009)
Constant	-0.004	-0.012**	-0.014**	-0.000
	(0.004)	(0.003)	(0.003)	(0.001)
Sample	Full	Full	States requiring pre-auction filing	Full
N	51	51	35	51
R^2	0.600	0.563	0.725	0.838

Appendix Table 2
Ex Ante Credit Supply, Zip Codes Near Border Sample

This table presents evidence on whether zip codes in judicial versus non-judicial states experience differential credit supply before the foreclosure crisis in 2008 and 2009. The sample for all specifications is the border discontinuity zip code sample, and all specifications include border-strip fixed effects. Columns 1 and 2 of Panel A replicate the first stage in the border discontinuity sample. Loan size is defined to be the average loan size of mortgages originated for the purpose of home purchase in a zip code. Loans to income is the total amount of mortgages originated for the purpose of home purchase scaled by total aggregate IRS income in the zip code. Non-GSE loans are mortgages that are not sold to a GSE within a year of origination. In Panel B, each coefficient is from a separate regression for the dependent variable in the column heading and the year in the row heading. Standard errors in all specifications are clustered at the border-strip level.

Panel A: First Stage and 2005 Credit Supply Measures

	(1) Foreclosures per homeowner 08-09	(2) Foreclosures per delinquency 08-09	(3) Ln(loan size 05)	(4) Loans/Income, 05
Judicial foreclosure requirement	-0.021*	-0.118*	0.045	-0.008
	(0.008)	(0.052)	(0.061)	(0.019)
Delinquencies per homeowner, 08-09	0.586**			
	(0.073)			
Constant	-0.002	0.413**	5.101**	0.164**
	(0.008)	(0.030)	(0.035)	(0.011)
N	870	869	866	866
R^2	0.713	0.457	0.441	0.256

Panel B: Coefficients by Year

	Ln(loan size)		Loans/Income		Non-GSE Loans/Income	
	Coeff	Std Error	Coeff	Std Error	Coeff	Std Error
1992	-0.0381	(0.054)	-0.0153	(0.010)	-0.0069	(0.005)
1993	-0.0365	(0.063)	-0.0245	(0.019)	-0.0079	(0.006)
1994	-0.0262	(0.066)	-0.0136	(0.018)	-0.0048	(0.009)
1995	-0.0012	(0.062)	-0.0127	(0.016)	-0.0061	(0.009)
1996	0.0260	(0.074)	-0.0106	(0.020)	-0.0025	(0.011)
1997	0.0245	(0.076)	-0.0084	(0.020)	-0.0017	(0.010)
1998	0.0429	(0.071)	-0.0083	(0.025)	-0.0022	(0.012)
1999	0.0576	(0.073)	-0.0058	(0.022)	0.0004	(0.011)
2000	0.0735	(0.072)	-0.0031	(0.017)	0.0041	(0.010)
2001	0.0841	(0.073)	0.0101	(0.015)	0.0073	(0.008)
2002	0.0941	(0.084)	0.0100	(0.016)	0.0096	(0.009)
2003	0.0546	(0.064)	0.0074	(0.015)	0.0067	(0.010)
2004	0.0502	(0.054)	0.0088	(0.019)	0.0087	(0.016)
2005	0.0452	(0.061)	-0.0081	(0.019)	-0.0060	(0.018)
2006	0.0089	(0.056)	-0.0125	(0.018)	-0.0093	(0.015)
2007	-0.0204	(0.051)	-0.0064	(0.014)	-0.0025	(0.010)

**,*,+ Coefficient statistically different than zero at the 1%, 5%, and 10% confidence level, respectively

Appendix Table 3
Foreclosure Statutes in Detail

The table presents coefficients from the first stage regression of foreclosures on whether a state requires a judicial foreclosure and all the consumer protection provisions reported in Rao and Walsh (2009). Standard errors are heteroskedasticity-robust.

	First Stage		
	(1) Foreclosures per homeowner 08-09	(2) Foreclosures per delinquency 08-09	(3) Delinquencies per homeowner 08-09
Judicial foreclosure requirement	-0.020**	-0.160**	-0.006
	(0.005)	(0.049)	(0.015)
Delinquencies per homeowner, 08-09	0.625**	1.351*	
	(0.100)	(0.517)	
Access to court review	0.008	0.071	-0.017
	(0.006)	(0.059)	(0.013)
Loss mitigation	-0.004	0.014	0.064
	(0.011)	(0.096)	(0.040)
Right to cure	-0.001	-0.054	-0.002
	(0.007)	(0.060)	(0.025)
Right to reinstate	-0.004	0.023	0.007
	(0.008)	(0.059)	(0.019)
Personal service requirement	-0.012	-0.092	-0.002
	(0.008)	(0.056)	(0.013)
Housing emergency fund	0.001	0.013	-0.023
	(0.007)	(0.060)	(0.018)
Right to redeem	-0.013*	-0.103+	-0.013
	(0.006)	(0.052)	(0.019)
Deficiency judgment	0.010	0.065	-0.014
	(0.007)	(0.060)	(0.014)
Accounting for sale proceeds	0.007	-0.014	0.015
	(0.011)	(0.084)	(0.022)
Prompt return of surplus	-0.011	-0.078	0.004
	(0.011)	(0.083)	(0.023)
Constant	-0.015	0.266**	0.102**
	(0.010)	(0.063)	(0.011)
N	51	51	51
R^2	0.748	0.517	0.163

Appendix Table 4
Foreclosures Lower in Massachusetts than New Hampshire and Rhode Island

This table shows that foreclosure rates are lower in Massachusetts relative to New Hampshire and Rhode Island, the latter two being states in New England where foreclosures require no legal filings. Panel A shows the mean differences. Panel B shows the regression coefficient on a Massachusetts indicator variable for zip codes in these three states. Standard errors for the coefficients in Panel B are clustered at the state level.

Panel A: Foreclosure Rates in MA, NH, and RI

	(1) Foreclosures per homeowner, 2008-2009	(2) Delinquencies per homeowner, 2008-2009	(3) Foreclosures per delinquency, 2008-2009
Massachusetts	0.025	0.079	0.251
New Hampshire	0.036	0.070	0.413
Rhode Island	0.045	0.096	0.345

Panel B: Regression Coefficient on Massachusetts Indicator Variable in Zip Code Level Data

	Foreclosures per homeowner		Delinquencies per homeowner	
	(1)	(2) With all controls listed in Table 6, column 3	(3)	(4) With all controls listed in Table 6, column 3
Massachusetts Indicator	-0.015**	-0.013*	0.001	0.003
	(0.001)	(0.003)	(0.006)	(0.003)
Delinquencies per homeowner	0.337*	0.215*		
	(0.052)	(0.007)		
Constant	0.015	-0.070+	0.079**	-0.043
	(0.005)	(0.022)	(0.006)	(0.127)
N	791	629	792	629
R^2	0.41	0.76	0.00	0.60

**,*,+ Coefficient statistically different than zero at the 1%, 5%, and 10% confidence level, respectively

Appendix Table 5
Results Switching Massachusetts to Non-Judicial State

This table replicates the first and second specifications for each dependent variable (from Tables 6, 8, and 9) when switching Massachusetts to a non-judicial state.

	State level	
	Only Delinquency Control	Delinquency and lagged dependent variable growth controls
	Zillow house price growth, 2007 to 2009	
Foreclosures per homeowner, 2008-2009	-1.962*	-1.423*
	(0.866)	(0.648)
	FCSW house price growth, 2007 to 2009	
Foreclosures per homeowner, 2008-2009	-1.699*	-1.159
	(0.844)	(0.774)
	Permit growth, 2007 to 2009	
Foreclosures per homeowner, 2008-2009	-5.606*	-5.089*
	(2.598)	(2.384)
	Auto sales growth, 2007 to 2009	
Foreclosures per homeowner, 2008-2009	-2.574+	-2.842+
	(1.529)	(1.578)

**,*,+ Coefficient statistically different than zero at the 1%, 5%, and 10% confidence level, respectively

Appendix Table 6
Results without Arizona and Nevada

This table replicates the first and second specifications for each dependent variable (from Tables 6, 8, and 9) after removing the two states (Arizona and Nevada) with the highest foreclosure rates.

	State level	
	Only Delinquency Control	Delinquency and lagged dependent variable growth controls
	Zillow house price growth, 2007 to 2009	
Foreclosures per homeowner, 2008-2009	-1.936+	-1.387+
	(1.079)	(0.789)
	FCSW house price growth, 2007 to 2009	
Foreclosures per homeowner, 2008-2009	-1.599	-0.920
	(1.283)	(1.284)
	Permit growth, 2007 to 2009	
Foreclosures per homeowner, 2008-2009	-6.689*	-5.882+
	(3.187)	(3.032)
	Auto sales growth, 2007 to 2009	
Foreclosures per homeowner, 2008-2009	-3.333+	-3.616+
	(1.991)	(1.953)

**,*,+ Coefficient statistically different than zero at the 1%, 5%, and 10% confidence level, respectively

Appendix Table 7
2001 Recession Placebo Test

This table presents the reduced form relation between permits and auto sales growth during the 2007 to 2009 recession and the 2001 recession. The 2001 recession represents a placebo test because there were negligible foreclosures and house prices did not decline. All specifications include a control variable for household delinquencies per homeowner during the same time period as the left hand side variable.

Panel A: Residential permits

	Residential permits growth, 2007 to 2009	Residential permits growth, 2000 to 2001	Residential permits growth, 2000 to 2002
Judicial foreclosure requirement	0.124*	-0.009	-0.015
	(0.058)	(0.025)	(0.041)
N	51	51	51

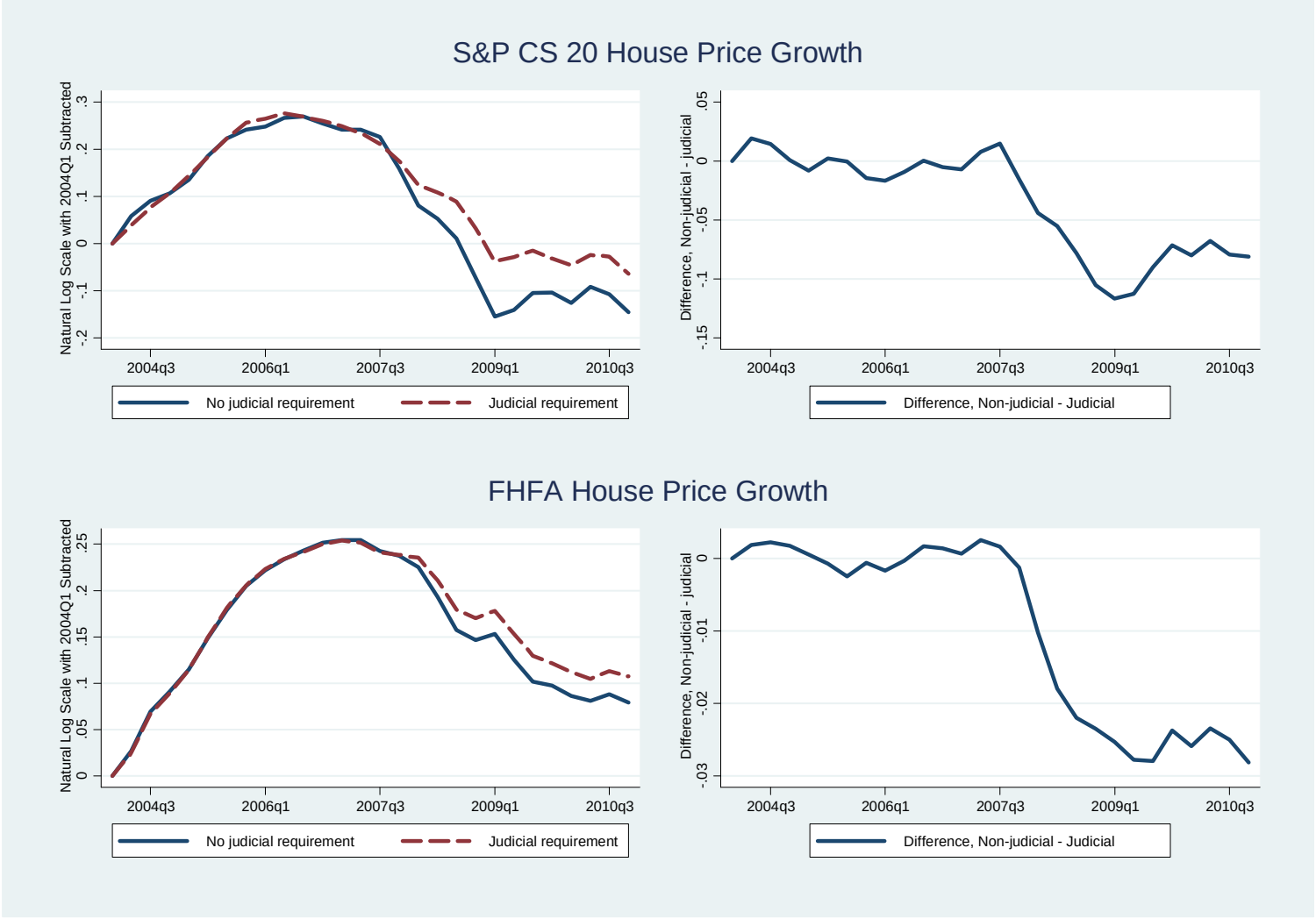
Panel B: Auto sales

	Auto sales growth, 2007 to 2009	Auto sales growth, 2000 to 2001	Auto sales growth, 2000 to 2002
Foreclosures per homeowner	0.062+	0.015	0.005
	(0.033)	(0.014)	(0.021)
N	51	51	51

**,*,+ Coefficient statistically different than zero at the 1%, 5%, and 10% confidence level, respectively

Appendix Figure 1
Foreclosures and House Prices using Publicly Available Data, Reduced Form

The figures plots house price growth in judicial and non-judicial states from 2004 to 2009. The averages are weighted by total population.



Appendix Figure 2
Judicial Foreclosure Requirement and Actual Foreclosures
Zip Codes Near Border Sample

This figure replicates Figure 4 but with Massachusetts switched to a non-judicial state