Foreclosures, House Prices, and the Real Economy*

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Abstract

From 2007 to 2009, states without a judicial requirement for foreclosures were more than *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 jumped discretely as one entered non-judicial states. There is no jump in other homeowner attributes such as credit scores, income, or education levels. Using state judicial requirement as an instrument for foreclosures, we show that foreclosures led to a large decline in house prices, residential investment, and consumer demand from 2007 to 2009. As foreclosures subsided from 2011 to 2013, the difference between foreclosure rates in non-judicial and judicial requirement states shrank and we find evidence of a stronger recovery in non-judicial states.

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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. Mortgage contracts give lenders the right to foreclose on a home if the homeowner defaults on his payment obligations. When a major shock hits the economy and millions of homeowners simultaneously default, theory suggests that the fire sale of foreclosed homes could lead to a further reduction in house prices, threatening real activity such as residential investment and consumer demand.[1]

As Figure 1 shows, the default rate on household debt and foreclosures skyrocketed from 2006 to 2009, before falling sharply from 2010 to 2013. This paper investigates the effect of this unprecedented foreclosure wave on house prices and real activity. This 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 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. 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

[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)

require judicial foreclosure impose substantial costs and time on lenders seeking to foreclose on a house.

Do legal differences in foreclosure laws affect the propensity to foreclose on a home? We find that the answer is a resounding yes. During the heart of the foreclosure crisis in 2008 and 2009, a delinquent homeowner in a non-judicial foreclosure state was more than *twice* as likely to experience foreclosure on a delinquent home. For example, there were 1.6 foreclosures per homeowner with a mortgage in the 2008-09 period in judicial foreclosure states versus 3.6 in non-judicial foreclosure states.

Zip code level analysis around bordering states that differ in their foreclosure laws shows a discontinuous jump in foreclosure propensity as one moves from judicial to non-judicial state. A similar jump is observed when we look at new house for sale listings, and the higher foreclosure propensity persists until 2010. Thus differences in state laws are associated with a large increase in foreclosure rates that translate into greater housing supply on the market.

The strong correlation between state foreclosure laws and foreclosure propensity suggests that state law may be used as an instrument for foreclosures. But what drives the difference in state foreclosure laws? One may be worried that differences in state foreclosure laws are spuriously correlated with state attributes that independently influence foreclosure propensity.

Ghent (2012) performs an in-depth analysis of the history of state foreclosure laws and summarizes her findings by saying that “there do not seem to be clear economic reasons for the different patterns of development in America’s mortgage laws”. She traces differences in state mortgage laws to “path-dependent quirks”. Consistent with Ghent’s observations, we find that state foreclosure laws are orthogonal to a wide range of state-specific economic attributes.

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, mortgage interest rates from 2002 to 2005, loan-to-value ratios of loans from 2002 to 2005, 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, the default rate, or house price growth from 2002 to 2005.[2]

Given the very strong effect of the judicial foreclosure requirement on foreclosures and the plentiful evidence that states with and without the requirement are otherwise similar, we use state foreclosure laws as an instrument to estimate the effect of foreclosures on house prices. We find that foreclosures have a strong effect on house prices. 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. A back-of-the-envelope calculation suggests that the foreclosure-induced increase in supply of houses can plausibly explain the entire house price effect of foreclosures. For example, our estimates imply that a foreclosure-induced increase of 10% in the supply of houses in non-judicial states decreased house prices by 4 percentage points.

Theoretical models predicting a supply-induced price effect of foreclosures often rely on temporary market displacement where natural buyers of an asset face limits in their ability to purchase homes, a phenomenon known as a fire sale.[3] In these models, a price rebound can occur

[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.
[3] Shleifer and Vishny (1992), Krishnamurthy (2003), and Lorenzoni (2008) all emphasize that the negative effect of asset sales on prices is amplified when the economy is weak and potential buyers who value the asset most cannot buy. As Krishnamurthy (2003) puts it, "The central idea is that *bad times for the economy* will also be times when the liquidation value of the collateral will be low since *potential buyers of these assets will be cash-strapped*" (our emphasis).

if the flow of houses hitting the market slows. A price rebound could also occur if limits on the ability of investors or owner-occupiers to purchase houses are lifted; for example, investors may take time to form pools of capital and mortgage lending may eventually become available for potential home-owners.

Our data on foreclosures go through the end of 2013, which allows us to evaluate the effects of foreclosures on house prices through the full cycle shown in Figure 1. From 2011 to 2013, the aggregate number of foreclosures declined significantly, as did the relative foreclosure rate in non-judicial versus judicial foreclosure states. By 2013, the difference in foreclosure rates between non-judicial and judicial states disappeared. We find evidence that prices rebounded more strongly in 2011 and 2012 in non-judicial states precisely as foreclosure propensity declined. By 2012, we cannot reject the hypothesis that house price growth from 2007 to 2012 was the same in judicial and non-judicial states. Foreclosures had a strong negative effect on prices during the heart of the Great Recession, but the effect appears to be reversed when the economy strengthened.

Does the foreclosure-induced reduction in house prices from 2007 to 2009 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 (2013) 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 during the Great Recession lead 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.[4] As house prices rebounded in 2011 and 2012 in non-judicial foreclosure states, permits and auto sales also caught up.

We use our estimates to quantify the aggregate effects of foreclosure on the macro-economy. From 2007 to 2009, our estimates suggest that foreclosures were responsible for 33% of the decline in house prices, 20% of the decline in residential investment, and 20% of the decline in auto sales over the same period. The details of this calculation are in Section V.

As mentioned above, house prices and real economic activity recovered faster in 2011 and 2012 in non-judicial foreclosure states as the foreclosure crisis subsided. An obvious question is why foreclosures matter if prices eventually rebound. The answer is that the additional decline in house prices and real economic activity in 2007 to 2009 were likely more painful because of the severe recession. In models of fire sales, the timing matters for the aggregate economy because fire sales occur when the economy is already very weak (e.g., Kiyotaki and Moore (1997) and Krishnamurthy (2003)).

Our findings are most closely related to recent studies on foreclosures and house prices (Calomiris, et al (2013), Campbell, et al (2011), Foote, et al (2008), Hartley (2010)). 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 all the way through the end of 2012.[5] Exploring the foreclosure crisis through its full cycle is important because, as we show, states that had been experiencing higher foreclosure rates from 2007 to 2010 recovered faster in 2011 and 2012 as foreclosure rates declined. In addition, we are the first to examine how foreclosures affect real economic activity.

[4] We conduct a number of robustness tests for these results. See Section V and the online appendix.
[5] 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.

Our study is also the first to use state laws on judicial requirement for foreclosure to identify the effect of foreclosures on house prices. [6] The importance of an instrument for foreclosures is mentioned prominently in the literature.[7] We are the first to compare the judicial requirement to other state laws related to foreclosure, and we show that it is much more important than other legal differences. We are also the first to show that the foreclosure difference between non-judicial and judicial states declined sharply in 2012 and completely disappeared in 2013.

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 2013. 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

[6] A subsequently written study by Gerardi, et al (2013) looks at the effect of the judicial foreclosure requirement on foreclosure propensity, but does not examine house prices or real economic activity. Their results strongly confirm that foreclosure propensity was much higher in non-judicial foreclosure states through April 2011, when their data end. We discuss this study in more detail below.

[7] As Campbell, et al (2011) 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.

foreclosure auction: a notice of trustee sale (NTS) and a notice of foreclosure sale (NFS). 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.

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 and foreclosure sales (NTS+NFS).[8]

Data on house prices at the zip code-quarter level are from Fiserv Case Shiller Weiss and Zillow.com. The FCSW data are available only through 2010 and the Zillow.com data through 2012. An excellent description of the differences and similarities between FCSW and Zillow.com is available in the appendix of Guerrieri, et al (2013). For a few tests, we also use house price data from CoreLogic which is also available through 2012. New residential permit data is from the Census and is available at the county-annual level through 2012. Auto sales data are from R.L. Polk and are available at the zip code-monthly frequency through 2012. For more information on the R.L. Polk data, see Mian and Sufi (2012b).

We supplement foreclosure, house price, residential investment, and auto sales data with zip code-quarterly level information on delinquencies from Equifax, which are available through

[8] 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 exclude REOs because almost all REO filings are preceded by an NTS or NFS filing, and we want to avoid double-counting.

2013.[9] 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.

We construct final data sets at both the state 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 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

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 0.028. 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 accounts per homeowners is 0.095, which implies an average pass-through from delinquency to foreclosure close to 30%.

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

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

We are interested in estimating the impact of foreclosures on house prices and real activity. As a result, we need an instrument that changes foreclosure propensity across otherwise similar areas. 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.[10] 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. Lenders in states with a *judicial foreclosure* requirement must file a notice with a judge providing evidence regarding the amount of the debt, 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

[10] General information on the foreclosure process presented in this section comes from Ghent (2012), 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.

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.).[11] 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." [12] 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.[13]

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 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

[11] 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.
[12] http://www.calculatedriskblog.com/2007/04/foreclosure-sales-and-reo-for-ubernerds.html
[13] See http://www.nytimes.com/2010/10/08/business/08frozen.html .

classification at RealtyTrac's website.[14] 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 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 in 2008 and 2009 for every state. States shaded in black require judicial foreclosure. The foreclosure rate in non-judicial states is clearly much higher. The 19 states with the highest foreclosure to delinquent account ratios all allow non-judicial foreclosure. The right panel of Figure 3 plots foreclosures per homeowner against delinquencies per homeowner focusing on the 2008 and 2009 period. 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 (slope of 0.40 versus 0.19 for judicial states).

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 0.020 lower than the foreclosure per homeowner ratio of 0.036 in non-judicial states. Foreclosure rates are more than *twice* as high in non-judicial states compared to judicial states (0.036 versus 0.016).

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

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

column (1) does not change the coefficient on judicial law dummy materially. Column (4) regresses foreclosures per delinquent account on the foreclosure law dummy. As already seen in Figure 3, foreclosures per delinquent account are much higher in non-judicial states.

A critical issue is how long the foreclosure differences between judicial and non-judicial states persist. 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 the difference peaks in 2009. The difference in foreclosure propensity declines slightly in 2010 and 2011, and then falls sharply in 2012 before becoming indistinguishable from zero in 2013. Recall from Figure 1 that the aggregate number of foreclosures also fell sharply from 2011 to 2013. As a result, in 2012 and 2013, both the total number of foreclosures and the difference in foreclosure propensity between judicial and non-judicial states were much lower than in 2008 and 2009. We will return to this fact when discussing house price patterns in 2011 and 2012.[15]

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

[15] Gerardi, et al(2013) find similar evidence of a long-lasting difference in foreclosure propensity between non-judicial and judicial states. As they state: "it is still the case that in judicial states almost 20 fewer borrowers per 100 have lost their homes 18 months after the beginning of a delinquency spell." However, they do not see higher cure rates for delinquent mortgages in judicial states which leads them to assert that eventually the foreclosure differences will subside as persistently delinquent borrowers in judicial states are foreclosed upon. They, however, do not actually see the foreclosure rate catch up because their data end in April 2011. Our findings suggest that the difference in foreclosure rates remained large through 2011, four years after the beginning of the foreclosure crisis in 2007. In 2012 and 2013, the difference disappeared.

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 encouraging 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. In other words, the transition into delinquency is exactly the same in judicial and non-judicial states, but the transition from delinquency to foreclosure is much faster in non-judicial 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 a list of 17 different variables: 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, fraction that lives in urban areas, the average interest rate on mortgages from 2002 to 2005, and the loan-to-value ratio on mortgages from 2002 to 2005.[16]

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 therefore be reasonably confident that otherwise similar states differ in their foreclosure laws, probably due to historical factors unrelated to contemporary economic conditions.

[16] The latter two variables come from CoreLogic.

D. Why do states differ in foreclosure laws: the historical perspective

Our empirical exercise requires that the variation in state foreclosure laws is orthogonal to other main factors such as leverage, income growth, or demographics that might independently influence the foreclosure propensity. We have seen through a robust array of observable variables that states that differ in foreclosure roles are remarkably similar to each other. There is no particular pattern in any of the observable variables considered to justify a serious concern that state foreclosure laws will not serve as a valid instrument.

If observable variables do not explain why foreclosure laws differ across states, what were the historical reasons for states picking one law versus another? This question is taken up in great detail by Ghent (2012). Ghent documents precisely when each state enacted the various statutes that govern foreclosure laws, with a particular focus on why some states followed the title versus the lien theory. She finds that older states are more likely to adopt the title theory. Importantly for our paper, Ghent shows that once states adopted a policy for dealing with foreclosures – say in the 19th century – they were highly unlikely to modify it. State foreclosure laws were set long ago. Ghent writes: "the procedure that lenders must follow to foreclose on a mortgage is determined very early in states' histories, typically before the U.S. Civil War".

Regarding differences in judicial versus non-judicial state laws, Ghent writes: "the availability of non-judicial foreclosure without significant restrictions is largely the result of path-dependent quirks in the wording of various proposed statutes and decisions of individual judges." In other words, idiosyncratic interpretation of case laws by judges is the main reason for differences in foreclosure laws. Ghent confirms that "there do not seem to be clear economic reasons for why states adopted different procedures for the remedies they offer lenders".

E. 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.[17]

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

[17] 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.

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 γ^i for the foreclosures per delinquent account for 2006 through 2013. In 2008 through 2010 there is a very sharp and large 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 at the border peaks in 2009, and falls significantly in 2012. There is no difference at all in 2013. This lines up closely with the findings in Table 2 that the foreclosure difference between judicial and non-judicial states falls in 2012 and disappears in 2013.

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:

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

$DIST$ 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 2013. The standard errors are clustered at the state-border level, with 40 total clusters.

The coefficients are reported in 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 and 2007. However, it quickly increases in magnitude and remains large and statistically significant from 2007 through 2010. The coefficient declines in 2011 and 2012. By 2012, the coefficient is less than half its value in 2008 through 2010. By 2013, it is indistinguishable from zero.

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, education, interest rates, and loan-to-value ratios. The plots show that there is no discernible jump in any of these variables at the border.

III. The Effect of Foreclosures on House Prices and Housing Inventory

A. The Effect of Foreclosures on House Prices

States that do not require a judicial foreclosure experienced much higher foreclosure rates from 2008 to 2010, at which point the foreclosure difference rates began to decline. There is no evidence of any other discernible difference between states based on the judicial foreclosure requirement. Figure 6 begins our analysis of house prices by showing house price indices for judicial versus non-judicial states from 2004 to 2012. 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 3.5%. Further, there is no systematic evidence of differential house price trends before the foreclosure crisis.

In Appendix Figures 1 and 2, we show the exact same finding using three different measures of house prices: CoreLogic, S&P Case-Shiller, and the FHFA. For all five indices, we see no difference in house price trends prior to the foreclosure crisis, and a much larger decline in house prices once the foreclosure crisis hits. The lack of any differential house price patterns from 2004 to 2007 supports the conclusion above that there were no systematic differences between judicial and non-judicial states prior to the foreclosure crisis.

For Zillow, we have data going through the end of 2012. The bottom panel of Figure 6 shows that house prices rebound in non-judicial states relative to judicial states at the end of 2011 and into 2012. This corresponds with the time that the aggregate foreclosure crisis subsides, and the relative foreclosure rate between non-judicial and judicial states declines. By the end of 2012, the difference in house prices is almost exactly zero. We do not have the FCSW data past 2010, but in the appendix we show that the exact same rebound is present in the CoreLogic, S&P Case-Shiller, and FHFA data. We will delay our discussion of the rebound until later in this section.

To estimate the effect of foreclosures on house prices during the foreclosure wave, we adopt the following state-level two-stage-least squares specification:

$$Ln(Y2009_s) - Ln(Y2007_s) = \alpha + \beta * \widehat{Foreclosures}0809_s + \Gamma * X_s + \varepsilon_s \quad (3)$$

$$Foreclosures0809_s = \pi + \theta * JudicialForeclosureRequirement_s + \Lambda * X_s + \eta_s \quad (4)$$

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 on an indicator variable for whether state *s* requires judicial foreclosure. The second stage in equation (3) regresses the growth rate in

outcome *Y* in state *s* from the end of 2007 to the end of 2009 on the predicted value of foreclosures from the first stage. Our primary focus in this section is on house prices, but later the outcome variably *Y* will be real estate listings, residential investment, and auto sales. Control variables are in the matrix *X*.

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.[18] 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.

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. [19]

[18]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.

[19] The reduced form graphs in Figure 6 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 6 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.

Lower house prices in states with higher foreclosure rates could be entirely driven by the foreclosed properties themselves. Neither the Zillow.com or FCSW data we use in Table 6 allow us to separate out foreclosed homes. However, CoreLogic has a house price index which excludes distressed properties. In Appendix Table 8, we replicate columns 1 and 2 of Table 6 using both the full CoreLogic index and the index that excludes distressed properties. The coefficient on foreclosures remains statistically significant, and the magnitude declines by only 15%. Foreclosures affect prices of homes that are not sold in distress.

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

Theories of fire sales make a strong empirical prediction: foreclosures lead to depressed prices because houses are dumped on the market and the natural buyers of those assets are unable to absorb the supply. We know from the evidence above that state foreclosure laws have a powerful effect on foreclosure propensity, and house prices drop in areas with more foreclosures. But does the higher foreclosure propensity in non-judicial states affect the supply of houses on the market?

To answer this question, 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.[20] In 2009, the fraction of new listings to homeowners is on average 6% across the states in the sample. In order to isolate the net supply effect, we use the number of new listings per homeowner as an independent variable.

Column 1 of Table 7 shows that the cumulative number of new for sale listings per homeowner 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 0.53 unit increase in

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

the number of new listings. Column 3 adds the mortgage 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 7 shows that there is strong evidence of a sharp increase in listings when one enters the non-judicial state.

Columns 4 and 5 of Table 7 confirm the statistical significance of the jump. As in Table 5, 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 evidence that foreclosures increase the net supply of houses on the market, which is exactly the mechanism emphasized by fire sale theories.

While there may be other channels through which foreclosures affect house prices during a foreclosure crisis, the evidence in this sub-section suggests an important role for the foreclosure-induced expansion in the supply of inventory. Our estimates imply that 10 percent increase in homes on the market is associated with a 4 percentage point decline in house prices. This evidence is consistent with Hartley (2010) and Anenberg and Kung (2013) who both find that the supply effect dominates the disamenity effect in most areas.

C. More Disaggregated Analysis?

Zip code level data shows a sharp and discontinuous jump in foreclosures at the border of two states that differ in the judicial foreclosure requirement. However, we have focused so far on state-level evidence when estimating the second stage effect of foreclosures on house prices. In this section, we explain why.

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 near the border of two states that differ in foreclosure laws. 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. This

raises the concern that the effect of foreclosures on house prices we estimate using state-level data are polluted by shocks to different regions of the country. We conduct a number of robustness tests to address this concern, and we discuss them in Section V below.

D. The Rebound in House Prices

Figure 6 shows evidence of stronger house price recovery in non-judicial states in 2012. Table 8 presents evidence on the statistical robustness of this pattern. More specifically, we present reduced form specifications of house price growth over different periods on an indicator variable of whether the state requires judicial foreclosure. Panel A uses the Zillow data, and Panel B uses house price data from CoreLogic. Recall that we do not have FCSW data past 2010.

In both panels, column 1 shows that house prices fell by less in states that require a judicial foreclosure, which is consistent with the results in Table 6. Column 2 of both panels shows that house price growth was essentially the same from 2009 to 2010. Column 3 shows that weaker house price growth in judicial foreclosure states from 2010 to 2012 shown in Figure 6 is in fact statistically significant, albeit only at the 10% level of confidence for the CoreLogic data. Column 4 shows that over the entire period 2007 to 2012, we cannot reject the hypothesis that house price growth was the same in judicial and non-judicial states.

These results are consistent with theories in which fire sales temporarily depress prices. During the heart of the Great Recession when massive amounts of foreclosures were hitting the market, we see a sizeable effect of foreclosures on house prices. However, once the foreclosure crisis dissipates (Figure 1) and the difference in foreclosure propensity across judicial and non-judicial states declines (Table 2, Figure 4, and Table 5), prices rebound more strongly in the non-judicial states.

One question remains: if participants expected house price growth to eventually recover in non-judicial states, why did house prices fall so dramatically from 2007 to 2009? Why didn't investors or owner-occupiers rush in to buy? In models of fire sales, it is typically because there is slow-moving capital or some other type of limits to arbitrage that prevent buyers from absorbing the large increase in supply.[21] These limits could be related to owner-occupiers being unable to obtain financing to buy a home during the Great Recession, or investors being unable to gather the capital and expertise to buy and rent out homes during the financial panic. Eventually, these limits are overcome and a recovery ensues. An examination of the precise frictions preventing buyers from immediately stepping in is beyond the scope of this study, but it is interesting material for future research.

One caveat is in order. We have shown plentiful evidence that judicial and non-judicial states were no different when the foreclosure crisis first began in 2007. However, the further we move away from 2007, the more likely that the natural experiment becomes polluted by differential responses by judicial and non-judicial states. From a statistical perspective, we have more confidence in the exogeneity of state foreclosure laws in 2008 and 2009 than in the latter part of the sample.

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 from 2007 to 2009. A central idea in the macroeconomics literature on fire sales is that a sharp negative movement in the relative price of durable goods can amplify shocks and lead to a

[21] Shleifer and Vishny (2011) make this exact point: "the discussion of fire sales of financial assets is intimately related to an older idea of limited arbitrage".

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 2012 as measured by new residential construction permits collected by the Census. The data used in the top panel are at the annual frequency.[22] 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. As with house prices, there is evidence of a relative rebound after 2010.

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 2011Q4 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 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. Once again, we see evidence of a stronger recovery in non-judicial states in 2012.

[22] 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.

Table 9 presents the state-level two-stage least squares estimates for residential investment and auto sales growth from 2007 to 2009. 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.

For auto sales, the estimate in column 5 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. Both the residential investment and auto sales results are statistically weaker with the full inclusion of control variables. It is important to remember that we have only 51 observations in these specifications, and we include a large number of control variables in order to see how robust the finding is.

One potential robustness test for the results in Table 9 would be to focus on zip codes or counties that are right near the border of two states that differ in foreclosure laws.[23] We know that foreclosure propensity jumps right at the border, but should we expect real economic outcomes to jump in a similar way?

The answer is no for the same reason we outlined above when discussing house prices. Foreclosures on one side of the border will affect the real economy on the other side of the border through many channels. The most direct effect is through house prices given some substitutability in people's preferences for housing across borders. However, this concern is amplified when looking at auto sales and residential investment because both sides of the border

[23] Auto sales data are available at the zip code level, but residential investment data from the Census is available only at the county level.

likely contribute to the same *economy*. If foreclosures and house price declines affect residential investment and auto sales on one side of the border, they will also affect the other side of the border through general equilibrium employment and income effects. In fact, 70% of the zip codes that are within 10 miles of the border of another state with a different foreclosure law are part of a metropolitan area that covers both states. In Section V, we discuss a robustness test using state-level data where we examine differences in auto sales and residential investment for bordering states that have differing foreclosure laws. This test helps alleviate the worry that regional shocks spuriously correlated with foreclosure laws are driving the results.

B. Macroeconomic Implications

We can use the estimates obtained in Tables 6 and 9 to inform the debate regarding the effect of the foreclosure wave on the macro-economy during the Great Recession. 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 driven by this very specific source of variation, we urge caution in using the full distribution of foreclosures to estimate aggregate impacts.[24]

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 -0.020, which implies that foreclosures per homeowner are 2 percentage points lower in judicial foreclosure requirement states.

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

We multiply the foreclosure coefficient estimates in Tables 6 and 9 with the 2.0 percentage point difference in foreclosure rates to estimate the aggregate impact of foreclosures on house prices, residential investment and auto sales. For house prices, we use an estimate of -2 from Table 6 which implies that house price growth from 2007 to 2009 was (-2*-0.020 =) 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 33% of the decline in house prices.

For residential investment, the estimate of -6.5 based on the coefficient estimates in Table 9 suggests that residential investment growth from 2007 to 2009 was (-6.5*-0.020 =) 13 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 17% of the overall decline in residential investment. For auto sales, we use an estimate of -4 based on Table 9 which implies that auto sales growth from 2007 to 2009 was (-4*-0.020 =) 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.

Overall, our analysis implies that foreclosures can explain 33% of the aggregate house price decline, and about 20% of the decline in residential investment and auto sales from 2007 to 2009.

C. The Rebound

Figure 9 shows evidence of a stronger rebound in residential investment and auto sales from 2010 to 2012 in non-judicial states, as the foreclosure crisis waned and the difference in foreclosure rates between non-judicial and judicial states disappeared. Table 10 tests whether the

rebound shown in Figure 9 is statistically significant. The first column of both panels shows that residential investment and auto sales declined by less in judicial foreclosure states, which is consistent with second-stage evidence in Table 8. Both residential investment and auto sales growth continued to be slightly stronger in judicial foreclosure states from 2009 to 2010, although not statistically significantly so. Column 3 shows weaker residential investment and auto sales growth from 2010 to 2012 in judicial foreclosure states, but only the auto sales results is statistically significant. Unlike with house prices, the evidence is weaker that the rebound is statistically robust.

An important question remains: if residential investment and auto sales eventually rebound faster in non-judicial foreclosure states, should we still care about the negative effects of foreclosures? Should we care if foreclosures shift some residential investment and auto sales from the present into the future? In macroeconomic models of fire sales, the timing matters because the foreclosure-induced drop in prices may exacerbate an already severe recession, when the marginal utility of consumption is high. Further, as Brunnermeier and Sannikov (2013) show, such fire sales in the midst of a financial crisis can create non-linear liquidity spirals and adverse feedback loops.

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 lasts for four 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. More specifically, there is no difference in delinquencies between judicial and non-judicial states in 2008 and 2009, and house price growth in both types of states prior to the foreclosure crisis is almost identical.

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 and our related discussion in the appendix for more details).

We also report our house price results in Appendix Figure 2 using the publicly available FHFA house price data and the Case Shiller 20-city indices. Unlike the Zillow, CoreLogic, 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 (2010)). 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.[25] 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 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. In fact, it is a much more powerful predictor of foreclosure differences than any other law.

D. Alternative State Foreclosure Law Classifications

We use 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 more foreclosures. If house prices drop further in non-judicial states, then

[25] 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.

more households are likely to be underwater and susceptible to strategic default on their mortgages. However, we do not find any evidence for this during the heart of the foreclosure crisis. Even through 2011, delinquency rates are similar in 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 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 Secular Shocks?

For reasons mentioned above, our second-stage estimation is carried out at the state level instead of a more disaggregated zip code- or county-level approach. We have provided a number of results that the difference in foreclosure rates at the state level is driven uniquely by the difference in the judicial requirement. Nonetheless, a remaining concern is that differential shocks in non-judicial and judicial foreclosure states are responsible for our results. Given the evidence on the recovery in house prices during the latter part of our sample, these differential shocks would have to be spuriously correlated with judicial foreclosure requirement both during the foreclosure crisis (2006 to 2009) and the crisis dissipation period (2011 to 2013).

We conduct a number of additional tests to address this concern. 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), which both happen to be non-judicial foreclosure states. The results using FCSW are weakened, which is not surprising given we are taking 2 of 24 observations out. But all other results are similar. 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.

The 2001 placebo test can be performed more generally. We have house price data from FCSW back to 1992 and residential investment data back to 1990.[26] We conduct the following series of placebo tests. For every year from 1994 to 2009, we regress house price growth over the last two years on the judicial foreclosure requirement indicator variable. We then plot the coefficients from each of these regressions, excluding the 2005 to 2007 and 2006 to 2008 period given they overlap with focus from 2007 to 2009. Appendix Figure 4 plots the coefficient estimates and shows that the coefficient on the 2007 to 2009 period is larger than any other period. We conduct the same test for residential investment growth from 1992 to 2009 and find the same result--2007 to 2009 is the only period in which residential investment growth was much weaker in non-judicial states. See the appendix for more details.

In Appendix Table 9, we conduct an exercise where we form pairs of states that border each other. For each state-pair, we construct the difference between the two bordering states in foreclosures, and the growth in house prices, residential investment, and auto sales from 2007 to 2009. We then instrument the difference in foreclosure rates with the difference in foreclosure

[26] The FCSW data go back further than 1992, but the number of zip codes covered shrinks quickly. From 1992 onwards, the sample is above 3,500. The auto sales and Zillow data only go back to 2004 and 2000, respectively.

laws across the state pairs, thereby isolating variation in foreclosure rates that is driven only by states that are neighbors. In this exercise, regional shocks cannot drive the results because we only use variation in foreclosure laws for states that neighbor one another. The second stage estimates show a robust effect of foreclosures on house prices and residential investment, but a weaker effect on auto sales. We describe this specification more fully in the appendix.

In Appendix Table 10, we present the results of the second stage estimation for house prices, residential investment, and auto sales at the CBSA-level. The underlying source of variation in foreclosure laws still comes from the state, but the CBSA-level specification allows us to more finely control for observable variables. The results are almost identical. In fact, the results for residential investment and auto sales are even stronger.

G. Other Robustness Tests

We also 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. A final test using data in Piskorski, Seru, and Witkins (2013) looks at the difference in investor share of purchases across judicial and non-judicial states. The investor share is almost identical across judicial and non-judicial states, and controlling for the investor share does not affect the results.

We also 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.

A unique contribution of our study is to examine the end of the foreclosure wave. As aggregate foreclosures decline in 2012 and 2013 and the difference in foreclosure rates between judicial and non-judicial states dissipates, we find evidence of a stronger recovery in non-judicial states. The stronger recovery is consistent with models of fire sales in which a large supply of assets hitting the market temporarily depresses prices until new buyers come in. An interesting question for future research is to examine the recovery period with a particular focus on what frictions were alleviated that led to the recovery.

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Table 1
Summary Statistics

This table presents summary statistics for the state-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}
Foreclosures per homeowner, 2008 and 2009	51	0.028	0.027	0.006	0.020	0.055
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
New mortgages/income, 2005	51	0.154	0.077	0.088	0.133	0.227
Debt to income increase, 2002 to 2005	51	0.267	0.156	0.103	0.248	0.463
Subprime consumer fraction, 2000	51	0.329	0.066	0.264	0.305	0.434
Ln(Income, 2005)	51	3.933	0.163	3.740	3.908	4.155
Fraction with income less than 25K, 2005	51	0.434	0.041	0.379	0.432	0.486
Unemployment rate, 2000	51	0.058	0.014	0.044	0.057	0.075
Poverty fraction, 2000	51	0.122	0.032	0.090	0.114	0.164
Black fraction, 2000	51	0.100	0.110	0.005	0.067	0.263
Hispanic fraction, 2000	51	0.055	0.068	0.009	0.030	0.127
Less than high school education fraction, 2000	51	0.182	0.043	0.129	0.180	0.247
Urban fraction, 2000	51	0.713	0.156	0.519	0.714	0.908

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 2013. 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	-0.020**	-0.004	-0.018**	-0.167**
	(0.006)	(0.012)	(0.004)	(0.032)
Delinquencies per homeowner, 08-09			0.458**	
			(0.081)	
Constant	0.036**	0.096**	-0.009	0.295**
	(0.006)	(0.008)	(0.006)	(0.029)
N	51	51	51	51
R^2	0.134	0.003	0.639	0.287

Panel B: First stage by year

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Foreclosure per homeowner in year:							
	2006	2007	2008	2009	2010	2011	2012	2013
Judicial foreclosure requirement	-0.004*	-0.005**	-0.007**	-0.012**	-0.011**	-0.010**	-0.005*	-0.001
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
Delinquencies per homeowner	0.217*	0.300**	0.249**	0.348**	0.365**	0.248**	0.095*	0.110*
	(0.086)	(0.074)	(0.058)	(0.057)	(0.050)	(0.072)	(0.041)	(0.042)
Constant	0.000	-0.001	-0.000	-0.007+	-0.007*	-0.002	0.005*	0.000
	(0.002)	(0.002)	(0.003)	(0.004)	(0.003)	(0.004)	(0.002)	(0.002)
N	51	51	51	51	51	51	51	51
R^2	0.238	0.322	0.459	0.699	0.678	0.482	0.150	0.224

**,*,+ 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)		
Interest rate on mortgages, average, 2002-2005	0.0973	51	0.024
	(0.082)		
LTV for mortgages, average, 2002-2005	-1.5120	51	0.013
	(1.845)		

**,*,+ 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.

	State-border	Number of zip codes		
		Within 50 miles of border	Within 25 miles of border	Within 10 miles of 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 at State Border

This table presents tests 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.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Foreclosure per delinquent mortgage in Year:							
	2006	2007	2008	2009	2010	2011	2012	2013
Judicial foreclosure requirement	0.013	-0.099	-0.190*	-0.170**	-0.195**	-0.146*	-0.077*	-0.036
	(0.067)	(0.070)	(0.078)	(0.047)	(0.051)	(0.058)	(0.036)	(0.033)
Distance	1.490	-0.042	-2.319	-1.990	-3.251*	-1.038	-0.841	-1.410
	(1.855)	(2.635)	(1.860)	(1.780)	(1.501)	(1.515)	(1.231)	(1.073)
Distance Squared	-9.369	-28.422	-19.115	-12.649	-14.185	-6.988	-7.737	-3.130
	(20.911)	(32.457)	(16.254)	(14.739)	(17.005)	(10.705)	(10.927)	(9.958)
Distance Cubed	-693.472	-749.139	214.943	190.733	591.298	-40.006	-45.630	290.781
	(888.528)	(1,309.71)	(843.873)	(624.268)	(561.586)	(556.379)	(386.404)	(389.672)
State-Border *10mile Strips FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
N	4,918	5,314	5,638	6,036	5,987	5,831	5,734	5,725
R^2	0.395	0.414	0.436	0.482	0.505	0.521	0.666	0.620

**,*,+ 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	-2.245*	-1.751*	-1.966*	-2.277*	-1.579+	-4.089+
	(1.020)	(0.810)	(0.952)	(1.082)	(0.870)	(2.312)
Delinquencies per homeowner, 08-09	-1.336*	-0.669	-0.914	-1.497**	-0.308	7.955
	(0.522)	(0.507)	(1.584)	(0.572)	(0.595)	(8.947)
House price growth, 02-06		-0.113	-0.200*		-0.105	-0.128
		(0.083)	(0.100)		(0.104)	(0.183)
House price growth, 06-07		0.913**	0.407		1.180*	1.934*
		(0.240)	(0.328)		(0.600)	(0.933)
Delinquencies squared, 08-09			0.439			-17.544
			(4.552)			(20.878)
New mortgages/income, 2005			0.138			-0.395
			(0.392)			(0.767)
Debt to income increase, 02-05			-0.072			-0.074
			(0.102)			(0.167)
Subprime consumer fraction, 2000			-0.175			-0.198
			(0.282)			(0.726)
Income, 2005			0.075			-0.490*
			(0.129)			(0.229)
income < 25K fraction, 2005			-0.088			-3.119*
			(0.598)			(1.534)
Unemployment rate, 2000			-0.087			-8.301**
			(1.673)			(1.862)
Poverty fraction, 2000			1.298			3.364**
			(0.852)			(1.070)
Black fraction, 2000			0.069			-0.643
			(0.129)			(0.489)
Hispanic fraction, 2000			-0.077			1.040
			(0.189)			(0.892)
< high school education fraction, 2000			-0.016			0.602
			(0.357)			(0.664)
Urban fraction, 2000			-0.144+			-0.138
			(0.085)			(0.242)
Constant	0.072**	0.049	-0.157	0.048	0.009	3.021*
	(0.027)	(0.031)	(0.706)	(0.040)	(0.049)	(1.268)
N	48	45	45	24	24	24
R^2	0.674	0.786	0.849	0.738	0.826	0.909

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

Table 7
New For Sale Listings

This table presents evidence on the effect of foreclosures on new houses being listed for sale. Column 1 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).

	(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		0.533*	0.520*		
		(0.222)	(0.231)		
Delinquencies per homeowner			0.112		
			(0.207)		
Constant	0.116**	0.093**	0.085**		
	(0.004)	(0.007)	(0.011)		
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 *10mile Strips FE				Yes	Yes
N	51	51	51	8,235	8,235
R^2	0.063	0.386	0.415	0.369	0.335

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

Table 8
House Price Growth, 2007-2012
Judicial versus Non-Judicial States

This table presents coefficients of the reduced form relation between house price growth and whether a state has a judicial foreclosure requirement. Panel A uses house prices from Zillow, and Panel B uses house prices from CoreLogic. The unit of observation is a state. Standard errors are heteroskedasticity-robust.

Panel A: Zillow

	(1) House price growth, 2007-2009	(2) House price growth, 2009-2010	(3) House price growth, 2010-2012	(4) House price growth, 2007-2012
Judicial foreclosure requirement	0.037*	-0.005	-0.046+	-0.014
	(0.018)	(0.016)	(0.025)	(0.028)
Delinquencies per homeowner, 08-09	-1.444**	-0.350	0.039	-1.755**
	(0.367)	(0.216)	(0.444)	(0.577)
House price growth, 02-06	-0.112	-0.000	0.162+	0.050
	(0.086)	(0.048)	(0.091)	(0.107)
House price growth, 06-07	1.017**	-0.028	-0.136	0.853*
	(0.252)	(0.209)	(0.358)	(0.384)
Constant	0.059+	-0.026	-0.015	0.018
	(0.033)	(0.019)	(0.034)	(0.045)
N	45	45	45	45
R^2	0.791	0.081	0.198	0.565

Panel B: CoreLogic

	(1) House price growth, 2007-2009	(2) House price growth, 2009-2010	(3) House price growth, 2010-2012	(4) House price growth, 2007-2012
Judicial foreclosure requirement	0.034*	0.011	-0.030*	0.015
	(0.014)	(0.008)	(0.013)	(0.022)
Delinquencies per homeowner, 08-09	-0.755*	-0.198	-0.052	-1.005*
	(0.288)	(0.147)	(0.221)	(0.400)
House price growth, 02-06	-0.270**	-0.034	0.054	-0.249**
	(0.052)	(0.035)	(0.044)	(0.063)
House price growth, 06-07	0.901**	-0.002	-0.200	0.698**
	(0.270)	(0.107)	(0.218)	(0.255)
Constant	0.032	-0.008	0.024	0.048
	(0.028)	(0.010)	(0.023)	(0.034)
N	51	51	51	51
R^2	0.804	0.154	0.187	0.619

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

Table 9
Foreclosures, Residential Investment, and Auto Sales
2SLS Estimates

This table presents coefficients of the second stage of a 2SLS specification of residential investment and auto sales growth on foreclosures. The first stage regresses foreclosures on whether a state has a judicial foreclosure requirement. Standard errors are heteroskedasticity-robust.

	Residential permits growth 2007 to 2009			Auto sales growth 2007 to 2009		
	(1)	(2)	(3)	(4)	(5)	(6)
Foreclosures per homeowner, 08-09	-6.907*	-6.450*	-2.939	-3.437+	-4.001*	-4.570+
	(3.258)	(3.024)	(3.105)	(1.871)	(2.021)	(2.372)
Delinquencies per homeowner, 08-09	-0.962	-1.300	-10.975**	-0.712	-0.174	-2.768
	(1.642)	(1.419)	(3.431)	(0.916)	(0.889)	(3.717)
Growth in LHS variable, 02-06		-0.072	-0.215		0.194	0.511**
		(0.104)	(0.195)		(0.194)	(0.119)
Growth in LHS variable, 06-07		-0.098	-0.171		0.614	0.453
		(0.202)	(0.226)		(0.495)	(0.403)
Delinquencies squared, 08-09			26.969**			11.465
			(10.440)			(9.867)
New mortgages/income, 2005			-0.327			-0.471
			(0.969)			(0.763)
Debt to income increase, 02-05			-0.105			0.401
			(0.328)			(0.258)
Subprime consumer fraction, 2000			-0.527			-0.768
			(1.218)			(0.812)
Income, 2005			-0.370			-0.182
			(0.477)			(0.267)
income < 25K fraction, 2005			-1.501			-0.521
			(2.744)			(1.590)
Unemployment rate, 2000			-7.088+			0.730
			(3.893)			(1.960)
Poverty fraction, 2000			4.368			0.501
			(3.158)			(1.501)
Black fraction, 2000			0.889			0.397
			(0.554)			(0.334)
Hispanic fraction, 2000			0.268			-0.114
			(0.668)			(0.420)
< high school education fraction, 2000			-0.387			0.376
			(1.419)			(0.921)
Urban fraction, 2000			0.431+			0.123
			(0.225)			(0.207)
Constant	-0.485**	-0.464**	1.990	-0.250**	-0.268**	0.742
	(0.087)	(0.079)	(2.911)	(0.048)	(0.046)	(1.613)
N	51	51	51	51	51	51
R^2	0.398	0.422	0.596	0.356	0.384	0.524

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

Table 10
Residential Investment and Auto Sales Growth, 2007-2012
Judicial versus Non-Judicial States

This table presents coefficients of the reduced form relation between residential investment growth (Panel A), auto sales growth (Panel B), and whether a state has a judicial foreclosure requirement. The unit of observation is a state. Standard errors are heteroskedasticity-robust.

Panel A: Residential investment

	(1) Residential permits growth, 2007-2009	(2) Residential permits growth, 2009-2010	(3) Residential permits growth, 2010-2012	(4) Residential permits growth, 2007-2012
Judicial foreclosure requirement	0.125*	0.017	-0.051	0.091
	(0.061)	(0.031)	(0.073)	(0.114)
Delinquencies per homeowner, 08-09	-4.102**	-0.405	0.535	-3.973**
	(0.779)	(0.394)	(1.008)	(1.316)
Residential permits growth, 02-06	0.008	-0.105	0.330	0.233
	(0.100)	(0.066)	(0.211)	(0.249)
Residential permits growth, 06-07	0.017	-0.110	-0.402	-0.496
	(0.227)	(0.124)	(0.322)	(0.403)
Constant	-0.428**	0.084+	0.074	-0.270+
	(0.100)	(0.044)	(0.088)	(0.146)
N	51	51	51	51
R^2	0.474	0.119	0.194	0.172

Panel B: Auto sales

	(1) Auto sales growth, 2007-2009	(2) Auto sales growth, 2009-2010	(3) Auto sales growth, 2010-2012	(4) Auto sales growth, 2007-2012
Judicial foreclosure requirement	0.074*	0.018	-0.039+	0.053
	(0.037)	(0.028)	(0.021)	(0.044)
Delinquencies per homeowner, 08-09	-1.990**	-0.157	0.062	-2.085**
	(0.497)	(0.385)	(0.282)	(0.728)
Auto sales growth, 02-06	0.671	0.190	-0.001	0.860+
	(0.444)	(0.430)	(0.285)	(0.463)
Auto sales growth, 06-07	0.226	0.436+	-0.074	0.588
	(0.229)	(0.217)	(0.100)	(0.353)
Constant	-0.234**	0.107**	0.190**	0.063
	(0.049)	(0.035)	(0.027)	(0.076)
N	51	51	51	51
R^2	0.496	0.275	0.068	0.448

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

Figure 1
Household Default Rate and Foreclosures

This figure shows aggregate foreclosures in the United States from RealtyTrac.com and the household default rate from Equifax.

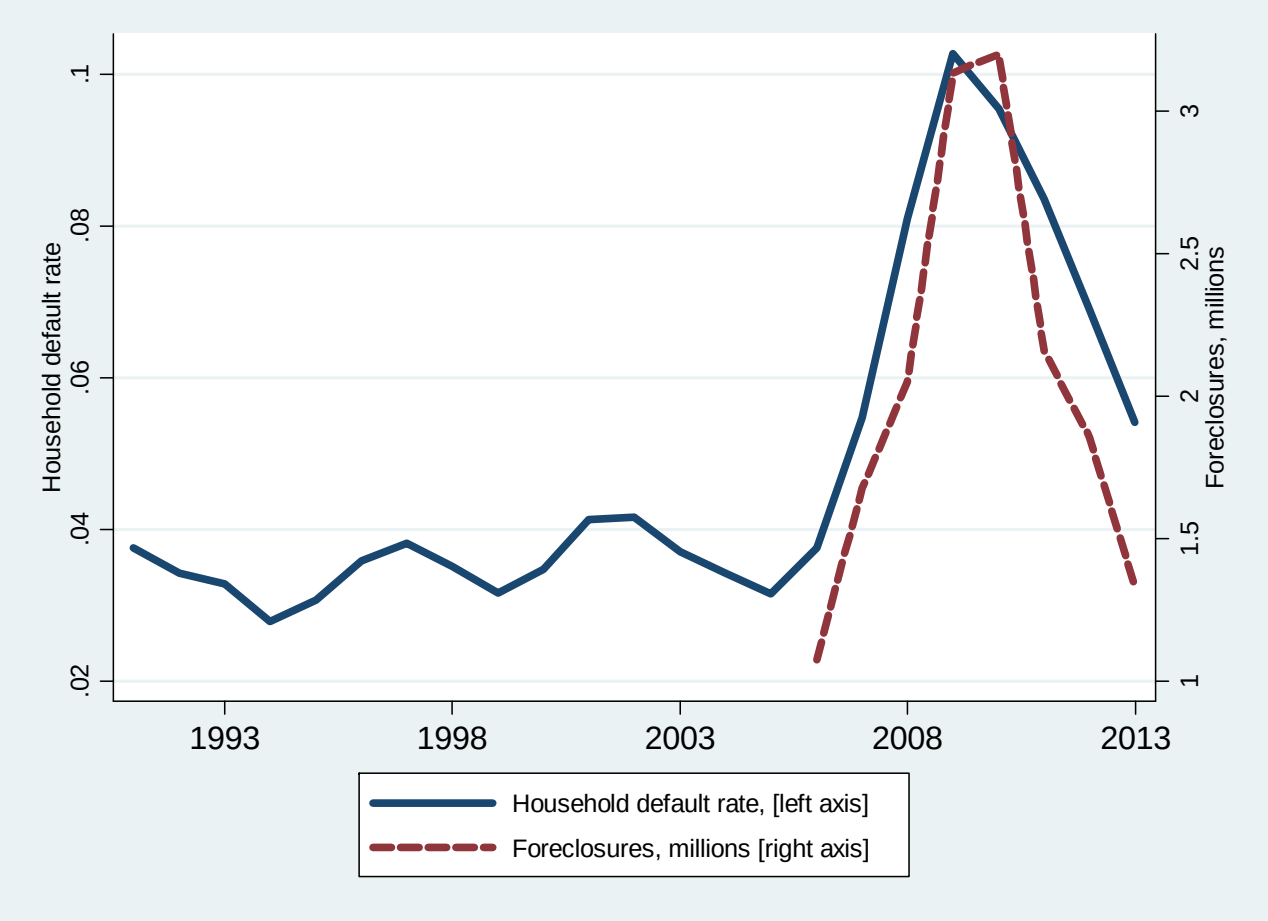

Figure 2
States with Judicial Foreclosure Requirement

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

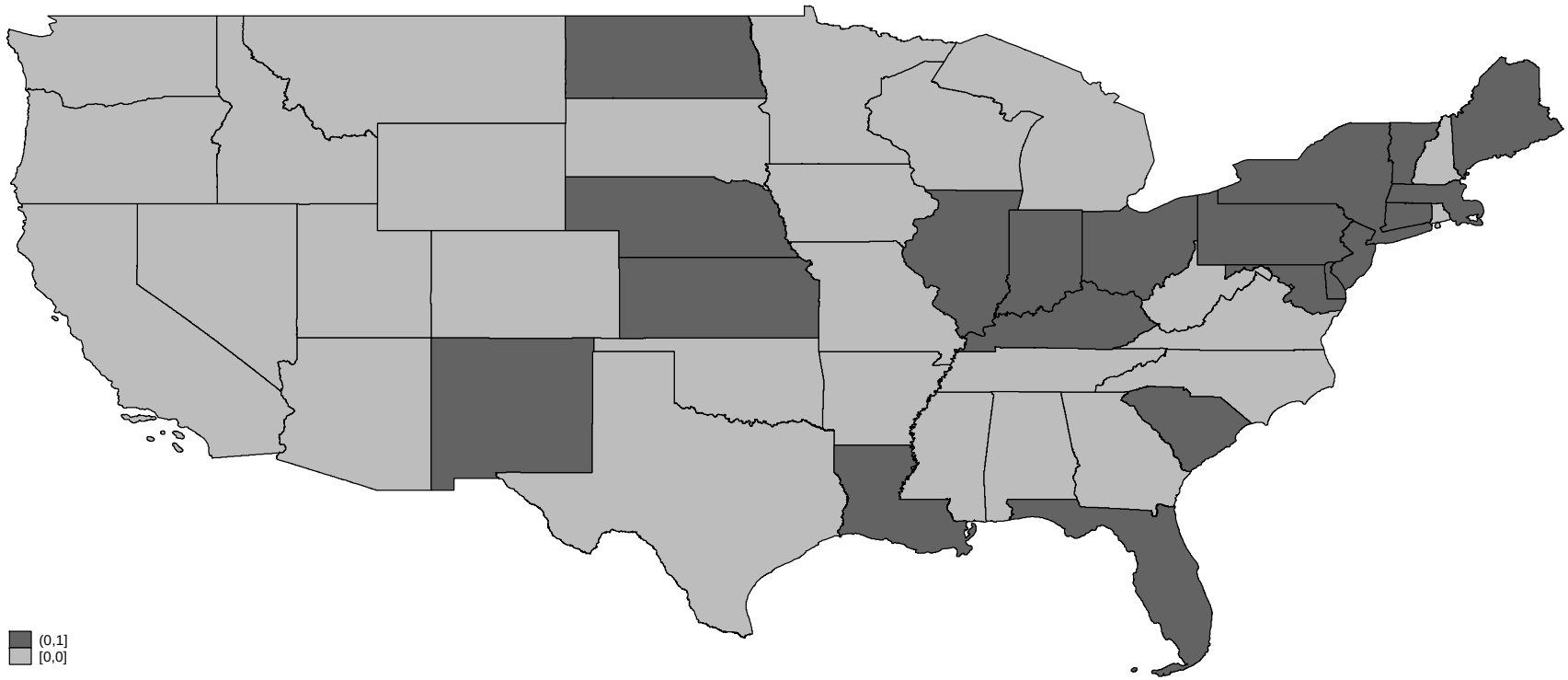

Figure 3

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 right panel plots foreclosures against delinquencies, where the sample is split by whether the state requires a judicial foreclosure.

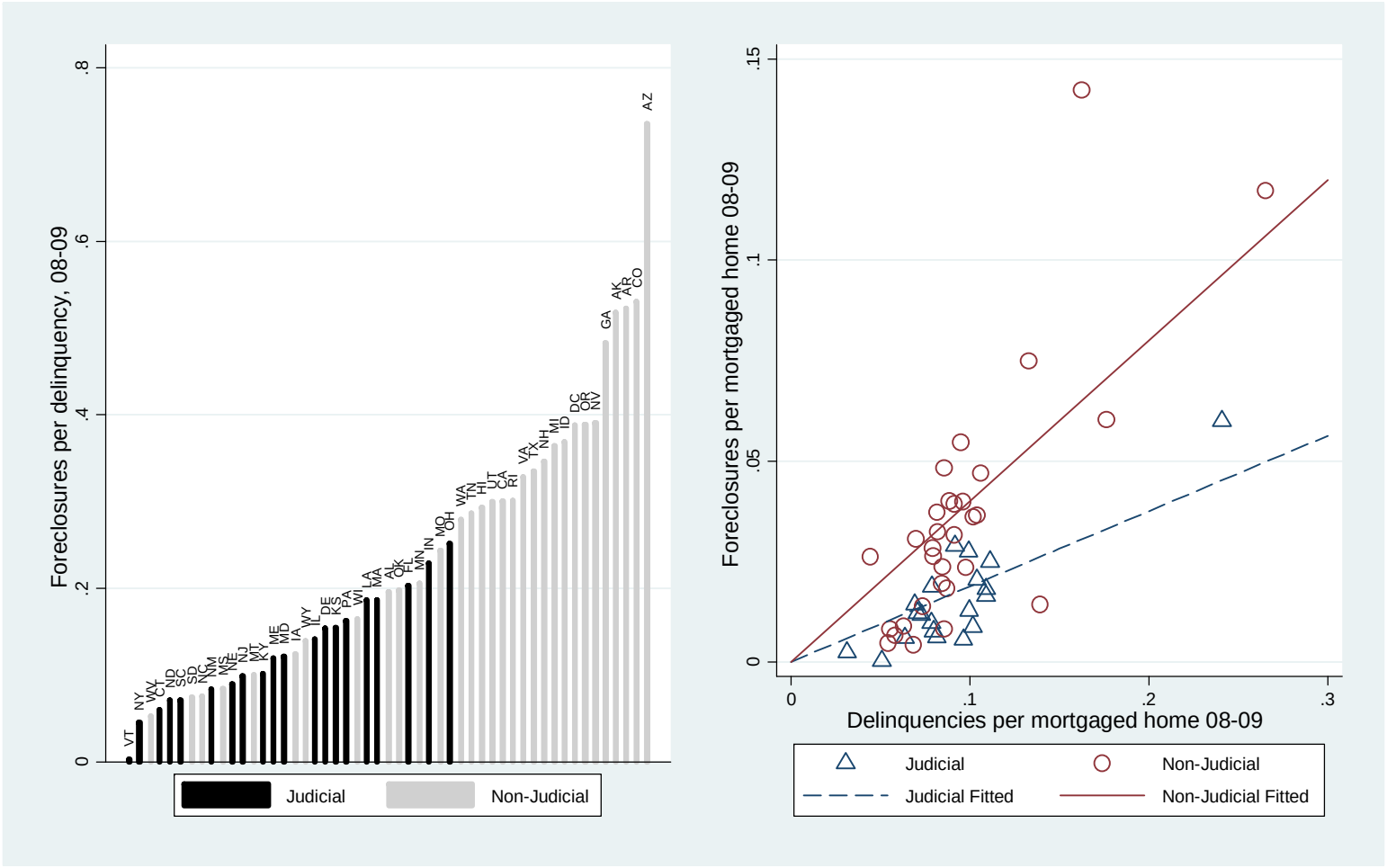

Figure 4

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.

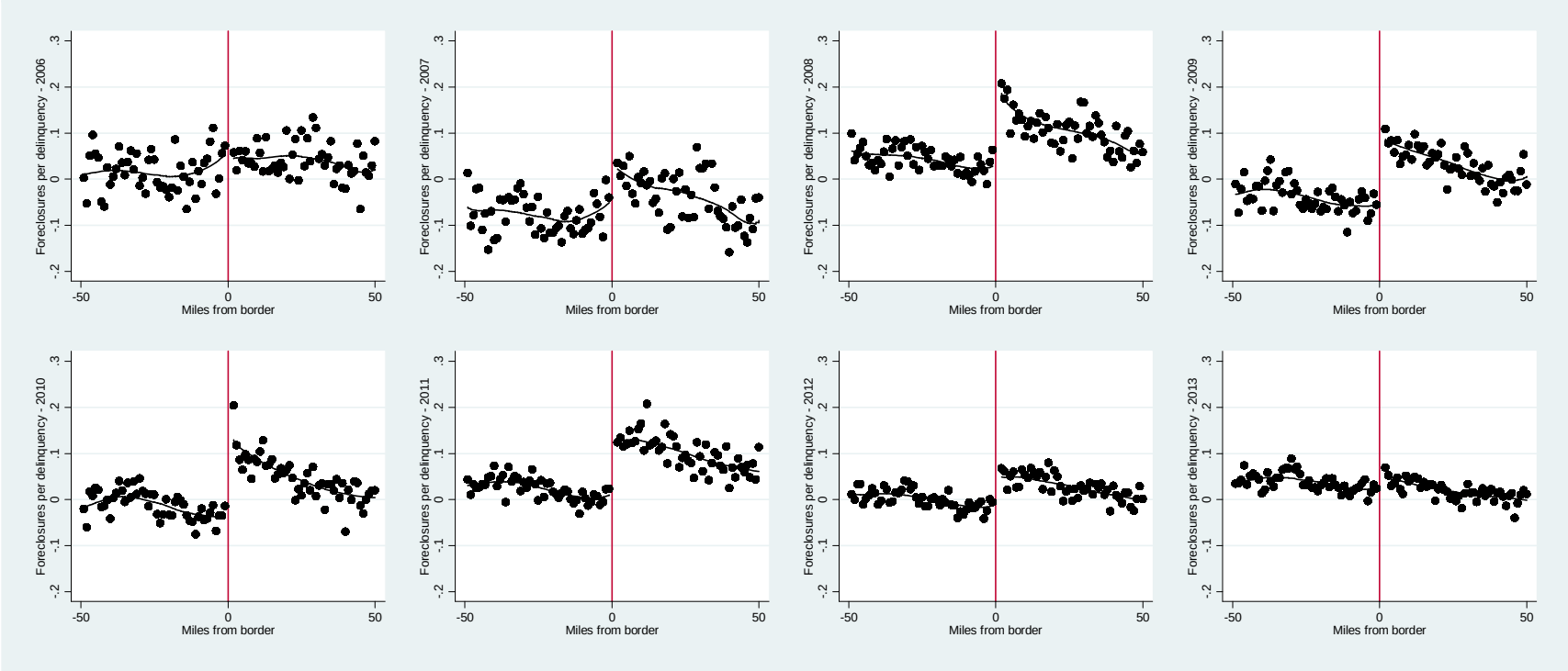

Figure 5
Other Variables and Judicial Requirement: Zip Codes Near the Border Sample

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.

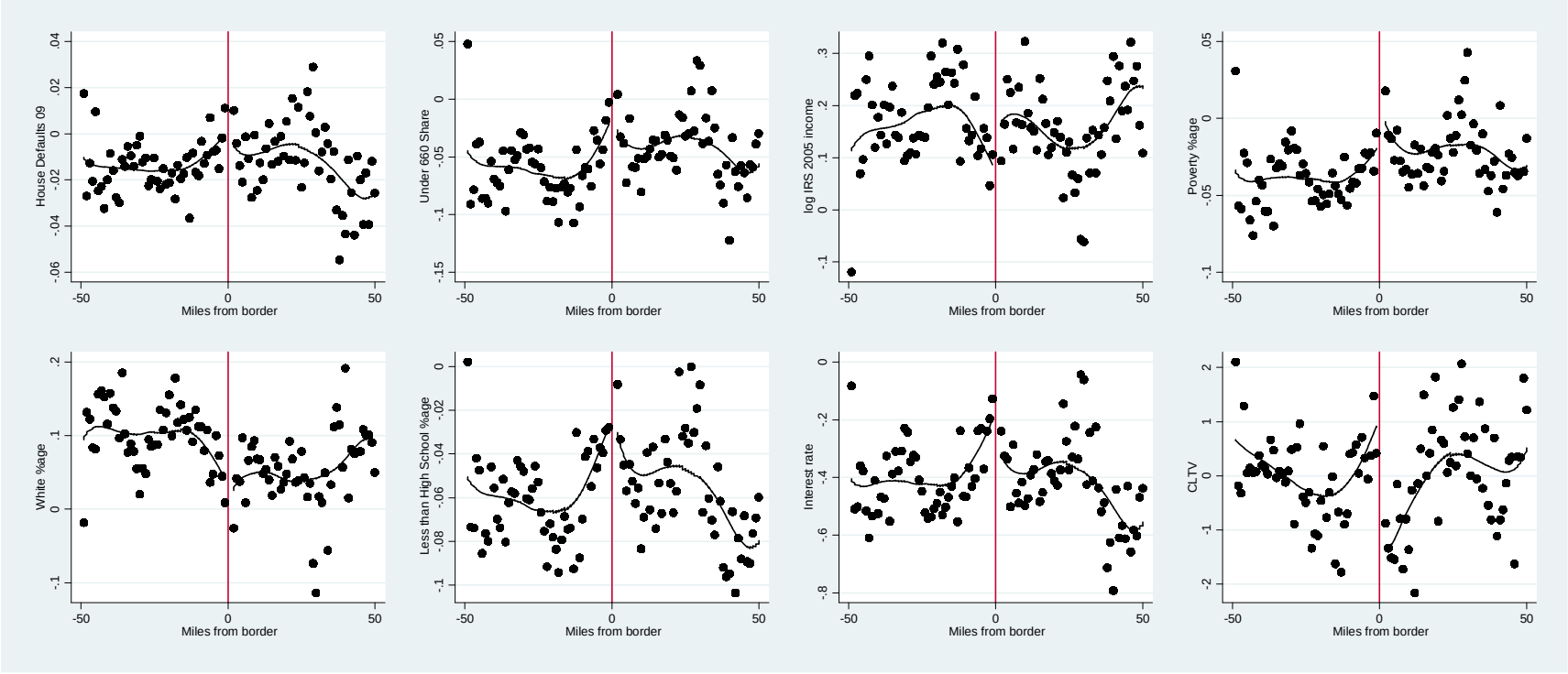

Figure 6
Foreclosures and House Prices, Reduced Form

The figures plots house price growth in judicial and non-judicial states from 2004 to 2012. The averages are weighted by total population.

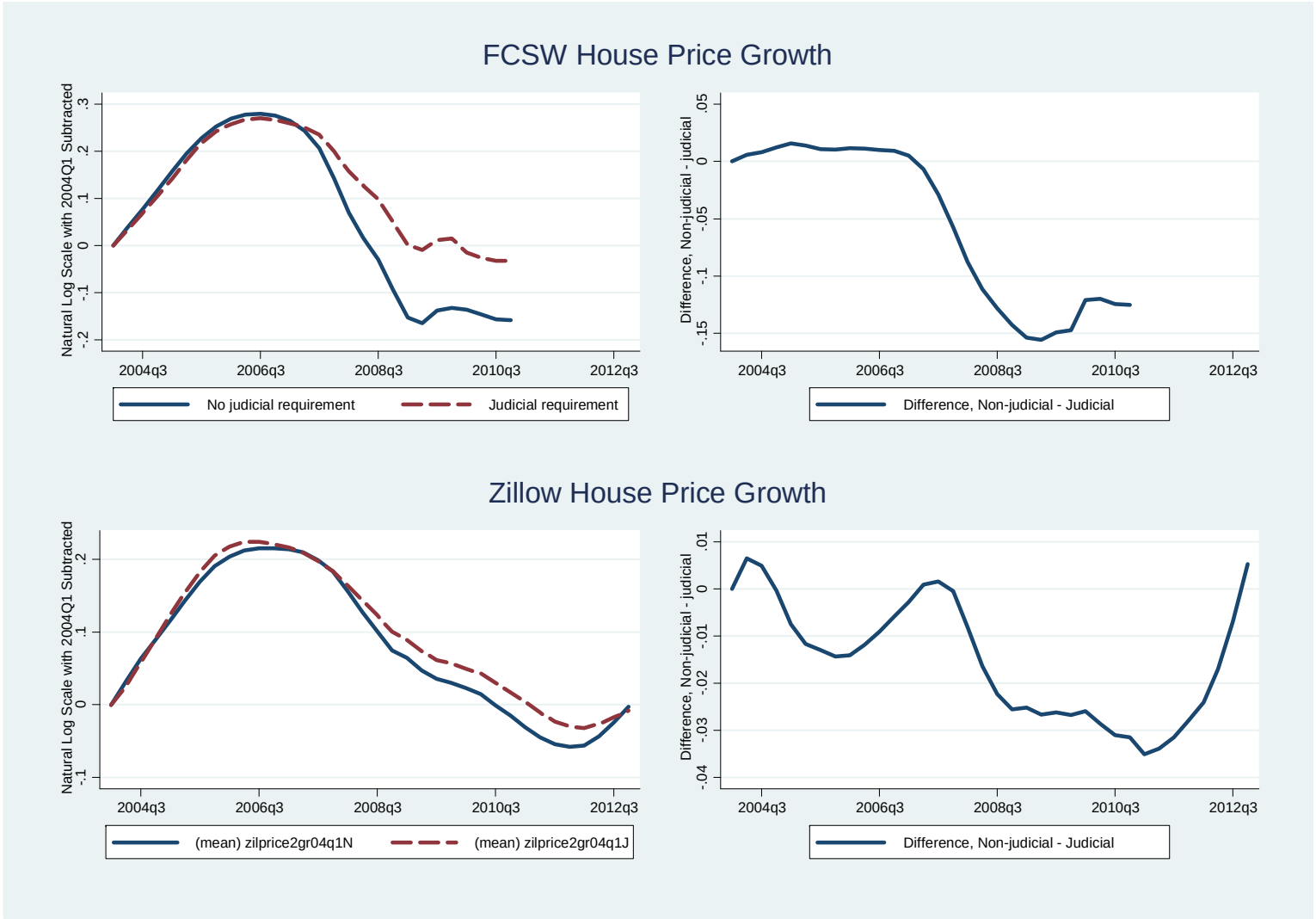

Figure 7
New For Sale Listings: Zip Codes Near Border Sample

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.

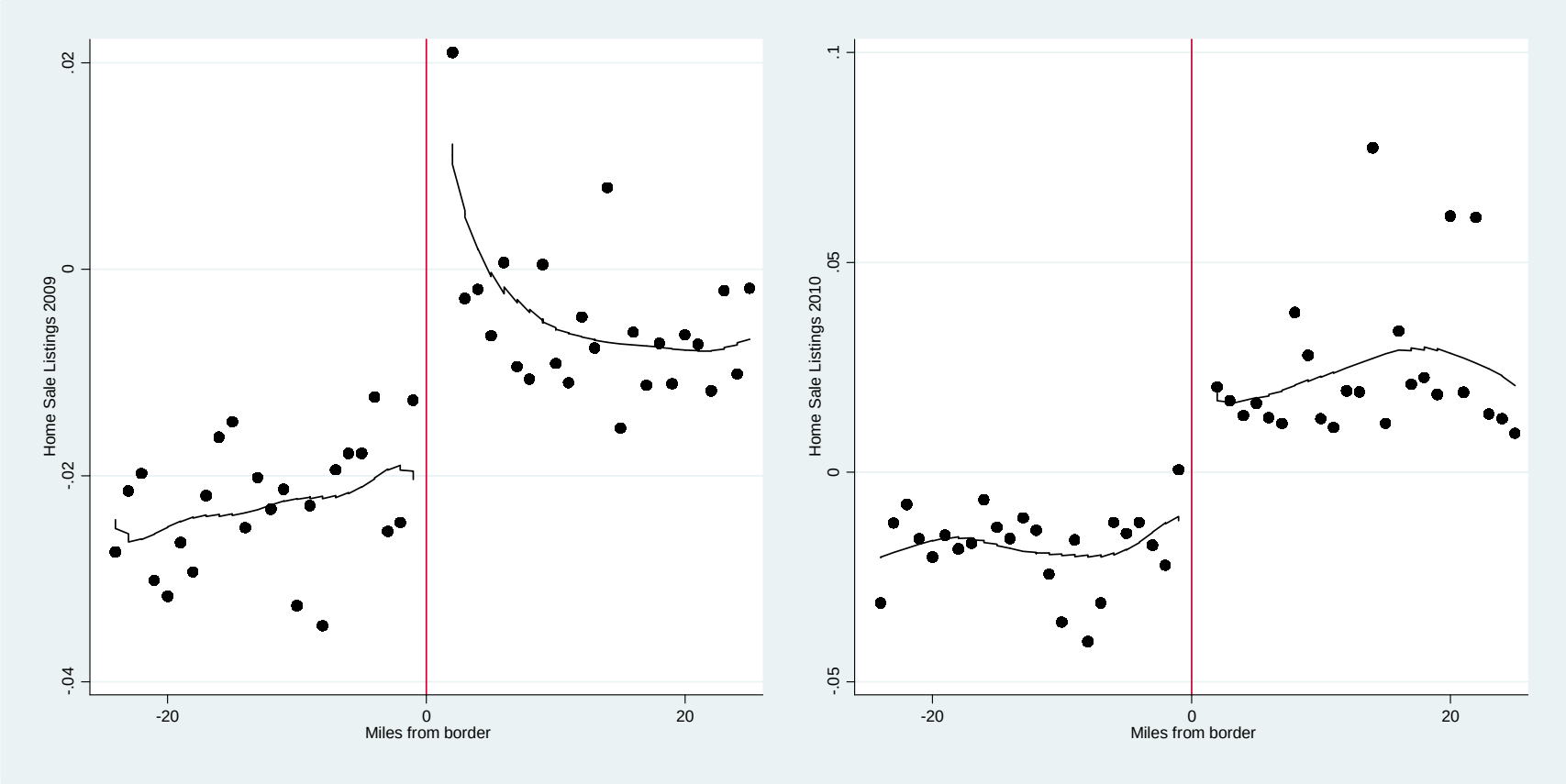

Figure 8
House Price Growth 2008-09: Zip Codes Near Border Sample

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.

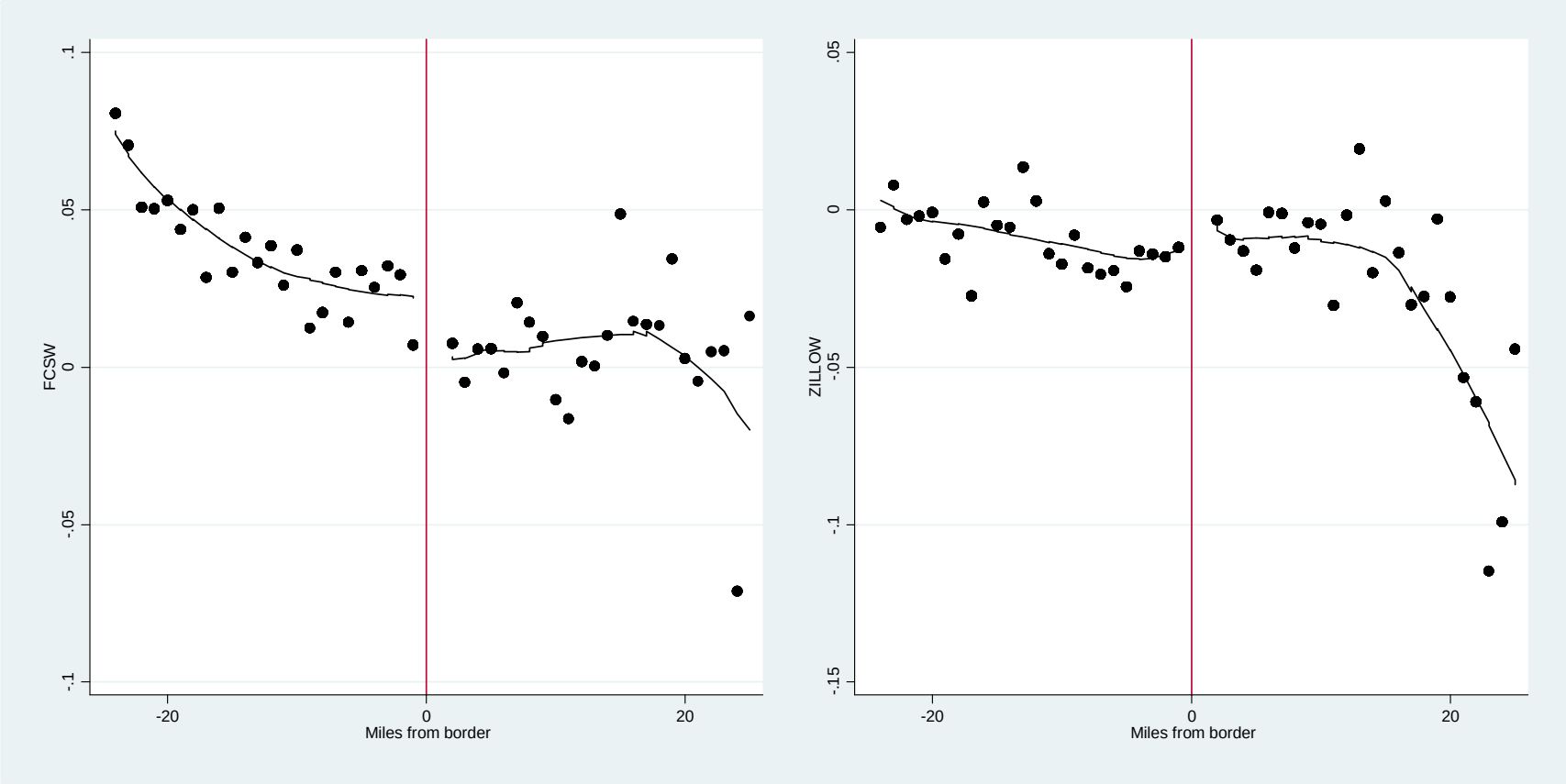

Figure 9
Foreclosures, Residential Investment, and Durable Consumption, Reduced Form

The figures plot residential investment (top) and auto sales (bottom) growth in judicial and non-judicial states from 2004 to 2012. The averages are weighted by total population.