Foreclosures, House Prices, and the Real Economy*

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December 2010

Abstract

A central idea in macroeconomic theory is that negative price effects from the leverage-induced forced sale of durable goods can amplify negative shocks and reduce economic activity. We examine this idea by estimating the effect of U.S. foreclosures in 2008 and 2009 on house prices, residential investment, and durable consumption. We show that states that require judicial process for a foreclosure sale have significantly lower rates of foreclosures relative to states that have no such requirement. Using state laws requiring a judicial foreclosure as an instrument for actual foreclosures, as well as a regression discontinuity design around state borders with differing foreclosure laws, we show that foreclosures have a large negative impact on house prices. Foreclosures also lead to a significant decline in residential investment and durable consumption. The magnitudes of the effects are large, suggesting that foreclosures have been an important factor in weak house price, residential investment, and durable consumption patterns during and after the Great Recession of 2007 to 2009.

*We thank Paul Beaudry, Christopher James, and seminar participants at Boston University, the University of British Columbia, and UCLA for comments. We also thank the National Science Foundation and the Initiative on Global Markets at the University of Chicago Booth School of Business for funding. Filipe Lacerda provided excellent research assistance. Atif Mian: atif@haas.berkeley.edu; Amir Sufi: amir.sufi@chicagobooth.edu; Francesco Trebbi: ftrebbi@interchange.ubc.ca.

An extensive body of research postulates that a levered economy is subject to large swings in economic activity (e.g., Fisher (1933)). One of the key mechanisms through which leverage is believed to amplify shocks is negative price effects from the leverage-induced forced sale of durable goods (e.g., Shleifer and Vishny (1992), Kiyotaki and Moore (1997), Krishnamurthy (2003, 2009), and Lorenzoni (2008)). This amplification can occur through a variety of channels including reduction in collateral value, balance sheet weakness, or negative wealth effects. But the central conclusions from this literature are clear: first, the forced sale of durable goods can have negative price effects and, second, these negative price effects can lead to a significant decline in real economic activity.

We examine this idea in the context of the recent rise in foreclosures. The top left panel of Figure 1 shows that aggregate foreclosure filings in the U.S. increased from 750,000 in 2006 to almost 2.5 million in 2009. While we do not have data on foreclosures before 2006, the mortgage default rate increased above 10% in 2009, which is more than twice as high as any year since 1991. By any standard, the recent U.S. mortgage default and foreclosure crisis is of unprecedented historical magnitude.

The sharp rise in foreclosures accompanied large drops in house prices, residential investment, and durable consumption. As the top right panel of Figure 1 shows, nominal house prices fell 35% from 2005 to 2009. The drop in residential investment from 2005 to 2009 shown in the bottom left was larger than any drop experienced in the post World War II era. The drop in durable consumption is also large, but more comparable to recent recessions. While durable consumption and residential investment are small components of overall GDP, they are especially important in understanding macroeconomic fluctuations (Leamer, 2007).

This paper evaluates the effect of the recent foreclosure crisis on house prices, and then examines the amplification effect by estimating how foreclosures affect residential investment and durable consumption. We utilize a micro-level data set covering the entire United States until the end of 2009 with information on a number of variables of interest including house prices, residential investment, auto sales, mortgage delinquencies, and foreclosures. We have all of these variables at the zip code-year level, with the exception of residential investment and auto sales which are at the county-year level.

A study seeking to estimate the effect of foreclosures on house prices is confounded by concerns of unobserved shocks and reverse causality. For example, an unobserved negative shock can drive down house prices and increase delinquencies and foreclosures at the same time. Further, reverse causality is a major concern given that a necessary condition for foreclosure is that a borrower have negative equity (Deng, Quigley, and Van Order (2000), Bajari, Chu, and Park (2008)). Consequently, foreclosures and house prices will be strongly negatively correlated in the data, even if foreclosures have no independent effect on house prices. An empirical strategy seeking to estimate the effects of foreclosures on house prices must employ plausibly exogenous variation in foreclosures.

Our strategy relies on variation in foreclosures that is driven by state rules on whether a foreclosure must take place through the courts (a *judicial foreclosure*). In states that require a judicial foreclosure, a lender must sue a borrower in court before conducting an auction to sell the property. In states without this requirement, lenders have the right to sell the house after providing only a notice of sale to the borrower (a *non-judicial foreclosure*). As first highlighted in the economics literature by Pence (2006), the 21 states that require judicial foreclosure impose substantial costs and time on lenders seeking to foreclose on a house.

We begin by showing that there is indeed a very strong negative correlation between actual foreclosures and whether a state requires a judicial foreclosure. States that require judicial foreclosure have a rate of foreclosures per homeowner during 2008 and 2009 that is 3 percentage points lower than states without, which translates to a 2/3 standard deviation and is more than half of the mean (4.5% homeowners in foreclosure). Using data on mortgage delinquencies, we show that states with judicial requirements have a much lower ratio of foreclosures to delinquent accounts. In fact of the 14 states with the highest propensity to convert delinquent homes into foreclosure sales, *none* require judicial foreclosure, and only 2 of the top 24 states require judicial foreclosure.

While judicial requirement strongly predicts the foreclosure rate, it can only be a legitimate instrument for foreclosures if it is *not* correlated with other factors that may have contributed to the severity of a recession in a state. We show that states with a judicial foreclosure requirement are remarkably similar to other states in all attributes of interest except the propensity to foreclose. For example, as of 2000 states that do and do not require judicial foreclosure display no difference in the fraction of subprime borrowers, the fraction of lower income residents, the unemployment rate, the minority share of the population, and the fraction of the residents living in urban areas. Similarly, there is no evidence of differential credit growth or differential house price growth between 2000 and 2005, and no difference in mortgage delinquency rates during the mortgage default crisis. In other words, the rate at which homeowners default on their homes is almost identical in states that do and do not require judicial foreclosure. But the rate at which delinquencies progress into foreclosures is substantially lower in judicial requirement states.

Using state laws requiring judicial foreclosure as an instrument for foreclosures, we estimate the effect of foreclosures on house prices. We find a large effect. Our state-level baseline estimate suggests that a one standard deviation increase in foreclosures in 2008 and 2009 leads to 2/3 standard deviation lower house price growth over the same period. Alternatively, moving from the median to the 90th percentile of the foreclosure per homeowner distribution leads to 9% lower house price growth from 2007 to 2009.

Our estimate of the effect of foreclosures on house price growth is robust to extensive controls for demographics and income differences across states. All specifications explicitly control for the effect of mortgage delinquencies on house prices. In other words, our estimate captures the incremental price effect of foreclosures above and beyond delinquencies. In addition, the effect is similar when we conduct the analysis at the MSA-level and is robust to the use of either the Fiserv Case Shiller Weiss or Zillow.com house price indices.

We also employ a zip code-level border regression discontinuity (RD) specification that is similar to the specification that Pence (2006) uses for credit. This specification allows us to compare zip codes that are very close to each other in geographical distance and observable characteristics. Consistent with the state level correlations, there is a sharp increase in the foreclosure rate as one crosses the border from a judicial requirement state into a state with no judicial requirement. However, there is no similar jump in other observable variables as one crosses the border. Focusing only on zip codes that are very close to the border between two states that differ in judicial foreclosure requirement laws, we find similar two-stage least squares estimates of the effect of foreclosures on house prices. The similarity of the results using the zip code-level RD design mitigates omitted variable concerns in state- and CBSA-level regressions.

We then turn to residential investment and durable consumption. Employing a similar two stage least squares estimation strategy, we find that a one standard deviation increase in foreclosures per homeowner leads to a 2/3 standard deviation decrease in permits for new residential construction. Further, a one standard deviation increase in foreclosures leads to a 2/3 standard deviation decline in auto sales. The estimates are robust to controls for demographics and income. Data on residential investment and auto sales are disaggregated only to the county level. Nonetheless, we employ a similar border discontinuity strategy using county-level data and find similar coefficient estimates, although the statistical power of the discontinuity estimation is weak.

We use our microeconomic estimates to quantify the aggregate effects of foreclosure on the macro-economy. Our estimates suggest that foreclosures were responsible for 15 to 30% of the decline in residential investment from 2007 to 2009 and 20 to 40% of the decline in auto sales over the same period. The details of this calculation are in Section V. B.

It is important to emphasize that we do not take a stand on whether foreclosures help to bring house prices, durable consumption, or residential investment closer to or further from their-long-run socially efficient levels. For example, in the absence of foreclosures, house prices may display downward rigidity given loss aversion (Genesove and Mayer (2001)). Alternatively, house prices may be kept above their socially efficient level by government support. Further, it is conceivable that the declines we document would occur in the long run even in the absence of foreclosures; it is also conceivable that states where foreclosure is relatively easy will experience a faster housing recovery.

But our estimates suggest that foreclosures lead to more abrupt declines in these outcomes than would be observed in the absence of foreclosures, and these declines are likely to

be more painful in the midst of a severe recession. This is consistent with the amplification mechanisms emphasized in Kiyotaki and Moore (1997) and Krishnamurthy (2003). We believe that these results demonstrate a direct connection between a financial friction--forced sales induced by foreclosures--and a reduction in residential investment and durable consumption during and after the recession of 2007 to 2009.

Our findings are most closely related to recent studies on foreclosures and house prices (Calomiris, Longhofer, and Miles (2008), Campbell, Giglio, and Pathak (2010), Foote, Gerardi, and Willen (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 2009.[1] We are also the first to use state laws on judicial requirement for foreclosure to identify the effect of foreclosures on house prices. The importance of an instrument for foreclosures is mentioned prominently in the literature.[2] Further, to the best of our knowledge, we are the first to examine the effect of foreclosures on real economic activity.[3]

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

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[1] 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.

[2] As Campbell, Giglio, and Pathak (2010) note, "…foreclosures are endogenous to house prices because homeowners are more likely to default if they have negative equity, which is more likely as house prices fall. Ideally, we would like an instrument that influences foreclosures but that does not influence house price except through foreclosures; however, we have not been able to find such an instrument" (15).

[3] The importance of precise estimates of the effect of foreclosures on real economy activity is highlighted by the large number of policy interventions that seek to reduce foreclosures, such as the Bush Administration's Foreclosure Prevention Act of 2008, the foreclosure moratoria in Maryland and California, and the Obama Administration's Home Affordability Modification Program of 2009.

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 2009. RealtyTrac.com collects data from legal documents that are submitted by lenders during the foreclosure process. There are five types of filings collected by RealtyTrac.com. The first two are filings that are done before a foreclosure auction: a notice of default (NOD) and a *lis pendens* (LIS). Two of the filings are directly associated with a foreclosure auction: a notice of trustee sale (NTS) and a notice of foreclosure sale (NFS). Finally, RealtyTrac.com collects information on whether the foreclosed home is purchased by the lender at auction, or real-estate owned (REO).

For every zip code, we have the total number of filings for each of these five categories. To avoid double-counting filings for the same property, RealtyTrac.com provided us totals for the last filing in the process for a given property in a given year. For example, if a borrower received a notice of default and a notice of trustee sale in the same year, RealtyTrac.com records one notice of trustee sale for the property. Our measure of total foreclosures in a zip code is the total number of notices of trustee sale, foreclosure sales, or real estate owned (NTS+NFS+REO).[4]

Data on house prices at the zip code-quarter level are from Fiserv Case Shiller Weiss and Zillow.com. An excellent description of the differences and similarities between FCSW and Zillow.com is available in the appendix of Guerrieri, Hartley, and Hurst (2010), which we

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

summarize here. Both FCSW and Zillow.com data are collected from underlying transactions data based on deeds. FCSW uses a repeat sales methodology to capture the price growth of properties that are similar in characteristics. In contrast, Zillow.com combines the underlying transactions data with a hedonic adjustment model that assigns values to homes based on characteristics of the home. The hedonic model used by Zillow.com is not publicly available, but is a function of the size of the home, the number of bedrooms, and the number of bathrooms.

New residential permit data is from the Census and is available at the county-annual level. Auto sales data are from R.L. Polk and are available at the county-monthly frequency. For more information on the R.L. Polk data, see Mian and Sufi (2010a).

We supplement foreclosure, house price, residential investment, and auto sales data with zip code-quarterly level information on delinquencies from Equifax.[5] The Equifax data also allow us to measure at the zip code level the fraction of borrowers that had credit scores below 660 as of 2000. Finally, we supplement the zip code level data with demographic information from the 2000 Decennial Census.

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

The main restriction on the data is the availability of zip code house price indices. Zillow.com zip code level house price data are available for 8,900 zip codes in our sample, and FCSW house price data are available for 4,199 zip codes. Zip code level data are available from one of these two sources for 9,213 zip codes. These zip codes represent 65% of the total U.S.

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

population, 81% of total home-related debt as of 2005, and 83% of total foreclosures in 2008 and 2009. By far the largest observable difference between zip codes for which we do and do not have data is whether the zip code is in an urban area. Almost 80% of zip codes for which we have house price data available are in urban areas; only 19% of zip codes for which we do not have house price data are in urban areas.

B. Summary Statistics

The top panel of Table 1 presents summary statistics of the state level data used in the analysis. The average number of foreclosures per homeowner in 2008 and 2009 is 0.045. The number of homeowners is approximated using the number of mortgage accounts as of 2005 according to Equifax. The median is significantly lower than the mean, which reflects a very high number of foreclosures at the high end of the distribution. 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 50%.

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 15 to 20% depending on the data source. Residential investment at the state level dropped by 80% as measured by the Census data on permits for new residential construction. Auto sales dropped by 41%.

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

II. Correlations

A crucial insight from previous research is that house price declines are a necessary condition for foreclosures. If a homeowner owns a house with positive equity but faces significant liquidity constraints in making mortgage payments, she can either refinance to loosen the constraint or sell the home to liquefy the positive equity position. However, she will not allow for the bank to foreclose if she has positive equity (Deng, Quigley, and Van Order (2000), Bajari, Chu, and Park (2008)). This logic implies that foreclosures and house price growth will be mechanically negatively correlated.

The results in Table 2 confirm this mechanical correlation. In columns 1 and 2, we report estimates form an OLS specification of house price growth from 2007 to 2009 (or first quarter of 2010 for Zillow.com) on foreclosures in 2008 and 2009. Even after controlling for mortgage delinquencies, there is a strong negative correlation. The coefficient estimate in column 1 of Panel A implies that a one standard deviation increase in foreclosures is associated with 5% lower house price growth. The magnitude is similar using Zillow.com data. In column 2 we use an alternative functional form by regressing house price growth on foreclosures per delinquent account. The estimate implies that a one standard deviation increase in foreclosures per delinquent account (0.22) is associated with 7% lower house price growth, which is more than half a standard deviation.

Columns 3 and 4 show the correlation between house price growth and foreclosures at the CBSA level. The columns report specifications from OLS regressions of house price growth on foreclosures with the inclusion of state fixed effects. In columns 5 and 6, we examine the correlation at the zip code level with the inclusion of CBSA fixed effects. In all specifications,

house price growth is strongly negatively correlated with house price growth. This correlation holds when using variation in foreclosures across states, within states, and within CBSAs. In terms of magnitudes, the coefficients for the within state and within CBSA regressions are smaller than the cross-state specification. But distributional effects are similar.[6]

Figure 2 shows the scatter plot of house price growth against foreclosures at the state level. Arizona and Nevada have by far the largest number of foreclosures per homeowner and also sharply lower house prices. However, the correlation is also strongly negative among the other states in the sample.

The results in Table 2 and Figure 2 confirm a strong negative correlation between foreclosures and house price growth. This correlation is robust in variation that is within-CBSA, within-state, and across state. It is difficult, however, to infer the direction of causality. Given that a borrower must have negative equity in order to allow a foreclosure to occur, it would be shocking if there were anything but a strong negative correlation. An analysis seeking to estimate the effect of foreclosures on house prices must utilize plausibly exogenous variation foreclosures. We discuss our strategy in the next section.

III. Empirical Strategy

We utilize state laws that require judicial foreclosures as an instrumental variable for actual foreclosures.[7] In this section, we first provide background on judicial foreclosures and then provide evidence on the legitimacy of the identification strategy.

[6] The distributional effects are similar because the within-state and within-CBSA foreclosure variation is a larger portion of the overall variation relative to house prices. For example, a one within-CBSA SD increase in foreclosures (0.08) is associated with half a within-CBSA SD decline in house price growth (0.04/0.09).
[7] General information on the foreclosure process presented in this section comes from Pence (2003, 2006), http://www.all-foreclosure.com/judicial.htm, http://en.wikipedia.org/wiki/Foreclosure, and http://www.calculatedriskblog.com/2007/04/foreclosure-sales-and-reo-for-ubernerds.html.

A. Judicial Foreclosure Requirement as an Instrument

A foreclosure represents a forced sale of a property by a lender with the purpose of reimbursing the lender for the debt outstanding against the property. The process by which the lender executes the sale differs across states. One of the most important differences is whether a state requires that the sale be implemented through the courts. In states that require a judicial foreclosure, lenders 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 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.). 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, on calculatedriskblog.com, one of

the main bloggers writes: "Non-judicial foreclosure is almost always faster and cheaper for the lender than a judicial foreclosure." [8]

The October 2010 announced 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 stopped all foreclosure activity in states that require judicial foreclosure.[9]

Figure 3 shows states that require judicial foreclosure shaded in dark gray. The classification of states comes from RealtyTrac.com and follows closely the classification used by Pence (2006) and the classification listed on all-foreclosures.com.[10] While the majority of states that require judicial foreclosure are located in the upper Midwest and Northeast, there is geographical variation outside this area.

One particular set of zip codes that we focus on in the empirical analysis includes those that are close to the border of two states that differ in whether judicial foreclosures are required. We refer to these zip codes as the border discontinuity sample. To form this sample, we restrict the sample to zip codes that meet the following three restrictions: (1) the zip code must have available house price data from FCSW, (2) there must be zip codes across the nearest state border that also have house price data available, and (3) the state that is across the border must have a different law regarding judicial foreclosures. These three restrictions leave us with 870 zip codes.

Table 3 lists the state borders that are included in the border discontinuity analysis, along with the number of zip codes as the sample is isolated to zip codes within 50, 25, and 5 miles of

[8] http://www.calculatedriskblog.com/2007/04/foreclosure-sales-and-reo-for-ubernerds.html
[9] See http://www.nytimes.com/2010/10/08/business/08frozen.html .
[10] The only states that differ across these three classifications are Massachusetts, Nebraska, Oklahoma, Rhode Island, and Wisconsin.

the border. One disadvantage of the border discontinuity sample that is obvious from Table 3 is that none of the states with the largest incidence of foreclosures are included (i.e., Arizona, California, Florida, and Nevada).

B. Two-Stage Least Squares Specification

Our estimation of the effect of foreclosures on house prices, residential investment and durable consumption is based on a two stage least squares specification of the following form:

$$Ln(Y2009_{gs}) - Ln(Y2007_{gs}) = \alpha + \beta * \widehat{Foreclosures}0809_{gs} + \Gamma * X_{gs} + \varepsilon_{gs} \quad (1)$$

$$Foreclosures0809_{gs} = \pi + \theta * JudicialForeclosureRequirement_{s} + \Lambda * X_{gs} + \eta_{gs} \quad (2)$$

Equation (2) represents the first stage. We regress foreclosures in 2008 and 2009 scaled by the number of homeowners as of 2005 in geographical unit *g* (which can be a state or CBSA) on an indicator variable for whether the geographical unit is in a state *s* that requires judicial foreclosure. If the level of analysis is the state level then the *g* subscript is redundant. The second stage in equation (1) regresses the growth rate in outcome *Y* in geographical unit *g* from the end of 2007 to the end of 2009 on the predicted value of foreclosures from the first stage. Outcomes include house prices, residential investment, and auto sales. The matrix *X* contains control variables.

The specification outlined in (1) and (2) treats the variation in foreclosures induced by differences in state laws on judicial foreclosure as random, and uses this random variation to examine house prices, residential investment, and durable consumption. One obvious drawback from this approach is that we cannot back out the structural parameters of the full system of

equations where each of these three outcome variables (house prices, residential investment, and durable consumption) is allowed to affect one another. In other words, if foreclosures lead to a reduction in residential investment in the two-stage least squares specification, we cannot discern whether foreclosures directly affect residential investment, or whether foreclosures indirectly affect residential investment through their effect on prices. Nonetheless, under the identifying assumptions, we are able to use the specification to estimate the overall effect of foreclosures on each of these outcomes.

A consistent estimate of the coefficient β requires two conditions. First, whether a state requires judicial foreclosure must be correlated with the actual incidence of foreclosures. Second, the exclusion restriction must be met. The instrument must be uncorrelated with the error term in the underlying relation between the outcome of interest and foreclosures. The next two subsections discuss each of these two conditions.

C. Judicial Foreclosure Requirement and Actual Foreclosures

The evidence in this section overwhelming supports the argument that foreclosures are less likely in states that require judicial foreclosure. Table 4 presents regressions of foreclosures on an indicator variable for whether the state requires judicial foreclosure, which is a specific version of the first stage shown above in equation (2). As column 1 shows, states with a judicial foreclosure requirement have a foreclosure per homeowner ratio in 2008 and 2009 that is 0.030 lower, which represents 2/3 of the mean and 2/3 of a standard deviation of the left hand side variable.

Further, column 2 shows that mortgage delinquencies display no strong correlation with whether states require judicial foreclosure. The standard error is small, and we are able to reject

at the 10% level the hypothesis that delinquencies per homeowner are a two-third standard deviation lower in judicial foreclosure requirement states. The inclusion of delinquencies per homeowner as a control variable does not materially change the lower foreclosure rate in judicial states.

In column 4, we examine the pass-through rate, which we define to be the number of foreclosures scaled by the number of delinquent mortgage accounts. As the coefficient estimate shows, the pass-through rate to foreclosures is significantly lower in judicial foreclosure states. The magnitude is large. Judicial states have a pass-through rate to foreclosure that is a full standard deviation lower than non-judicial states.

Figure 4 shows more evidence on the pass-through rate. In the left panel, we show the foreclosures per delinquent account ratio for every state. States shaded in black require judicial foreclosure. The 14 states with the highest foreclosure to delinquent account ratios all allow non-judicial foreclosure. Of the 27 states with the highest pass-through rate from delinquencies to foreclosures, only 3 require judicial foreclosure. The right panel of Figure 4 plots foreclosures per homeowner against delinquencies per homeowner. Judicial states are plotted as triangles, and non-judicial states are plotted as circles. Consistent with the left panel, there is a much lower sensitivity of foreclosures to delinquencies in judicial states.

In order to isolate the sample to geographic areas that are similar, we plot in Figure 5 the pass-through rate for zip codes in the border discontinuity sample described in the above sub-section. More specifically, to produce the plots in Figure 5, we estimate the following specification:

$$Foreclosures\ Per\ Delinquent\ Account_{zbsx} = \alpha_{bsx} + \sum_{i=-50}^{50} \gamma^i * D_{zbsxi} + \varepsilon_{zbsx} \qquad (3)$$

where $Foreclosures\ Per\ Delinquent\ Account_{zbsx}$ represents foreclosures per delinquent account for zip code z that is located near border b in state s within a 10 mile strip x of the border.[11] The specification includes fixed effects at the level of border-state-10 mile strip (α_{bsx}). The dots in Figure 5 represent the coefficient estimates of γ^i on the indicators D_{zbsxi}, which are indicators for each one mile on either side of the border, with negative values being in the state that requires judicial foreclosure. These coefficient estimates represent the average foreclosures per delinquent account ratio for one mile wide bands around the border of a judicial state and non-judicial foreclosure state, after controlling for (border state*10 mile strip) fixed effects.

Figure 5 plots the estimates of $\gamma^i$for the foreclosures per delinquent account for 2006 through 2009. Consistent with the state level analysis in Figure 4, there is a very sharp jump in the foreclosure to delinquent account ratio as one crosses the border from a judicial requirement state into a non-judicial requirement state. This border discontinuity jump is weaker in 2006 and becomes stronger through time.

As a final check we assessed the issue of possible weakness of our instrumental variable. Weak instruments arise in the presence of low correlation between the included endogenous variable and the instrument. The ensuing weak identification leads to IV statistics that are non-normal even in large samples, and standard IV tests become unreliable in terms of size and bias. The strong correlation between judicial proceedings on foreclosure rates at the state level is reassuring that the instrument is strong in state-level regressions. The issue of weak instruments, however, could still potentially arise in CBSA or zip code-level analysis due to the fact that the level of variation we employ for the IV remains at the state-level. Reassuringly, in Tables 4 and following, we generally observe F statistics above Stock and Yogo (2005) weak identification

[11] 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.

critical values, rejecting the hypothesis that the IV is weak. However, on occasion, the instrument displayed Kleibergen-Paap F statistics below the 10% maximal IV size, suggesting the potential for the IV inference being misleading. We 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 (our specific instance).

D. Exclusion Restriction

The bottom panel of Table 4 shows that there are no obvious statistically significant differences in observable covariates between judicial and non-judicial states. In particular, states with judicial foreclosure do not show a statistically significant difference in delinquency rates, house price growth from 2002 to 2005, subprime fraction of the population, income, unemployment, poverty, racial demographics, education, or ruralness. The standard errors are relatively small. For almost every single variable in Panel B, we can reject at the 10% level of confidence that judicial requirement states are different by a 3/4 standard deviation. The only variable for which we cannot reject the difference is FCSW house price growth from 2002 to 2005, and this is due to a small sample of only 24 states.

In Figure 6, we examine the validity of the exclusion restriction using the zip code border discontinuity sample. More specifically, Figure 6 shows whether zip codes on either side of the border are different in terms of their delinquency rates, subprime borrowers, income, poverty incidence, minority share, or education. The specification that produces these plots is analogous to equation (3) with different outcome variables. As the coefficient estimates on the one-mile bands show, there is no discernable jump in any of the observable variables at the border.

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, Garmaise, and Moskowitz (2005) on commercial mortgages).

We explore this concern using the zip code border discontinuity sample, which is similar to the strategy used in Pence (2006). In Table 5, we report results from our estimation of the following equation:

$$Outcome_{zbsx} = \alpha_{bsx} + \theta * JudicialForeclosureRequirement_s + \eta_{zbsx} \quad (4)$$

where an outcome in zip code *z* near state border *b* in state *s* is regressed on a border-state-10-mile strip fixed effect and the judicial foreclosure requirement indicator variable. In Panel A of Table 5, we first replicate the first stage where the outcome variable is the foreclosure rate. As column 1 shows, the foreclosure rate per homeowner is significantly lower in judicial states. The magnitude of the effect is similar to the state level evidence in Table 4. Column 2 shows that the foreclosure per delinquency ratio is also much lower in zip codes on the judicial state side of the border.

In column 3, we examine whether the average mortgage for home purchase in a zip code is smaller if the zip code is in a judicial state. This specification is similar to the one reported in

Pence (2006) except we are using the average in a zip code instead of the underlying loans and we are examining the 2005 loans instead of 1994 and 1995 loans. The mortgage data come from HMDA. In column 4, we use an alternative left hand side variable, which is the total amount of mortgages for home purchase in a zip code scaled by total income from the IRS in that zip code. As the estimates in columns 3 and 4 show, we find no evidence that average loan sizes or total lending are significantly lower in judicial states, despite the fact that ex post foreclosure rates are significantly lower. The standard errors are sufficiently small that we can reject at the 10% level the hypothesis that loans sizes or loans to income are 3/4 standard deviation lower in zip codes on the judicial state side of the border.

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

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

Why does the Pence (2006) result weaken over time? Or in other words, 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 potential 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, Lehnert, Sherlund, and Willen (2008)). If lenders assigned a very low probability to default states, then the loss given default likely played a small 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. Relatedly, most of the loans originated in general, i.e. the conforming loans, are guaranteed by the GSEs against default. There is no evidence that we know of that suggests 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 losses given default in different states. Finally, we find that 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.[12] The net effect of these two forces may be neutral.

E. State Foreclosure Statutes in Further Detail

State laws requiring foreclosures to take place through courts are only one of many legal differences in mortgage markets across states. To assess the importance of the additional legal differences, we employ the Rao and Walsh (2009) taxonomy of consumer protection clauses included in state foreclosure statutes.[13] Our goal is to examine whether other legal differences are

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

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

(1) responsible for our results on judicial foreclosure requirement and (2) important in their own right.

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

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

Examining the foreclosure per homeowner ratio in 2008 and 2009, the judicial foreclosure indicator maintains its original size and significance in each of the ten augmented specifications and in the specification with all clauses simultaneously (column 1). Foreclosure rates appear significantly lower in judicial foreclosure states. The judicial foreclosure variable eliminates the statistical significance of all of the other Rao and Walsh (2009) clauses except for the "right to reinstate before sale" and the "housing emergency assistance fund." The results are

similar if we control for delinquencies per homeowner in 2008 and 2009 and when the left-hand-side variable is the foreclosure per delinquency ratio in 2008 and 2009. In fact, the foreclosure per delinquency ratio remains significantly lower in judicial foreclosure states and does not vary systematically with any additional protection clause.

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

IV. The Effect of Foreclosures on House Prices

In this section, we present results from our two-stage least squares estimation of the effect of foreclosures on house prices. The first section utilizes state and CBSA level data for the full sample, and the second section utilizes the zip code border discontinuity sample.

A. Full Sample

Figure 7 presents the reduced form version of our two-stage least squares estimation strategy. It plots house price growth in states with and without a judicial foreclosure requirement from 2004 to the end of the sample period. For both the FCSW (top) and Zillow.com (bottom) indices, there is a larger drop in house prices in states that do not require judicial foreclosure. The magnitude of the relative decline is significantly larger using the FCSW index. For the FCSW index, house prices in non-judicial states fell by 43% from the middle of 2006 to the

beginning of 2009. They fell by only 28% in judicial states. The top right panel plots the difference over time. The drop using Zillow.com from the second quarter of 2007 to the third quarter of 2009 is about 4%.[14] Further, there is no systematic evidence of differential house price trends before the foreclosure crisis.

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 the fourth quarter of 2007 through the first quarter of 2010. As the estimates show, there is a strong negative effect of foreclosures on house price growth. 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 8 to 12% relative drop in house price growth, which is 2/3 to a full standard deviation decrease in house price growth. The estimate in column 2 implies that moving from the state with median foreclosure rate to a state with the 90th percentile foreclosure rate leads to 9% lower house price growth from 2007 to 2010.

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 III 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. The similarity in direction and magnitude of the coefficient estimates is reassuring given the different methodologies used by FCSW and Zillow.com. Given that Zillow.com attempts to

[14] In Appendix Figure 1, we replicate Figure 7 using publicly available data from the FHFA and the S&P Case Shiller 20 MSA indices. For the S&P CS indices, we exclude three MSAs that cross the borders of states that differ in their judicial foreclosure requirement laws (Chicago, IL; Charlotte, NC; and Washington, DC). The relative drop in non-judicial states using the S&P CS publicly available data is 12%, and the relative drop using FHFA is 3%. FHFA data excludes non-conforming (mostly subprime and jumbo loans) loans in its construction and hence tends to underestimate house price changes driven by the mortgage crisis.

adjust for characteristics of the home, it is unlikely that our estimate is driven by the effect of foreclosures on upkeep alone.

In Table 7, we replicate the specifications using CBSA level data. While the variation in judicial requirement for foreclosures in the first stage is at the state level, the CBSA level-analysis allows us to control for other characteristics at a more granular level. This is a particularly useful specification because CBSAs are formed in part because they are considered by government agencies to be a geographical economic unit.

The estimates imply a negative effect of foreclosures on house prices that is statistically significant at the 10% level in all specifications except for column 3. The magnitude of the coefficient estimates is slightly smaller in the CBSA level analysis. The estimate in column 2 implies that a one standard deviation increase in foreclosures per homeowner leads to a 1/3 standard deviation lower house price growth.

While statistical power is strong enough to reject the null hypothesis of zero effect in most specifications, standard errors are in general quite large. This reflects the fact that we cluster all standard errors at the state level given that our instrument varies only at the state level. This is the main disadvantage of the judicial foreclosure requirement instrument.

The 2SLS magnitude of the effect of foreclosures on house price growth is similar using the Zillow.com or FCSW indices. However, the reduced form graphs in Figure 7 suggest a smaller relative decline with the use of Zillow.com. This difference in reduced form and 2SLS magnitude is driven by two effects. First, the reduced form graph does not condition on delinquencies while 2SLS controls for delinquencies. Doing so does not change the reduced form relationship for Zillow.com index, but decreases the reduced form difference between judicial and non-judicial states for FCSW index by about 25 percent. Second, the first stage for FCSW

index is based on a smaller subset of states. These states turn out to have a stronger first stage.[15] Since the 2SLS coefficient is based on the ratio of reduced form coefficient and first stage coefficient, the 2SLS estimate based on FCSW index is similar to the one based on Zillow.com index despite larger reduced form relationship based on FCSW index.

B. Zip Code Border Discontinuity

In this section, we estimate the effect of foreclosures on house prices using the zip code border discontinuity sample described in Section III. The benefit of this methodology is that it estimates the causal impact of foreclosures on house prices under the relatively mild assumption of local continuity in omitted variables of interest. More specifically, Table 8 presents estimates from the following two-stage least squares estimation:

$$HousePriceGrowth0809_{zbsx} = \alpha_{bsx} + \beta * \widehat{Foreclosures}09_{zbsx} + \Gamma * X_{zbsx} + \varepsilon_{zbsx} \quad (5)$$

$$Foreclosures09_{zbsx} = \alpha_{bsx} + \theta * JudicialForeclosureRequirement_s + \Lambda * X_{zbsx} + \eta_{zbsx} \quad (6)$$

where $HousePriceGrowt0809_{zbsx}$ is house price growth from 2008 to 2009 in a zip code z that is located near border b in state s within a 10 mile strip x of the border. The specification includes fixed effects at the level of border-state-10 mile strip (α_{bsx}). The first stage in equation (6) regresses foreclosures in 2009 on an indicator variable for whether the state in which the zip code is located requires judicial foreclosure. The second stage in equation (4) estimates the effect of foreclosures in 2009 on house price growth from 2008 to 2009.

One difference in the empirical specification for the border discontinuity sample is that we focus only on foreclosures as of 2009. In the smaller sample, the first stage is weak for 2008.

[15] The first stage is -0.03 for states with Zillow.com index, and -0.044 for states with FCSW index.

This is likely due to the fact that the foreclosure crisis in the border discontinuity sample was muted relative to the full sample in 2008; indeed, states with very high foreclosure rates as of 2008 (e.g., Arizona, California, Florida, Nevada) are not included in the border discontinuity sample.

The second stage specification reported in Panel A of Table 8 uses the entire sample of zip codes in the border discontinuity sample. The coefficient estimate of β is negative and statistically significant at the 1% level in column 1. In this subsample, the magnitude of the estimate in column 1 implies that a one standard deviation increase in foreclosures per homeowner in 2009 leads to a one standard deviation lower house price growth from 2008 to 2009. This magnitude calculation is done using standard deviations that are within each state-border-10 mile strip group. The congruence of the quantitative estimates of the RD with the state-level analysis estimates is reassuring in terms of external validity of the RD results.

The statistical power of the estimate is slightly weaker with control variables. The results using Zillow.com house price data are similar in magnitude and significant at the 10% level of confidence. While the coefficient estimate is twice as large, the within state-border-10 mile strip group standard deviation in Zillow.com house price growth is also twice as large implying a similar distributional effect.

In order to further homogenize the sample of zip codes in judicial and non-judicial states and to tighten the identification of the foreclosure coefficient, we restrict the sample in Panels B through D to zip codes that are within 50, 25, and 5 miles of the border. While the statistical power of the tests diminishes, the magnitudes are similar.

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

A. Two-stage least squares estimates

The results in the above section document a large negative effect of foreclosures on house prices. A central idea in macroeconomic research is that a sharp negative movement in the relative price of durable goods can amplify shocks and lead to a reduction in real economic activity. This section explores this idea in the context of residential investment and durable consumption.

As we emphasize in Section III, we do not attempt to separate the independent effects of house price declines and foreclosures on residential investment and auto sales. In other words, the effect of foreclosures on residential investment and auto sales could come either directly from foreclosures or indirectly through the house price effects of foreclosures documented above. Our empirical strategy is designed to detect the impact of an exogenous increase in foreclosures on house prices, residential investment, and auto sales. But we cannot identify the exact channels through which each of these variables affects each other, absent additional identifying information.

In the left panel of Figure 8, we present the state-level correlation between residential investment growth from 2007 to 2009 and foreclosures per homeowner in 2008 and 2009. There is a very strong negative correlation. Arizona and Nevada are the extreme states, but the correlation is quite strong even among the other states in the sample. The same is true of durable consumption as measured by auto sales. More specifically, the right panel shows a strong negative correlation between auto sales growth from 2007 to 2009 and foreclosures per homeowner in 2008 and 2009.

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 2009 as measured by new residential construction permits collected by the Census. The data used in the top panel are at the annual frequency.[16] 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.

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 2010Q2 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.

The first three columns of Table 9 present the state-level two-stage least squares estimates for residential investment as measured by new residential construction permits. The estimate in column 2 on foreclosures per homeowner implies that a one standard deviation increase in foreclosures leads to a 0.65 standard deviation decrease in residential investment

[16] 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.

growth from 2007 to 2009. Alternatively, moving from the median to the 90th percentile of the distribution of foreclosures leads to 23 percentage points lower residential investment growth from 2007 to 2009. The CBSA level estimates imply a similar magnitude. The state level estimates are sensitive to the inclusion of the full set of control variables in column 3, but are robust when examined at the CBSA level even when standard errors are clustered at the state level.

Table 10 presents the corresponding results for auto sales. The estimate in column 2 implies that a one standard deviation increase in foreclosures leads to a 0.70 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 14 percentage points lower auto sales growth from 2007 to 2009.

One concern with the results in Tables 9 and 10 is that omitted variables across states or CBSAs pollute the two-stage least squares estimates. Unlike the house price data, we do not have zip code level information on auto sales or residential investment. However, the original data from the Census and R.L. Polk are at the county level. This allows for a less granular border discontinuity design where the units of observation are counties that are very near the border of two states that have differing foreclosure rules.

The exact specification isolates the sample to counties that are within 10 miles of the border of two states which differ on whether judicial foreclosure is required. The specification utilizes border fixed effects and is clustered at the border level. In other words, the two-stage least squares estimates exploit variation in foreclosures for two counties right across the border from another, where one county is in a state that requires judicial foreclosure while the other county is not.

The county-level border discontinuity second stage results are in Table 11. For residential investment, the standard errors are quite large. The point estimates are similar in magnitude as the CBSA level results in Table 9, but there is almost no precision. The results for auto sales using the border discontinuity specification are similar in magnitude as the CBSA level results in Table109. The standard errors are smaller, and we can reject the null of no effect at the 10% level in columns 4 and 5.

B. Macroeconomic Implications

We can use the estimates obtained in Tables 9 and 10 to inform the debate regarding the effect of foreclosures on the macro-economy. However, it is critical to emphasize that the marginal effects estimated in Tables 9 and 10 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.[17]

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 4 for the state level data and Table 5 for the zip code border discontinuity 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.[18] The estimates are close to -0.03 in both, which

[17] For more on this issue, see Chapter 4 of Angrist and Pischke (2009).
[18] An alternative approach would use the overall variation in foreclosures by picking states or CBSAs with very low foreclosures as a control group or using a one standard deviation change in foreclosures in the cross-section.

implies that foreclosures per homeowner are 3 percentage points lower in judicial foreclosure requirement states.

We multiply the coefficient estimates in Tables 9 and 10 with the 3 percentage point difference in foreclosure rates to estimate the aggregate impact of foreclosures on residential investment and auto sales. The state-level estimate in column 2 of Table 9 suggests that residential investment growth from 2007 to 2009 was (-4.1*-0.03 =) 12 percentage points lower in non-judicial versus judicial states. The average decline in the sample (from Table 1) is 77 percentage points, which implies that foreclosures can explain about 15% of the overall decline in residential investment. A similar calculation using the CBSA-level estimate in column 5 of Table 9 implies that foreclosures can explain 30% of the overall decline in residential investment.

For auto sales, the estimate in column 2 of Table 10 implies that auto sales growth from 2007 to 2009 was (-2.6*-0.03 =) 8 percentage points lower in non-judicial versus judicial requirement states. The average decline in the sample (from Table 1) is 41 percentage points, which implies that foreclosures can explain about 20% of the overall decline in auto sales. Using the CBSA-level estimate in column 5 of Table 10 implies that foreclosures can explain 40% of the overall decline in auto sales from 2007 to 2009.

Overall, our analysis implies that foreclosures can explain 15 to 30% of the dramatic decline in residential investment from 2007 to 2009 and 20 to 40% of the dramatic decline in auto sales over the same period. It is critical to emphasize that these effects represent the total impact of foreclosures on outcomes of interest; these total effects may come about through many channels. For example, foreclosures may reduce residential investment in distressed properties through neglect of maintenance or debt overhang frictions. Foreclosures may also reduce

residential investment through their effect on house prices within a standard Tobin's Q investment model.

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.

In this study, we bridge this gap by examining the price and real effects of foreclosures. Using variation in foreclosure rates induced by state-specific laws on judicial requirements, we show a large and statistically significant negative effect of foreclosures on house prices. Further, we show that foreclosures lead to lower levels of durable consumption and residential investment, each an important cyclical components of GDP.

Our estimates of the effect of foreclosures on residential investment and auto sales can partially explain both the magnitude and length of the recession of 2007 to 2009. For example, the sharp rise in foreclosures began relatively late in the recession and continues into 2010. If we combine this fact with the finding in Leamer (2007) that residential investment is among the most powerful NIPA components leading the U.S. out of recession, one can conjecture that foreclosures have likely contributed to the length of the recession and sluggishness of the recovery. Similar arguments apply to our findings on auto sales. Leamer (2007) identifies durables as the consumer item with the largest negative average cumulative contribution to economic growth during recessions. Under the assumption that our results on auto sales extend

to the entire durable goods share of the economy (23.6 % of GDP in 2008), foreclosures can explain the relatively sluggish growth in durables well into 2010. Given that the 2007 to 2009 recession and its aftermath have been closely related to depressed levels of durable consumption and residential investment, our results highlight an important role for foreclosures and house prices in understanding weakness in the economy.

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Table 1
Summary Statistics

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

	N	Mean	SD	10th	50th	90th
State level data						
Foreclosures per homeowner, 2008 and 2009	51	0.045	0.043	0.010	0.035	0.090
Delinquencies per homeowner, 2008 and 2009	51	0.095	0.042	0.058	0.086	0.133
Zillow house price growth, 2002 to 2006	43	0.336	0.159	0.167	0.328	0.592
Zillow house price growth, 2006 to 2007	45	-0.020	0.048	-0.085	-0.014	0.043
Zillow house price growth, 2007 to 2010q1	46	-0.144	0.127	-0.261	-0.131	0.013
FCSW house price growth, 2002 to 2006	24	0.365	0.199	0.097	0.347	0.675
FCSW house price growth, 2006 to 2007	24	-0.070	0.069	-0.196	-0.048	-0.002
FCSW house price growth, 2007 to 2009	24	-0.206	0.162	-0.476	-0.178	-0.066
Residential permits growth, 2002 to 2006	51	0.289	0.275	-0.071	0.245	0.656
Residential permits growth, 2006 to 2007	51	-0.198	0.141	-0.339	-0.191	-0.037
Residential permits growth, 2007 to 2009	51	-0.768	0.270	-1.082	-0.726	-0.496
Auto sales growth, 2004 to 2006	51	-0.020	0.123	-0.116	-0.046	0.093
Auto sales growth, 2006 to 2007	51	-0.022	0.056	-0.104	-0.019	0.050
Auto sales growth, 2007 to 2009	51	-0.413	0.157	-0.578	-0.399	-0.238
CBSA level data						
Foreclosures per homeowner, 2008 and 2009	958	0.034	0.040	0.003	0.022	0.075
Delinquencies per homeowner, 2008 and 2009	958	0.092	0.044	0.050	0.083	0.140
Zillow house price growth, 2002 to 2006	296	0.367	0.193	0.121	0.353	0.631
Zillow house price growth, 2006 to 2007	312	-0.029	0.077	-0.141	-0.018	0.051
Zillow house price growth, 2007 to 2010q1	320	-0.180	0.152	-0.384	-0.163	-0.003
FCSW house price growth, 2002 to 2006	121	0.385	0.213	0.096	0.396	0.677
FCSW house price growth, 2006 to 2007	120	-0.098	0.112	-0.249	-0.058	0.007
FCSW house price growth, 2007 to 2009	120	-0.201	0.158	-0.443	-0.162	-0.042
Residential permits growth, 2002 to 2006	946	0.317	0.567	-0.311	0.281	1.010
Residential permits growth, 2006 to 2007	947	-0.159	0.442	-0.559	-0.179	0.264
Residential permits growth, 2007 to 2009	945	-0.771	0.517	-1.480	-0.757	-0.138
Auto sales growth, 2002 to 2006	958	-0.049	0.121	-0.170	-0.060	0.079
Auto sales growth, 2006 to 2007	958	-0.024	0.080	-0.125	-0.020	0.072
Auto sales growth, 2007 to 2009	958	-0.420	0.153	-0.624	-0.413	-0.227
New mortgages/income, 2005	958	0.113	0.094	0.038	0.082	0.235
Debt to income increase, 2002 to 2005	958	0.193	0.325	-0.087	0.190	0.481
Subprime consumer fraction, 2000	958	0.343	0.094	0.236	0.328	0.474
Ln(Income, 2005)	958	3.757	0.215	3.542	3.722	4.015
Fraction with income less than 25K, 2005	958	0.470	0.062	0.401	0.469	0.540
Unemployment rate, 2000	958	0.061	0.022	0.038	0.057	0.089
Poverty fraction, 2000	958	0.138	0.056	0.079	0.128	0.211
Black fraction, 2000	958	0.084	0.121	0.002	0.028	0.276
Hispanic fraction, 2000	958	0.060	0.120	0.005	0.019	0.140
Less than high school education fraction, 2000	958	0.210	0.077	0.127	0.194	0.320
Urban fraction, 2000	958	0.617	0.188	0.362	0.612	0.881

Table 2
Foreclosures and House Price Growth: Correlations

This table presents correlations between foreclosures and house price growth. The specifications reported in columns 1 and 2 are estimated at the state level, specifications reported in columns 3 and 4 are estimated at the CBSA level using state fixed effects, and specifications reported in columns 5 and 6 are estimated at the zip code level using CBSA fixed effects. Standard errors in columns 3 and 4 are clustered at the state level. Standard errors in columns 5 and 6 are clustered at the CBSA level.

Panel A: Zillow house price growth, 2007 to 2010q1

	State level		CBSA level with State FE		Zip code level with CBSA FE	
	(1)	(2)	(3)	(4)	(5)	(6)
Foreclosures per homeowner, 2008 and 2009	-1.112**		-0.806**		-0.104*	
	(0.310)		(0.297)		(0.052)	
Delinquencies per homeowner, 2008 and 2009	-1.426**		-0.800**		-0.458**	
	(0.302)		(0.243)		(0.086)	
Foreclosures per delinquency, 2008 and 2009		-0.276**		-0.246**		-0.040**
		(0.094)		(0.084)		(0.010)
Constant	0.047*	-0.035	-0.050**	-0.081*	-0.137**	-0.189**
	(0.021)	(0.035)	(0.014)	(0.034)	(0.012)	(0.004)
N	46	46	320	320	8,949	8,788
R^2	0.661	0.224	0.716	0.635	0.737	0.682

Panel B: FCSW House price growth, 2007 to 2009

	State level		CBSA level with State FE		Zip code level with CBSA FE	
	(1)	(2)	(3)	(4)	(5)	(6)
Foreclosures per homeowner, 2008 and 2009	-1.379**		-0.860*		-0.265**	
	(0.474)		(0.402)		(0.094)	
Delinquencies per homeowner, 2008 and 2009	-1.450**		-0.638**		-0.402**	
	(0.436)		(0.199)		(0.077)	
Foreclosures per delinquency, 2008 and 2009		-0.344*		-0.353		-0.073**
		(0.143)		(0.210)		(0.020)
Constant	0.044	-0.056	-0.061**	-0.050	-0.157**	-0.209**
	(0.037)	(0.050)	(0.013)	(0.090)	(0.009)	(0.009)
N	24	24	120	120	4,098	4,095
R^2	0.754	0.269	0.871	0.783	0.858	0.777

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

Table 3
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. The total sample is restricted to zip codes for which the border in question is the closest state border and for which FCSW house price data are available.

Total

Border	Number of zip codes
Connecticut - Rhode Island	80
Georgia - South Carolina	53
Illinois – Wisconsin	150
Massachusetts - New Hampshire	170
Massachusetts - Rhode Island	181
Michigan – Ohio	151
North Carolina - South Carolina	85

Within 50 miles of border

Border	Number of zip codes
Connecticut - Rhode Island	80
Georgia - South Carolina	12
Illinois – Wisconsin	150
Massachusetts - New Hampshire	170
Massachusetts - Rhode Island	180
Michigan – Ohio	117
North Carolina - South Carolina	76

Within 25 miles of border

Border	Number of zip codes
Connecticut - Rhode Island	27
Georgia - South Carolina	4
Illinois - Wisconsin	55
Massachusetts - New Hampshire	149
Massachusetts - Rhode Island	142
Michigan - Ohio	27
North Carolina - South Carolina	57

Within 5 miles of border

Border	Number of zip codes
Connecticut - Rhode Island	2
Georgia - South Carolina	2
Illinois - Wisconsin	8
Massachusetts - New Hampshire	36
Massachusetts - Rhode Island	34
Michigan - Ohio	6
North Carolina - South Carolina	12

Table 4
Judicial Foreclosure Requirement Instrument

Panel A presents coefficients from the first stage regression of foreclosures on whether a state requires a judicial foreclosure. Each row of Panel B represents an univariate regression of the variable in the first column on whether a state requires a judicial foreclosure. 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	-0.030**	-0.004	-0.026**	-0.236**
	(0.010)	(0.012)	(0.006)	(0.048)
Delinquencies per homeowner, 08-09			0.788**	
			(0.143)	
Constant	0.057**	0.096**	-0.019	0.464**
	(0.009)	(0.008)	(0.012)	(0.041)
N	51	51	51	51
R^2	0.116	0.003	0.698	0.277

Panel B: Correlation with Other Observable Variables

	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)		
Zillow house price growth, 2002 to 2005	0.029	45	0.007
	(0.050)		
FCSW house price growth, 2002 to 2005	0.049	24	0.018
	(0.073)		
Debt to income increase, 2002 to 2005	-0.026	51	0.007
	(0.042)		
Subprime consumer fraction, 2000	-0.0161	51	0.014
	(0.018)		
Ln(Income, 2005)	0.0332	51	0.010
	(0.050)		
Fraction with income less than 25K, 2005	-0.0046	51	0.003
	(0.012)		
Unemployment rate, 2000	-0.0046	51	0.029
	(0.004)		
Poverty fraction, 2000	-0.0078	51	0.014
	(0.009)		
Black fraction, 2000	0.0103	51	0.002
	(0.030)		
Hispanic fraction, 2000	0.0050	51	0.001
	(0.021)		
Less than high school education fraction, 2000	0.0013	51	0.000
	(0.012)		
Urban fraction, 2000	0.0266	51	0.007
	(0.046)		

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

Table 5
Ex Ante Credit Supply, Border Discontinuity Zip Codes

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

Panel A: First Stage and 2005 Credit Supply Measures

	(1) Foreclosures per homeowner 08-09	(2) Foreclosures per delinquency 08-09	(3) Ln(loan size 05)	(4) Loans/Income, 05
Judicial foreclosure requirement	-0.033*	-0.188**	0.045	-0.008
	(0.013)	(0.071)	(0.061)	(0.019)
Delinquencies per homeowner, 08-09	0.736**			
	(0.097)			
Constant	0.001	0.531**	5.101**	0.164**
	(0.010)	(0.040)	(0.035)	(0.011)
N	870	869	866	866
R^2	0.709	0.498	0.441	0.256

Panel B: Coefficients by Year

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

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

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 4, regresses foreclosures on whether a state has a judicial foreclosure requirement. Standard errors are heteroskedasticity-robust.

	Zillow house price growth, 07-10q1			FCSW house price growth, 07-09		
	(1)	(2)	(3)	(4)	(5)	(6)
Foreclosures per homeowner, 08-09	-1.749*	-1.642**	-2.693**	-1.457*	-1.074+	-3.747
	(0.791)	(0.631)	(0.973)	(0.684)	(0.580)	(2.567)
Delinquencies per homeowner, 08-09	-0.903	-0.099	1.379	-1.384*	-0.158	5.758
	(0.698)	(0.599)	(2.150)	(0.596)	(0.599)	(10.570)
House price growth, 02-06		-0.053	-0.251		-0.126	-0.347
		(0.063)	(0.155)		(0.105)	(0.351)
House price growth, 06-07		0.988**	0.665+		1.151*	1.420
		(0.220)	(0.372)		(0.576)	(1.291)
Delinquencies squared, 08-09			-3.730			-9.955
			(5.048)			(24.139)
New mortgages/income, 2005			0.712			0.323
			(0.563)			(1.394)
Debt to income increase, 02-05			-0.085			-0.119
			(0.129)			(0.244)
Subprime consumer fraction, 2000			-0.045			-0.377
			(0.423)			(0.906)
Income, 2005			-0.222			-0.738
			(0.172)			(0.463)
income < 25K fraction, 2005			-0.960			-4.242
			(0.918)			(2.666)
Unemployment rate, 2000			0.913			-6.236*
			(1.868)			(2.792)
Poverty fraction, 2000			0.747			3.117*
			(1.010)			(1.273)
Black fraction, 2000			-0.178			-0.507
			(0.198)			(0.547)
Hispanic fraction, 2000			-0.138			0.975
			(0.246)			(1.100)
< high school education fraction, 2000			0.388			1.270
			(0.485)			(1.095)
Urban fraction, 2000			-0.083			-0.138
			(0.134)			(0.290)
Constant	0.028	-0.020	1.074	0.041	0.006	4.463+
	(0.032)	(0.029)	(1.003)	(0.039)	(0.045)	(2.639)
N	46	43	43	24	24	24
R^2	0.643	0.746	0.751	0.753	0.835	0.846

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

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

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

	Zillow house price growth, 07-10q1			FCSW house price growth, 07-09		
	(1)	(2)	(3)	(4)	(5)	(6)
Foreclosures per homeowner, 08-09	-1.159+	-1.176**	-0.736	-1.238+	-0.952+	-2.370*
	(0.625)	(0.404)	(0.642)	(0.748)	(0.570)	(1.040)
Delinquencies per homeowner, 08-09	-1.172**	-0.720*	-1.923**	-1.045+	-0.526	-0.475
	(0.422)	(0.326)	(0.523)	(0.591)	(0.321)	(0.711)
House price growth, 02-06		-0.217**	-0.148*		-0.202*	-0.407**
		(0.046)	(0.061)		(0.087)	(0.090)
House price growth, 06-07		0.071	-0.247		0.261+	0.065
		(0.155)	(0.178)		(0.142)	(0.225)
Delinquencies squared, 08-09			1.961**			0.614
			(0.751)			(1.427)
New mortgages/income, 2005			-0.204			0.449+
			(0.168)			(0.241)
Debt to income increase, 02-05			-0.084**			-0.096+
			(0.026)			(0.058)
Subprime consumer fraction, 2000			0.333*			0.125
			(0.157)			(0.389)
Income, 2005			-0.151**			-0.236**
			(0.055)			(0.080)
income < 25K fraction, 2005			-0.482			-1.104*
			(0.337)			(0.538)
Unemployment rate, 2000			-0.222			-0.486
			(0.483)			(0.743)
Poverty fraction, 2000			-0.058			1.298*
			(0.429)			(0.638)
Black fraction, 2000			0.142*			-0.228
			(0.072)			(0.309)
Hispanic fraction, 2000			0.161*			0.005
			(0.074)			(0.117)
< high school education fraction, 2000			-0.177			0.342
			(0.183)			(0.243)
Urban fraction, 2000			0.103*			0.126
			(0.047)			(0.082)
Constant	0.010	0.037	0.786**	0.017	0.035	1.222**
	(0.017)	(0.025)	(0.293)	(0.037)	(0.035)	(0.434)
N	320	296	296	120	120	120
R^2	0.551	0.629	0.717	0.693	0.770	0.793

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

Table 8
Foreclosures and House Prices:
Zip Code Level 2SLS with Border Discontinuity

This table presents coefficient estimates from the zip code level second stage of a 2SLS specification of house prices on foreclosures. Every specification includes fixed effects for 10 mile strips on either side of the border. The control variables are house price growth from 2002 to 2006 and from 2006 to 2007 and delinquencies per homeowner from 2008 to 2009. Standard errors are clustered at the 10 mile strip level.

Panel A: Full Sample of Zip Codes Near Border of Two States with Different Judicial Foreclosure Laws

	(1)	(2)	(3)	(4)
	FCSW house price growth 08-09		Zillow house price growth, 08-10q1	
Foreclosures per homeowner, 09	-1.050**	-1.004	-2.108+	-2.234+
	(0.389)	(0.836)	(1.189)	(1.232)
Control variables?	N	Y	N	Y
N	862	862	746	746

Panel B: Within 50 Miles of Border

	(1)	(2)	(3)	(4)
	FCSW house price growth 08-09		Zillow house price growth, 08-10q1	
Foreclosures per homeowner, 09	-1.050**	-1.072	-2.110+	-2.232+
	(0.389)	(0.935)	(1.190)	(1.270)
Control variables?	N	Y	N	Y
N	776	776	674	674

Panel C: Within 25 Miles of Border

	(1)	(2)	(3)	(4)
	FCSW house price growth 08-09		Zillow house price growth, 08-10q1	
Foreclosures per homeowner, 09	-1.175*	-1.596*	-2.234	-1.742+
	(0.480)	(0.745)	(1.415)	(1.050)
Control variables?	N	Y	N	Y
N	458	458	415	415

Panel D: Within 5 Miles of Border

	(1)	(2)	(3)	(4)
	FCSW house price growth 08-09		Zillow house price growth, 08-10q1	
Foreclosures per homeowner, 09	-0.846**	-1.202*	-1.178	-1.468+
	(0.323)	(0.492)	(0.967)	(0.806)
Control variables?	N	Y	N	Y
N	96	96	82	82

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

Table 9
Foreclosures and Residential Investment, 2SLS

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

	Residential Permits Growth, 2007 to 2009					
	State-level 2SLS			CBSA-level 2SLS		
	(1)	(2)	(3)	(4)	(5)	(6)
Foreclosures per homeowner, 08-09	-4.707*	-4.132*	-1.829	-7.800*	-6.656+	-6.107
	(2.117)	(1.893)	(2.241)	(3.815)	(3.549)	(3.822)
Delinquencies per homeowner, 08-09	-0.417	-0.896	-11.171**	1.281	-0.084	-2.629
	(1.735)	(1.537)	(3.955)	(2.183)	(2.051)	(2.011)
Residential permits growth, 02-06		-0.115	-0.213		-0.085*	-0.069
		(0.111)	(0.229)		(0.036)	(0.046)
Residential permits growth, 06-07		-0.040	-0.141		-0.383**	-0.373**
		(0.188)	(0.244)		(0.065)	(0.067)
Delinquencies squared, 08-09			28.695*			7.843
			(11.905)			(5.779)
New mortgages/income, 2005			-0.498			-0.345
			(1.037)			(0.580)
Debt to income increase, 02-05			-0.077			0.087
			(0.388)			(0.055)
Subprime consumer fraction, 2000			-0.440			0.584
			(1.484)			(0.398)
Income, 2005			-0.425			-0.445*
			(0.578)			(0.199)
income < 25K fraction, 2005			-1.641			0.018
			(3.303)			(0.944)
Unemployment rate, 2000			-6.763			0.366
			(4.555)			(1.547)
Poverty fraction, 2000			3.983			-0.826
			(3.585)			(0.705)
Black fraction, 2000			0.892			-0.207
			(0.663)			(0.263)
Hispanic fraction, 2000			0.326			0.058
			(0.781)			(0.266)
< high school education fraction, 2000			-0.306			-0.304
			(1.671)			(0.535)
Urban fraction, 2000			0.437			0.493**
			(0.266)			(0.138)
Constant	-0.515**	-0.471**	2.267	-0.622**	-0.570**	0.912
	(0.087)	(0.077)	(3.523)	(0.091)	(0.086)	(1.000)
N	51	51	51	945	943	943
R^2	0.448	0.483	0.624	0.051	0.180	0.233

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

Table 10
Foreclosures and Durable Consumption, 2SLS

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

	Auto Sales Growth, 2007 to 2009					
	State-level 2SLS			CBSA-level 2SLS		
	(1)	(2)	(3)	(4)	(5)	(6)
Foreclosures per homeowner, 08-09	-2.342+	-2.643+	-2.939+	-6.181*	-5.489*	-4.268*
	(1.279)	(1.381)	(1.694)	(2.936)	(2.315)	(1.824)
Delinquencies per homeowner, 08-09	-0.441	0.161	-2.728	2.055	1.598	0.356
	(1.052)	(1.087)	(4.297)	(1.710)	(1.338)	(0.919)
Auto sales growth, 04-06		0.172	0.517**		-0.331*	-0.201
		(0.214)	(0.134)		(0.161)	(0.120)
Auto sales growth, 06-07		0.718	0.607		-0.387*	-0.097
		(0.480)	(0.482)		(0.161)	(0.109)
Delinquencies squared, 08-09			13.318			3.863+
			(10.894)			(2.075)
New mortgages/income, 2005			-0.693			-0.018
			(0.795)			(0.295)
Debt to income increase, 02-05			0.437			0.043
			(0.301)			(0.031)
Subprime consumer fraction, 2000			-0.598			-0.255+
			(0.968)			(0.138)
Income, 2005			-0.273			-0.148+
			(0.337)			(0.084)
income < 25K fraction, 2005			-0.855			-0.012
			(1.886)			(0.378)
Unemployment rate, 2000			1.113			0.274
			(2.168)			(0.465)
Poverty fraction, 2000			-0.034			-0.279
			(1.712)			(0.244)
Black fraction, 2000			0.355			-0.105
			(0.398)			(0.106)
Hispanic fraction, 2000			-0.080			-0.171*
			(0.475)			(0.084)
< high school education fraction, 2000			0.504			-0.264
			(1.056)			(0.167)
Urban fraction, 2000			0.123			0.200**
			(0.241)			(0.049)
Constant	-0.265**	-0.289**	1.221	-0.397**	-0.405**	0.258
	(0.054)	(0.054)	(1.961)	(0.066)	(0.057)	(0.418)
N	51	51	51	958	958	958
R^2	0.352	0.398	0.578			0.145

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

Table 11
Foreclosures, Residential Investment, and Auto Sales
County-Level 2SLS with Border Discontinuity

This table presents coefficients of the second stage of a 2SLS specification of residential investment growth or auto sales on foreclosures. The sample includes only counties that are within 10 miles of the border of a state with the opposite judicial foreclosure law. All regressions include border fixed effects. The first stage regresses foreclosures on whether a state has a judicial foreclosure requirement. Standard errors are heteroskedasticity-robust and clustered at the border level.

	Residential permits growth, 08-09			Auto sales growth, 08-09		
	(1)	(2)	(3)	(4)	(5)	(6)
Foreclosures per homeowner, 09	-9.961	-4.267	-10.769	-4.998+	-3.963+	-3.081
	(18.905)	(4.506)	(17.838)	(2.833)	(2.321)	(2.074)
Delinquencies per homeowner, 08-09	-0.760	-1.345	3.965	0.050	-0.143	-0.574
	(2.664)	(2.001)	(3.873)	(0.430)	(0.416)	(0.734)
Permits growth, 02-06		-0.067+	-0.179*		0.003	0.008
		(0.041)	(0.088)		(0.007)	(0.009)
Permits growth, 06-07		-0.078	-0.104		-0.043**	-0.038**
		(0.114)	(0.089)		(0.015)	(0.014)
Delinquencies squared, 08-09			-23.803			1.682
			(19.042)			(3.559)
New mortgages/income, 2005			0.325			0.218
			(1.483)			(0.175)
Debt to income increase, 02-05			0.095			0.010
			(0.139)			(0.017)
Subprime consumer fraction, 2000			0.422			-0.333+
			(1.318)			(0.196)
Income, 2005			-0.223			-0.002
			(0.444)			(0.082)
income < 25K fraction, 2005			-1.174			0.506
			(1.888)			(0.311)
Unemployment rate, 2000			1.345			0.881+
			(3.586)			(0.534)
Poverty fraction, 2000			-0.116			-0.395
			(2.040)			(0.284)
Black fraction, 2000			0.520			0.201
			(0.906)			(0.167)
Hispanic fraction, 2000			-0.242			0.161
			(0.871)			(0.131)
< high school education fraction, 2000			-0.146			-0.358+
			(1.247)			(0.214)
Urban fraction, 2000			-0.060			0.020
			(0.216)			(0.034)
N	409	400	400	416	402	402
R^2	0.001	0.062	0.063	-0.302	-0.126	0.066

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

Figure 1

Foreclosures, House Prices, Residential Investment, and Durable Consumption

The top left panel shows aggregate foreclosures from RealtyTrac.com and the household default rate from Equifax. House price growth in the top right panel is from S&P/Case Shiller. Residential investment and durable consumption growth in the bottom panels are from the NIPA.

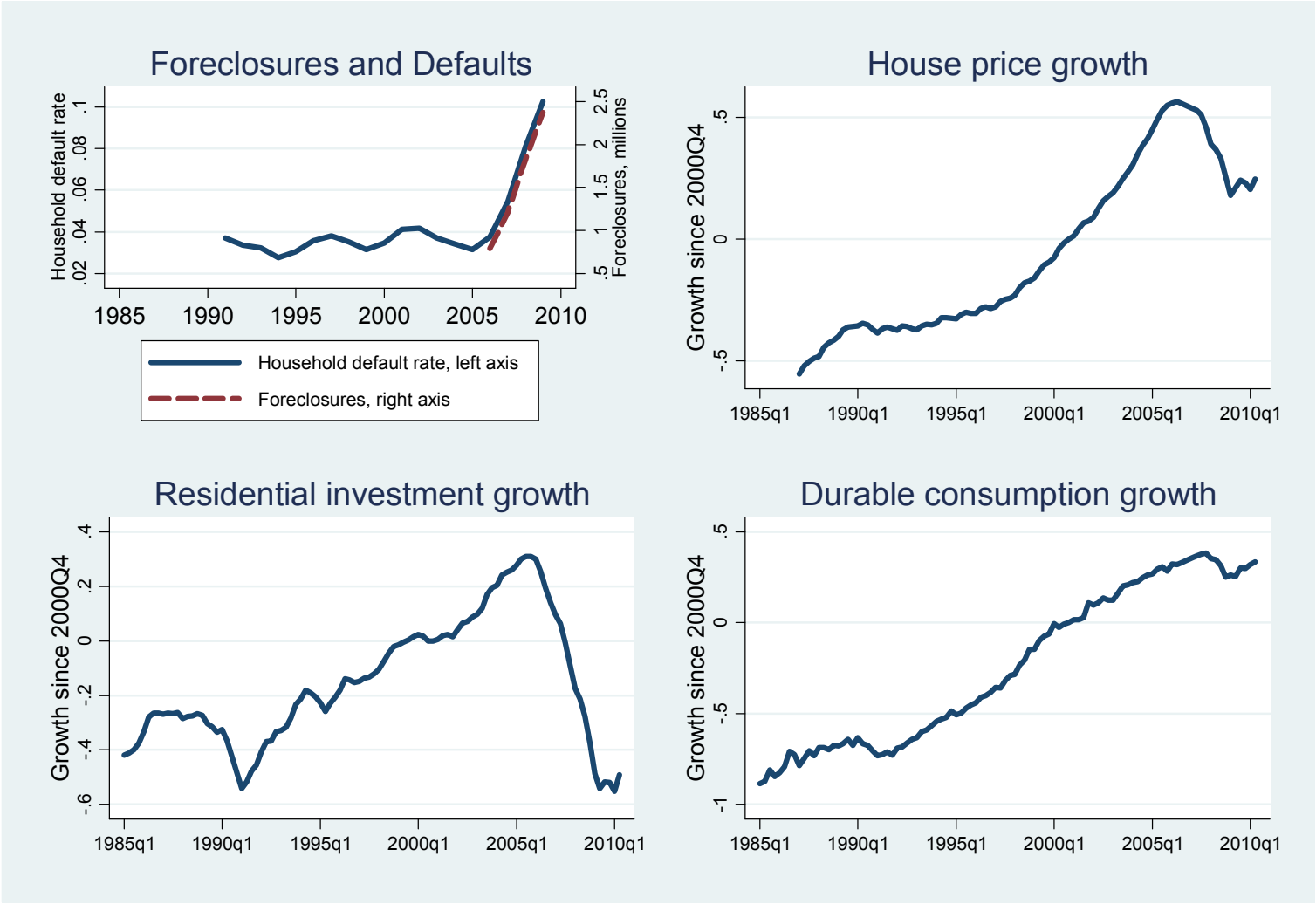


Figure 2
State Level Correlation of Foreclosures with House Price Growth

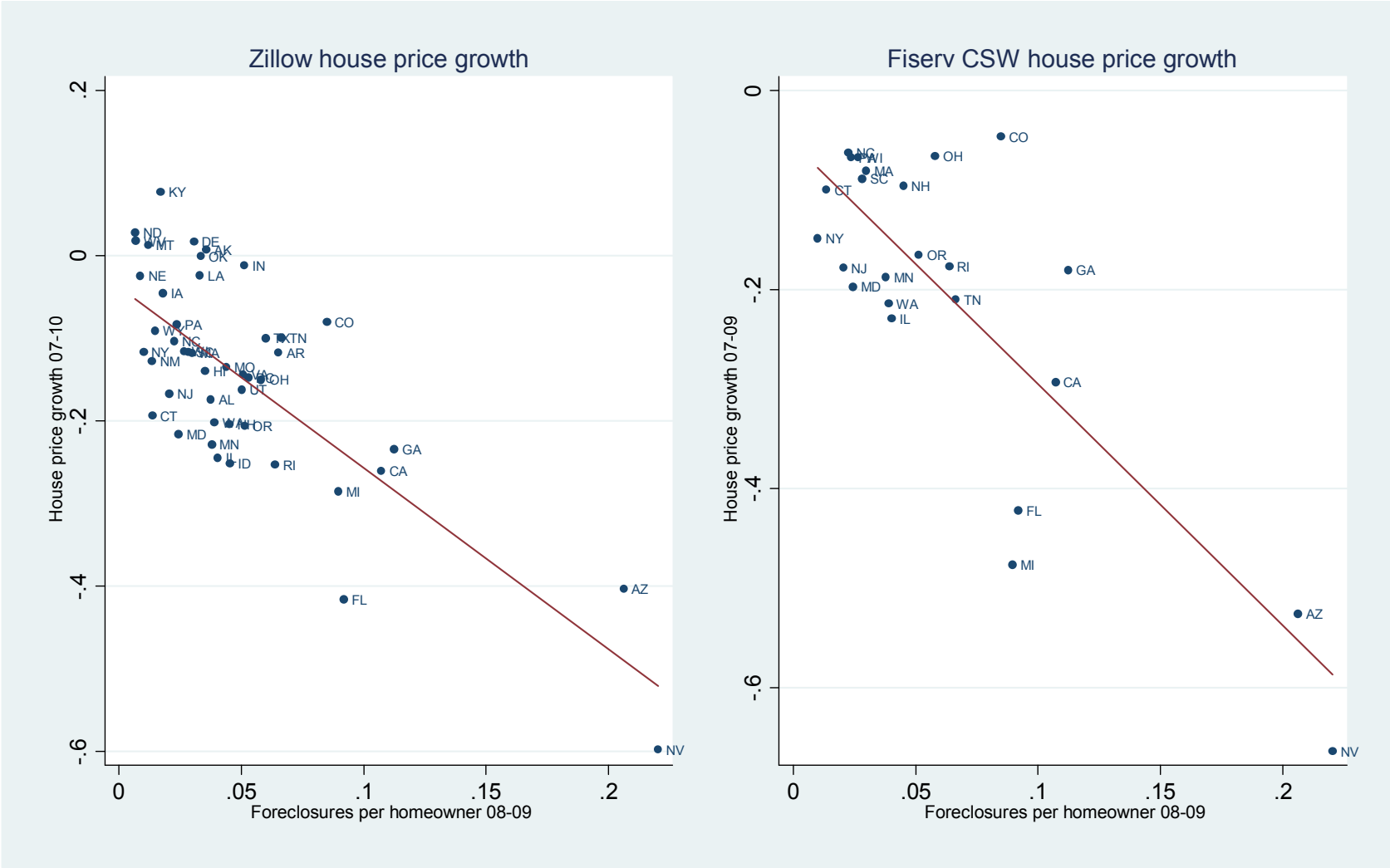


Figure 3
States with Judicial Foreclosure Requirement

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

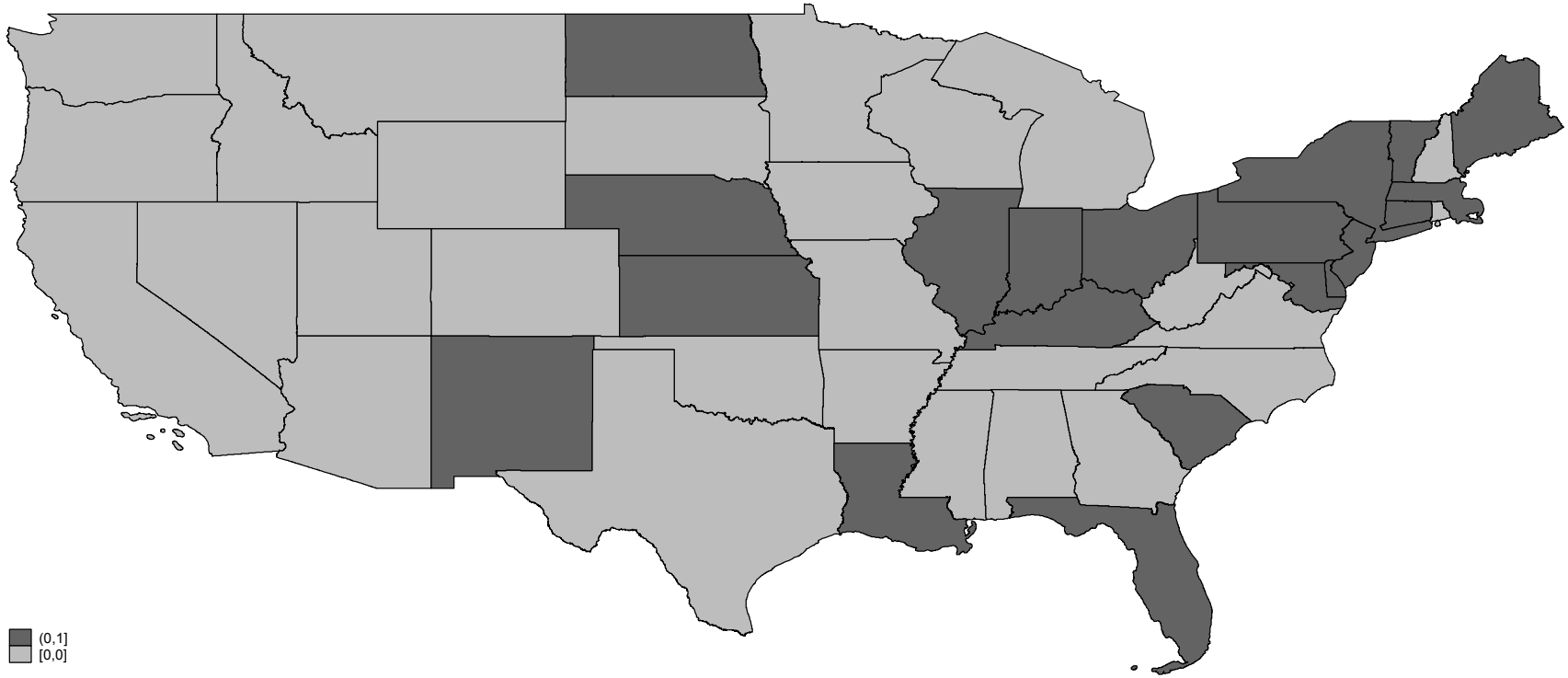


Figure 4

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.

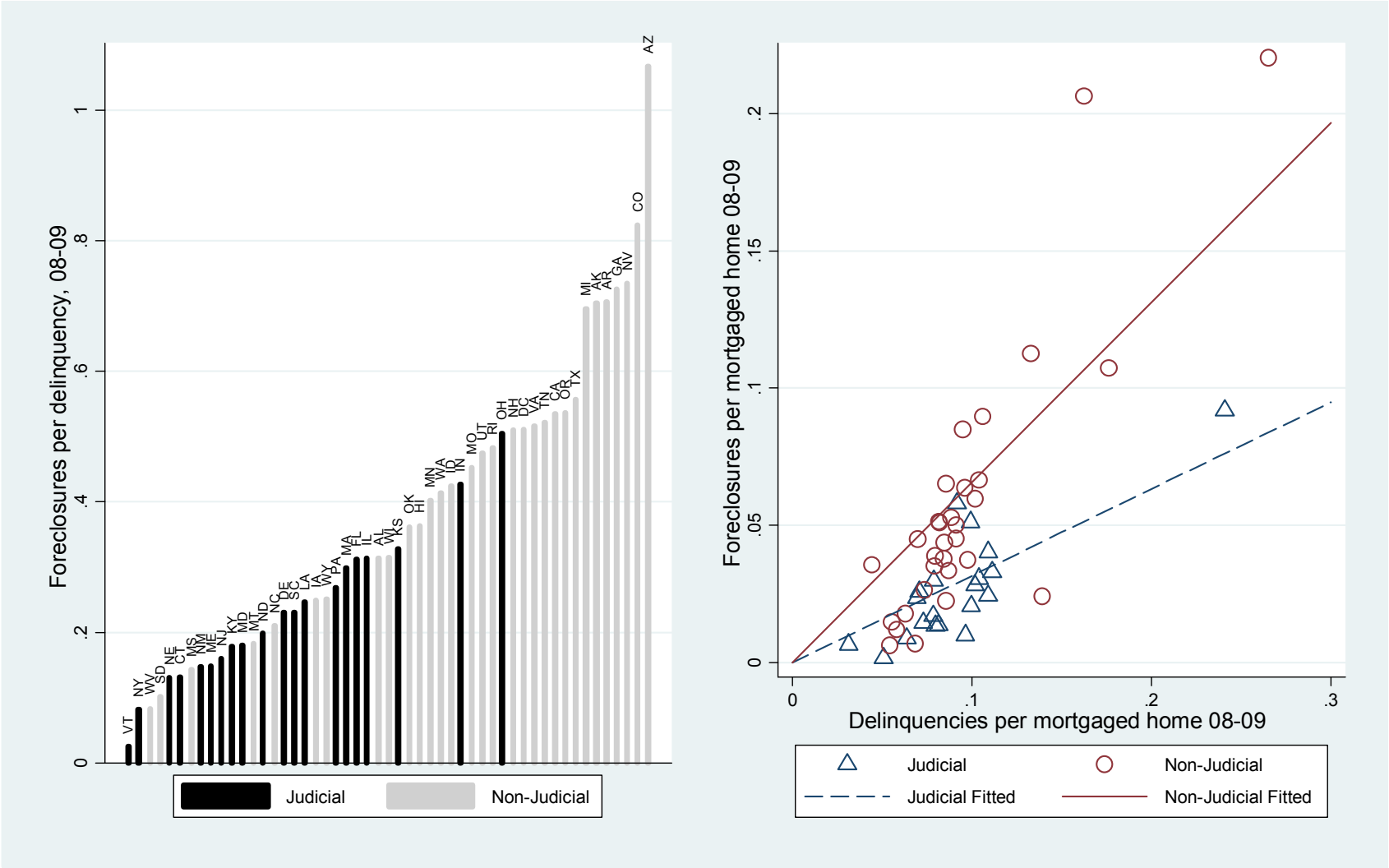


Figure 5
Judicial Foreclosure Requirement and Actual Foreclosures
Zip Code Level Border Discontinuity

The figures plot the foreclosures per delinquency ratio by year for zip codes that are near borders where the judicial requirement regime changes across states. We generate the graphs by regressing the foreclosures per delinquency 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 distance-to-the-border dummies. The border is at 0, the omitted category.

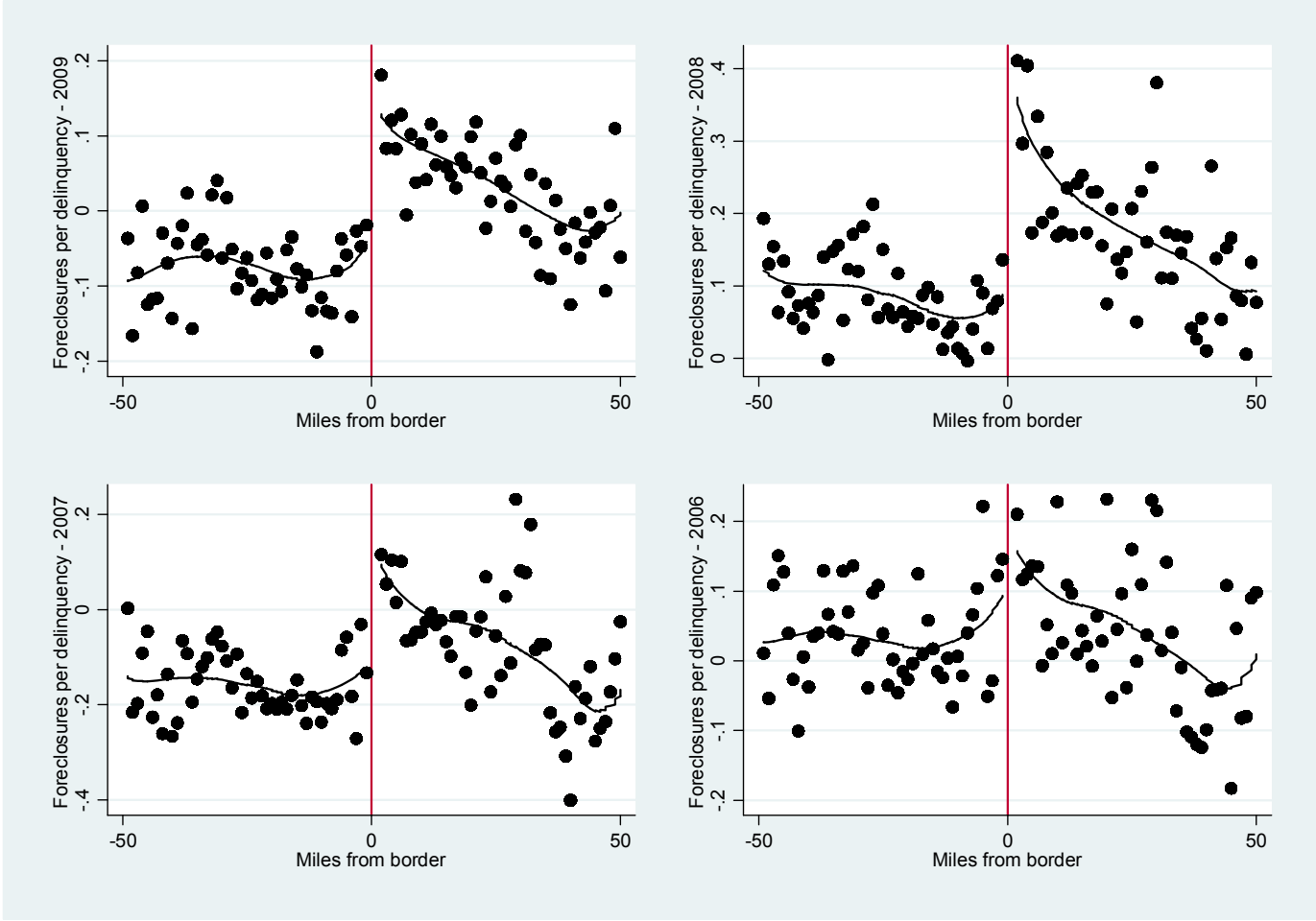


Figure 6
Zip Code Border Discontinuity: Other Variables

The figures plot averages of other variables for zip codes that are 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 assume negative values for judicial states) and then plot the coefficients on the distance-to-the-border dummies. The border is at 0, the omitted category.

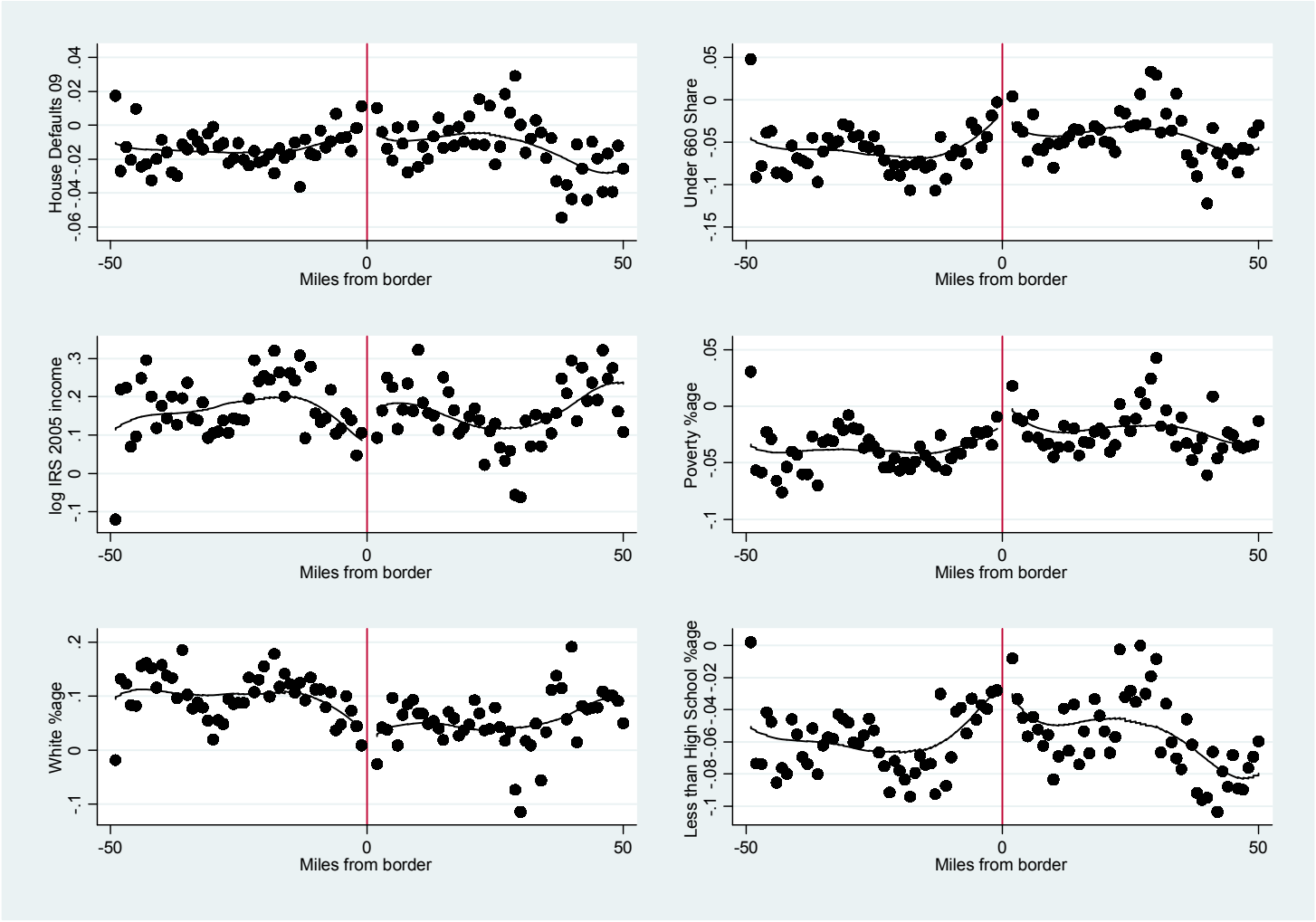


Figure 7
Foreclosures and House Prices, Reduced Form

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

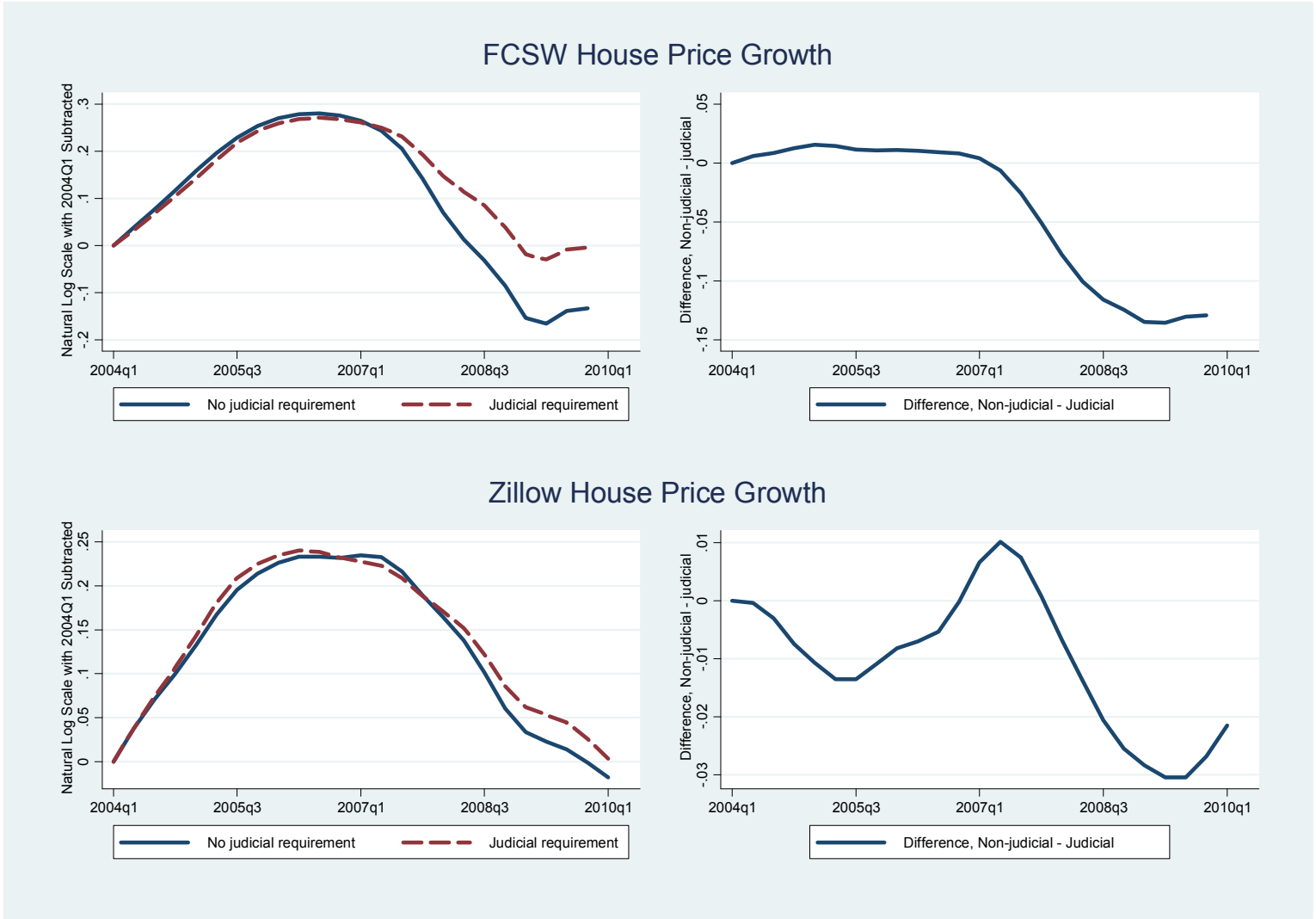


Figure 8

State Level Correlation of Foreclosures with Residential Investment and Durable Consumption

Residential investment is measured by the value of new permits for new residential construction as collected by the Census. Auto sales data are from R.L. Polk.

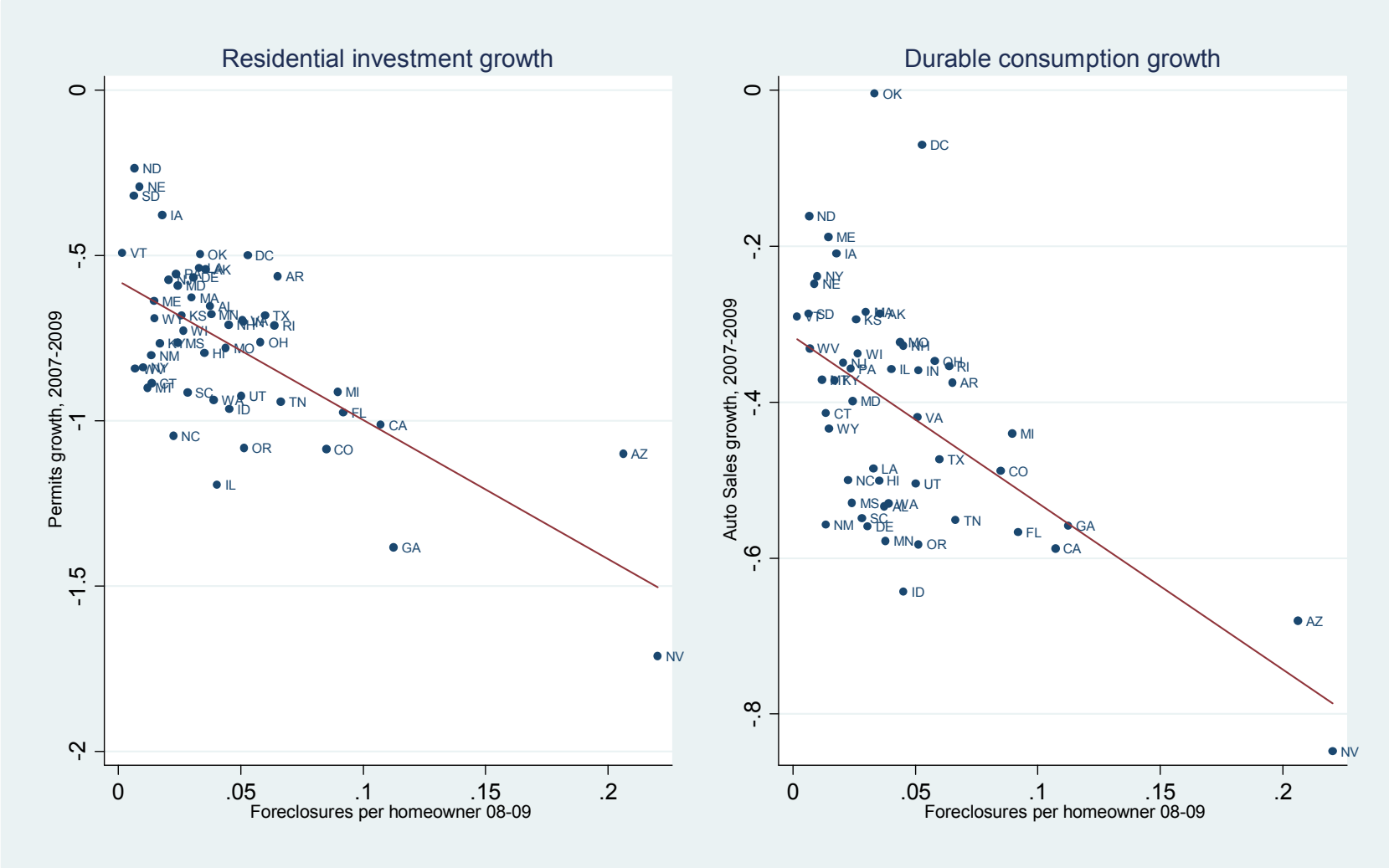
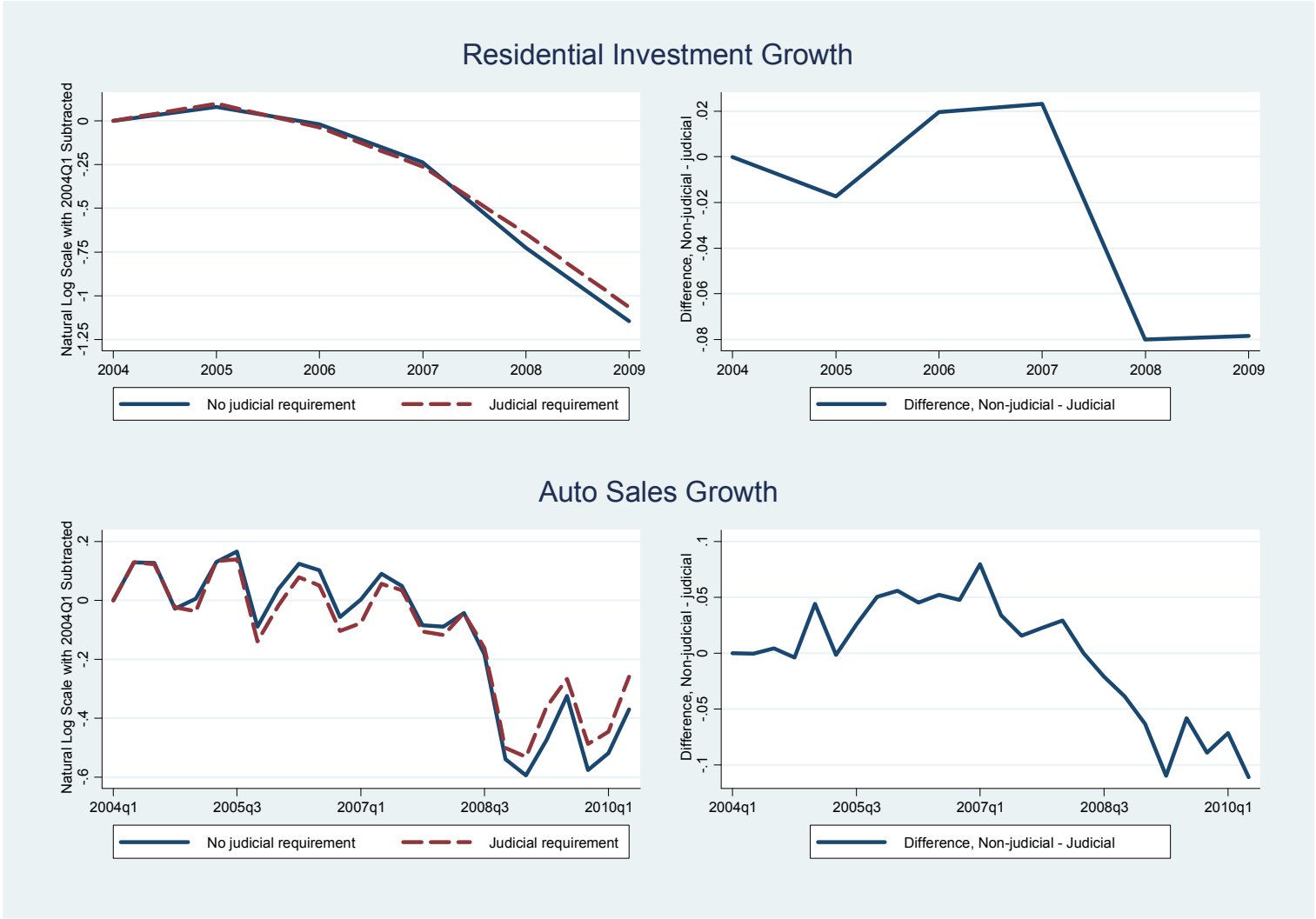


Figure 9

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 2009. The averages are weighted by total population.



Appendix Table 1
Foreclosure Statutes in Detail

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

	First Stage		
	(1) Foreclosures per homeowner 08-09	(2) Foreclosures per delinquency 08-09	(3) Delinquencies per homeowner 08-09
Judicial foreclosure requirement	-0.026**	-0.205**	-0.006
	(0.007)	(0.059)	(0.015)
Delinquencies per homeowner, 08-09	0.799**	1.823**	
	(0.131)	(0.649)	
Access to court review	0.011	0.096	-0.017
	(0.008)	(0.073)	(0.013)
Loss mitigation	-0.005	0.026	0.064
	(0.014)	(0.121)	(0.04)
Right to cure	0.00001	-0.059	-0.002
	(0.009)	(0.074)	(0.025)
Right to reinstate	-0.006	0.022	0.007
	(0.011)	(0.075)	(0.019)
Personal service requirement	-0.015	-0.118	-0.002
	(0.01)	(0.072)	(0.013)
Housing emergency fund	0.002	0.016	-0.023
	(0.009)	(0.076)	(0.018)
Right to redeem	-0.016+	-0.122+	-0.013
	(0.008)	(0.066)	(0.019)
Deficiency judgment	0.011	0.06	-0.014
	(0.01)	(0.076)	(0.014)
Accounting for sale proceeds	0.009	-0.009	0.015
	(0.014)	(0.105)	(0.022)
Prompt return of surplus	-0.015	-0.105	0.004
	(0.014)	(0.104)	(0.023)
Constant	-0.021	0.309**	0.102**
	(0.013)	(0.079)	(0.011)
N	51	51	51
R^2	0.745	0.511	0.163

Appendix Figure 1
Foreclosures and House Prices using Publicly Available Data, Reduced Form
The figures plots house price growth in judicial and non-judicial states from 2004 to 2009. The averages are weighted by total population.