The Journal of FINANCE
The Journal of THE AMERICAN FINANCE ASSOCIATION

THE JOURNAL OF FINANCE • VOL. LXX, NO. 6 • DECEMBER 2015

Foreclosures, House Prices, and the Real Economy

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ABSTRACT

From 2007 to 2009, states without a judicial requirement for foreclosures were *twice* as likely to foreclose on delinquent homeowners. Analysis of borders of states with differing foreclosure laws reveals a discrete jump in foreclosure propensity as one enters nonjudicial states. Using state judicial requirement as an instrument for foreclosures, we show that foreclosures led to a large decline in house prices, residential investment, and consumer demand from 2007 to 2009. As foreclosures subsided from 2011 to 2013, the foreclosure rates in nonjudicial and judicial requirement states converged and we find some evidence of a stronger recovery in nonjudicial states.

THE POST-2006 COLLAPSE IN THE U.S. housing market led to a 35% drop in house prices and an increase in mortgage delinquency rate that reached over 10% in 2009. Mortgage contracts give lenders the right to foreclose on a home if the homeowner defaults on his payment obligations. When a major shock hits the economy and millions of homeowners simultaneously default, theory suggests that the fire sale of foreclosed homes could lead to a further reduction in house prices, threatening real activity, such as residential investment and consumer demand.[1]

As Figure 1 shows, the default rate on household debt and foreclosures skyrocketed from 2006 to 2009, before falling sharply from 2010 to 2013. In this paper we investigate the effect of this unprecedented foreclosure wave on house prices and real activity. Shedding light on this question can help us better understand the transmission and amplification of financial shocks into the real

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[1] Models that emphasize amplification of shocks from the leverage-induced forced sale of durable goods include Shleifer and Vishny (1992), Kiyotaki and Moore (1997), Krishnamurthy (2003, 2010), and Lorenzoni (2008).

DOI: 10.1111/jofi.12310

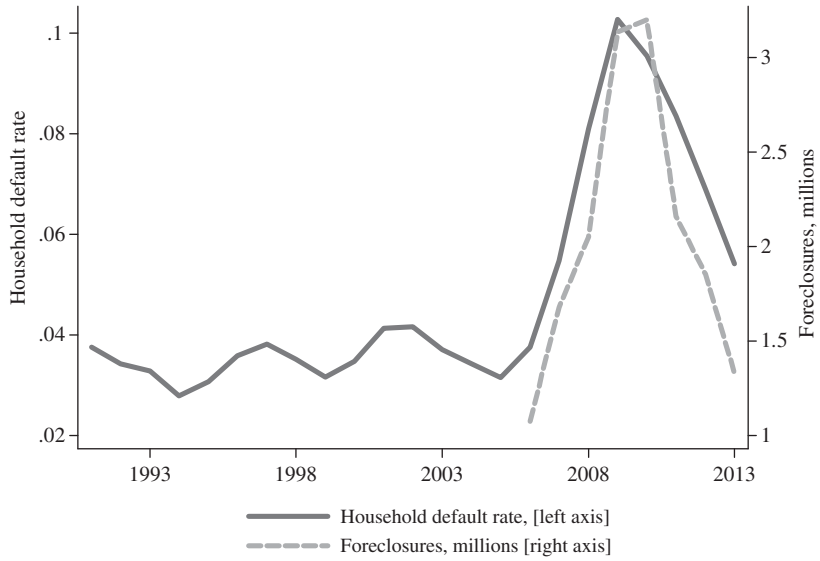

Figure 1. Household default rate and foreclosures. This figure shows aggregate foreclosures in the United States from RealtyTrac.com and the household default rate from Equifax.

economy. However, isolating the causal effect of foreclosures is difficult because of omitted variables and reverse causality. The latter effect is especially important: homeowner, will only allow a foreclosure to occur if they are underwater on their mortgage. As a result, house price declines will be strongly correlated with foreclosures even if foreclosures have no direct effect on house prices.

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

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

Zip code-level analysis around bordering states that differ in their foreclosure laws shows a discontinuous jump in foreclosure propensity as one moves from

a judicial to nonjudicial state. A similar jump is observed when we look at listings of new houses for sale, and the higher foreclosure propensity persists until 2010. Thus, differences in state laws are associated with a large increase in foreclosure rates that translates into greater housing supply on the market.

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

Ghent (2012, p. 2) performs an in-depth analysis of the history of state foreclosure laws and concludes that "there do not seem to be clear economic reasons for the different patterns of development in America's mortgage laws." She traces differences in state mortgage laws to "path-dependent quirks." Consistent with Ghent's observations, we find that state foreclosure laws are orthogonal to a wide range of state-specific economic attributes.

State-level analysis shows that there are no significant differences between judicial and nonjudicial states in terms of mortgage defaults, house price growth from 2002 to 2005, the level of house prices in 2005, leverage or debt-to-income growth from 2002 to 2005, the fraction of subprime mortgages, mortgage interest rates from 2002 to 2005, loan-to-value ratios from 2002 to 2005, household income, the precrisis unemployment rate, racial mix, poverty rate, or education level. Similarly, the sharp discontinuity in the zip code-level analysis exists *only* in foreclosure propensity: there is no equivalent jump in other zip code-level attributes including credit score, income, race, education, default rate, or house price growth from 2002 to 2005.[2]

Given the strong effect of the judicial foreclosure requirement on foreclosures and the abundant evidence that states with and without this requirement are otherwise similar, we use state foreclosure laws as an instrument to estimate the effect of foreclosures on house prices. We find that foreclosures have a strong effect on house prices. Moving from the median to the 90th percentile of the foreclosure per homeowner distribution leads to eight-percentage-point lower house price growth from 2007 to 2009. A back-of-the-envelope calculation suggests that the foreclosure-induced increase in supply of houses can plausibly explain the entire effect of foreclosures on house prices. For example, our estimates imply that a foreclosure-induced increase of 10% in the supply of houses in nonjudicial states decreased house prices by four percentage points.

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

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

[3] Shleifer and Vishny (1992), Krishnamurthy (2003), and Lorenzoni (2008) emphasize that the negative effect of asset sales on prices is amplified when the economy is weak and potential buyers

of investors or owner-occupiers to purchase houses are lifted; for example, investors may take time to form pools of capital and mortgage lending may eventually become available for potential homeowners.

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

Does the foreclosure-induced reduction in house prices from 2007 to 2009 lead to a reduction in real activity as well? A significant drop in house prices negatively impacts the balance sheet of *all* households in the neighborhood and threatens to reduce residential investment and consumer demand (see Mian, Rao, and Sufi (2013) and Mian and Sufi (2014) for related evidence). Using foreclosure laws as an instrument, we find that a one-standard-deviation increase in foreclosures per homeowner during the Great Recession leads to a 1/2-to-2/3 standard-deviation decrease in permits for new residential construction and a 2/3-to-one-standard-deviation decline in auto sales.[4] As house prices rebounded in 2011 and 2012 in nonjudicial foreclosure states, permits and auto sales also caught up.

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

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

Our findings are most closely related to recent studies on foreclosures and house prices (Calomiris, Longhofer, and Miles (2013), Campbell, Giglio, and

who value the asset most cannot buy. As Krishnamurthy (2003, p. 278) puts it, "The central idea is that *bad times for the economy* will also be times when the liquidation value of the collateral will be low since *potential buyers of these assets will be cash-strapped*" (emphasis added).

[4] We conduct a number of robustness tests for these results. See Section V and the Internet Appendix, available in the online version of the article on the *Journal of Finance* Web site.

Pathak (2011), Foote, Gerardi, and Willen (2008), Hartley (2010)). One advantage of our study relative to existing literature is comprehensiveness: our analysis covers the entire United States, as opposed to one state or one city, and we examine foreclosures through the end of 2012.[5] Exploring the foreclosure crisis through its full cycle is important because, as we show, states that had been experiencing higher foreclosure rates from 2007 to 2010 recovered faster in 2011 and 2012 as foreclosure rates declined. In addition, we are the first to examine how foreclosures affect real economic activity.

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

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

I. Data and Summary Statistics

A. Data

We use data from a number of sources. We obtain foreclosure data from RealtyTrac.com, one of the leading foreclosure listing Web sites, at the zip code level at an annual frequency for 2006 through 2013. RealtyTrac.com collects data from five types of filings submitted by lenders during the foreclosure process. The first two types of filings are submitted before a foreclosure auction: a notice of default and a lispendens. Another two are directly associated with a foreclosure auction: a notice of trustee sale and a notice of foreclosure sale. Finally, RealtyTrac.com collects information on whether the foreclosed home is

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

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

[7] As Campbell, Giglio, and Pathak (2011) note, "... foreclosures are endogenous to house prices because homeowners are more likely to default if they have negative equity, which is more likely as house prices fall. Ideally, we would like an instrument that influences foreclosures but that does not influence house price except through foreclosures; however, we have not been able to find such an instrument" (p. 15). We find that the unconditional OLS estimate of the effect of foreclosures on house prices is 50% larger than the 2SLS estimate.

purchased by the lender at auction, or is real estate owned. For every zip code, we have the total number of filings for each of these five categories.

The term "foreclosure" requires some explanation. The foreclosure process is initiated when a lender files a preauction filing (i.e., a lispendens or a notice of default). However, these filings in and of themselves do not represent a foreclosure, as a preauction filing does not necessarily lead to a sale or an eviction, nor does it mean the house will be acquired or sold by the lender. Instead, a foreclosure represents the forced sale of a property by the lender for the purpose of reimbursing the claim. This is best measured by the filing that directly precedes the auction itself. As a result, our measure of total foreclosures in a zip code is the total number of notices of trustee sale and foreclosure sales.[8]

Data on house prices at the zip code-quarter level are from Fiserv Case Shiller Weiss (FCSW) and Zillow.com. The FCSW data are available only through 2010 and the Zillow.com data through 2012. An excellent description of the differences and similarities between FCSW and Zillow.com is available in the appendix of Guerrieri, Hartley, and Hurst (2013). For a few tests, we also use house price data from CoreLogic, which are also available through 2012.[9] New residential permit data come from the Census and are available at the county-year level through 2012. Auto sales data come from R.L. Polk and are available at the zip code-month level through 2012. For more information on the R.L. Polk data, see Mian and Sufi (2012).

We supplement foreclosure, house price, residential investment, and auto sales data with information on delinquencies from Equifax, which are available at the zip code-quarter level through 2013.[10] The Equifax data also allow us to measure at the zip code level the fraction of borrowers that had credit scores below 660 as of 2000. Finally, we supplement the zip code level data with demographic information from the 2000 Decennial Census.

We construct final data sets at both the state and the zip code levels. The underlying zip code level data cover approximately 31,000 zip codes, which represent the entire U.S. Zip codes, are matched to states using zip-codes.com. The main restriction on the data is the availability of zip code-level house price indices. Zillow.com house price data are available for 10,322 zip codes in our sample, and FCSW house price data are available for 4,099 zip codes. Zip code-level data are available from one of these two sources for 10,450 zip codes. These zip codes represent 65% of the total U.S. population, 81% of total

[8] We are grateful to Tyler White for providing us with information on the foreclosure data from RealtyTrac.com. Readers interested in acquiring the foreclosure data should contact tyler.white@realtytrac.com. We exclude REOs because almost all REO filings are preceded by an NTS or NFS filing, and we want to avoid double counting.

[9] The Zillow data were initially obtained in March 2011, and updated with data through 2012 in January 2014. The FCSW data were initially obtained in May 2010 and then updated with data through 2010 in September 2011. When updating for more recent data, we keep only zip codes in the original data set. The CoreLogic data that we use are state-level indices obtained in December 2013.

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

Table I
Summary Statistics

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

	N	Mean	*SD*	10^{th}	50^{th}	90^{th}
Foreclosures per homeowner, 2008 and 2009	51	0.028	0.027	0.006	0.020	0.055
Delinquencies per homeowner, 2008 and 2009	51	0.095	0.042	0.058	0.086	0.133
Zillow house price growth, 2002 to 2006	45	0.326	0.163	0.133	0.330	0.588
Zillow house price growth, 2006 to 2007	47	−0.018	0.047	−0.083	−0.014	0.041
Zillow house price growth, 2007 to 2009	48	−0.119	0.126	−0.268	−0.091	0.012
FCSW house price growth, 2002 to 2006	24	0.364	0.199	0.094	0.347	0.674
FCSW house price growth, 2006 to 2007	24	−0.070	0.069	−0.194	−0.049	−0.002
FCSW house price growth, 2007 to 2009	24	−0.205	0.162	−0.475	−0.177	−0.065
Residential permits growth, 2002 to 2006	51	0.289	0.275	−0.071	0.245	0.656
Residential permits growth, 2006 to 2007	51	−0.198	0.141	−0.339	−0.191	−0.037
Residential permits growth, 2007 to 2009	51	−0.768	0.270	−1.082	−0.726	−0.496
Auto sales growth, 2004 to 2006	51	−0.020	0.123	−0.116	−0.046	0.093
Auto sales growth, 2006 to 2007	51	−0.022	0.056	−0.104	−0.019	0.050
Auto sales growth, 2007 to 2009	51	−0.413	0.157	−0.578	−0.399	−0.238
New mortgages/income, 2005	51	0.154	0.077	0.088	0.133	0.227
Debt to income increase, 2002 to 2005	51	0.267	0.156	0.103	0.248	0.463
Subprime consumer fraction, 2000	51	0.329	0.066	0.264	0.305	0.434
Ln(Income, 2005)	51	3.933	0.163	3.740	3.908	4.155
Fraction with income less than 25K, 2005	51	0.434	0.041	0.379	0.432	0.486
Unemployment rate, 2000	51	0.058	0.014	0.044	0.057	0.075
Poverty fraction, 2000	51	0.122	0.032	0.090	0.114	0.164
Black fraction, 2000	51	0.100	0.110	0.005	0.067	0.263
Hispanic fraction, 2000	51	0.055	0.068	0.009	0.030	0.127
Less than high school education fraction, 2000	51	0.182	0.043	0.129	0.180	0.247
Urban fraction, 2000	51	0.713	0.156	0.519	0.714	0.908

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 are in urban areas; only 19% of zip codes for which we do not have house price data are in urban areas.

B. Summary Statistics

Table I presents summary statistics of the state-level data used in the analysis. The underlying zip code-level data summary statistics are in the Internet Appendix. The average number of foreclosures per homeowner in 2008 and 2009 is 0.028. The number of homeowners is approximated using the number of mortgage accounts as of 2005 according to Equifax. The number of

60-days-past-due delinquent mortgage or home equity accounts per homeowner is 0.095, which implies an average pass-through from delinquency to foreclosure close to 30%.

Data on house prices and residential investment show the dramatic turn of events starting in 2006 and 2007. From 2007 to 2009, house prices dropped by 10% to 20% depending on the data 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 I also contains information on other important variables, including the increase in the debt-to-income ratio from 2002 to 2005, the fraction of consumers that were subprime borrowers as of 2000, and the unemployment rate as of 2000.

II. State Foreclosure Laws and Propensity to Foreclose

We are interested in estimating the impact of foreclosures on house prices and real activity. As a result, we need an instrument that changes foreclosure propensity across otherwise similar areas. One possible candidate for such an instrument is the difference in state laws that determine the ease with which a lender may foreclose on a property.[11] We discuss this difference below.

A. *Judicial versus Nonjudicial Foreclosure States*

The ease with which a lender can sell a delinquent property through foreclosure depends on the laws governing a particular state. Lenders in states with a *judicial foreclosure* requirement must file a notice with a judge providing evidence regarding the amount of the debt, the delinquency of the debt, and why the delinquency should allow the lender to sell the property. This filing is typically called a lispendens. The borrower is notified of the filing and has a chance to respond. If the court finds that the lender is accurate in his claim, a property will move to the auction stage of the process.

In a *nonjudicial 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 nonjudicial 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.).[12] If the borrower fails to pay the debt or disputes the notice, a notice of sale is subsequently filed that begins the auction process.

A large body of evidence suggests that costs to lenders are substantially higher for judicial versus nonjudicial foreclosures (Wood (1997), Ciochetti

[11] General information on the foreclosure process presented in this section comes from Ghent (2012), Pence (2003, 2006), http://www.all-foreclosure.com/judicial.htm, http://en.wikipedia.org/wiki/Foreclosure, and http://www.calculatedriskblog.com/2007/04/foreclosure-sales-and-reo-for-ubernerds.html.

[12] According to RealtyTrac, there are 16 nonjudicial states that do not require a notice of default before the auction filing. See the Internet Appendix for more information.

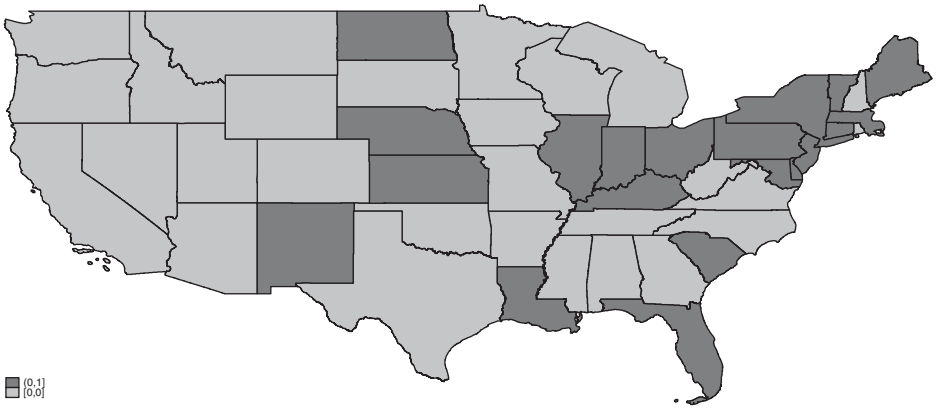

Figure 2. States with judicial foreclosure requirement. States shaded in dark gray require judicial foreclosure. The data come from RealtyTrac.com and are available at: http://www.realtytrac.com/foreclosure-laws/foreclosure-laws-comparison.asp.

(1997), Pence (2003), Pennington-Cross (2004)). Web sites covering the mechanics of foreclosure frequently state that judicial foreclosures are expensive for lenders. For example, the reputable blog calculatedriskblog.com writes that "Nonjudicial foreclosure is almost always faster and cheaper for the lender than a judicial foreclosure."[13] The October 2010 temporary foreclosure moratorium by JPMorgan-Chase, GMAC, and Bank of America highlights the costs to lender in states that require judicial foreclosure. Given problems with the verification of documents, these servicers temporarily stopped foreclosure activity in states that require judicial foreclosure.[14]

Figure 2 shows the variation across U.S. states in the classification of foreclosure laws, with judicial foreclosure states shaded in dark gray. The classification of states comes from RealtyTrac.com. While the majority of states that require judicial foreclosure are located in the upper Midwest and Northeast, there is geographical variation outside this area as well.

We note that there is a certain degree of subjectivity in the classification of state laws requiring judicial approval for a foreclosure. We follow the classification of RealtyTrac for the following reasons. First, the information from RealtyTrac is publicly available, concrete, and justified—we have no ability to manipulate the classification and other researchers can examine the precise reasons for the classification at RealtyTrac's Web site.[15] Second, RealtyTrac specializes in the collection of legal filings on foreclosures and our data on foreclosures come from RealtyTrac—it is therefore natural to use its classification of foreclosure laws. Nonetheless, we perform an extensive set of robustness checks using alternative classifications of state foreclosure laws in the Internet Appendix.

[13] See http://www.calculatedriskblog.com/2007/04/foreclosure-sales-and-reo-for-ubernerds.html.
[14] See http://www.nytimes.com/2010/10/08/business/08frozen.html.
[15] See http://www.realtytrac.com/foreclosure-laws/foreclosure-laws-comparison.asp.

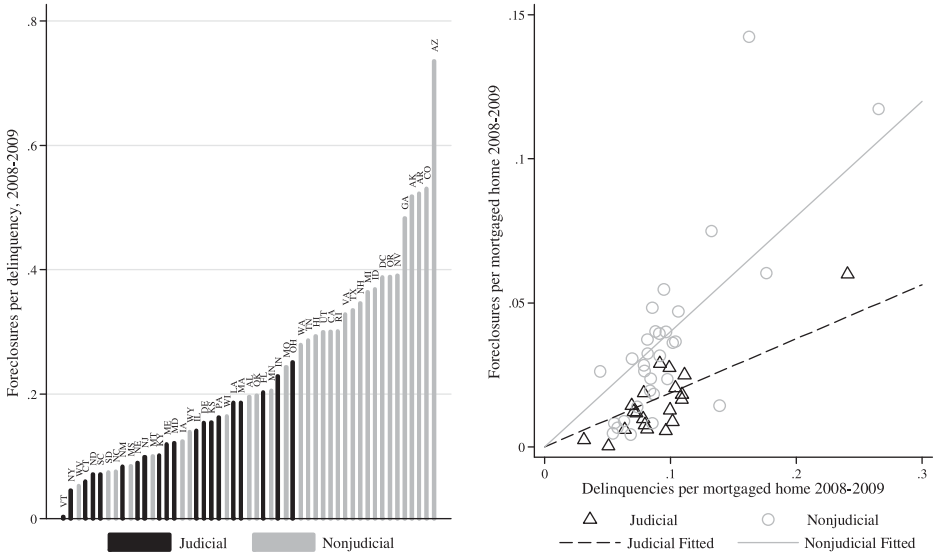

Figure 3. The effect of judicial foreclosure requirements on actual foreclosures. The left panel plots the foreclosure per delinquent account ratio for 2008 and 2009 by state. States that require a judicial foreclosure are shown in black. The right panel plots foreclosures against delinquencies, where the sample is split by whether the state requires a judicial foreclosure.

B. Do Foreclosure Laws Effect Foreclosure Propensity?

Do state laws influence the rate of foreclosure? Figure 3 shows that the answer to this question is a resounding yes. The left panel plots foreclosures per delinquent account in 2008 and 2009 for every state. States shaded in black require judicial foreclosure. The foreclosure rate in nonjudicial states is clearly much higher. The 19 states with the highest foreclosure-to-delinquent account ratios all allow nonjudicial foreclosure. The right panel of Figure 3 plots foreclosures per homeowner against delinquencies per homeowner focusing on the 2008 and 2009 period. Judicial states are plotted as triangles and nonjudicial states as circles. Consistent with the left panel, nonjudicial states convert defaults into foreclosures at a much higher rate (slope of 0.40 versus 0.19 for judicial states).

Panel A of Table II analyzes the impact of the formal first stage of foreclosure laws on the propensity to foreclose. In particular, we regress foreclosures on an indicator variable capturing whether the state requires judicial foreclosure. Column (1) shows that foreclosures per homeowner with a mortgage in 2008 and 2009 is 0.020 lower in states with a judicial foreclosure requirement than the ratio of 0.036 in nonjudicial states. Thus, foreclosure rates are more than *twice* as high in nonjudicial states compared to judicial states (0.036 versus 0.016).

The finding of higher foreclosure rates in nonjudicial states is not driven by higher default rates. Column (2) shows that default rates in 2008 and 2009

Table II

Judicial Foreclosure Requirement Instrument

Panel A presents coefficients from the first stage regression of foreclosures during 2008 and 2009 on whether a state requires a judicial foreclosure. Panel B repeats the first stage regression separately for each year from 2006 through 2013. Standard errors are heteroskedasticity-robust.

Panel A: First Stage

	Foreclosures per Homeowner 2008–2009	Delinquencies per Homeowner 2008–2009	Foreclosures per Homeowner 2008–2009	Foreclosures per Delinquency 2008–2009
	(1)	(2)	(3)	(4)
Judicial foreclosure requirement	−0.020**	−0.004	−0.018**	−0.167**
	(0.006)	(0.012)	(0.004)	(0.032)
Delinquencies per homeowner, 2008–2009			0.458**	
			(0.081)	
Constant	0.036**	0.096**	−0.009	0.295**
	(0.006)	(0.008)	(0.006)	(0.029)
N	51	51	51	51
R^2	0.134	0.003	0.639	0.287

(Continued)

Table II—*Continued*

Panel B: First Stage by Year

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

**, *, and + are coefficients statistically different from zero at the 1%, 5%, and 10% confidence level, respectively.

are not statistically different between judicial and nonjudicial states. Hence, adding the default rate in column (3) to the regression in column (1) does not change the coefficient on the judicial law dummy materially. Column (4) regresses foreclosures per delinquent account on the foreclosure law dummy. As already seen in Figure 3, foreclosures per delinquent account are much higher in nonjudicial states.

A critical question that arises is how long the foreclosure differences between judicial and nonjudicial states persist. Panel B of Table II regresses foreclosures per homeowner on the judicial foreclosure dummy and defaults per home owner separately for each year. The difference between judicial and nonjudicial foreclosure rates increases sharply in 2008 and 2009, and the difference peaks in 2009. The difference in foreclosure propensity declines slightly in 2010 and 2011, and then falls sharply in 2012 before becoming indistinguishable from zero in 2013. Recall from Figure 1 that the aggregate number of foreclosures also fell sharply from 2011 to 2013. As a result, in 2012 and 2013 both the total number of foreclosures and the difference in foreclosure propensity between judicial and nonjudicial states were much lower than in 2008 and 2009. We return to this fact when discussing house price patterns in 2011 and 2012.[16]

C. Are Judicial and Nonjudicial States Systematically Different?

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

We have already seen in column (2) of Table II, Panel A that there is no significant difference in the initial impact of mortgage defaults in judicial and nonjudicial states. This result is encouraging as any differences in borrower attributes between judicial and nonjudicial states should translate into systematically different default rates in the two types of states. In other words, the transition into delinquency is exactly the same in judicial and nonjudicial states, but the transition from delinquency to foreclosure is much faster in nonjudicial states.

[16] Gerardi, Lambie-Hanson, and Willen (2013, p. 7) find similar evidence of a long-lasting difference in foreclosure propensity between nonjudicial and judicial states. As they state, "it is still the case that in judicial states almost 20 fewer borrowers per 100 have lost their homes 18 months after the beginning of a delinquency spell." However, they do not see higher cure rates for delinquent mortgages in judicial states, which leads them to assert that eventually the foreclosure differences will subside as persistently delinquent borrowers in judicial states are foreclosed upon. They do not actually see the foreclosure rate catch up, however, because their data end in April 2011. Our findings suggest that the difference in foreclosure rates remained large through 2011, four years after the beginning of the foreclosure crisis in 2007. In 2012 and 2013, the difference disappeared.

Table III
Are Judicial Foreclosure Law States Different?

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

	Judicial Foreclosure Requirement	N	R^2
Delinquencies per homeowner, 2006	0.0014	51	0.003
	(0.004)		
Delinquencies per homeowner, 2009	−0.0028	51	0.001
	(0.010)		
Log Zillow house price, 2005	−0.0023	47	0.00
	(0.13)		
Zillow house price growth, 2002 to 2005	−0.001	45	0.000
	(0.051)		
FCSW house price growth, 2002 to 2005	0.049	24	0.018
	(0.073)		
Debt to income increase, 2002 to 2005	−0.026	51	0.007
	(0.042)		
Subprime consumer fraction, 2000	−0.0161	51	0.014
	(0.018)		
Ln(Income, 2005)	0.0332	51	0.010
	(0.050)		
Fraction with income less than 25K, 2005	−0.0046	51	0.003
	(0.012)		
Unemployment rate, 2000	−0.0046	51	0.029
	(0.004)		
Poverty fraction, 2000	−0.0078	51	0.014
	(0.009)		
Black fraction, 2000	0.0103	51	0.002
	(0.030)		
Hispanic fraction, 2000	0.0050	51	0.001
	(0.021)		
Less than high school education fraction, 2000	0.0013	51	0.000
	(0.012)		
Urban fraction, 2000	0.0266	51	0.007
	(0.046)		
Interest rate on mortgages, average, 2002 to 2005	0.0973	51	0.024
	(0.082)		
LTV for mortgages, average, 2002 to 2005	−1.5120	51	0.013
	(1.845)		

**, *, and $^+$ are coefficients statistically different than zero at the 1%, 5%, and 10% confidence level, respectively.

Table III tests if other relevant characteristics are different across judicial and nonjudicial states by regressing each characteristic on a dummy for judicial foreclosure law. We use 17 different variables: delinquencies per homeowner in 2006 and 2009, growth in house prices from 2002 to 2005, the level of house prices in 2005, leverage or debt-to-income growth between 2002 and 2005, the fraction of consumers that are subprime in 2000 (i.e., have a credit score below 660), the level of income in 2005, the unemployment rate in 2000, the

fraction of mortgage holders below the poverty line, the fraction that are black or Hispanic, the fraction with less than a high school degree, the fraction that lives in urban areas, the average interest rate on mortgages from 2002 to 2005, and the loan-to-value ratio on mortgages from 2002 to 2005.[17]

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

D. Why Do States Differ in Foreclosure Laws: The Historical Perspective

Our empirical exercise requires that the variation in state foreclosure laws be orthogonal to other factors, such as leverage, income growth, or demographics, that might independently influence the foreclosure propensity. Above we show that states that differ in foreclosure roles are remarkably similar to each other along a number of other observable variables. In particular, there is no pattern in any of the observable variables considered to indicate that state foreclosure laws do not serve as a valid instrument.

If observable variables do not explain why foreclosure laws differ across states, what were the historical reasons for states picking a specific set of laws over another? This question is taken up in great detail by Ghent (2012). Ghent documents precisely when each state enacted the various statutes that govern foreclosure laws, with a particular focus on why some states followed the title versus the lien theory. She observes that "the procedure that lenders must follow to foreclose on a mortgage is determined very early in states' histories, typically before the U.S. Civil War" (p. 2), and finds that older states are more likely to adopt the title theory. Importantly for our purposes, Ghent shows that after states adopt a policy for dealing with foreclosures, they are highly unlikely to modify it.

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

[17] The latter two variables come from CoreLogic.

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

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

To conduct this analysis, we focus on zip codes that are close to the border of two states that differ in whether judicial foreclosures are required. Table IV lists the state borders that are included in the border analysis, along with the number of zip codes within 25 and 10 miles of the border. Using this sample, we ask the following question: as one moves from a judicial state to a nonjudicial state, does the foreclosure rate "jump" at the border? Under the assumption (which we test) that zip codes on either side of the border are otherwise similar, the only change that happens when one crosses the border is the change in state laws applicable to delinquent mortgages.

Formally, we estimate the following specification:

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

where $FOR\ CLOSUREC\ RATE_{zbsx}$ represents foreclosures per delinquent account for zip code z that is located within 50 miles of border b in state s and lies on a 10-mile strip x of the border. The 10-mile strips are constructed such that they run perpendicular to the direction of the state border. The specification includes fixed effects at the border-state-level times 10-mile strips (α_{bsx}). These fixed effects ensure that we compare zip codes that lie on the same 10-mile strip running across the state border in question.[18]

The dots in Figure 4 represent the coefficient estimates of γ^i on 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 number of foreclosures per delinquent account for one-mile-wide bands around the border of a judicial foreclosure state and nonjudicial foreclosure state, after controlling for (border-state*10-mile strip) fixed effects.

Figure 4 plots the estimates of γ^i for 2006 through 2013. In 2008 through 2010 there is a very sharp and large jump in the ratio of foreclosures to delinquent accounts as one crosses the border from a judicial requirement state into a nonjudicial requirement state. The difference at the border peaks in 2009, and falls significantly in 2012. There is no difference at all in 2013. This lines up closely with the findings in Table II that the foreclosure difference between judicial and nonjudicial states falls in 2012 and disappears in 2013.

[18] The 10-mile strip indicator variables control nonparametrically 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.

Table IV

Borders of States with Different Foreclosure Rules

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

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

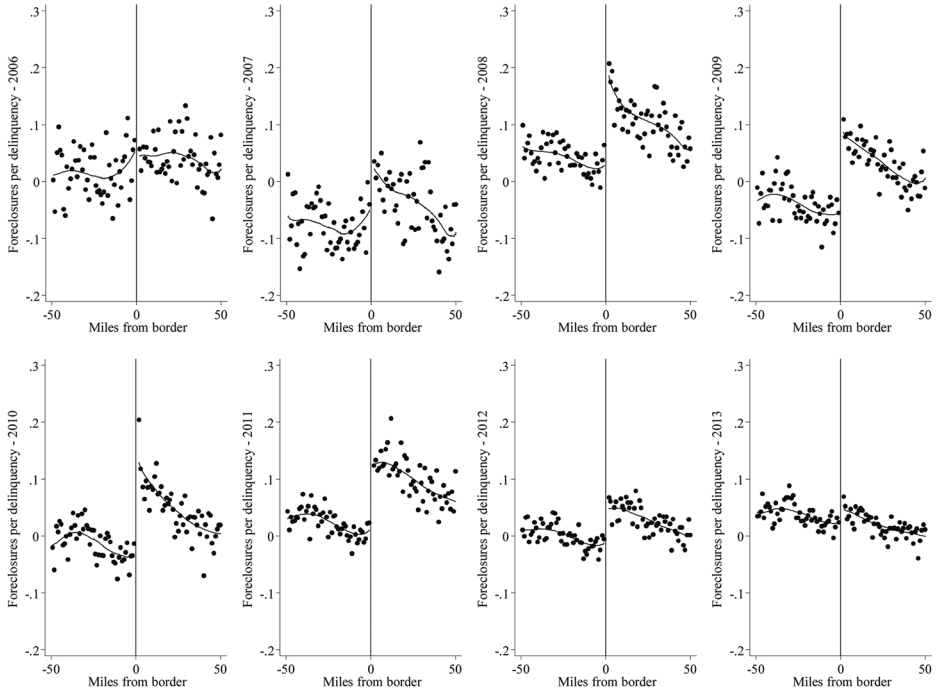

Figure 4. Foreclosures and judicial requirement: Zip codes near the border. These figures plot averages of foreclosures near borders where the judicial requirement regime changes across states. We generate the graphs by regressing the variable of interest on state-border-group fixed effects and on one-mile distance-to-the-border dummies (where the dummies are negative for judicial states) and then plot the coefficients on the distance-to-the-border dummies. The border is at zero, the omitted category.

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

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

where $DIST$, represents the distance in miles of a zip code from a state border, with distance in judicial states represented by a negative number, and $DISTSQ$ and $DISTCUBE$ represent squared and cubic terms of this distance variable. The polynomial specification allows the foreclosure rate to vary in a flexible, nonlinear fashion. The coefficient β_4 on $JUDICIAL$ tests for any discontinuity at the state-border level. We estimate equation (2) separately for each year from 2006 through 2013. The standard errors are clustered at the state-border level, with 40 total clusters.

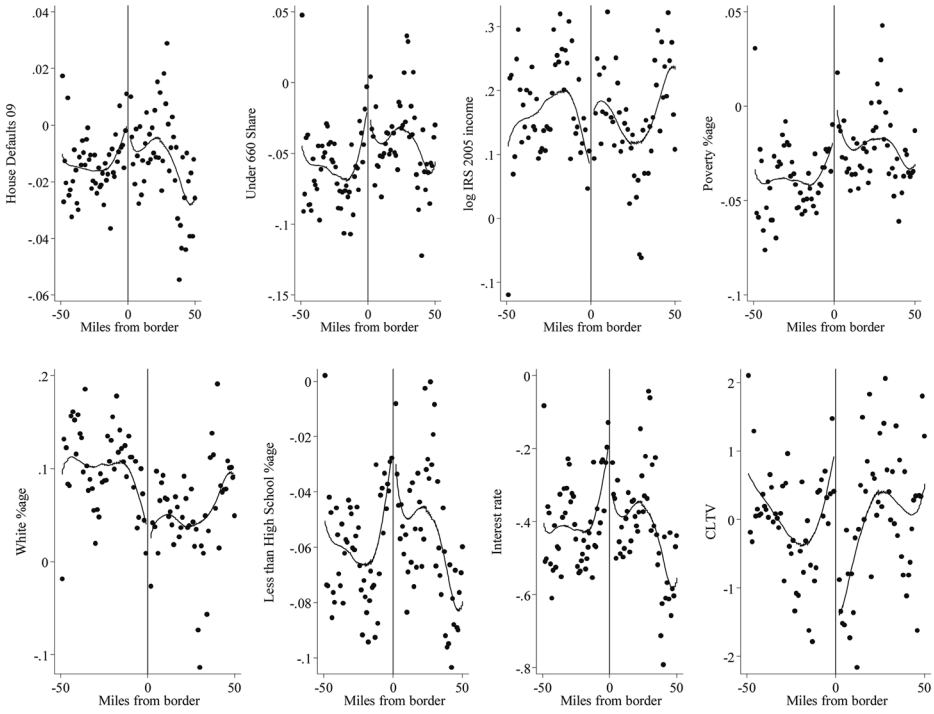

Figure 5. Other variables and judicial requirement: Zip codes near the border. These figures plot averages of variables near borders where the judicial requirement regime changes across states. We generate the graphs by regressing the variable of interest on state-border-group fixed effects and on one-mile distance-to-the-border dummies (where the dummies are negative for judicial states) and then plot the coefficients on the distance-to-the-border dummies. The border is at zero, the omitted category.

The coefficients are reported in Table V. The number of zip codes in each regression varies by year because the dependent variable is not defined for zip codes with zero mortgages in default. The results show that the jump in foreclosure rate at the state-border level is small and not statistically significant at the 10% level in 2006 and 2007. However, it quickly increases in magnitude and remains large and statistically significant from 2007 through 2010. The coefficient declines in 2011 and 2012. By 2012, the coefficient is less than half its value in 2008 through 2010. By 2013, it is indistinguishable from zero.

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

Table V

Foreclosures at State Border

This table presents tests for discontinuity in foreclosure rate at the state border using zip code-level data. Distance is defined in miles from the border divided by 1,000 and is multiplied by −1 for judicial states.

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

**, *, and $^+$ are coefficients statistically different from zero at the 1%, 5%, and 10% confidence level, respectively.

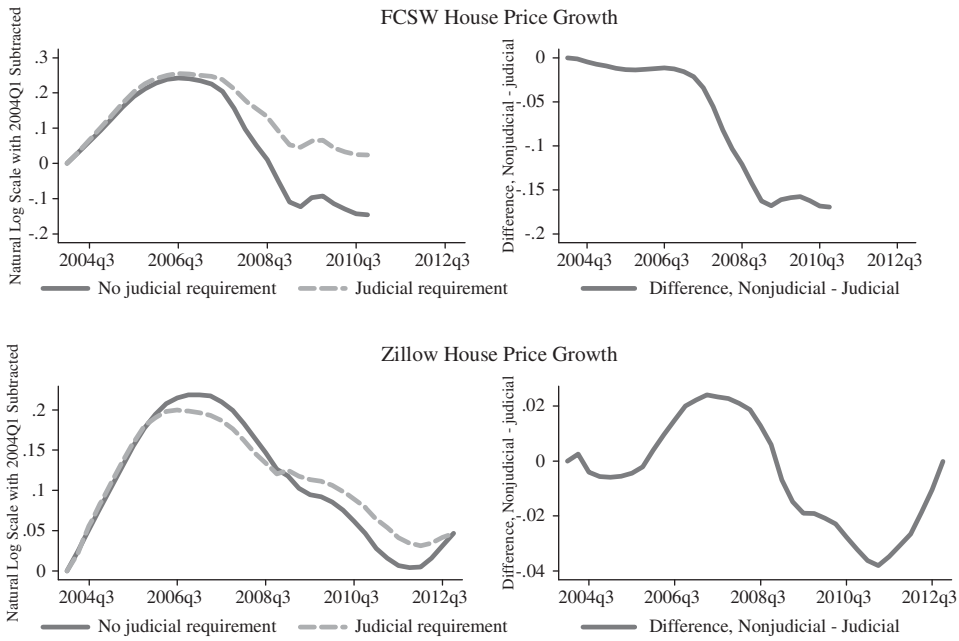

Figure 6. Foreclosures and house prices, reduced form. The figures plot house price growth in judicial and nonjudicial states from 2004 to 2012. Averages are calculated by first calculating the log difference at time t and 2004Q1 for every state, and then taking the equal-weighted average for judicial and nonjudicial categories.

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

A. The Effect of Foreclosures on House Prices

States that do not require a judicial foreclosure experienced much higher foreclosure rates from 2008 to 2010, at which point the foreclosure difference rates began to decline. There is no evidence of any other discernible difference between states based on the judicial foreclosure requirement. Figure 6 begins our analysis of house prices by showing house price indices for judicial versus nonjudicial states from 2004 to 2012. For both the FCSW (top) and Zillow.com (bottom) indices, there is a larger drop in house prices in states that do not require judicial foreclosure. The magnitude of the relative decline is significantly larger using the FCSW index. For the FCSW index, house prices in nonjudicial states fell by 38% from the middle of 2006 to the beginning of 2009. They fell by only 23% in judicial states. The top right panel plots the difference over time. The drop using Zillow.com from the second quarter of 2007 to the third quarter of 2009 is about 3.5%. In the Internet Appendix, we show the exact

same finding using the CoreLogic house price data. For all three indices, we see a larger decline in house prices once the foreclosure crisis hits.[19]

Both the Zillow series and the CoreLogic series, reported in the Internet Appendix, show some evidence of a differential rise in house prices in nonjudicial states in 2006 and 2007 just before the foreclosure crisis begins. This differential increase is not present in the FCSW data. In the Internet Appendix, we find that this pretrend is driven mostly by just two states that saw very strong growth in 2006 and 2007: Idaho and Utah. Excluding these two states has only a small effect on the magnitude of the decline in house prices in nonjudicial states from 2007 to 2009. In regressions below, we control for house price growth prior to 2007 to make sure it is not responsible for the results.

For Zillow, we have data through the end of 2012. The bottom panel of Figure 6 shows that house prices rebound in nonjudicial states relative to judicial states at the end of 2011 and into 2012. This corresponds with the period during which the aggregate foreclosure crisis subsides, and the relative foreclosure rate between nonjudicial and judicial states declines. By the end of 2012, the difference in house prices is almost exactly zero. We do not have FCSW data past 2010, but in the Internet Appendix we show that the exact same rebound is present in the CoreLogic data. We delay our discussion of the rebound until later in this section.

To estimate the effect of foreclosures on house prices during the foreclosure wave, we adopt the following state-level two-stage least squares (2SLS) specification:

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

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

Equation (4) represents the first stage. We regress foreclosures in 2008 and 2009 scaled by the number of homeowners with a mortgage as of 2005 on an indicator variable capturing whether states requires judicial foreclosure. The second stage in equation (3) regresses the growth rate in outcome Y in states from the end of 2007 to the end of 2009 on the predicted value of foreclosures from the first stage. Our primary focus in this section is on house prices, but later the outcome variable Y will be real estate listings, residential investment, and auto sales. Control variables are in the matrix X.

Table VI presents the second-stage estimates of the effect of foreclosures on house price growth. Columns (1) through (3) focus on house price growth measured by Zillow.com from 2007 to 2009. As the estimates show, there is a strong negative effect of foreclosures on house price growth.[20] The estimates

[19] Another potential house price index is the FHFA price index. However, the FHFA price index has a well-known selection bias because it only includes transactions for which a conforming GSE-backed mortgage is used, which excludes subprime and Alt-A mortgages, where much of the price increase and decline was concentrated over the 2002–2009 period. It also includes appraisals from refinancing, which do not reflect transaction prices. See Noeth and Sengupta (2011).

[20] For both Zillow and FCSW, the 2SLS estimate of the effect of foreclosures on house prices conditional on delinquencies is slightly larger than the OLS correlation conditional on delinquencies.

Table VI

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

	Zillow House Price Growth, 2007–2009			FCSW House Price Growth, 2007–2009		
	(1)	(2)	(3)	(4)	(5)	(6)
Foreclosures per homeowner, 2008–2009	−2.245*	−1.751*	−1.966*	−2.277*	−1.579+	−4.089+
	(1.020)	(0.810)	(0.952)	(1.082)	(0.870)	(2.312)
Delinquencies per homeowner, 2008–2009	−1.336*	−0.669	−0.914	−1.497**	−0.308	7.955
	(0.522)	(0.507)	(1.584)	(0.572)	(0.595)	(8.947)
House price growth, 2002–2006		−0.113	−0.200*		−0.105	−0.128
		(0.083)	(0.100)		(0.104)	(0.183)
House price growth, 2006–2007		0.913**	0.407		1.180*	1.934*
		(0.240)	(0.328)		(0.600)	(0.933)
Delinquencies squared, 2008–2009			0.439			−17.544
			(4.552)			(20.878)
New mortgages/income, 2005			0.138			−0.395
			(0.392)			(0.767)
Debt to income increase, 2002–2005			−0.072			−0.074
			(0.102)			(0.167)
Subprime consumer fraction, 2000			−0.175			−0.198
			(0.282)			(0.726)
Income, 2005			0.075			−0.490*
			(0.129)			(0.229)
Income <25K fraction, 2005			−0.088			−3.119*
			(0.598)			(1.534)
Unemployment rate, 2000			−0.087			−8.301**
			(1.673)			(1.862)
Poverty fraction, 2000			1.298			3.364**

(Continued)

Table VI—*Continued*

	Zillow House Price Growth, 2007–2009			FCSW House Price Growth, 2007–2009		
	(1)	(2)	(3)	(4)	(5)	(6)
			(0.852)			(1.070)
Black fraction, 2000			0.069			−0.643
			(0.129)			(0.489)
Hispanic fraction, 2000			−0.077			1.040
			(0.189)			(0.892)
<high school education fraction, 2000			−0.016			0.602
			(0.357)			(0.664)
Urban fraction, 2000			−0.144^{+}			−0.138
			(0.085)			(0.242)
Constant	0.072**	0.049	−0.157	0.048	0.009	3.021*
	(0.027)	(0.031)	(0.706)	(0.040)	(0.049)	(1.268)
N	48	45	45	24	24	24
R^2	0.674	0.786	0.849	0.738	0.826	0.909

**, *, and $^{+}$ are coefficients statistically different from zero at the 1%, 5%, and 10% confidence level, respectively.

in columns (1) through (3) imply that a one-standard-deviation increase in foreclosures per homeowner in 2008 and 2009 leads to a 5% to 7% relative drop in house price growth, which is a 2/5- to 3/5-standard-deviation decrease in house price growth. The estimate in column (1) implies that moving from a state with the median foreclosure rate to a state with the 90th percentile foreclosure rate leads to 8% lower house price growth from 2007 to 2009.

The inclusion of control variables does not have a large effect on the magnitude of the estimates. These results are consistent with evidence in Section II that states with and without judicial foreclosure requirements 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 are available for only 24 states in the sample.[21]

Lower house prices in states with higher foreclosure rates could be driven by the foreclosed properties themselves. Neither the Zillow.com nor FCSW data we use in Table VI allow us to separate out foreclosed homes. However, CoreLogic has a house price index that excludes distressed properties. In the Internet Appendix, we replicate columns (1) and (2) of Table VI using both the full CoreLogic index and the index that excludes distressed properties. The coefficient on foreclosures remains statistically significant, and the magnitude declines by only 15%. Foreclosures affect prices of homes that are not sold in distress.

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

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

To answer this question, we utilize a separate zip code-level data set from Target Data Inc. that records the number of new for-sale listings from the Multiple Listing Service for 2009 and 2010.[22] In 2009, the ratio of new listings to homeowners is on average 6% across the states in the sample. To isolate

If we do not condition on delinquencies in either the OLS or 2SLS approach (unreported), the OLS coefficient increases sharply and is 50% larger than the 2SLS coefficient. This is consistent with a bias in the OLS regression that overstates the negative effect of foreclosures on house prices.

[21] The reduced-form graphs in Figure 6 suggest a larger decline in house prices using the FCSW indices relative to Zillow, yet the 2SLS magnitudes for both indices are similar. This is driven by two effects. First, Figure 6 does not condition on delinquencies whereas the 2SLS specification does. Conditioning on delinquencies does not change the Zillow reduced form, but decreases the FCSW reduced form by about 25%. Second, the FCSW indices are only available for 24 states, and the first stage is stronger among these states. Given that the 2SLS estimate is based on the ratio of the reduced-form coefficient to the first stage, the 2SLS estimate for FCSW is similar given the larger first stage.

[22] See http://www.targetdata.net/ for more details. Data for years before 2009 are not available.

Table VII
New For-Sale Listings

This table presents evidence on the effect of foreclosures on new houses listed for sale. Column (1) presents the reduced-form relation between the judicial foreclosure requirement and new for-sale listings. Columns (2) and (3) present coefficients of the second stage of a 2SLS specification of the number of new for-sale listings on foreclosures. The first stage regresses foreclosures on whether a state has a judicial foreclosure requirement. The right-hand side variables are measured as of the same year as the left-hand side. Columns (4) and (5) repeat the state-border discontinuity test for new listings per homeowner. Standard errors for all zip code-level regressions are clustered at the state-border level (40 clusters in total).

	New For-Sale Listings per Homeowner in				
	2009 and 2010 (1)	2009 and 2010 (2)	2009 and 2010 (3)	2009 (4)	2010 (5)
Judicial foreclosure requirement	−0.013+			−0.019**	−0.016**
	(0.007)			(0.004)	(0.005)
Foreclosures per homeowner		0.533*	0.520*		
		(0.222)	(0.231)		
Delinquencies per homeowner			0.112		
			(0.207)		
Constant	0.116**	0.093**	0.085**		
	(0.004)	(0.007)	(0.011)		
Distance				−0.132	−0.192
				(0.181)	(0.223)
Distance squared				−2.903	−1.306
				(2.973)	(2.677)
Distance cubed				27.679	−1.871
				(109.898)	(120.909)
State-border *10-mile strips FE				Yes	Yes
N	51	51	51	8,235	8,235
R^2	0.063	0.386	0.415	0.369	0.335

**, *, and + are coefficients statistically different from zero at the 1%, 5%, and 10% confidence level, respectively.

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

Column (1) of Table VII shows that the cumulative number of new for-sale listings per homeowner in 2009 and 2010 is 10.8% (−0.0126/0.116) lower in judicial states that have a lower foreclosure rate. Column (2) estimates the 2SLS effect of foreclosures on new listings and finds that a one-unit increase in foreclosures per homeowner leads to a 0.53-unit increase in the number of new listings. Column (3) adds the mortgage default rate as a control variable and shows that the results are similar.

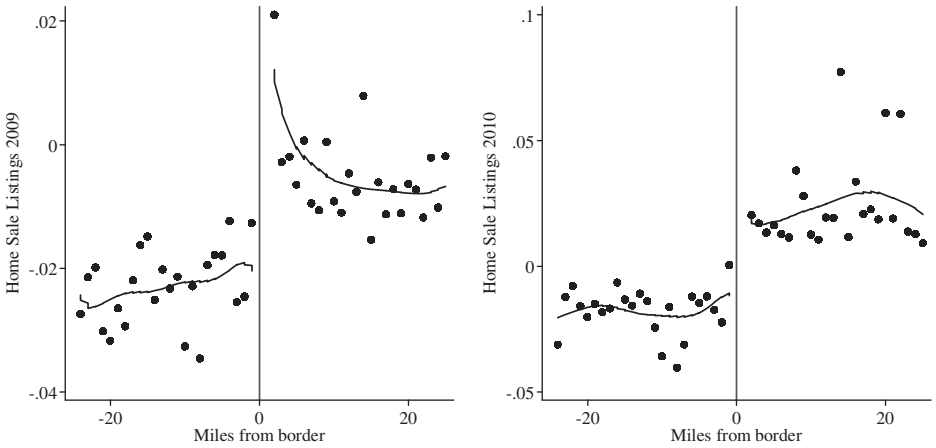

Figure 7. New for-sale listings: Zip codes near border. The figures plot the number of houses newly listed for sale per homeowner in 2009 and 2010 for zip codes that are near borders where the judicial requirement regime changes across states. We generate the graphs by regressing the outcome variable on state-border-group fixed effects and on one-mile band distance-to-the-border dummies (where the dummies assume negative values for judicial states) and then plot the coefficients on the dummies. The border is at zero, the omitted category.

Since the underlying new listings data are available at the zip code level, we can replicate the state-border discontinuity analysis summarized by equation (1) using the number of new listings per homeowner as the dependent variable. Figure 7 shows strong evidence of a sharp increase in listings when one enters the nonjudicial state.

Columns (4) and (5) of Table VII confirm the statistical significance of the jump. As in Table V, standard errors are clustered at the state-border level with 40 borders in total. The number of listings jumps by 1.9 and 1.6 percentage points in 2009 and 2010, respectively. These effects are large given that zip code-level listings per capita have a mean of 5.1 and 4.8 in 2009 and 2010, respectively. We therefore find strong evidence that foreclosures increase the net supply of houses on the market, which is exactly the mechanism emphasized by fire sale theories.

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

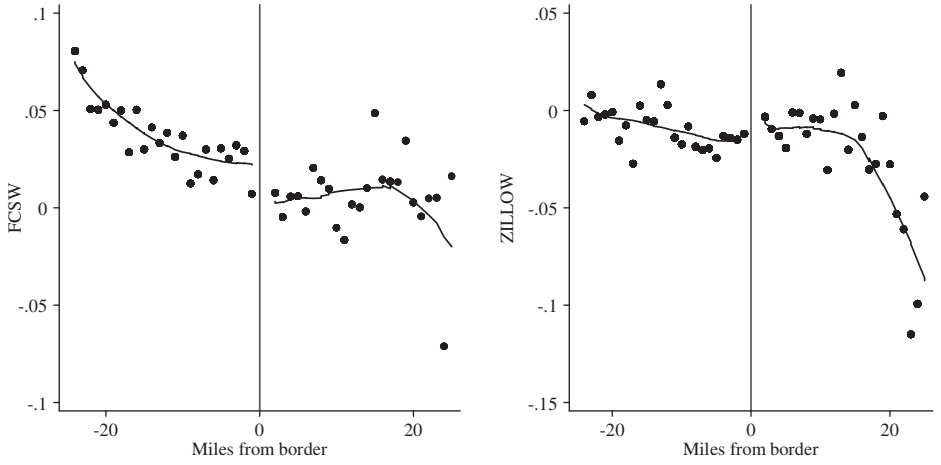

Figure 8. House price growth 2008–2009: Zip codes near border. The figures plot house price growth from 2008 to 2009 for zip codes that are near borders where the judicial requirement regime changes across states. We generate the graphs by regressing the outcome variable on state-border-group fixed effects and on one-mile band distance-to-the-border dummies (where the dummies assume negative values for judicial states) and then plot the coefficients on the dummies. The border is at zero, the omitted category.

C. More Disaggregated Analysis?

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

Even with the sharp discontinuity in foreclosures and a true effect of foreclosures on house prices, one would not expect a sharp discontinuity in house price growth near the border of two states that differ in foreclosure laws. The main reason is that housing markets are not sharply divided by a border between two states. If home buyers view houses in zip codes across a state border as close substitutes, a foreclosure-induced drop in house prices on the nonjudicial side of the border will have spillover effects onto the housing markets on the judicial side of the border.

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

(although less clear using Zillow). House prices continue to decline as one goes further into the nonjudicial state.

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

The spillover effects of housing markets on either side of the border prevents a traditional regression discontinuity approach for evaluating the effect of foreclosures on house prices. This raises the concern that the effect of foreclosures on house prices that we estimate using state-level data are polluted by shocks to different regions of the country. We conduct a number of robustness tests to address this concern, which we discuss in Section V below.

D. The Rebound in House Prices

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

In both panels, column (1) shows that house prices fell by less in states that have judicial foreclosure requirements, which is consistent with the results in Table VI. Column (2) of both panels shows that house price growth was essentially the same from 2009 to 2010. Column (3) shows that the weaker house price growth in judicial foreclosure states from 2010 to 2012 shown in Figure 6 is statistically significant at the 10% level for the CoreLogic data, while it is not statistically significant at a reasonable level in the Zillow data. Column (4) shows that, over the entire 2007–2012 period, we cannot reject the hypothesis that house price growth was the same in judicial and nonjudicial states.

The timing of the house price effect, which is similar for residential investment and auto sales as we show in the next section, raises interesting questions regarding the underlying theoretical model that is most consistent with the results. We discuss this issue in detail in Section V below. In evaluating the results from 2010 to 2012, one caveat is in order. We find abundant evidence that judicial and nonjudicial states were no different when the foreclosure crisis first began in 2007. However, the further we move away from 2007, the more likely that the natural experiment becomes polluted by differential responses by judicial and nonjudicial states. From a statistical perspective, we have more

Table VIII

House Price Growth, 2007–2012 Judicial versus Nonjudicial States

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

Panel A: Zillow

	House Price Growth 2007–2009 (1)	House Price Growth 2009–2010 (2)	House Price Growth 2010–2012 (3)	House Price Growth 2007–2012 (4)
Judicial foreclosure requirement	0.037*	−0.005	−0.017	0.015
	(0.018)	(0.016)	(0.023)	(0.031)
Delinquencies per homeowner, 2008–2009	−1.444**	−0.350	0.156	−1.638**
	(0.367)	(0.216)	(0.353)	(0.542)
House price growth, 2002–2006	−0.112	−0.000	0.003	−0.109
	(0.086)	(0.048)	(0.082)	(0.097)
House price growth, 2006–2007	1.017**	−0.028	−0.208	0.781+
	(0.252)	(0.209)	(0.316)	(0.392)
Constant	0.059+	−0.026	−0.017	0.015
	(0.033)	(0.019)	(0.023)	(0.031)
N	45	45	45	45
R^2	0.791	0.081	0.054	0.572

(Continued)

Table VIII—*Continued*

Panel B: CoreLogic				
	House Price Growth 2007–2009 (1)	House Price Growth 2009–2010 (2)	House Price Growth 2010–2012 (3)	House Price Growth 2007–2012 (4)
Judicial foreclosure requirement	0.034*	0.011	−0.030*	0.015
	(0.014)	(0.008)	(0.013)	(0.022)
Delinquencies per homeowner, 2008–2009	−0.755*	−0.198	−0.052	−1.005*
	(0.288)	(0.147)	(0.221)	(0.400)
House price growth, 2002–2006	−0.270**	−0.034	0.054	−0.249**
	(0.052)	(0.035)	(0.044)	(0.063)
House price growth, 2006–2007	0.901**	−0.002	−0.200	0.698**
	(0.270)	(0.107)	(0.218)	(0.255)
Constant	0.032	−0.008	0.024	0.048
	(0.028)	(0.010)	(0.023)	(0.034)
N	51	51	51	51
R^2	0.804	0.154	0.187	0.619

**, *, and $^+$ are coefficients statistically different from zero at the 1%, 5%, and 10% confidence level, respectively.

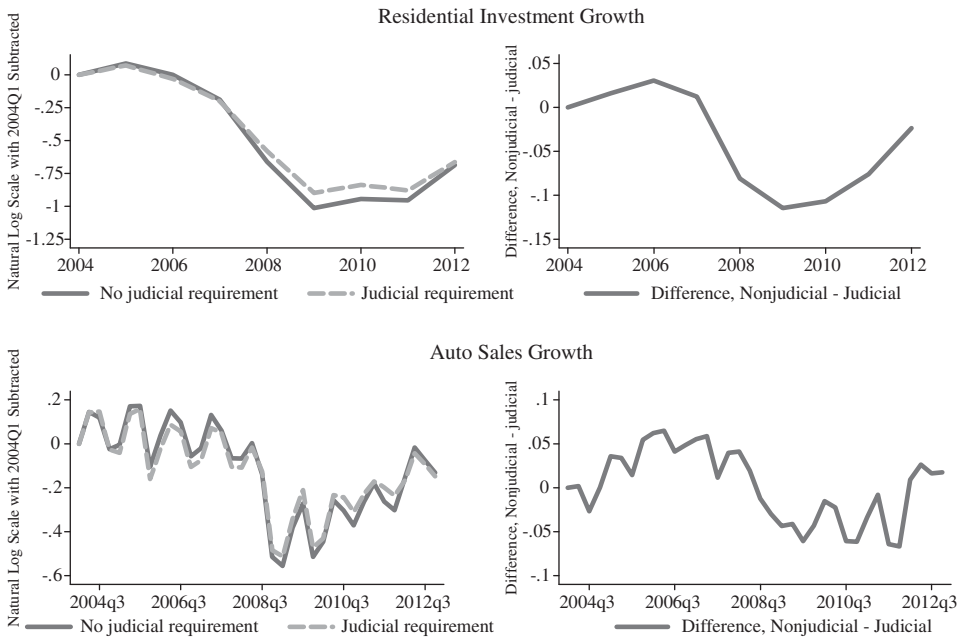

Figure 9. Foreclosures, residential investment, and durable consumption, reduced form. The figures plot residential investment (top) and auto sales (bottom) growth in judicial and nonjudicial states from 2004 to 2012. Averages are calculated by first calculating the log difference at time t and 2004Q1 for every state, and then taking the equal-weighted average for judicial and nonjudicial categories.

confidence in the exogeneity of state foreclosure laws in 2008 and 2009 than in the latter part of the sample.

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

A. Two-Stage Least Squares Estimates

The results in Section III document a large negative effect of foreclosures on house prices from 2007 to 2009. A central idea in the macroeconomics literature on fire sales is that a sharp negative movement in the relative price of durable goods can amplify shocks and lead to a reduction in real economic activity. This section explores this idea in the context of residential investment and durable consumption.

Figure 9 presents the reduced-form version of our 2SLS specification. The top panel plots residential investment growth in nonjudicial and judicial states from 2004 to 2012 as measured by new residential construction permits collected by the Census. The data used in the top panel are at an annual

frequency.[23] 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 nonjudicial 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 nonjudicial and judicial states. Residential investment dropped by nine percentage points more in nonjudicial states relative to judicial states from 2007 to 2008 and fell slightly further in 2009. As with house prices, there is evidence of a relative rebound after 2010.

The bottom panel of Figure 9 plots auto sales. It shows a smaller decline in auto sales in states that require judicial foreclosure. As the bottom right panel shows, auto sales in each quarter from 2008Q2 to 2011Q4 were lower in nonjudicial versus judicial states relative to their respective 2004Q1 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 nonjudicial states is large. Once again, we see evidence of a stronger recovery in nonjudicial states in 2012.

Table IX presents the state-level 2SLS estimates for residential investment and auto sales growth from 2007 to 2009. The estimate in column (1) on foreclosures per homeowner implies that a one-standard-deviation increase in foreclosures leads to a 2/5-standard-deviation decrease in residential investment growth from 2007 to 2009. Alternatively, moving from the median to the 90th percentile of the distribution of foreclosures leads to 23-percentage-point lower residential investment growth from 2007 to 2009.

For auto sales, the estimate in column (5) implies that a one-standard-deviation increase in foreclosures leads to a 3/5-standard-deviation decrease in auto sales growth from 2007 to 2009. Alternatively, moving from the median to the 90th percentile of the foreclosures distribution leads to 12-percentage-point lower auto sales growth from 2007 to 2009. Both the residential investment and auto sales results are statistically weaker with the inclusion of all the control variables. It is important to remember that we have only 51 observations in these specifications, and we include a large number of control variables to see how robust the finding is.

One potential robustness test for the results in Table IX would be to focus on zip codes or counties that are near the border of two states that differ in foreclosure laws.[24] We know that foreclosure propensity jumps right at the border, but should we expect real economic outcomes to jump in a similar way?

[23] 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 two-thirds 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 that is less than annual.

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

Table IX

Foreclosures, Residential Investment, and Auto Sales 2SLS Estimates

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

	Residential Permits Growth 2007 to 2009			Auto Sales Growth 2007 to 2009		
	(1)	(2)	(3)	(4)	(5)	(6)
Foreclosures per homeowner, 2008–2009	−6.907*	−6.450*	−2.939	−3.437+	−4.001*	−4.570+
	(3.258)	(3.024)	(3.105)	(1.871)	(2.021)	(2.372)
Delinquencies per homeowner, 2008–2009	−0.962	−1.300	−10.975**	−0.712	−0.174	−2.768
	(1.642)	(1.419)	(3.431)	(0.916)	(0.889)	(3.717)
Growth in LHS variable, 2002–2006		−0.072	−0.215		0.194	0.511**
		(0.104)	(0.195)		(0.194)	(0.119)
Growth in LHS variable, 2006–2007		−0.098	−0.171		0.614	0.453
		(0.202)	(0.226)		(0.495)	(0.403)
Delinquencies squared, 2008–2009			26.969**			11.465
			(10.440)			(9.867)
New mortgages/income, 2005			−0.327			−0.471
			(0.969)			(0.763)
Debt to income increase, 2002–2005			−0.105			0.401
			(0.328)			(0.258)
Subprime consumer fraction, 2000			−0.527			−0.768
			(1.218)			(0.812)
Income, 2005			−0.370			−0.182
			(0.477)			(0.267)
Income <25K fraction, 2005			−1.501			−0.521
			(2.744)			(1.590)

(Continued)

Table IX—*Continued*

	Residential Permits Growth 2007 to 2009			Auto Sales Growth 2007 to 2009		
	(1)	(2)	(3)	(4)	(5)	(6)
Unemployment rate, 2000			−7.088^{+}			0.730
			(3.893)			(1.960)
Poverty fraction, 2000			4.368			0.501
			(3.158)			(1.501)
Black fraction, 2000			0.889			0.397
			(0.554)			(0.334)
Hispanic fraction, 2000			0.268			−0.114
			(0.668)			(0.420)
<high school education fraction, 2000			−0.387			0.376
			(1.419)			(0.921)
Urban fraction, 2000			0.431^{+}			0.123
			(0.225)			(0.207)
Constant	−0.485**	−0.464**	1.990	−0.250**	−0.268**	0.742
	(0.087)	(0.079)	(2.911)	(0.048)	(0.046)	(1.613)
N	51	51	51	51	51	51
R^2	0.398	0.422	0.596	0.356	0.384	0.524

**, *, and $^{+}$ are coefficients statistically different from zero at the 1%, 5%, and 10% confidence level, respectively.

The answer is no for the same reason we outline above when discussing house prices. Foreclosures on one side of the border affect the real economy on the other side of the border through many channels. The most direct effect is through house prices given some substitutability in people's preferences for housing across borders. However, this concern is amplified when looking at auto sales and residential investment because both sides of the border likely contribute to the same *economy*: if foreclosures and house price declines affect residential investment and auto sales on one side of the border, they will also affect the other side of the border through general equilibrium employment and income effects. Indeed, 70% of the zip codes within 10 miles of the border of another state with a different foreclosure law are part of a metropolitan area that covers both states. In Section V, we discuss a robustness test using state-level data where we examine differences in auto sales and residential investment for bordering states that have differing foreclosure laws. This test helps alleviate the concern that regional shocks spuriously correlated with foreclosure laws are driving the results.

B. Macroeconomic Implications

We can use the estimates obtained in Tables VI and IX to inform the debate regarding the effect of the foreclosure wave on the macroeconomy during the Great Recession. However, it is important to emphasize that the estimated marginal effects are driven by variation in foreclosures that comes from the judicial foreclosure requirement in certain states. Given that the local average treatment effect is driven by this very specific source of variation, we urge caution in using the full distribution of foreclosures to estimate aggregate impacts.[25]

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 II for the state-level data. The advantage of this approach is that it utilizes variation that can be explained with the first stage, and is therefore analogous to an "in-sample" treatment effect where judicial foreclosure requirement states represent the control group. The estimate is -0.020, which implies that foreclosures per homeowner are two percentage points lower in judicial foreclosure requirement states.

We multiply the foreclosure coefficient estimates in Tables VI and IX by the two-percentage-point difference in foreclosure rates to estimate the aggregate impact of foreclosures on house prices, residential investment, and auto sales. For house prices, we use an estimate of -2 from Table VI, which implies that house price growth from 2007 to 2009 was four ($= -2^{*}-0.020$) percentage points lower in nonjudicial versus judicial states. The average decline in the

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

sample is 12 percentage points, which implies that foreclosures can explain about 33% of the decline in house prices.

For residential investment, the estimate of −6.5 based on the coefficients in Table IX suggests that residential investment growth from 2007 to 2009 was 13 (= −6.5*−0.020) percentage points lower in nonjudicial versus judicial states. The average decline in the sample is 77 percentage points, which implies that foreclosures can explain about 17% of the overall decline in residential investment. For auto sales, we use an estimate of −4 based on Table IX, which implies that auto sales growth from 2007 to 2009 was eight (= −4*−0.020) percentage points lower in nonjudicial versus judicial requirement states. The average decline in the sample (from Table I) is 41 percentage points, which implies that foreclosures can explain about 20% of the overall decline in auto sales.

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

C. The Rebound

Figure 9 shows evidence of a stronger rebound in residential investment and auto sales from 2010 to 2012 in nonjudicial states, as the foreclosure crisis waned and the difference in foreclosure rates between nonjudicial and judicial states disappeared. Table X tests whether the rebound shown in Figure 9 is statistically significant. The first column of both panels shows that residential investment and auto sales declined by less in judicial foreclosure states, consistent with the second-stage evidence in Table VIII. Both residential investment and auto sales growth continued to be slightly stronger in judicial foreclosure states from 2009 to 2010, although not statistically significantly so. Column (3) shows weaker residential investment and auto sales growth from 2010 to 2012 in judicial foreclosure states, but only the auto sales results are statistically significant. Unlike with house prices, the evidence is weaker that the rebound is statistically robust.

V. Timing and Implications for Theory

The patterns above raise interesting questions regarding the timing of the effects of foreclosures on house prices and real economic activity. To summarize: between 2007 and 2009, the United States witnessed a foreclosure crisis that was unprecedented (Figure 1). Foreclosures rose slightly in 2010, and then began to fall sharply. The difference between foreclosure rates in nonjudicial and judicial states increased substantially from 2007 to 2009, and the difference persisted until 2011 at which point it declined (Table II). House prices fell in nonjudicial states substantially more than in judicial states from 2007 to 2009, and they remained depressed through 2010. House prices rebounded from 2010 to 2012 in nonjudicial states (Table VIII). Auto sales and residential

Table X

Residential Investment and Auto Sales Growth, 2007–2012 Judicial versus Nonjudicial States

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

Panel A: Residential Investment

	Residential Permits Growth 2007–2009 (1)	Residential Permits Growth 2009–2010 (2)	Residential Permits Growth 2010–2012 (3)	Residential Permits Growth 2007–2012 (4)
Judicial foreclosure requirement	0.125*	0.017	−0.051	0.091
	(0.061)	(0.031)	(0.073)	(0.114)
Delinquencies per homeowner, 2008–2009	−4.102**	−0.405	0.535	−3.973**
	(0.779)	(0.394)	(1.008)	(1.316)
Residential permits growth, 2002–2006	0.008	−0.105	0.330	0.233
	(0.100)	(0.066)	(0.211)	(0.249)
Residential permits growth, 2006–2007	0.017	−0.110	−0.402	−0.496
	(0.227)	(0.124)	(0.322)	(0.403)
Constant	−0.428**	0.084+	0.074	−0.270+
	(0.100)	(0.044)	(0.088)	(0.146)
N	51	51	51	51
R^2	0.474	0.119	0.194	0.172

(Continued)

Table X—*Continued*

Panel B: Auto Sales

	Auto Sales Growth 2007–2009 (1)	Auto Sales Growth 2009–2010 (2)	Auto Sales Growth 2010–2012 (3)	Auto Sales Growth 2007–2012 (4)
Judicial foreclosure requirement	0.074*	0.018	−0.039+	0.053
	(0.037)	(0.028)	(0.021)	(0.044)
Delinquencies per homeowner, 2008–2009	−1.990**	−0.157	0.062	−2.085**
	(0.497)	(0.385)	(0.282)	(0.728)
Auto sales growth, 2002–2006	0.671	0.190	−0.001	0.860+
	(0.444)	(0.430)	(0.285)	(0.463)
Auto sales growth, 2006–2007	0.226	0.436+	−0.074	0.588
	(0.229)	(0.217)	(0.100)	(0.353)
Constant	−0.234**	0.107**	0.190**	0.063
	(0.049)	(0.035)	(0.027)	(0.076)
N	51	51	51	51
R^2	0.496	0.275	0.068	0.448

**, *, and + are coefficients statistically different from zero at the 1%, 5%, and 10% confidence level, respectively.

investment show a similar pattern, although the rebound is not as statistically robust (Table X).[26]

Why did the effect of foreclosures on house prices, auto sales, and residential investment concentrate in 2008 and 2009, when the foreclosure differences between judicial and nonjudicial states persisted all the way through 2011? We believe that both *expectations* and *investor purchases* play an important role. With respect to expectations, the magnitude of the foreclosure crisis was well understood by 2009. As a result, the effect of foreclosures on house prices was likely already priced in the market by 2009. In other words, once market participants understood in 2008 and 2009 that more foreclosures were likely to hit the market in the future, house prices adjusted rapidly.

This is a difficult hypothesis to test, because market participants' expectations are not easily measured. In the Internet Appendix, we show evidence from Google Trends that Google searches for the term "foreclosure" grew 50% in 2008, and then fell by 10% in 2009. They fell a further 30% in 2010 and continued to fall every year afterward. According to this measure, the positive shock to expectations of foreclosures was largest in 2008, and declined afterward.

An additional piece of evidence supporting the importance of expectations is the fact that the effect of foreclosures on permits for new residential construction is observed entirely in 2008 (see Figure 9 and the Internet Appendix). The Census data are based on new permits, and in 2008 it took eight months from permit authorization to completion of the unit. Given this waiting period, builders are forward-looking when filing for permits. Permits in nonjudicial states collapsed dramatically in 2008 relative to judicial states, but there was little additional decline in 2009. An expectation of higher foreclosures, and therefore an expectation of greater inventory of houses on sale, led to a quick decline in construction activity in nonjudicial states.

Another reason that the effect of foreclosures on house prices and the real economy were smaller after 2009 is related to investors. Beginning in 2009, investors started aggressively purchasing homes. An imperfect measure of investor purchases used widely in the housing industry is the incidence of houses bought with 100% cash. As the Internet Appendix shows, cash-only purchases grew 2% from 2007 to 2008, but then grew 20% from 2008 to 2009. They grew another 10% in 2010 and 5% in 2011 and 2012. In contrast, purchases financed with a mortgage fell every single year from 2006 to 2011. Foreclosures likely had a mitigated impact on house prices in 2010 and thereafter because investors relieved some of the downward price pressure associated with foreclosures hitting the market. Both of these channels—expectations and investor purchases—help explain why the house price and real effects of foreclosures were mitigated after 2009.

[26] In the Internet Appendix, we break out the effect of foreclosures on house prices and real outcomes from 2007 to 2008 and from 2008 to 2009 separately. The decline in Zillow house prices and auto sales is similar in both periods, whereas the decline in FCSW house prices and residential investment is concentrated in the 2007–2008 period.

Why didn't investors or owner-occupiers immediately rush in to buy in 2008, that is, why did prices overshoot on the downside in nonjudicial states before recovering? In models of fire sales, over-reaction typically occurs because there is some limit to arbitrage that prevents buyers from absorbing the large increase in supply.[27] Here, the limit could be related to owner-occupiers being unable to obtain financing to buy a home during the Great Recession, or investors being unable to gather the capital and expertise to buy and rent out homes during the financial panic. Eventually, these limits are overcome and a recovery ensues. The evidence on investor purchases in the Internet Appendix suggests that this process began in 2009 and accelerated in 2010 and 2011.

On the real side, if residential investment and auto sales eventually rebound faster in nonjudicial foreclosure states, should we still care about the negative effects of foreclosures? In particular, should we care if foreclosures shift some residential investment and auto sales from the present into the future? In macroeconomic models of fire sales, timing matters because the foreclosure-induced reduction in prices may exacerbate an already severe recession, when the marginal utility of consumption is high.

VI. Further Robustness Checks

Our results on the effect of foreclosures on house prices, residential investment, and durable consumption are based on using state foreclosure laws as an instrument for foreclosures. Above we discuss a number of results that confirm the legitimacy of this instrument. First, both state-level comparisons and state-border discontinuity tests show a strong impact of state laws on foreclosure intensity. Second, the foreclosure law impact lasts for four years, highlighting the scale of the mortgage default crisis. Third, despite stark differences in foreclosure intensity, judicial and nonjudicial states are remarkably similar otherwise, providing support for the exclusion restriction. More specifically, there is no difference in delinquencies between judicial and nonjudicial states in 2008 and 2009, and house price growth in both types of states prior to the foreclosure crisis is almost identical.

In this section we discuss additional robustness checks regarding the validity of our empirical analysis. In the interest of brevity we only provide a brief summary of the robustness checks here; future details are in the Internet Appendix that accompanies this paper.

A. Alternative Foreclosure and House Price Data

Our foreclosure data come from RealtyTrac, which is the primary source of foreclosure data in the country. An alternative source of data on foreclosure starts at the state level is the Mortgage Bankers Association (MBA). However, the MBA data are not well suited for our analysis because they do not

[27] Shleifer and Vishny (2011, p. 35) make this exact point: "the discussion of fire sales of financial assets is intimately related to an older idea of limited arbitrage."

differentiate a foreclosure *start* from a foreclosure *auction*. The RealtyTrac data allow us to separate out the auction stage, which is the focus of our analysis here (see the Internet Appendix for more details).

B. Ex Ante Credit Supply

Perhaps the biggest concern for the exclusion restriction is the ex ante differential incentives of lenders to supply credit in judicial versus nonjudicial states. Given that lenders can more easily foreclose on collateral in nonjudicial 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 nonjudicial states is responsible for the outcomes we find. Support for this concern comes from Pence (2006), who applies a census-tract-border discontinuity design to 1994 and 1995 data and finds that individual mortgages are 3% to 7% smaller in judicial versus nonjudicial states (see also Benmelech, Garmaise, and Moskowitz (2005) on commercial mortgages).

We explore this concern using the border sample, which is similar to the strategy used in Pence (2006). In the Internet Appendix we show that during the 1990s there is some evidence of higher credit supply to states with no judicial foreclosure requirement. But by the late 1990s and into the 2000s, there is no evidence that lenders were willing to lend higher amounts in states with no judicial foreclosure requirement.

Why does the Pence (2006) result weaken over time, that is, why did lenders from 2000 to 2005 not extend more credit to borrowers in nonjudicial states where the costs of foreclosure are lower? One reason is that, during the housing boom, lenders and intermediaries assigned a very low probability to states of the world in which house prices declined substantially (Gerardi et al. (2010)). If lenders assign a very low probability to default states, then the loss given default would play a negligible role in lending decisions.

Another reason is a 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. Additionally, most of the loans originated in general (i.e., the conforming loans) are guaranteed by the government-sponsored enterprises (GSEs) against default. There is no evidence that GSE insurance premiums differ by the foreclosure laws in a given state. As a result, originators would be indifferent between judicial and nonjudicial states when it comes to evaluating the loss given default in different states.

Finally, we find that the ease of foreclosure leads to larger price declines. If ex ante banks 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.[28] The net effect of these two forces may be neutral.

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

C. Other State Laws

One concern with regard to the exclusion restriction is whether other laws related to foreclosures are correlated with the judicial versus nonjudicial difference, and whether these other laws are responsible for our results. In the Internet Appendix, we examine this issue in detail and find that the difference in foreclosure rates across judicial and nonjudicial states is robust to the consideration of other laws, such as the right to cure, deficiency judgment rules, and others. In fact, it is a much more powerful predictor of foreclosure differences than any other law.

D. Alternative State Foreclosure Law Classifications

We use RealtyTrac's classification of judicial versus nonjudicial states and discuss reasons for doing so in Section II. However, there are some questions concerning RealtyTrac's definition. In particular, RealtyTrac classifies Massachusetts as a judicial state but other sources count it as a nonjudicial state. We explore this issue at length in the Internet Appendix. We discuss why RealtyTrac lists Massachusetts as a nonjudicial state, justify the classification based on the data, and show that the results are similar if we reclassify Massachusetts as a state with no judicial requirement.

E. House Price Effect and Strategic Default

We show in Section II that mortgage defaults in 2008 and 2009 are similar in both judicial and nonjudicial states. We also show that nonjudicial states experience a larger decline in house prices due to more foreclosures. If house prices drop further in nonjudicial states, then more households are likely to be underwater and susceptible to strategic default on their mortgages. However, we do not find any evidence for this during the heart of the foreclosure crisis. Even through 2011, delinquency rates are similar in judicial and nonjudicial states.

What explains the lack of difference in default rates despite the steeper house price declines in nonjudicial states? An important offsetting effect is that households in nonjudicial states may be less willing to strategically default because of the ease of foreclosure. Evidence supporting this view comes from the 2011Q4 report from CoreLogic on negative equity, which shows that mortgages in nonjudicial states are more likely to be underwater. In particular, CoreLogic reports that 20.5% of mortgages are underwater or near underwater in judicial states while 25.7% of mortgages are underwater or near underwater in nonjudicial states.

As a result, more people in nonjudicial states continue to service their mortgages despite being underwater. It is likely that these two effects—nonjudicial states see sharper price declines but higher penalties from delinquency—offset one another and lead to similar delinquency rates in judicial and nonjudicial states.

F. Other Secular Shocks?

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

In the Internet Appendix, we conduct a number of additional tests to address this concern. First, we show that our core results are robust to the exclusion of the two states with the highest foreclosure rates (Arizona and Nevada), which both happen to be nonjudicial foreclosure states. The results using FCSW are weakened, which is not surprising given that we are removing 2 out of 24 observations, but all other results are similar. Second, we show that we do not see a similar reduction in real economic activity in states with no judicial requirement during the 2001 recession when foreclosures were negligible. This latter test refutes the hypothesis that states with no judicial requirement are inherently more cyclical or prone to boom-bust cycles.

The 2001 placebo test can be performed more generally. We have house price data from FCSW back to 1992 and residential investment data back to 1990.[29] We conduct the following series of placebo tests. For every year from 1994 to 2009, we regress house price growth over the last two years on the judicial foreclosure requirement indicator variable. We then plot the coefficients from each of these regressions, excluding the 2005–2007 and 2006–2008 periods given that they overlap with the 2007–2009 period. The results show that the coefficient on the 2007–2009 period is larger than that for any other period. We conduct the same test for residential investment growth from 1992 to 2009 and find the same result—2007 to 2009 is the only period in which residential investment growth was much weaker in nonjudicial states.

We further conduct an exercise where we form pairs of states that border each other. For each state pair, we first construct the difference between the two bordering states in foreclosures and in the growth in house prices, residential investment, and auto sales from 2007 to 2009. We then instrument the difference in foreclosure rates with the difference in foreclosure laws across the state pairs, thereby isolating variation in foreclosure rates that is driven only by states that are neighbors. In this exercise, regional shocks cannot drive the results because we only use variation in foreclosure laws for states that neighbor one another. The second-stage estimates show a robust effect of

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

foreclosures on house prices and residential investment, but a weaker effect on auto sales.

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

G. Other Robustness Tests

We also test whether higher mobility out of nonjudicial states explains the drop in real activity in these areas. It turns out this is not the case. In particular, while it is true that MSAs that experienced large declines in house prices experienced a reduction in the average likelihood of staying in the same house, the drop is driven by people who moved but remained in the same county. We perform this test using individual-level data first used in Mian and Sufi (2011) that track individual mobility. Thus, our state-level analysis on real outcomes is unaffected by mobility concerns. An additional test using data in Piskorski, Seru, and Witkins (2013) looks at the difference in the investor share of purchases in 2006 across judicial and nonjudicial states. The investor share is almost identical across judicial and nonjudicial states, and hence controlling for the investor share does not affect the results.

We also assess whether our instrumental variable is weak. In general, we observe F-statistics above Stock and Yogo (2005) weak identification critical values, rejecting the hypothesis that the instrument is weak. We further verify that our results are 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.

VII. Conclusion

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

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

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

Initial submission: January 30, 2013; Final version received: December 29, 2014
Editor: Kenneth Singleton

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Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's website:

Appendix S1: Internet Appendix.