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Does judicial foreclosure procedure help delinquent subprime mortgage borrowers?

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Abstract

We conduct comprehensive analyses on whether and how the judicial foreclosure procedure helps subprime mortgage borrowers to reinstate their delinquent loans outside foreclosure liquidation. Even though the transition rates of various exit types are all higher in non-judicial states, we argue such higher rates can be mechanically driven by the faster shrinking pool of delinquent mortgages in non-judicial states over time. Based on the cumulative proportions of various exit types during a period of up to 5 years post the mortgage first become 90 days past due, we find that judicial states offer more opportunities for delinquent borrowers to reinstate their loans outside foreclosure liquidation, especially during a housing market downturn. Cures, modifications, and paid-offs were all important alternative ways to resolve serious delinquencies during 2007–2008. After modifications became widely available in 2009, loan modifications became the most important alternative for subprime borrowers to reinstate their delinquent mortgages outside foreclosure liquidation. The lion's share of the judicial foreclosure benefit shows up after the start of the foreclosure process.

KEYWORDS

cure, foreclosure liquidation, Home Affordable Modification Program, judicial foreclosure procedure, modification, power-of-sale, short-sale

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INTRODUCTION

There is much variation in foreclosure laws across different states. For instance, while some states (judicial foreclosure states) require a foreclosed sale to take place through the courts, other states (non-judicial foreclosure states) do not have such a requirement. It has been observed and confirmed in the academic literature that foreclosure practices have been quite different among states with and without judicial procedure, and lenders have been experiencing longer foreclosure resolution time in judicial states than in non-judicial states.

The literature on the impact from different foreclosure laws has been voluminous. Among the various aspects of welfare implications from different foreclosure laws, many researchers are interested in the question of whether the judicial foreclosure procedure helps borrowers reinstate their delinquent loans. The general finding in the recent literature is that judicial foreclosure procedure has *not* helped mortgage borrowers to reinstate their delinquent loans via cure, paid-off, or modifications, even though the foreclosure liquidation rates are lower in judicial states (see the detailed literature review in section "Literature review and our contribution").

We argue, however, that drawing conclusions purely on the coefficients of the transition rates in a hazard model can be misleading. Even if the number of liquidations outside foreclosure in non-judicial states are lower than those in judicial states, the transition rates of non-foreclosure-liquidation exits can still remain higher in non-judicial states, mechanically driven by the faster shrinking pool of delinquent mortgages in non-judicial states. For this reason, we should investigate the cumulative proportions of different types of exits from the initial pool of seriously delinquent loans to assess the impact from the judicial foreclosure procedures. We provide more details on the methodology and our contributions in section "Our contributions".

We conduct comprehensive analyses using a large loan-level dataset on subprime mortgages from 2000 to 2015. We examine the entire path of each loan's life from its first 90 DPD month to various forms of exits including cure, paid-off, modification, foreclosure liquidation, or December 2015, whichever is first.

We find that, for the entire period, the proportions of cured or modified delinquent mortgages are quite close in both types of states and slightly lower in judicial states in the first few months since 90 DPD. The number of modifications in judicial states quickly picks up and the cumulative proportion of 90 DPD loans being modified in judicial states surpasses that in the non-judicial states within 1 year since 90 DPD. The advantage of non-judicial states in cure lasts longer, and the cumulative proportion of 90 DPD subprime loans being cured in judicial states surpasses that in non-judicial states in about 3 years since the first 90 DPD. By contrast, more seriously delinquent mortgages are paid off in non-judicial than in judicial states for the entire time duration. The judicial foreclosure benefit mainly shows up after the start of the foreclosure process but not before.

Although judicial states offer more opportunities for delinquent borrowers to reinstate their loans outside foreclosure liquidation, there is also variation in the benefits from the judicial foreclosure process over time. The judicial benefit mainly shows up during the housing market downturn period from 2007 to 2011. Although we can identify the judicial benefit during the housing market boom from 2000 to 2006, the benefit was small during this period.

In addition, modification is not always the most important alternative. During 2007–2008, the downturn period before the Home Affordable Modification Program (HAMP) was introduced by the federal government, mortgages in judicial states experienced substantially higher modification, cure, and paid-off rates than those in non-judicial states. From 2009 to 2011, however, a higher proportion of delinquent mortgages in judicial states were reinstated outside foreclosure liquidation possibly because of attractiveness of the modification terms provided by the HAMP.

Over a 5-year period since the subprime mortgages become 90 DPD, the difference in the proportion of delinquent loans reinstated outside foreclosure liquidation between judicial and non-judicial states ranges from roughly 15% to 20% during the housing market downturn period 2008–2011 when modification programs were generally available. If we apply a difference of 15% to the original sample of 1.5 million 90 DPD subprime mortgages, the judicial foreclosure procedure can help at least 225,000 delinquent subprime mortgage borrowers retain their homes during the latest housing market downturn.

We have conducted additional analysis to ensure the robustness of the above results. Following the literature (such as Gerardi et al., 2013), we have conducted all the analysis using a border sample which includes mortgages within 10 miles of a judicial and non-judicial state border. We have also tried excluding loans from California, Florida, and New York in our analyses so that our results are not driven by the large states. We find the benefit of the judicial procedure to hold in all robustness tests.

In summary, we find that the slower judicial foreclosure procedure indeed offers help to subprime mortgage borrowers, and the benefits predominantly occur after the start of the foreclosure process. In addition, before modifications became widely used, judicial states have higher proportions of loans exiting 90 DPD through cure, paid-off, and modification than non-judicial states. After 2009, the primary venue to achieve this benefit is through loan modification.

The paper that is most related to this study is Gerardi et al. (2013) but there are three differences between the two papers. First, Gerardi et al. (2013) only investigate modifications up to 18 months post the first 90 DPD and they do not convert modification hazard rates to cumulative proportions of different exit types of serious delinquency. Second, loan modifications were uncommon before 2008, and modification was not the focus of Gerardi et al. (2013). Our study reveals the crucial role played by modification as an alternative to foreclosure liquidation in the long term. Third, through our comprehensive analyses,

we are able to zoom in to uncover the variations in the use of different alternatives to foreclosure liquidation in various stages of the housing market cycle, as well as during the periods before and after the foreclosure start.

The rest of the paper is organized as follows. We have a brief discussion on state foreclosure laws, review the literature, and describe our contributions in detail in the next section. Section "Data and sample description" describes the data. We present empirical results in section "Empirical results" and conclude briefly in the last section.

STATE FORECLOSURE LAWS AND LITERATURE REVIEW

State foreclosure laws

Foreclosure is triggered by the terms in the mortgage contract that allow for the acceleration of debt into a single lump-sum payment by selling property to a third party so that the lender can be repaid if the borrower defaults on the scheduled mortgage payment. There are two types of foreclosure by sale across different states in the United States: (1) foreclosure by judicial sale and (2) power of sale (or non-judicial). In the first type, the lender files a foreclosure petition through the court system, and the foreclosure is executed by the court. In the second type, the foreclosure filing does not need to go through the court.

The advantage of the judicial process is that the foreclosing bank must show documents to demonstrate that the borrower has defaulted on the mortgage; the bank owns the mortgage, and that these documents can be legally challenged. In judicial states, to challenge a foreclosure based on a fraudulent affidavit, borrowers simply raise the issue in the foreclosure case. In non-judicial states, however, borrowers must file a lawsuit in court to stop the foreclosure, which obviously is more challenging. The issue of fraudulent affidavits was quite widespread during the latest housing market crisis, as is reflected in the "robo-signing" litigation.[1] Therefore, advocates for mortgage borrower rights protection argue that stronger borrower protection should help mortgage

[1]It was discovered that the foreclosures during the latest housing market crisis were often based on missing, erroneous, or even fraudulent documents. The term "robo-signing" was used to describe the robotic process of the mass production of false and forged execution of mortgage documents. This controversy began to be revealed in the media in late October 2010, and as a response, several large banks temporarily halted their foreclosure proceedings in some or all states. On February 9, 2012, it was announced that the five largest mortgage servicers (Ally/GMAC, Bank of America, Citi, JPMorgan Chase, and Wells Fargo) agreed to a historic settlement with the federal government and 49 states. The settlement was known as the National Mortgage Settlement (NMS), and the five banks were also required to comply with 305 new mortgage servicing standards. See, for example, web references such as https://en.wikipedia.org/wiki/2010_United_States_foreclosure_crisis for references on robo litigation.

borrowers, since without such protection, lenders will be quick to foreclose on homeowners in default on their mortgage obligations. Moreover, the longer judicial process can increase the chance that a borrower will be able to right-size his or her financial situation and render borrowers more time to reinstate their loans by finding a job so he or she can resume mortgage payments or by finding a better price when selling the house (see, for instance, Bauer, 1985; Nelson & Whitman, 1985; Rao & Walsh, 2009; Stewart, 2010). Further, the higher costs associated with the judicial foreclosure process might also affect lenders' cost–benefit calculation about resolution outside foreclosure, making the latter more appealing compared to foreclosure in judicial states.

Foreclosure processes vary by state. Some states offer both judicial and non-judicial procedures, with the non-judicial process more frequently used in these states. Power of sale is used almost exclusively in some states, while other states only recognize judicial foreclosure. Categorizing states as either judicial or non-judicial is not trivial, and we follow the classification from the National Consumer Law Center (NCLC).

Other than the aspect of whether the foreclosure sale is filed through the judicial system, state foreclosure laws also differ in terms of statutory right of redemption, recourse (or deficiency judgment), and the right to cure. Redemption right is the right of the borrower to pay off the default amount after the foreclosure sale and involves a window of opportunity called the redemption period. Recourse is the right of the lender to go after the borrower's remaining assets when the proceeds of the collateral sale are not sufficient to cover the debt. Further, 27 states provide a right for a delinquent borrower to cure a default before a foreclosure sale, while such an option is at lenders' discretion in other states. We focus on the judicial versus the non-judicial process in this paper, but in our analyses, we control for redemption, recourse, and cure right, as there is evidence in the literature that resolution of mortgage default is also affected by redemption and recourse laws (e.g., Collins et al., 2011; Ghent & Kudlyak, 2011).[2]

Literature review and our contribution

Literature review

The literature on how state foreclosure laws affect mortgage designs, default rates, and foreclosure practices dates back to the 1980s, and the interest in this

[2]There are other differences across state regulations. For example, some states require lenders to send multiple notices before the lender can initiate foreclosures, and the number of required notices and number of required days elapsed between notices also differ by states. For instance, NC and VA were both non-judicial foreclosure state during our study period, but NC required three notices sent over 60 days before a lender may move from default to foreclosure, whereas VA only required one notice 14 days prior to foreclosure. However, such differences are not as important as other dimensions we include on the right-hand side in our model.

area has picked up since the start of the latest housing market crisis.[3] A question of general interest is whether state foreclosure laws designed to protect mortgage borrowers actually help them.[4] We explore in this study whether and how the judicial foreclosure process helps delinquent subprime mortgage borrowers reinstate their delinquent loans.

Early studies on this question are typically based on limited samples,[5] and they differ in their research design by covering different parts of the entire path from the first serious delinquency month to default resolution. Recent studies since the latest housing market crisis generally find evidence that the judicial procedures fail to result in more opportunities for delinquent borrowers outside foreclosure liquidation. Even though the foreclosure liquidation rates are lower in judicial states, researchers find that the judicial foreclosure procedure does not give borrowers more motivation or chances to reinstate their delinquent mortgages (e.g., Gerardi et al., 2013; Cordell & Lambie-Hanson, 2016).[6]

Our contributions

Inference through the cumulative proportions of exit types

One main contribution of the paper is our inference through the cumulative proportions of exit types, and we find that judicial states do offer more opportunities over time for delinquent borrowers to reinstate their loans outside foreclosure liquidation. This conclusion is very different from the literature relying directly on hazard rates from the model.

Our paper is most related to Gerardi et al. (2013). Gerardi et al. (2013) used hazard rates to compare cure and modification rates across states. By contrast, we make inferences based on cumulative proportions of different exit types of serious delinquency rather than using hazard rates directly. Although the hazard rates to cure, paid-off, or modifications are always lower in judicial states than in non-judicial states, significantly lower hazard rates in judicial states do not necessarily mean that judicial states do not provide troubled mortgage borrowers more

[3]See, for example, Meador (1982), Clauretie (1987), Clauretie and Herzog (1990), Jones (1993), Phillips and Rosenblatt (1997), Pence (2006), Ghent and Kudlyak (2011), Campbell et al. (2011), and Mian et al. (2015).

[4]These papers explore various aspects of the welfare implications of state foreclosure laws, such as whether protective regulations actually help mortgage borrowers by reducing delinquency rates or foreclosure rates, and whether mortgage rates or origination amounts are significantly different among states with different foreclosure laws.

[5]For example, Pennington-Cross (2010) uses 5000 loans, Phillips and VanderHoff (2004) use 1907 loans, and Capozza and Thomson (2006) use 6000 loans.

[6]The evidence from Cordell and Lambie-Hanson (2016) is based on the Black Knight Financial Services McDash data, which consists largely of prime mortgages.

TABLE 1 An example of the relationship between transition rates and cumulative proportion of exit types

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
					Number of loans									
	Transition rates (hazard rates)				Exiting the 90+ DPD pool in each quarter				Remaining in the 90+ DPD pool		Cumulative proportion of loans exiting the 90+ DPD pool by each quarter			
	Judicial state		Non-judicial state		Judicial state		Non-judicial state				Judicial state		Non-judicial state	
Quarter starting from 90 DPD	Liq.	Non-liq.	Liq.	Non-liq.	Liq.	Non-liq.	Liq.	Non-liq.	Judicial	Non-judicial	Liq.	Non-liq.	Liq.	Non-liq.
0									1000	1000				
1	3.3%	8.1%	9.9%	11.2%	33	81	99	112	886	789	3.3%	8.1%	9.9%	11.2%
2	9.1%	8.2%	21.0%	9.8%	81	73	166	77	732	546	11.4%	15.4%	26.5%	18.9%
3	7.7%	8.6%	15.0%	9.3%	56	**63**	82	**51**	614	414	17.0%	21.6%	34.7%	24.0%
4	6.9%	7.7%	13.5%	8.3%	42	**47**	56	**34**	524	323	21.2%	26.4%	40.2%	27.4%
5	6.2%	6.9%	12.2%	7.5%	33	**36**	39	**24**	455	260	24.5%	**30.0%**	44.2%	**29.8%**
6	5.6%	6.2%	10.9%	6.7%	25	**28**	28	**18**	401	214	27.0%	**32.8%**	47.0%	**31.6%**
7	5.0%	5.6%	9.8%	6.1%	31	**23**	21	**13**	348	180	30.1%	**35.1%**	49.1%	**32.9%**
8	4.5%	5.1%	8.9%	5.5%	16	**18**	16	**10**	315	154	31.7%	**36.8%**	50.7%	**33.9%**
9	4.1%	4.5%	8.0%	4.9%	13	**27**	12	**8**	275	134	33.0%	**39.5%**	51.9%	**34.6%**

Note: We show a simple example illustrating the relationship between transition rates and cumulative proportion of exit types. We show in Columns (2)–(4) transition rates to resolution via foreclosure liquidation (Liq.) and resolution outside foreclosure liquidation (Non-liq.), with the latter including property sales, cure, and modification. For simplicity, we lump all resolutions outside foreclosure liquidation into one exit type in this table. We start from 1000 loans in both the judicial and non-judicial states. For each quarter q and for judicial state columns $m = 6$ and 7, $\text{Col}(m)_q = \text{Col}(10)_{q-1} \times \text{Col}(m-4)_q$; for non-judicial state columns $m = 8$ and 9, $\text{Col}(m)_q = \text{Col}(11)_{q-1} \times \text{Col}(m-4)_q$; and for each cumulative proportion column $k = 12$ to 15, $\text{Col}(k)_q = \sum_{i=1}^{q} \text{Col}(k-6)_i/1000$.

opportunities to reinstate their delinquent mortgages. Lower hazard rates in judicial states can co-exist with higher proportions of exits in judicial states.

To illustrate this point more clearly, we present a simplified numeric example in Table 1, which has 15 columns. In the first column, we have the number of quarters starting from the first 90 DPD month, which also indicates the row number. In Columns (2) to (5), we present transition rates to resolution via foreclosure liquidation (Liq.) and resolution outside foreclosure liquidation (Non-liq.), with the latter including paid-off, cure, and modification. For simplicity, we lump all resolutions outside foreclosure liquidation into one exit type in Table 1. The transition rates for a judicial state are reported in Columns (2) and (3) and those for a non-judicial state are presented in Columns (4) and (5). The transition rates in Table 1 are hypothetical just for illustration purpose, but we make sure that the transition rates here are higher in the non-judicial state for each period, to be consistent with the findings in the literature.

Columns (10) and (11) show the remaining number of loans in the 90+ DPD pool. We start from 1000 loans in both judicial and non-judicial states in this example, and Columns (6)–(9) report the number of loans exiting in each quarter. For each quarter q and for the judicial state columns $m = 6$ and 7, we have $\mathrm{Col}(m)_q = \mathrm{Col}(10)_{q-1} \times \mathrm{Col}(m-4)_q$. For the non-judicial state columns $m = 8$ and 9, we have $\mathrm{Col}(m)_q = \mathrm{Col}(11)_{q-1} \times \mathrm{Col}(m-4)_q$. For example, Column (6) shows 33 loans ($= 1000$ [from Column (10) in Quarter 0] $\times$ 3.3% [Column (2) from Quarter 1]) exit the 90+ DPD pool in the judicial state in the first quarter via foreclosure liquidation. Similarly, 81 loans ($= 1000 \times 8.1\%$ [Column (3) from Quarter 1]) exit from the 90+ DPD via resolution outside foreclosure liquidation in the judicial state in the first quarter. As a result, 886 loans ($= 1000 - 33 - 81$) remain in the 90+ DPD pool in the judicial state after the first quarter. In the same manner, 789 loans ($= 1000 - 99 - 112$) remain in the 90+ DPD pool in the non-judicial state after the first quarter.[7]

Row 2 (the second quarter starting from the first 90 DPD) shows that 81 ($= 886 \times 9.1\%$) and 73 ($= 886 \times 8.2\%$) exit from the 90+ DPD pool via liquidation and non-liquidation, respectively, and by the end of the second quarter, 732 loans ($= 886 - 81 - 73$) remain in the 90+ DPD pool in the judicial state. Similar calculation suggests that only 546 loans remain in the 90+ DPD pool in the non-judicial state after two quarters.

The cumulative proportions of loans exiting the pool are calculated as follows: for columns $k = 12$ to 15 in Table 1, $\mathrm{Col}(k)_q = \sum_{i=1}^{q} \mathrm{Col}(k-6)_i / 1000$. Therefore, the cumulative proportion of loans exiting the pool via resolution outside foreclosure liquidation after two quarters since the first 90 DPD is 15.4% ($=[81 + 73]/1000$) in the judicial state (Row 2 and Column [13]) and 18.9% ($=[112 + 77]/1000$) in the non-judicial state (Row 2 and Column [15]).

[7]Ninety-nine in Column (8) and row 1 = $1000 \times 9.9\%$, and $112 = 1000 \times 11.2\%$.

We carry out the same calculation for more quarters. Even though the transition rates are always *lower* in the judicial state (Column [3]) than in the non-judicial state (Column [5]), starting from the third quarter on, the number of loans exiting the 90+ DPD pool outside liquidation are *higher* in the judicial state (Column [7]) than in the non-judicial state (Column [9]). For example, the number in Column (7) in the third row is 63 (= 732 × 8.6%), whereas the number in Column (9) of the same row is 51 (= 546 × 9.3%), and the lower number of exits through resolution outside foreclosure liquidation in the non-judicial state is driven by the lower number of loans remaining in the 90 DPD pool in the non-judicial state (i.e., 546 in non-judicial states vs. 732 in the judicial states) even though the transition rate is higher.

The numbers in Columns (12)–(15) are based on the exit numbers in Columns (6)–(9) and the initial number of loans in the pool. We can see that the cumulative proportions of 90+ DPD loans resolved outside foreclosure liquidation in the judicial state (Column [13]) are initially lower than those in the non-judicial state (Column [15]), which is not surprisingly because of the higher transition rates in the non-judicial states. However, the number of loans exiting the pool in Column (7) exceeds that in Column (9) starting from the third quarter on, and starting from the fifth quarter post the first 90 DPD, the cumulative proportions (calculated as cumulative number of loans divided by the initial pool) in Column (13) exceed those in Column (15). Note that through the entire period, the transition rates in Column (3) are always lower than those in Column (5).

Table 1 thus shows that it is critical to obtain cumulative proportions of the initial pool to draw valid inferences on the impact from judicial foreclosure procedure on default resolution, rather than interpret directly from the coefficient estimates of the hazard models. Hazard models estimate the hazard rates of loans being cured, paid off, modified, or liquidated as proportions of *remaining* delinquent loans in the pool. They do not directly provide the results of primary interest, that is, the proportions of loans eventually resolved outside foreclosure liquidation, which are measured by the cumulative proportions of different types of exits out of the *initial* pool of delinquent loans. Since the delinquent loans are more quickly liquidated in non-judicial states, the pool of loans remaining to be resolved shrinks much faster in non-judicial states than in judicial states. With the smaller number of remaining delinquent loans in the pool (used as the denominator), the hazard rate of an exit type can be higher even if the number of exits (used as the numerator) is lower.

To further illustrate this point, we depict in Appendix A raw hazard rates and cumulative proportions of all exit types; such results are generated from the same raw data that we will use to build the hazard model. From the data, we can observe the number of loans exiting the 90+ DPD pool through different types of default resolution (corresponding to Columns [6] to [9] in Table 1 but with more types of exits). We then back out

the transition rates and the cumulative proportions of different exit types following similar calculation in Table 1 (but with more exit types). Appendix A, Figure A1 clearly shows that the raw transition rates are always higher in non-judicial states, while Figure A2 suggests that raw cumulative proportions of cures and modifications are higher in judicial states than in non-judicial states.

Modifications

The second important distinction of our study from the prior literature is our examination of modifications, which as an alternative way to resolve seriously delinquent subprime mortgages have yet to be thoroughly investigated in the prior literature on subprime mortgages. The earlier studies such as Capozza and Thomson (2006), Pennington-Cross (2010), do not include modifications as an exit type as modifications were almost non-existent before 2005, and a recent study by Zhu and Pace (2015) only investigate short sales as the exit type. Gerardi et al. (2013) only examine modifications up to 18 months after loans turn 90 DPD.

Summary of what we do

This paper attempts to conduct a comprehensive study on the impact of the judicial foreclosure procedure based on a large subprime loan-level dataset for an extended time window spanning January 2000 to December 2015. To further investigate whether the impact of the judicial foreclosure procedure varies at different stages of a housing market cycle, we conduct analysis for housing market boom and downturn separately. Our study covers the entire path from the first 90 DPD month to the end of default resolution, and we also investigate the impact of the judicial foreclosure procedure at different stages of the foreclosure process, that is, before and after the start of the foreclosure process, separately. We pay special attention to the role of loan modifications as an important option for the default resolution.

DATA AND SAMPLE DESCRIPTION

Data source

Our main dataset is DataQuick ABS/MBS, a monthly loan-level panel dataset that covers over 95% of private-label subprime mortgage-backed securities.[8] Our sample period is from January 2000 to December 2015, and we only include first lien subprime mortgages. We focus on loans that have entered 90 DPD

[8]All mortgages in this study are securitized, so our results are not affected by lender mortgage holding concentrations in the neighborhood, as argued by Favara and Giannetti (2017).

during our sample period and exclude from our study loans that have never been 90 DPD.[9] We construct our sample from the first month after the loan becomes 90 DPD. There are four exit types in consideration from 90+ DPD: (1) returning to performing status (resuming mortgage payments or "cure"), (2) being paid off (via property sales, including short sales), (3) being modified, and (4) being liquidated via the foreclosure auction. The first type is identified if the loan returns from 90+ DPD to the "current" status for four consecutive months without going through a loan modification. Note that results do not change drastically if we define "cure" using alternative cutoff points, such as 3, 6, or 9 consecutive months. We consider a loan being liquidated via a foreclosure auction if the paid-off indicator follows the foreclosure status or if the loan enters real estate owned. We consider a loan paid off if the loan status in the months preceding the month with the paid-off indicator does not show the foreclosure status. Modification can be readily identified from the data. We keep a loan in the sample until the loan is cured, paid off, modified, foreclosed, or censored by the end date of the dataset.

Note that a loan could be paid off due to various reasons, such as refinancing, selling properties because of moving to another house, or selling the property preemptively because of inability to pay or involuntarily under the pressure from the lender due to missed mortgage payments (i.e., short sales).[10] It is hard to differentiate various motivations behind the paid-off observation in the DataQuick ABS/MBS data because of the lack of information. However, it is not easy to obtain refinancing if the loan is in serious delinquency status, and the paid-offs in our sample should thus be overwhelmingly driven by property sales.[11] Thus, in the rest of the paper, we use the words "paid-off" and "property sales" interchangeably.

DataQuick ABS/MBS contains detailed loan and borrower information at origination, such as loan amount, initial interest rate upon loan origination, interest rate type,[12] loan-to-value (LTV) ratio, low/no documentation indicator, owner/investor indicator, private mortgage insurance (PMI) information,[13] FICO credit score, property type,[14] property location, product type,[15] interest-only indicator,

[9]We choose 90 DPD because related existing studies such as Gerardi et al. (2013) all use 90 DPD to define their sample. By choosing loan performance starting from the first 90 DPD month, we do not necessarily assume that foreclosure will start at the 90 DPD month. This is just a starting point that is required by the duration models.
[10]We do not identify in our sample any loans being paid off upon maturity.
[11]DataQuick ABS/MBS provides payment amount information, and this information is non-missing for roughly 60% of the loans in our sample when they are paid off. We find that over 75% of these paid-offs incur losses, which points toward a short sale of the property. Therefore, based on the loss upon sales information, the majority of paid-offs in our sample are due to short sales. Because of the significant amount (~40%) of missing information in loss estimation, we do not separate short sales from other types of paid-offs.
[12]Interest rate types typically include fixed interest rate, floating interest rate, and combinations of them as in adjustable-rate mortgages (ARMs).
[13]PMI is usually needed when down payments are less than 20%.
[14]Property types include single-family house, one to four units, condominiums, planned unit development, etc.
[15]Product types include fixed-rate mortgage (FRM), ARM, or hybrid, etc.

balloon indicator,[16] loan purpose,[17] the existence of a prepayment penalty, etc. It also contains monthly updated information since origination, such as loan balance, current interest rate, monthly payment, delinquency status, date of last payment, date of next payment due, etc.

DataQuick ABS/MBS provides LTVs at origination only. To estimate updated LTV, we need the current outstanding amount of the mortgage (which is available in DataQuick ABS/MBS) and the current property prices. To arrive at the current property prices, we adjust the origination property prices using the change in zip-level home price index (HPI) from the origination month, while the HPI information is from Black Knight (formerly known as LPS). However, we find that there are cases with non-trivial discrepancies between the origination mortgage amount, origination property price, and origination LTV, and it is difficult to figure out whether any or which of the three origination values are right. To minimize error contaminations, we only keep mortgages in the sample where there is less than one percentage point of difference between the origination LTV as reported and the origination LTV calculated from origination loan amount and origination property prices. We further include in our analysis other local macro variables such as zip-level HPI, unemployment rate and personal income at the county level, monthly ratio of state foreclosure inventory to the overall number of outstanding mortgages in the state, and monthly ratio of foreclosures being started to the overall mortgage numbers in the state.[18] As a result, our raw data of the entire sample consist of 1,486,470 unique loans since 90 DPD and a total of 23,569,817 loan-month observations. Because of computer memory constraints, we are not able to run the multi-state proportional hazards model using the entire raw data.[19] Using stratified sampling by the origination year, our sample data consist of 3% of the population in this study. As a result, our sample data contain 42,874 unique mortgages with 680,800 loan-month observations. We have conducted robustness tests using other samples from the original data. The coefficient estimates from these alternative samples are very close quantitatively to those reported in the paper, indicating that our sample data are representative of the original data.

Data description

Table 2 provides the summary statistics on our sample data. The mean origination FICO score is 654, with many of the loans having adjustable rate mortgages or lack of full documentation. Fourteen percent of these loans have negative amortization,

[16]Balloon loans do not fully amortize the term of the loans, thus leaving balances due at maturity; they are therefore riskier than the fully amortized loans but less risky than interest-only loans.
[17]Loan purpose includes new purchase or refinancing, and whether there is cash out upon refinancing.
[18]Zip-level HPI is from Black Knight. All other local macro variables are from Haver Analytics.
[19]Our grid has six compute nodes and each node has 12 CPUs and 384 GB of memory.

TABLE 2 Summary statistics

Panel A: Our sample data

Variable names	Mean	SD
Origination FICO	654.49	68.63
Proportion of fixed rate mortgages	30.04%	45.84%
Proportion of loans with full documentation	40.69%	49.13%
Proportion of interest only loans	28.73%	45.25%
Proportion of loans with balloon payments	9.21%	28.91%
Proportion of loans with private mortgage insurance (PMI)	15.63%	36.31%
Proportion of loans with prepayment penalty	56.63%	49.56%
Proportion of loans with purchase purpose	43.12%	49.52%
Proportion of loans with negative amortization	14.16%	34.87%
Proportion of owner occupied	86.68%	33.98%
Origination interest rate (%)	6.86	2.33
Origination amount (in $1000)	291.04	223.90
Origination loan-to-value (LTV) ratio (%)	79.74	9.08
Origination combined loan-to-value (CLTV) ratio (%)	84.57	11.72
Current loan-to-value (LTV) ratio (%)	108.62%	51.76%
Current interest rate (%)	6.91	2.07
Outstanding loan amount (in $1000)	290.27	230.66
State-level monthly foreclosure start ratio (%)	1.19	0.65
State-level monthly foreclosure inventory ratio (%)	5.13	3.75
Proportion from states allowing recourse	68.88%	46.30%
Proportion from states allowing redemption	17.75%	38.21%
Proportion from non-judicial states	53.33%	49.89%
Zip level per-capita income (in $1000)	42.86	11.04
Zip-level unemployment rate (%)	8.57	2.95
Number of Obs.	680,800	

Panel B: By judicial and non-judicial states

Variable names	Judicial	Non-judicial	*t* Stat
Origination FICO	649.01	659.28	−61.873
Proportion of fixed rate mortgages	32.68%	27.74%	44.281
Proportion of loans with full documentation	40.95%	40.47%	4.004
Proportion of interest only loans	23.48%	33.32%	−90.740

(Continues)

TABLE 2 (Continued)

Panel B: By judicial and non-judicial states

Variable names	Judicial	Non-judicial	*t* Stat
Proportion of loans with balloon payments	10.45%	8.11%	33.107
Proportion of loans with private mortgage insurance (PMI)	17.15%	14.29%	32.266
Proportion of loans with prepayment penalty	53.01%	59.80%	−56.505
Proportion of loans with purchase purpose	43.02%	43.21%	−1.561
Proportion of loans with negative amortization	11.92%	16.13%	−50.223
Proportion of owner occupied	85.01%	88.13%	−37.639
Origination interest rate (%)	7.11	6.64	83.959
Origination amount (in $1000)	268.54	310.74	−78.480
Origination loan-to-value (LTV) ratio (%)	80.05	79.47	25.931
Origination combined loan-to-value (CLTV) ratio (%)	84.31	84.80	−17.293
Current loan-to-value (LTV) ratio (%)	105.90%	111.00%	−42.005
Current interest rate (%)	7.08	6.76	64.301
Outstanding loan amount (in $1000)	266.32	311.23	−81.264
State-level monthly foreclosure start ratio (%)	1.26	1.13	82.595
State-level monthly foreclosure inventory ratio (%)	7.18	3.33	468.246
Proportion from states allowing recourse	100.00%	41.64%	713.318
Proportion from states allowing redemption	22.22%	13.84%	89.677
Proportion from non-judicial states	0.00%	100.00%	−3084.792
Zip level per-capita income (in $1000)	44.33	41.57	99.377
Zip-level unemployment rate (%)	8.10	8.99	−125.640
Number of Obs.	317,777	363,023	

Note: Our primary dataset is DataQuick ABS/MBS, a monthly loan-level panel dataset that covers over 95% of private-label mortgage-backed securities. Our sample period is from January 2000 to December 2015, and we only include first lien mortgages. The statistics reported here are based on our sample data. We only include loan-months since the loan becomes 90 days past due (90+ DPD), and we keep the loan in the sample until the loan is cured, paid off, modified, liquidated, or censored. Classification of judicial or non-judicial states follows the classification from the National Consumer Law Center (NCLC). See section "Data source" for a detailed description of the data source and data construction.

while 28.7% of them are paying the interest rate only. Another 9.2% of the loans have balloon payments at the end. The bulk of the loans have a prepayment penalty, and more than half of the loans result from refinancing instead of purchasing of a new house. The mean combined loan-to-value (CLTV) ratio at origination is

84.6%, and the mean LTV at origination is slightly less than 80%. Most of these loans do not need PMI at origination. The loan characteristics in Table 2 thus suggest that the loans in this study are quite risky. The overwhelming majority of our sample loans were originated from 2005 to 2007.

Panel B of Table 2 shows the summary statistics by judicial and non-judicial states. Our sample is roughly evenly divided between judicial and non-judicial states, with slightly more loans from non-judicial states. Compared with loans from non-judicial states, those from judicial states have slightly lower origination FICOs, marginally higher origination LTVs but slightly lower combined LTVs, and higher interest rates.[20] A higher proportion of sample loans from non-judicial states are interest only, with prepayment penalty, and negative amortization, while a higher proportion of sample loans from judicial states carry fixed-rates, and a higher fraction of judicial state loans have balloon payments at maturity. Both origination loan amount and current outstanding loan size are higher in non-judicial states than in judicial states.

Both the current LTV (which is largely driven by HPI) and the unemployment rate are higher in non-judicial states during our sample period, while personal income is higher in judicial states. Results in Appendix B show that the above patterns are largely driven by the period during 2009–2011, and post-2012 recovery is stronger in non-judicial states than in judicial states. Since most of our loan-month observations are from the 2009–2011 period, the overall economic conditions in our sample are worse in non-judicial states than in judicial states. Foreclosure start is slightly higher in judicial states, but the foreclosure inventory is more than twice as high in judicial states than in non-judicial states. We next turn to regression analysis by controlling for loan characteristics and macro variables at the local level.

EMPIRICAL RESULTS

We fit the data with a popular multi-state proportional hazards model for competing risks (Kalbfleisch & Prentice, 2002; Jackson, 2011), and the transitions are illustrated in Appendix C.

[20]Pence (2006), Feinstein (2018), and others have found that lenders alter their ex ante lending behavior in respect to the foreclosure procedures that they would face ex post. One might suspect that lenders may filter out riskier borrowers in judicial states because of the higher foreclosure costs, and the mortgages in judicial states might be less risky. This finding might hold among the entire mortgage borrower population. Our sample consists of mortgages that are 90+ DPD, and we can see from Table 1 of the paper that the loans in our sample are slightly riskier in judicial states. Further, we control for the borrower characteristics in the regressions, so the impact from selection bias should not be severe.

TABLE 3 Results from the multi-state model—From 90 DPD to cure, paid-off, modification, or foreclosure liquidation

	Outcomes			
	Modification	**Cure**	**Paid-off**	**Liquidation**
Judicial state dummy	**−0.17** (0.03)	**−0.27** (0.05)	**−0.47** (0.06)	**−0.68** (0.02)
0–3 months post 90 DPD	**0.62** (0.04)	**1.05** (0.07)	**1.01** (0.06)	**−0.41** (0.03)
4–6 months post 90 DPD	**0.63** (0.04)	**0.94** (0.07)	**0.65** (0.07)	**0.59** (0.03)
7–12 months post 90 DPD	**0.62** (0.04)	**0.81** (0.07)	**0.52** (0.07)	**0.42** (0.03)
13–24 months post 90 DPD	**0.48** (0.04)	**0.57** (0.07)	**0.40** (0.07)	**0.13** (0.03)
25–36 months post 90 DPD	**0.30** (0.05)	**0.23** (0.08)	**0.28** (0.08)	0.06 (0.03)
Origination dummy for 2005	−0.01 (0.03)	**−0.09** (0.04)	**0.10** (0.04)	**0.15** (0.02)
Origination dummy for 2006	**0.17** (0.02)	**−0.11** (0.04)	0.00 (0.04)	**0.04** (0.02)
Current loan-to-value ratio	0.01 (0.01)	**−0.92** (0.07)	**0.02** (0.00)	0.01 (0.01)
Current interest rate	−0.01 (0.01)	**−0.11** (0.01)	**−0.11** (0.01)	**0.09** (0.00)
Loan purpose: Purchase	**−0.31** (0.02)	**−0.17** (0.03)	**0.16** (0.03)	**0.28** (0.01)
Interest only mortgage dummy	**−0.08** (0.02)	**−0.23** (0.04)	**0.20** (0.03)	**0.10** (0.02)
Fixed rate dummy	**0.17** (0.02)	**0.19** (0.03)	0.00 (0.04)	**−0.26** (0.02)
Full documentation dummy	**0.10** (0.02)	**0.49** (0.03)	0.04 (0.03)	**−0.18** (0.01)
State-level monthly foreclosure start ratio	**−0.24** (0.02)	**−0.25** (0.03)	**−0.34** (0.03)	0.02 (0.01)
Recourse allowed in the state	**−0.14** (0.04)	−0.06 (0.05)	**−0.14** (0.06)	**−0.10** (0.03)
Redemption allowed in the state	−0.02 (0.03)	**0.10** (0.04)	−0.05 (0.05)	**0.10** (0.02)
Cure right	0.01 (0.03)	**0.18** (0.05)	0.00 (0.05)	**0.06** (0.02)
Baseline	**−4.25** (0.01)	**−5.32** (0.02)	**−5.26** (0.02)	**−3.60** (0.01)
Log likelihood	−187,768			
Number of observations	695,582			

Note: We fit the data with a multi-state proportional hazards model for competing risks. Because of computer memory constraints, we are not able to run the model using the entire sample, and we use 3% of the population as our sample. Classification of judicial or non-judicial states follows the classification from the National Consumer Law Center (NCLC). See section "Data source" for data construction. Standard errors are reported in parentheses. We bold the coefficient estimates that are statistically significant at the 5% level.

Results from the entire sample from 2000 to 2015

Results from 90 DPD to cure, paid-off, modification, or foreclosure liquidation

All the loans in the analysis reported in Table 3 start from the first month of 90 DPD and have four potential exit states: cure, modification, paid-off, or foreclosure liquidation as described in Figure C1. Among all the local macro

variables, we include only the monthly ratio of foreclosures being started to the overall mortgage numbers at the state level in the right hand side (RHS) of the model because of the multi-collinearity problem among various local macro variables.[21] Note that we have tried including in the hazard model all loan-level or macro variables listed in Table 2, but these additional variables do not show coefficients that are statistically significant and thus we do not include them in Table 3 to keep the model parsimonious. In addition, inclusion of these other loan-level or macro variables does not qualitatively affect findings on the coefficient estimate of the judicial dummy in the multi-state proportional hazard model or the findings on the cumulative proportions of different types of exits.

We account for the number of months since the first 90 DPD month in Table 3, and we incorporate in the model a few dummy variables for durations since the first 90 DPD month. More than 36 months since the first 90 DPD month is the omitted category in Table 3. The coefficients of the duration dummy variables in the first column of Table 3 are rather flat in the first 12 months, suggesting that the transition rates to modification do not change much during the first year since 90 DPD. Since all duration dummies have positive coefficients in the modification, cure, and paid-off equations, the transition rates to these three states are significantly lower after the loans are in 90 DPD for over 3 years. Columns 2 and 3 of Table 3 indicate that the first 3-month period since the first 90 DPD has the highest cure and paid-off transition rates, and the transition rates to these states decline afterward. The last column of Table 3 implies that liquidation is very unlikely during the first 3 months since 90 DPD. The highest transition to liquidation happens four to 6 months since the first 90 DPD and then declines afterward.

Table 3 also shows that less risky loans are more likely to transit from 90 DPD to cure: these mortgages have lower current LTVs and lower interest rates, and are more likely to be for refinancing purposes,[22] less likely to be interest only, more likely to carry fixed rates on the mortgage, and more likely to have full documentation. Loans originated in 2005 and 2006 are also less likely to be cured, which is not surprising as studies have shown loans originated in these years are riskier. Loans are more likely to transit to cure when the local economy is stronger, that is, when the state-level foreclosure start ratio is lower, while the transition rates to cure are higher in states with redemption law or allowing cure rights.

[21]The monthly ratio of state foreclosure inventory to the overall number of outstanding mortgages in the state is very closely related to the judicial dummy variable.

[22]We find from our data that "purchase" loans tend to have higher origination LTVs than refinancing loans. "Purchase" loans are also more likely to have second or higher lien loans, leading to higher combined LTVs at loan origination. Therefore, borrowers of "purchase" loans are, on average, riskier than borrowers of refinancing loans.

TABLE 4 Results from the multi-state model—from 90 DPD to cure, paid-off, modification, or foreclosure start

	Outcomes			
	Modification	**Cure**	**Paid-off**	**Foreclosure start**
Judicial state dummy	−0.04 (0.04)	−0.03 (0.06)	**−0.23** (0.07)	0.01 (0.03)
0–3 months post 90 DPD	**0.58** (0.09)	**0.26** (0.10)	**0.92** (0.13)	**0.98** (0.06)
4–6 months post 90 DPD	**0.69** (0.09)	**0.24** (0.10)	**0.74** (0.13)	**0.41** (0.06)
7–12 months post 90 DPD	**0.57** (0.09)	0.13 (0.10)	**0.44** (0.13)	**0.24** (0.06)
13–24 months post 90 DPD	**0.38** (0.09)	0.00 (0.10)	0.24 (0.14)	0.10 (0.06)
25–36 months post 90 DPD	0.17 (0.10)	−0.17 (0.12)	0.07 (0.16)	**0.25** (0.07)
Origination dummy for 2005	0.03 (0.04)	−0.03 (0.05)	**0.13** (0.05)	**0.08** (0.02)
Origination dummy for 2006	**0.22** (0.03)	−0.08 (0.04)	−0.04 (0.05)	0.03 (0.02)
Current loan-to-value ratio	0.01 (0.01)	**−0.88** (0.07)	**0.02** (0.00)	**−0.08** (0.02)
Current interest rate	**0.02** (0.01)	**−0.09** (0.01)	**−0.08** (0.01)	**0.05** (0.00)
Loan purpose: Purchase	**−0.23** (0.03)	**−0.11** (0.04)	**0.25** (0.04)	**0.20** (0.02)
Interest only mortgage dummy	−0.02 (0.03)	**−0.15** (0.05)	**0.28** (0.04)	**0.12** (0.02)
Fixed rate dummy	**0.14** (0.03)	**0.13** (0.04)	**−0.11** (0.04)	**−0.17** (0.02)
Full documentation dummy	0.04 (0.03)	**0.39** (0.04)	−0.05 (0.04)	**−0.21** (0.02)
State-level monthly foreclosure start ratio	**−0.12** (0.02)	**−0.18** (0.04)	**−0.30** (0.03)	**0.13** (0.01)
Recourse allowed in the state	0.02 (0.05)	0.02 (0.06)	−0.09 (0.07)	0.04 (0.03)
Redemption allowed in the state	−0.06 (0.03)	0.02 (0.05)	−0.04 (0.05)	0.01 (0.02)
Cure Right	**−0.09** (0.04)	**0.14** (0.05)	−0.01 (0.06)	**−0.14** (0.03)
Baseline	**−3.71** (0.01)	**−4.50** (0.02)	**−4.60** (0.02)	**−2.76** (0.01)
Log likelihood	−124,392			
Number of observations	294,960			

Note: We fit the data with a multi-state proportional hazards model for competing risks. Classification of judicial or non-judicial states follows the classification from the National Consumer Law Center (NCLC). See section "Data source" for construction of the full data, and we drop loan-month observations since the start of foreclosure process for analysis in this table. Standard errors are reported in parentheses. We bold the coefficient estimates that are statistically significant at the 5% level.

Loans with higher transition rates to modification are more likely to have refinancing as the loan purpose, less likely to be interest only, more likely to have fixed interest rates, and more likely to have full documentation. However, based on a comparison of the coefficient estimates in the first two columns of Table 3, these loans are in general riskier than loans that are more likely to transit to the cure status. Transition rates to modification are also higher when the local economy is stronger and in states without recourse law.

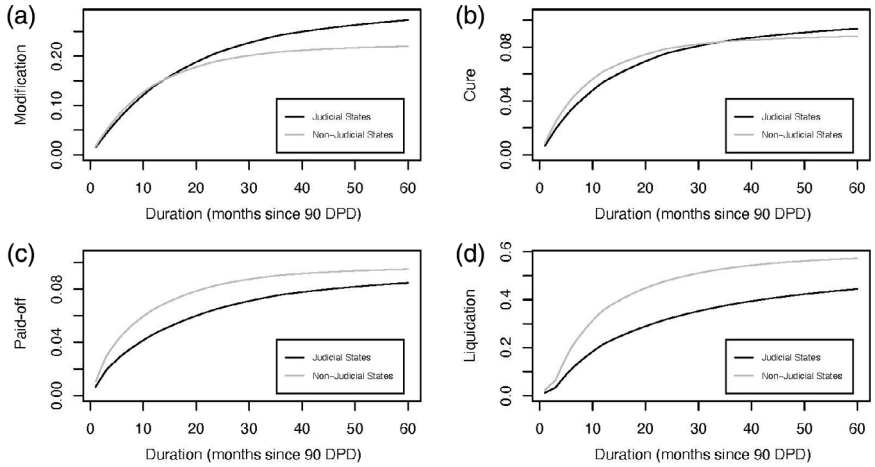

FIGURE 1 Proportion of different exit types by each month since the first 90 DPD to (a) modification, (b) cure, (c) paid-off, or (d) foreclosure liquidation. This figure illustrates the cumulative fractions of loans modified, cured, paid off, and liquidated, out of the initial pools of 90 DPD loans, based on the parameters of the multi-state hazard models reported in Table 3. For this exercise, we use a typical pool of loans with the loan characteristics all equal to the means of our sample loans during the first 90 DPD month. We keep the loan characteristics constant over time and the same across judicial and non-judicial states. Hence, the only contributing factor to the cumulative fractions over time is the increasing duration of loans in the 90 DPD state, and the difference in exit probabilities between the judicial and non-judicial states is purely due to the judicial state dummy in the multi-state hazard model

By contrast, delinquent mortgages with higher transition rates to paid-off or liquidation are riskier, and transition rates to paid-offs are higher when the state foreclosure start rates are lower and in states not allowing recourse. Finally, delinquent loans with higher transition rates to liquidation tend to be the riskiest.

The judicial dummy variable is significantly negative in all four equations in Table 3, suggesting the hazard rates to all four exit types are lower in judicial states than in non-judicial states. These results are consistent with those in Table 4 of Gerardi et al. (2013). However, lower hazard rates do not necessarily mean judicial states have lower proportions of modification, cure, paid-off, and liquidation out of the initial pool of 90+ DPD loans.

Based on the parameters of the multi-state hazard models reported in Table 3 following the same calculation in Table 1, we estimate the cumulative proportions of exits using a typical pool of loans with the loan characteristics all equal to the means of our sample loans during the first 90 DPD month. We keep the loan characteristics constant over time and the same across judicial and non-judicial states so that the only contributing factor to the cumulative proportions

over time are the increasing duration of loans in the 90 DPD state, and the difference in the cumulative proportions of the different types of exits between the judicial and non-judicial states are therefore purely due to the judicial state dummy in the multi-state hazard model. Such results on cumulative proportions of different types of exits out of the initial pool of 90+ DPD loans during each month since the first 90 DPD month are depicted in Figure 1.[23]

The first graph in Figure 1 shows that the proportions of loans modified are quite close and initially slightly lower in judicial states than in non-judicial states, which is not surprising as the modification hazard rates are lower in judicial states and the impact from the denominator has not shown up yet. However, we can see from this graph that the gap between the two lines shrinks, and after the first year is over, more loans out of the initial pool of 90 DPD loans are modified in judicial states than in non-judicial states, and the spread between the two lines widens with duration. Since the denominators do not change in this calculation, the spread is purely driven by the numerators that rise proportionately faster in judicial states than in non-judicial states. Over a 5-year period after loans become 90 DPD, 27% of the initial pool of delinquent loans are modified in judicial states, while 22% are modified in non-judicial states.

Panel (b) of Figure 1 depicts the cumulative proportions of delinquent loans cured over time. The non-judicial line rises higher than the judicial line in the first year. After that, the spread between the two lines shrinks, indicating that proportionally more delinquent loans are cured monthly in judicial states than in non-judicial states after 1 year since 90 DPD. Within roughly 3 years, the cumulative proportion of cured delinquent loans in judicial states exceeds that in non-judicial states. By the end of the fifth year, 9.4% of delinquent loans in judicial states are cured, versus 8.8% in non-judicial states.

Panel (c) of Figure 1 shows the cumulative proportions of loans paid off. The judicial line is always below the non-judicial line in this graph, even though the gap between the two lines starts to shrink beginning from 1.5 years after the first 90 DPD. By the end of the fifth year, roughly 9.5% of the initial delinquent pool are paid off outside foreclosure liquidation in non-judicial states, and the corresponding number is roughly 8.5% in judicial states.

The last graph in Figure 1 illustrates the cumulative proportions of delinquent loans ending up in foreclosure liquidation. This graph shows that delinquent mortgages are more likely to be liquidated in non-judicial states. Even though the fraction of loans liquidated picks up in judicial states, the spread between the two lines remains large. The difference is around 13 percentage points at the end of the fifth year, and the overwhelming majority of this is due to more loan modification in judicial states.

[23]When we use the coefficients in table 4 of Gerardi et al. (2013) and construct the cumulative proportions of different types of exits, we find graphs similar to those in Figure 1 here.

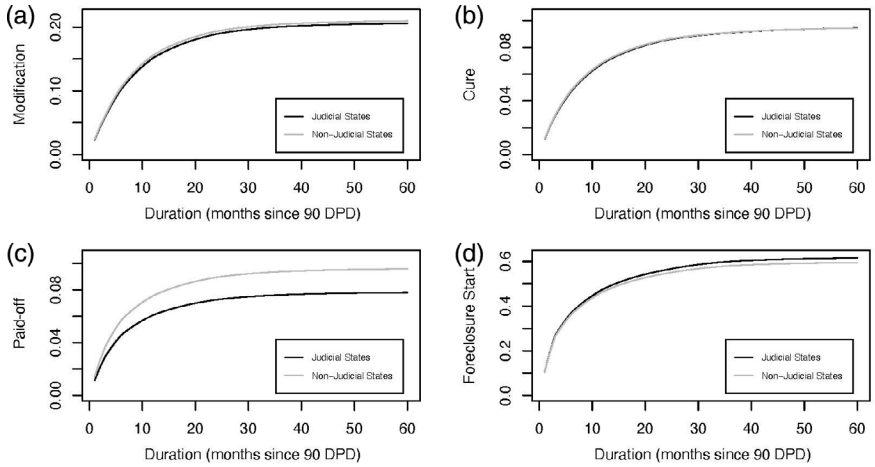

FIGURE 2 Proportion of different exit types by each month since the first 90 DPD to (a) modification, (b) cure, (c) paid-off, or (d) foreclosure start. This figure illustrates the cumulative fractions of loans modified, cured, paid off, and foreclosure start, out of the initial pools of 90 DPD loans, based on the parameters of the multi-state hazard models reported in Table 4. For this exercise, we use a typical pool of loans with the loan characteristics all equal to the means of our sample loans during the first 90 DPD month. We keep the loan characteristics constant over time and the same across judicial and non-judicial states. Hence, the only contributing factor to the cumulative fractions over time is the increasing duration of loans in the 90 DPD state, and the difference in exit probabilities between the judicial and non-judicial states is purely due to the judicial state dummy in the multi-state hazard model

Further, we can see from Figure 1 that, in both judicial and non-judicial states and at each point in time since the first 90 DPD, more loans are modified than cured and paid off combined, thus suggesting that modifications are the most important alternatives for subprime borrowers to reinstate their delinquent mortgages outside foreclosure liquidation. Further, modifications outweigh cure and paid-off more in judicial states than in non-judicial states. Figure 1 therefore shows that modifications benefit the most from the slower judicial foreclosure processes, and there is overall benefit from the judicial process among subprime mortgage borrowers.

Results before foreclosure starts

We now fit a multi-state proportional hazards model to our first sub-sample data following the states described in Figure C2. The loans in Table 4 start in 90 DPD and migrate to four potential exit states: modification, cure, paid-off, or foreclosure start.

The duration step function shows that modification transition rates reach a high point during the period 4–6 months post the first 90 DPD and then decline afterward. By contrast, the last three columns of Table 4 suggest that as a loan stays longer in the 90 DPD status, it becomes less likely to be cured or paid off, and a significant fraction of foreclosure starts within 3 months of the first 90 DPD. In addition, the findings on the loan characteristics are in general not too different between Tables 3 and 4. Delinquent loans transiting to cure are generally less risky, followed by modification, while loans with higher transition rates to paid-off or to start the foreclosure process are riskier.

Based on the coefficients reported in Table 4, we calculate the cumulative fraction of 90 DPD loans modified, cured, paid off, or for which foreclosure starts, and we plot the graphs in Figure 2. We can see that the judicial line is above the non-judicial line in panel (d) of Figure 2, suggesting that the lenders are more likely to start the foreclosure process in judicial states. The spread is around two percentage points in the third year.

The gray and black lines in the modification and the cure graphs of panels (a) and (b) are largely on top of each other. The judicial lines are clearly underneath the non-judicial line in panel (c), where the gap increases with duration. By the third year, the gap between the two lines is about two percentage points in the paid-off graph.

Therefore, Figure 2 suggests that the judicial foreclosure procedure does not help delinquent borrowers before foreclosure starts. The delinquent mortgage borrowers experience a higher probability of the start of the foreclosure process, and they do not have more opportunities to modify their loans, cure their loans, or to pay off their loans before foreclosure starts. The fraction of loans modified before foreclosure starts is only slightly more than that for cure and paid-off combined. These results imply that although modification may be the most important alternative before foreclosure starts, its role is far from dominant at this stage.

Results after foreclosure starts

We next fit a multi-state proportional hazards model to our second sub-sample data following the states described in Figure C3. The loans considered in Table 5 are those after foreclosure starts to four potential exit states: modification, cure, paid-off, or foreclosure liquidation. Note that all observations in this sub-sample are the loan-months since foreclosure starts. Different from the duration terms in Tables 3 and 4, we allow for different duration step functions in judicial states and non-judicial states in Table 5.

Based on the coefficient of the loan characteristics, we can see that, again, the cure transition rates are higher for less risky loans—lower current LTV, lower current interest rates, refinancing loans, more likely to be full documentation and carry fixed interest rate, and less likely to be interest-only loans. Loans

TABLE 5 Results from the multi-state model—from start of foreclosure to cure, modification, paid-off, or foreclosure liquidation

	Outcomes			
	Modification	**Cure**	**Paid-off**	**Liquidation**
Judicial state dummy	−0.23 (0.12)	−**0.74** (0.25)	−**0.64** (0.21)	−0.09 (0.07)
0–6 months post foreclosure start	−**0.38** (0.10)	0.28 (0.20)	−**0.62** (0.18)	**1.47** (0.06)
7–12 months post foreclosure start	**0.58** (0.10)	**0.60** (0.21)	**0.81** (0.17)	**1.02** (0.06)
13–24 months post foreclosure start	**0.52** (0.10)	**0.44** (0.21)	**0.49** (0.17)	**0.61** (0.07)
25–36 months post foreclosure start	0.18 (0.12)	0.38 (0.24)	**0.42** (0.20)	**0.26** (0.08)
Jud × 0–6 months post foreclosure start	**0.36** (0.13)	**0.52** (0.26)	−0.18 (0.26)	−**1.29** (0.07)
Jud × 7–12 months post foreclosure start	0.04 (0.13)	0.25 (0.28)	−0.34 (0.22)	−**0.42** (0.08)
Jud × 13–24 months post foreclosure start	−0.03 (0.13)	0.31 (0.28)	0.08 (0.22)	−**0.29** (0.08)
Jud × 25–36 months post foreclosure start	0.03 (0.15)	−0.03 (0.33)	−0.13 (0.25)	−**0.19** (0.09)
Origination dummy for 2005	−0.03 (0.05)	−**0.24** (0.09)	0.16 (0.08)	**0.10** (0.02)
Origination dummy for 2006	**0.11** (0.04)	−**0.22** (0.08)	**0.18** (0.08)	0.01 (0.02)
Current loan-to-value ratio	−0.04 (0.05)	−**1.17** (0.14)	**0.02** (0.01)	−0.01 (0.02)
Current interest rate	−**0.03** (0.01)	−**0.10** (0.02)	−**0.13** (0.02)	**0.08** (0.00)
Loan purpose: Purchase	−**0.28** (0.04)	−**0.14** (0.07)	**0.16** (0.06)	**0.20** (0.01)
Interest only mortgage dummy	−**0.09** (0.04)	−**0.29** (0.08)	0.12 (0.06)	**0.04** (0.02)
Fixed rate dummy	**0.08** (0.04)	0.10 (0.07)	0.06 (0.07)	−**0.18** (0.02)
Full documentation dummy	0.01 (0.04)	**0.48** (0.07)	0.01 (0.07)	−**0.06** (0.02)
State-level monthly foreclosure start ratio	−**0.30** (0.03)	−**0.16** (0.07)	−**0.23** (0.05)	−0.01 (0.01)
Recourse allowed in the state	−**0.43** (0.07)	−**0.27** (0.12)	−0.19 (0.12)	−**0.18** (0.03)
Redemption allowed in the state	0.01 (0.05)	**0.31** (0.08)	−0.09 (0.09)	**0.09** (0.02)
Cure right	0.00 (0.06)	0.01 (0.10)	−**0.28** (0.11)	**0.17** (0.02)
Baseline	−**4.78** (0.02)	−**6.31** (0.04)	−**6.09** (0.04)	−**3.17** (0.01)
Log likelihood	−106,178			
Number of observations	400,873			

Notes: We fit the data with a multi-state proportional hazards model for competing risks. Classification of judicial or non-judicial states follows the classification from the National Consumer Law Center (NCLC). See section 3.1 for construction of the full data, and we only keep in the analysis in this table loan-month observations since the start of foreclosure process. Standard errors are reported in parentheses. We bold the coefficient estimates that are statistically significant at the 5% level.

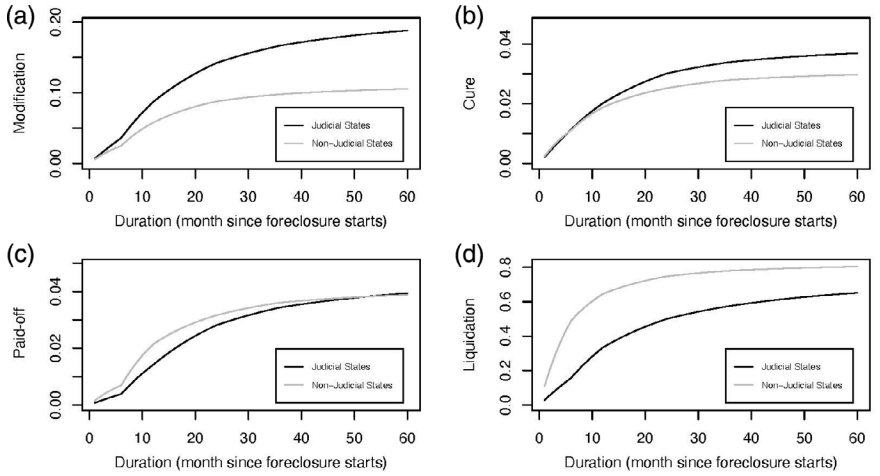

FIGURE 3 Proportion of different exit types by each month since the start of foreclosure to (a) modification, (b) cure, (c) paid-off, or (d) foreclosure liquidation. This figure illustrates the cumulative fractions of loans modified, cured, paid-off, and liquidated, out of the initial pools of loans entering the foreclosure process, based on the parameters of the multi-state hazard models reported in Table 5. For this exercise, we use a typical pool of loans with the loan characteristics all equal to the means of our sample loans during the first 90 DPD month. We keep the loan characteristics constant over time and the same across judicial and non-judicial states. Hence, the only contributing factor to the cumulative fractions over time is the increasing duration of loans in the foreclosure state, and the difference in exit probabilities between the judicial and non-judicial states is purely due to the judicial state dummy in the multi-state hazard model

with higher transitions rates to modification are more risky than cured loans, but less risky than paid-off loans, while the liquidation transition rates are the highest among the riskiest loans. Further, transition rates to all types of exits outside foreclosure liquidation are lower during the period when the state foreclosure start rates are higher.

Figure 3 depicts the cumulative fraction of loans modified, cured, paid off, or liquidated since they enter the foreclosure process calculated based on the multi-state hazard model reported in Table 5. We can see that the proportion of loans cured or paid off is much lower in Figure 3 than in Figure 2 for both judicial and non-judicial states. However, the cure and paid-off rates are still far from trivial in Figure 3, indicating that they remain important alternatives to foreclosure liquidation even after the start of the foreclosure process. Further, the judicial modification line in Figure 3 is roughly of the same magnitude as the judicial modification line in Figure 2, while the non-judicial modification rates fall by nearly half from Figures 2 to 3. As in Figure 1, in both judicial and non-judicial states, the modification rates are substantially higher than cure rates and paid-off rates combined. Hence, Figure 3 provides strong evidence

that modifications are the most important alternatives for subprime borrowers to reinstate their delinquent mortgages outside foreclosure liquidation post foreclosure start, especially in judicial states.

One drastic difference between Figure 3 and Figure 2 is that the judicial lines for modification and cure are both overwhelmingly above the non-judicial lines in Figure 3, where the gaps between the judicial and non-judicial lines are large and expand with duration. By the end of the fifth year since foreclosure starts, the spread between the judicial and non-judicial states is roughly 8.3 percentage points for modification, and about 0.7 percentage points for cure, while the gap in paid-off lines between judicial and non-judicial states evaporates in Figure 3. These numbers largely make up for the difference in the foreclosure liquidation rates between judicial and non-judicial states in panel (d) of Figure 3. Therefore, Figure 3 and the contrast between Figures 2 and 3 provide clear-cut evidence that the benefit of the judicial foreclosure process mainly takes place after the start of the foreclosure procedure. The slower foreclosure process in judicial states indeed provides delinquent subprime borrowers more opportunities to modify, cure, and pay off their delinquent mortgages outside foreclosure liquidations.

Results from the border sample

Because judicial and power-of-sale procedures are not randomly assigned across states and judicial states are regionally clustered in the Northeast and Midwest, we have conducted all analysis in sections "Results from 90 DPD to cure, paid-off, modification, or foreclosure liquidation," "Results before foreclosure starts," and "Results after foreclosure starts" among a border sample. The border sample includes loans located in zip codes within 10 miles of a border between a judicial and non-judicial state. Because of the much smaller sample size, we use 50% of the full border sample in this analysis. We present the figures on the cumulative proportion of default exit types in Appendix D. The coefficient estimates for this border sample are not reported to save space, and they are available upon request.

We can see that Figures D1–D3 in Appendix D are largely similar to those in Figures 1–3. In addition, the cure rates seem to be higher in judicial states than in non-judicial states in Appendix D, even before foreclosure starts. Therefore, earlier results hold in the border sample.

Results excluding California, Florida, and New York

It is also possible that loans from the large states might have driven the earlier results. To address this concern, we have conducted another robustness test by excluding loans from California (20% of our sample), Florida (16% of our sample), and New York (7% of our sample). The rest of the states constitute no

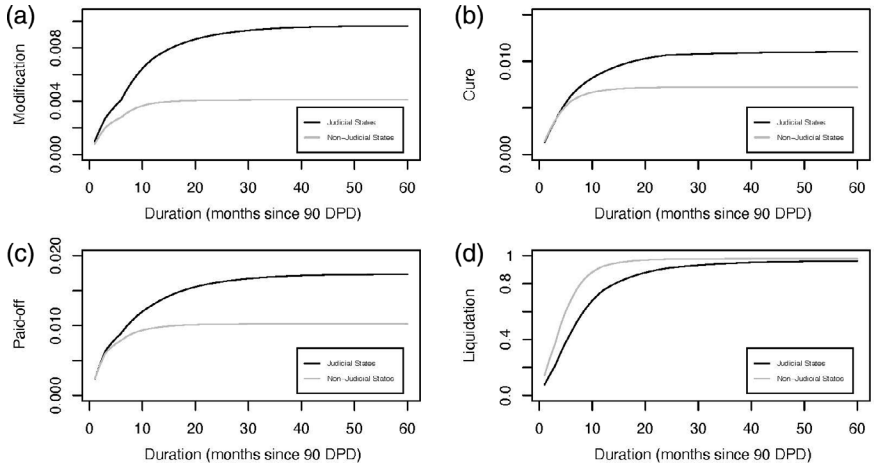

FIGURE 4 Proportion of different exit types by each month since the first 90 DPD to (a) modification, (b) cure, (c) paid-off, or (d) foreclosure liquidation—from 2000 to 2006. This figure illustrates the cumulative fractions of loans modified, cured, paid off, and liquidated, out of the initial pools of 90 DPD loans. For this exercise, we use a typical pool of loans with the loan characteristics all equal to the means of our sample loans during the first 90 DPD month. We keep the loan characteristics constant over time and the same across judicial and non-judicial states. Hence, the only contributing factor to the cumulative fractions over time is the increasing duration of loans in the 90 DPD state, and the difference in exit probabilities between the judicial and non-judicial states is purely due to the judicial state dummy in the multi-state hazard model

more than 3% of our sample. We present graphs of the proportions of cumulative exits of this alternative sample in Appendix E, Figures E1–E3. We can see that the lines in Appendix E are very similar to those in Figures 1–3. Consequently, our results are not driven by the large states.

Results from the sub-periods

We next break the analysis into five sub-periods: the period from 2000 to 2006 (which covers the period of a booming housing market), the year 2007 (which is the start of the latest housing market downturn, as can be seen from panel (b) of Appendix B, Figure B1, but modification was still uncommon), the year 2008 (when modification started to be more common but still not widely used as HAMP has not started yet), the period from 2009 to 2011 (when HAMP was in effect after being passed by the federal government but the housing market was still in downturn).[24] The coefficient estimates for these sub-periods are not reported to save

[24]HAMP was introduced in 2009 as part of the Emergency Economic Stabilization Act of October 2008.

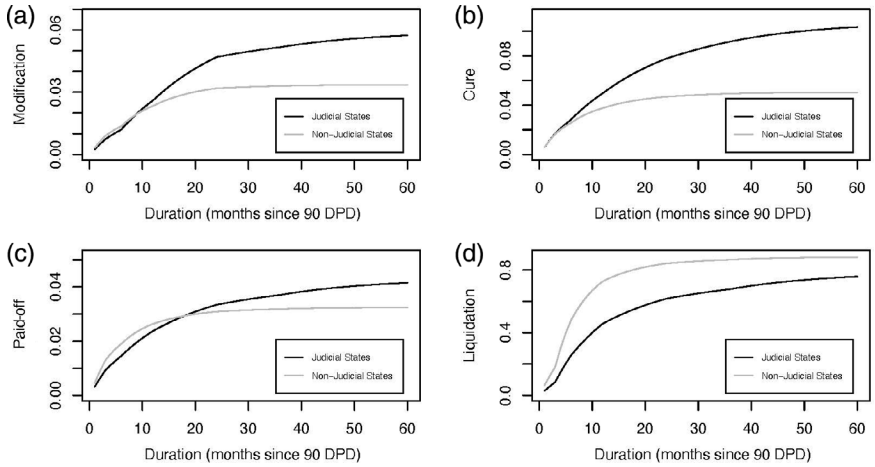

FIGURE 5 Proportion of different exit types by each month since the first 90 DPD to (a) modification, (b) cure, (c) paid-off, or (d) foreclosure liquidation—during 2007. This figure illustrates the cumulative fractions of loans modified, cured, paid off, and liquidated, out of the initial pools of 90 DPD loans. For this exercise, we use a typical pool of loans with the loan characteristics all equal to the means of our sample loans during the first 90 DPD month. We keep the loan characteristics constant over time and the same across judicial and non-judicial states. Hence, the only contributing factor to the cumulative fractions over time is the increasing duration of loans in the 90 DPD state, and the difference in exit probabilities between the judicial and non-judicial states is purely due to the judicial state dummy in the multi-state hazard model

space, and they are available upon request. We do not provide results from the period 2012–2015. The reason is that nearly all the loans in the post 2012 sample are subprime loans originated in 2005 and 2007. Therefore, these loans have several years' seasoning and these borrowers continued to make the mortgage payments during the 2007–2009 crisis. As a result, the loans in the 2012–2015 sample might not be random or representative and results from this sample may not be reliable.

Figure 4 is based on all loan-month observations before December 2006. We can see that the judicial lines for modification, cure, and paid-off are all above the non-judicial lines in this figure. However, the magnitude in these three panels are all very small, and the differences in the modification, cure, and paid-off rates between judicial and non-judicial states are all below one percentage point, far from economically significant. Accordingly, the two lines in panel (d) of Figure 4 largely converge in the end. This result suggests that, although a smaller fraction of 90 DPD mortgages end up being liquidated in judicial states than in non-judicial states before 2006, the benefit from the judicial foreclosure procedure for subprime mortgage borrowers during the booming housing market years from 2000 to 2006 seems rather limited.

Figure 5 is based on loan-month observations in 2007 only. A major difference between Figures 4 and 5 is that the modification, cure, and paid-off rates

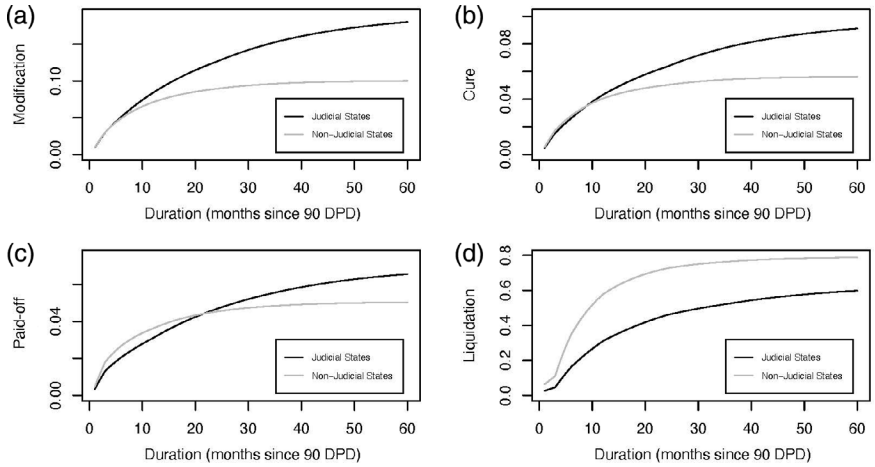

FIGURE 6 Proportion of different exit types by each month since the first 90 DPD to (a) modification, (b) cure, (c) paid-off, or (d) foreclosure liquidation—during 2008. This figure illustrates the cumulative fractions of loans modified, cured, paid off, and liquidated, out of the initial pools of 90 DPD loans. For this exercise, we use a typical pool of loans with the loan characteristics all equal to the means of our sample loans during the first 90 DPD month. We keep the loan characteristics constant over time and the same across judicial and non-judicial states. Hence, the only contributing factor to the cumulative fractions over time is the increasing duration of loans in the 90 DPD state, and the difference in exit probabilities between the judicial and non-judicial states is purely due to the judicial state dummy in the multi-state hazard model

are all higher in Figure 5 than in Figure 4. The judicial lines in Figure 5 are clearly above the non-judicial lines for modification, cure, and paid-off, and not surprisingly, the last panel of Figure 5 indicates that the 5-year liquidation rate is more than 10 percentage points lower in judicial states than in non-judicial states in 2007. The modifications shown in Figure 5 are without direct government involvement, and modification rates are thus low in this period. We can see from Figure 5 that, before modifications are common, the judicial benefit is most reflected in the higher cure rates in judicial states, which exceeds cure rates in non-judicial states by roughly five percentage points by the fifth year since the loan first becomes 90 DPD. Figure 6 depicts the same graphs as Figures 4 and 5 using loan-month observations from the year 2008. We can see that the judicial lines are above the non-judicial lines for modification, cure, and paid-off, consistent with the patterns in Figure 5. The modification rates are much higher in Figure 6 than in Figure 5; this is not surprising as mortgage modification became more popular when the housing market condition worsened. Some of the modifications in 2008 were driven by government intervention, such as the countrywide settlement. In addition, the modification, cure, and paid-off

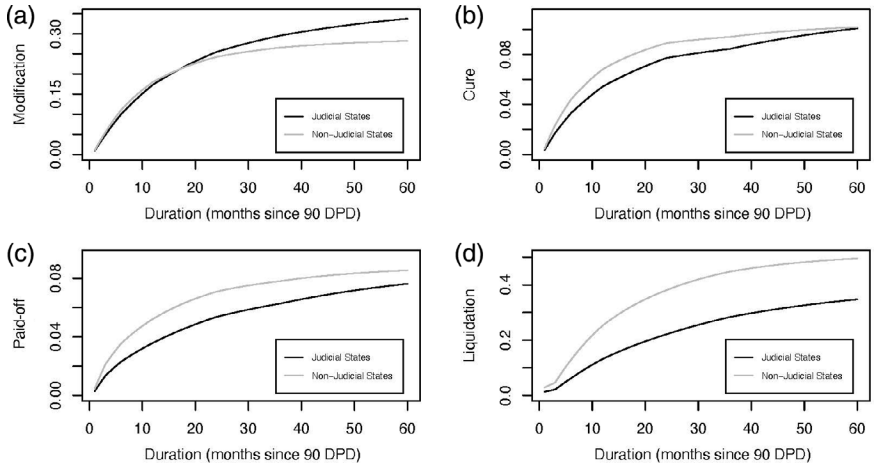

FIGURE 7 Proportion of different exit types by each month since the first 90 DPD to (a) modification, (b) cure, (c) paid-off, or (d) foreclosure liquidation—from 2009 to 2011. This figure illustrates the cumulative fractions of loans modified, cured, paid off, and liquidated, out of the initial pools of 90 DPD loans. For this exercise, we use a typical pool of loans with the loan characteristics all equal to the means of our sample loans during the first 90 DPD month. We keep the loan characteristics constant over time and the same across judicial and non-judicial states. Hence, the only contributing factor to the cumulative fractions over time is the increasing duration of loans in the 90 DPD state, and the difference in exit probabilities between the judicial and non-judicial states is purely due to the judicial state dummy in the multi-state hazard model

rates are all higher in Figure 6 than in Figure 5, for both judicial and non-judicial states. The lift of these lines likely resulted from the built-up in foreclosure inventory (as can be seen in panels (c) and (d) of Appendix B, Figure B1), which motivated resolution outside foreclosure liquidation. In addition, the legislative responses to the foreclosure crisis in non-judicial states might have also provided more opportunities for delinquent mortgage borrowers to reinstate their loans outside foreclosure.[25] Another noticeable difference between Figures 5 and 6 is that the spreads between the two lines are larger in Figure 6 than in Figure 5, and as a result, the difference in proportions of loans eventually liquidated through foreclosure between judicial and non-judicial states is much larger in Figure 6 than in Figure 5.

Results from Figures 5 and 6 are important, as the judicial foreclosure systems have yet to be more severely clogged than those in non-judicial states before 2009,

[25]The non-judicial states witnessed a drastic increase in the changes of foreclosure statutes as the housing market condition worsened. Immergluck et al. (2011) identify 12 provision changes in 2006, 19 in 2007, 38 in 2008, and 70 in 2009 in non-judicial states.

as can be seen in panel (d) of Appendix B, Figure B1.[26] Therefore, the judicial benefit shown in Figures 5 and 6 are not likely driven by the abnormal disparity in foreclosure inventory build-up between judicial and non-judicial states.

Figure 7 illustrates the same graphs based on loan-month observations from the years 2009–2011. First note that the modification rates are much higher in Figure 7 than in Figure 6, which is not surprising as the HAMP, which was sponsored by the federal government started in 2009. Figure 7 clearly shows that loans in judicial states benefit more from modification programs than those in non-judicial states. Note that the cure and paid-off rates are lower in judicial states than in non-judicial states in Figure 7, a pattern different from that in Figures 4–6. It is possible that, after HAMP became available, the modification terms were so favorable that borrowers prefer modifications to cures or paid-offs as alternative ways to reinstate their delinquent mortgages. Because of the large fraction of loans modified in this period, the judicial foreclosure process still enables a higher proportion of loans to be reinstated outside foreclosure liquidation than the non-judicial process.

We do not have space to report results for the before foreclosure and post foreclosure periods for the sub-periods, as these results are similar to those in Figures 2 and 3, and they are available upon request.

Additional investigations

We have conducted additional investigations to test the robustness of our results besides the two robustness tests discussed in section "Results from the entire sample from 2000 to 2015." It is possible that the results above are driven by the practices of different banks. We thus conduct additional analysis using loans issued by one large bank with a nationwide footprint, and we find results qualitatively similar to those reported above and our conclusions do not change. We have also run the analyses among loans of different purposes: refinancing versus purchase, and we do not find different patterns between these two types of loans. These results are not reported here to save space, but they are available upon request.

Discussions

We find evidence that modifications benefit the most from the judicial foreclosure procedure. Since studies have shown that the re-default rates post modification is

[26]The "robo-signing" scandal broke in late 2010, in which it was revealed that servicers signed foreclosure documents without reviewing them. The robo-signing scandal primarily affected judicial states. In response to the scandal, some servicers halted foreclosures in judicial states for a period of time.

very high, at around 50% (e.g., Adelino et al., 2013; Mason, 2007; OCC, 2011), one could argue that the judicial foreclosure procedure actually may not help.

We first point out that modifications were uncommon in 2007 and were not widely used in 2008. In both years, cure and paid-off rates in judicial states are much higher in non-judicial states, and modifications are not the primary driver behind the judicial benefit in Figures 5 and 6. The reason we find modifications benefit the most from the judicial foreclosure procedure in the overall sample is due to the high modification rates post 2009 and the larger sample from the period 2009–2011, but readers should not overlook the role of cure and paid-off in judicial states before 2009.

Secondly, we contend that the issue of high re-default rate post modifications is a question by itself and deserves separate investigations. The high re-default rates might be due to bad loan modification programs, for example, failure to reduce principal loan amount, and studies (such as Agarwal et al., 2011; Haughwout et al., 2016; Quercia & Ding, 2009; Schmeiser & Gross, 2016; Voicu et al., 2012) have found that certain modifications have been more successful than others (for instance, a reduction in principal loan amount or a reduction in monthly payments or interest rates). So how to construct a good modification program is an important question by itself. Nevertheless, we cannot disregard the benefit of a slower judicial procedure just because of our lack of understanding of effective loan modification programs.

Finally, we have investigated the re-default rates post modifications by judicial and non-judicial states, and we find the re-default rates to be very similar in our sample, at around 50%. If we apply a 15-percentage point difference in modification rates between judicial and non-judicial states, judicial states would still have a higher rate of 7.5 percentage points of loan re-instatement due to modifications.

CONCLUSIONS

We investigate whether and how the judicial procedure of the foreclosure process helps subprime borrowers to reinstate their delinquent mortgages outside foreclosure liquidation. Over the entire period of 2000–2015, we find that the judicial procedure overall provides subprime borrowers more opportunities to reinstate their loans outside foreclosure liquidation. However, we do identify different impacts over sub-periods. The benefit of the slower judicial foreclosure procedure for subprime borrowers primarily shows up during the housing market downturn in 2007–2011, and the benefit is small during the housing market boom from 2000 to 2006. Further, before modifications were widely used, the benefit from the judicial procedure is reflected in higher cure, modification and paid-off rates. After modifications became popular since 2009, loan modification became the most important alternative for delinquent subprime borrowers to reinstate their loans outside foreclosure liquidation. The lion's share of the benefit occurs post the start of foreclosure.

Finally, why do loan modifications reap the most benefit from the slower judicial foreclosure procedure? This result may be partially related to the finding in the literature that there might be hurdles to acquire loan modification information (see for instance, Boehm & Schlottmann, 2020), and default counseling is effective in curing delinquent mortgages (e.g., Collins et al., 2011). As a result, the slower foreclosure process in judicial states might allow delinquent mortgage borrowers more time to learn about modification programs and engage in default counseling to reinstate their mortgages.

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APPENDIX A: RAW TRANSITION RATES FROM 90 DPD TO MODIFICATION, CURE, PAID-OFF, AND FORECLOSURE LIQUIDATION AND RAW CUMULATIVE PROPORTION OF DEFAULT EXIT TYPES

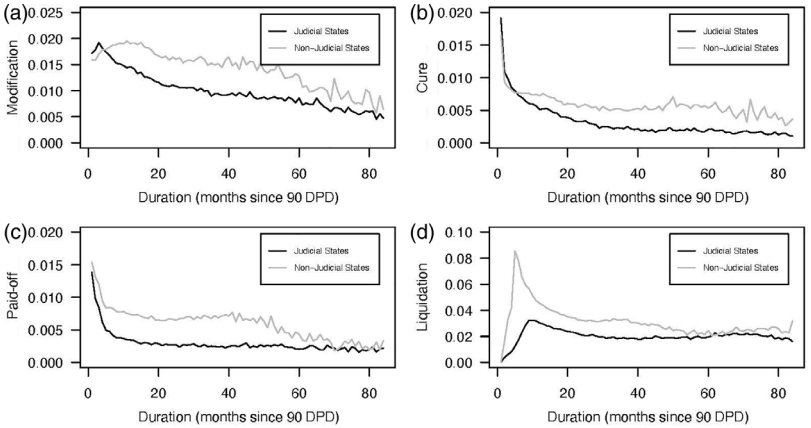

FIGURE A1 Raw transition rates from 90 DPD to (a) modification, (b) cure, (c) paid-off, and (d) foreclosure liquidation by each month since the first 90 DPD. These results are based on the raw data of 1,486,470 loans and 23,569,817 loan-month observations constructed from the DataQuick ABS/MBS data

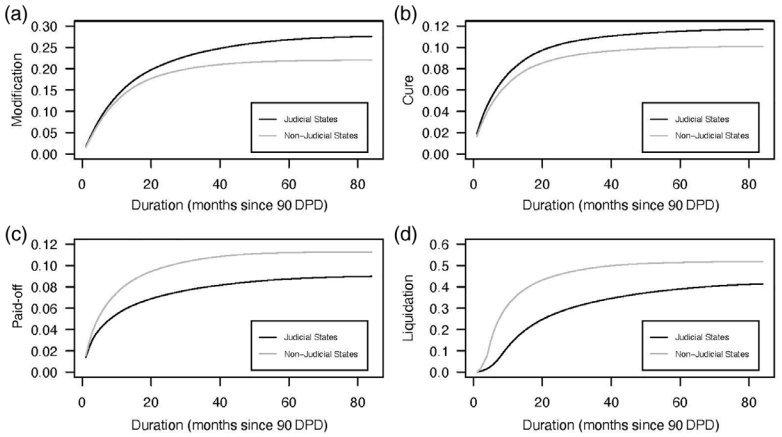

FIGURE A2 Raw cumulative proportion of different exit types by each month since the first 90 DPD: (a) modification, (b) cure, (c) paid-off, and (d) foreclosure liquidation. These results are based on the raw data of 1,486,470 loans and 23,569,817 loan-month observations constructed from the DataQuick ABS/MBS data. See section "Data and sample description" for details of data construction

APPENDIX B: TIME SERIES OF MACRO VARIABLES BETWEEN JUDICIAL AND NON-JUDICIAL STATES

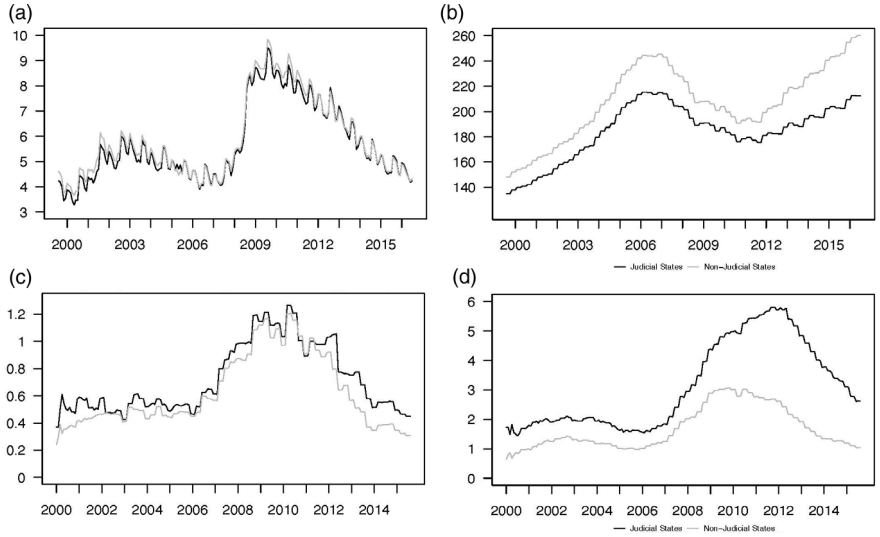

FIGURE B1 (a) State-level unemployment rate (in %); (b) housing price index—non-seasonally adjusted. (c) Average monthly ratio of foreclosures being started to the overall mortgage numbers (in %); (d) Average monthly ratio of state foreclosure inventory to the overall number of outstanding mortgages (in %). The data source is Haver Analytics

APPENDIX C: GRAPHICAL ILLUSTRATION OF THE STATES OF THE MULTI-STATE PROPORTIONAL HAZARDS MODEL

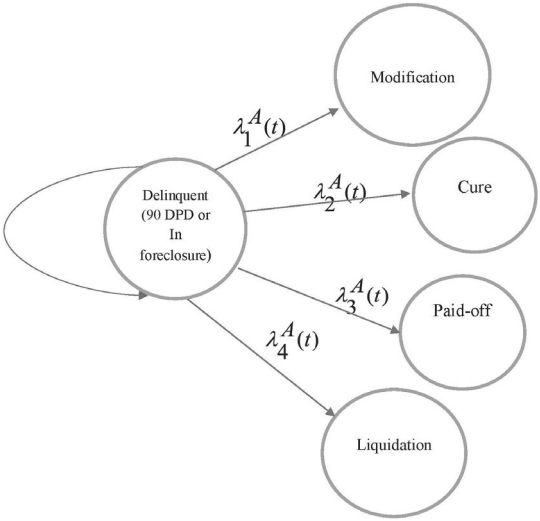

FIGURE C1 The model that combines delinquent loans before and after foreclosure start

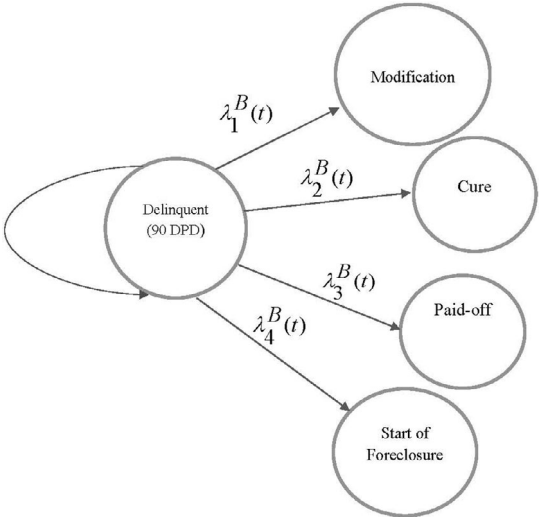

FIGURE C2 The model with only delinquent loans before foreclosure start

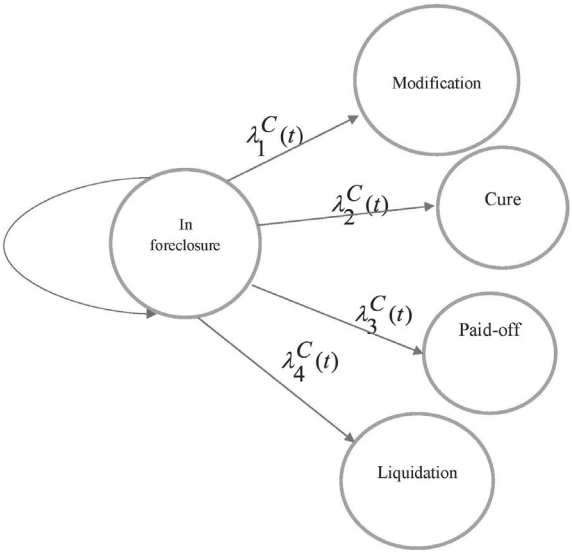

FIGURE C3 The model with only delinquent loans after foreclosure start

APPENDIX D: RESULTS FROM THE BORDER SAMPLE

The border sample includes loans located in zip codes within 10 miles of a border between a judicial and non-judicial state. Because of the much smaller sample size, we use the full border sample in this analysis, instead of taking a sample for analysis.

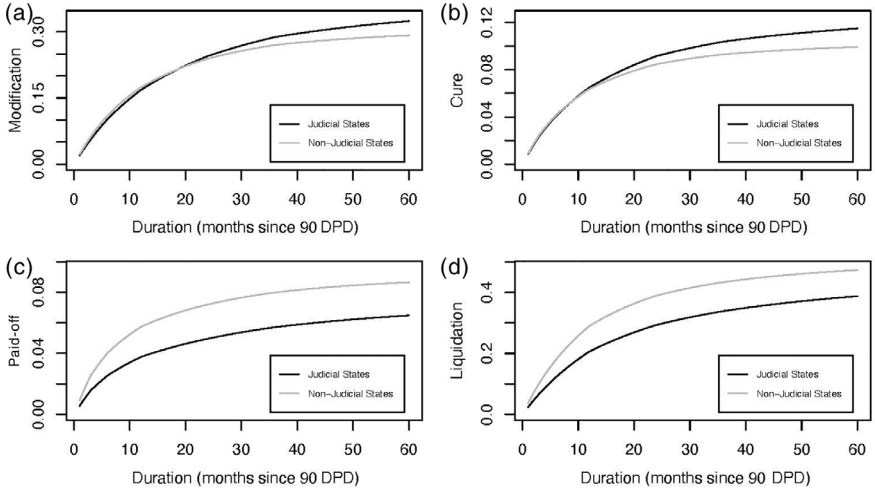

FIGURE D1 Border sample—Proportion of different exit types by each month since the first 90 DPD to (a) modification, (b) cure, (c) paid-off, or (d) foreclosure liquidation

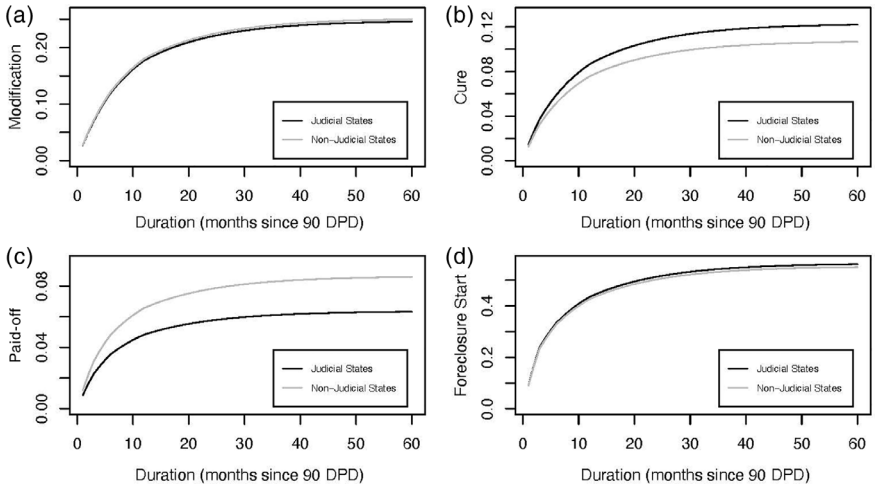

FIGURE D2 Border sample—Proportion of different exit types by each month since the first 90 DPD to (a) modification, (b) cure, (c) paid-off, or (d) foreclosure start

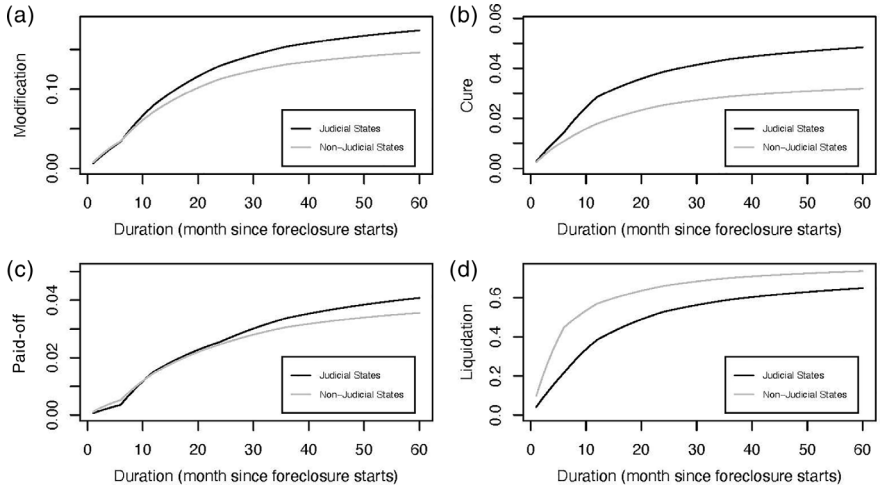

FIGURE D3 Border sample—Proportion of different exit types by each month since the start of foreclosure to (a) modification, (b) cure, (c) paid-off, or (d) foreclosure liquidation

APPENDIX E: RESULTS EXCLUDING CALIFORNIA, FLORIDA, AND NEW YORK

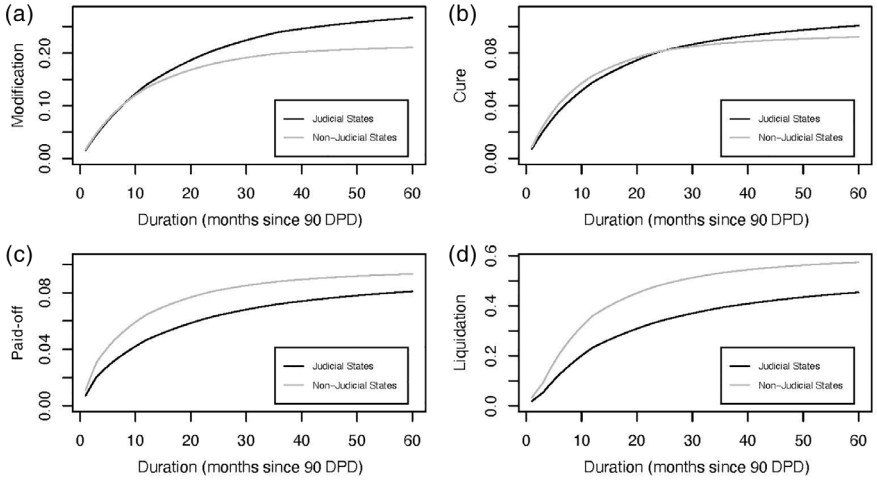

FIGURE E1 Sample excluding California, Florida, and New York—Proportion of different exit types by each month since the first 90 DPD to (a) modification, (b) cure, (c) paid-off, or (d) foreclosure liquidation

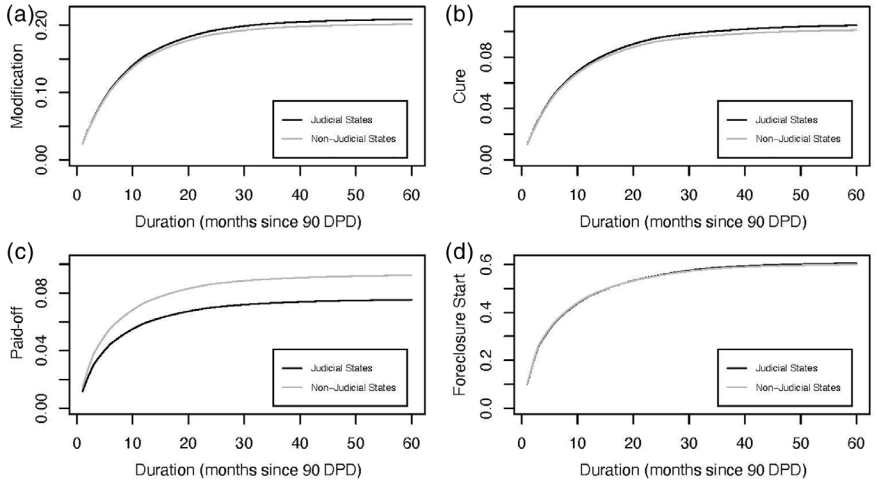

FIGURE E2 Sample excluding California, Florida, and New York—Proportion of different exit types by each month since the first 90 DPD to (a) modification, (b) cure, (c) paid-off, or (d) foreclosure start

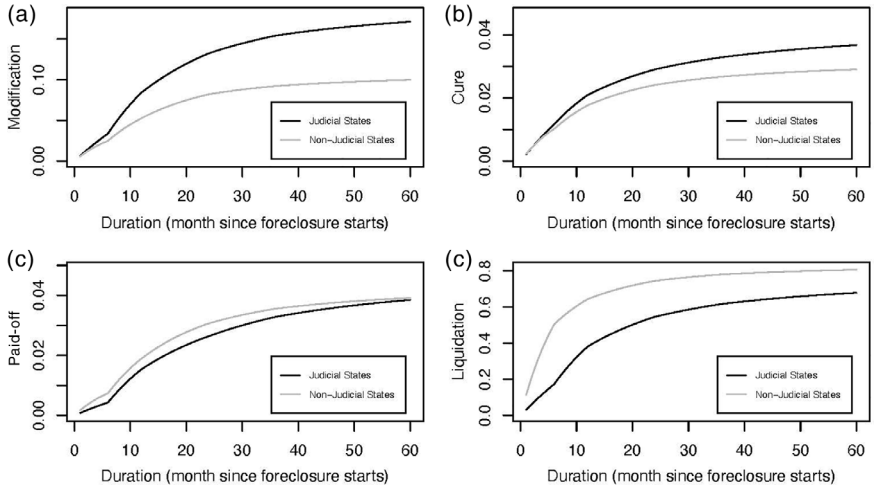

FIGURE E3 Sample excluding California, Florida, and New York—Proportion of different exit types by each month since the start of foreclosure to (a) modification, (b) cure, (c) paid-off, or (d) foreclosure liquidation