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Regime Shift and the Post-Crisis World of Mortgage Loss Severities

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Motivation

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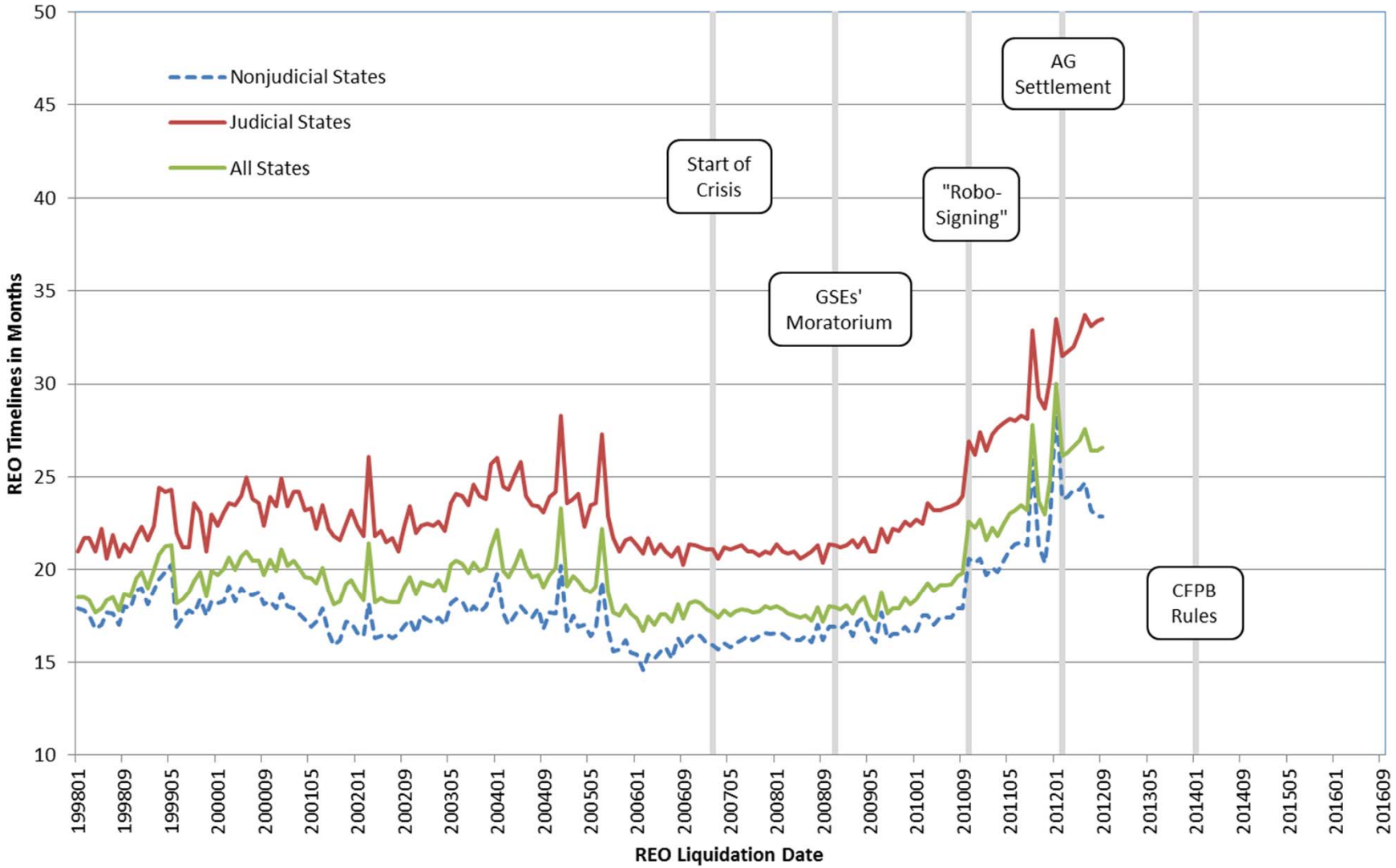

Source: Cordell et al. (2015), based on McDash Analytics data

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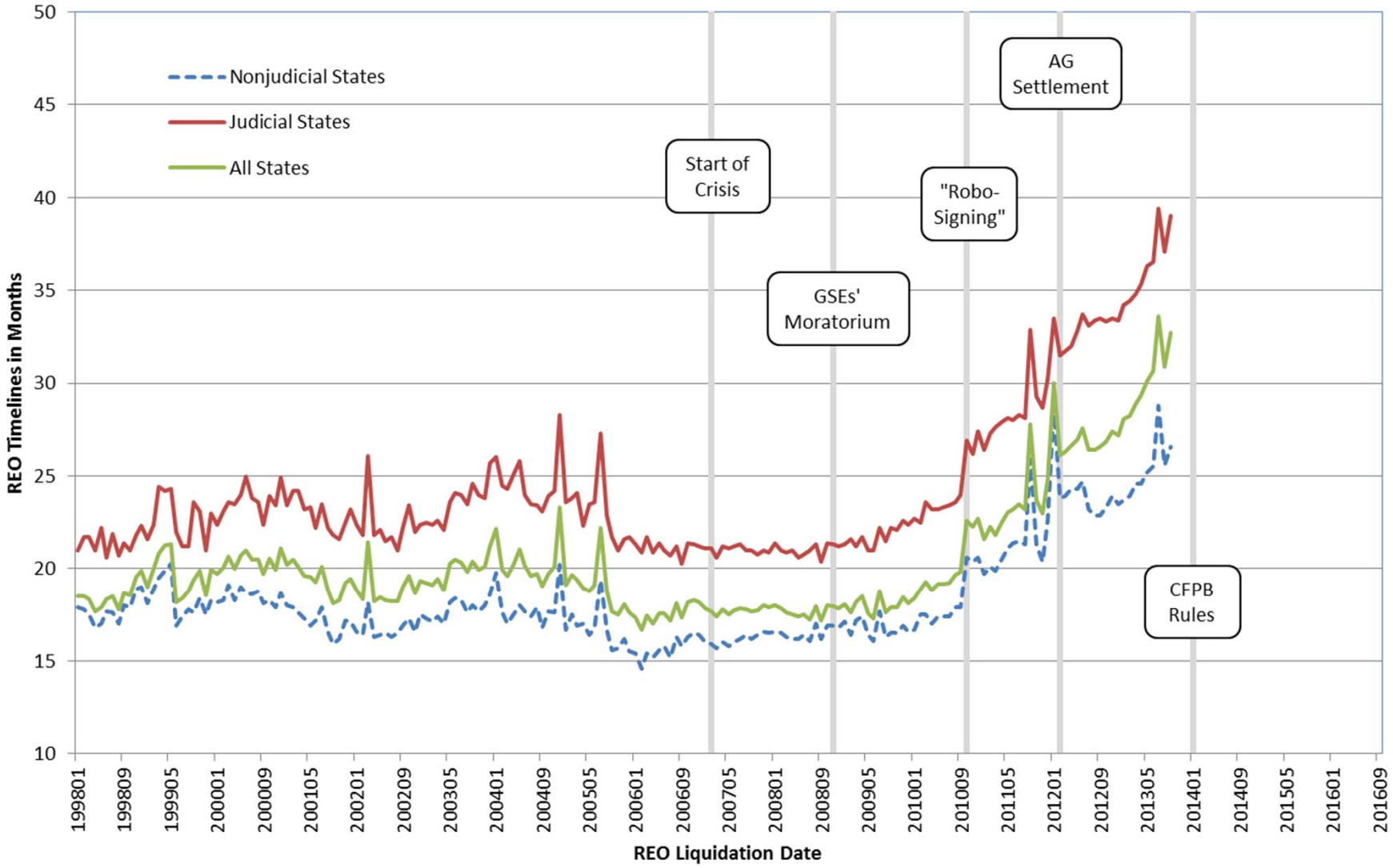

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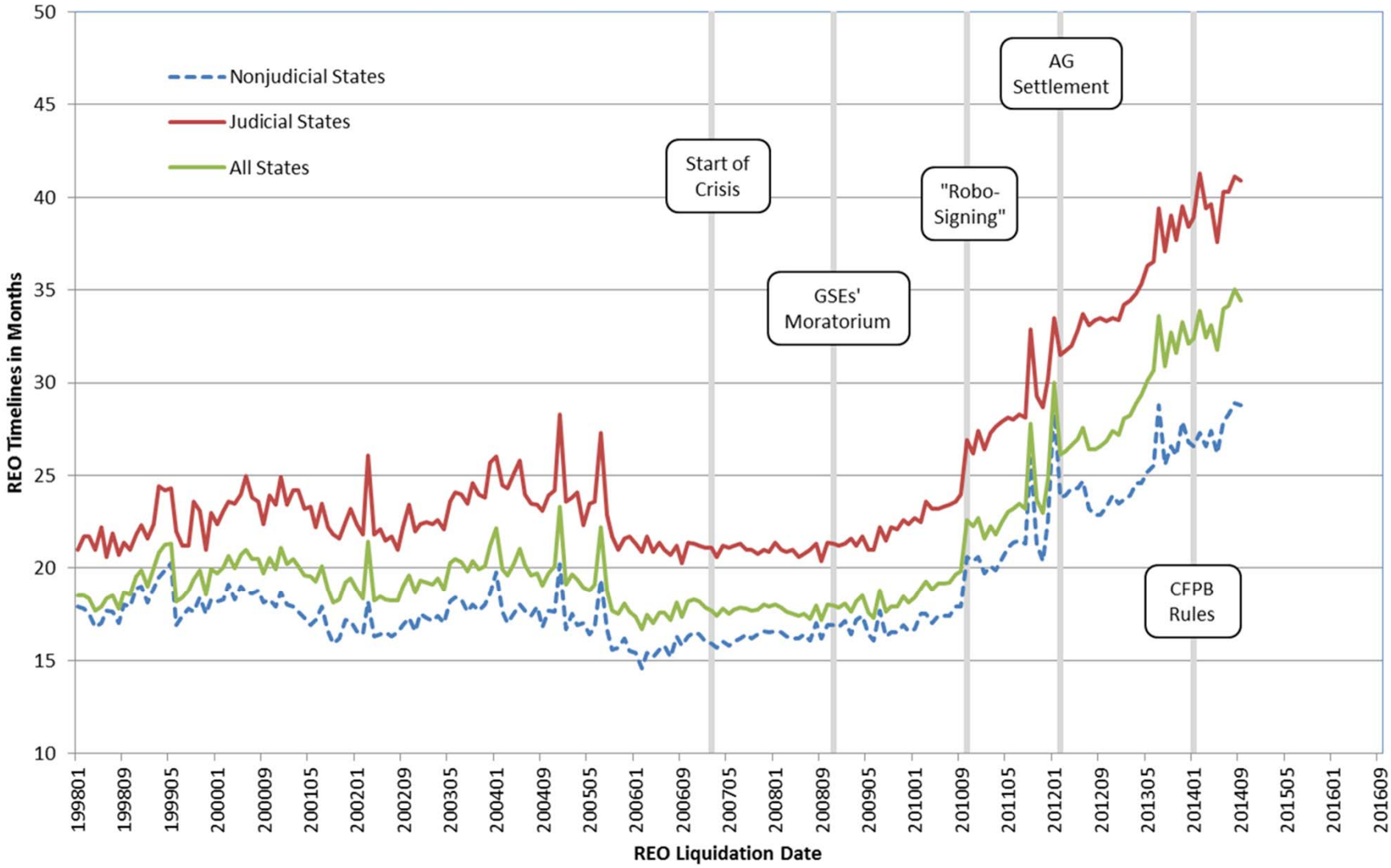

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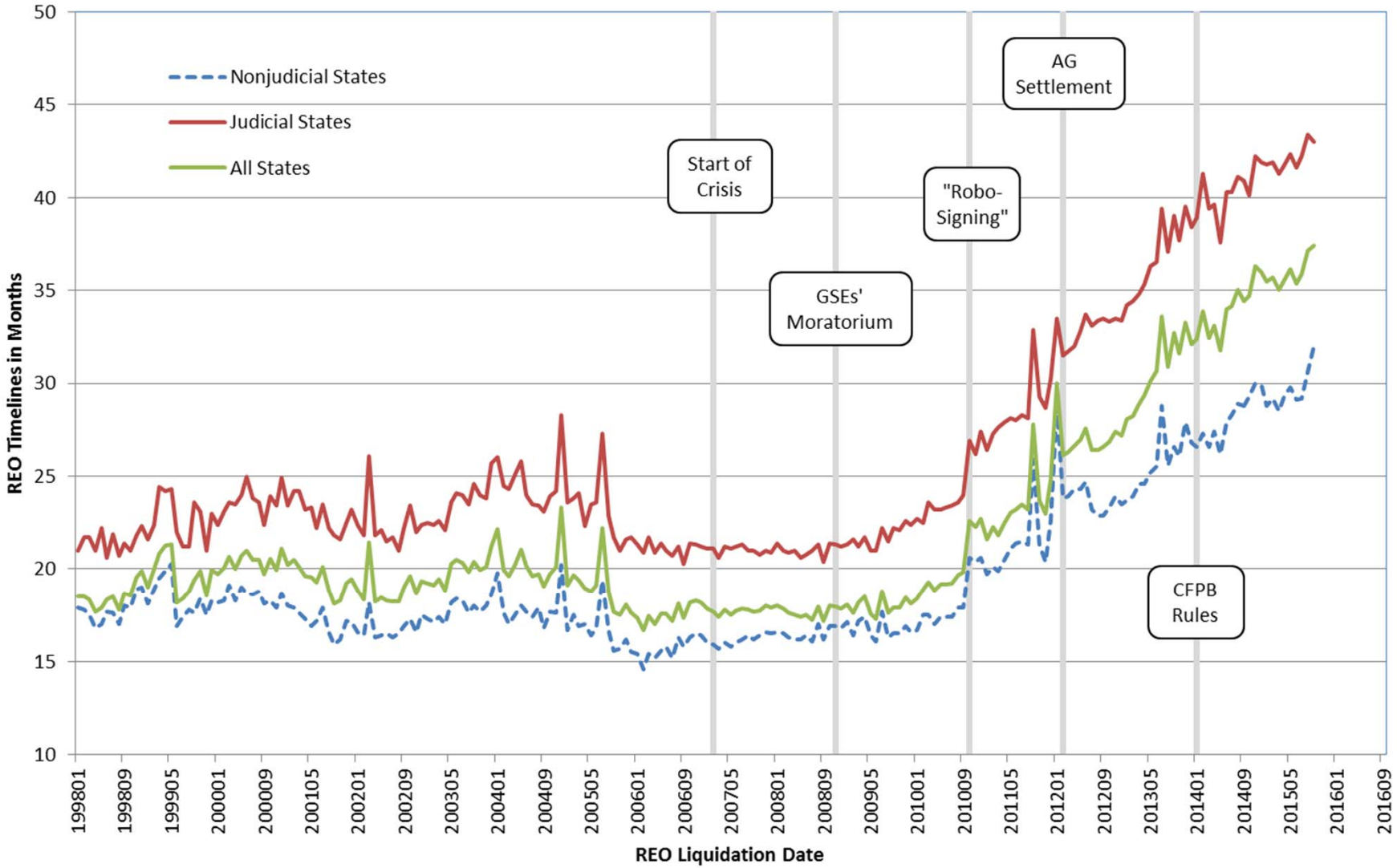

Source: Cordell et al. (2015), based on McDash Analytics data

Motivation (cont'd)

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- Recent changes in the servicing industry had profound impacts on foreclosure timelines.
  - What does this imply to loss severities?
- Release of the GSE loan-level data provides an opportunity for us to deep dive into the question.
  - Loan-level data with detailed loss information
  - Data encompass the full boom, bust and recovery periods surrounding the financial crisis

Existing Literature

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- $EL = PD \cdot LGD$
- Tons of published papers on *PD*, very few on *LGD*
  - Lekkas, Guigley and Van Order (1993); Crowford and Rosenblatt (1995); Berkovec, Canner, Gabriel and Hannan (1998); Pennington-Cross (2003); Calem and LaCour-Little (2004); Capozza and Thomson (2005); and, Qi and Yang (2009); Goodman and Zhu (2015)
  - Lack of data is a major reason—until now!

Roadmap

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- Default process and loss formation
- Data
- Rise in loss severities
- Regime shift
  - Loss severity regression results
  - Diff-in-diff results
- The new world of loss severities
- Conclusions and discussion

Default Process

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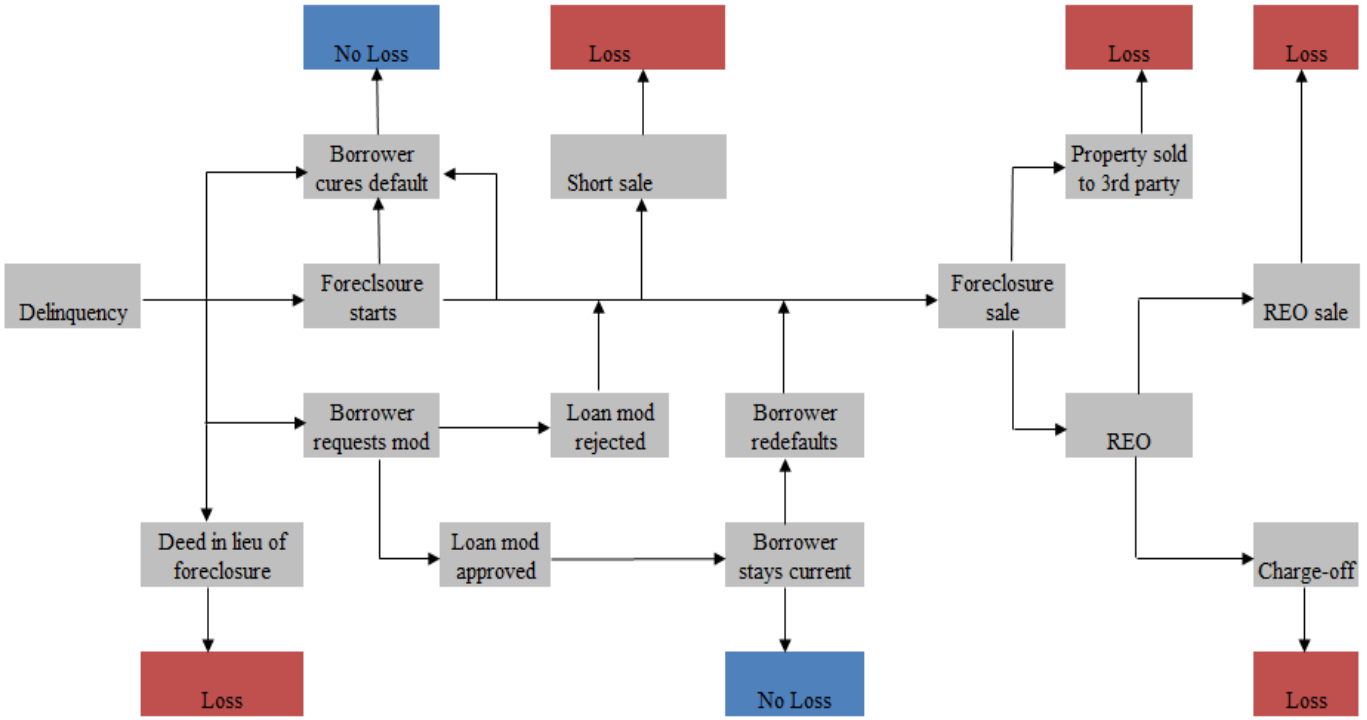

Data

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- Freddie Mac Single-Family Loan-Level Dataset
  - Full doc FRM loans originated since 1999
  - 339,217 loans liquidated during 2000-2015, about 2% of the acquisition sample
  - Loss information: liquidation date, the type of liquidation, default unpaid principle balance (UPB), liquidation expenses, net sale proceeds, mortgage insurance (MI) recoveries and non-MI recoveries.
  - Loan information: loan characteristics and performance history

Data (cont'd)

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- Supplemental data
  - Freddie Mac funding costs in SNL
  - CoreLogic zip code-level HPI
  - McDash loan performance (for zip code-level SDQ rate calculation)
  - BLS county-level unemployment rates
  - Servicer merger & acquisition information from various sources

Data (cont'd)

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- Loss severity break down

Variable	Mean	Std Dev	P1	Q1	Median	Q3	P99
Loss severity	0.424	0.317	-0.125	0.173	0.412	0.642	1.215
Net sale proceeds	0.596	0.287	0.000	0.398	0.603	0.800	1.255
Liquidations expenses	0.118	0.097	0.001	0.048	0.095	0.162	0.479
Carrying costs	0.044	0.024	0.009	0.028	0.037	0.052	0.498
Mortgage insurance (MI) recoveries	0.081	0.130	0.000	0.000	0.000	0.178	0.397
for loans with MI	*0.215*	*0.128*	*0.000*	*0.128*	*0.267*	*0.317*	*0.397*
Non-MI recoveries	0.034	0.086	0.000	0.003	0.009	0.019	0.379
Number of loans				339,217			

$$\text{severity} = \frac{Losses - recoveries}{UPB}$$

$$= \frac{UPB + carrying\ costs + expenses - sales - MIrecov - nonMIrecov}{UPB}$$

Loss Severity Trends

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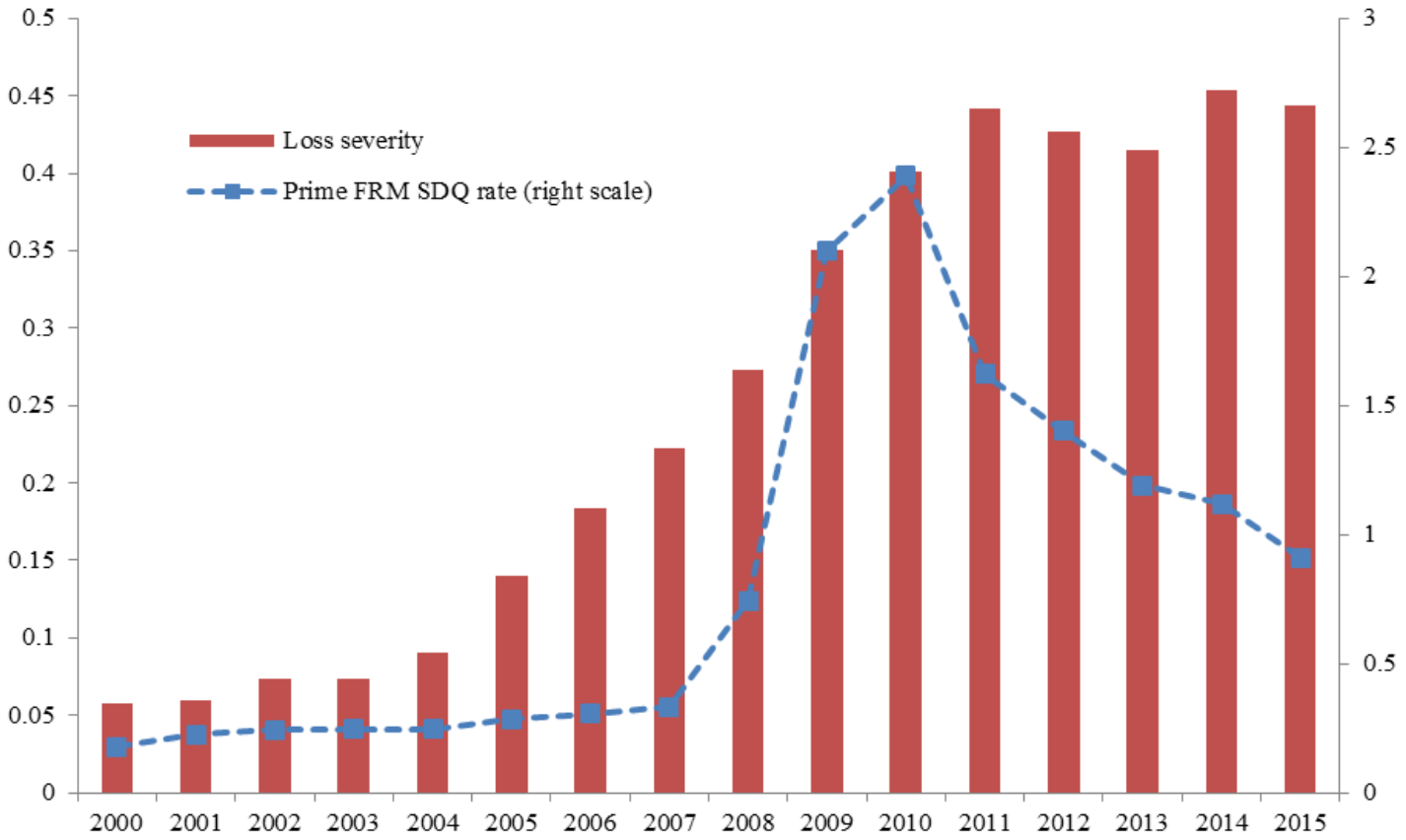

Loss Severity Trends (cont'd)

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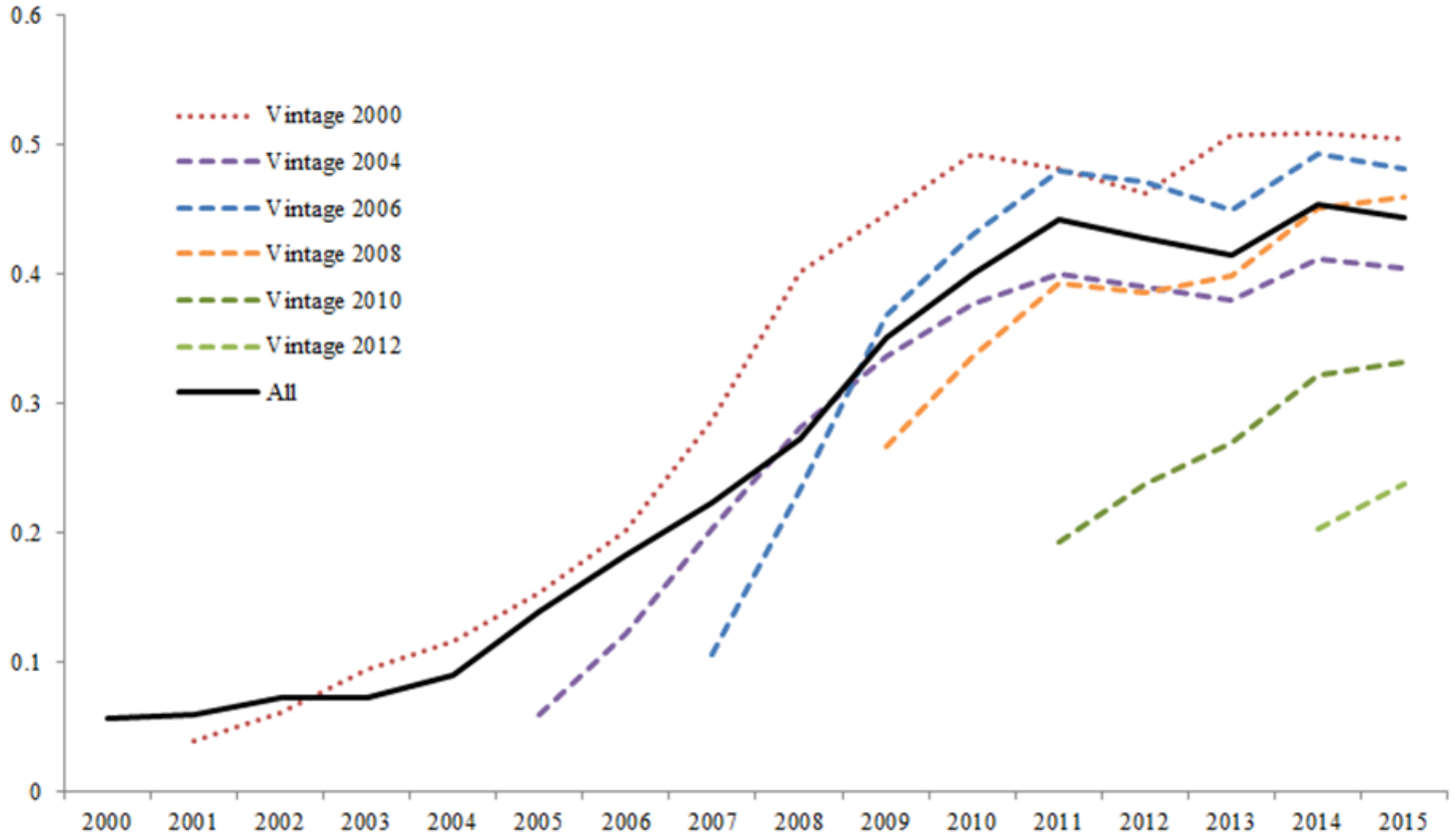
- Loss severity by vintage



Loss Severity Trends (cont'd)

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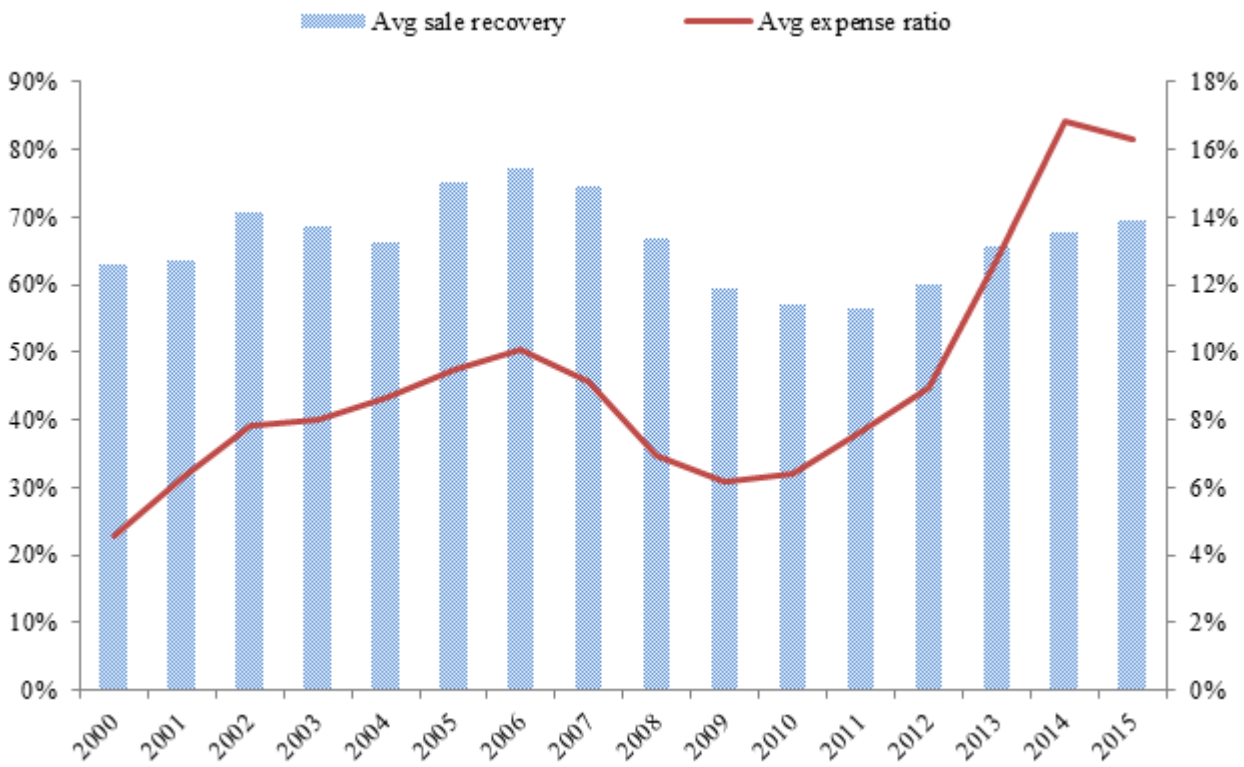
- Loss severity components



Loss Severity Regression

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- A simple linear model on loss severity rates:

$$y_i = \alpha + X_{it}\beta + Z_i\gamma + \varepsilon_{i,j}$$

  - y_i: loss severity rate
  - X_{it}: a vector of factors that are related to time including the equity position of the property, housing market conditions at the time of property disposal and liquidation timeline
  - Z_i: non-time-varying factors including the legal environment and various borrower and property characteristics
  - $\varepsilon_{i,j}$: clustered error term
  - Weighted least square to account for potential heteroskedasticity (reciprocal of default UPB as weight)

Severity Regression Results

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	Full sample		Loans without MI	
	Model 1	Model 2	Model 1	Model 2
Contemporaneous LTV spline function				
<=100%	0.5148***	0.5253***	0.6166***	0.6232***
	(0.0215)	(0.0206)	(0.0333)	(0.0337)
>100%	0.5029***	0.5083***	0.5954***	0.5991***
	(0.0174)	(0.0168)	(0.0260)	(0.0267)
Zip code-level SDQ rate	1.6627**	1.6345***	1.3190**	1.3214**
	(0.6390)	(0.6003)	(0.5714)	(0.5374)
State-level foreclosure pipeline volume	1.2920***	1.6012***	1.1849***	1.5880***
	(0.2970)	(0.2738)	(0.3117)	(0.2742)
Liquidation timeline spline function				
<=6 months		0.0061***		0.0053***
		(0.0009)		(0.0011)
6-36 months		0.0067***		0.0063***
		(0.0004)		(0.0004)
>36 months		0.0059***		0.0055***
		(0.0003)		(0.0003)
Liquidated during 2009-2012	0.0503***	0.0043	0.0510***	0.0008
	(0.0158)	(0.0118)	(0.0184)	(0.0132)
Liquidated during 2012-2014	0.1173***	0.0381***	0.1087***	0.0283**
	(0.0141)	(0.0099)	(0.0163)	(0.0114)
Liquidated after 2014	0.2205***	0.1191***	0.2086***	0.1080***
	(0.0136)	(0.0117)	(0.0148)	(0.0135)
Loan seasoning	Y	Y	Y	Y
Loan characteristics	Y	Y	Y	Y
Borrower FICO	Y	Y	Y	Y
Liquidation type (REO vs. non-REO)	Y	Y	Y	Y
Loan vintage-fixed effect	Y	Y	Y	Y
State × servicer-fixed effects	Y	Y	Y	Y

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Loan seasoning	Y	Y	Y	Y
Loan characteristics	Y	Y	Y	Y
Borrower FICO	Y	Y	Y	Y
Liquidation type (REO vs. non-REO)	Y	Y	Y	Y
Loan vintage-fixed effect	Y	Y	Y	Y
State × servicer-fixed effects	Y	Y	Y	Y

Regime Shift

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- Post-crisis changes in the servicing industry
  - AG settlements
    - The National Mortgage Settlements, the Ocwen National Servicing Settlements, the National SunTrust Settlements
    - Cash compensations, plus compliance with over 300 servicing standards
  - CFPB new servicing rules
    - Give borrowers more “protection”, make servicers’ life much harder
    - Extend foreclosure timelines
    - Significant increase in compliance costs

Regime Shift (cont'd)

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- Increased costs in servicing loans in default
  - *"From 2008 to 2014, the cost of servicing performing loans increased 268 percent compared with 404 percent for non-performing loans." The number of loans a single employee can service has fallen from 1,638 in 2008 to 706 in 2014.*

    MBA and Urban Institute
  - *"We do not want to be in the business of foreclosure because it is exceedingly painful for our customers, and it is difficult, costly and painful to us and our reputation."*

    Jamie Dimon, CEO of JPMorgan
    in 2015 *Annual Report to Shareholders*

Regime Shift (cont'd)

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- Difference-in-differences test

$$y = \alpha + \beta_1 T + \beta_2 P + \beta_3 T \cdot P + W\gamma + \varepsilon$$

  - Treatment group and control group
  - β_1 captures the generic difference between the treatment and the control group
  - β_2 captures the time trend
  - β_3 captures the impact of policy change

Regime Shift (cont'd)

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- Foreclosure timelines diff-in-diff test

Owner-occupied property loans as treatment group

	National Mortgage Settlement	CFPB servicing rules
Owner	-0.008	-0.028
	(0.014)	(0.016)
Post-event	0.278***	0.336***
	(0.030)	(0.030)
Owner × Post-event	0.264***	0.231***
	(0.030)	(0.030)
Control variables	Y	Y
State × servicer FE	Y	Y
Observations	37,423	55,928
-2LogL	72,744	61,320

Regime Shift (cont'd)

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- Foreclosure timelines diff-in-diff test (cont'd)

Loans serviced by the Big 5 servicers as treatment group

	National Mortgage Settlement	CFPB servicing rules
Big 5 servicer	-0.379***	0.143***
	(0.010)	(0.011)
Post-event	0.041**	0.625***
	(0.014)	(0.015)
Big 5 servicer × Post-event	0.136***	-0.118***
	(0.020)	(0.018)
Control variables	Y	Y
State × servicer FE	Y	Y
Observations	87,130	51,485
-2LogL	185,136	54,609

Regime Shift (cont'd)

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- Loss severity diff-in-diff test

Owner-occupied property loans as treatment group

	National Mortgage Settlement	CFPB servicing rules
Owner	-0.128***	-0.093***
	(0.008)	(0.008)
Post-event	0.057***	0.078***
	(0.013)	(0.020)
Owner × Post-event	0.034***	0.014*
	(0.012)	(0.008)
Control variables	Y	Y
State × servicer FE	Y	Y
Observations	12,923	11,273
Adjusted R-squared	0.523	0.518

Regime Shift (cont'd)

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- Loss severity diff-in-diff test (cont'd)

Loans serviced by the Big 5 Servicers as treatment group

	National Mortgage Settlement	CFPB servicing rules
Big 5 servicers	0.030***	0.017***
	(0.005)	(0.005)
Post-event	0.084***	0.102***
	(0.007)	(0.014)
Big 5 servicers × Post-event	0.009	-0.028**
	(0.008)	(0.013)
Control variables	Y	Y
State × servicer FE	Y	Y
Observations	13,914	21,095
Adjusted R-squared	0.478	0.532

Regime Shift (*cont'd*)

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- Recap on what the new regime looks like
  - Prolonged liquidation timelines
  - Increased fixed liquidation expenses

Regime Shift (cont'd)

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- A direct assessment of the impact of servicing policy changes

	Full Sample	Loans without MI
Loans affected by the robo-signing scandal	0.019***	0.010***
	(0.001)	(0.001)
Loans affected by the NMS	0.027***	0.022***
	(0.002)	(0.002)
Loans affected by the CFPB servicing rules	0.072***	0.067***
	(0.002)	(0.002)
Contemporaneous LTV	Y	Y
Zip code–level SDQ rate	Y	Y
State-level foreclosure pipeline volume	Y	Y
Liquidation timeline spline function	Y	Y
Loan seasoning	Y	Y
Loan characteristics	Y	Y
Borrower FICO	Y	Y
Liquidation type (REO vs. non-REO)	Y	Y
Loan vintage-fixed effect	Y	Y
State × servicer-fixed effects	Y	Y
Number of observations	302,163	195,328
Adjusted R-squared	0.556	0.532

The New World

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- A rough estimate of severities in the new regime
  - For loans that fell into SDQ after 2014M1 and have either been liquidated or are still in SDQ, the average liquidation timelines are estimated to be 31 months in non-judicial states and 38 months in judicial states.
  - Increases in loss severity rates resulting from these timeline increases (comparing to pre-crisis):11 percentage points in non-judicial states and 14 percentage points in judicial states.
  - We add an additional seven percentage points of non-timeline related losses due to the CFPB rules.
  - As a result, expected average loss severity rates are around 27% in non-judicial states and 37% in judicial states going forward.

Conclusions

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- The rise of loss severities from the early 2000s to the crisis period is astonishing.
  - A tripling of loss severities on Freddie Mac's traditional business clearly played a role in bringing it down.
- The persistently high loss severities post-crisis reflect a regime shift.
  - High loss severities could be the "new norm".

Implications

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- High loss severities could affect (have affected) mortgage availability
  - $EL = PD \cdot LGD$. Given high LGD, what could you do to bring down EL?
  - The rise of “squeaky clean” loans
- Losses can be under-estimated by not considering regime shifts.
  - Statistical models can fail if they do not incorporate specific institutional settings and structural breaks in models (Rajan, Seru, and Vig, 2015)
- Are the CRT bonds priced correctly?
  - The current expectation is 25 bps of losses

Appendix

Data

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- Data sample

Year of Origination	N	%
1999	9,412	2.8
2000	8,021	2.4
2001	21,412	6.3
2002	25,111	7.4
2003	30,308	8.9
2004	28,170	8.3
2005	56,563	16.7
2006	56,751	16.7
2007	63,985	18.9
2008	31,109	9.2
2009	6,130	1.8
2010	1,517	0.5
2011	452	0.1
2012	198	0.1
2013	78	0.0
2014	–	–
2015	–	–
Total	339,217	100

Year of liquidation	N	%
1999	–	–
2000	114	0.0
2001	1,059	0.3
2002	3,027	0.9
2003	6,378	1.9
2004	8,873	2.6
2005	9,129	2.7
2006	8,146	2.4
2007	8,465	2.5
2008	12,984	3.8
2009	25,055	7.4
2010	44,423	13.1
2011	53,956	15.9
2012	57,358	16.9
2013	42,767	12.6
2014	35,902	10.6
2015	21,581	6.4
Total	339,217	100

Timeline Model

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- An accelerated failure time model

$$\log(T) = \alpha + \sum(x_i \beta_i) + \sigma \cdot \epsilon$$

		Judicial	Non-judicial
Default timing			
	After Jan. 2014	1.147***	1.580***
		(0.011)	(0.011)
	Oct. 2012 - Jan. 2014	1.073***	1.484***
		(0.009)	(0.01)
	Sept. 2010 - Oct. 2012	1.024***	1.312***
		(0.008)	(0.009)
	Nov. 2008 - Aug. 2010	0.809***	1.207***
		(0.009)	(0.01)
	Feb. 2007 - Oct. 2008	0.594***	1.059***
		(0.009)	(0.011)
Contemporaneous LTV		Y	Y
State-level foreclosure pipeline volume		Y	Y
Previous 12-month HPA		Y	Y
Deficiency judgment		Y	Y
Redemption state		Y	Y
Loan characteristics		Y	Y
Borrower FICO		Y	Y
Intercept		Y	Y
Scale		Y	Y
Number of observations		225,244	285,291
-2LogL		439,341	676,186

Timeline Update

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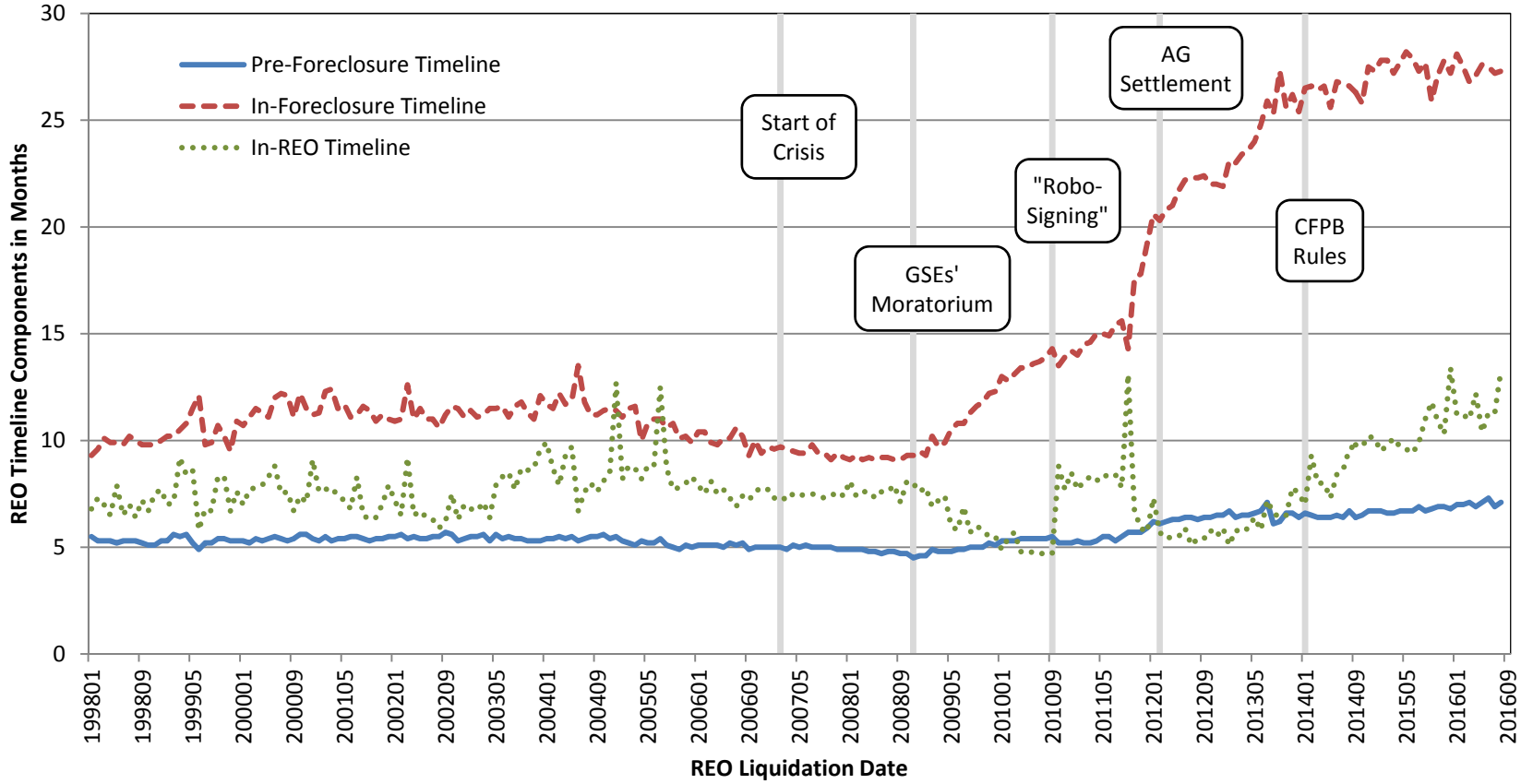
- With more recent data…



Out-of-sample Tests

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- Out-of-Sample Prediction Error

	Without incorporating regime shift		Incorporating regime shift	
	Prediction error	% prediction error	Prediction error	% prediction error
2012	0.004	1%	0.016	3%
2013	-0.016	-3%	0.002	0%
2014	-0.081	-16%	-0.027	-5%
2015	-0.109	-23%	-0.026	-6%

Notes: We use loans liquidated before 2011 to estimate the model and then predict loss severity rates of loans liquidated after 2011. Prediction error is calculated as predicted value minus actual value, therefore a negative prediction error indicates under-prediction by the model (with and without regime shift factors, see Table 7 for the one with regime shift factors). We limit loans to be those originated before 2010 without mortgage insurance.

Fannie Mae Monthly Summary

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- March 2017

TABLE 8. SERIOUS DELINQUENCY RATES

	Conventional Single-Family[5]				Multifamily
		Credit Enhanced			
	Non-Credit Enhanced	Primary MI and Other[6]	Credit Risk Transfer[7]	Total	Total[8]
March 2016	1.39%	2.39%	0.10%	1.44%	0.06%
April 2016	1.36%	2.29%	0.10%	1.40%	0.05%
May 2016	1.33%	2.23%	0.11%	1.38%	0.05%
June 2016	1.28%	2.17%	0.10%	1.32%	0.07%
July 2016	1.26%	2.14%	0.11%	1.30%	0.08%
August 2016	1.19%	2.27%	0.12%	1.24%	0.07%
September 2016	1.20%	2.19%	0.12%	1.24%	0.07%
October 2016	1.17%	2.21%	0.14%	1.21%	0.06%
November 2016	1.19%	2.21%	0.15%	1.23%	0.06%
December 2016	1.16%	2.18%	0.17%	1.20%	0.05%
January 2017	1.17%	2.14%	0.17%	1.20%	0.05%
February 2017	1.17%	2.09%	0.17%	1.19%	0.05%
March 2017	1.12%	1.95%	0.16%	1.12%	0.05%