Mortgage Stress without Government Guarantees. Lessons from Hurricanes and the Credit Risk Transfers.

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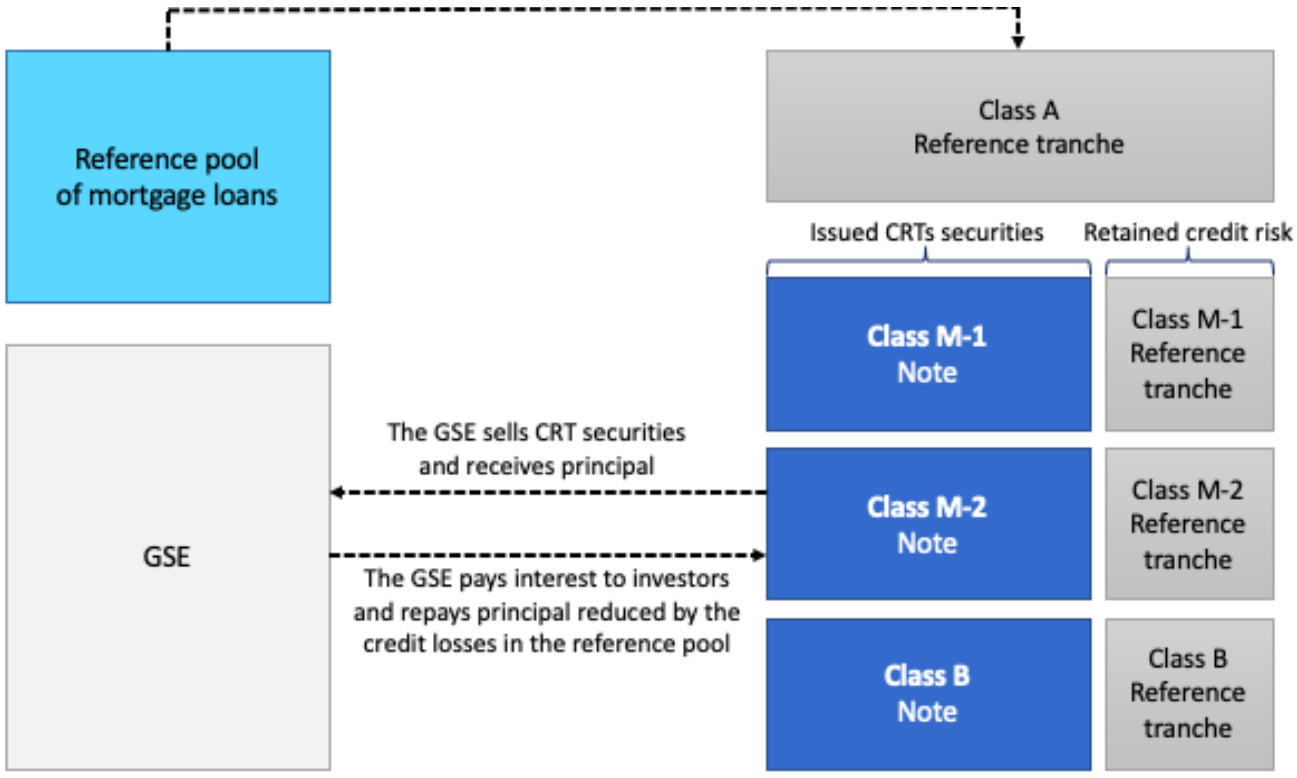
Goals:

- What would be the price of mortgage credit risk without the GSEs?
- How would markets price credit risk from natural disasters?

Credit Risk Transfers (CRTs)



- From July 2013 to June 2017, the GSEs, using CRTs, transferred risk on $1.3 trillion of mortgage loans

Strategy, Step 1:

- Hand-collected a unique database of CRTs by combining information from different sources
- Exploit heterogeneity in CRT exposure to unpredictable exogenous local shock that alters credit risk
  - Hurricanes Harvey and Irma in 2017 are such shock

Strategy, Step 1 continued:

- CRTs differ in
  - seniority of tranches
  - loan-to-value (LTV)
  - geographical composition of reference pool
- Study effects of hurricanes in spreads of CRTs traded in secondary market
  - Control for liquidity, time to maturity and many other factors

Strategy, Step 2:

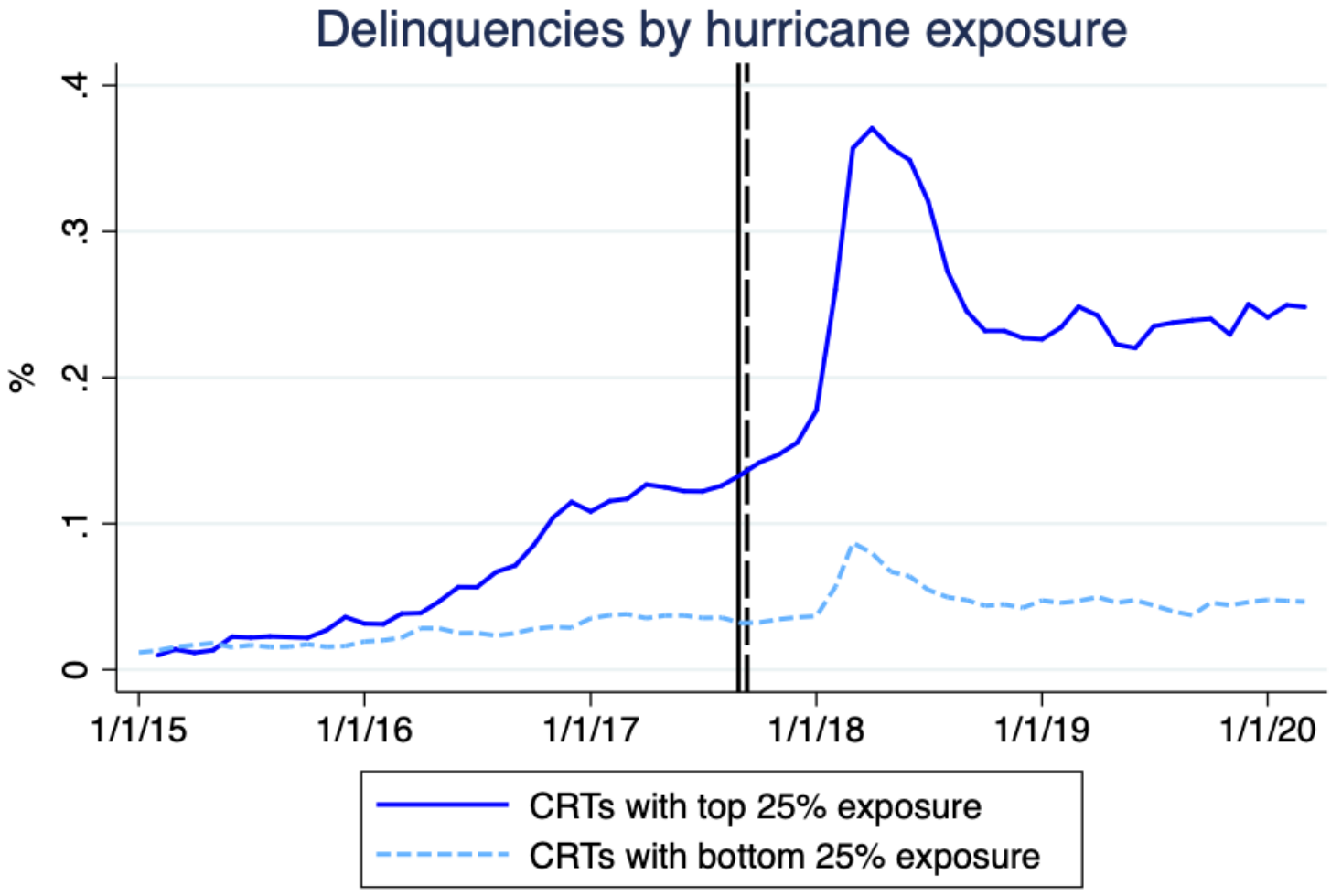
- Calibrate model of credit supply to match estimates from Step 1
- Run simulations and predict market-implied mortgage rates for crisis and non-crisis scenarios with no GSEs

Preview of Results

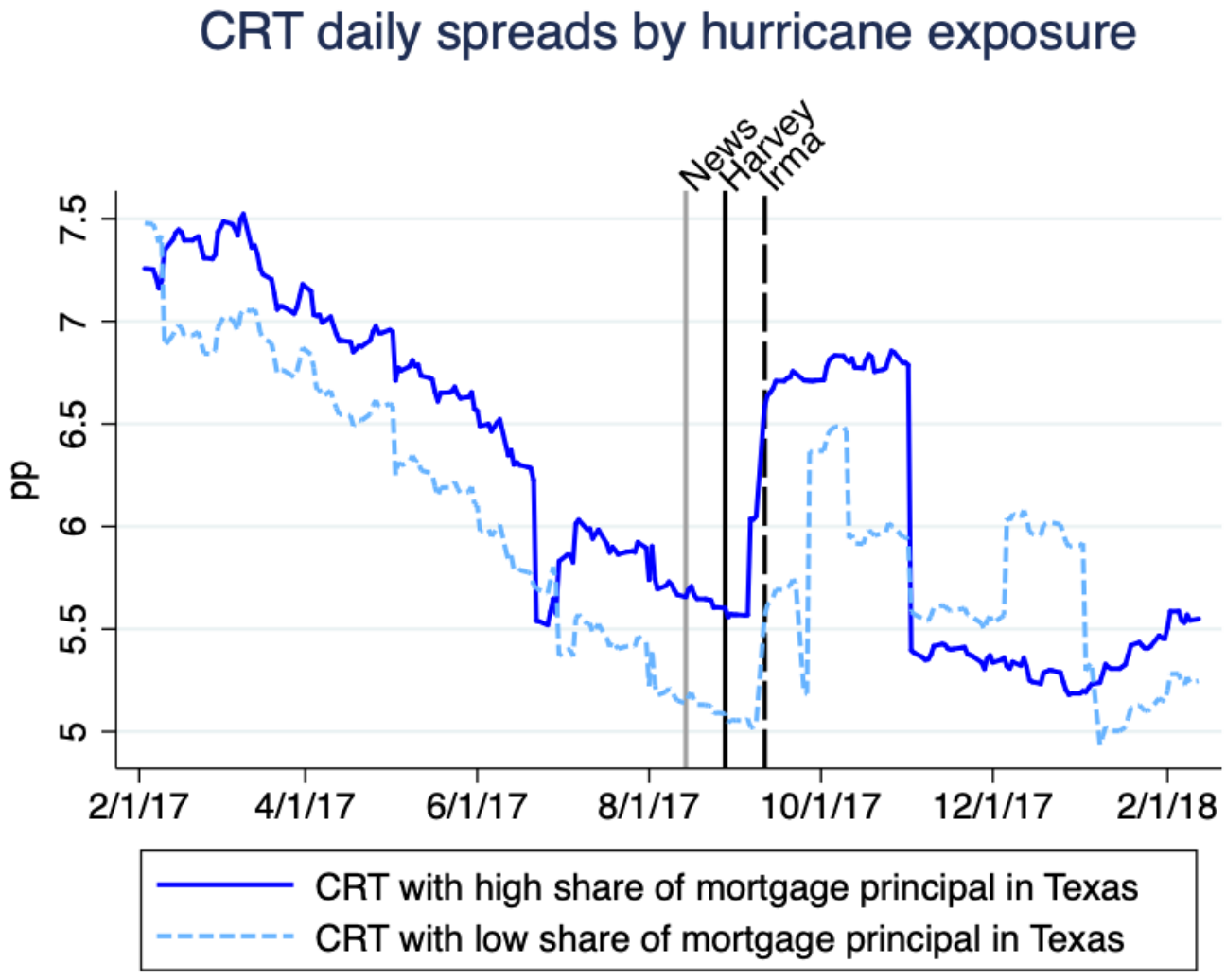
- Hurricanes increased spreads for the riskiest CRTs by 10% of the average spreads before the landfall. That is, by 0.73 percentage points

- During the Global Financial Crisis mortgage rates would have increased by 3.89 percentage points, that is, by 29% absent government guarantees and monetary policy interventions

CRTs heterogeneous in geographical exposure

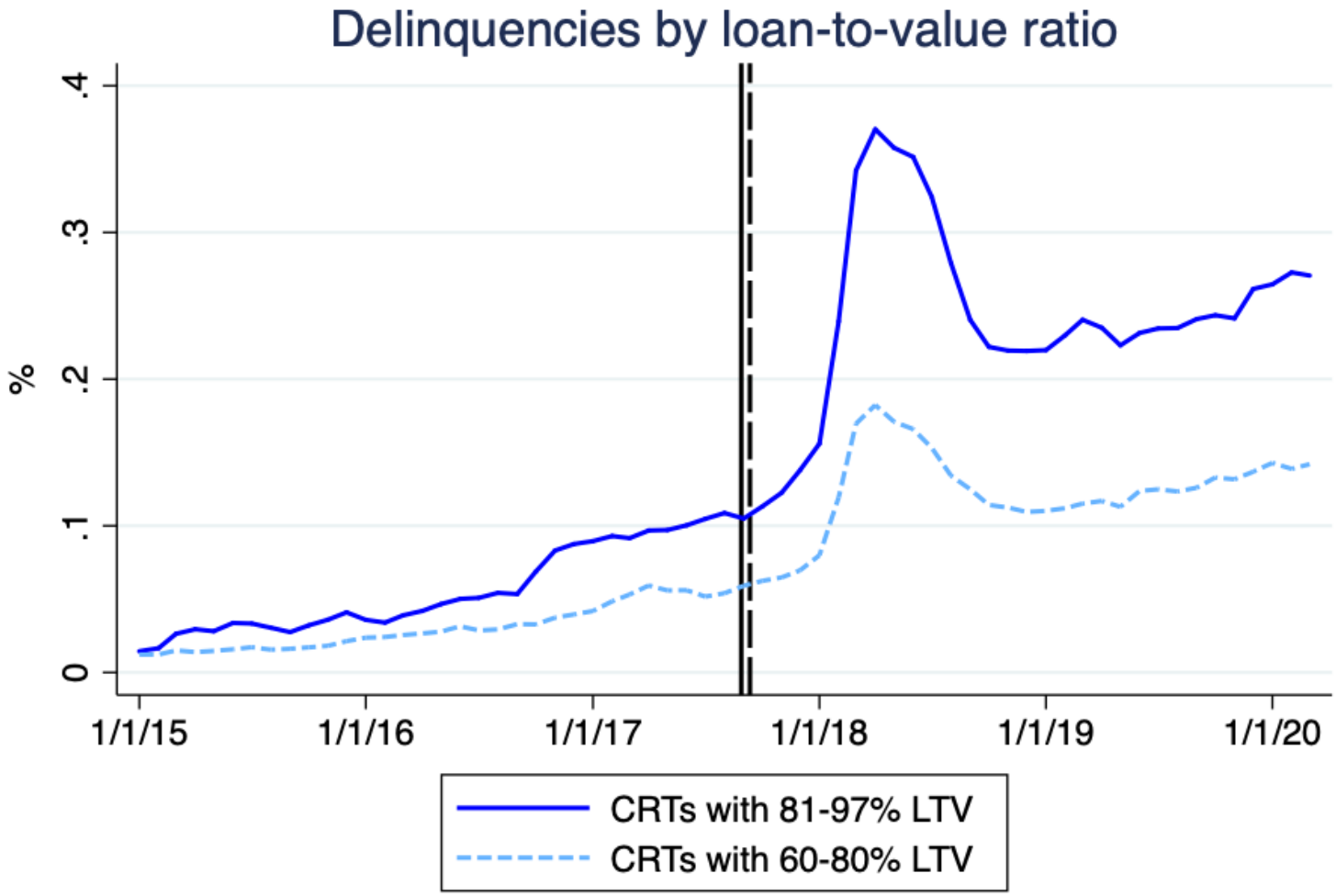


Average share of unpaid principal balance delinquent for more than 120 days. Vertical lines show the landfalls of Harvey and Irma.



Daily spread (yield to maturity - Libor) in the secondary market of CRTs.

CRTs heterogeneous in LTV



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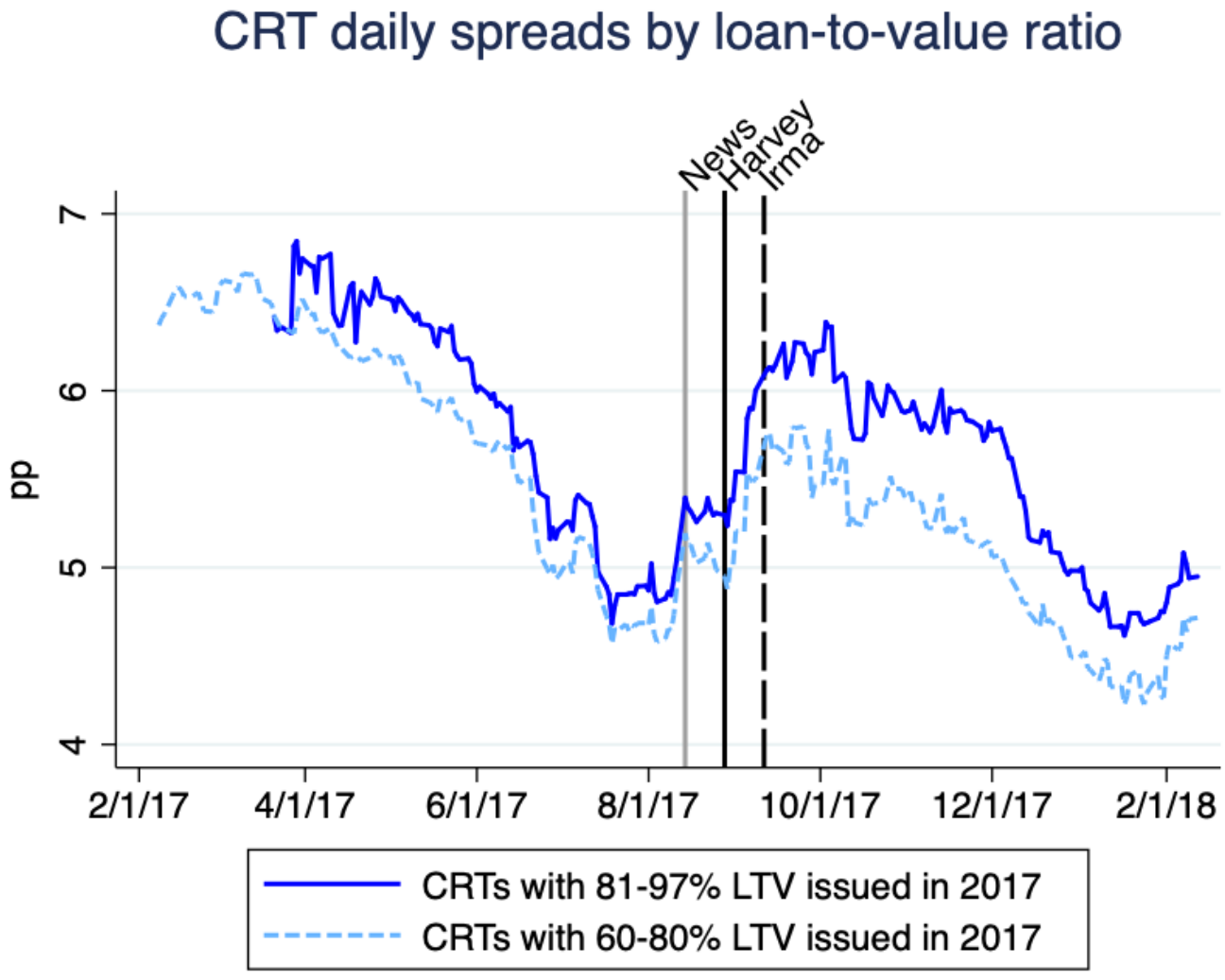
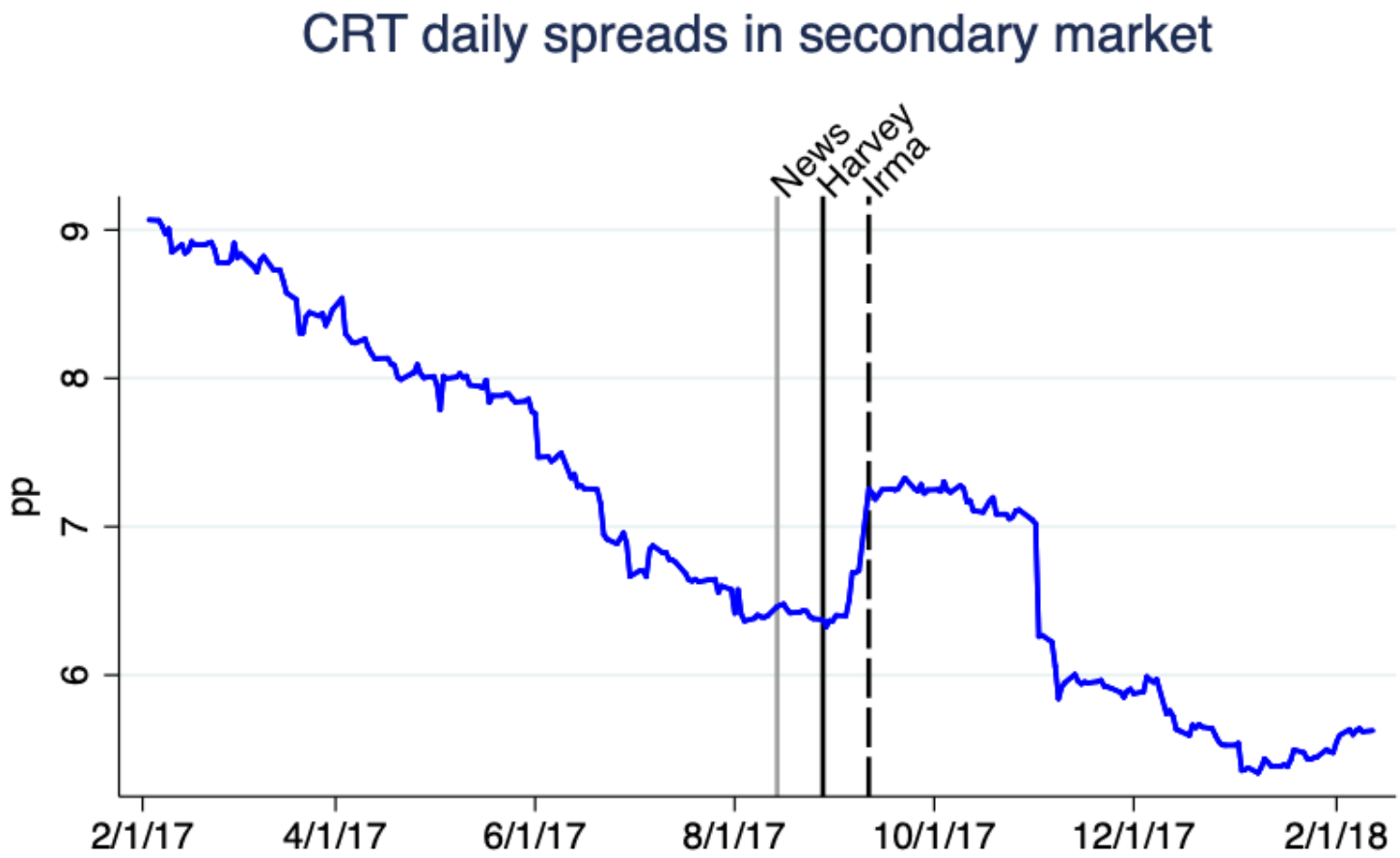


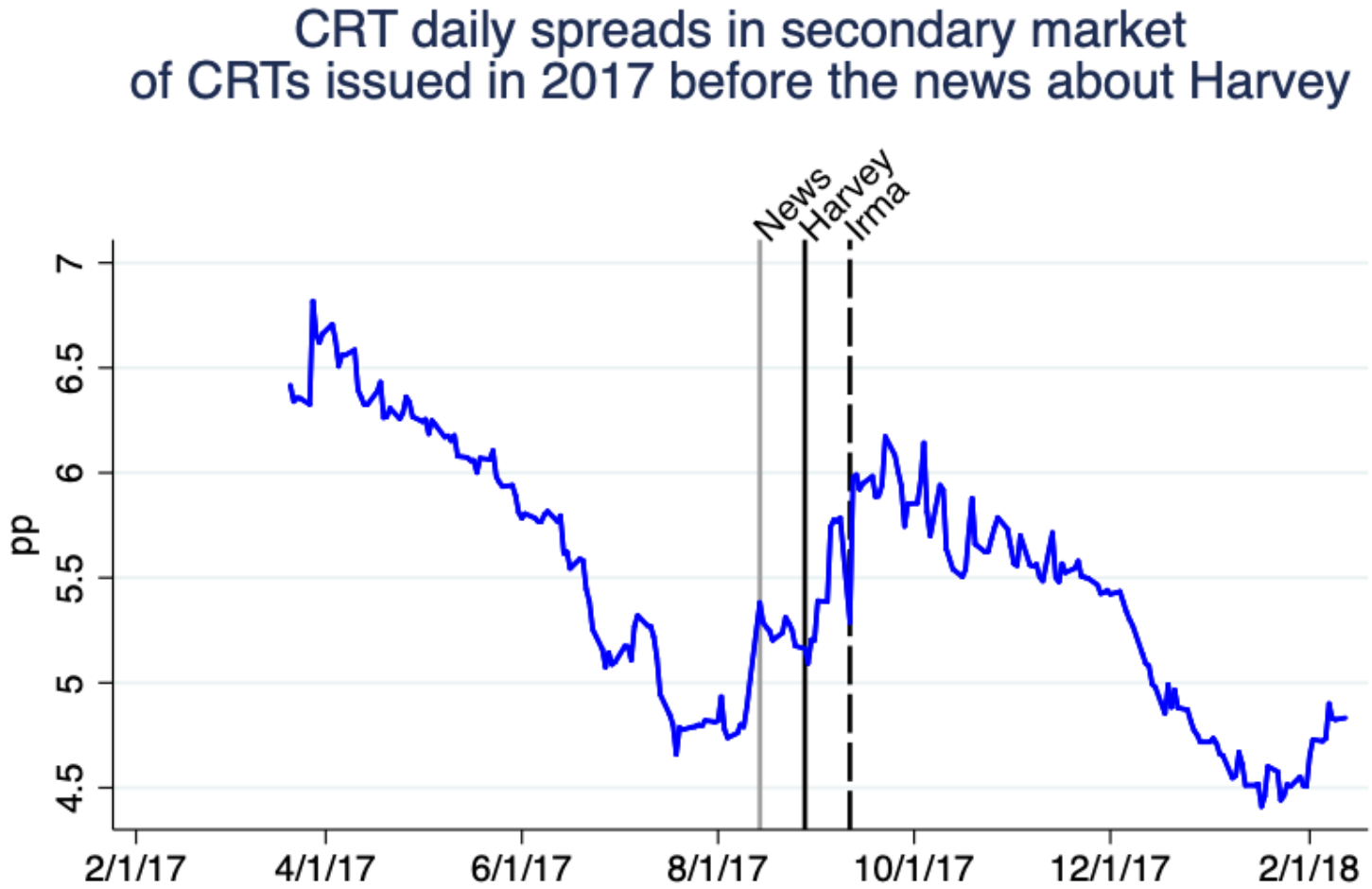
Daily spread (yield to maturity - Libor) in the secondary market of CRTs.

Overall CRT spreads



Daily spread (yield to maturity - Libor) in the secondary market of CRTs.

Recently issued CRTs



Daily spread (yield to maturity - Libor) in the secondary market of CRTs.

Specification Diff-in-Diff

$$S_{i,t} = \beta_0 + \beta_1 T_t + \beta_2 E_i + \beta_3 T_t E_i + C_i + D_t + u_{i,t}$$

- $S_{i,t}$: spread over one month U.S. Dollar Libor of CRT security i at day t
- T_t : 1 for t on and after the first trading day after the landfall in the U.S. coast of Hurricane Irma on September 11th 2017, zero otherwise
- E_i : geographical exposure to default: share of CRT unpaid principal balance of mortgages in the counties hit by Harvey and Irma
- C_i : controls as floater spread, dummy for Freddie, issuance year dummies; D_t : 10-year and 2-year treasury rates
- Separate estimations for junior versus mezzanine tranches, and for LTV ratios below versus above 80%

Junior Tranches React to Hurricanes

	Spread for Junior CRTs with LTV 81-97%					
Window (weeks)	±2	±3	±4	±5	±6	±7
Landfall × exposure	0.11***	0.09***	0.08***	0.07***	0.06***	0.05***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Hurricane landfall	0.04	0.07	0.14	0.20**	0.26***	0.30***
	(0.12)	(0.10)	(0.10)	(0.09)	(0.08)	(0.08)
Exposure	0.12***	0.12***	0.13***	0.13***	0.14***	0.15***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)
Observations	231	341	451	561	671	781
R-squared	0.834	0.82	0.80	0.78	0.77	0.75

Standard errors in parentheses. ***sig. at 1%; **sig. at 5%. Sample: Fannie Mae's and Freddie Mac's CRTs issued up to August 15th 2017.

	Spread for Junior CRTs with LTV 61-80%					
Window (weeks)	±2	±3	±4	±5	±6	±7
Landfall × exposure	0.07***	0.07***	0.07***	0.07***	0.07***	0.07***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Hurricane landfall	0.23***	0.18***	0.17***	0.17***	0.16***	0.17***
	(0.09)	(0.07)	(0.06)	(0.06)	(0.05)	(0.05)
Exposure	0.08***	0.07***	0.05***	0.05***	0.05***	0.06***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Observations	272	402	532	662	792	922
R-squared	0.90	0.90	0.90	0.90	0.89	0.88

Standard errors in parentheses. ***sig. at 1% level. Sample: Fannie Mae's and Freddie Mac's CRTs issued up to August 15th 2017.

Takeaway: Impact of hurricanes on CRT spreads

	Spread of Junior CRTs					
Window (weeks)	±2	±3	±4	±5	±6	±7
LTV 81-97%						
Change in CRT spread (pp)	0.73	0.68	0.66	0.67	0.66	0.64
LTV 61-80%						
Change in CRT spread (pp)	0.63	0.59	0.57	0.56	0.56	0.55
Change in 1 month Libor (pp)	0.001	0.01	0.01	0.01	0.14	0.14

- CRT spreads increase by 0.73 pp on average two weeks after the landfall, compared to two weeks before
- equivalent to 10% of the average level of spreads before the landfall

Credit Supply Model

- Lenders price mortgages to ensure costs equal expected revenue from the mortgage
- Mortgage supply equation comes from zero-profit condition:

$$(1 + r_t^d + r_t^w)L = (1 - \pi_t)(1 + r_t^m)L + \pi_t \gamma_t P_h$$

- r_t^d = lenders cost of funds (e.g. deposits or warehouse funding); r_t^w = origination costs per mortgage
- L = loan size; P_h = house value
- π_t = default probability; r_t^m = mortgage rate
- γ_t = recovery rate of collateral. Also proxies risk aversion.

- r_t^g is the market-implied guarantee fee:

$$r_t^g = r_t^m - r_t^d - r_t^w$$

That is, decompose mortgage rates into:

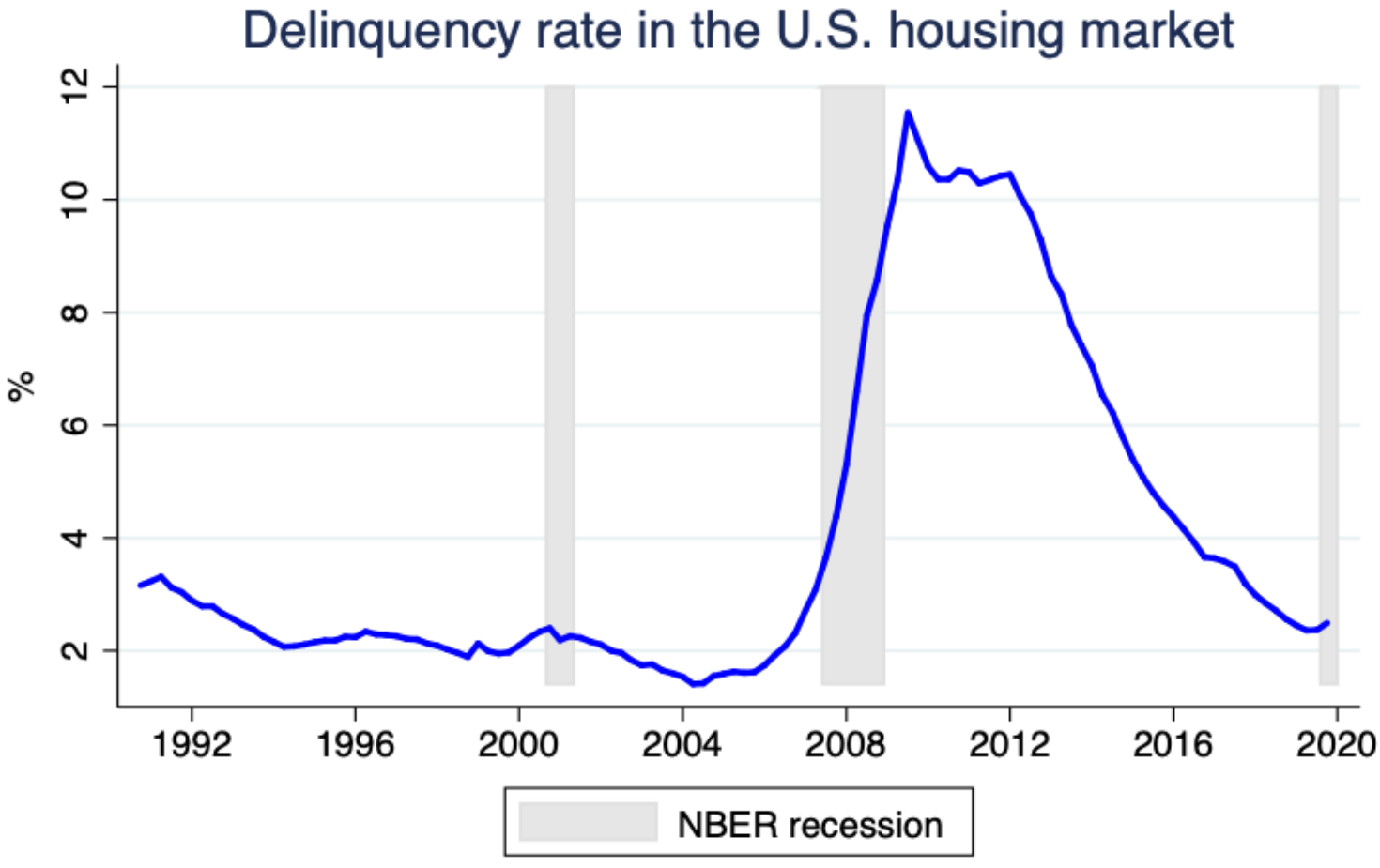
- compensation for credit risk
- cost of funds
- origination costs

Calibration

Exogenous parameters		
Parameter	Value	Description
$\frac{P_h}{L}$	1.215	Inverse of a 82.3% loan-to-value ratio
r_0^d	0.910%	Lender's cost of funds: 5y CD rate in July 2017
r_0^w	1.170%	Lender's origination cost in July 2017
r_0^m	8.442%	Avg mortgage rate 2 weeks before landfall
π_0	9.512%	Avg default probability 2 weeks before landfall
$\pi_1 - \pi_0$	1.456 pp	Change in default probability due to landfall

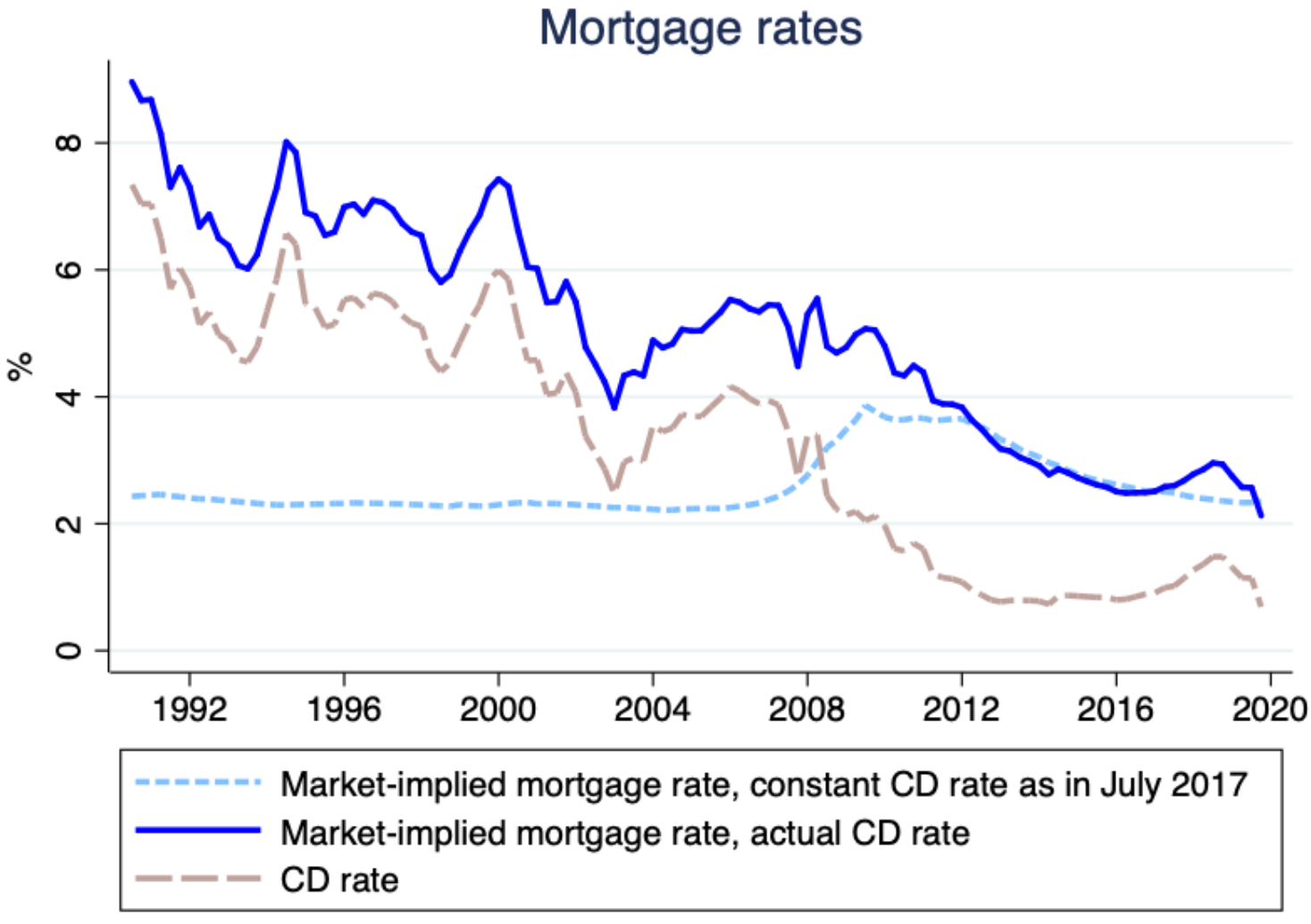
Targets		
$r_{m,1} - r_{m,0}$	0.728 pp	Change in rates from CRT estimates
$\frac{d\gamma}{d\pi} \mid_{\pi_0}$	-0.5	Avg slope of $\gamma_t = f(\pi_t) = 1 - a\pi_t^{b-1}$
Endogenous parameters		
a	0.551	Value of a in $\gamma_t = f(\pi_t) = 1 - a\pi_t^{b-1}$
b	0.113	Value of b in $\gamma_t = f(\pi_t) = 1 - a\pi_t^{b-1}$

Simulations: stress is exogenous change in default risk



Mortgage rates under stress without government guarantees

Initial level of		Change in		Description
default rate	mortgage rate	default rate	mortgage rate	
1.35%	4.74%	3.89 pp 288% ↑	1.38 pp 29% ↑	During Great Recession (2007-2011)
1.58%	2.55%	1.76 pp 114% ↑	0.55 pp 21% ↑	During Covid pandemic (second quarter 2020)


Mortgage rates
%
0
2
4
6
8
1992
1996
2000
2004
2008
2012
2016
2020
Market-implied mortgage rate, constant CD rate as in July 2017
Market-implied mortgage rate, actual CD rate
CD rate


Guarantee fees
%
0
.5
1
1.5
2
1992
1996
2000
2004
2008
2012
2016
2020
Market-implied g-fees
GSE admin g-fees

Conclusions

- Hurricanes significantly increased spreads for the riskiest CRTs by 10% of the average spreads before the landfall
- CRT investors are absorbing part of the risk of natural disasters due to climate change

- GSEs imply countercyclical policy:
  - strong subsidies to mortgage rates during mortgage stress episodes
  - Market-implied g-fees rise above actual levels in market stress scenarios
  - Rises in actual g-fees before COVID brought them above what market would price in good times

Appendix

Summary statistics: Securities in the sample

		Number of securities		
		Fannie Mae	Freddie Mac	All
Loan-to-Value Ratio	81-97%	27	45	72
	61-80%	42	49	91
Tranches	Junior	15	23	38
	Mezzanine	54	71	125
Issuance Year	2013	2	4	6
	2014	9	17	26
	2015	8	26	34
	2016	29	31	60
	2017	21	16	37
Total		69	94	163

The sample consists of the Fannie Mae's and Freddie Mac's CRT securities issued from July 23, 2013 to August 15, 2017.

Summary Statistics for Junior Tranches

	Mean	SD	Min	Max
LTV 81-97%				
Spread daily (pp)	7.519	0.790	5.645	9.004
Hurricane landfall dummy	0.524	0.501	0	1
Geographical exposure (%)	6.475	2.777	2.160	9.300
Floater spread (pp)	10.273	1.552	7.950	12.750
Issue by Freddie dummy	0.727	0.446	0	1
LTV 61-80%				
Spread daily (pp)	7.020	0.882	5.020	8.486
Hurricane landfall dummy	0.522	0.500	0	1
Geographical exposure (%)	5.474	2.777	2.170	9.600
Floater spread (pp)	10.249	1.366	7.550	12.250
Issue by Freddie dummy	0.614	0.488	0	1
Ten year treasury rate (%)	2.170	0.066	2.050	2.280
Two year treasury rate (%)	1.358	0.056	1.270	1.460

Data

- Time series of daily yields in the secondary market of CRTs and one month U.S. Dollar Libor benchmark from Thomson Reuters Eikon
- All CRT issuances: issuance date, original principal balance, floater spread, seniority tranches from Bloomberg
- Mortgages' features and performance in CRT reference pools, from the GSEs: LTV, geographical composition, and delinquencies
- Delinquency rates and guarantee-fees (g-fees) since 1991