Pricing Mortgage Stress – Lessons from Hurricanes and Credit Risk Transfer Securities

Authors:
Pedro Gete (IE Business School)
Athena Tsouderou (IE Business School)
Susan Wachter (Wharton)

Discussion:
Fabrice Tourre (Copenhagen Business School)

October 29, 2021

The paper in one slide

Motivation

- How do markets price mortgage credit risk related to natural disasters?
- How would mortgage rates behave absent credit insurance supplied by Fannie/Freddie?

What the paper does

- Study price behavior of CRT securities during hurricane Harvey and Irma via diff-in-diff analysis, exploiting CRTs' cross-sectional differences in exposure to hurricane-hit areas
- Build mortgage credit model
- Use calibrated model to quantify subsidy to hurricane-prone areas from uniform G-fees
- Use calibrated model to study time-series variation in hypothetical mortgage rates where credit risk is priced by private market

Mortgage Pricing Model

Framework (*at least my understanding of it*)

- Exponentially amortizing mortgage, floating rate (?)
- Exogenous short rate process, no prepayment option
- Exogenous default intensity (π_t) and loss-given-default (ℓ_t)
- Perfectly competitive, risk-neutral credit insurance sector
- Credit insurance premium (s_t)

When all processes are constant (*my calculations*), $s = \pi\ell$

From CRT Prices to Market-Implied Mortgage Credit Spreads

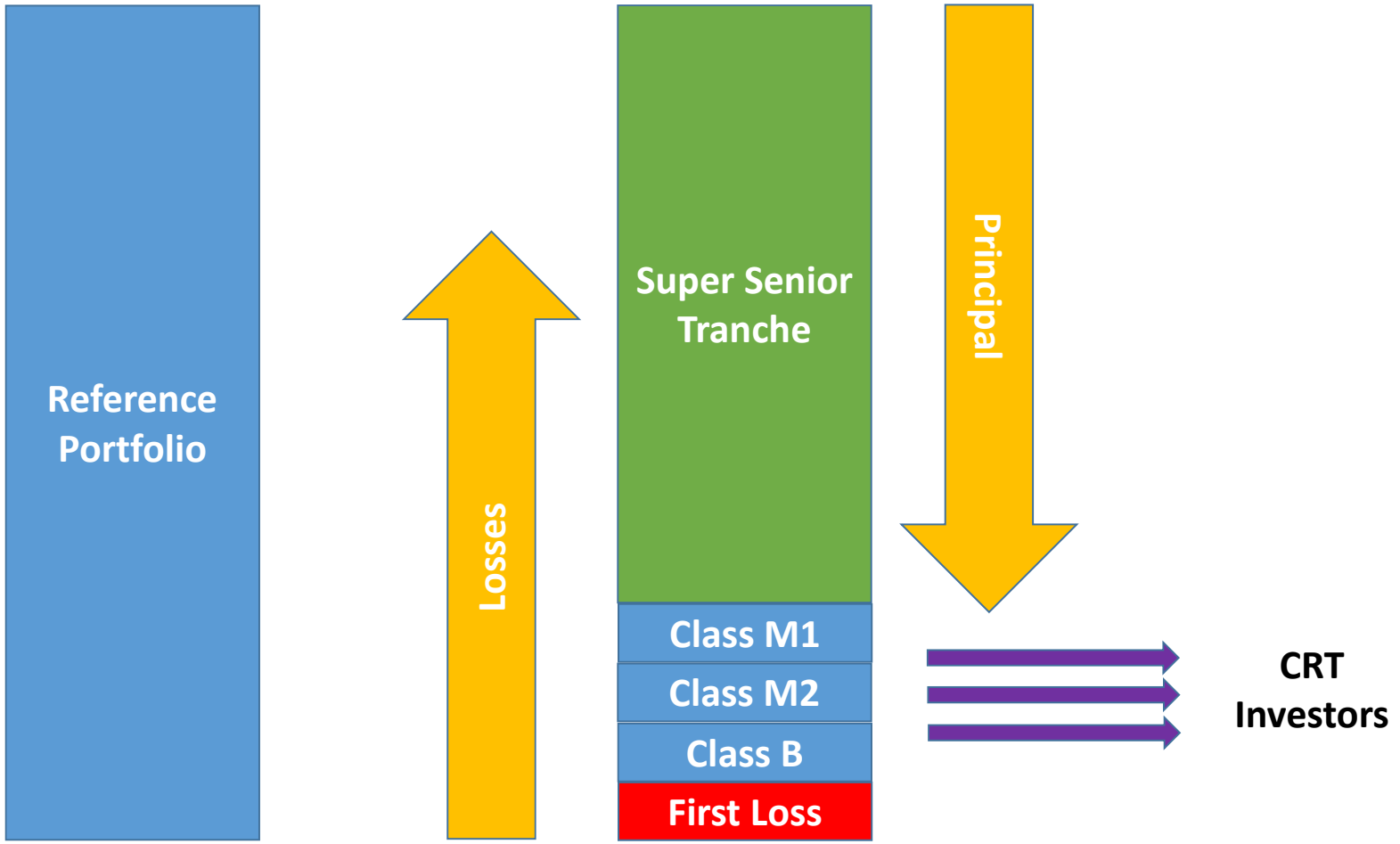
What this paper does

- Uses increase in (a) observed credit spreads of junior CRT tranches and (b) delinquencies due to hurricane realization;
- Uses the previous mortgage credit pricing model;
- Estimates incremental default probability *due* to hurricane risk;
- Backs out "market-implied" credit cost for hypothetical mortgages originated in hurricane-prone coastal areas

Statistical measure $\mathbb{P}$ vs. risk-neutral measure $\mathbb{Q}$?

- Mortgage pricing model features risk-neutral investors without "priced" aggregate risks
- Do we need CRT securities' market price to estimate incremental credit cost due to hurricane risk?
  - If hurricane risk is not "priced", no difference between $\mathbb{P}$ and $\mathbb{Q}$;
  - Mortgage average default rate: 1.78bps p.a.
  - 1 hurricane/year increases baseline hazard rate by 57%
  - $\Rightarrow$ Incremental yearly loss rate $= 57\% \times 1.78bps \times LGD$

From CRT Prices to Market-Implied Mortgage Credit Spreads



From CRT Prices to Market-Implied Mortgage Credit Spreads

What if aggregate risk is priced?

- To estimate market-implied pricing of different mortgage credit products, need to rely on pricing of *all* CRT tranches

Without information on all CRT Tranches?

- Market-implied measures becomes highly "model-dependent"
- Example:
  - Portfolio of 2 mortgages (default probability p_i, default correlation ρ)
  - LGD of 100%
  - First-loss tranche $0 - 50$ and Super-senior tranche $50 - 100$

$$EL_{FL} = p_1 + p_2 - p_1 p_2 - \rho\sqrt{p_1 p_2 (1 - p_1)(1 - p_2)}$$
$$EL_{SS} = p_1 p_2 + \rho\sqrt{p_1 p_2 (1 - p_1)(1 - p_2)}$$

  - If $\uparrow EL_{FL}$, is this due to $\uparrow p_i$, or $\downarrow \rho$?
- "Real-world" example: May 2005 auto/credit correlation crisis

What about prepayment risk?

In the model: no prepayment option

In the data: Agency FRM with prepayment option

- Agency FRMs exhibit negative interest rate convexity...
- ... and thus (potentially significant) negative credit convexity:
  - Given LLPA matrix pricing, when borrower's credit conditions improve, borrower more likely to prepay, thus extinguishing the premium earned by protection seller;
  - Given DTI and other requirement for QM mortgages, when borrower's economic conditions deteriorate, borrower less likely to prepay, thus extending duration of credit risk taken by protection seller.
- But credit convexity could also go the other way:
  - In bad economic environment with high default rates, Fed QE program leads to a drop in long term rates and wave of refinancings...

Tranche Exposure to Prepayments

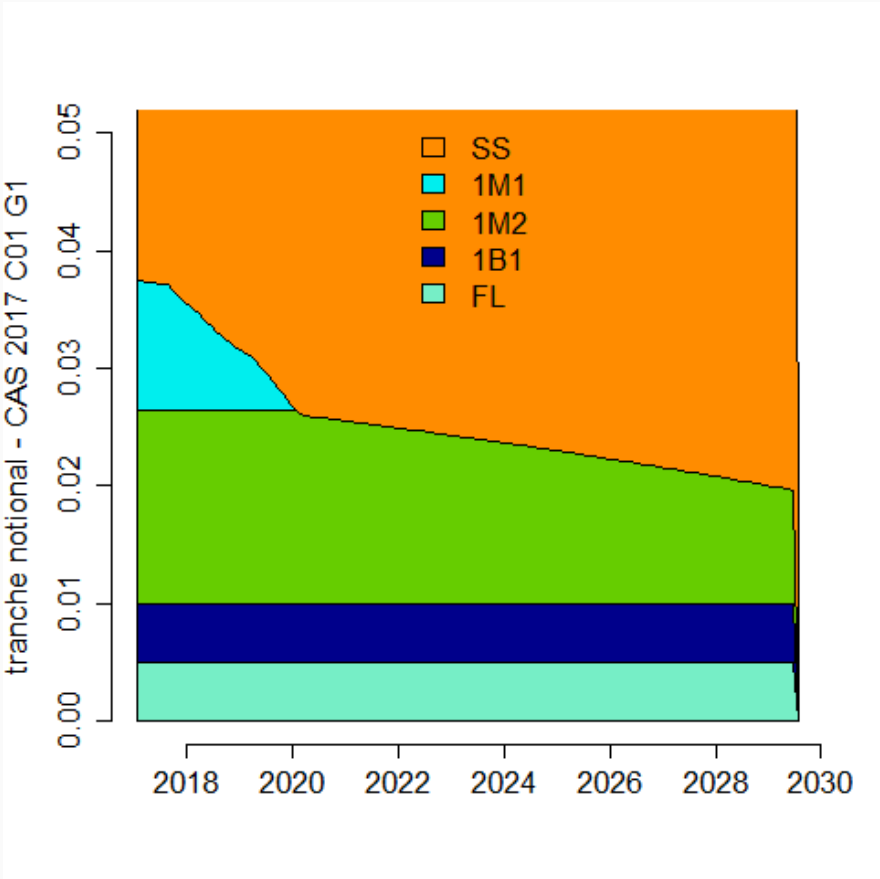


Figure 1: 0% CPR

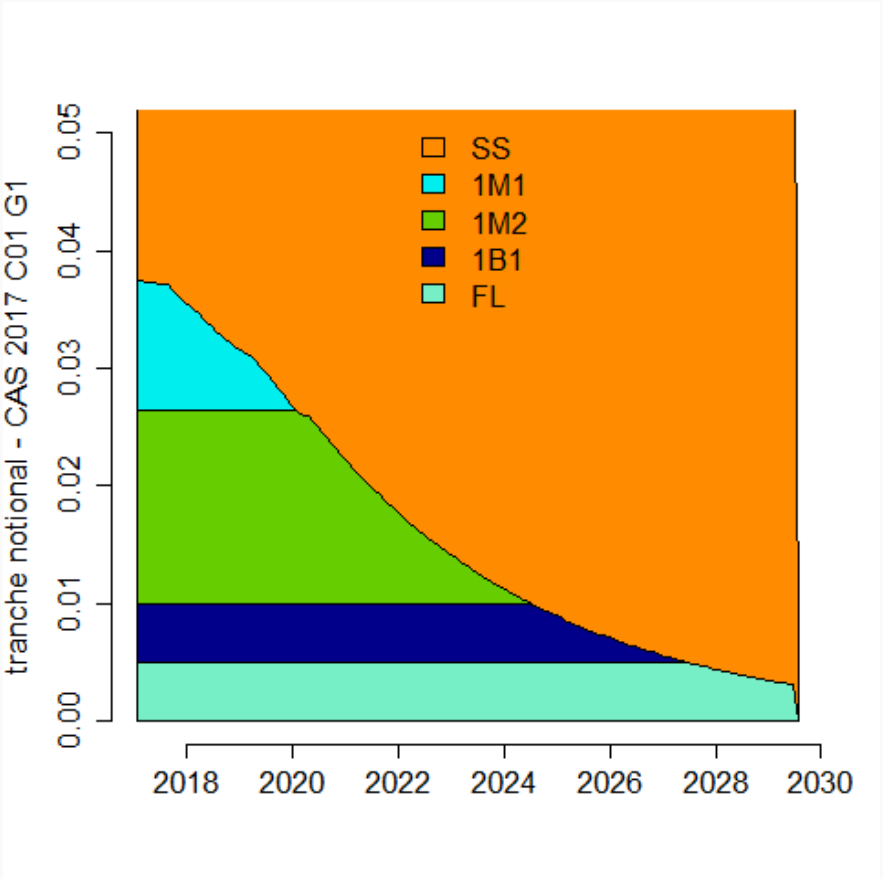


Figure 2: 20% CPR

Delinquencies vs. realized losses

In the paper: focus is on mortgage delinquencies

In the contractual structure of CRTs: payoff linked to realized losses

	Current Loan Status							Pipeline		Pool Removal			
Prior Loan Status	Current	D30	D60	D90	D120	D150	D180+	Modified	REO Acq	Credit Event	Defect	Prepaid	Total
Current	60.47%	0.52%	0.23%	0.19%	0.17%	0.18%	1.89%	0.01%	0.00%	0.08%	0.01%	36.25%	100.00%
D30	50.19%	9.07%	3.07%	1.95%	1.60%	1.50%	14.09%	0.15%	0.02%	0.69%	0.09%	17.58%	100.00%
D60	33.27%	8.92%	6.15%	3.93%	2.92%	2.69%	26.20%	0.44%	0.11%	2.57%	0.05%	12.76%	100.00%
D90	30.19%	6.16%	4.57%	3.68%	2.79%	2.57%	31.55%	0.33%	0.32%	5.89%	0.20%	11.74%	100.00%
D120	24.83%	5.97%	3.96%	3.45%	2.77%	2.57%	32.52%	1.22%	0.58%	8.76%	0.12%	13.25%	100.00%
D150	27.65%	4.67%	3.09%	2.35%	2.01%	2.88%	36.45%	0.42%	0.54%	8.55%	0.21%	11.17%	100.00%
D180+	19.22%	3.27%	1.75%	1.55%	0.77%	1.50%	44.89%	0.75%	2.45%	12.80%	0.21%	10.84%	100.00%
Mod	48.65%	8.76%	4.45%	2.16%	2.22%	1.28%	24.75%			0.22%	0.49%	7.02%	100.00%