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)

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**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
Framework (at least my understanding of it)

- Exponentially amortizing mortgage, floating rate (\(?\))
- Exogenous short rate process, no prepayment option
- Exogenous default intensity (\(\pi_t\)) and loss-given-default (\(\ell_t\))
- 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%
  • $\implies$ Incremental yearly loss rate = $57\% \times 1.78\text{bps} \times LGD$
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 $\rho$)
  - LGD of 100%
  - First-loss tranche 0 – 50 and Super-senior tranche 50 – 100

$$EL_{FL} = p_1 + p_2 - p_1p_2 - \rho \sqrt{p_1p_2(1 - p_1)(1 - p_2)}$$

$$EL_{SS} = p_1p_2 + \rho \sqrt{p_1p_2(1 - p_1)(1 - p_2)}$$

- 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

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