Credit Risk Transfer and the Pricing of Mortgage Default Risk

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The GSEs (Fannie Mae and Freddie Mac) were directed to develop and implement credit risk transfer (CRT) after their bailout in 2008

- Federal gov’t prices and holds the credit risk on most residential mortgages

The main way the GSEs comply with that mandate is with CRT securities

This analysis addresses the questions of whether CRT securities are an effective and efficient means of credit risk transfer, and whether they promote price discovery?

Our findings suggest that:

- CRT securities provide opaque price signals that may provide little marginal information about mortgage market risk
- CRT securities are likely to be a relatively expensive way for the GSEs to transfer risk to private sector investors

*Part of a broader research agenda that investigates the costs and risks of government investment and financing decisions*
Potential benefits of CRT for GSEs

- Information revelation
  - Creates market-price signals about cost of risk in conforming mortgage market
  - That information is otherwise unavailable while the GSEs are in conservatorship

- Transfers risk from government/taxpayers to private sector
  - Is this really a benefit?
  - Risk transfer in itself is unlikely to add value while GSEs in conservatorship
    • Private investors must be paid to take on the risk (zero NPV at best)
    • Requires private sector to be more efficient at allocating the risk to have value-added

- If GSEs are (re)privatized then CRT can reduce their systemic risk
  • Similar to benefits for other TBTF institutions
  • Potentially a partial substitute for capital requirements, but perhaps not a desirable substitute
Potential drawbacks of CRT securities (issuer/gov’t perspective)

- Opaque and illiquid
  - Highly complex structures, hard to price
  - Limited investor base, limited competition
  - Hard to infer information about overall mortgage market cost of risk
- Significant issuance costs
- Amount of risk transfer is difficult to assess, and it varies over time
  - Depends on structural details that differ across issuances
  - GSEs may refrain from issuing them when price of risk is elevated, when the price information would be most valuable
- Market participants love them

*Market forces need not eliminate persistent structural problems in gov’t-designed securities*
What are CRT securities?

- Can be thought of as highly structured catastrophe bonds or credit default swaps, where buyers earn a high coupon, but their principal is reduced as defaults on a reference pool of mortgages are realized.
Table 1: Summary Data for STACR Trust 2019 DNA1

<table>
<thead>
<tr>
<th>Classes of Reference Tranches</th>
<th>Initial Class Notional</th>
<th>Subordination</th>
<th>Coupon</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class A-H</td>
<td>$23,561,926,526</td>
<td>4.250%</td>
<td>--</td>
<td>NR</td>
</tr>
<tr>
<td>Class M-1 and Class M-1H</td>
<td>$307,596,952</td>
<td>3.000%</td>
<td>LIBOR + .9%</td>
<td>BBB</td>
</tr>
<tr>
<td>Class M-2A and Class M-2AH</td>
<td>$233,773,684</td>
<td>2.050%</td>
<td>LIBOR + 2.65%</td>
<td>B+</td>
</tr>
<tr>
<td>Class M-2B and Class M-2BH</td>
<td>$233,773,684</td>
<td>1.100%</td>
<td>LIBOR + 2.65%</td>
<td>B+</td>
</tr>
<tr>
<td>Class B-1A and Class B-1AH</td>
<td>$61,519,391</td>
<td>0.850%</td>
<td>LIBOR + 4.65%</td>
<td>B-</td>
</tr>
<tr>
<td>Class B-1B and Class B-1BH</td>
<td>$61,519,391</td>
<td>0.600%</td>
<td>LIBOR + 4.65%</td>
<td>B-</td>
</tr>
<tr>
<td>Class B-2A and Class B-2AH</td>
<td>$61,519,390</td>
<td>0.350%</td>
<td>LIBOR + 10.75%</td>
<td>NR</td>
</tr>
<tr>
<td>Class B-2B and Class B-2BH</td>
<td>$61,519,390</td>
<td>0.100%</td>
<td>LIBOR + 10.75%</td>
<td>NR</td>
</tr>
<tr>
<td>Class B-3H</td>
<td>$24,607,757</td>
<td>0.000%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: 1-month LIBOR; Rating is expected from S&P; coupons are only notional for H classes

- Principal value of the CRT securities = $714 million
- Underlying principal of $24.6 billion in the reference pool
- Default losses historically never exceeded a few percentage points
CRT data sources

- GSE offering documents and financial statements
- Proprietary data on secondary market pricing from Vista Data Services
  - Tracks 164 individual tranches of CRT securities issued between 2014 and 2020
  - Constructs price indices for subgroupings by class (e.g., all mezzanine tranches for a given vintage year)
  - Static information includes: amount issued, name and CUSIP, and vintage year
  - Daily time series data from January 1, 2017 to September 28, 2020 includes: secondary market price, current coupon, and amount outstanding.
  - An illiquid market
  - Some data from quotes, some interpolated
“Default cost” is principal-weighted average of CRT coupons at issuance
- Constructed from Freddie DNA and FQA offering data
- Expressed as a ratio to the reference pool of mortgages, in basis points
- Suggestive, but not a true cost measure

Default cost averages about 17 bps (when fair A-H spread is 0, blue dots)
Cost estimates are quite sensitive to unobserved value of fully retained tranches
Default cost jumped post-pandemic, but still in line with historical costs
GSEs both stopped issuing for several months during height of market disruptions
"Default cost" vs. time path of average CRT coupon

Figure 10: Average investor coupon by month

Average coupon is model-generated, as described later on.
“Retained share” is the portion of the default cost held by the GSEs in retained tranches.

Estimate is also quite sensitive to unobservable value of fully retained tranches.

We calculate average retention of about 50%, much higher than GSE-reported retention of less than 25%.

Conservative in that riskiest mortgages are excluded from reference pools.

Fairly stable over time, did not increase after the onset of the pandemic.
What correlates with default cost?

- Default cost is highly correlated with the BB spread (correlation = .72)
- Also positively correlated with 120-day mortgage delinquency rate but less so
  - delinquencies are only marginally significant in a regression on BB spread and delinquencies
- Raises question of whether CRT pricing more indicative of housing market or of high yield market
Is default cost information used to set g-fees?

- Clearly not. (Correlation = .15)
Unlikely that changes in expected default losses could fully account for the large price declines that started around March 13 and that continued for several weeks.

Declines persisted even after passage on March 25 of the CARES Act, which put a stay on foreclosures.

Data source: Vista Security Services
Liquidity, market depth and issuance costs

• Information from various sources suggests high issuance costs and low liquidity

<table>
<thead>
<tr>
<th>Table 3: Data on Liquidity and Depth of Market</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of investors at issuance</td>
</tr>
<tr>
<td>Unique investors at issuance</td>
</tr>
<tr>
<td>Number of TRACE trades/month (STACR)</td>
</tr>
<tr>
<td>Volume of TRACE trades/month (STACR)</td>
</tr>
<tr>
<td>Average trade size</td>
</tr>
<tr>
<td>Sources: FMCC disclosures and TRACE data</td>
</tr>
</tbody>
</table>

• Significant compensation to market makers from premium pricing in secondary market
  • That cost appears to be on order of the total cost of risk transfer
Model-based analysis of returns

- Model produces distribution of cash flows for each tranche
  - Driven by stochastic models of default, prepayment, and recovery on the underlying pool of mortgages
  - Incorporates the rules for the CRT prepayment and default waterfalls

- Combined with issuance prices, it predicts the distribution of realized returns for each tranche.

- Comparison of those returns to those on similarly risky bonds used to suggest whether CRT appears fairly priced, or is cheap or expensive
Driving processes for default, prepayment, recovery are mean reverting and bounded

The default and recovery processes have a common jump component that induces a negative correlation between the current default rate and the recovery rate one year later.

\[ x_{i,t+1} = x_{i,t} + \rho_i (\bar{x}_i - x_{i,t}) + \sigma_i \varepsilon_i + I_{j_i} J_i \]

\[ x_{i,t+1} = \max(x_{i,t+1}, x_{i,min}) \]

\[ x_{i,t+1} = \min(x_{i,t+1}, x_{i,max}) \]

where \( x_{i,t} \) is the rate in period \( t+1 \), \( \rho_i \) is the speed of mean reversion, \( \bar{x}_i \) is the mean-reverting rate, \( \sigma_i \) is the standard deviation of a standard normal shock, \( \varepsilon_i \), \( J_{i,t} \) is an indicator variable that a jump has occurred, \( J_i \) is the fixed size of a jump that has probability \( p_{i,j} \) of occurring, and \([x_{i,min}, x_{i,max}]\) is the range of permitted values; \( i=d, R, \) or \( pp \) for default, recovery or prepayment.
Driving processes calibrated to be consistent with historical performance data for pools of mortgages

- Monthly values for default and prepay
- Note: realized defaults precede CRT cash flows by 2 years

Table 4: Parameters for driving rate processes, monthly basis for default and prepayment

<table>
<thead>
<tr>
<th></th>
<th>Mean-reverting level</th>
<th>speed revert</th>
<th>std dev</th>
<th>lower bound</th>
<th>upper bound</th>
<th>prob jump</th>
<th>jump value</th>
<th>initial value</th>
</tr>
</thead>
<tbody>
<tr>
<td>default</td>
<td>0.00020</td>
<td>0.1466</td>
<td>0.00004</td>
<td>0.0000</td>
<td>0.0010</td>
<td>0.0250</td>
<td>0.0010</td>
<td>0.0002</td>
</tr>
<tr>
<td>recovery</td>
<td>0.60000</td>
<td>0.2308</td>
<td>0.0300</td>
<td>0.3000</td>
<td>0.9000</td>
<td></td>
<td>0.3000</td>
<td>0.6000</td>
</tr>
<tr>
<td>prepay</td>
<td>0.01600</td>
<td>0.3500</td>
<td>0.0050</td>
<td>0.0000</td>
<td>0.0400</td>
<td></td>
<td>0.0000</td>
<td>0.0160</td>
</tr>
</tbody>
</table>
Model logic in brief

- At the beginning of each Monte Carlo run, all quantities that update over time are reset to their time 0 values.
- In each subsequent period \( t \), draws from a random draws determine the current realizations for default, recovery and prepayment rates for the reference pool.
- The size of the reference pool is adjusted down with realized defaults, realized prepayments, and scheduled payments.
- For each \( t \), the cash flows paid to each CRT tranche is calculated and recorded, and the principal balance is then updated to its value at the start of the next period.
- Coupon payments are based on the beginning-of-period tranche principal and the current coupon rate.
- Principal is repaid or written down according to the rules of the waterfall.
- Partial prepayments of principal may be paid out and included in cash flows, starting with the most senior tranches, depending on realized prepayments and loss performance tests.
- The realized defaults cause write-downs on CRT principal balances starting with the most subordinated tranche.
The mezzanine tranches have almost no exposure to default risk, yet their expected return is one or two percentage points higher than LIBOR.

The B1 tranche is riskier than the M2 tranche, but it absorbs much less credit risk and has a higher expected return, than corporate bonds with comparable ratings.

- Suggests CRT securities are rated conservatively relative to corporate bonds of similar risk.

Expected returns on the mezzanine tranches are fairly insensitive to significant increases in assumed default risk.

Results fairly insensitive to varying parameters of default and prepayment models.
The analysis of STACR issuance data, and evidence on transactions costs and market liquidity, point to the conclusion that CRT securities are a relatively expensive way for the GSEs to transfer risk.

The information content is limited by the complexity of the structures and retention of risk by the GSEs (both first loss and most subordinated losses).

A modest structural change that could reduce the GSEs’ cost with minimal reduction in the amount of risk transferred would be for the GSEs to retain a larger share of the mezzanine tranches.

The analysis points to the importance of academic investigations of gov’t-designed securities markets, where the competitive forces that would drive out inefficient private sector products are absent.