Discussion of

Credit Cycles in Tokenized Real Estate Markets

Huang, Laturnus, and Ruf

Siema Hashemi

University of Liverpool

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Summary of the main results

- Theoretical framework: real estate-backed tokens generate rental income and can be pledged as collateral to increase leverage
  - ⇒ Sudden interest rate increases can cause market crashes, especially when investors are highly leveraged

- Empirical results: transaction-level data from Decentralized Finance (DeFi) trading and lending platforms
  - ⇒ Investor borrowing activity increases trading volume and upward price pressure in both DEX and YAM marketplace for real estate-backed tokens
  - ⇒ However, the price impact is persistent only in YAM
  - ⇒ Suggesting that structural features of the lending platform (the algorithmically-determined price mechanism?) help contain systemic fragility

My comments

- **Main contribution**: The price effects from leverage, while using real estate tokens as collateral, are not destabilizing the AMM-based DeFi platforms
- Providing empirical evidence on the lesser-known credit cycles in DeFi
- **My comments:**
  1. Theoretical prediction
  2. Empirical results
  3. Further notes

Theoretical model I

- In period t, the strategy to *borrow* & *buy* real-estate tokens generates expected wealth

$$\mathbb{E}_t(W_{t+1}) = N(\ell_t)(\mathbb{E}_t(P_{t+1}) + D_{t+1}) - B(\ell_t)(1 + r_t) = W_t \left\{ 1 + r_t + \frac{\mathbb{E}_t(P_{t+1}) + D_{t+1} - P_t(1 + r_t)}{(1 - \ell_t)P_t} \right\}$$

  constrained by $B(\ell_t) \leq \lambda N(\ell_t) P_t$

- Optimal leverage is defined by

$$\ell_t^* = \begin{cases} \lambda & \text{if } \dfrac{\mathbb{E}_t(P_{t+1}) - P_t}{P_t} + \overbrace{\dfrac{D_{t+1}}{P_t}}^{\text{rental yield}} \geq r_t \\ 0 & \text{if } \dfrac{\mathbb{E}_t(P_{t+1}) - P_t}{P_t} + \dfrac{D_{t+1}}{P_t} < r_t \end{cases}$$

If the borrower does not take its price impact into account

Theoretical model II

- Assuming a linear price impact (later a constant-product AMM model)

$$P_t = P_0 + \phi N$$

- As long as the token is not traded, there is no price impact and ℓ^*_{t-1} remains optimal
- If the gross borrowing rate exogenously increases

$$\underbrace{\frac{\mathbb{E}_t(P_{t+1}) - P_t}{P_t}}_{(-)} + \underbrace{\frac{D_{t+1}}{P_t}}_{(-)} - r_t < 0$$

borrower starts to unwind s_t, constrained by

$$(1 + r_t)B_t - s_t P_t \leq \lambda(n_t - s_t)[P_t - \phi s_t]$$

in order to prevent margin calls

(1) What are the underlying assumptions?

1. The borrowing rate is variable and exogenous, unaffected by unwinding debt
2. The rental income D_t is not reinvested or used to repay debt
3. What is the borrowing constraint?

   Preposition 1: $B_t(\ell_t) \leq \lambda N_t(\ell_t) \min\{P_t, P_{t+1}\}$ marked to market
   Preposition 2: $B_t(\ell_t) \leq \lambda N_t(\ell_t) P_t$

4. Borrowing and buying are inseparable because initial wealth is in stablecoins
5. Borrowers prevent margin calls at all times
6. Borrowers do not internalize their own price impact (even big investors in thin markets)

(2) Consistency of theory & empirics

- Theoretical prediction: in a constant-product AMM, the prevalence of leverage increases the risk of fire-sales triggered by extraneous funding shocks

- Empirical results:
  1. Borrowing leads to greater price increases
  2. However, in the AMM-based DEX liquidity pools, these price effects are transient in contrast to the peer-to-peer YAM marketplace
  3. As a result, leverage price influences are *not* inherently destabilizing

(4) Is the price impact *underestimated* in DEX?

- Regression setup:
  - Capturing price differentials between transactions in which the successful bidder is levered versus a transaction in which the successful bidder is unlevered
  - Borrower is an investor who borrows and buys on the same day
- What about:
  - Leverage increasing the number of bidders in the market, and thus overall higher prices for both levered and unlevered investors
  - Investors borrowing today, intending to buy in the future, anticipating lower prices
    - How sensitive are borrowing rates to demand changes?
    - How prevalent is borrowing with fixed rates?
    - What could be the difference between wallet level and individual level?

(5) Are the two markets comparable?

- DEX is an exchange with an algorithmically-determined price versus YAM as a peer-to-peer marketplace
- Also, DEX is more liquid (# of transactions), with fewer borrowers 3% (versus 14%)

  $\Rightarrow$ When aggregate leverage in the market changes, the marginal information on bid prices may be transmitted differently in these two market setups
- Alternative specification:

$$avg.daily\ price_{tj} = \beta_0 + \beta_1\ avg.daily\ leverage_{tj} + Token\ FE_j + Day\ FE_t + \epsilon$$

  Tying back to the real economy evidence: changes in aggregate leverage, has destabilizing price effects

Further comments

- In AMM, *"Equilibrium is reached through a change in the size of a pool rather than a change in price because larger pools mechanically have a smaller price impact"* (Lehar & Parlour, 2025)
  - In DEX: If larger aggregate leverage increases aggregate outflow, it would trigger a stronger price impact

- How cheap is collateralized lending in the DeFi market?
  - *"Leverage is cheap and nearly unlimited"*
  - Average rental yield of tokenized real estate properties is $0.10(0.09 - 0.11)$, versus stable borrowing rate $0.15(0.09 - 0.20)$ and variable borrowing rate $0.09(0.06 - 0.11)$

- Transmission mechanism between traditional and crypto markets
  - Are these two markets complements or substitutes?
  - How does the price of the underlying real asset influence the pricing in the liquidity pools?

Concluding remarks

- Extremely interesting and timely paper on leveraged real-estate investments in DeFi platforms
- Would like to see more on the theoretical framework & aggregate empirical impact
- I encourage everyone interested to read it too

Thank you!