Discussion
"DeFi Leverage"

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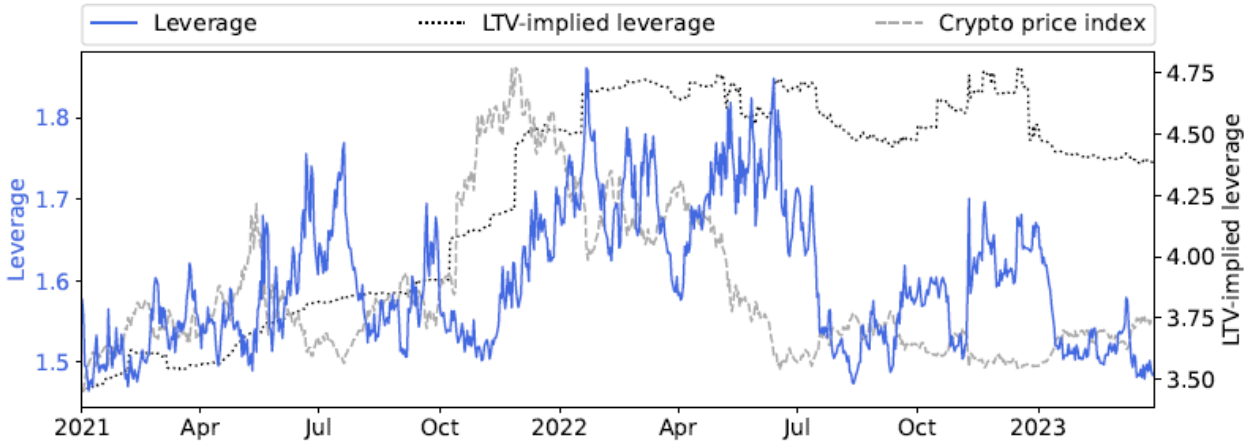
2023 EBA Policy Research Workshop
Paris, 8th November 2023

This paper . . .

- This paper examines **user-level leverage (asset-to-equity ratio) in DeFi**
  - to what extent the user's assets are supported by his own equity
- How?
  - Using granular data (at the user-level and wallet-level) from the Ethereum blockchain between January 2021 and March 2023.
- Findings

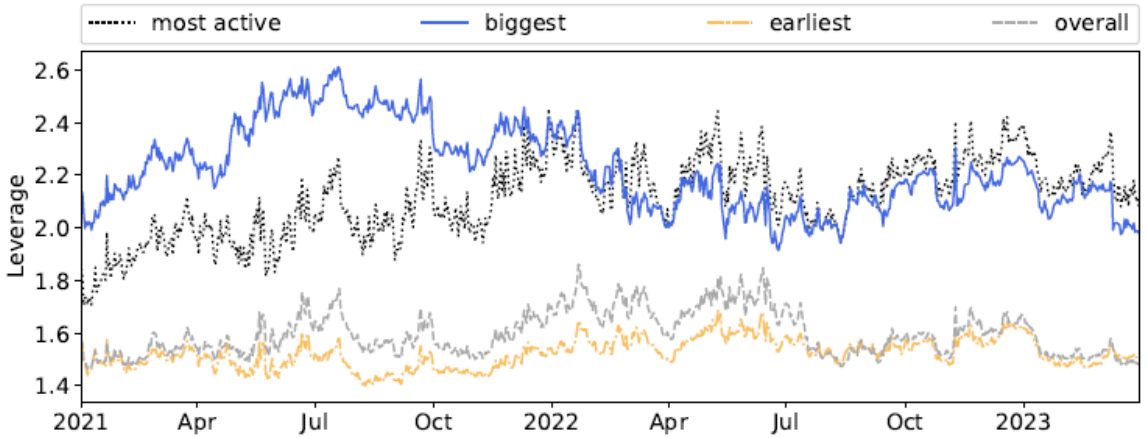
1. The overall leverage of DeFi users ranges from 1.4 to 1.9.



This paper . . .

- Findings

2. User leverage exhibits heterogeneity across groups: the largest and most active wallets exhibit higher leverage compared to the remaining users



3. Drivers of leverage: Leverage is mainly driven by loan-to-value requirements, and borrow rates, as well as crypto market price movements and sentiments.

4. The effects of leverage:

   - Higher borrower leverage generally undermines lending resilience.

   - Borrowers with high leverage are more likely to tilt towards volatile collateral when their debt positions are about to be liquidated.

General comments

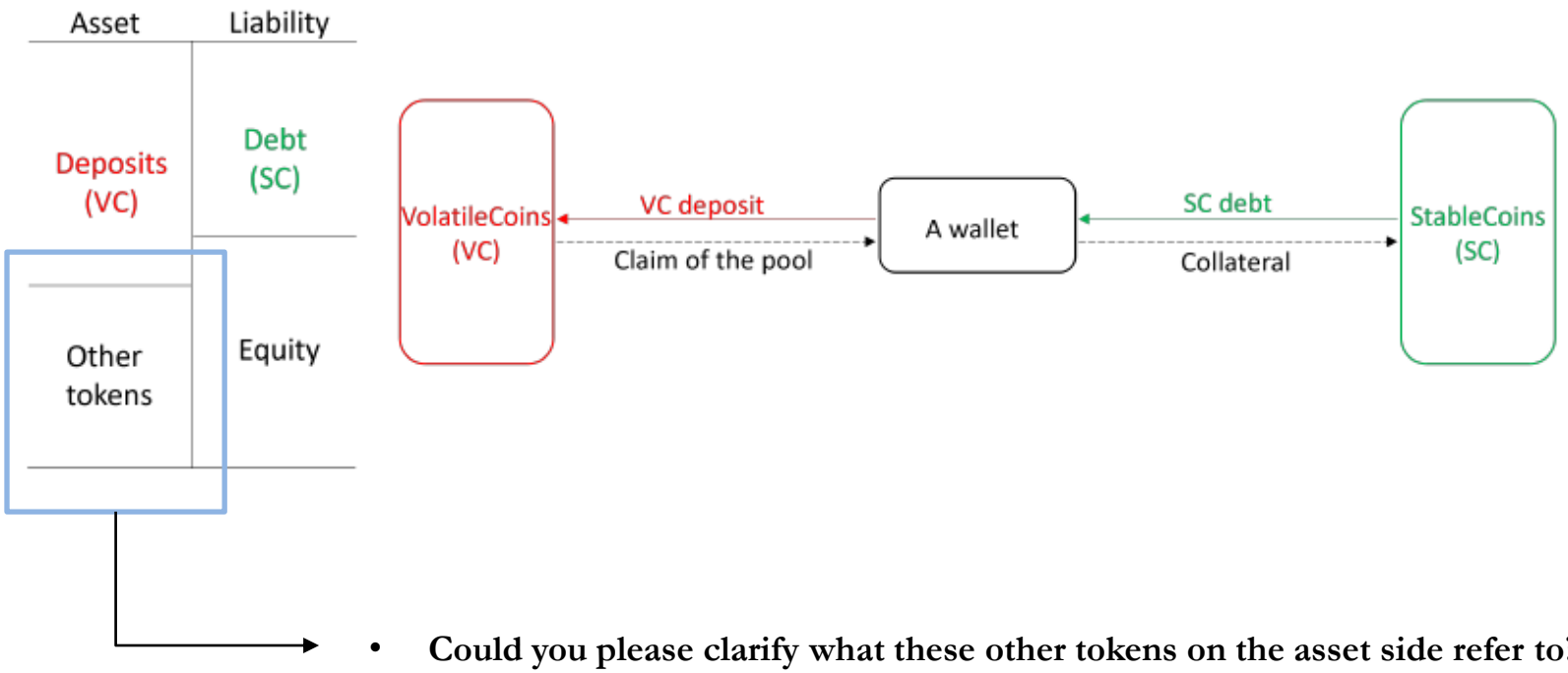
- The paper **contributes** to a very recent literature on DeFi
  - To my knowledge (including some intensive searches), it is the first paper that **documents user-level leverage in DeFi.**
- The paper provides valuable insights **on an alternative approach to collateralized borrowing**, despite differences with repo markets.
- Their findings reveal the relevance of considering **user behavior, market dynamics, and automated risk mitigation** in the **design and management of collateralized borrowing platforms** (DeFi or TradFi).
- **Excellent job in collecting a** unique set of data (user level and wallet level).
- The paper is **well-written and easily comprehensible**, even for non-experts in the field.

General comments: Suggestions and questions

- The motivation of the paper could be improved:
  - **The paper is motivated based on the growth of DeFi lending** ["*Decentralized finance (DeFi) has witnessed a meteoric rise since 2020, disrupting traditional financial services by offering users an alternative way of conducting transactions*"] **but not on DeFi leverage.**
  - **Why does DeFi leverage matter**?
    - We know the implications of leverage in traditional financial markets, but are the implications of leverage different in DeFi?
    - The authors could provide anecdotal evidence (if available) on the implications of DeFi leverage.
      - Aramonte et al (2021): "*The destabilizing role of leverage came to the fore in the latest cryptoasset crash in September 2021. Forced liquidations of derivatives positions and loans on DeFi platforms accompanied sharp price falls and spikes in volatility*"

General comments: Suggestions and questions

- Leverage is measured with each user's **asset-to-equity ratio:**



- **Could you please clarify what these other tokens on the asset side refer to?**
- **Could you clarify what percentage of the total assets do they represent?**
- **My concern: An increase or decrease in the value of these other tokens may affect the leverage of each user?**

General comments: Suggestions and questions

- Are you just examining the leverage of large crypto investors?

Table 3. Summary statistics. In panel A, #Wallets is the number of wallets, #Obs is the number of observations and ratio represents the ratio between the number of observations and the number of wallets. For debt, assets and equity, we first aggregate across days for each wallet and report the average across users. In panel B, we report the distribution statistics across users.

Panel A: Overall sample

Platform	#Wallets (Unit)	#Obs (Unit)	Ratio (Unit)	Avg daily debt ($)	Avg daily asset ($)	Avg daily equity ($)
AAVEV1	4,629	1,358,940	294	224,498	607,759	383,261
AAVEV2	42,123	9,625,813	229	340,479	685,142	344,662
CompoundV2	16,836	5,862,197	348	985,870	1,752,627	766,757
Total	57,555	13,094,094	228	580,497	1,168,491	587,995

Panel B: Heterogeneity across users

Variable	Mean	Std	25%	Median	75%	Max
Debt ($)	580,497	13,258,569	72	4,038	36,644	1,123,007,715
Assets ($)	1,168,492	22,937,139	1,080	15,824	121,712	2,828,857,418
Equity ($)	587,995	11,825,693	793	10,069	76,905	1,833,842,618
Leverage (Unit)	1.644	0.731	1.140	1.431	1.861	7.554
Leverage^I (Unit)	4.229	1.130	3.428	4.000	5.068	7.692

On average, a user's daily outstanding asset of around $1.2 million → large investors.

Large dispersion (from $121,712$ to $2,8bn) → Can you run a separate analysis for large vs retail investors?

- **Large investors are better informed than retail investors.**
  - Then, their leverage could be higher
  - As better-informed investors, their behavior could be different

General comments: Suggestions and questions

- Classifications of users: Heterogeneities across users
  - **Why are there 1,000 users in each group given that you have 55,948 users in your sample?**
    - Further discussion is required as the number 1,000 appears to have been introduced without any clear context or explanation.
    - It may be more reasonable to group users based on percentiles, such as the 1st or 5th percentile for each dimension (most active users, largest users, and earliest users).

Table 5. Driving factors of DeFi leverage. We report the regression results for the following model $Leverage_{i,t} = \beta_0 + \beta_1 Leverage^{I}_{i,t} + \beta_2 BorrowRate_{i,t} + \beta_3 Utilisation_{i,t} + \beta_4 SignedVCPrice_{i,t} + \beta_5 Volatility_{i,t} + \beta_6 DepoRate_{i,t} + \gamma_i + \mu_t + \varepsilon_{i,t}$. We estimate the double-clustered standard errors following Petersen (2008). T-stats are reported in brackets.

	All	Winsorised	Largest	MostActive	Earliest
Leverage^I	0.0845***	0.0834***	0.1528	0.2278***	0.1354***
	(12.430)	(12.427)	(1.5954)	(4.1065)	(3.6859)
BorrowRate	-0.0245***	-0.0231***	-0.2325***	-0.1347***	-0.0471
	(-2.9826)	(-2.8320)	(-3.1131)	(-2.7884)	(-1.2038)
Utilisation	0.0557***	0.0514***	0.4884*	0.3920**	0.0796
	(3.5172)	(3.2431)	(1.9176)	(2.3212)	(1.2778)
SignedVCPrice	-0.0543***	-0.0529***	-0.1340***	-0.0653***	-0.0341***
	(-15.823)	(-15.167)	(-3.5696)	(-2.8230)	(-2.5950)
Volatility	-0.0928**	-0.0930**	-0.2102*	-0.4501**	-0.1709**
	(-2.0358)	(-2.0287)	(-1.8085)	(-2.3455)	(-2.5120)
DepoRate	0.0802***	0.0741***	3.5843***	0.0037	0.0250
	(3.0497)	(2.8081)	(2.7549)	(0.0211)	(0.0975)
Time FE	✓	✓	✓	✓	✓
User FE	✓	✓	✓	✓	✓
No. Observations	6780434	6608334	83220	142725	190389
R-squared	0.0187	0.0177	0.0729	0.0566	0.0443

If each group contains 1,000 users, why is there such a large difference in the number of observations?

- Since the unit of measure for these regressions is the (i) "wallet", it seems that there are very different patterns in the number of wallets held by each type of user. Does it matter?

General comments: Suggestions and questions

- Collateral selection at liquidation

  - **You run the following cross-sectional regression to investigate the relationship between leverage and the behaviour of collateral selection**

$$Diff_i = \beta_0 + \beta_1 Leverage_i + Debt_i + \varepsilon_i$$

	Diff	Diff	Diff
Leverage	0.0078		
	(4.561)		
Leverage^I		0.0050	
		(5.594)	
Leverage^I - Leverage			0.0100
			(6.067)
Debt	-0.0001	-0.0002	0.0000
	(-0.595)	(-0.990)	(0.214)
No. Observation	145	145	145
R-squared	0.1754	0.1836	0.1383

- **None of the coefficients are not statistically significant but the results are interpreted as if they were . . .**

  "The first column shows that when the wallet's leverage is higher, the difference between the actual collateral volatility and the simulated one that keep the collateral composition unchanged is higher"

  Without having statistically significant results, I would be more cautious about arguing that "*highly leveraged users are more likely to tilt towards volatile collateral when their debt positions are about to be liquidated*"

Minor comments

- The authors may decide to provide more information about the three platforms: Aave v1, Aave v2 and Compound.
  - Could any technical differences between these platforms influence the outcomes?
- What happens when no liquidator is willing to take on collateral if the amount of debt is greater than the collateral value at the liquidation threshold??
  - If the users know that no liquidation is taking place, they could change (or not) their behavior when they are close to the liquidation threshold.
- Hypothesis 6. *"A user has lower leverage when he faces higher deposit rates"*
  - But the authors find that a user has higher leverage when he faces higher deposit rates
    - ➢ more discussion is needed to understand this result
- I would suggest the authors testing directly the impact on DeFi leverage of having a liquitation process (auctioning off the collateral to liquidators at a discount as soon as a user's LTV ratio rises above a certain threshold)
  - Distance-to-Liquidation: LTV liquidation threshold – LTV ratio

Table 5. Driving factors of DeFi leverage.
$\beta_0+\beta_1 Leverage^I_{i,t}+\beta_2 BorrowRate_{i,t}+\beta_3 Utilisc$
We estimate the double-clustered standard err

	All
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	(12.430)
BorrowRate	-0.0245***
	(-2.9826)
Utilisation	0.0557***
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Time FE	✓
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Good luck with the publication process!

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