

# A Token Economics Explanation for the De-Pegging of the Algorithmic Stablecoin: Analysis of the Case of Terra: Open Review

Jaewoo Cho <sup>\*†</sup>

Reviewers: Reviewer A, Reviewer B

**Abstract.** The final version of the paper “A Token Economics Explanation for the De-Pegging of the Algorithmic Stablecoin: Analysis of the Case of Terra” can be found in Ledger Vol. 8 (2023) 27-36, DOI 10.5195/LEDGER.2023.283. There were two reviewers involved in the review process, neither of whom has requested to waive their anonymity at present, and are thus listed as Reviewers A and B. After initial review by Reviewers A and B, the submission was returned to the authors with feedback for revision (1A). The authors resubmitted their work and responded to reviewer comments (1B). It was returned to the reviewers for further review, after which the resubmission was deemed sufficient to address any prior concerns, thus ending the peer review process. Author responses in 1B have been bulleted for reader clarity.

## 1A. Review

### Reviewer A

*Does this paper represent a novel contribution to cryptocurrency or blockchain scholarship?*

Yes, incremental contribution(s)

*Please briefly explain why you think the paper makes or does not make a novel contribution.*

The paper analysis an important market event which hasn't been discussed a lot by academic literature. It uses blockchain and exchange data and has good analytical explanations of the results it presents. However, I think that the author could have developed a bit more his arguments, with more proof from literature or more word explanations rather than charts. I would also suggest to the author if there is the time, to look at additional datasources, as swaps which happened on-chain on decentralized exchanges, or even market events which could have been observed in the lending protocols of the Terra blockchain, namely the Anchor protocol.

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*Is the research framed within its scholarly context and does the paper cite appropriate prior works?*

Important references are missing

*Please assess the article's level of academic rigor.*

Good (not excellent but a long way from poor)

*Please assess the article's quality of presentation.*

Good (not excellent but a long way from poor)

*How does the quality of this paper compare to other papers in this field?*

This is a good or average paper.

*Please provide your free-form review for the author in this section.*

The paper is interesting, good analysis is done but a bit incomplete given the fact that the author does not look to the complete story (and data sources). The complete story includes what the author describes, in addition to what he misses, that is what happened on decentralized exchanges as Curve Finance or on Anchor (lending protocol). I think there is a lot more to say in terms of story but also in terms of explanation of the results found.

## **Reviewer B**

*Does this paper represent a novel contribution to cryptocurrency or blockchain scholarship?*

Yes, incremental contribution(s)

*Please briefly explain why you think the paper makes or does not make a novel contribution.*

see comments below

*Is the research framed within its scholarly context and does the paper cite appropriate prior works?*

Important references are missing

*Please assess the article's level of academic rigor.*

Good (not excellent but a long way from poor)

*Please assess the article's quality of presentation.*

Good (not excellent but a long way from poor)

*How does the quality of this paper compare to other papers in this field?*

This is a good or average paper.

*Please provide your free-form review for the author in this section.*

The paper titled “A token economics explanation for the depegging of the algorithmic stablecoin: Analysis of the case of Terra” highlights a token economic mechanism behind the UST de-pegging with empirical evidence by means of on-chain analysis.

The paper is interesting and shed some light on a recent event. Due to this fact, I recommend the publication of the paper after minor revision.

1) Authors could add more literature that has been published in relation to Terra-Luna case, thus, authors provide readers with a proper background about this case. For instance:

- Uhlig, H. (2022). A Luna-tic Stablecoin Crash (No. w30256). National Bureau of Economic Research.

- Briola, A., Vidal-Tomás, D., Wang, Y., and Aste, T. (2022). Anatomy of a stablecoin’s failure: the terra-luna case. Finance Research Letters, 103358.

2) Authors should be more “cautious” when writing the paper, i.e. even with a granger test, we (as scholars) cannot completely confirm the reasons of a given event. For instance, authors wrote “What, then, was the real reason for the de-pegging?”, a more appropriate writing should be “What, then, could be a plausible reason for the de-pegging?”

3) In line with previous line, authors stated that “This means that the UST market price follows the value of UST guaranteed by the blockchain in the short term (4-10 minutes). It also rebuts arguments that loss of trust in the stability of the UST price (in the market) caused the depegging event”. This could be quite counterintuitive given that one of the problems of all the algorithmic stablecoins is the “bear market” that could be originated by fear, as it was the case of Iron finance and Titan. It is difficult (and impossible) to say that the only relevant variable was the redeemed value. Indeed, the authors also state that algorithmic stablecoins can work during bull markets, but problems arise during downmarkets.

4) Please, re-read the paper in order to highlight that the mechanism is "another trigger to consider" but you cannot state that it is the real reason (as the only relevant) for the depegging

## **1B. Author Response**

### **Reviewer A**

The paper analysis an important market event which hasn't been discussed a lot by academic literature. It uses blockchain and exchange data and has good analytical explanations of the results it presents.

- Thank you for your review and for considering our manuscript for publication. I have taken your comments and suggestions into consideration.

However, I think that the author could have developed a bit more his arguments, with more proof from literature or more word explanations rather than charts.

- I expanded the manuscript from 2,210 words to 3,231 words to provide a more thorough and detailed analysis of the causes of the de-pegging event. Additionally, I have made revisions to the manuscript accordingly. I added more academic literature to support my arguments, including:

- Briola, A., Vidal-Tomás, D., Wang, Y., & Aste, T. (2022). Anatomy of a Stablecoin's failure: The Terra-Luna case. *Finance Research Letters*, 51, 103358.
- Calcaterra, C., Kaal, W. A., & Rao, V. (2020). Stable cryptocurrencies: First order principles. *Stan. J. Blockchain L. & Pol'y*, 3, 62.
- Uhlig, H. (2022). A Luna-tic Stablecoin Crash (No. w30256). National Bureau of Economic Research.

I would also suggest to the author if there is the time, to look at additional datasources, as swaps which happened on-chain on decentralized exchanges, or even market events which could have been observed in the lending protocols of the Terra blockchain, namely the Anchor protocol.

- Thank you for your valuable input. In response, I have gathered additional data sources, including Astroport and Terraswap, and also analyzed Anchor protocol data such as total lending and borrowing and statistics by accounts. However, I decided not to include this data in my analysis as it did not seem to fit perfectly with the focus of my analysis.

The paper is interesting, good analysis is done but a bit incomplete given the fact that the author does not look to the complete story (and data sources). The complete story includes what the author describes, in addition to what he misses, that is what happened on decentralized exchanges as Curve Finance or on Anchor (lending protocol). I think there is a lot more to say in terms of story but also in terms of explanation of the results found.

- Thank you for your comment. I did conduct a thorough analysis of the Anchor protocol, and some of my findings were featured in media (please see <https://news.kbs.co.kr/news/view.do?ncd=5520528>). I also analyzed on-chain data related to the activities of Terraform Labs and its inner circle, such as Do Kwon. However, I ultimately decided not to include data from the Anchor and Mirror protocols, as I felt that it might detract from the focus of the study, the misdesigned token economics.
- I hope that these changes address your concerns and that the revised manuscript will be suitable for publication. I appreciate your time and attention to our work, and I look forward to your response. Thank you again for your valuable feedback.

**Reviewer B**

The paper titled “A token economics explanation for the depegging of the algorithmic stablecoin: Analysis of the case of Terra” highlights a token economic mechanism behind the UST de-pegging with empirical evidence by means of on-chain analysis. The paper is interesting and shed some light on a recent event. Due to this fact, I recommend the publication of the paper after minor revision.

- Thank you for your review and comments. I have incorporated your suggestions into the manuscript. Please see my responses to each point you raised below.

Authors could add more literature that has been published in relation to TerraLuna case, thus, authors provide readers with a proper background about this case. For instance:

- Briola, A., Vidal-Tomás, D., Wang, Y., & Aste, T. (2022). Anatomy of a Stablecoin’s failure: The Terra-Luna case. *Finance Research Letters*, 51, 103358.

- Uhlig, H. (2022). A Luna-tic Stablecoin Crash (No. w30256). National Bureau of Economic Research.

- Thanks for your suggestion. According to your comment, I have added the literature you suggested into the manuscript.

Authors should be more “cautious” when writing the paper, i.e. even with a granger test, we (as scholars) cannot completely confirm the reasons of a given event. For instance, authors wrote “What, then, was the real reason for the de-pegging?”, a more appropriate writing should be “What, then, could be a plausible reason for the depegging?”

- I really appreciate your thorough review that improves my study significantly. I have revised the manuscript to address your points. In particular, I have revised the paragraph you pointed out to be more careful in my language. “This arbitrage activity is normal and expected, as it helps to secure the pegging. By purchasing and burning UST, the demand for UST increases while the supply decreases, leading to an increase in the price of UST to \$1. If the blockchain always redeems \$1 worth of LUNA for UST holders, the peg would be recovered. However, from the perspective of token economics, the de-pegging event continued. What could be the possible reason for this?”

In line with previous line, authors stated that “This means that the UST market price follows the value of UST guaranteed by the blockchain in the short term (4-10 minutes). It also rebuts arguments that loss of trust in the stability of the UST price (in the market) caused the depegging event”. This could be quite counterintuitive given that one of the problems of all the algorithmic stablecoins is the “bear market” that could be originated by fear, as it was the case of Iron finance and Titan. It is difficult (and impossible) to say that the only relevant variable was the redeemed value. Indeed, the authors also state that algorithmic stablecoins can work during bull markets, but problems arise during downmarkets.

- To address your comment, I added Fig 7 showing the difference between the oracle price of LUNA, set by the Terra blockchain, and the market price of LUNA to verify that the swap rate is not directly related to the market price. Additionally, I revised the paragraphs overall to be more cautious in stating the causal relationship. Thank you for bringing this to my attention and for your valuable input.

Please, re-read the paper in order to highlight that the mechanism is "another trigger to consider" but you cannot state that it is the real reason (as the only relevant) for the depegging

- Thank you for your suggestion. I have revised the overall tone of the text and specifically added a paragraph at the end of the introduction to make it clear that the flaw in token economics was not the sole cause of the de-pegging of Terra. Please see as below:

“It is important to note that the de-pegging of stablecoins can be triggered by various factors, such as a bear market and high negative price volatility, a lack of reserves, a loss of trust leading to a bank run, and design flaws in token economics. While these other factors are still important, many empirical studies have pointed out that flawed token economic structures can be a "destined for doom" scheme for algorithmic stablecoins, which can be triggered by arbitrage trading between on-chain redemption and the external markets. However, these studies often lack detailed blockchain-level data.”

Again, I appreciate your thorough review and detailed comments for improving my research.



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