DeFi Undercollateralized Loans (UCL)

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Abstract

This document describes one possible solution for implementing undercollateralized loans in DeFi lending platforms such as Aave, Compound, and Bonded Finance.

1 Problem

Lending platforms are fairly known in the DeFi space, some big examples of that are Aave and Compound, which make a 10 Billion US$ market combined. In addition to that, we could even add Bonded Finance for small caps projects.

All these lending platforms are based on the same principle, *the collateral value* ***exceeds*** *the value of the loan.* Even if this has some advantages for the borrower, it clearly limits the use of the platform.

2 Solution

Since DeFi is anonymous and decentralized, there is always the risk of someone leaving with the loan without paying it back. This is why an Undercollaterized Loan (UCL) rests on the principle that the collateral and the loan are locked in the platform of borrowing.

This avoids the risk of not paying the loan back and incentivizes the borrower to take other financial products on the platform.

The user benefits therefore from having a credit line for its collateral without risking a lot of their capital. However, the borrower also faces the risk of liquidation that will depend on the ratio of borrowing q and on the profit taken by the platform.

Now, let's focus on calculating the liquidation price of the asset:

$$\begin{aligned} 1 - P_{drop} &= \frac{l_i(1+\pi)}{l_i + c_i} \\ P_{drop} &= 1 - \frac{c_i \cdot q(1+\pi)}{c_i(1+q)} \\ &= 1 - \frac{q(1+\pi)}{1+q} \end{aligned} \tag{1}$$

Where P_{drop} is the needed price drop to liquidate the assets, π is the profit taken from the platform, l_i is the initial value of the loan, q is the ratio between the loan value and the collateral value at $t = 0$ and c_i is the initial value of the collateral.

One big benefit of this solution is that the profit can be adjusted in order to incentivize some loan factor q. For an example, one platform could incentivize taking bigger loans for less volatile assets like BTC and take smaller loans for more volatile assets (or incentivize taking bigger loans for more volatile assets in order to maximize profitability).

3 Profit functions

The profit function π is where the platform could take the best advantage. Having few models that describe this function and choose between for differents assets could maximize revenues, or the platform could simply DAO this function. Here we propose few examples for this function as well as the liquidation price drop of the loan.

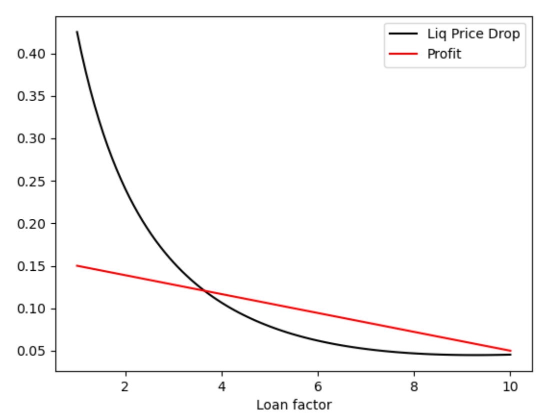
Let's give some examples of these models (take into account that they are examples and the percentage is shown could not be representative of the strategy of one platform).

3.1 $\pi \sim$ lineal

In this case, we have a pretty simple solution where:

$$P_{drop} = q \tag{2}$$

It could be interesting for less volatile assets like BTC, encouraging the user to take bigger loans.



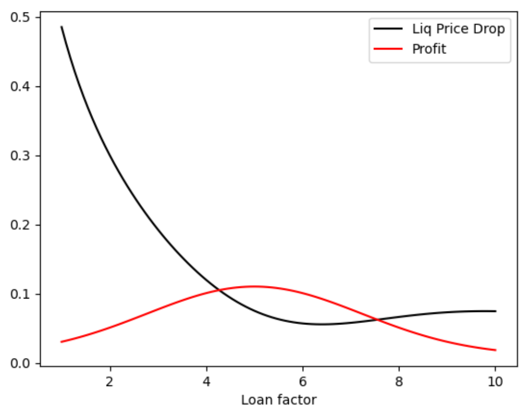
Note that this should be adapted when having a bigger loan factor.

3.2 $\pi \sim \mathcal{N}(\mu, \sigma^2)$

For $\mu = 5$ and $\sigma = 10$ we have:

$$\pi = \frac{1}{10} \exp\left(\frac{-(q-5)^2}{10}\right) + 0.01 \tag{3}$$

Another interesting equation that might be useful for assets like ETH, where the volatility is a bit higher, so you can encourage user to take smaller loans.

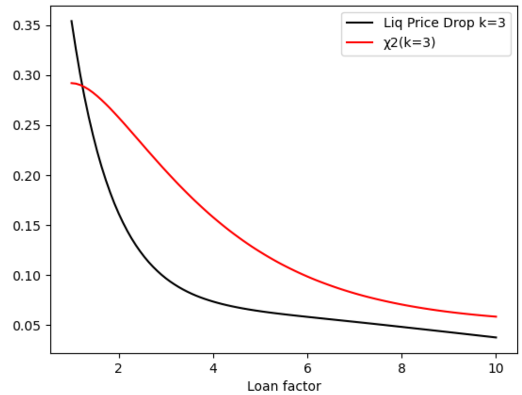


3.3 $\pi \sim \chi^2$

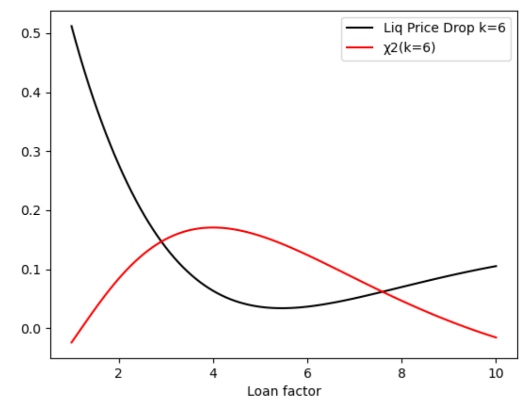
χ^2 functions have a trickier expression, we will focus on the cases $k = \{3, 6, 9\}$:

$$\chi^2(k, x) = \frac{1}{2^{k/2} \cdot \Gamma(k/2)} x^{k/2-1} e^{-x/2} \tag{4}$$

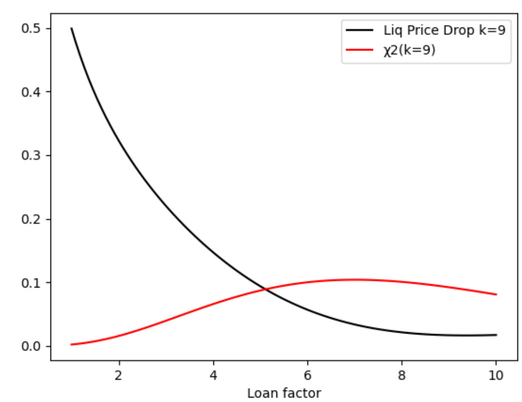
This cases go from the less volatile asset (where big loans are needed), for example DAI or USDT to really small caps where is not the best idea to take big loans.



$k = 3$



$k = 6$

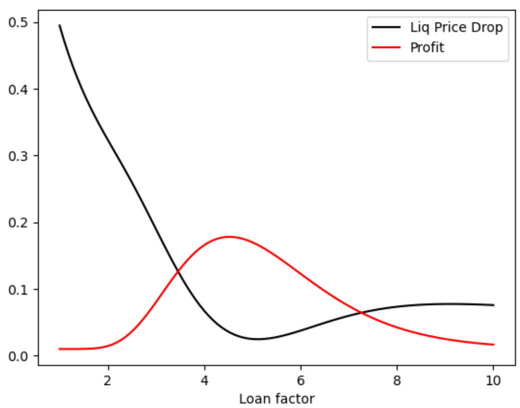


$k = 9$

3.4 π follows another distribution

This is a slightly modified version of the $\chi^2(k = 1)$ function, in this case we have this distrubution (focusing on taking bigger profits for $q = 5$):

$$\pi = \frac{0.8}{q} \cdot \exp\left(\frac{-(q-5)^2}{q}\right) + 0.01 \tag{5}$$



$k = 9$

4 Conclusion

In this document, we furnish a solution for presenting undercollateralized loans into the DeFi space. This solution could led to leveraged spot trading within a platform available for every asset, no matter the market cap of it. The only aspect needed is a pool big enough of lenders and borrowers. Another advantage of this model is that since the assets are not actually given to the user, it makes the gas cost of the platform really low.