Hedging the ETH Pool

June 15, 2022

Executive Summary

- The Lyra protocol supports permissionless trading on ETH, BTC, LINK and SOL options.
- When the AMM sells a call option, it buys one unit of the underlying asset (say, ETH).
- Short calls (from the AMM's perspective) account for a large amount of the protocol's volume. This means that the AMM will naturally be long deltas.
- The largest pool (ETH) is currently unhedged due to technical constraints.
- Such an exposure to the underlying has caused some rounds to incur losses. This was especially noticeable in round 8, which suffered losses of $1.58m, 7.7% of the deposited TVL
- In this mini report we show that (retrospectively) hedging the ETH pool will have resulted in more consistent returns for LPs.
- Specifically, round 8 was particularly bad with a net loss of $1.58M (7.7% of the original TVL).
- In round 8 with delta hedging turned on the AMM would have performed substantially better, with PNLs ranging from + 100K profit (0.5%) to -170K (0.8%) loss.

Context

The Lyra AMM attempts to profit for LPs by trading options with edge - it does not aim to profit from the movement of the underlying asset. By this, we say that the AMM aims to be "Delta neutral". The current version of the AMM fully collateralizes its shorts. This means that whenever the AMM sells a call (respectively, put) option, it locks the full amount of collateral required (1 ETH for calls, the strike price in sUSD for puts). For instance, if the AMM sells a 20 delta call option, it will be 20 delta short from the option. However, since it has to buy 1 ETH to collateralize the call, it will be net long 80 delta.

A consequence of this is that the AMM will almost always ends up long delta. To minimise exposure to the underlying, the AMM would delta hedge periodically. For technical reasons, this has to date not been enabled for the ETH and BTC pools. Hedging will be live in the Avalon release (21 June) with more flexible hedging logic.

In this report we look back over the last 8 rounds for the ETH pool and see how delta hedging would have affected the final PNL for LPs.

Specifically, this report has 3 objectives:

1. Understand the delta risk profile of the AMM throughout the first 8 rounds of trading,
2. Breakdown the profit and loss the AMM experiences from trading options (excluding PNL from locked collateral) and

3. Show that with delta hedging, the previous 8 rounds will have (on average) resulted in consistent positive expectancy for the AMM.

Delta Risk Profile

In Figure 1, we show the net delta (the sum of the delta of all the pool's options AND delta of the collateral) of the pool (y axis) over the duration of the round in hours (x axis). The net delta of the pool is almost always positive, reaching as high as 3500. This represents a very large exposure for the pool, since a "modest" price drop of, say, \$100 would represent a loss in value of $3500 \times 100 = \$350,000$.

In Figure 2 a) we show the net delta of the pool with hedging conducted every 16 hours (currently, the LINK and SOL pools are hedged with this frequency). It is clear that with hedging, the maximum delta exposure of the pool falls sharply to approximately 1000 delta. Most large spikes are a result of an expiry releasing a large amount of collateral or the AMM running out of funds to hedge (the AMM locks 1/3 of its original TVL to delta hedge). In Figure 2 b) we show the liquidity available for the AMM to hedge. Note that in rounds with high volume, the amount of hedging liquidity can drop to 0, meaning further hedging may not be possible.

Nevertheless, **hedging would dramatically reduce the delta risk the pool experiences** due to its collateralization mechanics.

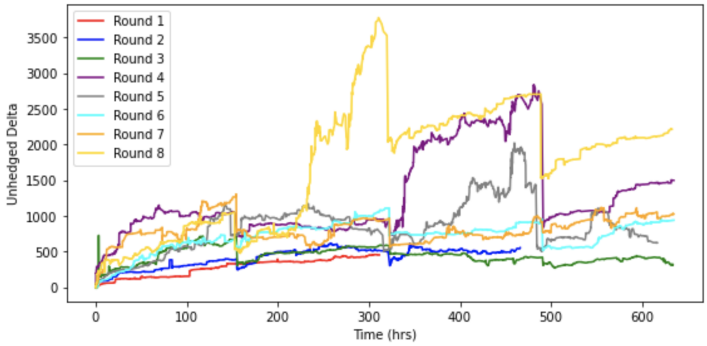

Figure 1: Net Delta (unhedged) of the ETH pool for each round.

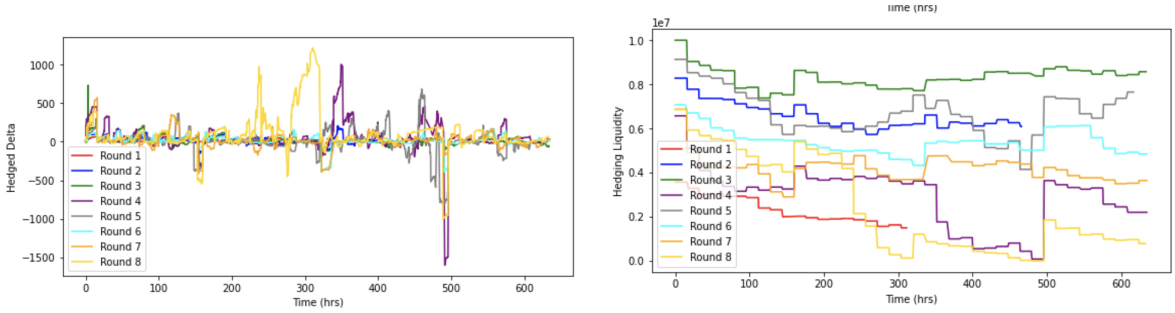

Figure 2: a) Hedged Delta per round and b) liquidity available for trading.

AMM Trading Performance (excluding collateral)

So has the ETH pool made money trading options? In Figure 3 we show the trading performance for each round. The blue bar represents the net premiums + fees received (negative, if premiums paid out) for each round. The orange bar shows the value of the AMM's options position at expiry and green the SNX fees charged when the AMM needs to collateralize its short calls. It is clear that:

- The AMM has been profitable trading ETH options over all but one round (shown by the sum of the orange + blue bars).
- With hedging turned on, these profits would probably decrease (the deltas of the options should vanish).
- In recent rounds (esp round 5), the AMM paid out more in premiums than it receives. That is, it bought more options than it sold.
- SNX fees for collateralizing shorts (10 basis points) were small but noticeable.
- Overall, with hedging, the AMM should only profit from its edge - what we see here is some net profit from unhedged option deltas.

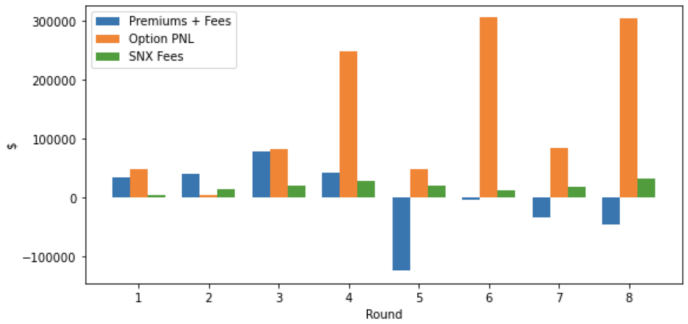

Figure 3: Trading PNL per round (option PNL, premiums/fees paid and received).

PNL with/without Hedging

Why has the AMM lost money in some rounds? Why were the losses in round 8 so pronounced?

Almost all the AMM's loses (and most of its profits!) have been froms the huge amount of collateral it holds. This means the AMM has lived and died by the price of ETH/underlying.

Let's look at Figure 4 a): this is a plot of the ETH collateral over time. For instance, in round 8 the AMM at one point was holding 4000 ETH in collateral. This means that if the price of ETH were to drop (which it did, by quite a lot), then the value of this collateral follows accordingly.

In Figure 4 b) we show the collateral PNL of each round in blue: in round 8, the AMM lost nearly $1.8M purely from the drop in value of the collateral it held. **This means that even though the AMM made almost $300,000 in (unhedged) profit from the options it traded, it lost almost 6 times this amount from the collateral it had to hold!**

So how does hedging play into this? In orange we show how much the AMM would have made if it delta hedged every 16 hours. Unsurprisingly, this amount will be approximately the same as that lost by the AMM's collateral. In green we show the fees paid by the AMM to hedge; these are relatively small (on the order of $10-30K) compared to the huge swings seen in the collateral.

So how does the total PNL fare? In Figure 5 a) and b) we show the PNL for each round with various hedging frequencies. As b) makes clear, having hedging turned on makes the AMM profitable for each round. That said, round 6 which was originally very profitable because of a high PNL in the collateral became less so (since all the upside was hedged away).

Specifically, in round 8, ETH decreased in price by approximately 38% and the PNL of the pool was down 7.7% (approx. $1.58M). With delta hedging turned on, we see that the PNLs of the pool will range between +100K (up 0.5%) and -170K (down 0.82%) - a substantial improvement.

It's also interesting to note that the PNL is not a clear function of the hedging frequency. That is, hedging every 24 hours is not always more/less profitable than every 48 hours. This is probably because large trades/sudden price moves in ETH could be missed when the AMM hedges at certain times. Running these simulations with more granular hedging and averaging out the results will smooth these discrepancies.

This could also be a minor issue with the methodology used to produce these results. We scrapped the on chain data of all trades conducted on the AMM and then set the time to hedge as 16 hours (or whatever frequency) from the first trade. Due to the limitations of the data, the hedging would occur at the next trade after the new hedging time. For instance, if the first trade occurs at 10am Monday, then the next hedge would occur at the first trade after 2am Tuesday. If there were no trades until 5am Tuesday, this is when the hedging would occur. For an active market like ETH this is not much of an issue (trades are quite frequent), but it is a small error that could contribute to these results.

If the AMM hedges too frequently (say, every 30 minutes), then fees increase noticably (approx 50-60K per round) and offers marginally more risk protection. For this reason, a hedging frequency anywhere between 16 and 48 hours seems appropriate.

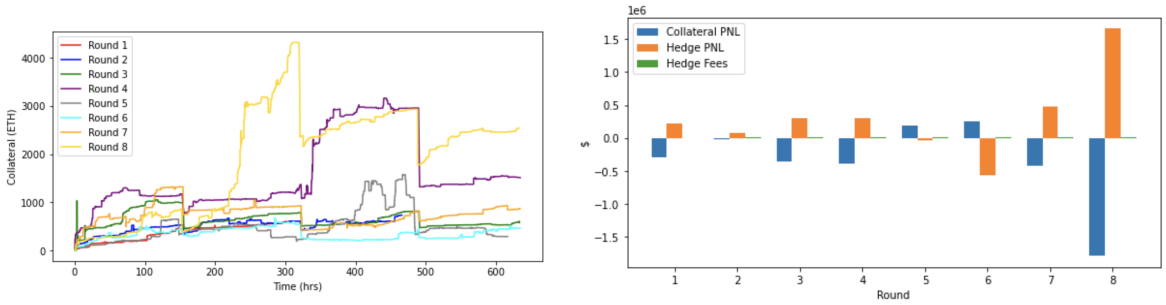

Figure 4: a) Collateral locked for each round, b) Collateral PNL per round.

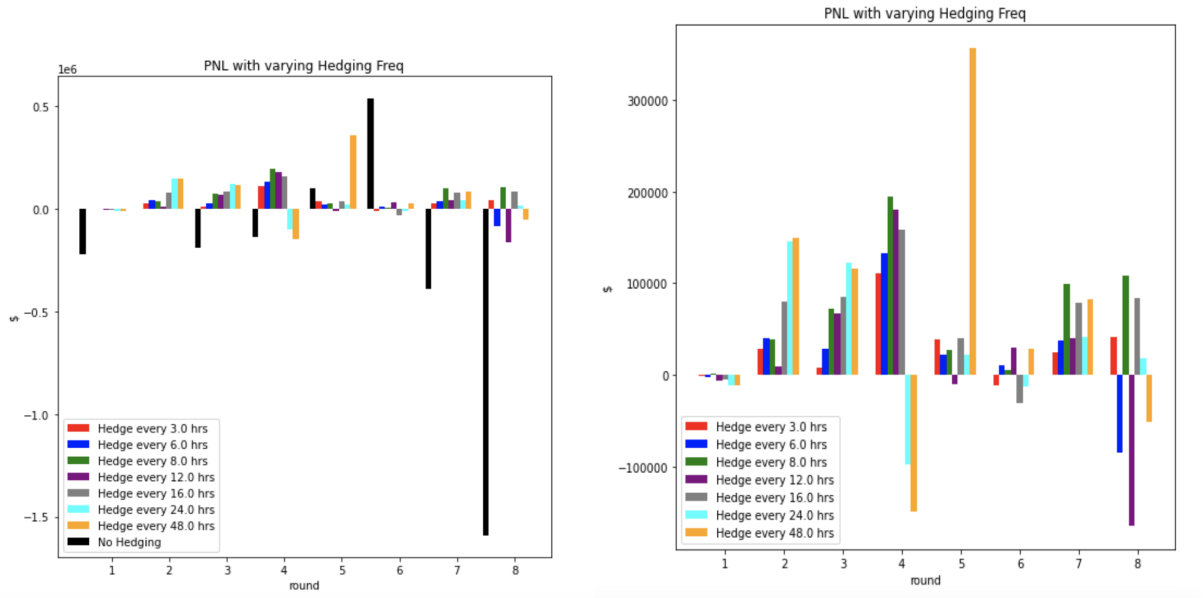

Figure 5: a) PNL (including unhedged), b) PNL (excluding unhedged for better resolution).

Conclusion

Lyra's AMM has traded for 8 rounds and the results so far have been solid. That said, there have been some under-performing rounds (8). This report has shown that with delta hedging turned on:

1. The AMM's delta risk profile will be substantially reduced,
2. The AMM's net PNL has historically been positive across the first 8 rounds and 7 months of trading had delta hedging been enabled.

Further rounds will be needed to see how the AMM performs across all markets, and we'll be continuing to post similar analysis over the coming months.