# Aquo v1

Oakley, Trevor Lee

May 24, 2024

**Abstract**

We propose an extensible liquidity DeFi protocol called Aquo. Aquo is for RWAs using principles of flatcoins which are pegged to a basket of RWAs prices. This protocol, is extensible to allow in later versions DeFi Composition, AMM Composition, and integration of DeFi protocols (such as lending) into Aquo's protocol.

**Keywords:** Real World Assets (RWA), Flatcoins, Decentralized Finance (DeFi), Automated Market Maker (AMM), Liquidity Model, Aquo Protocol, DeFi Composition, AMM Composition, Lending Protocols

## 1 Introduction

Aquo introduces novel and new reward models for liquidity provision in real-world asset markets (RWAs). These reward models are based on liquidity demand, and rebalancing within Automated Market Makers (AMMs).

We greatly extend existing ideas about AMMs, many of which are very limited for example to requiring an asset pair in the AMM from the liquidity provider (LP).

In the Aquo protocol, we introduce flatcoins, RWA mining, LP mining, feedback loops, composable AMMs [11] [21], and bonding curves into the liquidity model.

We propose in this document v1 for Aquo, but later versions are planned which would involved integration of DeFi protocols via composition [18], and improving feedback loops via reinforcement learning networks.

## 2 Problem Definition

The fundamental problem is to write an in-demand use case for blockchain technology taking into account costs, stability, useability, and one which solves real-world problems.

We focus on financial models and decentralized finance (DeFi). DeFi has grown very dramatically from it early roots in 2017 and 2018 but today is affected by high swap fees, price slippage and capital inefficiency.

### Liquidity

Within the broad DeFi spectrum, we focus on a market segment related to liquidity in real-world assets (RWAs). A long-standing problem with RWAs is they are illiquid. Illiquid assets cannot easily be converted into cash [16]. This illiquidity stems from the fact the underlying RWA (e.g. a house) is illiquid by its nature. It cannot be sold easily due to the high cost of a RWA and the sale usually involve extensive legal work including registrations with state regulators.

Various models developed for RWA tokenization but tokenization in itself will not create liquidity. It simply provides a digital representation of the RWA and the token itself has to be saleable.

# 3 Solution Approaches

We propose a solution based on several key components:

- RWA Tokenization
- Aggregation
- Token Bonding Curve (Flatcoin)
- Automated Market Marker (AMM)
- Concentrated Liquidity

These will be explained more fully in this document. As an introduction, we can introduce these components as follows.

### RWA Tokenization

RWA tokenization we process of tokenizing an RWA which usually involves defining shares in a RWA and the shares are then tokenized. We propose using existing platforms for RWA tokenization and not to directly produce new systems to tokenize RWAs.

### Aggregation

Aggregation of RWAs is under a general branch of protocol technology called composition. This is the process of taking a lot of RWAs to create a single pool or reserve of RWAs in a basket type philosophy (similar to concepts in a basket of commodities) which have been widely debated for decades [9].

### Token Bonding Curve

A bonding curve defines an asset and its price [7]. Hence we can define an asset its price is determined by a bonding curve. We propose using bonding curves to an emerging type of coin called the flatcoin [8]. A flatcoin has its value pegged to the cost of goods and it represents purchasing power. We propose a new angle of a flatcoin which is to peg its value to a basket of RWAs. This is a fundamental component to the Aquo liquidity solution.

### RWA Mining

We propose RWA mining, a reward in the AQUO token to RWA token providers to the flatcoin pool. This is akin to Liquidity Mining already used in DeFiu which rewards liquidity providers for contributing to liquidity pools [12].

### Automated Market Makers

Automated Market Makers (AMMs) have existed in blockchain architectures since 2017 and 2018 (when Bancor and Uniswap launched respectively). AMMs swap a pair of assets based on an invariant curve (e.g. a product invariant curve). Curve v1 launched with a AMM called Stableswap. We propose using a variation on Curve v1 with Uniswap v4 so that a RWA flatcoin can be swapped with a stablecoin (e.g. USDC). This will create liquidity.

### Concentrated liquidity

Concentrated liquidity was implemented in Uniswap v3 and this is liquidity constrained within a price range. We propose in using concentrated liquidity bounded by the trading range for the flatcoin against the stablecoin.

# 4 Aquo Protocol's Architecture

Aquo consists of various key components, already described, and we can draw these in figure 1.

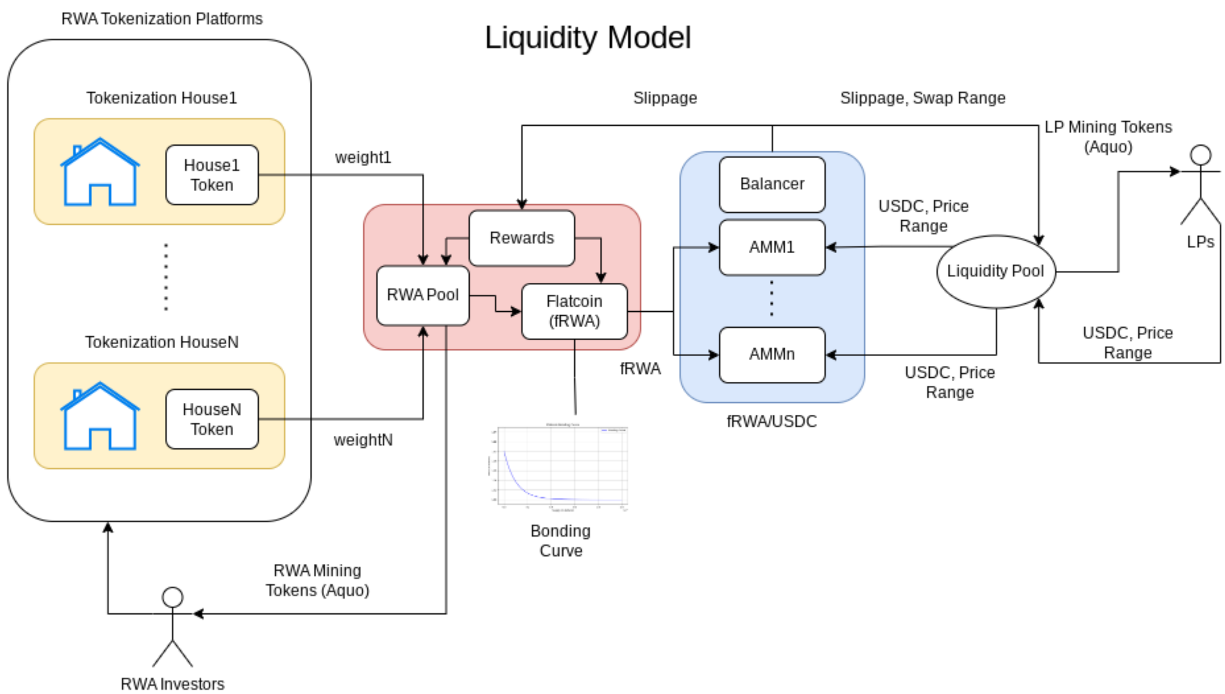


Figure 1: Design

## 4.1 RWA Tokenization

RWA tokenization has been a solved problem since the early tokenization models in 2017 and today platforms such as Blocksquare [2]. In Aquo's design, the RWA tokenization is done via third parties and Aquo's systems will take already tokenized assets.

Blocksquare itself does due dilligence using RICS [20] and the values provided by the tokenization platforms can be accepted. That part of the infrastructure is labour intensive with low returns, Aquo does not propose building tokenization platforms for RWAs but using existing ones.

## 4.2 RWA Pool

Liquidity can only be found via a certain volume of RWA tokens. This amount is dependent on the trading activity via the AMMs. Therefore a feedback loop is engineered for slippage into the RWA pool.

As the slippage is high then that implies more liquidity is needed so the reward is increased for RWA token holders.

The rewards takes two forms:

- Minting Flatcoins above the face value of the RWA token
- Minting RWA Mining tokens for the RWA token holders

The flatcoin minting is done via a bonding curve. The rewards are vested to stop a cycle of transfers in and out for rewards. So once the RWA token holder transfers into the RWA pool to make it deeper, their tokens are vested for a period with withdrawal penalties (i.e. loss of rewards).

Similarly Aquo tokens are minted for rewards and these are also vested. The period of vesting depends on the demand for liquidity from the AMMs.

If the demand is high, then the price of the liquidity is raised and the rewards raised too.

### 4.3 Token Bonding Curve/Flatcoin

The underlying theories of linking a price to a basket of commodities is well established [15] [6] and has been widely debated.

We extend the idea to RWAs and a basket of RWAs in a pool. We mint a flatcoin when RWA tokens are added to the RWA pool. The issue is then the price for the flatcoin. The price is controlled via a bonding curve which is dynamic. It will depend on the demand for liquidity. When a pool starts the demand will be higher than for a more mature pool. Therefore earlier investors will be rewarded by getting more flatcoins for an RWA token.

To take a static example to show the principle, we can consider a curve as shown below.

$$\text{Price} = 1.0 + 0.1 \cdot e^{-\frac{\text{Supply}}{1000000}}$$

The precises value of the parameter will vary (e.g. 1000000) so that the curve fits the use case. Figure 2 has an example curve.

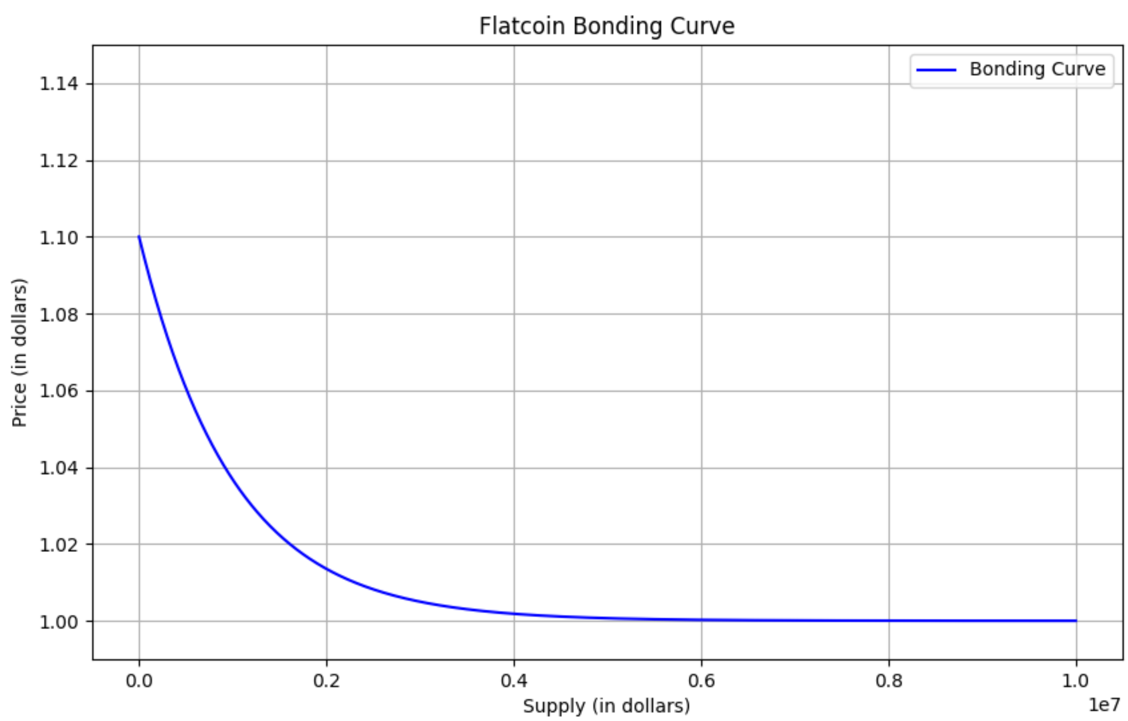


Figure 2: Bonding Curve

In this example the parameter is static but the real system will be dynamic so that finally a balance (equilibrium is reached) between liquidity demand and supply for RWA tokens.

## 4.4 Slippage Feedback

The principles of feedback are well known in control systems [19] and we use this same concept. As the AMM trades there is slippage and this will be reduced by more liquidity.

Hence we can say:

Slippage ($\sigma$) is calculated when flatcoins are swapped:

$$\sigma = \left| \frac{\Delta USDC_{\text{expected}} - \Delta USDC_{\text{actual}}}{\Delta USDC_{\text{expected}}} \right|$$

The AMMs will use different invariants (e.g. product) and therefore the Reward module is just taking the final slippage value, and not calculating the slippage. Hence this is empirically obtained, and later an AI (reinforcement learning network [17]) could be used (in later versions of Aquo).

## 4.5 AMMs

The concepts and designs of AMMs were pioneered by Chen et al. and others [5] who worked on the theoretical aspects of AMMs and convex optimization.

In the blockchain sector, Bancor and Uniswap were early adopters of AMMs concepts to create DEXs. DEXs today are widely used. They suffer from price slippage and capital efficiency; and impermanent loss.

We propose in Aquo of extending Curve v1 (known originally as Stableswap) so that the flatcoin can be swapped for a stablecoin (eg USDT).

Also Aquo can integrate using AMM composition so that a transaction for liquidity can be split across AMMs.

## 4.6 Concentrated Liquidity

Concentrated liquidity was implemented in Uniswap v3 and improved capital efficiency. We propose using concentrated liquidity limiting the price range to the price movements in the flatcoin which allows for far greater efficiency than a passive LP model (across all prices).

# 5 RWA Tokenization

The underlying concepts of real-world asset tokenization come from merging two ideas of real assets (as used in financial systems) and tokenization (as widely used in blockchain systems).

Real assets are parts of the economy which generate income (usually), e.g. factories, land, workers, machines, and knowledge. This is contrasted to financial assets which are claims on the income generated by real assets (e.g. dividends) [3].

Blockchain ideas extended the TradFi's perspective on real assets to form a real-world asset (RWA) which means a real asset in a tokenized form. Hence we talk of RWA tokenization.

Tokenization has existed for a number of years and we do not need to dwell in-depth on tokenization principles. As a summary, we link in a tokenized model a reference asset to a digital or crypto asset [4]. Tokenized models have been widely applied from stablecoins to future earnings via someone's labour.

We focus on RWA tokenization [1] which a form of tokenization which links RWAs to a tokenized asset and then DeFi protocols can be used with the tokens.

## 6 Flatcoins

An emerging concept in DeFi and blockchains is the flatcoin [8] [10]. The original design of flatcoins was to allow for inflation by pegging a flatcoin to a basket of commodities. But the concept can be used to peg the value of a flatcoin to a RWA [14].

We propose a new flatcoin for a basket of RWAs which maintains value for the RWAs. This allows a tradeable coin to be created which provides liquidity and stability.

## 7 Concentrated Liquidity

Under a concentrated liquidity model, liquidity is provided within a price range [13].

## 8 Summary

Aquo proposes a new model which focuses on the following:

- Rewarding RWA investors and liquidity providers
- Implementing a dynamic pricing and liquidity price mechanism to incentize and reduce slippage and capital efficiency
- To issue a new Aquo token for rewards
- To issue a new flatcoin pegged to a basket of RWA tokens

## References


[1] Andry Alamsyah, Gede Natha Wijaya Kusuma, and Dian Puteri Ramadhani. A review on decentralized finance ecosystems. *Future Internet*, 16(3):76, 2024.

[2] Blocksquare. Blocksquare — tokenization infrastructure for real estate, 2024.

[3] Zvi Bodie and Alex Kane. Investments. 2020.

[4] Francesca Carapella, Grace Chuan, Jacob Gerszten, Chelsea Hunter, and Nathan Swem. Tokenization: Overview and financial stability implications. 2023.

[5] Yiling Chen, Lance Fortnow, Nicolas Lambert, David M Pennock, and Jennifer Wortman. Complexity of combinatorial market makers. In *Proceedings of the 9th ACM Conference on Electronic Commerce*, pages 190–199, 2008.

[6] Kenneth W Clements and Renée Fry. Commodity currencies and currency commodities. *Resources Policy*, 33(2):55–73, 2008.

[7] CoinMarketCap Academy. Bonding curve definition, 2024. Accessed: 2024-05-23.

[8] CoinMarketCap Academy. Flatcoin definition, 2024.

[9] Kevin Dowd and Kevin Dowd. Commodity-basket monetary standards. *Competition and Finance: A Reinterpretation of Financial and Monetary Economics*, pages 337–380, 1996.

[10] Jeff Emmett, Danilo Lessa Bernardineli, and Jamsheed Shorish. Flatcoins: Inflation-adjusted stablecoins. 2023.

[11] Daniel Engel and Maurice Herlihy. Composing networks of automated market makers. In *Proceedings of the 3rd ACM Conference on Advances in Financial Technologies*, pages 15–28, 2021.

[12] Michael Feng, Rajiv Bhat, and Carlo P Las Marias. Liquidity mining: A marketplace-based approach to market maker compensation. *Hummingbot research paper*, 2019.

[13] Robin Fritsch. Concentrated liquidity in automated market makers. In *Proceedings of the 2021 ACM CCS Workshop on Decentralized Finance and Security*, pages 15–20, 2021.

[14] Robby Greenfield. Solving for secondary rwa liquidity: An introduction to the real-world-asset token bonded curve (rwa tbc) for tokenized bonds. *Available at SSRN 4574438*, 2023.

[15] Friedrich August von Hayek. A commodity reserve currency. *The Economic Journal*, 53(210-211):176–184, 1943.

[16] Investopedia. Illiquid, 2024. Accessed: 2024-05-23.

[17] Leslie Pack Kaelbling, Michael L Littman, and Andrew W Moore. Reinforcement learning: A survey. *Journal of artificial intelligence research*, 4:237–285, 1996.

[18] Stefan Kitzler, Friedhelm Victor, Pietro Saggese, and Bernhard Haslhofer. Disentangling decentralized finance (defi) compositions. *ACM Transactions on the Web*, 17(2):1–26, 2023.

[19] I Michael Ross, Pooya Sekhavat, Andrew Fleming, and Qi Gong. Optimal feedback control: foundations, examples, and experimental results for a new approach. *Journal of Guidance, Control, and Dynamics*, 31(2):307–321, 2008.

[20] Royal Institution of Chartered Surveyors. Welcome to rics, 2024.

[21] Srisht Fateh Singh, Panagiotis Michalopoulos, and Andreas Veneris. Deeper: enhancing liquidity in concentrated liquidity amm dex via sharing. In *2023 IEEE International Conference on Blockchain and Cryptocurrency (ICBC)*, pages 1–7. IEEE, 2023.