Temporal

Unifying Temporally Discrete Markets into Continuous Forward Curves

Litepaper V1

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Abstract

Incumbent DeFi solutions offer no fixed-rate lending and borrowing at short timeframes, for example a weeklong duration, let alone custom maturities. Nor is there a solution that offers market determined yield / forward curve – vital pieces of infrastructure currently missing from the DeFi ecosystem and preventing it from reaching full potential.

Temporal's market mechanism unifies Temporally Discrete Markets such as Futures and Lending & Borrowing into Realtime, Continuous, Forward Curves shaped purely by market forces. This allows users to enter Market-Priced, Custom-Maturity Futures and Lending & Borrowing contracts, creating an entirely new DeFi primitive; in contrast to typical exchanges which offer a few standardized-maturity contracts with siloed liquidity.
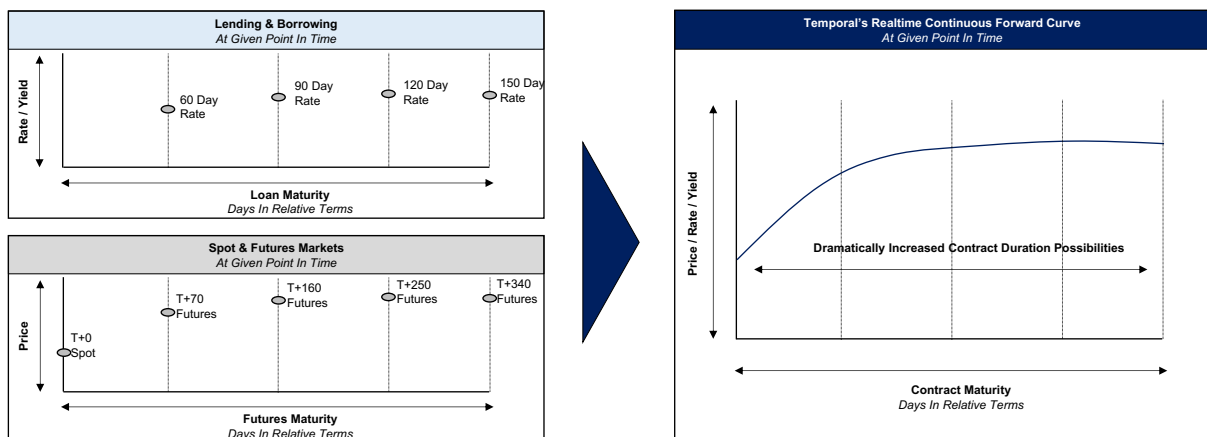
1. Introduction

Debt Capital Markets are a foundational infrastructure for any financial ecosystem. Even more so at the short end of the curve – money market instruments – where currently $5 Tn in assets are deposited in TradFi. These instruments are the bedrock on which yield curves are built, and all financial instruments priced.

The principle is as true for DeFi as it is for TradFi. However, this critical market determined yield curve or forward curve is missing from the DeFi Universe. Temporal aims to bring this primitive to both Debt and Derivative Markets of DeFi.

Thus far, implementing a reliable and efficient fixed-rate lending and borrowing mechanism in DeFi has been a challenge. Among many, some of the prominent reasons include:

- The volatile nature of cryptocurrencies
- Over-engineered rates – determined by mathematical formula with few degrees of freedom.[1]
- Rates at the mercy of decentralized governance instead of being set by market forces.[2]

Incumbents currently have a partial solution in place, offering fixed rates but only at fixed maturities such as 3 months, 6 months, and 9 months. A well-functioning financial ecosystem requires overnight borrowing and customization for individual market participants to satisfy their requirements. Further, current pricing mechanisms are especially open to exploitation as they are not a market derived price, but a modelled price whose limitations are easily determined.

The Temporal Solution offers a 'modified order book' that amalgamates Discrete Markets such as Futures and Lending & Borrowing into Realtime, Continuous, Forward Curves shaped purely by market forces.

Creating this continuous Forward Curve leads to an entirely new DeFi primitive. A primitive that enables market participants to borrow / lend for any duration they need while ensuring the most competitive rate possible.

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[1] Alliance DAO talks of this as a problem worth solving in 2023 : https://alliancedao.notion.site/Crypto-Web3-Startup-Ideas-2023-Edition-48d40ccadeeb42a48056659fcce109b1#ebb3aa8e31af4d28bfe2cfe688ce5424

[2] Temporal's community presides governance over Temporal's activities, rates are market-determined

2. Temporal Order-Book

Temporal Modifies the Traditional Order-Book Mechanism as Follows:

A. Orders

- Orders in the 'Temporal Order Book are parametrized by
    - **'Quantity'**
    - **'Price'**
    - **'Duration'**
    - **'Type'**: Liquidity Consumer, Liquidity Provider

- While 'Quantity' and 'Price' parameters are present in traditional order books, 'Duration' and 'Type' parameters are introduced by Temporal

- Order 'Type' –
    - In case of 'Liquidity Consumer' Type Orders, 'Duration' represents the <u>Exact Required Contract Duration</u>
    - In case of 'Liquidity Provider' Type orders, 'Duration' represents the <u>Maximum Contract Duration They Are Willing to Enter</u> as Counterparties to 'Liquidity Consumers'

B. Order Matching Mechanism
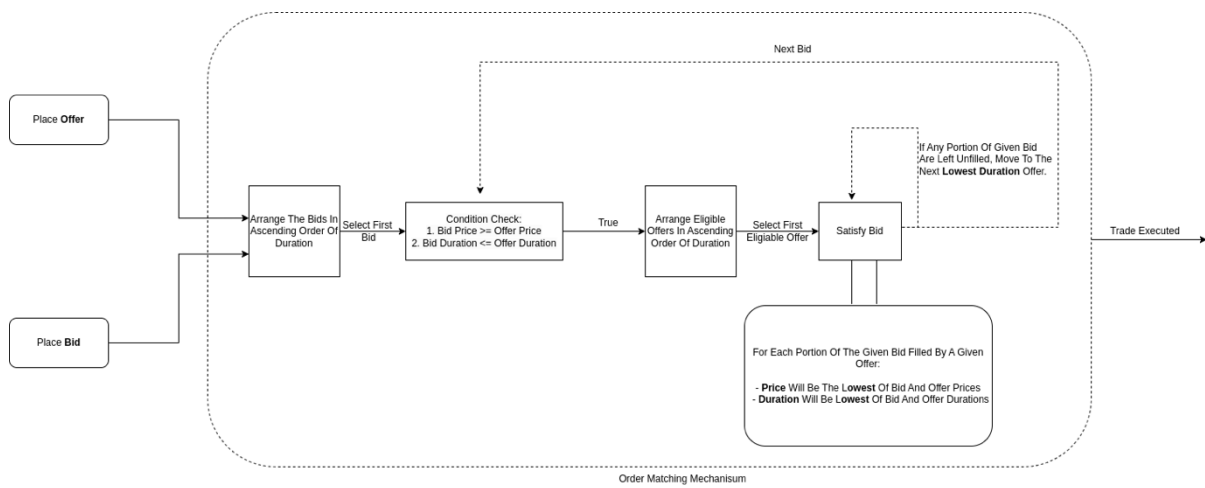
a. Only Match Orders with other Orders of Different 'Type': 'Liquidity Consumer' Type Orders only match with 'Liquidity Provider' Type Orders and Vice-Versa

b. In this implementation:
    i. All 'Bid Orders' Are 'Liquidity Consumer' Type Orders – in the following example, these are 'Borrowers'

      ii.   All 'Offer Orders' Are 'Liquidity Provider' Type Orders – in the following example, these are 'Lenders

c.   Sort 'Bid Orders' into List in Ascending Order of Duration.

d.   For the First Bid Order in the List, Check Eligibility of 'Offer Orders', Using Following Conditions:
      i.   Price Condition: (Bid Price) $\geq$ (Offer Price)
      ii.   Duration Condition: (Bid Duration) $\leq$ (Offer Duration)

e.   After Checking Each 'Offer Order' For Eligibility as Above, Eligible 'Offer Orders' Are Listed (Where Price Condition and Duration Conditions Are Both Met):
      i.   Eligible 'Offer Orders' are Listed and Sorted in Ascending Order of Duration
      ii.   Satisfy As Much of Bid Order as Possible with Eligible Offer Order Having Minimum Duration (First in Eligible Offer List)
      iii.   If Any of The Bid Is Left Unfilled, Move to The Next Lowest Duration Eligible Offer (Next in Eligible Offer List)
      iv.   For Portions of Bid Order Which Are 'Filled' / 'Matched' with 'Offer Order',
            1.   Price Will Be the Lowest of Bid and Offer Prices
            2.   Duration Will Be Lowest of Bid and Offer Durations

f.   Once Bid Order Is Filled, Move to The Next One in The List From (c) With Descending Order of Bid Duration, And Repeat Steps (c) To (f)

C. Lending & Borrowing Simulation Results

Graphs 1 and 2 depict the state of the Order Book prior to any execution. With market participants (= borrowers and Lenders) entering their desired rates and Order quantities for the desired Duration.

Graphs 3 and 4 showcase execution of the Temporal mechanism: with graph 3 depicting the market determined yield curve in real-time.
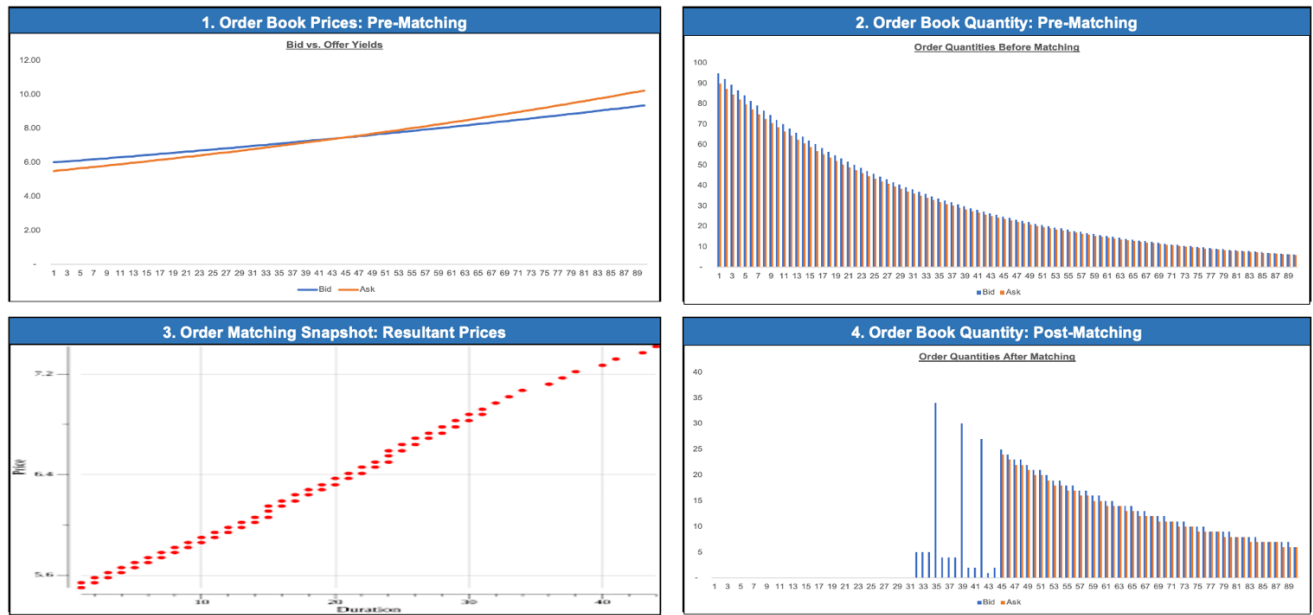
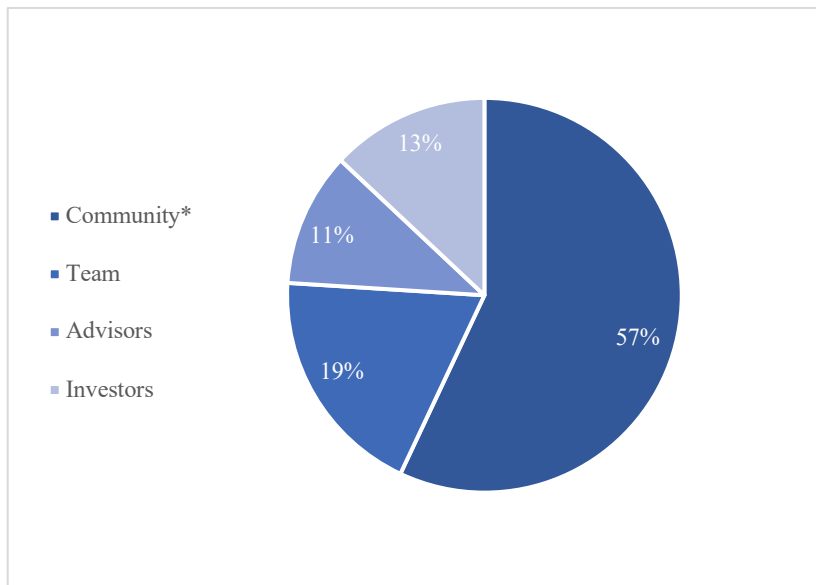

3. LP Incentive Structure
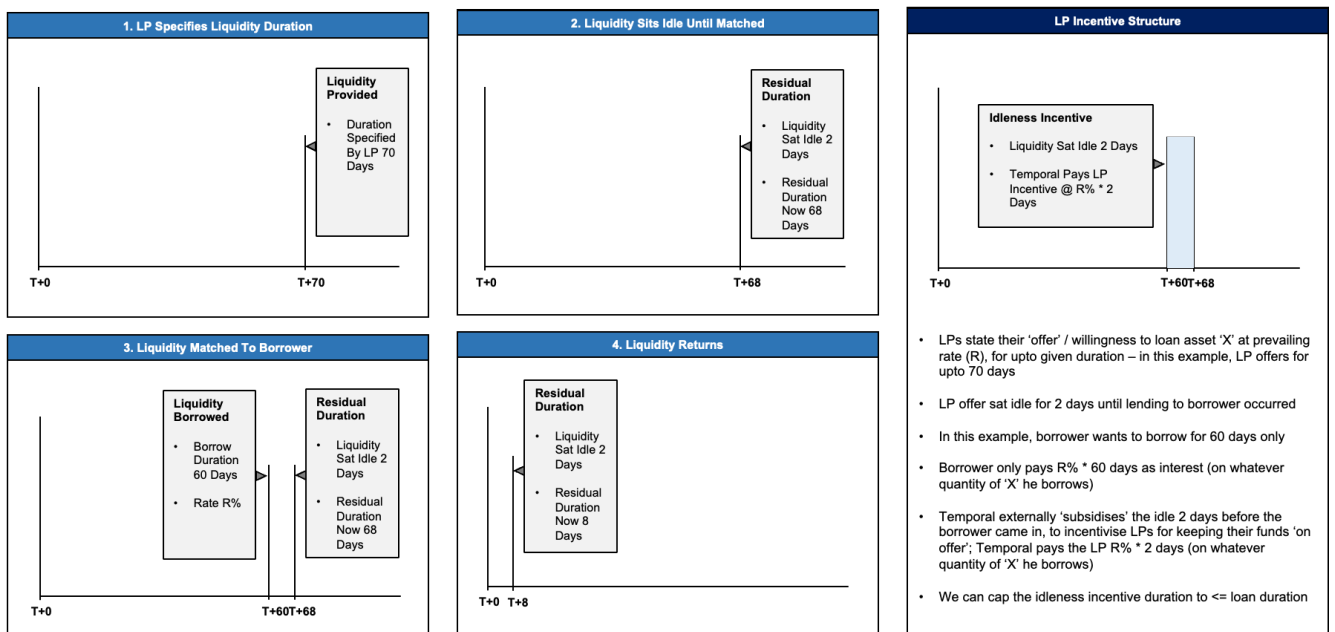
- LPs state their 'offer' / willingness to loan asset 'X' at prevailing rate (R), for up to a given duration – in this example, LP offers for up to 70 days.

- LP offer sat idle for 2 days until lending to borrower occurred.

- In this example, borrower wants to borrow for 60 days only.

- Borrower only pays R% × 60 days as interest (on whatever quantity of 'X' they borrow)

- Temporal externally 'subsidizes' the idle 2 days before the borrower came in, to incentivize LPs for keeping their funds 'on offer'; Temporal pays the LP R% × 2 days (on whatever quantity of 'X' they borrow).

- We can cap the idleness incentive duration to ≤ loan duration.

4. Tokenomics

Token Pie

* Includes LP Incentives + Emergency Liquidity Reserves + Treasury. The split is subject to update as Temporal enters subsequent development stages.

Token Value Accrual Mechanism:
- Transaction fees collected in governance token $TEMP
- Tokens collected as fees are burnt by protocol