

# Astera Lend Whitepaper

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## Abstract

Astera Lend is a cryptocurrency-native money market module implemented on the Ethereum Virtual Machine. Compared to existing money markets, Astera Lend enhances functionality by introducing Mini-Pools, Collateral Flow Controls, and collateral Rehypothecation. Astera Lend aims to address the industry’s most pressing issues: liquidity fragmentation and risk management.

**Keywords:** Decentralized Finance, Cryptocurrency, Lending Market, Money Market, Astera

## 1. Introduction

Decentralized Finance (DeFi) lending protocols allow lenders to deposit a cryptocurrency that is lent out to borrowers in return for regular interest, and typically require borrowers to deposit collateral to access a crypto loan.

Current DeFi lending protocols often suffer from capital inefficiency. They experience significant idle capital, arbitrary interest rate curves, and outdated market parameters that cannot adapt to evolving market conditions, leading to unanticipated risk exposure.

Moreover, in the pursuit of market share, protocols have historically taken on additional risk without effective mitigations. This has resulted in a fragmented liquidity landscape and increased risk for both lenders and borrowers.

In this paper, we present Astera Lend, which vastly reduces DeFi risks while increasing the variety of collaterals and behaviors accepted on the platform. Astera Lend better-aligns borrowers and lenders in relation to risk tolerance and potential yield, while isolating and managing protocol risk and reducing liquidity fragmentation. It does so through the following features:

- Mini-Pools: Market risk parameters can be controlled by deploying isolated markets. Mini-Pools can be funded by Core-Pool assets while isolating borrow-side exposure.

Parameters like Deposit Caps, Loan To Value (LTV) ratios, Interest Rates, and Liquidation Bonuses, are programmed for every Mini-Pool, allowing for bluechip markets to scale with demand, and for implementation of exotic collateral markets without exposing the protocol to excessive risk.

- **Collateral Flow Control:** Astera Lend enables the control of Mini-Pool exposure in response to shifts in market conditions. By deploying a new Mini-Pool with adjusted risk parameters and shifting the flow of Core-Pool collateral supply from the old Mini-Pool to the new Mini-Pool, Astera Lend can reduce Core-Pool asset risk exposure in real time, in a way that does not impact existing loans. If the LTV of a collateral/debt configuration is reduced in a new Mini-Pool, existing positions in the old Mini-Pool will not be liquidated as a result.
- **Rehypothecation:** Astera Lend implements a rehypothecation engine that exposes underutilized collateral to yield on behalf of depositors. Rehypothecation is executed in the safest possible manner, interacting only with known, high security strategies.
- **Native Stablecoin:** Astera Lend will be the primary Facilitator for a unique stablecoin being developed by Astera. Users will be able to deposit collateral and mint the stablecoin, which will be reinforced with state-of-the-art interest rate management, Algorithmic Market Operation (AMO) contracts, and integrated risk mitigations. This feature will be detailed in a subsequent Whitepaper.

## 2. Mini-Pools

Mini-Pools are subdivisions within the Astera Lend platform that allow for granular control over risk exposure. Mini-Pools effectively perform as isolated lending markets within the Astera Lend architecture. While the Core-Pool accepts deposits of highly liquid, blue-chip collateral for supply, Mini-Pools are the mechanism by which global collateral supply is distributed in an isolated manner without fragmenting liquidity. The Core-Pool extends lines of credit to Mini-Pools, reinforcing their asset supply to backfill loans as demand grows (Figure 1).

Users have the freedom to deposit assets in the Core-Pool to gain exposure to global asset demand, with risk managed by Astera Lend, or deposit assets directly in Mini-Pools and isolate their exposure and asset demand.

Mini-Pools allow the protocol to accept unique and exotic collaterals, by setting debt ceilings and interest rates that reflect the risk profile of collateral.

### 2.1 Debt Ceilings

The debt ceiling for a Mini-Pool is programmed by quantity of a Core-Pool asset, regardless of its price, further limiting risk exposure. Meanwhile, interest earned by Core-Pool

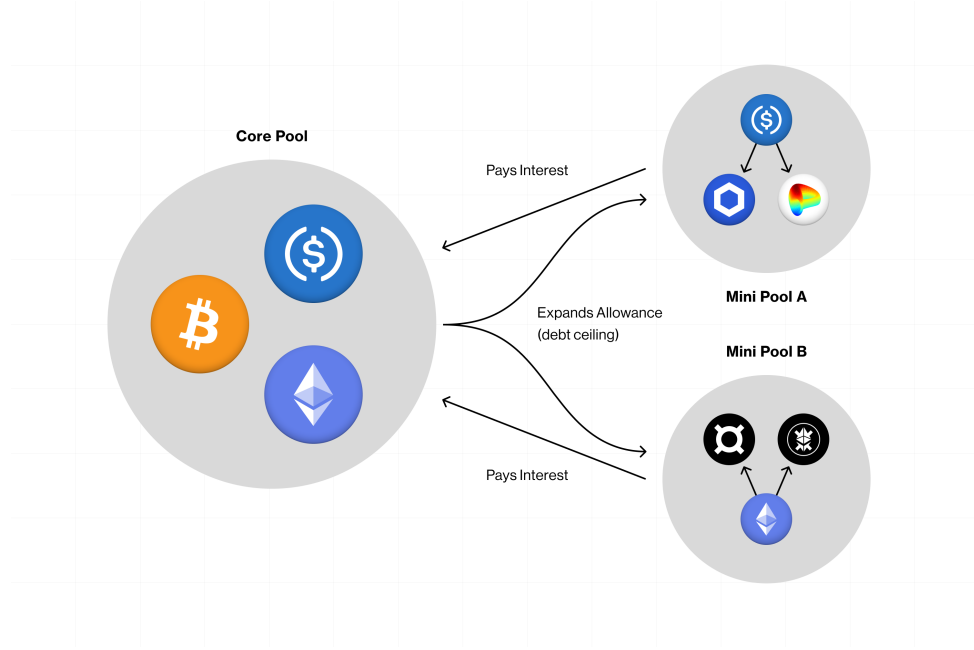


Figure 1: The Mini-Pool construct.

assets in Mini-Pools is returned to Core-Pool depositors, providing them with a broad, scalable source of yield.

## 2.2 Interest Rate Control System

Lend-borrow interest rates are governed by independent control systems (Boneh, 2024) that are tuned to maintain optimum utilization by constantly adapting to current utilization levels and autonomously adjusting interest rates. The effect is that interest rates for assets borrowed by Core-Pool borrowers (users and Mini-Pools), as well as Mini-Pool borrowers, adapt to market conditions and interest rate arbitrage automatically, without human intervention. This approach corrects utilization over time, reduces illiquidity risks associated with high utilization, and ensures competitive interest rates in low utilization conditions.

The primary interest rate is determined by Core-Pool utilization. This baseline interest rate is determined by the market utilization and is typically associated with the most premium and highest volume collaterals. Mini-Pools introduce an additional interest rate based on their isolated utilization, which is paid on top of the primary interest rate. For example, if the Core-Pool borrower interest rate for an asset is 2%, the Mini-Pool borrower interest rate will be 2% plus the interest rate governed by the Mini-Pool asset utilization (Figure 2).

This structure allows Mini-Pools to function as isolated markets without fragmenting liquidity from the Core-Pool. Meanwhile, adaptive interest rate controllers work autonomously to maintain appropriate utilization levels in both the Core-Pool and Mini-Pools. These controllers adjust interest rates to account for the market's risk appetite, ensuring stability and efficiency.

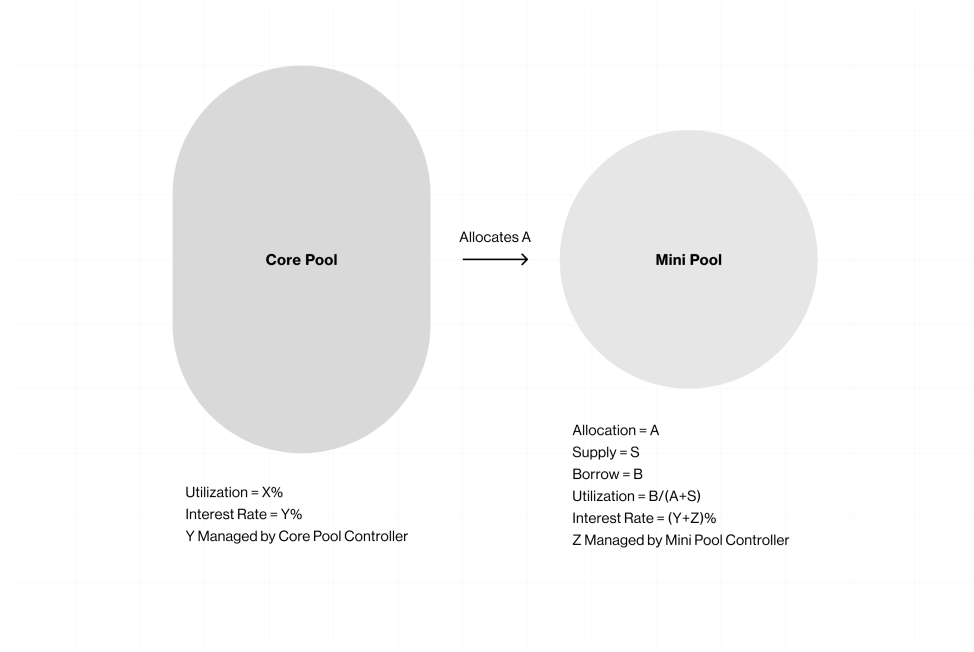


Figure 2: Visual representation of the interest rate architecture.

Mini-Pools operate as tightly scoped lending platforms that are designed to mitigate risk without totally isolating collateral. Mini-Pools interact with the Core-Pool through modulation of debt ceilings and interest rates, but with a specific set of risk parameters that allow the Core-Pool to backfill loans. Adaptive interest rate controllers work autonomously to maintain appropriate utilization levels in both the Core-Pool and Mini-Pools, allowing Mini-Pools to borrow assets from the Core-Pool while limiting Core-Pool exposure.

### 2.3 Improved Debt Utility

Mini-Pools automatically wrap and unwrap supplied assets as needed to enable debt token accounting. This means that a user supplying collateral to the Core-Pool, who wants to access Mini-Pool assets, can simply deposit their Core-Pool asset receipt into the Mini-Pool, and borrow Mini-Pool assets, without manually removing their underlying assets from the Core-Pool. This greatly enhances user experience and accounting, as users do not need to constantly withdraw and deposit collateral between the Core-Pool and Mini-Pools.

## 3. Collateral Flow Control

When market conditions shift, developers can deploy new Mini-Pools with adjusted risk parameters. This involves defining the new risk parameters for the Mini-Pool, such as lower LTV ratios or different collateral requirements.

To reduce Core-Pool asset risk exposure, any flow of collateral supply is redirected from the old Mini-Pool to the new Mini-Pool (Figure 3).



Figure 3: Collateral Flow Control: (a) old Mini-Pool, remains functional for existing positions, (b) new Mini-Pool with reduced LTV, Core-Pool assets redirected.

This process involves reallocating Core-Pool allocations to the new Mini-Pool and continuously monitoring the collateral distribution and adjusting the routing logic as needed to maintain minimal risk exposure.

### 3.1 Impact on Existing Loans

One of the key advantages of this approach is that it does not directly impact existing loans. Each Mini-Pool operates independently, meaning that changes in one Mini-Pool do not directly affect the loans in another. If the LTV of a collateral/debt configuration is reduced in a new Mini-Pool, this change does not retroactively apply to existing positions in the old Mini-Pool. Existing loans remain governed by the parameters under which they were originated. Existing positions in the old Mini-Pool are not liquidated as a result of the new Mini-Pool's parameters. This ensures stability for borrowers and lenders, maintaining trust in the platform.

The premise of this feature is to give lenders and borrowers more control over their risk exposure, and more access to market activity, while protecting the protocol from bad debt.

### 3.2 Improved Capital Efficiency

When Collateral Flow is utilized to backfill a loan on a Mini-Pool, the Mini-Pool deposits the borrowed Core-Pool asset back into the Core-Pool and collateralizes the debt token. If the Core-Pool contains 100 ETH and backfills a 10 ETH loan in a Mini-Pool, the Mini-Pool will redeposit the 10 ETH into the Core-Pool while it is being lent out to a user. In this case, the Core-Pool will account for 110 ETH supplied with 10 ETH utilized, while the Mini-Pool has its own utilization. This reflects lower Core-Pool utilization accounting and with the dynamic interest rate controller, allows for Astera Lend to issue a greater volume of debt for the same volume of supply, without taking on additional illiquidity risk, as interest rates will continue to adjust to market needs.

## 4. Rehypotheication

Liquidity in traditional crypto money markets is largely fragmented from the broader ecosystem. Funds that are deposited, but not borrowed, sit idle while diluting yield of users whose funds are actively being lent out. This idle liquidity has low capital efficiency as large portions go underutilized.

Rehypotheication allows Astera Lend to reinject liquidity into the broader ecosystem, thus defragmenting liquidity, while generating more yield for depositors. The rehypotheication approach focuses on minimal-risk strategies, achieving yield parity with the perceived risk-free lending rate and making Astera Lend the most efficient and scalable lending protocol in DeFi (Figure 4).

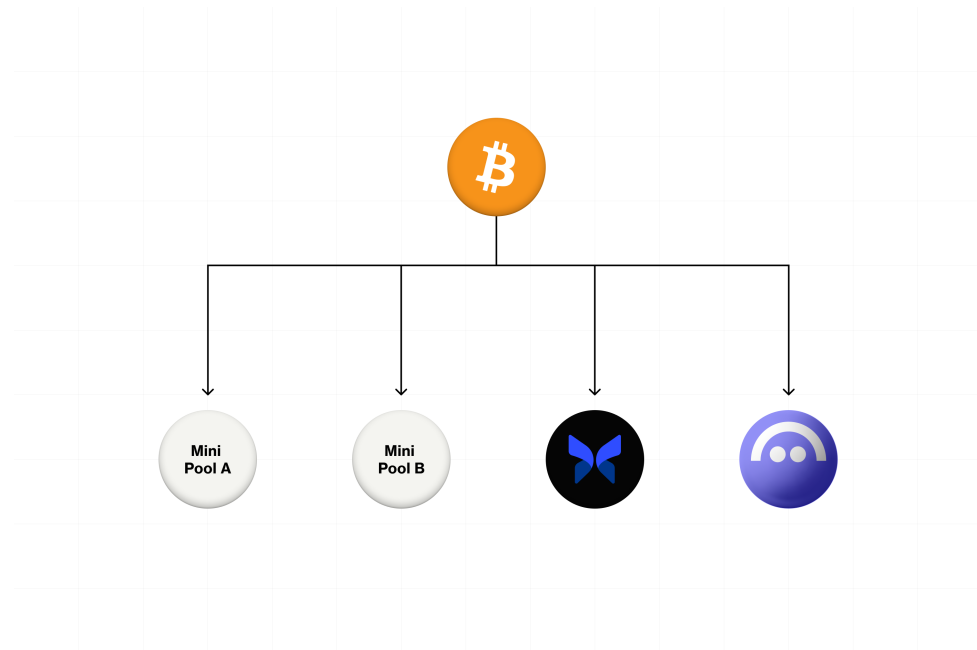


Figure 4: Rehypotheication can achieve interest rate arbitrage on behalf of depositors.

The scope of rehypotheication is intended to be extremely limited. It applies only to Core-Pool assets that typically achieve yield parity organically as they are highly liquid, premium assets. In most cases, rehypotheication will not be required. However, if a sustainable, competitive yield opportunity is identified, Astera Lend is capable of allocating underlying collateral to a private vault, which can deploy capital to external systems on behalf of depositors. Similar to Mini-Pools, rehypotheication lines of credit are managed entirely by smart contracts, capable of returning yield to depositors, and derisking the system in the event of unprofitable indicators.

## 5. Conclusion

Astera Lend gives lenders more control over their risk and outcomes while empowering borrowers with more collateral options and better LTV ratios, all while decreasing overall

protocol risk.

By leveraging the flexibility of Mini-Pools and dynamic risk management strategies, Astera Lend can effectively navigate changing market conditions. This approach not only reduces Core-Pool asset risk exposure but also ensures that existing loans remain unaffected, providing a robust and reliable lending platform for both developers and investors.

Current DeFi money markets often limit users' access to functionality to reduce perceived risk, hindering user experience. Astera Lend focuses on giving users more tools while mitigating the industry's biggest risks. Astera Lend addresses liquidity fragmentation and protocol risk management by introducing Mini-Pools and Collateral Flow Controls in a safe and scalable manner.

Looking ahead, Astera Lend has the potential to significantly impact the DeFi ecosystem by providing a more efficient and secure lending platform. Custom smart contract hooks and permissionless Mini-Pool deployment will allow Astera Lend to scale passively and adaptively to suit any use case. Future developments will focus on expanding the range of collateral types accepted, optimizing risk management strategies, and integrating with other DeFi protocols to create a more interconnected and resilient financial system.

## References

Boneh, Y. (2024). Adaptive money market interest rate strategy utilizing control theory. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.4810469>