

# Flow Credit Markets (FCM): Overview and Quantitative Analysis

*Active Rebalancing Infrastructure for Next-Generation DeFi Lending*

## Executive Summary

Flow Credit Markets (FCM) revolutionizes DeFi for regular consumers and developers of consumer apps by giving regular people the power to safely use the instruments of finance previously only available to traditional finance insiders and risk-tolerant DeFi pioneers. It launches with three core components:

The Flow Automated Lending Protocol (ALP) represents a fundamental advancement in DeFi lending infrastructure, introducing active rebalancing as a superior alternative to traditional liquidation mechanisms. Built on the scheduled callback architecture that is unique to the Flow blockchain, FCM eliminates the reactive liquidation model that has dominated lending protocols, replacing it with proactive position management that preserves user capital and maximizes protocol efficiency.

On top of this foundation, Flow Yield Vaults offers consumers extremely aggressive LTV while protecting their collateral automatically, without the risk or costs of third-party, offchain providers. Our agent-based simulation analysis demonstrates that the active rebalancing approach used by Flow Yield Vaults delivers 99.8% cost savings compared to traditional liquidation protocols, with 100% liquidation prevention during market stress events.

FCM supports asset-agnostic yields through a medium of exchange token: MOET. MOET is backed 1:1 with other stables or minted on top of 125% overcollateralized notional value of other assets, and allows collateral in non-stable assets to access stablecoin yields. Through liquid markets supported by pools served by external actors, FCM converts stable yields back into deposited assets, thereby allowing yield profiles approaching those of stablecoins in assets like BTC or ETH.

Through sophisticated automation, concentrated liquidity optimization, and the unique capabilities of the Flow blockchain protocol, FCM offers superior performance compared to traditional web3 lending mechanisms. Across all backtests, FYV consistently protected principal against liquidation, and under periods of extreme market stress (50% collateral drawdowns) FYV supported up to 17.5:1 capital efficiency (TVL to Yield Token pools) in a recent capacity study.

# 1. Flow Credit Markets (FCM)

FCM is composed of three intertwined systems: an Active Lending Protocol (ALP) which allows for nimble allocation of the notional value of deposited collateral, a Medium of Exchange Token (MOET) which weaves yield sources and collateral deposit endpoints together, and Flow Yield Vaults (FYV) which provide the returns paid to depositors.

## Flow Active Lending Protocol (ALP) – Automatic Liquidation Protection

The Flow Active Lending Protocol (ALP) fundamentally reimagines lending infrastructure by replacing reactive liquidations with proactive rebalancing. The system leverages native scheduled transactions, similar to Linux cron jobs but executed completely onchain, to continuously monitor and manage user positions without external intervention.

Health Factor (HF) Framework:

- Initial Health Factor: User's starting position health is based on effective collateral value and initial debt
- Rebalancing Health Factor: The threshold below the initial health factor that triggers automated rebalancing
- Target Health Factor: Post-rebalancing health target, providing safety buffer above the liquidation threshold

This tri-level health management strategy creates a sophisticated early warning and intervention system that prevents positions from reaching critical liquidation zones.

## Medium of Exchange Token (MOET) – Protocol Native Overcollateralized Stable Asset

MOET (Medium of Exchange Token) is the core stable asset of the FCM Protocol, engineered to unify liquidity, streamline treasury management, and provide a robust, composable unit of account for the entire ecosystem. Unlike individual assets or algorithmic stablecoins, MOET is always fully backed—either by a 100% reserve of approved stablecoins or by volatile assets at a minimum 125% collateral ratio. This dual-backing model underpins MOET's stability, solvency, and resilience during market stress.

### Minting and Redemption Mechanisms

MOET is created (minted) and destroyed (burned) through two routes:

- Stablecoin Deposits: Users deposit a proportional blend of approved stables (initially USDC and USDF) to mint MOET 1:1, subject to minimal fees that incentivize pool balance.

- **Borrowing Against Collateral:** Users open overcollateralized positions ( $\geq 125\%$  collateral ratio) in FCP, depositing assets such as FLOW, BTC, or ETH, and minting MOET against their collateral.

Redemption is always available 1:1 for the underlying stablecoin deposits, with dynamic fees that penalize imbalances and protect the peg. When debt is repaid, that MOET is burned and removed from the supply.

Additional routes can be added based on upgrades determined by the governance process.

## Peg Stability and Automated Backstops

MOET maintains a \$1.00 peg through a multi-layered system:

- **Redeemer Facilitator:** Enables 1:1 redemption for basket assets, with dynamic fees to enforce pool balance and discourage imbalances.
- **Interest Rate Adjustments:** The protocol can increase or decrease MOET borrowing rates to incentivize minting or repayment if MOET deviates from \$1. This mechanism is designed to encourage market-driven peg restoration without forced liquidations.
- **Algo Stabilizer Facilitator:** Mints MOET to sell above \$1, capturing arbitrage and replenishing reserves. Proceeds are used to support liquidity and protocol-owned reserves.

If a basket asset de-pegs, the redemption price/mechanism automatically adjusts to reflect the new market reality, ensuring MOET remains fully backed by the prevailing value of its collateral.

The MOET architecture and operational controls are designed to ensure robust peg stability, capital efficiency, and seamless integration across FCM and partner protocols. This makes MOET a foundational building block for the next generation of DeFi applications on Flow.

## Flow Yield Vaults (FYV) - Automated Yield Strategies

### Leveraged Yield Strategy Architecture

Flow Yield Vaults are the flagship implementation of the FCM active rebalancing technology, enabling users to earn optimized yield on their assets through automated leveraged strategies. The system creates a three-asset relationship: collateral, MOET debt, and yield tokens, with sophisticated automation managing the interactions between all three.

Vault Mechanics:

1. **Collateralization:** User deposits supported assets into a Flow Yield Vault

2. MOET Borrowing: Protocol borrows MOET against collateral via Flow ALP
3. Yield Token Acquisition: MOET is swapped for tokenized yield products
4. Automated Rebalancing: The system sells yield tokens to maintain healthy debt ratios during market volatility

## Dual Position Management

Flow Yield Vaults implement a sophisticated two-tier health monitoring system:

Protocol Layer (Flow ALP):

- Monitors collateral-to-MOET debt ratio
- Provides base layer solvency protection

Vault Layer (Flow Yield Vaults):

- Executes rebalancing through yield token sales
- Optimizes for yield generation for users while preserving capital

This dual-layer approach ensures both protocol solvency and optimal capital efficiency, with each layer providing independent safeguards against market volatility.

## Yield Token Integration

Flow Yield Vaults supports both cross-chain yield tokens (bridged via LayerZero OFT) and Flow-native tokenized yield products. The system's flexibility allows for diverse yield strategies while maintaining consistent rebalancing mechanics regardless of underlying yield source.

Rebalancing Execution: When health factors approach rebalancing thresholds, the system automatically:

- Calculates optimal yield token sale quantities
- Executes trades through concentrated liquidity pools with minimal slippage
- Applies proceeds to MOET debt repayment
- Updates health factors and resets monitoring parameters

# 3. Technical Background

## Flow Blockchain Advantages

The unique properties of the Flow Blockchain and Cadence Programming Language provide several critical capabilities that enable Flow Credit Markets to innovate:

## Scheduled Transactions

Unlike other blockchains, which are dependent on third-party bots for automation, Flow supports native scheduled execution. This allows apps to autonomously execute functions at predetermined intervals 100% onchain and eliminates reliance on external keepers or bot networks for critical protocol functions.

## Fair Execution

Flow is designed to be MEV-Resistant. Users and node operators cannot pay for priority or manipulate transaction order. In a crisis, this means that transactions will be executed fairly and users are not at risk of losing their spot in line to another paying a higher fee, or face MEV risk from a third party trying to take advantage of the situation.

## Advanced Transaction Model

Transactions in Cadence are highly composable. They can run arbitrary code, atomically calling multiple functions from multiple smart contracts deployed by multiple owners with a single user signature. Transactions can be constrained to pre- and post-conditions, causing the entire transaction to revert if these conditions are not met. For example, a transaction can have a pre-condition that allows a debit of a specified amount of MOET, and a post-condition requiring the user now holds a specific position. With these conditions in place, extremely complex execution can occur without risk of bugs or errors to the user. If the conditions are not met, the transaction reverts as though nothing happened.

## Native Data Availability

Cadence scripts provide native availability to any public information on the Flow blockchain. Apps and developers are not limited to pre-deployed views already present in the contract or third-party data aggregators.

## Composable Automation Primitives

The Flow Actions framework provides standardized, composable smart contract components that enable complex multi-protocol workflows without requiring that the developer learn and implement the bespoke functions of each protocol:

- Source: Retrieves assets from vaults, pools, or user wallets for debt repayment
- Sink: Deploys assets to appropriate destinations (repayment, swapping, vault storage)
- Swap: Executes optimized trades using concentrated liquidity pools
- Flasher: Enables flash loans that are borrowed and returned within a single transaction
- Oracle: Provides real-time price feeds triggering automated actions based on health factor deviations

These features enable the protocol to maintain target health factors, automate yield compounding, and execute defensive maneuvers without manual intervention, creating a truly autonomous lending system.

## 4. Simulation Engine & Methodology

### Monte Carlo Framework Design

As a part of the development process for Flow Credit Markets (FCM), we built a robust simulation engine that implements production-grade DeFi mathematics to model FCM performance under both normal and extreme market conditions:

#### Agent Population Modeling:

- Dynamic agent counts (10-50 per simulation) with varied risk profiles and starting health factors (HF)
  - Conservative (30%): Initial HF 2.1-2.4
  - Moderate (40%): Initial HF 1.5-1.8
  - Aggressive (30%): Initial HF 1.2-1.5

#### Market Stress Simulation:

- BTC price decline from \$100,000 to \$76,342 (-23.66%) over a 60 minute period
- 60-minute sustained selling pressure with realistic volatility patterns

#### Pool State Management:

- Shared liquidity pools creating realistic competition for resources
- Permanent state mutations from all trading activity
- Real economic impact where each swap affects subsequent trades

### Experimental Rigor

The simulation maintains strict experimental controls:

#### Realistic Trading Mechanics:

- Concentrated liquidity calculations with tick-based pricing
- Actual slippage costs based on pool mechanics (0.05% fees for stable pairs)
- Production-ready pool configurations matching real DeFi deployments

#### Statistical Validation:

- Identical initial conditions for fair protocol comparison

- Multiple simulation runs for robust performance metrics

## 5. Flow Credit Markets vs. Traditional Liquidation Analysis

### Simulation Results Overview

Our analysis across multiple market stress scenarios demonstrates the superior performance of FCM compared to traditional liquidation protocols:

Metric	FCM	Aave (Traditional)	FCM Advantage
Principal Survival Rate	100%	64%	+56% better survival
Avg Cost per Agent	\$22	\$53,000	99.8% cost reduction
Principal Preservation	Complete	36% liquidated	No principal sold

The charts below compare the survival rate of positions on FYV vs. Aave, as well as the costs to rebalance or liquidate those positions through a variety of scenarios:

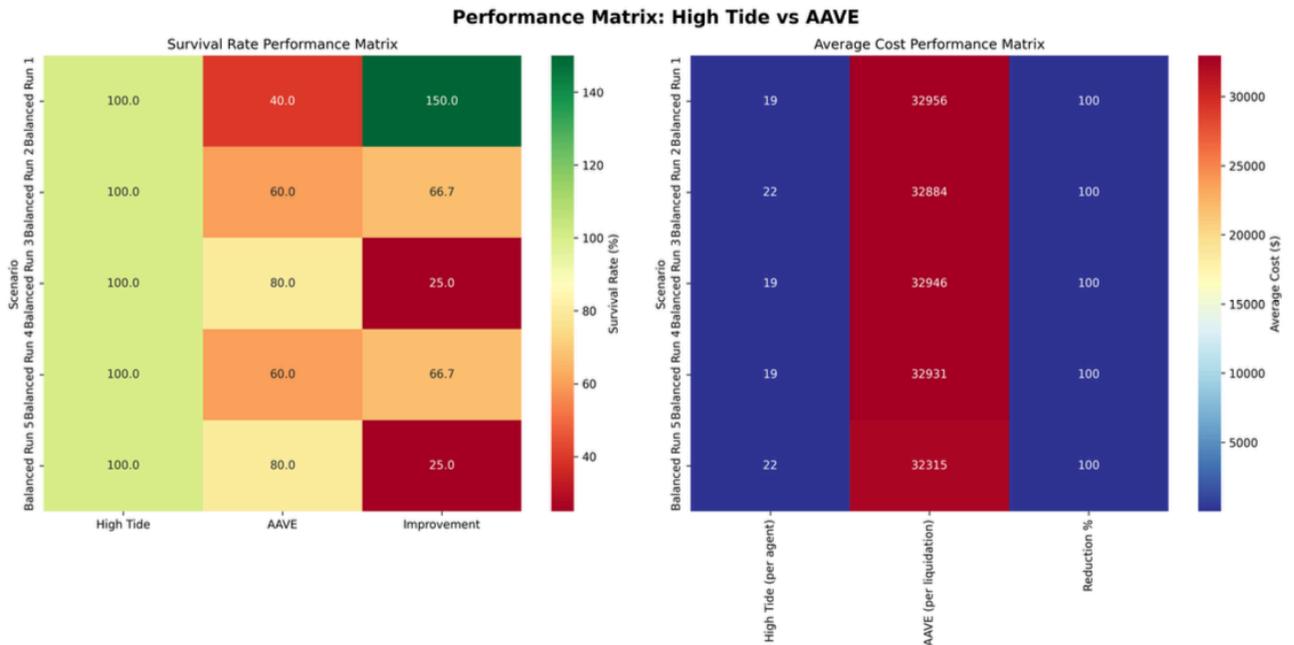


Figure 2: Performance Matrix Heatmap: High Tide vs AAVE

## Detailed Cost Analysis

FCM Rebalancing Costs (Total ~\$22 per agent):

- Trading fees: \$5-15 (Uniswap V3 fees at 0.05% for stable pairs)
- Slippage costs: \$3-8 (minimal due to concentrated liquidity)
- Multiple rebalancing events spread across market decline

Traditional Liquidation Costs (Total ~\$53,000 per liquidated agent):

- Liquidation penalty: \$1,500-3,500 (5% of liquidated debt)
- Collateral loss: \$30,000-50,000 (forced sale at market bottom)
- Single-point liquidation during maximum market stress

The graphics below detail the evolution of individual health factors and yield token values during a BTC price decline scenario:

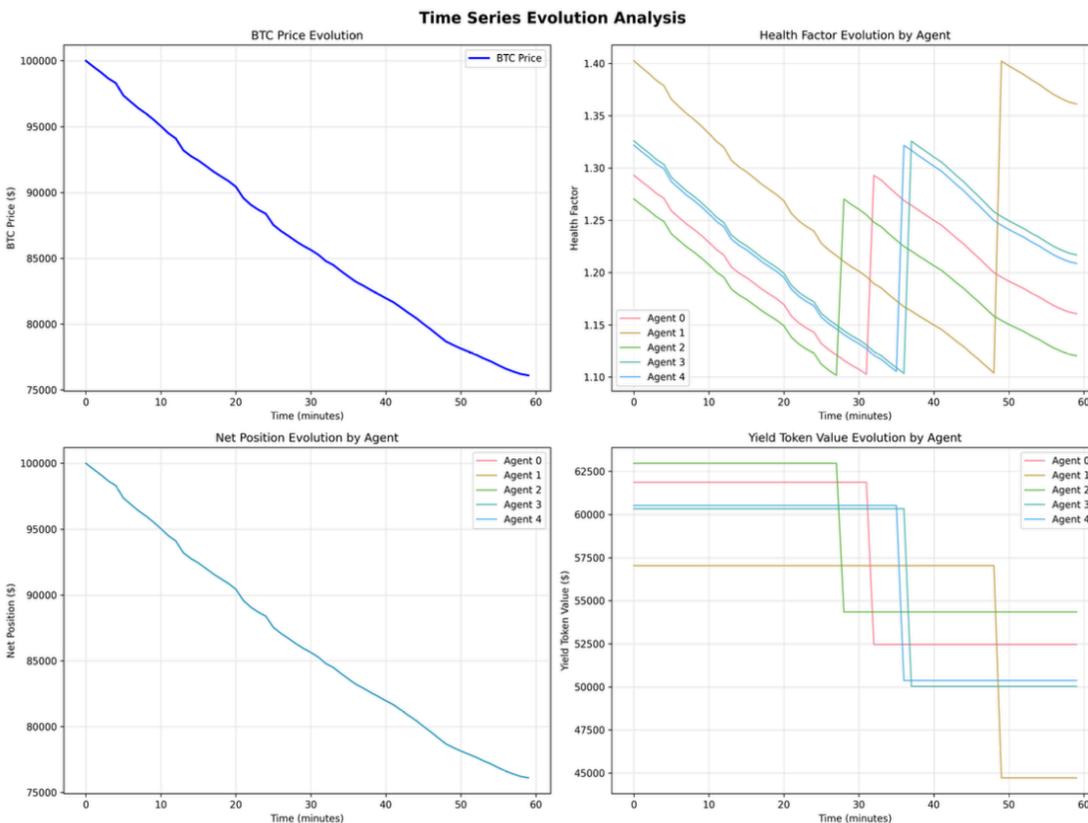


Figure 5: Time Series Evolution Analysis

## Mechanism Comparison: Proactive vs. Reactive

FCM uses onchain automation to determine when a user's position is at risk and automatically intervenes before a position gets liquidated to rebalance that position at a minimal cost.

FCM Proactive Approach:

- Continuous monitoring with early intervention at 1.10+ health factor
- Sells liquid yield tokens designed for trading
- Acts during normal market conditions before crisis points
- Preserves core collateral positions for market recovery
- Multiple small adjustments vs. single catastrophic liquidation

Traditional DeFi positions require either manual monitoring and adjustment, or trust in third party solutions which run offchain; require access to user keys; and behave unpredictably under the load of significant market events. At failure, the position is liquidated.

Traditional Reactive Approach:

- Triggered at crisis point (1.0 health factor)
- Forces collateral sales during maximum market stress
- No recovery potential—positions permanently closed
- Compounds losses with penalties and poor timing
- Binary outcome: survival or complete liquidation

## 6. Flow Credit Markets Capital Efficiency During Market Stress

This section presents a quantitative, simulation-driven analysis of the capital efficiency, cost structure, and operational resilience of FCM under extreme market stress. The results below are based on a dedicated protocol capacity study that incorporated realistic arbitrage delays and a 50% BTC price crash scenario. The accompanying charts illustrate pool utilization, price accuracy, agent health, and trading cost evolution throughout the event.

### Capacity Study Overview

Scenario Parameters:

- Agents: 120 FCM users set with the following Health Factor parameters:
  - Initial HF: 1.1
  - Rebalancing HF: 1.025 (2.5% away from liquidation)
  - Target HF: 1.04 (4% away from liquidation)
  - Each agent supplied 1 BTC of collateral and borrowed different amounts
- Time Period: 36 hours
- Market Stress: 50% BTC price decline over 36 hours

- Total Collateral: \$12M
- Total TVL (Debt Outstanding): ~\$8.7M
- MOET: Yield Token Pool Liquidity: \$500K
- Arbitrage Delay: 1 hour (simulating real-world settlement lag)
- Rebalancing Controls:
  - ALM (Automated Liquidity Management) at 12-hour intervals
  - Algo Rebalancer at 50 bps price deviation

## Performance Results

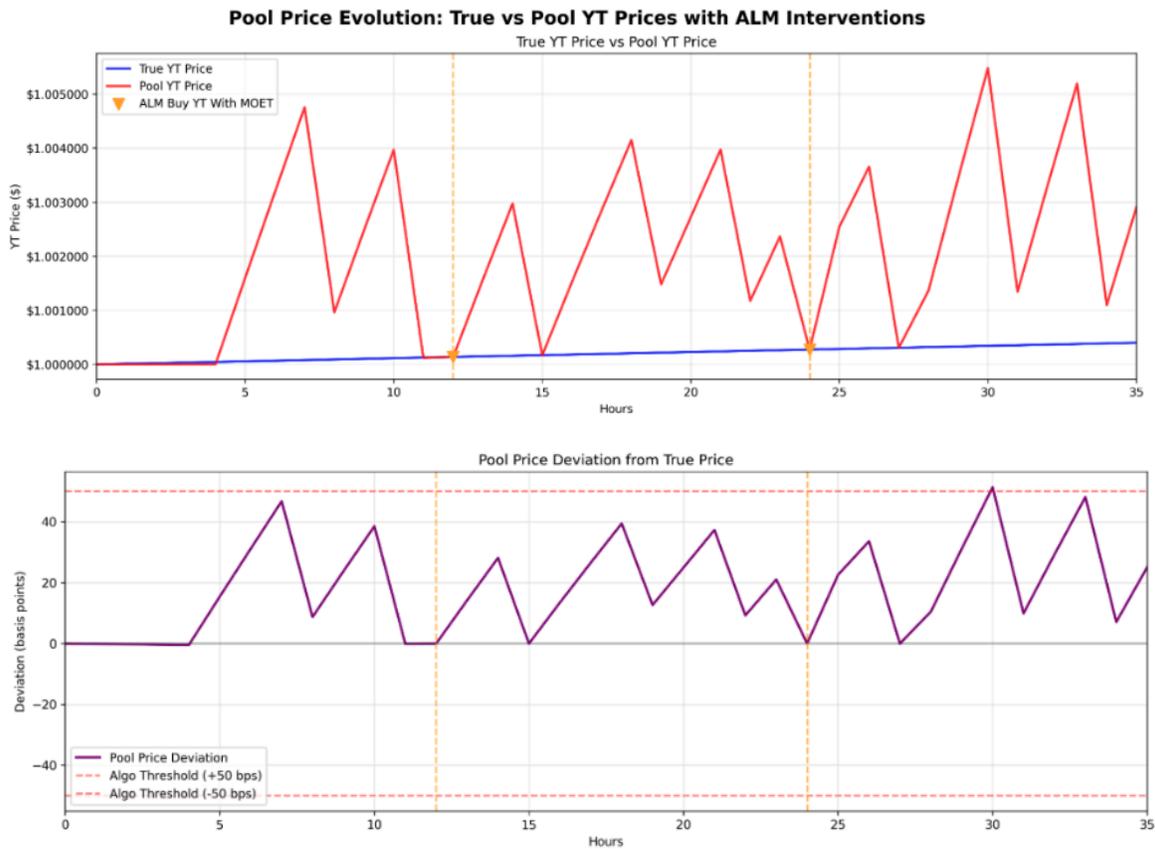
Metric	Value	Description
Survival Rate	100%	No agent liquidations
Total Rebalances	12,240	Avg. 102 per agent
Avg. Slippage/Rebalance	\$2.09	Extremely low cost
Total Slippage Cost	\$25,586 (0.21% TVL)	Highly efficient
Peak Pool Utilization	95.3%	\$476,556 single trade
YT Volume Processed	\$6.03M (12× pool size)	Handled seamlessly
Final Avg. HF	1.029	Healthy margin above liquidation

## Rebalancing Controls and Price Accuracy

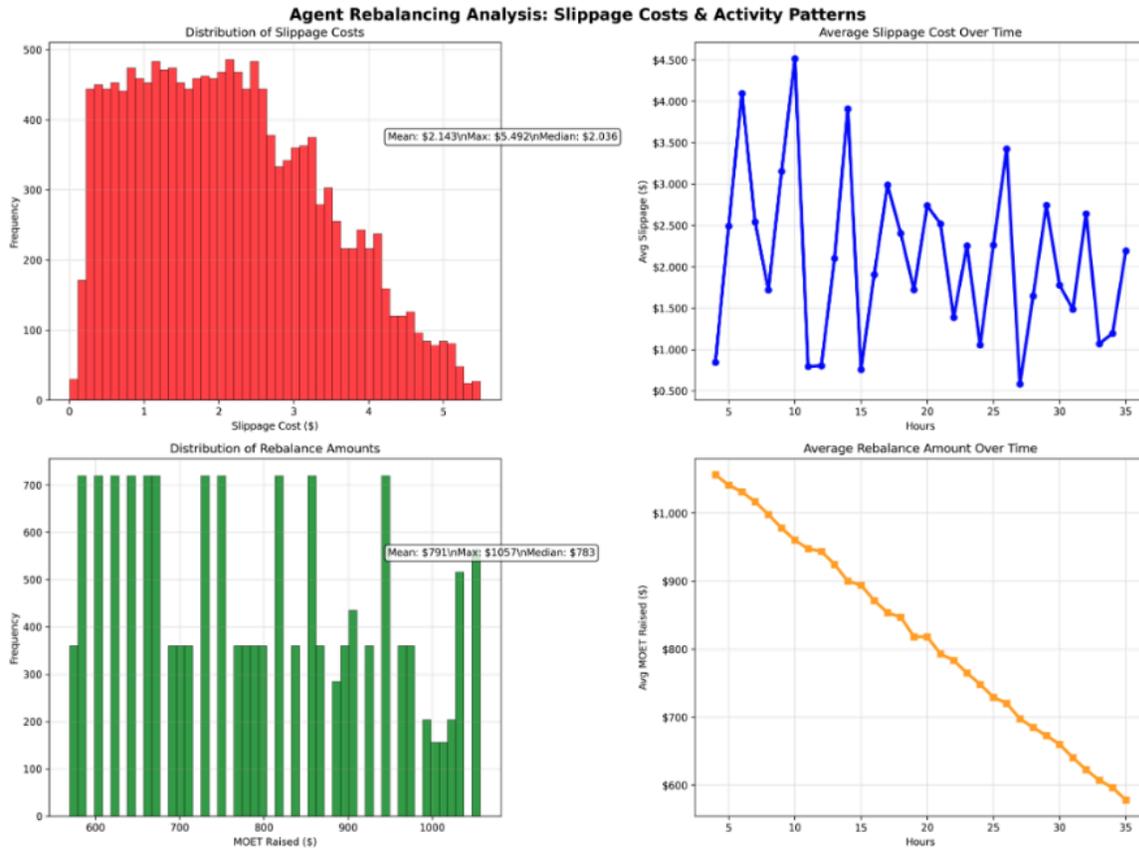
During this period of market stress, facilitating agent rebalances, the ALM and Algo rebalancer step in to ensure that the pool maintains peg and all swaps through the pool leverage the primary concentrated liquidity position. The Algo rebalancer sells additional Yield Tokens and

repays the outstanding debt with those proceeds. The ALM keeps inventory of both MOET and the Yield Token with a concentrated liquidity at the net asset value (NAV) for the Yield Token, shifting inventory from Yield Token to additional MOET (from redeeming the yield tokens from the issuing protocol and adding those funds to the other side of the liquidity pair).

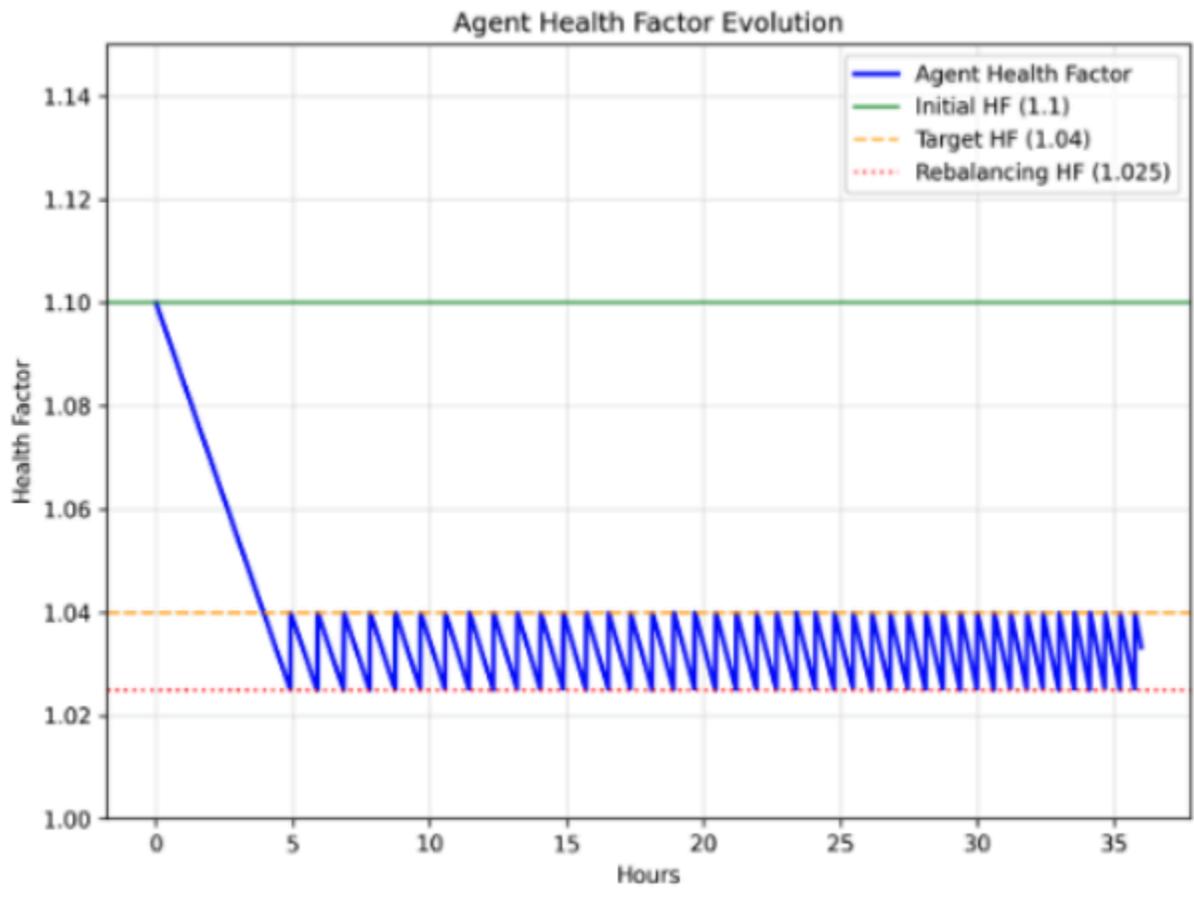
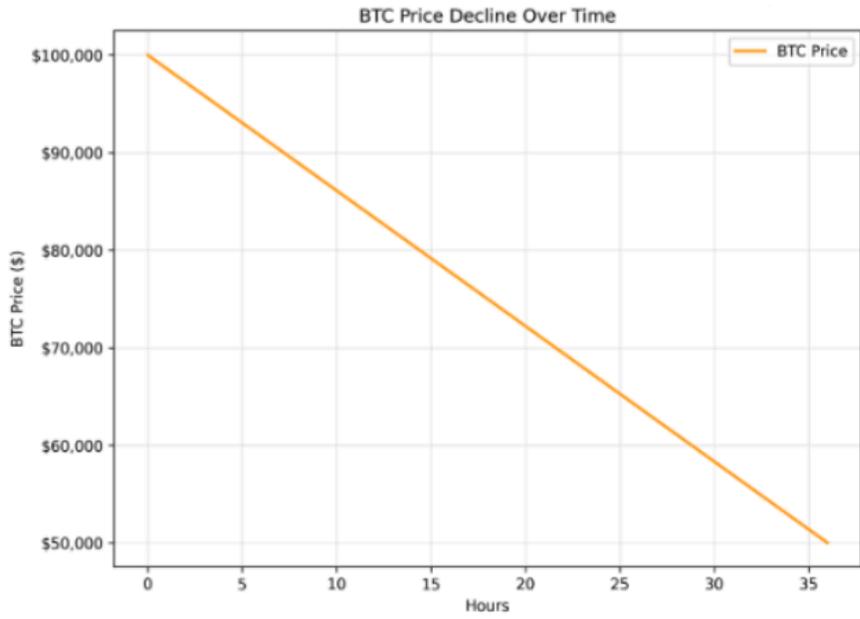
This process makes sure that all trade execution happens at the fair redemption price for the assets instead of the market value that might be compressed on other chains and other protocols. Since the system is fully integrated, it makes sure that the protocol normalizes the prices for all users.

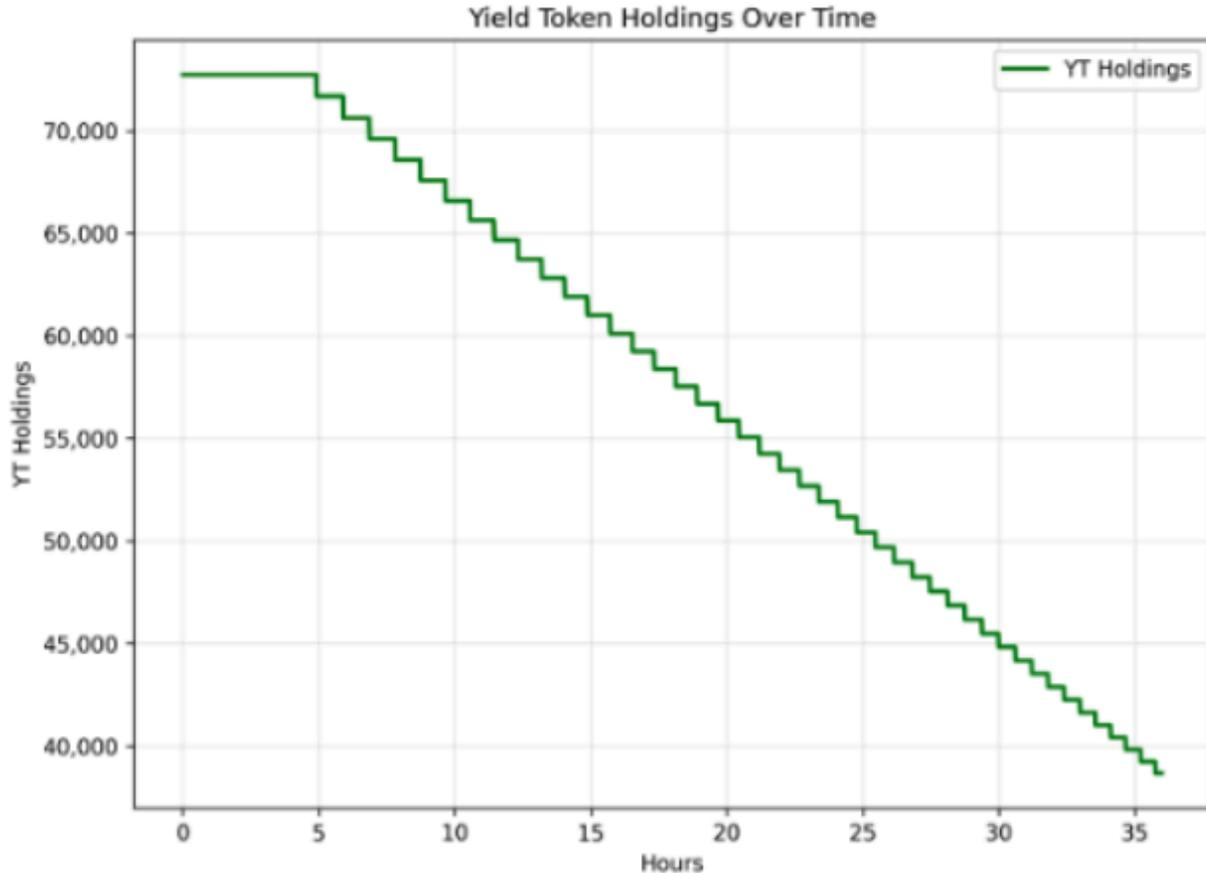


## Agent Health and Cost Efficiency



- Throughout the event, all 120 agents maintained healthy positions, with health factors restored above the trigger threshold after every rebalance.
- Rebalancing Frequency: The agents averaged 102 rebalances over 36 hours each, reflecting the protocol's highly responsive automation.
- Cost Predictability: Despite high-frequency trading and near-capacity utilization, average slippage per event remained just \$2.09, and total slippage costs represented only 0.21% of TVL.
- Yield Token Trading: The protocol processed \$6.03M in YT sales (12× the pool size) with minimal price impact, demonstrating deep liquidity and throughput.





## Capital Efficiency and Industry Comparison

Whereas traditional DeFi protocols require \$2–5 in liquidity per \$10 in TVL, FCM sustained \$8.7M in TVL with only \$500K in pool liquidity, even under a 50% BTC drawdown and 1-hour settlement delays—a 4x–9x improvement over industry standards.

## 7. Competitive Landscape & Positioning

### Fundamental Paradigm Shift

FCM represents a paradigm shift from liquidation-based to rebalancing-based lending, fundamentally altering the risk-reward profile for leveraged positions:

Traditional Liquidation Model Limitations:

- Binary outcomes during market stress (survive or lose everything)
- Forced selling at worst possible prices
- Liquidation penalties compound market losses
- No participation in market recovery for liquidated positions

- Adversarial relationship between protocol and users during crises

#### Active Rebalancing Advantages:

- Graduated response to market volatility
- Profit-taking on yield positions to reduce risk
- Maintains upside exposure through market cycles
- Cooperative protocol-user relationship during stress
- Cost-effective risk management vs. catastrophic liquidation penalties

#### Protocol Comparison Matrix

Protocol	Approach	Liquidation Risk	Capital Efficiency	User Control	Market Recovery
Flow Yield Vaults	Active Rebalancing	Eliminated through automation	High (leveraged yield)	Full position control	Complete participation
Aave/Compound	Reactive Liquidation	High during volatility	Moderate	Lost during liquidation	Subject to liquidation
Morpho	Optimized P2P Matching	High during volatility	High (improved rates)	Lost during liquidation	Subject to liquidation
Liquity V2	User-Set Interest Rates	Redemption + liquidation	High (90%+ LTV)	Rate setting control	Binary liquidation risk

#### Unique Value Propositions

##### For Sophisticated DeFi Users:

- Eliminates liquidation anxiety during market volatility
- Maintains leveraged exposure through full market cycles
- Predictable, gradual cost structure vs. binary liquidation penalties
- Automated optimization without constant position monitoring

##### For Yield Farmers:

- Access to leveraged yield strategies with downside protection
- Automated rebalancing optimizes for yield while managing risk
- Position preservation during temporary market downturns

- Composable integration with diverse yield opportunities

For Protocol Developers:

- DeFi Actions framework enables rapid strategy development
- Proven automation infrastructure reduces development costs
- Active rebalancing model applicable across asset classes and strategies

## Conclusion

Flow Credit Markets represents a fundamental advancement in DeFi lending infrastructure, demonstrating that active rebalancing can eliminate the liquidation risks that have constrained lending protocol adoption. Through sophisticated automation, concentrated liquidity optimization, and the Flow blockchain's unique capabilities, simulations demonstrate that FCM delivers 99.8% cost savings while preserving 100% of user positions during market stress.

The protocol's technical architecture provides a robust foundation for the next generation of DeFi applications, with composable automation primitives enabling rapid development of sophisticated financial strategies. As the DeFi ecosystem matures, FCM's proactive approach to risk management positions it as critical infrastructure for both retail and institutional adoption.

The simulation results validate FCM's approach under extreme market conditions, demonstrating consistent superior performance across all measured dimensions. This combination of technical innovation, proven performance, and ecosystem positioning establishes FCM as a transformative force in decentralized lending.