Fee Boost: A Market-Responsive Dynamic Fee Algorithm Template

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This document proposes a Fee Boost mechanism as a specific solution for optimizing swap fees in Curve pools. Fee Boost allows external Agents to temporarily control a pool's swap fee between a floor and a ceiling value. The elevated fee (committed with a delay) automatically reverts to a mid fee value after a market-determined duration. The mechanism is based on a Harberger-inspired continuous control model, where Agents acquire and maintain the right to control the fee by paying a continuous tax from a pre-deposited stake. This stake and the continuous payment serve as the primary anti-spam measure. The document details the Fee Boost mechanism. For a conversational summary, refer to the AI-generated Audio Podcast Explainer.

Date of Publication:
May 2025

curve.finance

I. PROBLEM STATEMENT

Currently, swap fees in AMMs are either entirely static or governed by state-based dynamic fee algorithms that, while attempting responsiveness, face inherent limitations. Existing state-based dynamic fee algorithms are fundamentally constrained by the data available within the pool's historic and current state, primarily looking at perceived deviations from a 'peg' to adjust fees. These on-chain algorithms lack access to external market information. They cannot see the fee structures of competing exchanges or aggregators, quantify broader market sentiment, or react to relevant news or order flow patterns elsewhere. This means they cannot assess how competitive the current fee is relative to the external environment. For instance, if a Curve pool is charging a conservative 1 basis point (bps) and, due to its superior depth or execution, is winning all relevant trade flow against a competing venue charging 5 bps, the current on-chain dynamic fee algorithm has no way of knowing that the pool could potentially raise its fee significantly (e.g., to 4 bps) and still retain the majority of that volume while increasing revenue for LPs and the DAO.

Case Study: Fee Optimization Through Informed Intervention

> The Curve pool at `0x90455bd11Ce8a67C57d467e634Dc142b8e4105Aa` (cUSDO/USDC) provides a concrete example of how routing dominance can be translated into higher protocol revenue through deliberate parameter tuning. Prior to any changes, the pool was charging a swap fee of 0.01% and capturing an overwhelming 99.1% of CowSwap trade volume for this token pair — despite active competition from a Balancer v3 pool. This kind of dominance signaled that the pool was offering the most attractive execution path, even at a conservative fee. After carefully evaluating external routing dynamics and competitor pricing, the fee was increased to 0.02%. As expected, this adjustment led to a slight reduction in routing share, down to 92.3% — but the result was an 86% increase in swap fee revenue. This outcome demonstrates that fee-setting cannot be purely reactive or on-chain-only. By recognizing that the pool could absorb a higher fee without losing meaningful flow, the DAO was able to capture significantly more revenue — all while remaining the preferred route for the majority of trades.

The very nature of smart contracts poses an additional constraint; they are not designed to efficiently process and interpret this vast array of constantly changing external data points. Instead, smart contracts serve as transparent and verifiable execution instruments for precisely defined instructions. Searchers, however, possess the capability to compress this kind of real-world data and their understanding of market microstructure onto the on-chain pool state. Empowering these experts allows for fee optimization based on information that the smart contract simply does not or cannot know. Valuable broad-market external intelligence from searchers, implicitly incorporated into the pool's fee setting, can unlock significant revenue opportunities while minimising the DAO's governance surface area.

II. PROPOSED SOLUTION: FEE BOOST

tl;dr

> The Fee Boost mechanism is designed to provide a targeted solution for dynamic fees by enabling Agents to (within strong constraints) temporarily elevate or lower a pool's swap fee above a base-fee floor. Upon expiry of the fee boost period, the pool state is restored back to its pre-boost state. Agents acquire and maintain the right to control the fee of a specific pool by declaring a cost at which they would give up control, pre-depositing crvUSD which are depleted as Harberger tax. Any other Agent can take control by paying the Harberger tax and declaring a higher control cost. In return, the Agent earns 100% of the admin fees generated by the pool. An Agent can cancel their boost whenever they wish via an Escape Hatch activated after a delay.

Core Concept

Conceptually, this mechanism brings a form of real-world dynamic pricing or surge pricing to Curve pools, but driven by external expertise rather than purely rigid on-chain formulas. This approach is common and highly effective in various industries – from ride-sharing (increasing fares during high demand to balance the network and incentivize drivers) to e-commerce and airlines (adjusting prices based on real-time factors like traffic, inventory levels, competitor pricing, and expected demand) – precisely because it is highly effective at maximizing revenue and efficiently allocating resources in response to volatile conditions and external market signals.

In the Fee Boost model, the Agent acts as a sophisticated, incentivized dynamic pricing manager for the pool's swap fee. Unlike limited on-chain algorithms that only see internal pool state, an Agent can synthesize a wide array of real-world, off-chain data such as competitor fee structures, aggregator routing logic, off-chain order book depth, trading news, market volatility signals not directly reflected on-chain, and general market sentiment. This is analogous to how professional market makers and proprietary trading desks constantly adjust their bid/ask spreads (their fee for providing liquidity) based on a comprehensive view of external factors and order flow dynamics beyond what's happening solely within the orderbook.

By allowing Agents to responsively adjust the fee above a base-fee floor (either raise it or lower it back to the base-fee floor), the mechanism enables the pool to capture potential revenue opportunities that static fees or simple state-dependent algorithms would miss. This means an Agent, observing high demand against a competitor charging 5 bps, can boost the Curve pool's fee from 1 bps to 4.9 bps to capture a larger share of value from incoming trades, increasing LP and DAO revenue, while likely still retaining the trade flow because (depending on pool sizes) 4.9 bps remains competitive against 5 bps. The temporary nature of the fee boost and the Agent's incentive structure (earning a share of the revenue generated during the boost) are designed to align the Agent's profit motive with the pool's revenue maximization during opportune, often transient, market conditions. This creates a decentralized, market-aware layer for dynamic fee optimization.

Delayed Commitment

There's a risk of malicious activity during the short timeframe of a single block. A rational searcher could exploit the ability to lower fees within a block to boost their arbitrage profits. Conversely, a malicious actor might rapidly increase fees within a single block, causing legitimate user transactions to fail due to breached slippage limits. While these attacks don't directly steal LP assets, they lead to lost revenue opportunities for liquidity providers. To mitigate these intra-block malicious MEV concerns, any fee changes committed by a booster will be finalized on-chain only after a set time interval, for example, 10 minutes (this duration is a parameter configurable by the DAO). This delay is designed to eliminate all intra-block extraction opportunities.

Mitigating Spam via Harberger Tax

The ability to control fees introduces a potential problem: the risk of misuse. An Agent could repeatedly activate these temporary fee increases, potentially setting fees so high that they drive away legitimate trading volume, disrupt the pool's natural rebalancing processes, and ultimately harm the pool's health and the interests of liquidity providers. They could also lower fees and increase arbitrage revenue at a cost to liquidity providers. Such repeated, harmful actions constitute spamming the fee boost mechanism.

To mitigate spam, a Harberger-inspired continuous cost of control is introduced. An Agent acquires the right to control the fee boost by declaring a per-unit-of-time value for that control right and pre-depositing a certain amount of funds. As long as they maintain control, their pre-deposited funds are continuously depleted at the declared rate, acting as a continuous tax. This mandatory, ongoing cost of holding the control right acts as the primary economic barrier against maintaining an artificially high fee state. If the cost per unit of time (or the Harberger Tax Rate) is set too low, it allows other participants to acquire boost ownership cheaply by paying the cheaply declared cost and revaluing the boost ownership higher. If the cost is set too high, the pre-deposited funds get depleted faster; for this behavior to be economically rational, the revenue earned from the fee boost must significantly outweigh the cost of the continuous tax. This design makes it economically unfeasible to hold control unprofitably or spam harmful boosts that do not genuinely generate sufficient additional revenue to justify the continuous expense.

Voluntary Revaluation

Beyond relying on an anti-takeover deposit, an Agent holding the fee boost slot can also proactively defend their control through a Voluntary Revaluation. This mechanism allows the current Agent to unilaterally increase their valuation for the control right at any time. By doing so, they immediately raise the continuous tax they pay from their pre-deposited funds, but critically, they also increase the cost for any other Agent attempting to take over the slot. This acts as a defensive maneuver, allowing the current Agent to signal their high conviction and willingness to pay more for the control right, making it more expensive for potential challengers without waiting for a takeover bid.

Pre-Deposit Capped Boost Duration

In this Harberger-inspired model, the duration of a fee boost is dynamically determined by the market and the Agent's deposit. An Agent gains control by declaring a per-unit-of-time value for the control right and pre-depositing funds. The duration of their control is then automatically determined by the size of their pre-deposit divided by their declared per-unit-of-time value. For example, depositing \$300 and declaring a value of \$1 per block grants control for 300 blocks. If another Agent takes over by declaring a higher value of \$2 per block and deposits \$100, their control will last for \$100 / \$2 per block = 50 blocks. The control is temporary because the pre-deposited funds will eventually be depleted by the continuous tax, at which point control automatically ends, and the fee reverts to the base rate. There is no need for a fixed maximum duration parameter set by the DAO; the market's valuation and the Agent's deposit dictate the duration.

Escape Hatch

A market's volatility can be unpredictable, and forcing agents to pay full upfront costs can be prohibitive. An Agent hence retains the ability to voluntarily relinquish control at any time via an escape hatch mechanism. This termination of their boosting period allows them to minimize further depletion of their pre-deposited funds, effectively cutting losses and ensuring the pool's fee reverts to its base state without waiting for the full depletion of their deposit. The Escape Hatch is only active after a delay, settable by the DAO. This unit of this delay can be an arbitrary number of blocks, an interval of time, or minimum threshold of Harberger Tax Income earned by the DAO.

Harberger Tax Redistribution via Gauge Rewards or Vote Markets

In a strategic realignment of incentives, the DAO shares 50% of accumulated Harberger tax revenue with Liquidity Providers (LPs) of each pool, potentially distributing it as rewards for gauge deposits or as vote incentives in veCRV Vote Markets. This measure is designed to mitigate a potential conflict where an Agent might set fees too high, deterring swap volume and negatively impacting LP earnings from trading fees. By providing LPs with this exogenous incentive from the Harberger tax, they are compensated even if the pool's direct swap fee revenue declines due to an Agent's aggressive fee strategy.

Dynamic Fee Floor and Ceiling

The fee floor and ceiling needs to be dynamic by utilising existing state-based dynamic fee algorithms in Stableswap and Cryptoswap. This approach allows safeguards against setting fees too low or too high. The floor and ceiling values would be a function of the existing state-based fee. For example, if the current Stableswap pool configuration states that a fee shall be 2 bps, the fee range shall be between 1 bps and 3 bps.

III. RISKS

Ineffective Harberger Tax Market

The system's primary defense against spam and misuse is the Harberger tax. This defense is only as strong as the market for fee control. For pools with low trading volume or less competition among Agents, an individual could potentially acquire and hold control for a very low cost, leading to suboptimal fee management.

DAO Revenue Reduction

A primary risk is the potential for a net reduction in DAO revenue. During a fee boost, the DAO forgoes its traditional admin fee from swaps and instead receives 50% of the Harberger tax paid by the Agent. A rational Agent will only pay a Harberger tax that is lower than the admin fees they expect to collect. This means the DAO's revenue (0.5 * Harberger Tax) will be inherently less than the total admin fees generated during the boost. The DAO is making a strategic bet that this new system will unlock revenue opportunities that were previously inaccessible, and that indirect benefits, such as increased utility for crvUSD, will compensate for the direct revenue share loss. However, there is no guarantee that this new, less predictable income will surpass the previous, more stable revenue from admin fees.

Short Escape Hatch Activation

The Escape Hatch allows an Agent to voluntarily end their boost period. If this mechanism is made available to an Agent too early, the Agent could signal a fee change, causing other market participants to adjust their strategies, only to abruptly cancel the boost and trade against those expectations. The proposed delay on the escape hatch is a mitigant, but its effectiveness depends entirely on the duration set by the DAO.

Increased Integrator Complexity

A higher volatility in fees can lead to a less predictable trading environment. Aggregators and other DeFi protocols that route trades through Curve may find it difficult to integrate with these unpredictable fees, potentially choosing to route volume to more stable, albeit more expensive, venues.

Cross-Venue Economic Warfare

A well-capitalized competing protocol or AMM could view the mechanism not as a tool for optimization, but as a lever to attack Curve's market position. The adversary's goal would be to intentionally degrade the user experience on a key Curve pool by acquiring control and setting a prohibitively high fee. This action, while unprofitable on its own, would be intended to make the Curve pool uncompetitive, thereby diverting trading volume and liquidity to the attacker's own platform. To prevent a rational, profit-seeking Agent from immediately seizing control and optimizing the fee, the attacker must declare a very high Harberger Tax for their control slot proportional to the very revenue opportunity they are destroying. Choosing a low Harberger Tax value creates a profitable opportunity for an honest Agent to pay a low buyout price, take control, and restore a sensible fee structure. This economic warfare vector exists, but is quite theoretical.

Another theoretical economic warfare scenario involves multiple competing venues: an initial competitor, Venue A, attacks a Curve pool by setting a high fee to divert trading volume to itself. A new, more efficient challenger, Venue B, then emerges with better pricing than Venue A. Rather than passively waiting for the market to slowly recognize its price advantage, Venue B might adopt an aggressive strategy to accelerate its rise to dominance. It could choose to take over the attack by paying Venue A's buyout price and committing to an even higher Harberger tax, thus initiating a bidding war. In both scenarios, Curve's DAO and the pool's LPs benefit from this theoretical and expensive attack that potentially leads to a Pyrrhic Victory, where the damage from the war is significantly greater to the competing venue(s) than it is to Curve.

IV. DISCUSSION

Positive Side Effect: Realtime Fee Burns

A side effect of the Fee Boost mechanism is its ability to reduce the DAO's revenue risk by creating a more frequent, real-time stream of income denominated in its base asset, crvUSD. Under the current system, swap fees are collected in the various, often volatile, assets of each individual pool. These diverse assets are converted into crvUSD through periodic batch auctions, which exposes the DAO's treasury to the price volatility of these assets in the interim. This delay means the DAO is constantly at risk of its income depreciating before it can be secured, effectively creating a bleeding bottom line due to an inability to hedge its revenue in real-time.

The Fee Boost mechanism provides a powerful solution to this problem. During a boost, the DAO's primary income stream shifts from delayed swap fees to its share of the Harberger tax. A core feature of the design is that this tax is paid by Agents directly from a pre-deposited stake of crvUSD. This process is continuous, with the Agent's deposit being depleted in near real-time as long as they maintain control of the fee. While the DAO still requires the current CowSwap fee burning infra, Fee Boost creates a parallel revenue stream that bypasses the latency of the weekly conversion process entirely: an instant and continuous burn. It ensures that a substantial portion of the protocol's income, especially during periods of high trading activity, is secured in crvUSD immediately. This reduces the DAO's reliance on the delayed auction system and mitigates the risk of value loss from holding volatile assets, thereby creating a more robust and stable real-time foundation for its bottom line.

On Missed MEV Opportunities

A key design choice in this initial version of the Fee Boost mechanism is to deliberately forgo the capture of intra-block Maximum Extractable Value (MEV) opportunities. The 10-minute delay for fee changes makes the system robust against same-block manipulation but also means it is too slow to react to the fleeting arbitrage opportunities that sophisticated bots exploit in milliseconds. While this represents a missed revenue opportunity for the DAO and LPs, the decision is a strategic trade-off that prioritizes security and predictability. Attempting to capture these opportunities introduces significant complexity, including the risk of transaction failure due to slippage and the potential for new attack vectors. However, the potential to share in the profits from on-chain arbitrage remains a compelling avenue for future enhancements. By treating MEV capture as a distinct, future module, we can focus on delivering the core value of the Fee Boost mechanism today. This phased approach allows us to build a solid foundation first and then strategically expand the protocol's capabilities once the initial system has proven its stability and effectiveness in the wild.

Drifting Fee Boost: Updating the AMM's State Based Fee Parameters

Drifting Fee Boost is a hybrid model where the AMM gradually adopts a Time-Weighted Average Price (TWAP) of the Agent-set dynamic fees as its state-based base/mid fee (off-peg fee multipliers untouched). Once the boost expires, the pool's base fee would temporarily adjust to this new, market-informed level, thereby optimising the DAO's and LP income during the unboosted period. To prevent permanent manipulation, this TWAP-derived fee would not be static; instead, it would immediately begin a gradual decay back to a secure, DAO-set default fee over a predetermined period. This mechanism presents a compelling vision for a more adaptive protocol but introduces significant new complexities. It creates challenges for DEX aggregators (who must now model the decaying fee) and increases the system's overall implementation and gas overhead. Given the trade-offs between responsiveness and predictability, the decaying TWAP is best viewed as a powerful but complex feature well-suited for a future iteration, pending the proven stability of the core Fee Boost mechanism.