

SHITE: The SHILLcoin-HODLcoin Interconnected Token Ecosystem A Smart Contract-Based Economic Simulation & Game

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1 Introduction

The SHILLcoin-HODLcoin Interconnected Token Ecosystem (henceforth "SHITE") is a gamified economic simulation with strictly enforced, time-invariant rules. At base, SHITE is designed as an artificial, regulated market, built on two main tokens - SHILLcoin and HODLcoin. SHITE is hosted on smart contracts published to the Ethereum blockchain, which allows it to run in a trustless, secure, verifiable, fair, transparent, and decentralized manner. Relevant economic quantities within SHITE vary deterministically, according to immutable rules.

Players of SHITE can buy or sell SHILLcoins and HODLcoins for Ether at any time, simply by interacting with one of the smart contracts. They can also exchange SHILLcoins for HODLcoins (or vice versa) in a similar fashion, or send their tokens directly to anyone else with an Ethereum address. Within the game, unique incentives encourage varied player actions, each of which in turn has political and economic consequences. To accomplish this, SHITE implements several as-of-yet unheard of novel economic mechanisms.

Both tokens vary in price (as measured in Ether) over time, in proportion to their current token supply. Players of SHITE also gain political and economic power over the tokens that they hold. This power is distributed in the form of accumulating rewards, in proportion to each player's share of the respective token multiplied by the fees paid by users of the other token. For example, players who hold SHILLcoins receive rewards in proportion to the number of SHILLcoins they own multiplied by the fees paid by users of HODLcoin. Transaction fees are paid whenever a player "uses" tokens (buying, selling, exchanging, or transferring them), and vary according to a novel, cyclical mechanism; players collectively control the current rate at which fees are charged through their actions. The incentives tying together tokens, rewards, and transaction fees – as well as their unique dynamic-dependent algorithmic behavior – encourage player engagement by consistently presenting opportunities for players to perfect their playstyles.

2 Political Statement

SHITE operates as a parody of the numerous economic systems within which it exists – including the smart contract and cryptocurrency spaces, but also

the global capitalist structure itself. The project was conceived as an economic system built so that financial incentives would encourage players to collectively act in a cyclical manner, with an implied political statement attached.

There is no real, free market as described by the idealizations of today's economists. There are only regulated and unregulated markets. In both types of markets, wealth serves to give the wealthy political power, which they use to manipulate the market, typically in ways that benefit themselves or groups that they identify with; these groups notably include their perceived economic and social class.

The cryptocurrency community at large is a manifest example of this behavior, as evidenced by the widespread market manipulation and persistent group-think that too often dominate cryptocurrency discussions. SHITE mocks this community through both superficial branding (naming the in-game currencies SHILLcoins and HODLcoins) as well as through its construction itself, which is designed to motivate different playstyles that imitate stereotypical actors in the cryptocurrency market ("shills" and "hodlers").

3 Smart Contracts & the Ethereum blockchain

SHILLcoin and HODLcoin live within two smart contracts embedded in the Ethereum blockchain. Running on the Ethereum blockchain means the verifiable, open-source code of SHITE runs in a reliable, decentralized manner; this guarantees that changes to the underlying rules are impossible and that the rules are always enforced.

The Ethereum blockchain targets a block time of 15 seconds, giving SHITE an approximately 15-second window in which a user action passes from initially submitted to the decentralized Ethereum network, to processed by the network according to the deterministic rules of SHITE's code, to immutably stored on the numerous nodes of the network. The smart contracts of SHITE form the backend of the game, tracking all in-game data and processing all in-game actions. All game data is also broadcast ("emitted") to the Ethereum network in the form of "events" that both comply with and surpass the technical specifications of the ERC-20 Token Standard. Thanks to this, SHITE operates in a 100% transparent, fair, and verifiable manner, in which every player can observe the past actions of all players, as well as act at any time on this data, with consequences of their actions determined by a public, deterministic ruleset.

4 SHITE's Smart Contracts

The SHILLcoin and HODLcoin contracts each manage their respective token. Each contract contains a ledger of all token holders and their token balances, as well as their accumulated and spent rewards. The Turing-complete functionality of the Ethereum Virtual Machine allows the contracts to generate a regulated market for their token, as well as algorithmically manage and adjust this market in response to changes to the economic state of their respective token. The generated market fluctuates according to two main arithmetic equations, which respond to actions taken by users of both contracts.

5 Token Pricing

The first equation governing SHITE’s algorithmically-generated markets causes the token price provided by each contract to scale linearly in proportion to the supply of the contract’s token; for example, the price for HODLcoins (as measured in Ether) provided by the HODLcoin contract increases slightly for each HODLcoin bought from the contract, and decreases slightly for each HODLcoin destroyed by selling it back to the contract. This construction – known as a Linear Bonding Curve – ensures that the smart contracts always maintain Ether balances equal to or exceeding the value of all existing SHILLcoins and HODLcoins, therefore guaranteeing that the smart contracts are always solvent. This relation is represented by:

$$TokenPrice = TokenSupply \times TokenPriceIncrement + BasePrice \quad (1)$$

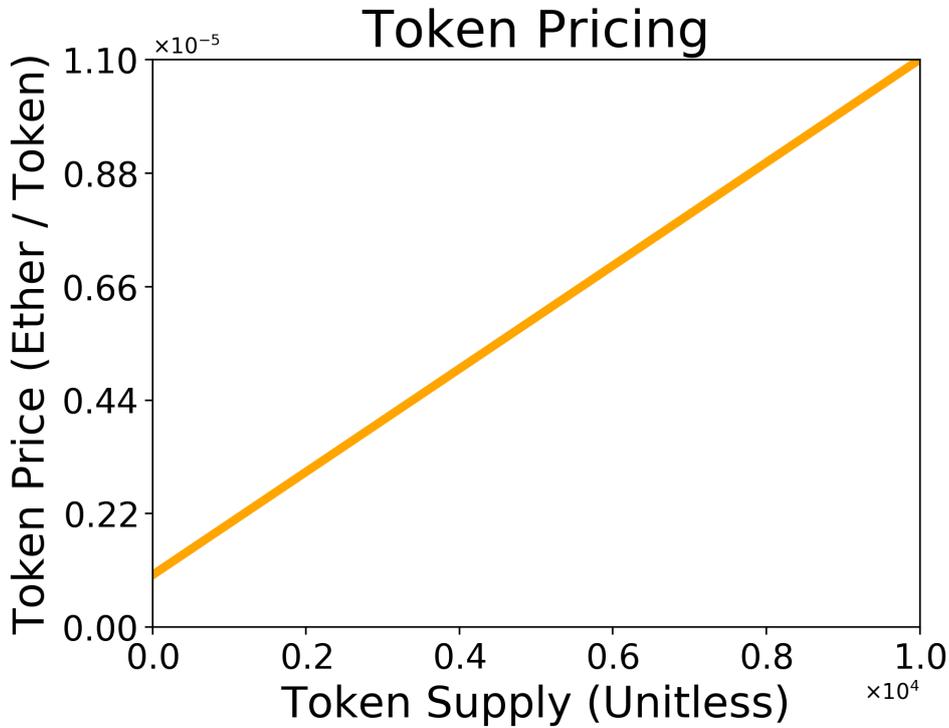


Figure 1: Automated Pricing of SHILLcoins and HODLcoins

When players purchase or sell more than one HODLcoin or SHILLcoin at a time, the total amount that they pay is a finite integral of equation 1, representing a section of a quadratic curve. This can be seen by integrating equation 1 with respect to the token supply to obtain:

$$\int_a^b TokenPrice = (b - a)^2 \times TokenPriceIncrement + (b - a) \times BasePrice \quad (2)$$

Where the left side of equation 2 represents the total Ether value of the tokens, and the difference $(b - a)$ represents the number of tokens purchased or sold

(i.e. the difference between the initial and final token supplies for the event in question). Equation 2 can be trivially solved for the quantity $(b - a)$ through use of the quadratic formula, which is the implementation employed in SHITE’s smart contracts.

Note: BasePrice is set to 10^{-6} ETH and the TokenPriceIncrement is set to 10^{-9} ETH in both the SHILLcoin and HODLcoin contracts.

6 Token Fees

SHITE implements regulated market cycles through a modular-math-based formula that causes transaction fees to be paid in a predictable, deterministic, algorithmic fashion. The smart contracts of SHITE interact in a unique manner, with transaction fees of each token paid to the holders of the other token. This places the two tokens in what we term a symbiotic-parasitic relationship, in which holders of each token feed off the users of the other token.

Incoming transaction fees from the other contract are not paid directly to token holders, but instead accumulate over time as Rewards, stored in a collective account known as the Slush Fund. A contract’s current transaction fees are determined by its slush fund balance, which at any time is equal to the total Ether value of the unspent rewards stored in the contract.

Specifically, the transaction fee rate charged by the contract varies according to:

$$FeeRate = \frac{SlushFundBalance \% CycleSize}{CycleSize} \times MaxRateModifier + BaseRate \quad (3)$$

Where % represents the modulo operator, which in this case finds the remainder of SlushFundBalance after division by CycleSize.

Equation 3 operates on a modular ring, producing a novel, cyclically-repeating “sawtooth cycle” in the behavior of the transaction fees charged within SHITE’s automated, regulated markets. In brief, equation 3 causes the FeeRate to vary linearly in proportion to the current SlushFundBalance, with a slope equal to $(CycleSize - 1)$, and an initial value equal to the BaseRate. However, once the SlushFundBalance is equal to the CycleSize, the FeeRate resets to the BaseRate. If the SlushFundBalance continues to increase, then the cycle begins again. This produces a sawtooth motion, in which the FeeRate varies smoothly from one value to another and then precipitously drops (or rises, if the SlushFundBalance is decreasing) back to the “original” value.

As is evident in Fig. 2, the FeeRate varies over a larger range for SHILLcoin (from 2.50% to 12.50%) than the range of rates for HODLcoin (from 5.00% to 10.00%). However, assuming a uniform random distribution of slush fund balances, the two contracts have the same average FeeRate (7.50%). The CycleLength is defined as 0.25 ETH for both SHILLcoin and HODLcoin. Taken together, this causes the FeeRate of SHILL to vary faster than that of HODL, potentially making it easier to manipulate. This key difference between the economic cycles of SHILLcoins and HODLcoins serves to encourage specific player behaviors.

Note: The FeeRate is the percentage charged by a contract on all Buy, Sell, and Transfer actions. When an Exchange action is initiated, each contract charges a percentage equal to $\frac{1}{2}$ of its current FeeRate.

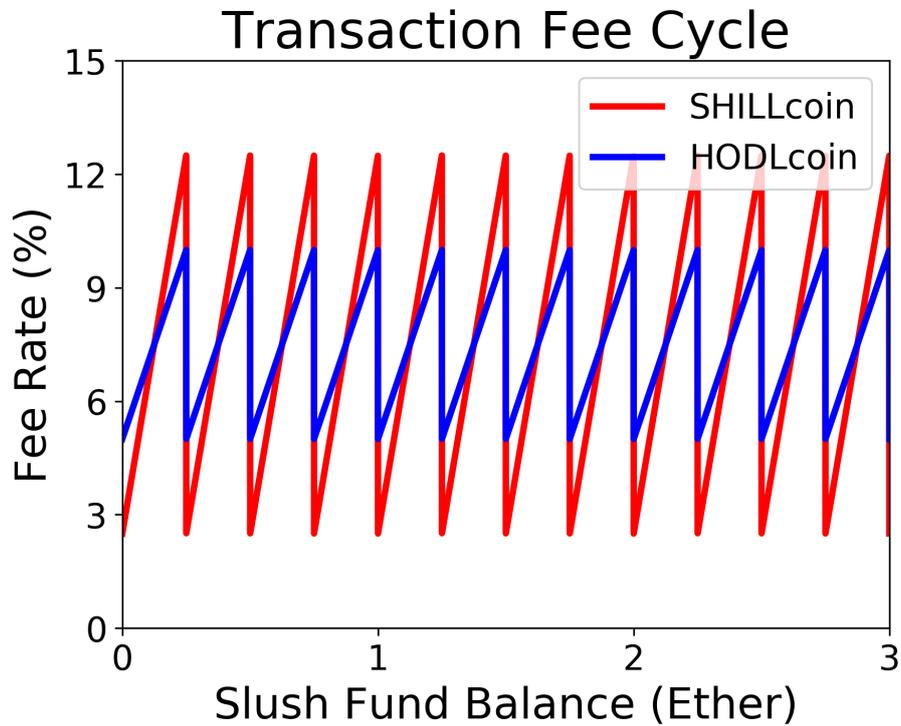


Figure 2: Transaction Fee Cycles of HODLcoin and SHILLcoin

7 Spending Rewards

At any time, players with accumulated rewards may spend their rewards to:

1. “Double Down” – transforming their rewards into more tokens
2. “Cash Out” – transforming their rewards into Ether and withdrawing it from the ecosystem

By spending their rewards at opportune times, players can make the most out of the political power that rewards provide. Spending one’s rewards will generally lower the fee rate.

However, if the fee rate is currently close to its lowest value, spending rewards can cause a sudden increase in the fee rate, as it “rolls back” to the end of a cycle.

Thus, astute players can:

1. Spend their rewards before they make a transaction in order to lower their own transaction fees and/or
2. Spend their rewards before others make a transaction, in order to:
 - (a) Decrease the transaction fees paid by other users OR
 - (b) Suddenly increase the transaction fees paid by other users

Players effectively accumulate political power over time as rewards. When players use their rewards, they spend their accumulated political power, either blindly or knowingly modifying the economic reality of the game. By design, a player must spend all of their accumulated rewards at a single moment in time. This encourages more frequent player interactions, as players who are interested in wielding the political power of their rewards towards a specific end are forced to correctly time their actions. Additionally, since rewards must be spent all at once and can accumulate to represent more than the size of a fee cycle, the political power of each individual's rewards "resets" after hitting this size. Thus, there is a cap on the accumulated political power that any individual player can hold at one time, minimizing the power of lone individuals who hold many tokens ("whales") to manipulate the game.

8 General Design Considerations

SHITE was designed to encourage medium to long term player engagement, frequent player interactions, and both cooperative and competitive playstyles.

Most simply, the game discourages very short-term players through built-in transaction fees. Since a fee is charged whenever a player buys or sells, it is impossible for someone to buy either SHILLcoins or HODLcoins, immediately resell them, and end up with more Ether than they started with. Opportunistic players can still enter the game when fees are low, but they are not guaranteed to stay that way. By giving accumulating rewards that can be spent on in-game tokens or redeemed for Ethereum to players who remain in the game, longer-term play is incentivized. Since rewards also represent political power within the game, they give token holders a cost-free manner in which to manipulate the market. Players will undoubtedly have varying views on the optimal market state at any time, and thus be placed in both oppositional and collaborative circumstances in relation to other players.

9 Tying Design Decisions to Player Actions

The larger range of transaction fees in the automated SHILLcoin market serves to make market manipulation easier. This is expected to promote greater market volatility and encourage shorter-term thinking, rewarding more "shill-like" behavior. Meanwhile, the slower-shifting, narrower range of transaction fees employed by HODLcoin act to dampen market volatility relative to SHILLcoins. Users of HODLcoin are thus encouraged to make decisions based on longer-term thinking, engaging in more "hodl-style" behavior.

10 Future Work

SHITE is designed to encourage players to compete to find strategies that optimally exploit the predictable economic machinery of the system itself. The system is intentionally difficult to master, acting as a way to test the behavior of human and programmatic players to novel economic scenarios. Since all in-game decisions are recorded on the Ethereum blockchain, SHITE provides a continuous source of data for analysis.

We anticipate it to be possible to classify individual players into “player categories” based upon the strategies that they employ. This will allow analyzing the data published by SHITE by modeling a realistic ensemble of players and player actions. We also expect back-testing to identify which strategies would have led to optimal outcomes to be of particular interest.

In addition, the events published by the smart contracts, their open source nature, and their publicly-shared Application Binary Interface (ABI) allow applications to track, analyze, and interact with the ecosystem in real time. In particular, interested developers are encouraged to build their own user interface for SHITE. We hope to see code written to interact with SHITE in an automated manner; this could include robotic players, or even smart-contracts that enable human players to pool their resources in a system that plays the game according to pre-coded instructions.

Broadly, the authors hope that SHITE inspires further work on similar types of economic simulations. An extension of the exchange functionality within SHITE to allow direct conversion of SHILLcoins and HODLcoins to additional types of tokens would be relatively straightforward. While we believe that expanding the fee/reward/slush fund system to incorporate additional tokens would present unique challenges, the authors are optimistic about the potential to find solutions to these challenges; we will not, however, propose any solutions within the present work.

Thanks for reading!

If you'd like to share your thoughts or ask questions, please contact:
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11 Appendix I: Additional Methods and Events

In accordance with the ERC-20 token standard, holders of SHILLcoins or HODLcoins can Approve another address, giving the address the power to transfer a share (or all) of their tokens.

Note: By design, a player approving another address to spend their tokens does not give that address the power to spend the player's rewards.

Each contract also emits a subscribable stream of events that users and external applications may freely access in order to track the economy of the contract and potentially analyze it over time.

Events are broadcast for each instance of:

1. Token generation (“minting”)
2. Token destruction (“burning”)
3. Token transfer
4. A change to Approval, i.e. either:
 - (a) An address newly approving another address to transfer a fixed amount of its tokens OR
 - (b) An address adjusting the amount of its tokens that another address is approved to transfer
5. A change to the Fee Rate
6. A player “Doubling Down” (defined above)
7. A player “Cashing Out” (defined above)