A Sea of Coins: The Cryptocurrencies Proliferation in UniswapV2

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ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

Finanziato
dall'Unione europea
NextGenerationEU

MUR
Ministero dell'Università e della Ricerca

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Introduction

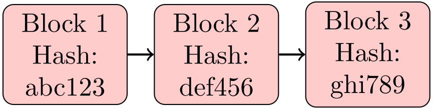
- We report some fundamental concepts on the Ethereum blockchain architecture and the Decentralized Exchange (DEX) Uniswap;
- Then, we describe how to create a new token deployed on this blockchain and we analyze historical data of tokens created on the Ethereum blockchain;
- We characterize these cryptocoins respect their security and financial properties.

Blockchain

A blockchain is a distributed ledger maintained by a network of computers (nodes).

Key Properties: Decentralization, immutability, and transparency.

Each block holds a batch of transactions and a reference (hash) to the previous block.



Block 1 Hash: abc123 → Block 2 Hash: def456 → Block 3 Hash: ghi789

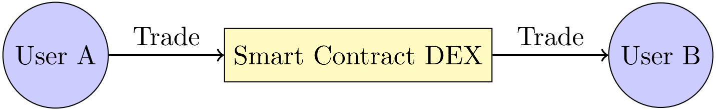
Figure 1: Blockchain

DEX

A DEX is a peer-to-peer marketplace where transactions occur directly between crypto traders without a central intermediary.

Automated rules that facilitate trades, handle custody of funds, and ensure trustlessness are written in Smart Contracts.

Pools of tokens locked in smart contracts that enable trading without the need for traditional order books.



AMM & Mempool

Automated Market Makers (AMMs): A type of DEX that uses a mathematical formula to price assets (**Constant Product Formula**);

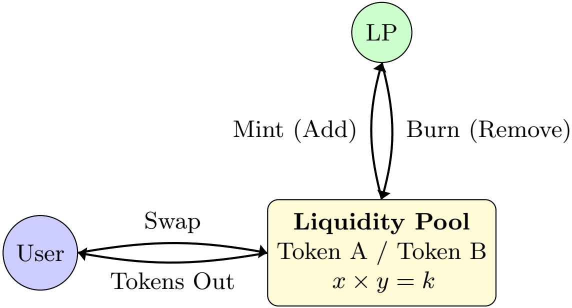
A mempool is a node's "waiting room" for unconfirmed transactions before they're added to a block.

Miners or validators typically pick transactions offering higher fees first (in many blockchains).During high activity, the mempool grows, increasing fees and wait times.

Some traders monitor mempool activity to anticipate and react to large transactions (Sandwich).

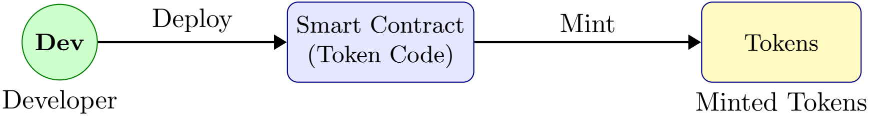
UniswapV2

- **Automated Market Maker (AMM)** using the formula between the quantity of Token A x and of Token B y in the reserves: $x \cdot y = k$.
- **Pool Pair**: Smart contract holding two tokens (e.g., Token A, Token B).



Token Creation

- **Smart Contract Code**: Written in a language (e.g., Solidity).
- **Deploy to Blockchain**: The contract is published (deployed) on an EVM-compatible chain (e.g., Ethereum).
- **Minting**: Upon deployment or via a function call, the token supply is created (minted).
- **Token Standard (e.g., ERC-20)**: Defines functions like `totalSupply()`, `balanceOf()`, `transfer()`, etc.
- **Ownership & Distribution**: Deployer or specified addresses receive the initial tokens.



Token Creation Smart Contract

```
contract DOPE is Context, IERC20, Ownable {
    mapping (address => uint256) private _balances;
    address payable private _taxWallet;
    uint8 private constant _decimals = 9;
    uint256 private constant _tTotal = 1000000000 * 10**_decimals;
    string private constant _name = unicode'Decentralization obligatory, practicality
↪   essential';
    string private constant _symbol = unicode'DOPE';
    // ... other variables ...
    constructor () {
        _taxWallet = payable(_msgSender());
        _balances[_msgSender()] = _tTotal;
       emit Transfer(address(0), _msgSender(), _tTotal);
    }
    function symbol() public pure returns (string memory) {  return _symbol;}
    function totalSupply() public pure override returns (uint256) { return _tTotal;}
    // ... other functions ...
    function _transfer(address from, address to, uint256 amount) private {
        // Swap Rule function
    }
}
```

Dataset Description

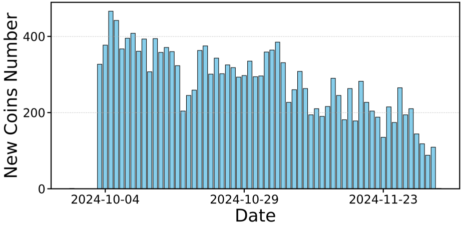
Retrieve information on:

- Newly created pairs (pair contract address, token0, token1) ↔ Token creation
- Swaps (amount swapped in/out) → Price behavior
- Mints and Burns (amount minted/burned, liquidity tokens) → Liquidity behavior

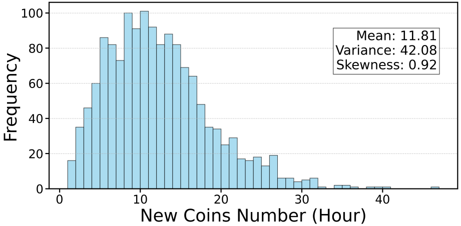
Approach:

1. **Connect to an Ethereum Node:** - Use a node or an RPC provider (e.g., Infura, Alchemy) via web3.
2. **Data:** - Use 17222 new coins created between the 10th October 2024 and the 2nd of December 2024.

Number of New Tokens Created



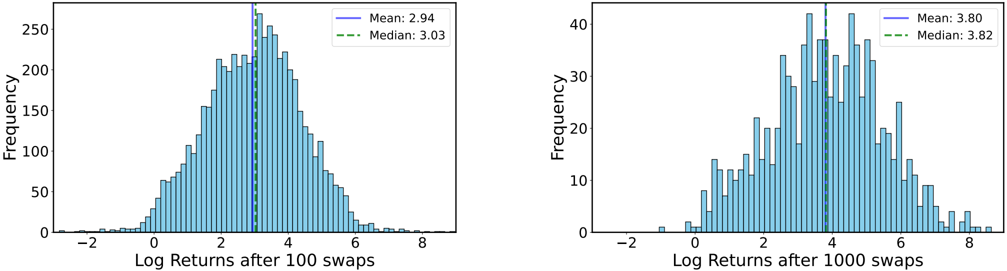
(a) Number of tokens created in a day for 2 months



(b) Distribution of the new token number in one hour.

We focused on the cases in which one of the two pairs of the pool was WETH.

Positive Returns

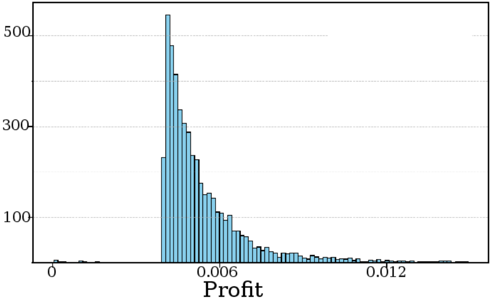


(a) Histogram of lagged log returns after 100 swaps.

(b) Histogram of lagged log returns after 1000 swaps.

Figure 3: Histograms of the lagged log returns of the new tokens after different number of swaps.

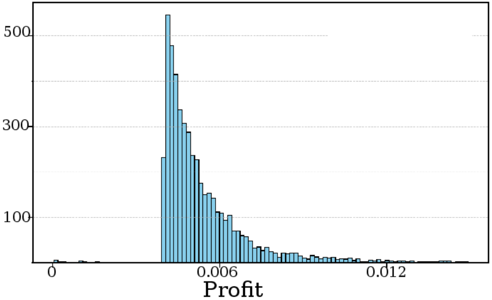
Profit distribution for a simple Buy & Hold strategy



We do not have considered:

1. Are the purchased tokens secure?
2. Presence of sandwich attacks
3. Swap time instead Physical time

Profit distribution for a simple Buy & Hold strategy



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Not All Tokens Are Sellable: Honeypots

Definition 1 (Honeypot)

A honeypot is a smart contract that pretends to leak its funds to an arbitrary user (victim), provided that the user sends additional funds to it. However, the funds provided by the user will be trapped and at most the honeypot creator (attacker) will be able to retrieve them.[1]

Possible Scam Honeypot Elements:

- Ownership & Renouncement
- Liquidity Addition
- Minting & Burning
- Slippage Tax Modifiable
- Blacklist/Whitelist
- Token Supply
- Swapping Mechanism
- Taxes & Fees
- Liquidity Burned/Locked

[1] Christof Ferreira Torres, Mathis Steichen, and Radu State. The art of the scam: Demystifying honeypots in ethereum smart contracts, USENIX Security 19, pages 1591-1607.

Token Classification: Safe vs. Honeypot

Motivation: Not all tokens remain safe throughout their lifecycle. Some evolve into honeypot contracts, making them effectively unsellable.

Our Approach:

- **Time-Based Analysis:** Observe each token over its entire history.
- **Security Detector Queries:** Use external security checks from:
  - honeypot.is — Honeypot detection service;
  - GoPlus Labs — Token security scoring;
- **Final Categorization:** At the end of its observed lifetime, each token is classified as:
  - **Safe**: No honeypot behavior detected;
  - **Honeypot**: Displays locked or blocked selling.

Token Capitalization

The Token Capitalization (TK) of the token i is given by:

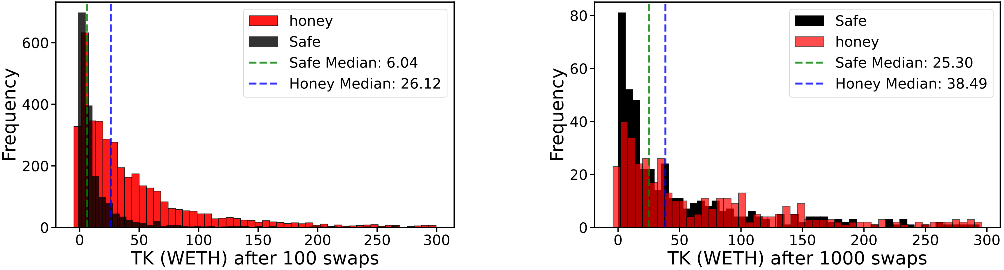
$$\mathrm{TK}_t^i = \left(\sum_{t=1}^{N_t} v_t^i \right) \cdot p^i(t = N_t) \tag{1}$$

where:

- v_t^i represents the signed token amount exchanged in the t-th swap for the i-th token;
- N_t is the number of swaps considered;
- $p^i(t = N_t)$ is the token price recorded at the N_t-th swap for the i-th token.

We are interested in the amount of money circulating around these new tokens.

TK Distribution



(a) Histogram of capitalization after 100 swaps.

(b) Histogram of capitalization after 1000 swaps.

Figure 4: Histograms of the capitalization of the new tokens after different number of swaps.

TK Property

TK is also an indicator of a sudden lack of liquidity in the market that is artificially triggered.

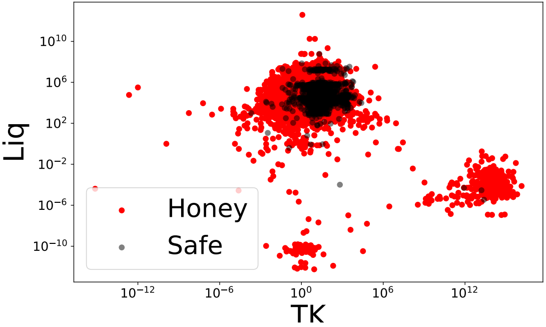
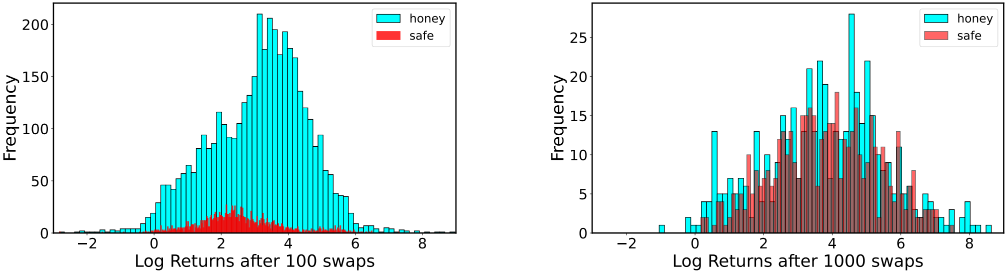


Figure 5: Scatter plot between the maximum value of TK in the lifetime of all new tokens and the corresponding value of Liquidity in that time.

Honeypot Returns

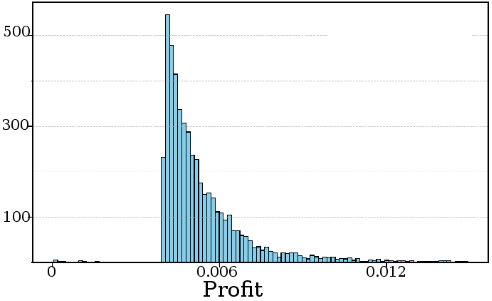


(a) Histogram of lagged log returns after 100 swaps.

(b) Histogram of lagged log returns after 1000 swaps.

Figure 6: Histograms of the lagged log returns of new safe and honey tokens.

Profit distribution for a simple Buy & Hold strategy



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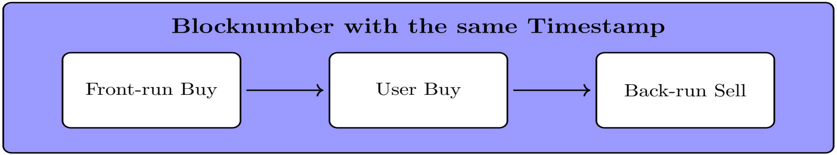
Sandwich Strategy Overview

High Profit for the presence of sandwich whose Txs are deployed in the same blocknumber.

- **Mempool Monitoring:** Identify a pending swap transaction (buying token y for some ETH x).
- **Front-Run:** Submit a transaction with higher gas to buy token y first.
- **Victim's Purchase:** The original, slower transaction then occurs, pushing the price up.
- **Back-Run:** Finally, sell the token y at the new higher price, capturing profit.



Blocknumber with the same Timestamp

Front-run Buy → User Buy → Back-run Sell

Optimal Sandwich

With a initial reserve x of the ETH in the LP in the pair:

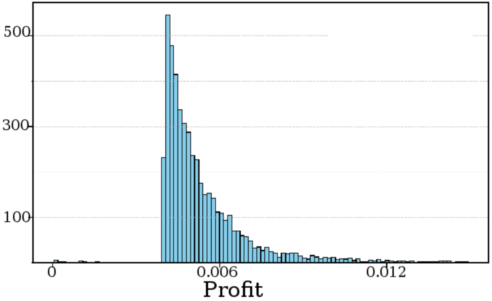
- The first swap of the font-running sells $\Delta x = a$ ETH;
- The swap of the slower trader sells $\Delta x_\epsilon = \epsilon$ ETH;
- The second swap of the font-running sells all of his tokens bought and obtains Δx_{tot} ETH.

The maximum of $s = \Delta x_{tot} - a$, with a pair pool fee $r = 1 - f$ $(f = 0.3\% \ll 1)$ and in the approx $fa \simeq O(\epsilon)$:

$$a_{\max} = \frac{\epsilon}{f} - x \; ; \tag{2}$$

$$s_{\max} = \frac{(\epsilon - fx)^2}{\epsilon} \; , \tag{3}$$

Profit distribution for a simple Buy & Hold strategy



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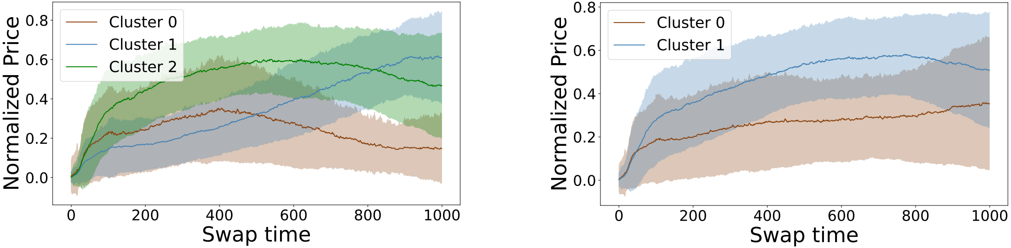
Clustering in swap time

The k-means algorithm partitions the trajectories into k distinct clusters by minimizing the within-cluster variance, thereby grouping similar trajectories based on their features.



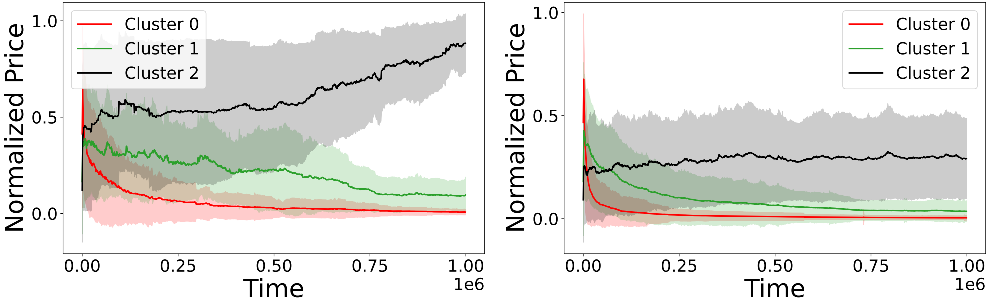
(a) Clustering resulting trajectories for $k = 3$.

(b) Clustering resulting trajectories for $k = 2$

Figure 7: The figures show the mean and the one standard deviation bands of the trajectories of length 10^3 resulting from the clustering, with $k = 2$ and $k = 3$.

Clustering in physical time

Now, we applied a dynamic time warping (DTW) method to categorize tokens into clusters based on their temporal price evolution.



The initial pick is associated with the BOT presence.

Conclusions

- The positive profits of new token returns suggest it may be convenient to trade in this currency.

- However, traders must consider:
  - The presence of honeypots.
  - The risk of sandwich attacks.
  - The necessity of a physical time strategy.

- The emergence of BOT activity significantly reduces potential profits, making careful strategic planning essential.

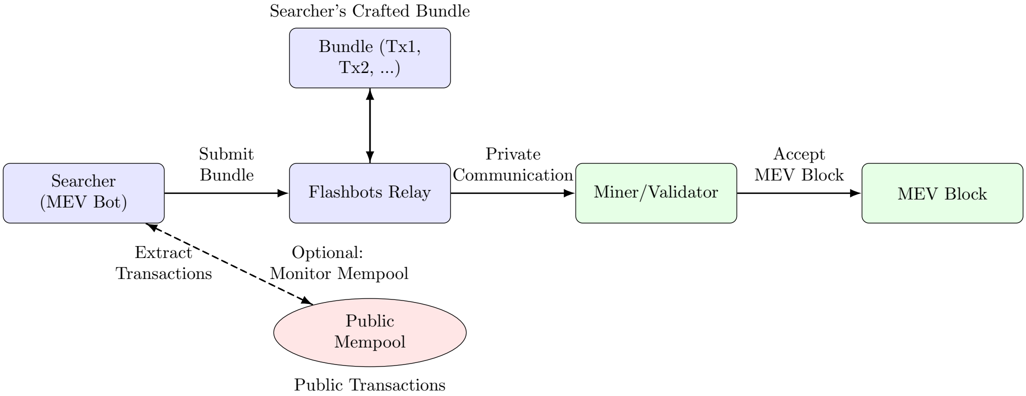
Optimal Sandwich: Example

Δx	Δy	x_{new}	y_{new}	**New Price**	**Old Price**	**Liquidity**
25.0000	-268464000	28.3199	35758537	7.920e-07	1.091e-08	31823
0.0500	-62833	28.3699	35695704	7.948e-07	7.920e-07	31823
-25.0316	268463996	3.3382	304159700	1.098e-08	7.948e-07	31865

In this case, $a_{\max} = 10$ ETH and $s_{\max} = 0.032$ ETH, with an initial reserve $x = 3.32$ ETH.

Sandwich on the token AIDLE in the pair WETH/AIDLE executed in the block number 21560868.

PNL


Searcher's Crafted Bundle
Bundle (Tx1, Tx2, ...)
Submit Bundle
Searcher (MEV Bot)
Flashbots Relay
Private Communication
Miner/Validator
Accept MEV Block
MEV Block
Extract Transactions
Optional: Monitor Mempool
Public Mempool
Public Transactions