Intrinsic Flaws in SafeMoon and Derivative Projects

A Technical Analysis by NotSafeMoon

Abstract

The purpose of this analysis is to demonstrate the intrinsic flaws in the SafeMoon Protocol and other derivative projects. As former stakeholders in many of these projects, the NotSafeMoon team performed independent audits of them all. Through these audits we have identified, what we believe to be, irreconcilable flaws in the contract codes preventing these projects from ever performing in the way they are intended and advertised.

All popular derivative projects are unmodified copies of the same original code. Throughout this analysis we will refer to SafeMoon and use examples from the SafeMoon contract transactions, but the discussed problems exist in all the derivative projects.

The efforts taken to understand and explain the failings of SafeMoon are borne of an initial enthusiasm for the project that, after discovering these core failures, inspired the creation of the NotSafeMoon protocol to correct them.

The following is based on mathematical and logical analysis of the raw data pulled directly from the Binance Smart Contract of the SafeMoon Protocol.

Flaws in Other Moon Coins:

- 1. Automatic Lopsided "Add Liquidity" Events: These events devalue the token in relation to their primary pegged token BNB.
- 2. Liquidity Pool (LP) is not excluded from rewards: This effectively cancels the rewards paid to all holders. (and due to a hardcoded "feature", the LP cannot be excluded without drastically changing the functionality of these tokens).
- 3. MAJOR RUG PULL RISK: Liquidity Pool Tokens from go to a developer wallet: LP Tokens retrieved from the automatic lopsided "add liquidity" events are transferred to the SafeMoon Contract Owner who of these tokens. These tokens are able to be withdrawn from the Liquidity Pool and the SafeMoon Contract's Owner's tokens represented at the time of analysis.
- 4. The "burn" address doesn't receive new tokens: Apart from the initial burn and the 5% distributed reward, no additional tokens are transferred to the burn address.
- 5. Steals your gas: If the Token Contract needs to perform one of its automatic actions it piggybacks on the next transaction in line and sticks them with the gas bill. We saw an increase of over 4 testing for a standard token transfer.

The Data

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Our analysis consists of the following data sources:
       Network:
                                             Binance Smart Chain - Main Network (bsc-mainnet)
       Chain ID:
       Chain ID (hex):
                                             0x38
       Addresses:
                                             0x8076C74C5e3F5852037F31Ff0093Eeb8c8ADd8D3
               SafeMoon Token:
               WBNB Token:
                                             0xbb4CdB9CBd36B01bD1cBaEBF2De08d9173bc095c
               USDT Token:
                                             0x55d398326f99059ff775485246999027b3197955
               SAFEMOON-WBNB PancakePair:
                                             0x9adc6Fb78CEFA07E13E9294F150C1E8C1Dd566c0
                                             0x20bCC3b8a0091dDac2d0BC30F68E6CBb97de59Cd
               WBNB-USDT PancakePair:
               PancakeRouter:
                                             0x05fF2B0DB69458A0750badebc4f9e13aDd608C7F
               PancakeLP Token:
                                             0x9adc6fb78cefa07e13e9294f150c1e8c1dd566c0
               "Burn":
                                             SafeMoon Contract Owner:
                                             0x79c4Af7c43F500b9cCBa9396d079cC03DFcAFdA1
               SafeMoon Contract Deployer:
                                             0xC95063D946242f26074A76C8A2E94c9D735dfc78
               PreSale Contract:
                                             0xa8736b9585a01d6dcC1b6E2Fc9dc208552c34b58
       Blocks*:
               From: 6433313
               To: 6553347
```



Polling Interval: 10 Seconds

Verified Contract Code: bscscan.com

Verified ABI:

bscscan.com

Data retrieval was performed by a local JavaScript app interacting directly with the deployed blockchain contracts using Web3 and the verified ABI of each respective contract above.

In this relatively small dataset we were able to capture ongoing occurrences of the issues mentioned above.

*Due to retrieving data on an interval rather than at every new block, the dataset does not encapsulate 100% of the available data in the time period analyzed. However, in this case, we believe the findings to still be accurate.

Issue 1

Automatic Lopsided "Add Liquidity" Events

To understand this issue, first we need to understand how the SAFEMOON contract was intended to work:

SafeMoon Protocol

SafeMoon employs 3 simple functions: Reflection + LP acquisition + Burn In each trade, the transaction is taxed a 10% fee, which is split 2 ways.

- 5% fee = redistributed to all existing holders
- 5% fee is split 50/50 half of which is sold by the contract into BNB, while the other half of the SAFEMOON tokens are paired automatically with the previously mentioned BNB and added as a liquidity pair on Pancake Swap.

Source: SafeMoon.net/whitepaper

- · When the SAFEMOON contract has a balance over a certain threshold it initiates a Liquidity Swap and Deposit.
- Half of the "Add Liquidity" amount is swapped to BNB using the SAFEMOON-BNB Liquidity Pool.
- Equal value of BNB and SAFEMOON is deposited to the pool.
- LP tokens are sent the SafeMoon contract owner (see Issue 3)

When any user implements the transfer method of the contract, the contract handles an override of the standard IUniswapV2Pair transfer method and the transfer is routed to the private _transfer method. This is the main entry point to where much of the logic happens for the token contract. Here the contract's token balance is checked. As the token contract collects fees, the balance of its own token grows. If the token balance is above a certain threshold the contract implements the swapAndLiquify function, in addition to the user's original transfer request. Here we see a record of the above situation.

Tx: 0x32ffbf0ff1f26bc1dacd2752e11428ba11388002dfb0cd6221ffca26a3e7e1bd

First, the SafeMoon tokens are transferred from the SafeMoon contract to the SafeMoon-BNB Liquidity Pool:



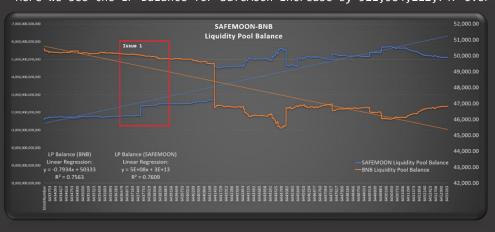
Then, half the tokens are swapped to BNB, and both the SafeMoon and BNB are deposited into the Liquidity Pool:

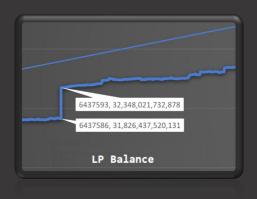


Next, LP Tokens are received in exchange for the liquidity. We pick this transaction back up in Issue 3 to see where they go; for now we examine the impact this has on the liquidity pool and price of the token.

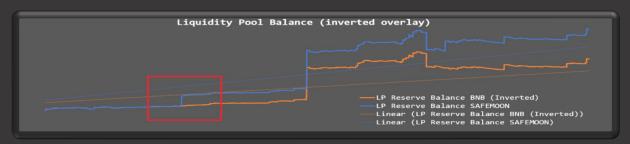


Here we see the LP Balance for SafeMoon increase by 521,584,212,747 over the course of 7 blocks.

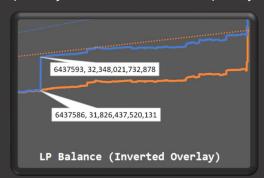




This gain represents the swapAndLiquify event depositing 500,000,000,000 SafeMoon Into the Liquidity Pool plus the reflection gained during this time period.

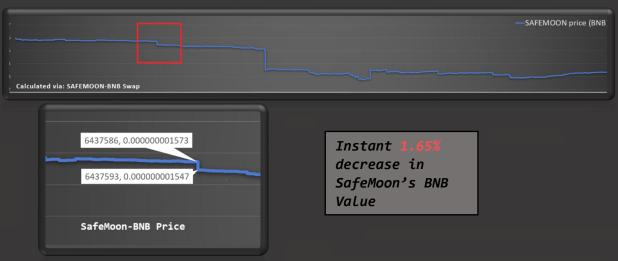


The quantity of SafeMoon in the Liquidity Pool increased by 1.64%, while the quantity of BNB stayed the same:



This Liquidity Pool
Transfer increases
SafeMoon balance by
1.64% & increases
BNB balance by 0.00%

This event added lopsided liquidity to the pool and devalued the SafeMoon token in relation to BNB. We See the decrease of SafeMoon's value reflected by an immediate 1.65% decrease in price against BNB:

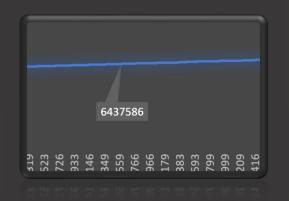




One more swap to USDT and we see that the price of SafeMoon has dropped 1.67%:



No additional reflection is gained by token holders even though a .5 Trillion SafeMoon transaction was made. This is due to the SafeMoon contract's exclusion from fees:

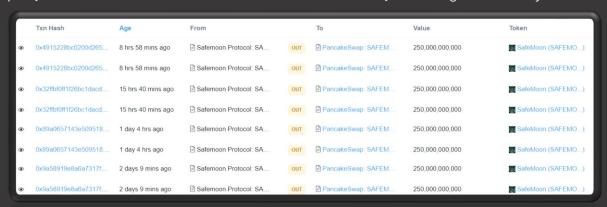


% Reward to
holders
(block 6437586)

The intent of this operation is to add value to the Liquidity Pool.

However, since the source of the deposited BNB was the Liquidity Pool itself, no additional value is added to the pool. This is a lopsided addition to the Liquidity Pool that changes the SAFEMOON-BNB ratio in the same way selling would. This automatic swapAndLiquify event devalues SAFEMOON in relation to BNB and all other currencies including USD.

This event happens on a regular automatic basis. Half of the 10% transaction fee is held in the SafeMoon token smart contract until it hits a balance of 500,000,000,000 then the tokens are dumped to the liquidity pool, and the LP tokens are sent to a SafeMoon dev wallet, devaluing the token by 2-4% each time:





This event is so predictable that our Twitter bot can predict it with 100% accuracy. Follow @notsafemoon

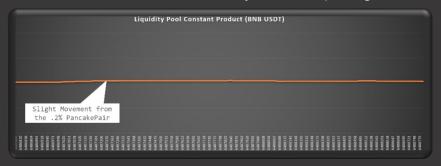


Issue 2

The Liquidity Pool is not excluded from the rewards

Liquidity Pool exchanges operate on the Constant Product Formula discussed by Ethereum founder Vitalik Buterin and brought to widespread use by UniSwap 👸.

A constant product formula is an algorithm used to determine the price of tokens on an Automated Market Maker (AMM) platform. The formula maintains that tokens in a liquidity pool must remain at a fixed value relative to each other. By fixing the relative value of the tokens, the formula is able to automatically determine pricing.



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The formula is simple:
        tokenA_balance(p) *
        tokenB_balance(p) = k
Which is simplified to:
        x * y = k
Where:
        x = reserve0 balance
        y = reserve1 balance
        k = constantProduct
```

Plot of constantProduct (k) for a healthy Liquidity Pool

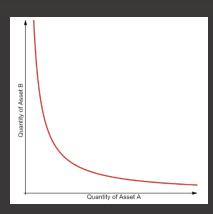
When the LP is initialized, k is set and future values of x and y are calculated off of it. If that balance is disturbed the market doesn't behave as it should and, in this case, a constant devaluing of one token takes place.

The value is based solely on the ratio between the tokens. The number of output tokens a trader receives for their input tokens is calculated such that after the trade, the product of the two liquidity pool reserves is the same as it was before the trade.

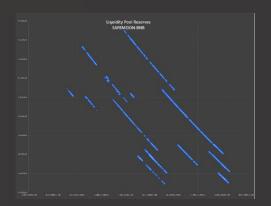
We have found that by including the Liquidity Pool in the rewards, it effectively cancels out the rewards paid to everyone else. All of these derivative "moon" projects contain the same issue. This coupled with the Automatic Lopsided "Add Liquidity" Events will prevent these projects from performing as advertised or intended.



Plot of constantProduct (k) for the SAFEMOON-BNB Liquidity Pool



Standard price curve for a Liquidity Pool With a proper constantProduct (k)



SafeMoon-BNB price curve - each shift is caused by the lopsided liquidity dumps

The Formal Specification of the Constant Product $(x \times y = k)$ Market Maker Model and Implementation can be found here:

https://github.com/runtimeverification/verified-smart-contracts/blob/uniswap/uniswap/x-y-k.pdf

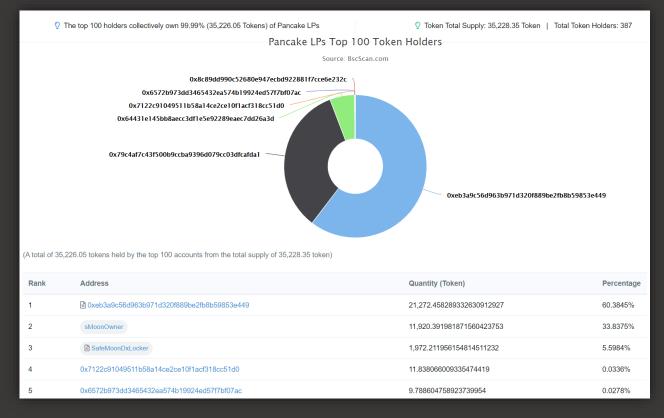
Additional Reading:

https://medium.com/bollinger-investment-group/constant-function-market-makers-defis-zero-to-one-innovation-968f7702215

Issue 3

Where are the Liquidity Pool tokens going?

When Liquidity is added to the Liquidity Pool, LP Tokens are given back in exchange. These tokens are used to withdraw the SAFEMOON and BNB that was added to the pool. We've all heard of the "Liquidity Time Lock" but what does that mean? Let's look at the top SafeMoon LP Token Holders:



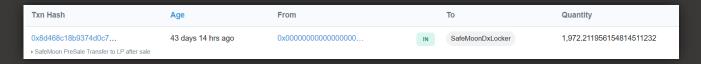
Source: https://bscscan.com/token/tokenholderchart/0x9adc6fb78cefa07e13e9294f150c1e8c1dd566c0

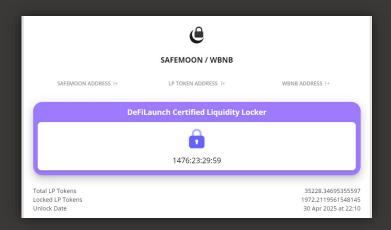
A total of 3 addresses hold 99.8% of the LP tokens. These tokens represent the value stored in the Liquidity Pool and are used to withdraw funds.



The #3 LP holder with only 5.6% is the Time Locked DxLocker Contract:

0x9adc6fb78cefa07e13e9294f150c1e8c1dd566c0 Which received LP tokens after the presale at Tx: 0x8d468c18b9374d0c79d846f38698c304e146becc67423663cde71116a0aa449b





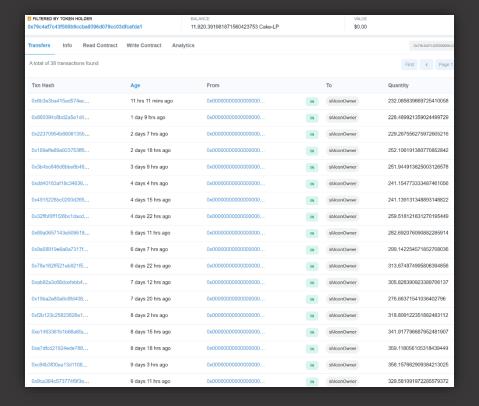
Source: https://dxsale.app/pages/dxlockview?id=8&add=0&type=lpdefi&chain=BSC

The #2 LP token holder with 33.8% of the LP tokens is the SafeMoon Token Contract Owner at TX Address: 0x79c4af7c43f500b9ccba9396d079cc03dfcafda1

We can verify this is the SafeMoon Contract Owner by calling the contract's owner method:

The contract owner address is a standard wallet address and not a smart contract so no "Time Lock" exists for these liquidity tokens. The contract owner can sell them at any time. Whenever a lopsided liquidity dump takes place, currently 1-3 times per day, the LP tokens are deposited to the contract owner's address. Each transfer represents 500B SafeMoon Tokens.

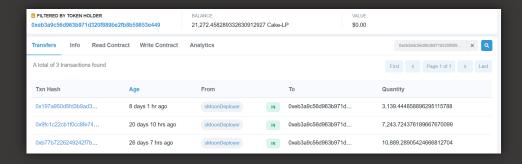
Source: https://bscscan.com/token/
https://bscscan.com/token/
https://bscscan.com/token/
https://bscscan.com/token/
https://bscscan.com/token/
https://oxpadc6fb78cefa07e13e9294f150c1e8c1dd566c0?a=
https://oxpadc6fb78cefa07e13e9294f150c1e8c1dd566c0?a=
https://oxpadc6fb78cefa07e13e9294f150c1e8c1de1





The #1 LP token holder with 60.4% of the LP tokens is a smart contract at TX Address:

0xeb3a9c56d963b971d320f889be2fb8b59853e449 and 100% of the tokens in this contract were manually transferred from the SafeMoon Contract Owner's wallet in these 3 transactions:



Source: https://bscscan.com/token/0x9adc6fb78cefa07e13e9294f150c1e8c1dd566c0?a=0xeb3a9c56d963b971d320f889be2fb8b59853e449

Although this contract is unverified and has no publicly available information, we can use BscScans's EVM bytecode decompiler to see that it is another token locker.

Source: https://bscscan.com/bytecode-decompiler?a=0xeb3a9c56d963b971d320f889be2fb8b59853e449

With no publicly available info on this locker, it seems we may have reached a dead, for now.

We cross referenced this locker's transactions found at:

https://bscscan.com/tokentxns?a=0xeb3a9c56d963b971d320f889be2fb8b59853e449

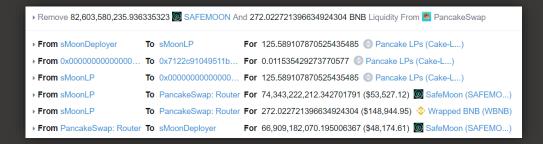
With the top SafeMoon token holders found at:

https://bscscan.com/token/0x8076c74c5e3f5852037f31ff0093eeb8c8add8d3

Then filtered the data by the SAFEMOON-BNB LP Token address: 0x9adc6fb78cefa07e13e9294f150c1e8c1dd566c0

We have not found any withdrawals of these SAFEMOON-BNB LP tokens from the locker at this time; we will continue to monitor it closely and update the community.

As we continue to dig through the data on the blockchain we find that, although the SafeMoon Dev's had a "fair launch" and bought into the presale, they are continuously cashing out the LP tokens for BNB and SAFEMOON.



Tx: 0xae5645287a13b05d0ff7ce12921722e32582fc0f4f321544100a39d86bbeaea8



Tx: 0x83a510e01ffb3385638f5e068b6c2be5bde7b9895f92f64d085857fbd50ce8a9





Tx: 0xf5c8111571b3d2863cb20eb1dc6e04be5a294b02fc013228c7da4251e0b09bad

Normally this would be understood and expected, but now that we have discovered the source of these LP Tokens to be at least partially from the automatic liquidity dumps into the pool, it raises the question: Just where exactly are the "burnt" tokens going? The data proves it's NOT the burn address.

Issue 4

The "burn" address doesn't receive new tokens.

At the time of this analysis, the "burn" address quantity reported via the SafeMoon contract method balanceOf returns 401106317922185147779181 or 401,106,317,922,185 tokens. This number is advertised as being the total number of "burned" tokens forever removed from the total original supply. However, when the "burn" address transaction history is pulled we find that the burn address has a total of 31 incoming SafeMoon Token Transfers totaling 295,543,752,308,360.

The difference in tokens is not due to tokens being transferred to the "burn" address, as no transaction records exist showing this. The gain in tokens is due to the contracts tokenFromReflection function, more commonly referred to as the token holder reward.

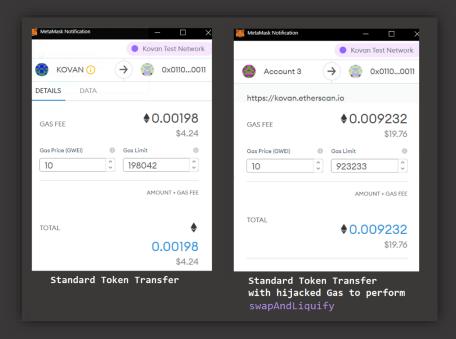
This shows that the "burn" address is not receiving any additional burns as advertised. The only incoming tokens to the burn address are that of the automatic reflection rewards.

Issue 5

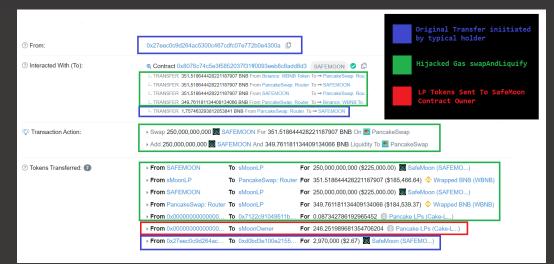
If the Token Contract needs to perform a swapAndLiquify you're buying the gas.

We deployed the verified SafeMoon contract code on the Ethereum Kovan testNet. As mentioned before, the token contract checks if certain conditions are met on every transaction. If the contract determines it needs to perform an additional task, such as swapAndLiquify, then it sticks the next transaction in line with the gas bill with NO additional warnings or confirmations.

In these controlled test conditions, we saw a 466% increase to the appropriate gas fee.







Above is an example of a typical small balance wallet making a transfer where the wallet owner is unknowingly hit with gas fees for the swapAndLiquify transaction

Follow Up:

For those interested in seeing how this develops, keep on eye on the following links and NotSafeMoon.com

SAFEMOON-BNB LP Token transactions with the secondary DxLocker:

https://bscscan.com/token/0x9adc6fb78cefa07e13e9294f150c1e8c1dd566c0?a=0xeb3a9c56d963b971d320f889be2fb8b59853e449 SafeMoon Contract Deployer's LP Token transactions:

https://bscscan.com/token/0x9adc6fb78cefa07e13e9294f150c1e8c1dd566c0?a=0xc95063d946242f26074a76c8a2e94c9d735dfc78
SafeMoon Contract Current Owner's LP Token transactions:

https://bscscan.com/token/0x9adc6fb78cefa07e13e9294f150c1e8c1dd566c0?a=0x79c4Af7c43F500b9cCBa9396d079cC03DFcAFdA1

The NotSafeMoon Protocol has fixed these intrinsic flaws.

Disclaimer

This is an analysis of publicly available data on the Binance Smart Chain and in no way is intended to defame or accuse anyone of intentional or unintentional wrong doing. The NotSafeMoon team has taken all reasonable measures to ensure the accuracy of this analysis and welcomes any feedback. However, we are human... most of us at least ... and humans make mistakes. If anything in this analysis appears to be invalid please contact us at info@NotSafeMoon.com with the supporting blockchain transactions, contracts, and addresses that led you to your conclusion. If an error has been made, a public acknowledgement will be made and the error will be corrected. And of course, all Content in this document is only our interpretation of information of a publicly available nature. Nothing in this document constitutes professional and/or financial advice, nor does any information in this document constitute a comprehensive or complete statement of the matters discussed or the law relating thereto.

