

Preamble

The aim of this post is providing an analysis on the transactions of the Smart Burn Engine (SBE) from 01 August 2023 until 05 October 2023, taking into consideration the impact of the [Parameters Update #1](#) (03 August 2023), which was effective on-chain on 20 August 2023.

This analysis is meant to update the community with the activity and effectiveness of the SBE's parameters reconfigured in Parameters Update #1

, while providing insights into the possible future parameter configuration methodology, where we decided to introduce a new factor (MKR price drawdown) in order to prevent possible MEV attacks. The whole analysis was conducted to assess what would the optimal SBE's parameters be in case of sudden drops of MKR's price. Market wide or token specific drawdowns would impact the Uniswap v2 DAI/MKR Liquidity Pool in which the SBE is targeted. The maximum extraction is still limited by the want

parameter (maximum worse price relative to oracle which is still tolerated).

Data Gathering

All data is pulled and presented as of 12:00 UTC 05 October 2023.

We pulled data from Etherscan on [Uniswap v2 DAI/MKR LP accumulation by the DSS Pause Proxy](#) as well as [DAI tokens Transferred from the DSS Flapper](#), while ETH and MKR prices are weighted average prices across major exchanges. The surplus buffer data comes from proprietary data sources. This provides a general overview of the amount of DAI used and LP tokens accumulated which can help determine total execution costs, efficiency, and LP focused metrics.

[Smart Burn Engine - Transaction Statistics and Metrics to 05 October 2023](#)

[Smart Burn Engine - Parameter Configuration & Drawdown Analysis 05 October 2023](#)

Further information can be found on the [Makerburn](#) site.

SBE transactions analysis

For the period 01 August 2023 – 05 October 2023, the SBE has used a total of 21,473,115 DAI - of which 10,745,000 spent and 10,728,115 paired - to accumulate a total of 296,557 units of Uniswap v2 DAI/MKR token - of which 137,314 units (46.3%) before the 20 August update and 159,243 (53.7%) after the 20 August update. When looking at daily units accumulated, we can see that after the update they were approximately halved, going from 7,011 daily units before the update to 3,468 daily units after the update. This is mainly due to the surplus buffer not exceeding the 50M threshold after which the SBE activates.

After the Parameters update taking place, we can see that the DAI necessary to be paired with MKR dropped from 19,990 DAI on 20 August to 19,965 DAI on 05 October, in line with the findings of the previous [SBE Transaction Analysis](#). This is due to the growth in pool size (327%) which increased in nominal terms by 24,242,938 DAI compared to 01 August.

Distribution of delay periods

During the 01 August 2023 – 20 August 2023 period (19.58 days), the SBE executed a total of 1,016 actions, ~5.22% lower than the theoretical maximum of 1,072 operations given hop

of 1,577.

On the other hand, during the 20 August 2023 – 05 October 2023 period (45.92 days), the SBE executed a total of 284 actions, ~54.7% lower than the theoretical maximum of 627 operations given hop

of 6,308.

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When comparing the SBE delays before and after the update, we can clearly see the presence of outliers increasing the delay time. After the parameters update, 3.5% of swaps were responsible for 97.7% of the total delay time. The ten swaps namely delayed for:

- 8.89 hours
- 15.52 hours
- 15.54 hours
- 23.10 hours
- 1.35 days
- 1.84 days
- 2.74 days
- 4.37 days
- 5.05 days
- 7.06 days

Since the SBE activates only when the surplus buffer is above the 50M threshold, we took a look at the number of trades and the DAI in the Surplus Buffer. From the graph, we can clearly see that the trades (green vertical lines) stopped when the surplus buffer went below the 50M threshold (red area), which mostly happened after the parameters update #1

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Market impact

The realized Market Impact of the SBE's trades can be calculated by looking at the amount of DAI that must be paired with MKR to provide in the LP, accounting for the 0.3% swap fee charged by Uniswap. To calculate the average market impact of each execution, we use the equation:

In line with the previous analysis' predictions, now that Maker is almost the entire pool's liquidity, market impact declined monotonically even after the parameters update and without experiencing any further upticks except for the new parameter configuration (20 August).

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Price drawdown analysis

As pointed out in the preamble, we are introducing a price dynamic factor in the parameter configuration in order to prevent potential MEV extraction in the case of market drawdowns. Given the historical data for both ETH and MKR from 01 March 2020, both tokens experienced the lowest daily return on 12 March 2020 (Black Thursday), where ETH plunged by 44.60%

and MKR for 60.48%. What is more important for the sake of the analysis, is looking at the highest intraday drops (High - Low) given a negative daily return they have incurred in, which again happened on the same day with ETH experiencing a 48.25% drop and MKR experiencing a 61.52% drop. When looking at the histogram of intraday drops, we can clearly see two negatively skewed distributions, with MKR's being more negative (-3.58) compared to ETH's (-3.01), hence implying a higher tail risk. While the arithmetic return beta between MKR and ETH is 0.94 (correlation 0.7), the intraday drop beta is 1.12 (correlation 0.84), meaning that MKR intraday drops are more pronounced than ETH's intraday drops. Following this rationale, we will simulate LP sizes based on 0% to 60% drops in MKR price, with 30% being the threshold covering 99% of the historical intraday drops.

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Sensitivity analysis

Given the LP size on 5 October 2023 equal to \$30,733,011, we assess the amount of tokens in the LP, as 11,406.17 MKR and 15,370,423.46 DAI, from which we can derive the Invariant Constant of the Uniswap v2 MKR/DAI LP through the equation:

Afterwards, the Uniswap AMM algorithm adjusts the new token quantities based on the Constant and the new token price, which in this case is given by the equation:

Given the 5 October 2023 MKR price of \$1,347.21, we can estimate the new MKR Quantities based on 5% price drops, which gives us the LP size for MKR tokens which should be equal to the LP size of DAI tokens under the relation:

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Assuming no changes in the price of DAI, we can then estimate the new pool sizes given MKR price drawdowns. The following graph shows how much the LP size would drop in percentage terms given a certain MKR price drawdown.

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We have then continued the analysis by estimating the optimal parameters for the simulated Liquidity Pools, given a 3-month average ETH price of \$1,743.1 and a conservative estimate of 50 gwei gas price. For all of the simulated liquidity pool sizes, the optimal bump

(lot size) in order to minimize the estimated loss due to gas and slippage, is always somewhere between 15,000 and 20,000 DAI. Based on the analysis, the current SBE parameters are optimized up to 30% MKR price drops, after which a lower bump

size will be preferred given the current low transaction fees. However, if the gas price and/or ETH price rise, or if pool liquidity significantly increases, the costs associated with gas consumption have the potential to surge. This suggests that a higher bump

would be more optimal in such scenarios. The graph below illustrates the estimated losses from gas and slippage as

percentage of the annual effective MKR Accumulation Rate for 0% to 60% price drawdowns.

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When optimizing for the bump

, one thing that must be taken into consideration is the possibility of sandwich attacks execution. The goal is choosing the optimal bump

for a given LP Size so that sandwich attacks become unprofitable. Thanks to the [defi-sandwich tool](#), we have simulated the limit below which, for a given pool size, sandwich attacks become unprofitable. Given the pool sizes resulting from sudden MKR price drawdowns, we can see sandwich attacks are unprofitable up to a lot size of 29,000 even for 60% drawdowns in MKR price. For the current pool size MEV attacks are not profitable for bumps below 46,500, while in case of 30% drawdowns, below 38,000. Considering these factors, the bump

size can potentially be higher than it currently is.

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Conclusions

The main takeaways from this analysis are the following:

- The SBE is currently transacting below the theoretical rate of accumulation, mainly due to the Surplus buffer being below the Surplus buffer limit of 50M DAI.
- The market impact of SBE's activity is declining monotonically, as expected given the growth of the pool liquidity through the SBE's actions.
- The parameters are currently optimized for cost reduction up to 30% drawdowns in MKR prices, which would not be optimal in case of larger MKR price drawdowns; nevertheless, the maximum impact is limited by the want

parameter.

- The bump

parameter is significantly below the theoretical threshold that would trigger profitable MEV activity, even in case of sudden drops in MKR price.

- Optimal parameters are highly subject to ETH price and gas price, suggesting potential increases in bump

might reduce the estimated losses in case of rising ETH price and network activity.

References

Data sheets:

[Smart Burn Engine - Transaction Statistics and Metrics to 05 October 2023](#)

[Smart Burn Engine - Parameter Configuration & Drawdown Analysis 05 October 2023](#)

More about SBE:

[Introduction of Smart Burn Engine and Initial Parameters](#)

[Smart Burn Engine - Performance to 30 July 2023](#)

Smart Burn Engine Parameters Update #1

External Resources:

<https://etherscan.io/token/0x517f9dd285e75b599234f7221227339478d0fcc8?a=0xbe8e3e3618f7474f8cb1d074a26affef007e98fb>

<https://etherscan.io/token/0x6b175474e89094c44da98b954eedeac495271d0f?a=0x0c10ae443ccb4604435ba63da80ccc63311615bc>

makerburn.com

defi-sandwi.ch

Sandwich Calculator

Check whether your Uniswap trade can be sandwich-attacked, and get an optimal order split.