Why the Safety Module's Slashing Percentage Costs the Aave DAO Millions

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Executive Summary

Aave's safety module acts as insurance for the Aave protocol. Depositors in the module earn yield from the Aave treasury, and in exchange Aave retains the optionality to slash their deposit in the event of a shortfall. The percentage of deposits that Aave governance may slash is dubbed the slashing percentage, and currently sits at 30%. Using simple risk-return analysis, we argue why any slashing percentage below 100% is strictly inefficient for the DAO. That is, the DAO pays a cost-of-capital to safety module depositors on capital that has zero utility for the protocol.

Based on 150 days of data on the Aave safety module, we estimate that the slashing percentage of 30% is costing the Aave DAO between 2 and 4 million dollars a year. To address this, we propose raising the slashing percentage on the stkAAVE pool and cutting emissions to the stkAAVE module, keeping its insurance power approximately constant.

To address potential concerns with abruptly raising the slashing percentage, discussed in detail in this report, we consider a gradual approach to raising the slashing percentage. We propose raising the slashing percentage to 60% and lowering emissions to 470 AAVE/day to the stkAAVE pool. This change will reduce emissions to the module by 29,200 AAVE per annum, or $\approx \$2M$ USD at recent AAVE prices. We also expect it will increase the safety module's insurance power, not decrease it. We may then measure the impact of our change on the safety module's capital efficiency and insurance power, and based on this evidence, decide whether we should raise it to 100%. Ultimately, we target a 25% reduction in the stkAAVE module's cost, or about $3.5 USD per annum. If successful, we will extend this recommendation to the stkABPT module as well.

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[*] Disclosure: The authors do not own `AAVE` token, nor are they affiliated with Aave Markets or any of its affiliates. This research was funded by a grant from the Aave Grants Program. Any opinions and results stated here are those of the authors, not of Aave or its affiliates. Henceforth any mention of "Aave" is in reference to the Aave Protocol, unless explicitly stated otherwise. Nothing in this paper should be construed as financial advice or trading advice.

1 Introduction

Aave's safety module backstops potential shortfalls within the Aave ecosystem. The Aave DAO pays a floating interest rate to the module's depositors (referred to as *stakers*) in exchange for the optionality to *slash* their deposits. A misunderstood component of the module is its *slashing percentage*. The slashing percentage dictates the percentage of deposits in the module that can be slashed and currently sits at 30%. The Aave DAO pays approximately $\$29M$ USD (401500 AAVE) to fund the safety module in exchange for approximately $\$100M$ in insurance. This is compared to $\$13M$ in annualized revenue for the Aave protocol according to Token Terminal[1][2].

For a borrow-lend protocol that assumes considerable risk from borrowers, the safety module is a critical component for ensuring solvency in adverse conditions. However, we argue that the current configuration of the safety module is inefficient due to the misconfiguration of the slashing percentage. As we discuss in Section 3, we estimate this costs the Aave DAO approximately $\$3.36M$ USD annualy in opportunity cost based on 150 days of data from the stkAAVE pool alone.

In this brief report, we model the capital efficiency of Aave's safety module using a very simple risk-return model. We isolate the module's default risk premium and express it as a function of the module's slashing percentage to show why increasing the slashing percentage is likely to result in increases to the module's capital efficiency. This is in contrast to the notion that a slashing percentage below 100% reduces the APR demanded by AAVE stakers and therefore makes the module more capital efficient.

Although investing in the Aave safety module is unlikely to be an efficient market, where risk preferences are perfectly priced into the module's APR, we argue that the the most likely outcome of raising the slashing percentage will be an increase in the module's capital efficiency. In Section 4, we propose a gradual roll-out of our recommendation that allows us to measure the impact of our proposed changes, as well as test the adequacy of our assumptions. Our proposal will lower emissions to the module by 29,200 AAVE per annum, or roughly $\$2M$ USD, without decreasing its insurance power.

1.1 On Data

Throughout this report we will refer to recent AAVE token price, safety module TVL, USD deposit rates, and stkAAVE APR. These quantities are averaged over 155 days of data, as discussed in Appendix A. We reproduce these averages below for clarity:

- AAVE price: \$72 USD.
- stkAAVE module TVL: $3.26M$ AAVE, or $\$235M$ USD.
- USDC deposit rate: 2%.
- stkAAVE APR: 6%.

2 Optimizing the Slashing Percentage

Rational investors only invest in the safety module if the expected returns from the investment match or exceed the risk-free rate plus their perceived risk premium. In this section, we decompose the expected return from the safety module into its risk-free component and its risky component, and further isolate the default risk from the risky component. This allows us to express the module's annual cost and insurance power as a function of the module's slashing percentage. We then show that as we increase the slashing percentage, the insurance power of the safety module likely increases

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[1] https://tokenterminal.com/terminal/projects/aave

[2] Aave revenue as of June 30th, 2023.

while keeping emissions constant. Equivalently, the cost of the Aave safety module decreases while keeping insurance power constant.

2.1 Deriving Annual Spend

Define the annual AAVE rewards for the safety module as R, the total value locked of the module (in units of AAVE) as $\textsc{tvl}$, and the annual percentage return of the module as $\textsc{apr}$. It follows that

$$\textsc{apr} = \frac{R}{\textsc{tvl}}. \tag{1}$$

A standard formulation for the $\textsc{apr}$ of an investment is as some risk-free rate plus some risk-premium[3]: $\textsc{apr} = r_0 + r_{prem}$. That is, we charge more interest when our investment is subject to risk. The concept of risk premia is ubiquitous in bond pricing literature (stkAAVE is basically a perpetual bond with an embedded put option) and is a foundation of the Capital Asset Pricing Model or Modern (Markowitz) Portfolio Theory (despite their purported flaws) [3]. We can rewrite Eq. 1 as

$$r_0 + r_{prem} = \frac{R}{\textsc{tvl}}. \tag{2}$$

A major component of the risk premium r_{prem} is the default risk, or slashing risk, faced by stakers. We can decompose the risk premium r_{prem} into a slashing risk component, which applies only to slashable funds, and a non-slashing component that captures other risks (these other risks may include a liquidity premium, delta risk from holding AAVE, smart contract risks):

$$r_{prem} = p \cdot r_{slash} + r_{other}, \tag{3}$$

where $p \in [0, 1]$ is the slashing percentage. Combining Eqs. 2 and 3 we may express the safety module's cost as a non-slashable investment and a slashable investment:

$$R = \textsc{tvl}(r_0 + r_{other} + p \cdot r_{slash}). \tag{4}$$

We can rearrange Eq. 4 into:

$$R(\textsc{tvl}, p) = \underbrace{(r_0 + r_{other})(1-p)\textsc{tvl}}_{\text{non-slashable investment}} + \underbrace{(r_0 + r_{other} + r_{slash})p\textsc{tvl}}_{\text{slashable investment}}, \tag{5}$$

We now make a key assumption: the risky rates r_{other} and r_{slash} are constant with respect to the slashing percentage p. It is straightforward why changing p does not affect liquidity, delta, or smart contract risk premia. When we say that increasing p does not affect r_{slash}, we are claiming that stakers will charge a fixed risky rate r_{slash} for every marginal unit of stake that may be slashed. We discuss the validity of this assumption in Section 2.3.

2.2 Maximizing Capital Efficiency

Notice the insurance power of the module is expressed as $p \cdot \textsc{tvl}$ (for our purposes, we ignore the slippage and potential price impact of a shortfall) where

$$\textsc{tvl} = \frac{R}{r_0 + r_{other} + p \cdot r_{slash}}. \tag{6}$$

The *capital efficiency* of the module is merely the insurance power per unit of AAVE used to fund the module

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[3] We will leverage this formulation without having to assume a particular risk free rate or risk premium.

$$C(p) = \frac{p \cdot \text{TVL}}{R} = \frac{p}{r_0 + r_{other} + p \cdot r_{slash}}, \tag{7}$$

where $C(p)$ denotes the capital efficiency. We show that, if r_{slash} remains constant with respect to p, capital efficiency is maximized at $p = 1$ by taking the derivative of $C(p)$:

$$\frac{dC}{dp} = \frac{r_0 + r_{other}}{(r_0 + r_{other} + p \cdot r_{slash})^2}. \tag{8}$$

Notice that for $r_0, r_{other} \geq 0$, we get a strictly non-negative derivative on C with respect p. This derivative is only equal to 0 when r_0 and r_{other} are equal to 0, implying no risk free rate. Given the various low-risk yield opportunities in both DeFi and in Traditional Finance, we find this to be an unlikely scenario. Therefore, the capital efficiency of the safety module with respect to p is maximized at $p = 1$.

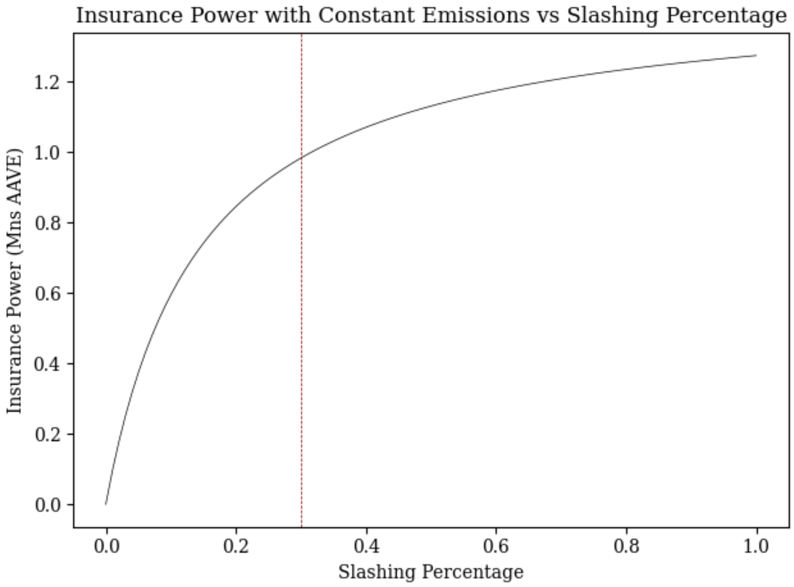

Figure 1: Insurance power of the AAVE-only pool using APR = 6%. We assume a risk free rate $r_0 = 0.02$ (roughly the USDC supply rate on Aave), a negligible liquidity and smart contract risk premium $r_{other} = 0$, and a slashing premium $r_{slash} \approx 13\%$ derived from the observed APR.

The insurance power of the module for *constant* emissions R is displayed in Fig. 1, which is generated from the code in this[4] repository. Notice that at the recent average of $\$235M$ TVL in the AAVE-only pool[5], there is roughly $\$70M$ in insurance power. This corresponds to the $\approx \$1M$ AAVE insurance power shown in the figure at the corresponding AAVE price of \$72. Furthermore, the increasing insurance power for constant R indicates increasing capital efficiency.

Intuitively, for any $p < 1$ the Aave DAO is paying a cost-of-capital (i.e., a risk-free rate plus non-slashing risk premia) on $1 - p$ of the safety module's TVL. Under our assumption that r_{slash} is constant with respect to p, it follows that this cost-of-capital comes at no benefit to the DAO, and it would be strictly more cost-effective to enforce a 100% slashing percentage.

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[4] `https://github.com/xenophonlabs/aave-safety-module`

[5] `0x4da27a545c0c5b758a6ba100e3a049001de870f5`.

2.3 Assumptions and Criticisms

Here we overview a our assumptions and why we believe they are fair. Given that we are basing our approach largely on CAPM (meaning we linearly relate an investor's risk and expected return), we tacitly imply that markets are efficient and investors are both rational and risk-averse. Of course, there are several idiosyncratic reasons why these assumptions might not hold entirely true in practice. However, our goal with this report is to be directionally correct: the change in the module's capital efficiency might not converge exactly to what we derive in Section 3, but we argue it is most likely to be positive, not negative.

2.3.1 Linear Risk Preferences

In our derivation we assumed that r_{slash} is constant with respect to p, leading to a linearity between the risk of staking (which is linear in p) and the returns demanded by investors (the APR). Specifically, we are claiming the following:

$$r_{slash} = \kappa \Pr(\text{slashing}), \tag{9}$$

where κ is some scaling factor. That is, the slashing risk premium is some linear function of the probability of default. For example, we might say that the slashing risk premium is equal to the perceived probability of default, meaning that investors "break even" in expectation when investing into the safety module. Consider the current APR of 6% and slashing percentage of 30%, and suppose a risk-free rate of 3%, then we might price the probability of a slashing event at:

$$\begin{aligned} 0.06 &= 0.03 + 0.3 \cdot \Pr(\text{slashing}) \\ \Pr(\text{slashing}) &= \frac{0.06 - 0.03}{0.3} \\ &= 10\%, \end{aligned}$$

where $\kappa = 1$. Of course, there are some factors that might make $\kappa \neq 1$, such as the expected realized loss from a default. That is, $p = 30\%$ means Aave may slash *up to* 30% of a staker's bond, but not necessarily all 30%. Any expectation that Aave might slash less than p, would lead to $r_{slash} \leq \Pr(\text{slashing})$, ceteris paribus. Given that Pr(slashing) does not change with respect to p, then neither would r_{slash}. Furthermore, AAVE price is directly related to the well-being of the module. Stakers might be inclined to backstop the protocol to retain the value of their AAVE token (whatever is left after slashing), which would further lower the risk premium they charge (e.g., by lowering κ).

More broadly, this linearity assumption is the foundation of the Capital Asset Pricing Model (CAPM), Markowitz' Modern Portfolio Theory (MPT), Arbitrage Pricing Theory (APT), and many other economic models. It essentially states that returns must grow linearly with respect to risk, whether that risk is systemic (i.e., Beta in the CAPM) or specific to the investment in question. Although these linearity assumptions are sometimes criticized by theorists and practitioners alike [4], these economic theories are ubiquitous in investment analysis and corporate finance [3]. Empirical studies often find evidence of linearity in various markets such as the New York Stock Exchange (NYSE) [1] and Global Insdustry Classification Standard (GICS) stocks [2].

2.3.2 Latent Liquidity

Apart from linear risk preference, we also assume that stakers are optimizing their positions with respect to their perceived risks. Formally, we assume that

1. Markets are efficient: new information regarding p is quickly and transparently distributed to all stakers and they react accordingly.

2. Stakers are rational and risk-averse: they base their decision to investing in the safety module off its perceived risk. That is, they demand some minimum APR at which they are willing to stake based on their current risk perception, and will stake or unstake accordingly.

Our primary concern here is that, if these assumptions are untrue, then it is possible that the current market conditions (i.e., the current APR) does not reflect the true risk preferences of investors. For example, investors might price the risk premium on investing in the AAVE safety module significantly higher than the current 6%, but for some idiosyncratic reason have not expressed their preferences. If we abruptly raise the slashing percentage p, we might trigger these latent investors to express their risk preferences and largely withdraw from the safety module. In this case, we might observe a surprisingly higher APR than what is expected based on the historical APR observed by the safety module. This potentially leads to a decrease in the capital efficiency of the module, not due to an error in our modeling, but because investors might express preferences that have not been previously observed.

It is difficult to predict or model the existence of latent liquidity, or how these investors might react to changes in market conditions such as raising p. It is possible they remain latent regardless of changes to p (that is, they are inelastic to changes in p). In this case, raising p or lowering emissions would result in a strictly higher capital efficiency for the safety module. Given this ambiguity, we discuss a gradual roll-out of our changes in Section 4, allowing us to measure changes in the observed risk preferences of stakers.

An example for how latent stake might manifest itself is the discrepancy in APR between the stkAAVE and stkABPT pools. The stkAAVE pool has been consistently around a 6% APR over the last several months, whereas the stkABPT has hovered around 12%. While both pools exhibit different risk profiles (for example, ABPT staking involves being an LP in an AMM, which carries its own risks such as impermanent loss, or more precisely, loss-versus-rebalancing [5]), it is possible that a portion of the stkAAVE pool consists of latent stakers who don't stake into the stkABPT pool despite its superior risk-return. This might be due to a variety of reasons: stakers lost access to their keys, moving their stake is cumbersome, they perceive Balancer pools as being particularly risky, etc..

Perhaps the most important reason is governance: as it stands, stkABPT holders cannot vote on Aave's governance proposals. Therefore, large Aave stakeholders who are deeply involved in protocol decisions choose to stake in the AAVE-only pool to retain governance power, driving this spread in APR. Given that this is primarily a technical issue which will likely be solved with a transition to Balancer v2, it is possible that these APRs will soon converge.

3 Estimating Impact

We have argued that the safety module's capital efficiency strictly increases as we raise the slashing percentage. Given this increase in capital efficiency, we can lower the emissions, R, while maintaining the same insurance power. We now derive the dollar impact of raising the slashing percentage from an arbitrary p_1 (e.g., the current 30%) to an arbitrary p_2, (e.g., our proposed $p = 100\%$) while keeping the insurance power constant. We call the this quantity the module's *Capital Inefficiency.* We first set the original and new insurance powers to be equivalent

$$p_1 \cdot \textsc{tvl}_1 = p2 \cdot \textsc{tvl}_2. \tag{10}$$

Using Eq. 4 we find

$$R_2 = R_1 \cdot \frac{p_1}{p_2} \cdot \frac{r_0 + r_{other} + p_2 \cdot r_{slash}}{r_0 + r_{other} + p_1 \cdot r_{slash}}, \tag{11}$$

where R_1 is the module's original annual AAVE emission and R_2 is the emission required to obtain the same TVL under p_2. It follows that the module's capital inefficiency is $I(p_1, p_2) = R_1 - R_2$, or

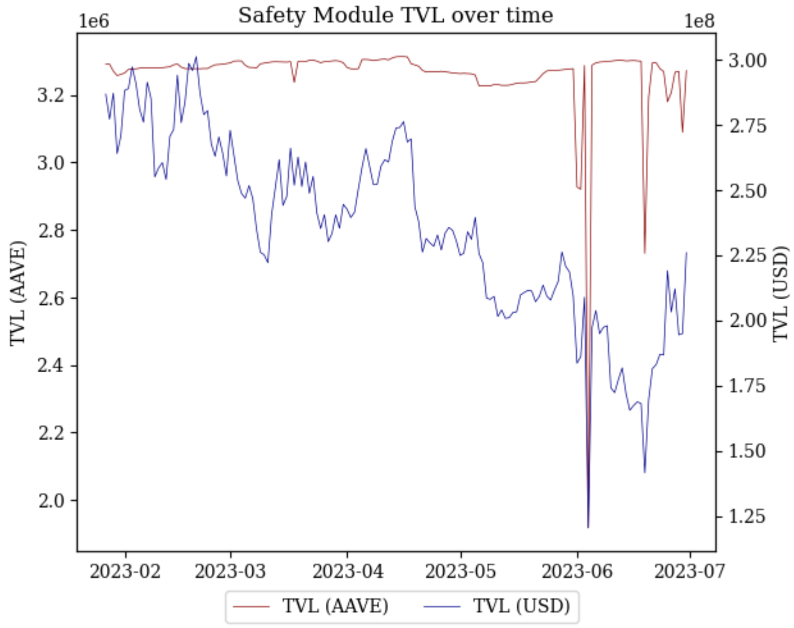

Figure 2: stkAAVE safety module TVL. Notice that the amount of AAVE held in the safety module is relatively constant over this period, indicating a certain inelasticity of stakers to possible risks, such as AAVE delta risk or other Aave protocol risks.

$$I(p_1, p_2) = R_1 \cdot \left(1 - \frac{p_1}{p_2} \frac{r_0 + r_{other} + p_2 \cdot r_{slash}}{r_0 + r_{other} + p_1 \cdot r_{slash}}\right). \tag{12}$$

Let us compute the capital inefficiency between the current slashing percentage $p_1 = 0.3$ and our proposed slashing percentage $p_2 = 1$ using recent data on the stkAAVE module's APR, AAVE price, and USDC deposit rates. Our methodology for acquiring this data is discussed in Appendix A. First, let's use the USDC supply rate on Aave as a proxy for our risk-free rate[6][7]. Further, let's suppose an "other risks" component of $r_{other} = 0$. The purpose of this exercise is to show what the cost savings would be under reasonable swings in r_0 and r_{other}. While we don't explicitly select an r_{other}, USDC supply rates undergo sufficiently large swings for us to gauge what high r_0 and r_{other} would mean in terms of cost savings.

We compute $I(0.3, 1)$ on 150 days of data, shown in Fig. 3. These figures correspond to risk-free rate range of $r_0 \in [0.48\%, 5.71\%]$. Notice how higher r_0 leads to higher expected cost savings, since it means r_{slash} is a smaller component of the safety module's APR.

Based on this data, we approximate that the Aave DAO could save an annual 3 to 4 million dollars by raising the slashing percentage and reducing emissions to the safety module, while keeping insurance power constant. Given that AAVE price is volatile, this quantity is an approximation.

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[6] Of course, depositing USDC on Aave is not risk-free, nor is staking ETH on Lido, or any other DeFi investment. We use USDC deposit rates as a proxy for risk-free rates because it is convenient for our illustration. Further, this rate has undergone significant swings over the last 150 days, allowing us to perform some sensitivity analysis on the impact of our changes.

[7] We could use U.S. Treasury rates to model our risk-free rates. This might overestimate the impact of our changes since treasuries currently sit at around 5% per annum, leading to a lower expected r_{slash}, and therefore a higher capital inefficiency.

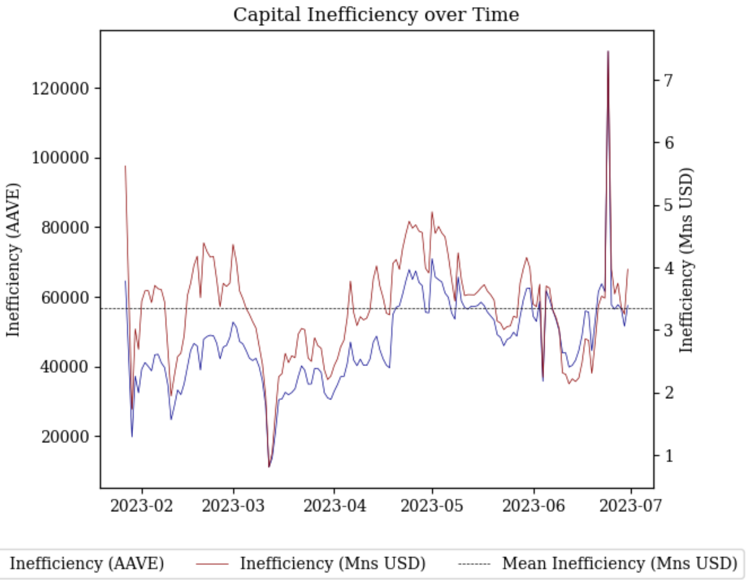

Figure 3: Capital Inefficiency (savings) of a $p = 0.3$ and a $p = 1$ stkAAVE safety module. The black dotted line indicates an average capital inefficiency of $\$3.36M$ USD in the module.

3.1 [In]Elasticity

As discussed in Section 2.3, we assume stakers are rational and risk-averse. In reality, there are a number of idiosyncratic reasons why stakers might not express (or have any) risk aversion. For example, stakers might not have immediate access to their tokens or they might be "Aave-maxis" and wish to backstop the protocol in case there is a shortfall. As mentioned, a large driver for inelasticity in the stkAAVE module is likely to be governance. Staking into the AAVE-only safety module is currently the only way to earn yield on AAVE while retaining governance power (as far as the authors are aware).

A great piece of evidence for stakers being inelastic to risk and returns is that the stkAAVE TVL has been roughly constant over the last 150 days, despite significant fluctuations in AAVE price and a turbulent crypto market with an uncertain risk profile. Regardless of the reason, those staking in the stkAAVE module are not consistently repricing their investment into the module.

It follows that, contrary to the criticisms in 2.3, this inelasticity might in fact work in favor of the DAO: we raise risks and lower returns, with a lower-than-expected decrease in the module's TVL. While this might seem unfair to the module's stakers at first, this change creates two positive second-order effects for stakers aside from improved insurance: (1) it increases the runway for Aave's treasury, which governance may use as it seems fit, and (2) it reduces the dilution of the AAVE token. For stakers that are aligned with the long-term success of the Aave protocol (or similarly, the AAVE token), we see this as a net positive change.

4 Recommendations

Following our analysis in the previous section, we recommend implementing a 100% slashing percentage on Aave's safety module. Doing so involves a few key implementation decisions, which we discuss in this Section.

Note: This section is a WIP, we are actively looking for feedback on the best way to structure our proposal.

4.1 On New Pools and Old Pools

The first implementation concern is whether it is acceptable to raise the slashing percentage p in the first place, and what kind of governance process and warning this might require. Of course, the DAO should not raise the slashing percentage without ample warning to existing stakers (at least as long as the current cooldown period of 20 days). As we have argued, raising the slashing percentage on existing pools would likely be a significant improvement in capital efficiency to the module, particularly due to the possible latent stakers who would be inelastic to our proposed changes. We are eager to engage in discussions with Aave governance for how we might raise the slashing percentage on existing pools, if possible.

Furthermore, as the reader might be aware, one of Aave's service providers, Llama.xyz[8], has already made several proposals regarding new pools for Aave's safety module. Since those are undeployed, their slashing percentages are still up to debate, and we may choose to set $p = 100\%$ on those.

4.2 Gradual Roll-Out

As discussed in Section 2.3, it is possible that stakers do not behave as expected, or that the assumptions underlying our conclusions are incorrect. To address this risk, we consider two approaches for a gradual roll-out of our changes. One involves raising p incrementally, and the second involves lowering R incrementally. When we raise p we consequently increase the capital efficiency of the module, which allows us to lower the module's emissions.

4.2.1 Raising the Slashing Percentage

To mitigate the above concerns, we consider a gradual roll-out of our changes. Particularly, we consider a two-part approach. We first raise the slashing percentage from 30% to 60% and measure impact over the course of a month by measuring the capital efficiency using Eq. 7. If capital efficiency increases following our change, we raise the slashing percentage once again, to 100%.

4.2.2 Reducing Emissions

In our formulation for capital inefficiency we kept a constant expected insurance power for the safety module. That is, we abstained from claiming that the module should be bigger or smaller than it currently is.

The new R we expect to be required to maintain approximately the same insurance power in the module is ≈ 420 AAVE per day, as opposed to the current 550 AAVE per day. Of course, this is based on our assumption that USDC supply rates are a reasonable proxy for a risk free rate. As discussed in Section 3, if we are overestimating this risk-free rate then we might end up with lower insurance power than the 150 day average. We can see that despite significant fluctuations in the r_0 we considered (recall that $r_0 \in [0.48\%, 5.71\%]$), the new R we expect to be required is mostly contained in a tight range between 400 and 500 AAVE per day.

Given our proposed gradual roll-out where we raise p from 30% to 60%, we recompute Fig. 4 with $p = 0.6$, depicted in Fig. 5.

Given the volatility of the new R we expect to be required, as well as the criticisms discussed in Section 2.3, we consider a conservative approach to lowering emissions. Instead of choosing the average R we expect will maintain the current insurance power, we choose the upper quartile observed

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[8] https://llama.xyz/

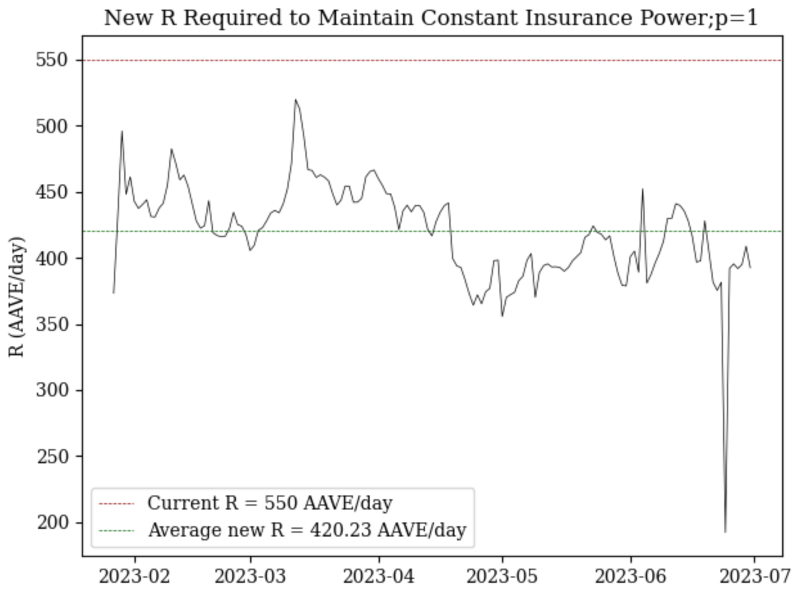

Figure 4: Expected R required to maintain the current insurance power when $p = 1$, based on 150 days of data.

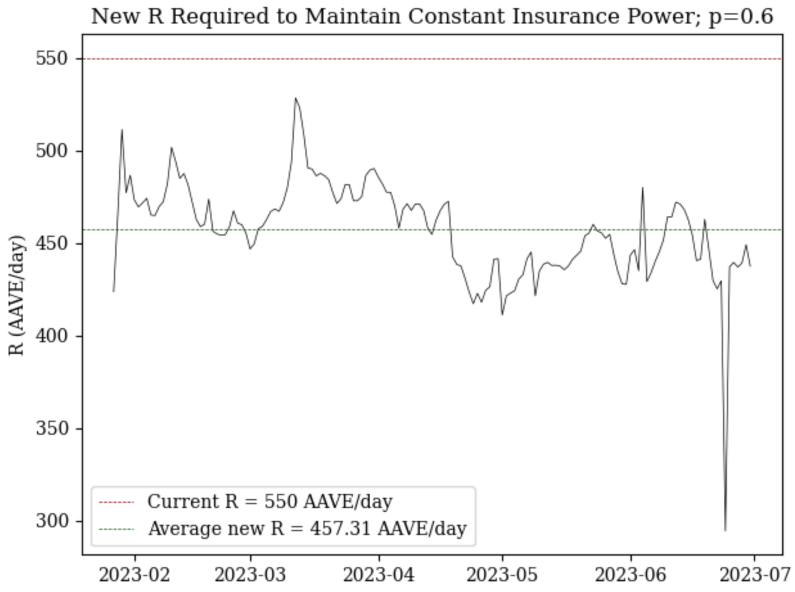

Figure 5: Expected R required to maintain the current insurance power when $p = 0.6$, based on 150 days of data.

over the last 150 days. While this mitigates the increase in capital efficiency we hope to achieve with our change, it also mitigates the consequences we might face if our assumptions are incorrect or if risk-free rates radically change upon the enactment of our change. We find that the third quartile of the R depicted in Fig. 5 is $R = 470$, equating to a cost reduction of $(550 - 470) \cdot 365 \cdot 72 \approx \$2M$ USD.

Ultimately, raising the slashing percentage to 100% and accordingly lowering emissions to 420 AAVE per day would result in a $\approx$ 24% reduction to the stkAAVE module's cost, whereas our conservative, interim solution of raising to 60% and lowering to 470 AAVE per day results in a $\approx$ 14.5% reduction.

4.3 Technical Specification

Following the successful transition of the safety module to v1.5[9], developed by BGD[10], changing the slashing percentage on an existing pool is straightforward. The slashing percentage is dictated by the `maxSlashablePercentage` state variable, which can be set using the `setMaxSlashablePercentage(.)`[11] method by the `SLASH_ADMIN`.

Furthermore, deploying new safety module pools under this paradigm takes as input the slashing percentage, and so creating a new pool with $p = 100\%$ is as simple as specifying a 100% slashing percentage in the function call. It might also involve increasing the `MAX_SLASHING` parameter on the Generic Proposal payload[12] for future pool creation.

4.4 Conclusion

We have argued that the safety module's slashing percentage creates material capital inefficiency for Aave's treasury to the tune of 2 to 4 million dollars annually. The DAO is paying a risk-free rate plus some non-slashing risk premium for capital that it cannot access. The misconception that this reduces the module's APR and therefore might make the module more capital efficient is not corroborated by our risk-return analysis. We propose the following to the Aave DAO, in an attempt to materially increase the capital efficiency of the safety module, and accordingly, lower its cost. This applies to the stkAAVE pool, although a similar proposal might be enacted on the stkABPT pool if we observe a successful increase of capital efficiency in the stkAAVE pool.

1. Raise p from 30% to 60%.
2. Lower R from 550 AAVE per day to 470 AAVE per day.
3. Measure impact on capital efficiency over the course of a month. If we observe an increase in capital efficiency, we raise p to 100% and reduce emissions accordingly.

We expect (1) and (2) to result in cost-savings of 29,200 AAVE per annum, or roughly $\$2M$ at an AAVE price of \$72, without decreasing the module's insurance power. Furthermore, we suggest that the slashing percentage on any new pools created by other service providers, such as the pools being proposed by Llamma.xyz, be set to 100%.

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[9] https://github.com/bgd-labs/aave-stk-v1-5/tree/3dbba868a21a19075562e43c6137e049aa6f22bc

[10] https://bgdlabs.com/

[11] https://github.com/bgd-labs/aave-stk-v1-5/blob/3dbba868a21a19075562e43c6137e049aa6f22bc/src/contracts/StakedTokenV3.sol#L317C1-L318C1

[12] https://github.com/bgd-labs/aave-stk-v1-5/blob/3dbba868a21a19075562e43c6137e049aa6f22bc/src/contracts/ProposalPayload.sol#L25

A Data Methodology

We have gathered data for our impact measurement as below. All of our data is included in our GitHub repository, and spans from January 27th, 2023 to June 30th, 2023.

- **AAVE Price:** We downloaded AAVE 1-day close price from Yahoo Finance.
- **USDC Deposit Rates:** We downloaded USDC deposit rates from Aavescan.
- **stkAAVE apr:** We compute the stkAAVE pool APR by dividing the annual emissions $R = 550 \cdot 365$ AAVE by the outstanding stkAAVE, which we download from the flipside query below. Find the results in our Flipside dashboard here.

```sql
WITH
bals AS (
  SELECT
    date_trunc('day', block_timestamp) AS DateTime,
    user_address AS Address,
    avg(balance) AS Balance
  FROM ethereum.core.fact_token_balances
  WHERE user_address = '0x4da27a545c0c5b758a6ba100e3a049001de870f5' -- stkAAVE
     -- OR user_address = '0xa1116930326d21fb917d5a27f1e9943a9595fb47' -- stkABPT
  GROUP BY 1, 2
  ORDER BY DateTime
),
meta AS (
  SELECT
    address AS Address,
    decimals AS Decimals,
    name AS Name,
    symbol AS Symbol
  FROM ethereum.core.dim_contracts
)

SELECT
  t.DateTime,
  t.Address,
  t.Balance / POWER(10, meta.Decimals) AS Balance,
  meta.Decimals,
  meta.Name
FROM bals AS t
JOIN meta ON (t.Address = meta.Address)
ORDER BY DateTime DESC
```

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